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# A MONOGRAPH

OF THE

# CULICIDAE

OR

# MOSQUITOES.

MAINLY COMPILED FROM THE COLLECTIONS RECEIVED AT

THE BRITISH MUSEUM

FROM VARIOUS PARTS OF THE WORLD.

IN CONNECTION WITH

THE INVESTIGATION INTO THE CAUSE OF MALARIA
CONDUCTED BY THE COLONIAL OFFICE
AND THE ROYAL SOCIETY.

BY

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# PREFACE.

The present "Monograph of the Culicidae or Mosquitoes" had its origin in the appointment by the Royal Society, at the request of the Right Hon. Joseph Chamberlain, of a Committee to co-operate with the officials of the Colonial Office in the investigation of the causes of malaria and the possibility of controlling that scourge of tropical lands. I was a member of that Committee, and very soon came to the conclusion that a most important service might be rendered in furtherance of the object in view by the preparation of a work describing the mosquitoes of all parts of the world, so as to enable the medical men engaged in tracing the connection between mosquitoes and human disease to indentify and to speak with precision of the species implicated. As the collection of *Culicidae* existing in the Natural History Museum was small, and the group had never been specially cultivated by any of our entomologists, I sought the assistance of the Colonial Office, the Foreign Office, and the India Office in the attempt to procure properly preserved collections of mosquitoes from all parts of the world. The most active steps were taken by the officials of those great departments of State, and the circular reprinted on p. x. was drawn up by the Secretary of State for the Colonies and despatched to every officer of the colonial service. Other organisations and institutions, as well as private individuals and collectors throughcut the world, were asked to assist in the undertaking. The result has been the reception at the Natural History Museum of a very large series of more or less extensive collections of mosquitoes from all parts of the world. Collections are still arriving, and it is to be hoped that this will continue for years to come. A complete list of the collections received up to the end of March, 1901, is given on page 357 of Vol. II. The Trustees of the British Museum, in view of the national importance of a thorough knowledge of the *Culicidae*, determined

to publish an illustrated monograph of the group based on these collections.

The Trustees were fortunate in being able to secure the services of Mr. F. V. Theobald, M.A. Cantab., who has been unremitting in his labours, and has produced the present work in a comparatively short space of time.

It appeared to me to be important, with a view to the special object of the work, that numerous text figures should be introduced, and that as many species as possible should be represented on an enlarged scale in coloured plates. I employed, in order to lose as little time as possible in getting the work issued to malaria students, a number of different firms of lithographers, and stipulated with them for rapid production. Mr. Theobald responded with a good will to my request for the completion of his work without any avoidable delay, and the consequence is that the student of tropical disease has now ready for his use a critical monograph of the mosquitoes, to the extension, correction, and improvement of which it will certainly be one of his main desires to contribute.

A supplementary volume will be necessary at no distant date to record additional species and correct present conclusions. In the meanwhile I shall be glad to receive further collections, as well as notes and suggestions, with a view to the completion and revision of the monograph, from all who have opportunities of studying the *Culicidae*.

E. Ray Lankester,
*Director.*

British Museum (Nat. Hist.),
*November 23rd*, 1901.

# INTRODUCTION.

The collections officially obtained and sent to the Natural History Museum from all parts of the world since the beginning of the year 1899 furnish the chief material upon which the present work is based. The collection previously existing in the Museum, though not extensive, has proved to be of considerable importance. I have received great help in the way of collections and information from South America through the kindness of Dr. Lutz and Senhor Moreira. To Professor Howard I am similarly indebted in regard to collections from North America.

Besides these a large number of collections and isolated specimens have been received by me unofficially, many of the collectors having given me permission to make what use I like of the unique specimens. These will be deposited in the general collection at the Museum.

As many of the old descriptions of *Culicidae* are very vague, and were compiled when but few species were known, the work of identification has been extremely difficult, and probably in several cases, could the types be traced and examined, my identifications would prove erroneous. Several of the old descriptions will apply to more than one distinct species, whilst, on the other hand, some totally different descriptions have been shown, by means of an examination of the types, to be actually taken from the same insect (vide *M. alternans*, p. 269, and *S. fasciata*, p. 289). Many of the older descriptions have evidently been drawn up from worn and imperfect specimens; and as the characters, coloration, &c., of the family *Culicidae* lie mainly in the scale ornamentation, such diagnoses are practically valueless.

The whole classification in this monograph is mainly based on the scale structure.

The short description of each species given first has been drawn up under a hand-lens. The majority of the specimens have been received in excellent condition. A few have been attacked by mould, some by mites, and a few damaged beyond repair

through rough usage in the post. Unfortunately a valuable collection of South American species, belonging to Dr. Lutz, was completely destroyed in the latter way.

In the investigation of the numerous species sent I have been considerably hampered by the absence of spirit specimens. In all cases, as far as possible, specimens of each species, preserved in spirit and numbered with similar numerals to the mounted ones, should be sent. It is very difficult to make preparations of the ungues, head, &c., from dried insects, and the former are most important in regard to specific distinctions. Specimens are best despatched in tubes, in forty per cent. alcohol, great care being taken that the numbers correspond with the mounted insects. The same applies to the larvae and pupae, scarcely any of which have been received from abroad.

In the description of the wings I have adopted the terminology used by Skuse in his 'Monograph of the Culicidae of New South Wales,' which is far the simplest, and serves for the purposes of identification perfectly.

Besides the numerous collections sent to the British Museum I have been fortunate in examining the *Culicidae* in Bigot's collection (many being, I believe, Macquart's specimens), to which Mr. Verrall gave me free access. He also allowed me to remove specimens for more leisurely examination, a privilege for which I desire to express my thanks.

Professor Poulton, of Oxford, who has specimens and old types of much interest in his care as Hope Professor, kindly entrusted these to me for study.

From South America Dr. Lutz has sent me the whole of his collection, and many valuable critical notes regarding them. Although one lot was destroyed in transit, the collection has proved of great help to me.

Amongst other collections placed at my disposal are those of Lieut.-Col. Giles, I.M.S., with his types of new species from India; collections formed by Captain Cornwall and Captain James, I.M.S., also from India; a large unmounted collection from Siam, by Dr. Sharp (only partly examined); a collection from Senegambia, of Dr. Burdetts; one from Hong Kong, by Dr. Rees, containing several types; a large collection, containing many new species, from Old Calabar and other parts of Africa, collected by Dr. Annett; a small collection from New South Wales, sent me by Mr. Froggatt; various North American species, and notes on them, from Professor Howard (in addition

to those sent to the Museum); a number of British *Culicidae* from Mr. Bradley and Mr. Verrall, and numerous other smaller lots, which have been of great help to me.

The collections received officially by the Director of the Natural History Departments, British Museum, are acknowledged in the Appendix, together with the names of the collectors.

The dates recorded after each collector's name are those of the communication sent with the specimens and printed on the labels.

There are still several districts from which we have absolutely no specimens and from which I know of no records of *Culicidae*, but which are sure to exist in numbers. Amongst the most important places so far unworked is the Pacific coast of South America, where we may expect many new species to be found. But little collecting has been done on the Pacific coast of North America. Practically nothing is known of the Western Australian forms, of those of the Cape and of the interior of South America. No new material has been received from the Malay Archipelago.

By far the greater number of specimens received have been those found in and around the habitations of man. There are probably still a great number of species to be found deep in woods and forests, purely sylvan species, especially amongst the *Megarhinas*, *Sabethes*, and *Wyeomyias*, and probably several new genera will be found on searching such localities. A collection, for instance, recently received from Trinidad, collected in forest growth and in cocoa plantations bordering the forests, did not contain a single species previously sent from the West Indies or South America, and contained a new genus (*Trichoprosopon*). Before this I had thought the West Indian species were exhausted.

Although these sylvan species are not of so much importance economically, they are nevertheless of interest and scientific value, and it is hoped collectors will avail themselves of opportunities of procuring *Culicidae* in distant inland and uninhabited parts of the various continents. I may here point out that *Culicidae* need not necessarily be pinned when fresh. When travelling and collecting, and time and space are of importance, mosquitoes may be collected in pill-boxes and kept firm by medicated cotton wool. Glass topped boxes are best, the gnats being placed on the glass and then a plug of wool placed on them. I have found they travel well this way, and keep free from mites, &c.

The chief object of this work is to point out the different groups and species of mosquitoes, so as to help that large body of medical men who are working at such diseases as malaria, yellow fever, &c., to attain to precision in the accounts and reports that they issue of the various experiments conducted with these insects. That certain species only of various genera carry the germs of certain diseases is probable, and thus it is important that the species as well as the genus should be identified. It is not enough to say that *Anopheles* carries malaria or exists in this or that place: we must note what species of *Anopheles* occurs. Moreover, I think much further investigation is required before we can place the blame of malaria-carrying on *Anopheles* alone. Other genera must be experimented with. There is nearly as much difference between *Culex* and *Stegomyia*, or *Culex* and *Panoplites*, as between *Culex* and *Anopheles*. In regard to the separation of numerous species previously included in *Culex* so as to form the genus *Stegomyia* there seems to be more justification than is afforded by structural difference alone: it appears that the two series of species differ in life-history. Yellow fever seems to have been traced to a member of the genus *Stegomyia*, and not to a typical *Culex* or *Anopheles*.

*Stegomyia fasciata*, Fabricius, is chiefly abundant where yellow fever occurs, writes Dr. Lutz, who has also come to the same conclusion regarding its relation to that fever as the American Commission in Cuba.

This work is only in an embryo stage, and some will certainly have to be remodelled. The time at my disposal has been so limited that I have been unable to go fully into such subjects as the variability of *Culex fatigans*, Wiedemann, and the complete synonymy of all the species. The non-piercing-mouthed group, *Corethrina*, I have paid little attention to: a few rare species that I have seen have been redescribed and figured; but I have neither had sufficient material nor time to remodel the two genera *Corethra* and *Mochlonyx* included in the group, nor have I seen the majority of them. Moreover, I feel very uncertain as to their true position. There are certainly characters in them common to the *Culicidae* and *Chironomidae*, and certain affinities to the *Tipulidae*, and I think their separation as a distinct family would be more satisfactory than their inclusion here.

In conclusion, I must express my thanks to the Director of the British Museum (Professor E. Ray Lankester), for his general help and suggestions; to Mr. Waterhouse, of the staff of the

Museum; to Captain James, I.M.S.; Captain Cornwall, I.M.S.; Professor Howard, Professor Poulton, Dr. Sharp, Mr. Verrall, Mr. Bradley, Dr. Grabham, Dr. St. George Gray, Mr. Froggatt (Government Entomologist, New South Wales), Senhor Moreira, Major Ronald Ross, Dr. Lutz, Dr. Chalmers, Dr. Daniels, Dr. Bancroft, and others, for the various notes and help generally given me.

Beyond all I am indebted to Lieut.-Col. Giles, I.M.S., who placed all his MS. notes of his admirably compiled work on mosquitoes in my hands long before its publication, and who has constantly been sending me fresh material to incorporate in this work, and notes and papers of great value during his prolonged service in India.

The majority of the plates have been prepared from carefully executed drawings by Miss C. Beard, who has devoted much time and trouble to this work, which has been one of great difficulty. So carefully and beautifully have they been executed that scarcely any have had to be returned for alterations. The larger and more pronounced *Megarhinas* and a few others have been drawn by Miss Fisher with considerable skill. Lastly, I must express my thanks for the great trouble taken by Mr. Hammond in preparing microphotographs of some hundreds of preparations; the figures of wing scales being collotyped from his negatives, whilst most of the wings have also been reproduced from them.

Fred. V. Theobald.

British Museum (Nat. Hist.),
*September 1st*, 1901.

## NOTE A.

DOWNING STREET,
*6th December*, 1898.

*Sir*,

*In my Circular despatch of the 19th of August last, I referred to an intended investigation of Malaria.*

*A Commission has now been appointed for the purpose and is about to proceed to Africa.*

*The Commissioners will report, from time to time, to a Committee appointed jointly by the Royal Society and myself, who will exercise a general supervision over the enquiry.*

*It has been suggested by this Committee, that, in view of the possible connection of Malaria with mosquitoes, it is desirable to obtain exact knowledge of the different species of mosquitoes and allied insects in the various tropical Colonies. I will therefore ask you, if there are facilities for the purpose, to be good enough to take the necessary steps at your early convenience to have collections made of the winged insects in the Colony which bite men or animals.*

*I enclose a printed copy of directions which have been drawn up by the British Museum for the guidance of those who may be employed on the work, and would add that several specimens of each kind of insect should be obtained, and that they should be sent direct to the British Museum (Natural History), Cromwell Road, London, S.W., to be examined and classified. A first series of the specimens will be retained by the Museum, whilst the duplicates will be available for distribution as may be desired.*

*As the question of the scientific investigation of Malaria is one to which I attach great importance, I trust that every effort will be made to carry out as speedily and as thoroughly as possible the directions contained in this despatch.*

*I have the honour to be,*

*Sir,*

*Your most obedient, humble Servant,*

J. CHAMBERLAIN.

*The Officer Administering*
*the Government of*

## NOTE *B*.

### HOW TO EXAMINE AND MOUNT A MOSQUITO.

The differences between many species of mosquitoes are often microscopic, and cannot be detected unless the specimens are critically examined under at least a two-third power. In many cases dissection is necessary, for the ungues, which can only be properly examined when mounted in xylol balsam, often separate two closely allied insects. In fact, ordinary museum specimens of obscure species are generally valueless in this family of Diptera, as I believe they will also prove to be in the case of the *Cecidomyidae* when that family has been properly worked out.

One great difficulty in describing *Culicidae* is the varied play of colours seen in different lights, especially when examined under the microscope and in bright sunlight. Dusky black or brown appears violet and purple under the lens, the brown and black scales of the legs often assume a bronzy or ochraceous hue in reflected light. The colours of the paler scales also alter at death, and under various conditions of death; white scales in the abdominal banding may sometimes be creamy, at others dull ochraceous, and also vary in colour according to the rays of light that strike them; ochraceous scales, however, never fade to white except in very old specimens exposed to sunlight; the golden scales often seen on the occiput fade after a time, and may become dull golden or even grey in hue.

A mosquito should be held in all manner of positions before it is described or when identifying it; for instance, in the genus *Uranotaenia* a good specific character in some species is to be found in the scales at the base of one or more veins of the wings, which are often unnoticeable unless the microscope is employed and the wings examined in different lights, when peculiar form and characteristic colouring may be detected.

After examining some thousands of specimens I have come to the conclusion that the scales form the most, and in fact in some groups, the only reliable generic and specific distinctive characters. By this means alone I have been able to separate many species with superficial resemblances and yet quite specifically distinct.

To properly examine and identify any species of mosquito some specimens must be looked at under a two-third power for scale structure, and others dissected, the wings mounted dry and the ungues in xylol balsam. Unless this is done endless confusion will ensue and wrong determinations will be made. Many species can be identified by scale ornamentation alone. To examine a specimen so as to show its scales, the following method of mounting should be employed : Every species should be pinned in three positions, so as to show (i) the dorsal, (ii) the ventral, and (iii) the lateral aspects. The insects may be killed either in cyanide of potassium bottles, by chloroform or sulphur fumes,

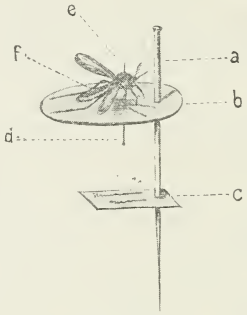



Fig. 1.
Method of setting a gnat.

a, pin through disc (b) ; c, label for date, locality, &c. ; d, No. 20 pin through disc (b) and gnat (f) ; e, point of d through thorax of gnat.

or by tobacco smoke. Cyanide of potassium and chloroform are recommended because changes in coloration have been noticed when both sulphur and tobacco smoke have been used.

The insect should be pinned as soon after death as possible with a No. 20 silver pin (Fig. 1, d) passed through a card disc (b), the pin being slightly nearer one end of the card than the other, to allow for the length of the legs behind. Before putting the fine silver pin through the card disc a puncture should be made, so as to break the surface, otherwise the pin will crinkle up. Date and place of capture and a numeral should be written on the disc, and any notes, with corresponding number, sent with the specimens, especially observations regarding their habits and breeding-

grounds. The specimens should be pinned, as shown in Fig. 1, through the mesothorax (e), the point of the pin not projecting more than 2 mm. above the surface of the thorax, so as to allow the lens to be brought close to it during examination. A stiff pin (a) should then be put through the disc near the edge, by means of which the specimen may be pinned in the cabinet or store-box. When required for examination the disc and insect can be taken off the large pin and placed on a piece of thick cardboard perforated in the middle (x), to allow the disc (b) to set flat, so that the object can be focussed under the microscope (Fig. 2). I have found that all the *Culicidae*, except *Psorophora*, *Mucidus* and the *Megarhinus*, are not at all brittle, and can be safely removed, as described above, without any damage being done. In all cases the detailed descriptions

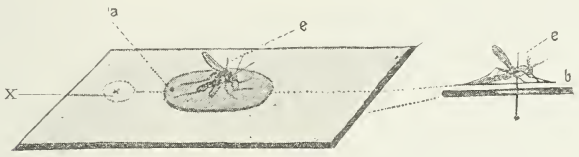



Fig. 2.
Method of examining a gnat under microscope.
x, circular hole in cardboard ; other lettering as in Fig. 1.

given in the work have been drawn up in this way, a two-third power on one of Swift's microscopes being used.

In using the dispositions of the cross-veins, the relative length of the fork-cells, their stems, &c., great care must be taken, no relative length should be given from a museum type. It is surprising how the least unevenness distorts the appearance of the neuration. Every wing, to be accurately described, should be mounted flat between an ordinary glass slide and an oil immersion cover slip, so that no misjudgment can be made.

By far the best way is to mount the wings dry and have them photographed, so that measurements can be made.

The exact measurements are, however, valueless in some species, for I find (vide *Culex pipiens* and *C. fatigans*) that there is some considerable variation even in specimens from the same batch of eggs.

For photographing the scales the wings must be mounted

in xylol balsam, the preparation being made as flat as possible. Exactly the same applies to the palpi as to the wings, for the number of joints cannot be made out from a museum specimen, the articulations being obliterated by scales. The scales have to be removed and the palpi mounted in balsam before the number of joints can be ascertained. There are often notches in the palpi, which may be rudimentary or degenerating joints, but which are certainly not existing articulations. These often appear as such, however, in specimens in which the palpi are covered with scales.

# LIST OF ILLUSTRATIONS IN VOL. I.

# A MONOGRAPH

OF THE

# CULICIDAE OF THE WORLD.

## THE STRUCTURE OF A TYPICAL MOSQUITO.

The mosquitoes or *Culicidae* belong to the order of insects known as Diptera. The essential character of this order is the presence of only two wings, the second pair being represented by a pair of club-shaped processes called "balancers" or "halteres." Dr. Sharpe* describes the order as possessing "two membranous wings, mouth suctorial, metamorphosis great," and this is all that really need be said of the order of "two-winged flies."

All that is necessary here is to point out the general structure of a typical member of the family *Culicidae* that is included in this large, neglected and yet most important order of the *Hexapoda*. There are some other diptera sometimes confused with them, such as the Midges, *Chironomidae*, the Gall Midges, *Cecidomyidae*, and a few others referred to on page 91.

I have not entered into the minute structural detail, which is not essential for the knowledge required for the identification of these insects. For minute detail of the structure the reader is referred to the writings of Hurst, Dimmock, Giles, and others, whose works and papers will be found tabulated at the end of this monograph.

As in all other hexapoda, so in the mosquito, the insect is divided into three regions: (i.) the head; (ii.) the thorax; and (iii.) the abdomen. To the first two divisions are articulated various appendages—sensory and masticatory to the head, ambulatory to the thorax.

* Camb. Nat. Hist. Ins. pt. i. p. 173.

(1.) **The head** (Fig. 7, III.).—The head is joined to the thorax by a narrow neck. It varies greatly in form in different groups, but its general structure is the same throughout all the genera of the family *Culicidae*.

That portion of the head lying nearest the neck is spoken of as the *occiput* (Fig. 7, III. oc), and is always more or less clothed with scales of various forms, the hindermost portion of the head being known as the *nape* or *cervix* (n); in front the major portion is taken up by the large compound eyes, which may or may not meet in the middle line; the space between the eyes and antennae is called the *frons* (f), whilst the space directly between the eyes at the isthmus joining the frons and occiput is called the *vertex* or *crown* (v); the part of the head that lies on the side beneath the eyes is called the *gena* or cheek; in front will be seen a more or less firm chitinous prolongation, the *clypeus* (Fig. 7, III. c, and Fig. 3). The compound eyes are

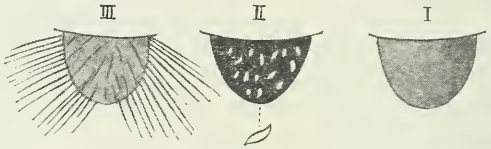



Fig. 3.
Types of clypeus.
I. *Culex*. II. *Stegomyia*. III. *Trichoprosopon*.

large and usually reniform, surrounding more or less the base of the antennæ, and are usually brilliant in colour when alive; no ocelli can be detected.

The antennae (Fig. 7, an) arise from the frons; the basal joint (f) is large, round and may or may not be provided with scales; this basal joint is cup-shaped, and in it fits the second antennal joint, which may be long or short; in the female the antenna (Fig. 12, 1) will be found to be made up of fourteen joints, the bases of the joints being constricted and usually paler in hue; just above the base or in the middle of each joint arises a band of long, moderately thick *verticillate hairs;* sometimes besides these, each joint has numerous smaller hairs, or a second row of smaller verticillate hairs; in the ♂ the bases of the joints are more oval and swollen, and the last two joints are very long, whilst the verticillate hairs are more dense, and are spoken of as being *plumose*.

The mouth of the *Culicidae* consists of a distinct proboscis composed of the following eight pieces:—The upper lip and epipharynx; two lancet-like pieces, the mandibles; two other delicate needle-like organs barbed at their summits, the maxillae; a thin tubular thread, the so-called *hypopharynx*, and the lower lip. As these parts are of little specific importance they are only briefly referred to.

The labrum, or upper lip, extends nearly to the tip of the proboscis, forming an upper sheath for the lancets, and has

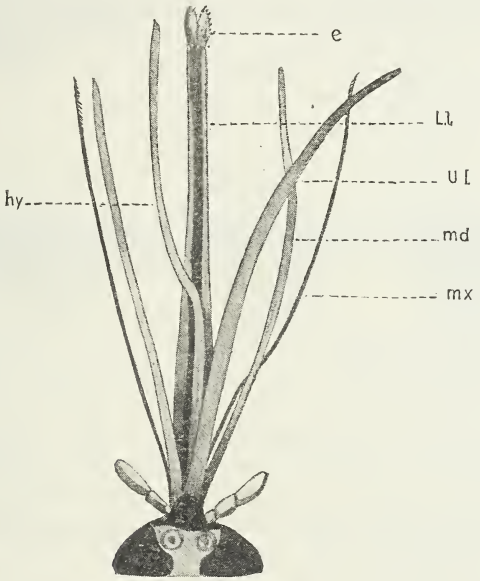



Fig. 4.

Diagram of the mouth-parts of a ♀ Mosquito.

mx = maxillae; md = mandibles; u. l. = upper lip and epipharynx; l. l. = lower lip; e = labella; hy = hypopharynx

closely united to it a piece, the *epipharynx** (Fig. 10); the mandibles and maxillae form four lancet-like pieces beneath it, and between them and the upper lip lies the hypopharynx, a small needle-like thread, connected with a poison gland (Fig. 5, c) at its base; the whole of the above are enclosed by the canal-shaped lower lip, which, however, is open above, the opening being closed by the upper lip; at the end of this lower canal

* The term epipharynx had best be abolished, as it is really part of the upper lip.

are two labellae, which represent the labial palpi; these are in the form of two jointed spatulate valves. During the act of piercing the skin, all the mouth-parts but the lower lip (Fig. 5, Lp) are inserted; the lower lip, or labium, bends and guides the other mouth-parts into the skin. The blood is drawn up the

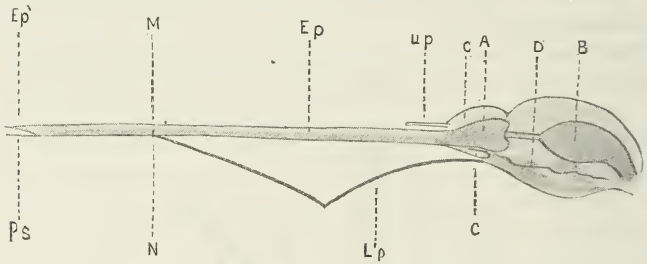



Fig. 5.

Section view (diagramatic) of part of a Mosquito mouth, &c. (when piercing the skin).

Lp = lower lip; MN = line of skin; Ep = labrum-epipharynx; Ep' = point of labrum-epipharynx; C = clypeus; A = bulb of epipharynx; B = suctorial bulb; C=poison gland; D=duct; Up=detached labrum (cut off); Ps=hypopharynx.

(Maxillae and mandibles not shown, upper lip really united to epipharynx.)

upper lip, the tube being formed by the upper lip, and closed below by the hypopharynx. Attached to the maxillae are the two maxillary palpi (Fig. 7, III. p), which vary in each group, and are of specific but not always generic value; they may be short in the ♀ only and long in the ♂ (*Culex*), or long in both sexes (*Anopheles*), or short in both sexes (*Aedes*); the joints vary from two to five, and are covered with scales, like the proboscis. There are also constrictions which are taken by Arribalzaga and others to represent joints (*vide* Fig. 11).

(2.) **The thorax** is mainly composed of the middle division or mesothorax (when the thorax is spoken of the mesothorax is always inferred, unless otherwise stated). Although the major area is taken up by the mesothorax, both pro- and metathorax are represented.

The prothorax (Fig. 7, I. pro) is present, more or less developed, in all the *Culicidae* I have examined, as two so-called "prothoracic lobes" — two swellings between the head and mesothorax—in some these lobes are densely scaled and large, in others minute, nude, or bristly. The mesothorax (mes) is large and convex, and forms the chief region of the mid-body; behind it, or between it and the metathorax, is divided off by

a suture a portion of the mesothorax called the *scutellum* (sc). The scutellum is usually trilobed, a central and two lateral lobes (*Culex*, &c.), but in *Corethra* it consists of a single piece only; its posterior border is always provided with a row of large and some small bristles—the "posterior border bristles"—which are in some cases of specific value in regard to their number on the mid lobe; there are also numerous bristles on the lateral lobes; this portion of the mid-body is more or less covered with scales; the metanotum (Fig. 6) is the smooth, very convex, nude, back portion of the thorax, large and distinct in *Culex* and *Anopheles*, but more or less hidden under the mesothorax in *Megarhinus**; in one genus, *Wyeomyia* (Fig. 6, II.), it carries a few chaetae, and in *Trichoprosopon* (III.), scales as well as chaetae.

The sides or pleurae can also be seen to be composed of three chief parts, each marked by the coxae of the three pairs of

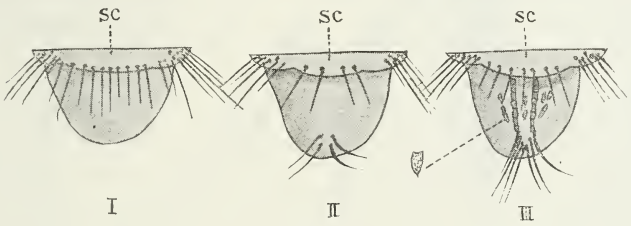



Fig. 6.

Types of metanotum.

I. *Culex*. II. *Wyeomyia*. III. *Trichoprosopon*. sc = scutellum.

legs. There is present in front of the fore coxa an oval scale which covers the prothoracic spiracle, not easily seen however; another spiracle exists on the mesothorax in front of the origin of the wings; I have never seen the metathoracic spiracle, but it is said to exist; the *mesopleura* is the space between the fore and mid coxae which carries the fore wing, the mid leg, and a spiracle; the *metapleura* lies behind, and carries a hind leg and haltere.

(3.) **The abdomen** is more slender than the thorax, and is narrower and more pilose in the ♂ than in the ♀. It consists of nine segments; each segment is composed of a dorsal plate or tergum, and a ventral plate or sternum,

* Usually spelt *Megharina*. The name originally given by Desvoidy is spelt *Megarhinus*. The former had previously been used for some of the *Tipulidae*.

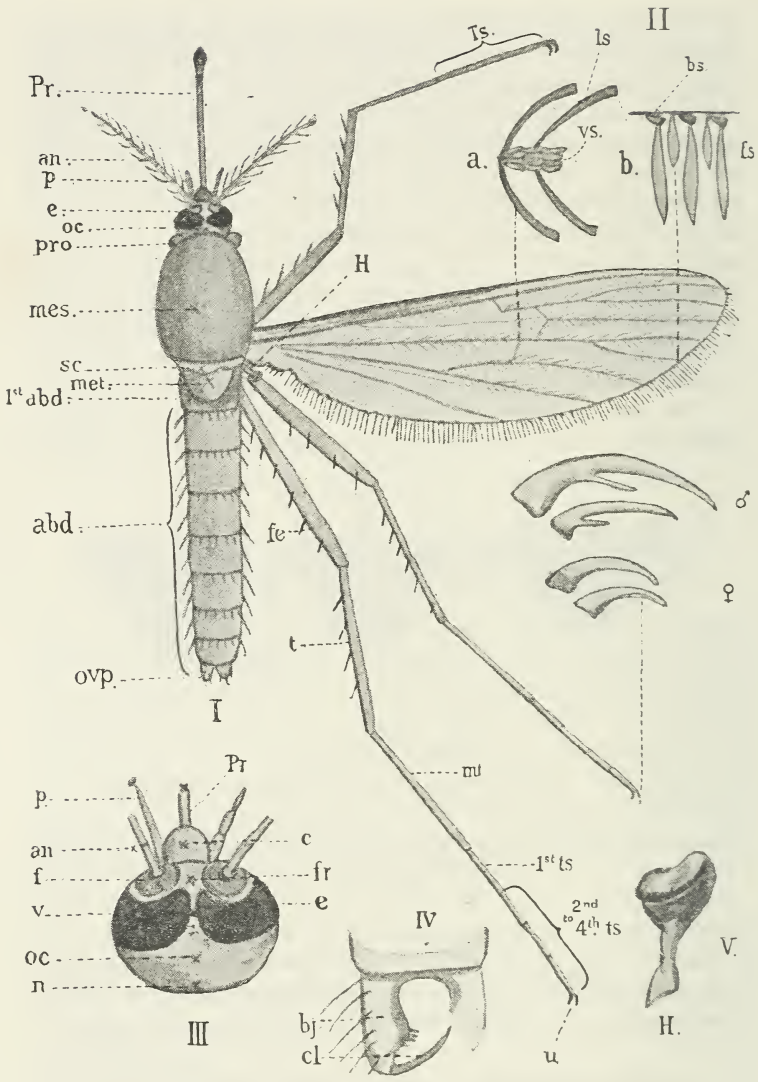



Fig. 7.

Anatomy of a typical *Culex*.

I. Pr., proboscis ; an., antennae ; p., palpi ; e., eyes ; oc., occiput ; pro., prothoracic lobes ; mes., mesothorax ; sc., scutellum ; met., metathorax ; 1st abd., first abdominal segment ; abd., abdomen ; ovp., basal lobes of ♀ ; H., haltere ; fe., femur ; t., tibia ; mt., metatarsus ; 1st ts., first tarsal ; Ts., tarsi ; u., ungues. II. Wing scales : a., of veins ; b., of fringe ; vs., median scales ; ls., lateral scales ; bs., border scales ; fs., fringe scales. III. Enlarged head of ♀ : Pr., proboscis ; p., palpi ; an., antennae ; f., basal lobe of antenna ; fr., frons ; oc., occiput ; c., clypeus ; e., eyes ; n., nape ; v., vertex. IV. Male genitalia : bj., basal lobe ; cl., clasper. V. Haltere (H).

united laterally by the soft spiracular membrane, in which the air-holes are placed. The last two segments have the genital and anal openings. The anus is on the venter of the eighth segment; the genital opening on the ninth; the upper part of the latter (the tergum) is often hidden in the eighth segment.

The genitalia are attached to the ninth segment, and consist of two various-shaped lobed appendages in both sexes, but in the male the basal lobes are provided at their apex with a clasper (Fig. 7, IV.), whilst in the ♀ they end in a bristly extremity. The ♂ genitalia are of specific importance. The first abdominal segment is of some service in identifying species, and is provided with flat scales (*Culex*, &c.) in various positions, and is always densely hairy.

The wings of the *Culicidae* have the veins clothed with scales which vary in different groups; the typical venation is given on page 18. The halteres (Fig. 7, V. H) have the knob mostly cup-shaped and scaled, and present so few characteristics that no further reference need be made to them.

The leg of *Culex* consists of a small coxa and trochanter at the base, the former often with a patch of scales; the femur and tibia, which are usually much about the same width and length and offer but few specific characters, although in a few cases the femur becomes much enlarged (*Anopheles* and *Uranotaenia*); the tibia is followed by the *metatarsus*, sometimes called the first tarsal joint; the metatarsus, which is the term I have adopted for the long joint following the tibia, is of specific value in regard to its proportionate length with the tibia in some species in the hind legs; the true *tarsus*, or foot, consists of four joints, which usually decrease to the apex, but which are often modified in other ways, especially in the male. The *ungues* are hooked claws at the end of the last tarsal joint; they may be equal and simple in the ♀, or may have a single tooth; in the ♂ those of the fore and mid legs are usually unequal and toothed in various ways; the hind are small and equal, and are usually simple. After studying a number of types, I have come to the conclusion they are of great specific value, but not of generic value, hence genera based largely on their structure have been omitted; when untoothed they are spoken of as simple, when single-toothed uniserrated, and when with two teeth, biserrated; in a few cases triserrated ungues exist. In connection with the ungues there also exist in a variety of forms the pulvilli and a plumose empodium.

## SCALES.

After examining some thousands of specimens of *Culicidae* sent to the Museum, to myself, and in private collections embracing all the genera, I am convinced that the scale structure is one of the most important characters for both generic and specific distinction and characters which cover a greater number of species than any other, such as the formation of the ungues or palpi, which vary materially in closely related species ; these latter characters are of specific value, but I am convinced they can go no further, hence several of Arribalzaga's genera have been here dispensed with ; even *Ochlerotatus*, which I retained for some time, has had to be given up because a very closely related species, which, if the genus was retained, would have to be excluded from the company of undoubted relations.

The genus *Culex* has previously contained all those *Culicidae* in which the palpi in the ♂ are long and in the ♀ short ; such are the number of *Culicidae* having this character in common that I searched for some other character by which the unwieldy genus could be subdivided : palpi, ungues, and halteres were alike examined, but nothing definite could be obtained from them nor from the ♂ genitalia. Strange to say, the halteres, which one would expect to show great variation owing to their being degenerating organs, are subject to little structural variation in this family of *Diptera*.

On the other hand, the structural peculiarity of the scales is very persistent in certain groups, for instance, in *Megarhinus*, *Aedes*, *Mucidus*, &c. In certain closely related species the arrangement of those on the head and wings alone enables the species to be separated. Scales form structural characters, and thus are of generic and specific value, and as such I have used them in this work. A short account of the various forms found is thus essential.

(1.) **Scales on the head.**—On the head of a typical *Culex*, such as *C. pipiens*, L., will be found three forms of scales ; on the occiput are rather narrow curved ones, which stand more or less from the surface and which lie in no definite order ; these (Fig. 8, 5) are spoken of in the text as "*narrow curved scales*," and are usually golden, brown, or creamy colour. As far as I

have observed, these curved scales show no play of colours, such as we see in many forms of squamae.

Dotted over the occiput, especially towards the nape, are upright scales with long stalks, expanded fan-like heads, which are more or less pointed at each side; these I have called "*upright forked scales*" (Fig. 8, 8 and 9). Some considerable minute variation is presented by these; some have the apex decidedly forked and smooth, others only slightly so, and in *Aedeomyia* the apical border is crenulated to a marked degree. "Upright forked scales" occur only on the head, and are usually dark-brown or black in colour, but may in some species be white, creamy, or yellow; they are fixed by a narrow, slightly expanded base to the surface of the head. Thirdly, on the *Culex* head will be found flat scales placed laterally; these "*flat scales*" have a narrow pointed base, and the apical border either flat or slightly convex, and may have the border smooth, crenulated, or with distinct points (serrated) projecting from it. These flat scales are closely applied to the surface, and overlay one another like the slates on the roof of a house; they vary greatly in colour, and many of them show the most wonderful play of colours, owing to the refraction of the rays of light. *Culicidae* in which the ♂ palpi are long and ♀ short, and which have the head ornamented with these three forms of scales (Fig. 9, B), are retained in the genus *Culex* for reasons given in subsequent pages.

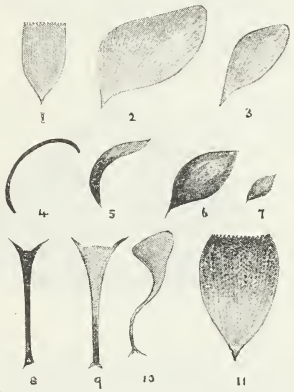


Fig. 8.

Typical scales.

1. Flat scale from abdomen. 2. Broad wing scale from *Panoplites*. 3. Broad wing scale from *Aedeomyia*. 4. Curved hair-like scale. 5. Narrow curved scale. 6. Flat spindle-shaped scale. 7. Small form of 6. 8 and 9. Upright forked-scales. 10. Twisted upright scale. 11. Inflated parti-coloured scale.

In many *Culices*, such, for instance, as *Megarhinus*, *Uranotaenia* and *Toxorhynchites*, only flat scales are found on the head, curved and upright forked ones being entirely absent, the whole head being clothed with a complete armour of flat overlapping scales (Fig. 9, D and K).

A number of the species formerly included in the genus *Culex* have this character, namely, the head clothed with flat

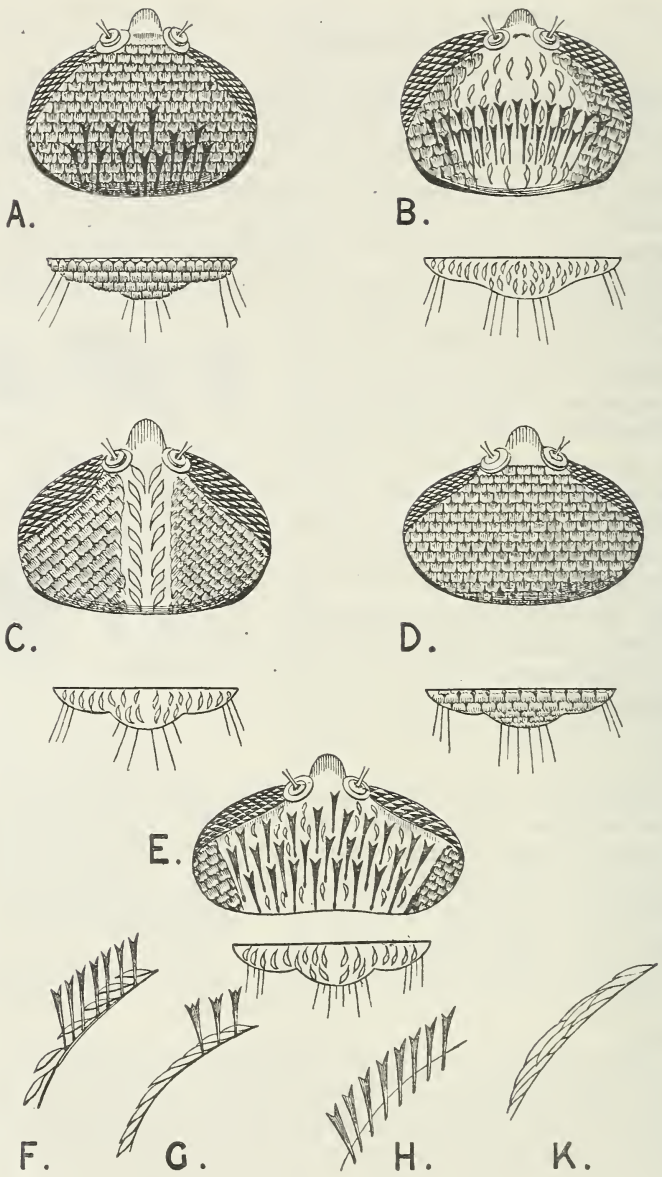



Fig. 9.

Cephalic and scutellar scale ornamentation.

A. *Stegomyia*. B. *Culex* (type). C. *Aedes*. D. *Megarhinus*. E. *Anopheles*. F. Side view of *Culex*. G. of *Stegomyia*. H. of *Anopheles*. K. of *Megarhinus*.

scales, no curved narrow ones being present, but differ from *Megarhinus* in that they have upright forked ones as well; this head ornamentation is persistent and very striking, and I have taken it as a character by which certain members of the old genus *Culex* can be isolated from that genus and grouped together in the new genus *Stegomyia* (Fig. 9, A). The cephalic scale structure does not require a high magnifying power to discern, it may be even made out by means of a strong Coddington lens, although microscopic examination is essential for every species for its proper identification and description. By this and other characters a number of closely related *Culices*, of which *C. fasciatus*, Fabricius can be taken as the type, are grouped together.

(2.) **Scales on the thorax.**—The thoracic scales are in five distinct forms:—

($\alpha$) narrow hair-like curved scales (Fig. 8, 4).
($\beta$) narrow curved scales (Fig. 8, 5).
($\gamma$) spindle-shaped scales (Fig. 8, 6).
($\delta$) flat scales (Fig. 8, 1).
($\epsilon$) long twisted scales (Fig. 8, 10).

The first ($\alpha$) are very thin and always curved, and often form a dense felting over the mesothorax; in colour they are mainly brown, golden-brown, reddish-brown, golden or yellowish, and they usually lie all in one direction.

The narrow curved scales ($\beta$) may occur all over the mesothorax and scutellum, or they may be noticed at the sides of the mesonotum and in front of the scutellum where the hair-like scales predominate.

The spindle-shaped scales ($\gamma$) lie more or less closely applied to the surface, irregularly scattered about, and are usually bronzy or white in colour and never form a complete thoracic covering. A small, rather short variety occurs in the genus *Megarhinus;* they are most typically exhibited in *Culex vigilax*, Skuse.

Flat scales resemble those of the head, and often occur as a covering to the scutellum (*Stegomyia*) (Fig. 9, A and D) and over the roots of the wings and prothoracic lobes (*Megarhinus*); they may be long or short, the long ones being found on the scutellum, the smaller on the sides of the mesothorax.

The long twisted scales are peculiar to the genus *Mucidus;* they have long stalks, more or less bent, and widely expanded

heads, and are usually white or pale yellow in colour, and give a mouldy appearance to the insect upon which they are found.

(3.) **The scales on the abdomen.**—In all *Culices*, save a few *Anopheles* and *Corethra*, the abdomen is densely covered with overlapping flat scales (Fig. 8, 1), which are iridescent and often show a marked play of colours. In the genus *Anopheles* they seldom occur on the abdomen, but a few small flat ones occur in patches in *A. Sinensis* and its varieties, and in *A. Pharoensis* the abdomen is covered with a thick felting of narrow curved scales. These abdominal scales often appear black or brown when the insect is held in one direction (with head facing the light), purple or violet when held in the reverse direction, as well as showing other colours often of great brilliancy.

(4.) **Scales on the wings.**—In all the genera of *Culicidae* scales cover more or less completely the veins of the wings, except the cross-veins, which are nude. The wing scales are usually arranged in a double row along each vein, being normally small, moderately broad flat plates lying side by side ; besides these, many of the veins, in some species all of them, have lateral scales on each side of the veins as well as the central ones ; these lateral scales are of very varied form, usually they are long and thin, and may be either straight or curved, present on one or both sides of the veins ; in some genera they are spatulate. (*Vide* Plates A to E.)

In the genus *Panoplites* many of the scales assume a very marked appearance, being very large and flat and much expanded, the apical border being convex (Fig. 8, 2) ; this large squama also occurs in a slightly modified form in *Aedeomyia* (Fig. 8, 3), where the wings are densely covered with broad squamae more asymmetrical and narrower than in *Panoplites*. In the genus *Mucidus* the wing scales are parti-coloured and pyriform or inflated (Fig. 8, 11), thus differing from any other scale found in this family. In *Taeniorhynchus*, as I retain the genus, the scales are dense, all of similar rather broad and elongated shape.

The fringe of the wing typically contains three sets of scales, two kinds of so-called " fringe-scales " and a third set of so-called " border scales " (Fig. 7, II. b).

The " fringe-scales " are of two sizes, being fitted to the edge of the wing by a narrow stalk, the scales being long, narrow and pointed towards the tip, the smaller ones being of very similar

shape and occur as a layer beneath the longer ones; the stalk of these fringe-scales often reaches a considerable length. "Border scales" (Fig. 7, II. bs.) are small, and resemble the "flat scales" of the head and body but are smaller and narrower; in some cases "border scales" are very narrow and very small, in others (*Panoplites*, &c.) they may be spatulate or asymmetrically broadened as those on the veins in that genus.

The scales of the wings are usually brown, yellow, or white, but in *Megarhinus* they may be azure blue or green, whilst in *Mucidus* they are parti-coloured—half dark and half white—a character seen in no other genus; in certain *Anopheles* (*A. Grabhamii*) they are jet black. The fringe-scales are often all one colour, but they may, as in *Mucidus* and *Anopheles*, be alternately dark and pale in definite tracts; in a few *Culices* the fringe appears white in some lights, dark in others; those on the basal lobes of the wing vary in form and are often dark.

(5.) **Scales of the legs.**—In nearly all members of the family the legs are clothed evenly with flat scales, which form a complete covering; these leg scales often exhibit marked metallic hues in certain lights and sometimes form dense tufts. In a few cases the leg scales become much narrowed, and form hair-like scales which may occur in tufts as in *Sabethes* and *Eretmapodites*. In *Mucidus* and *Psorophora* the leg scales become elongated in places and stand away from the surface of the legs; in *Aedeomyia* they are still further modified, becoming elongated, with a thin stem and expanded apex.

(6.) **Scales on the proboscis, palpi and antennae.**—The scales on the proboscis are found only on the sheath, and are usually small flat scales, but in some *Anopheles* (*A. Sinensis*, &c.), they stand at an angle to the surface, in others the scales are absent. The palpi in some species, as *Culex* (*Janthinosoma*) *musicus*, Say, may be densely scaled so that the joints are not visible, or the scales may be closely applied to their surface or even absent. The basal joint and first two or three of the following joints of the antennae may also be scaled; in *Megarhinus* the second joint is densely covered, whilst in *Culex*, &c., only a few scales exist on the feelers.

**Coloration produced by scales.**—The squamae in this family, like those of the *Lepidoptera*, account for the colours of the insect.

When denuded, the surface of a mosquito is smooth, often shiny and either steely black, ferruginous, or yellowish grey in colour. The scales alone give the beautiful appearance to these insects. The genus *Megarhinus* shows the most brilliant colours, which vary in hue and intensity with every different ray of light that strikes them, making a description extremely difficult to compile. The colours produced by these scales are due entirely to the refraction of the rays of light, and not in any way to colour pigments, the scales being often quite transparent when detached and examined under the microscope; some few, however, that I have seen contain a brown pigment similar in colour to that of the spots on the wings in such forms as *Mucidus alternans*, Westwood, and some *Anopheles* a jet black pigment. In the following descriptions I have tried to point out some of the varied hues a species has when held in different positions, which must be an essential feature in the description of all *Culicidae*. In a casual description one would describe, say, the legs as black, reverse the insect and you will find them purple or violet.

## ADULT CHARACTERS OF THE FAMILY CULICIDAE.

The characters of the family *Culicidae* may be summed up as follows:—

Head small and more or less rounded, the occiput covered with scales; eyes reniform; ocelli absent; mouth in the form of a proboscis which is usually very elongated and formed of the following parts: (1) a long pointed upper lip or labrum, united with an accessory piece, the epipharynx; (2) a long gutter-shaped lower lip or labium, ending in two jointed spatulate labella which appear to be the labial palps; (3) two narrow needle-like mandibles; (4) two thin maxillae, ending in serrated or barbed edges; and (5) a single piece of extreme thinness, the so-called *hypopharynx*, the whole being enclosed by the upper and lower lips (Fig. 10). In one section the proboscis is short and fleshy

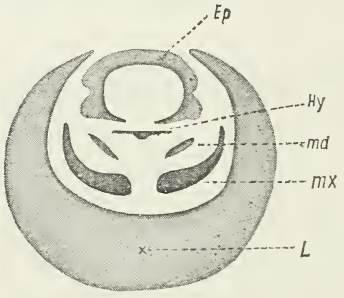



Fig. 10.

Transverse section of proboscis (after Dimmock).

*Ep.*, labrum-epipharynx; *Hy.*, hypopharynx; *md.*, mandibles; *mx.*, maxillae; *L.*, lower lip (labium).

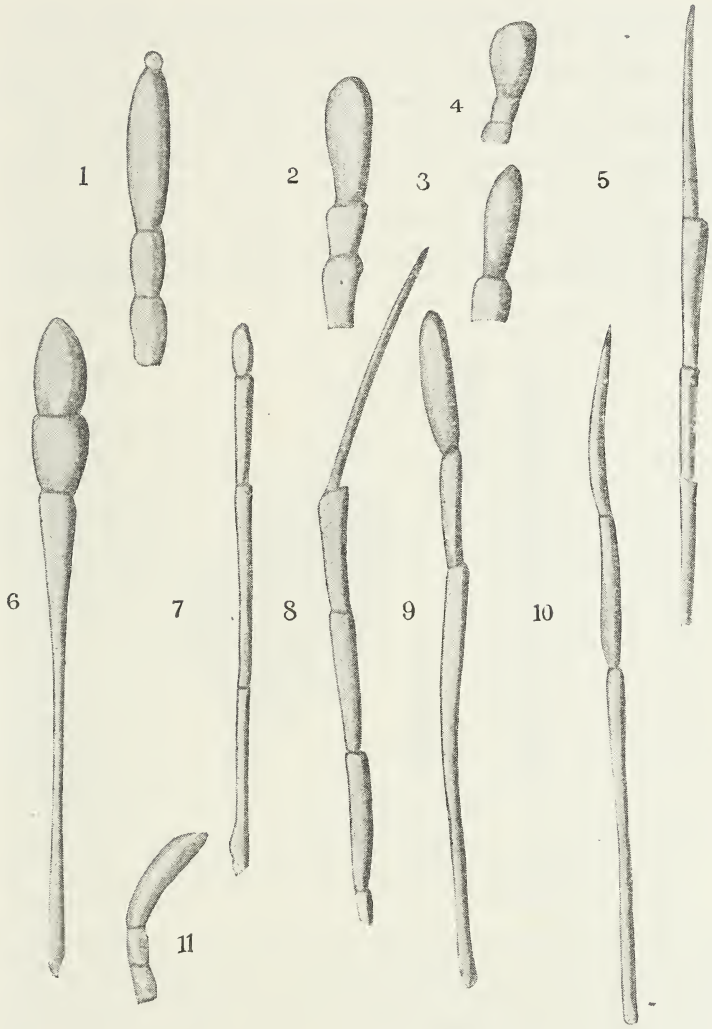



Fig. 11.

Male and female palpi of *Culicidae*.

1. *Culex nemorosus* (♀). 2. *C. pipiens* (♀). 3. *Aedes* sp. (?). 4. *C. annulioris* (♀). 5. *Megarhinus* (♀). 6. *Anopheles maculipennis* (♂). 7. *A. maculipennis* (♀). 8. *Megarhinus*, sp. (?) (♂). 9. *Culex annulatus* (♂). 10. *C. pipiens* (♂). 11. *Toxorhynchites brevipalpis* (♀).

(*Corethrina*) and nearly approaches the mouth of *Tipulidae*. The palpi (Fig. 11) may be long or short, and vary in the number of joints; in *Culex* they are short in the ♀, long in the ♂,

in *Anopheles* long in both sexes, in *Aedes* short in both sexes, &c.; the number of joints varies from two in *Aedes* to four in *Anopheles* and five in *Megarhinus*. Arribalzaga gives the palpi in *Aedes* as one-jointed; the basal joint, I fancy, was overlooked. In *Anopheles* the ♀ palpi are four-jointed, the ♂ three-jointed, but there exists in the base a small constriction which makes the ♀ appear five-jointed; in the ♂ constrictions also appear and make the palpi look six-jointed, but I prefer to look upon the ♀ palpi as four-jointed and the ♂ as three-jointed, the basal joint being very much elongated, whilst in *Megarhinus*

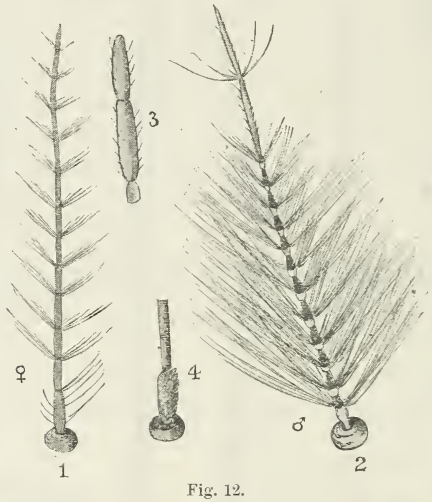



Fig. 12.

Antennae of *Culicidae*.

1. Antenna of ♀ *Culex*. 2. of ♂ *Culex*. 3. Apex of ♂ antenna of *Aedeomyia*. 4. Base of ♀ antenna of *Megarhinus*.

they are five-jointed in both sexes. In the ♀ *Culex* they vary from three to four (sometimes, owing to a constriction, five), in the ♂ three-jointed (five or six-jointed if we take the constrictions as representing articulations *). The antennae (Fig. 12) are plumose in the ♂, pilose in the ♀, fourteen-jointed in the ♀, fifteen-jointed in the ♂; the basal joint is globose and may be nude or scaly; the second joint may be swollen, elongated, or normal, and is usually more or less scaly; in the ♂ the last two joints are long and thin except in *Aedeomyia* (Fig. 12, 3).

* The subject of the palpi is a very complicated one, and will take some time to work out. Arribalzaga figures the constrictions as joints.

The thorax is chiefly composed of the mid-division, the mesothorax, which is large and convex; the prothorax is reduced to a pair of lobes—the prothoracic lobes—on each side of the mesothorax, between the head and the mesothorax.

The scutellum is very distinct, and may be composed of a median and lateral lobes, with a posterior border of bristles, or of a single lobe. The metanotum is well developed in all save *Megarhinus* and *Toxorhynchites*, where it is more or less hidden under the scutellum; it bears neither scales nor bristles, except in *Wyeomyia* and *Trichoprosopon*. The thoracic scales vary in the different groups; they are present on all parts save the metathorax (except *Trichoprosopon*), and may be either flat, narrow and curved or spindle-shaped. The abdomen joins the thorax closely, the first segment generally being more or less nude, but showing one or two patches of scales and numerous long hairs; the segments number nine, and may (*Culex*, *Megarhinus*) or may not (some *Anopheles*) be covered with broad or other scales, more or less hairy, especially in the ♂; male genitalia consists of a pair of large basal joints covered with scales and a thin nude terminal joint or clasper to each, which may be two-jointed; in the female the two anal lobes end in round, bristly, or scaly spatulate extremities. Wings with the veins covered and edged with scales of various forms, the membranous surfaces sometimes being hairy; the scales may be spread uniformly (*Culex pipiens*, &c.) or in groups, thus giving a spotted appearance to the wings (*C. annulatus*, &c.), or the wings may be coloured on the membrane (*Mucidus mucidus*, &c.).

There is always a border-fringe of scales which vary in form and arrangement; the costa is usually dark and may be spotted (*Anopheles*); the auxiliary or sub-costal vein joins the costa considerably before the apex of the wing, the first longitudinal near the apex; the second and fourth longitudinals are both forked, the forks forming the first sub-marginal (Fig. 13, D) and second posterior cells (G) respectively; these cells may be either long and thin (*Culex*, &c.) or very short (*Megarhinus*); the third long vein is simple, and is united to the second and fourth by the supernumerary- and mid-cross veins (y and z) respectively; the fifth long vein gives off an anterior branch at about half its length, forming a large anal cell (K), the anterior branch being united to the fourth long vein by the posterior cross-vein (*p*); the sixth long vein is simple and sinuous; the second and third long veins may be prolonged into the first basal cell, which is

usually large, but smaller in *Megarhinus*; the sub-costal transverse is always present but not always readily seen, whilst the second long vein is united to the first by the marginal transverse (*x*); there are one (*Culex*) or two (*Megarhinus*) indistinct incrassations of the wing membrane (*a'*) representing branches of the fourth trunk, which never reach the margin of the wing and are never provided with scales; in the ♂'s the fork-cells are usually much smaller than in the ♀'s (especially in *Culex* and *Anopheles*); the wings are recumbent in repose, and may or may not be longer than the abdomen.

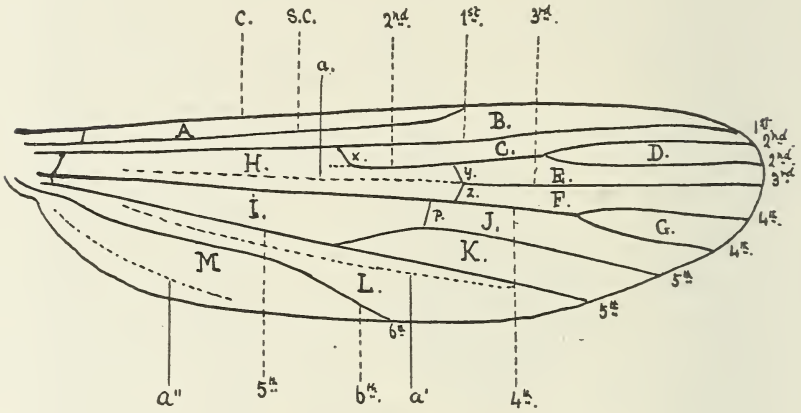



Fig. 13.

Venation of *Culex*.

c., costal vein; s.c., sub-costal; 1st to 6th, first to sixth longitudinal veins; *a*, *a'*, and *a''*, incrassations (*a'* called by Austen the 6th vein, *a''* the 8th); *y.*, supernumerary cross-vein; *z.*, mid cross-vein; *p.*, posterior cross-vein; A., costal cell; B., sub-costal cell; C., marginal cell; D., first sub-marginal cell; E., second sub-marginal cell; F., first posterior cell; G., second posterior cell; J., third posterior cell; K., anal cell; H., first basal cell; I., second basal cell; L., auxiliary; M., spurious cell.

In a pamphlet issued by the Museum, "How to Collect Mosquitoes," the wing venation of *Culex* is given as follows: the sub-costal is called the mediastinal, the second long vein is described and figured as issuing from the first, the third long vein as issuing from the second; the incrassation along the fifth is given as the sixth vein, the true sixth long vein is called the seventh, and an eighth long vein is shown where a fold sometimes occurs. The supernumerary cross-vein is taken to be part of the third long vein, and the middle transverse vein is called the anterior transverse.

The sixth and eighth veins in this nomenclature are really

only wing folds, the eighth seldom seen. Other folds like them also occur in various species on other parts of the wing; they are never scaled, are not of the same structure as veins, and cannot be looked upon as such. In a large number of *Culicidae* the third long vein passes some way into the basal cell, and certainly does not arise from the second long vein.

The legs are long, but not so long as in the *Tipulidae*, the hind metatarsus being usually long (except in *Mochlonyx*); the ungues are nearly always equal and small in the ♀, and may or may not be toothed; in the ♂ the fore and mid ungues are unequal and are toothed in various ways, but have rarely more than two serrations; the hind ones are always equal; the legs are scaly, except the coxae and trochanters, which are usually nude, but with occasional patches of squamae.

The chief characters by which the *Culicidae* are distinguished are—

(1) The piercing mouth.
(2) The scaled veins, head, thorax, body, &c.
(3) The venation composed of six distinct longitudinal veins and two prominent fork-cells, with their covering of scales, the costal vein being carried right round the edge of the wing.

## EGGS OF CULICIDAE.

From what little we know concerning the eggs of *Culicidae*, it appears that each genus has not only a differently formed egg, but often a different manner of depositing them. We know at least the ova of *Culex*, *Stegomyia*, *Panoplites*, *Anopheles* and *Corethra*.

The *eggs of Culex pipiens* (Fig. 15, c) are well-known natural history objects. They are laid on the surface of the water in boat-shaped masses, and were described first by Réaumur over one hundred and fifty years ago. All *Culex* (in the restricted sense) eggs are apparently laid in this way. The ova are oblong, slightly curved towards one end, and this end, which is narrowed and pointed, is placed upwards, so that when a number are joined together a concave "raft" is formed; at the lower end of each ovum is a kind of lid, really more a thinning of the eggshell, through which the larva escapes into the water. These groups, or "rafts," as they are popularly called, consist of from 200 to 400 eggs, which are held together by their sticky surfaces and are placed in

position by the aid of the gnat's legs. They are not very firmly united, and may be readily separated from one another, and fall apart directly the larvae have escaped. In length these "rafts" vary from one-fifth to one-third of an inch; the "rafts" float freely on the surface of the water. These egg masses are of irregular form, the most common being an elongated spindle-shaped mass (Fig. 15). In the case of *C. pungens* * they are laid, according to Professor Howard, in from six to thirteen longitudinal rows, with from three or four to forty in each row. The lower part of the "rafts" are freely submerged, the larger and thinner-shelled end of the eggs being in the water so that the developing embryos can obtain a supply of oxygen from it. It is almost impossible to keep these egg masses below the surface, as they are so buoyant. If they are kept completely immersed the larvae never develop. When first laid the ova are white, but they soon become grey in colour and at times have a greenish tinge. In the case of *C. pungens* they are dark greyish-brown at the tip, whilst the rest of the egg is dirty white.

*C. pipiens* ova measure 0·9 mm. in length, *C. nigritulus* 0·6, and according to Howard those of *C. pungens* (= *C. fatigans*, Wiedemann?) 0·7 in length and 0·16 in diameter.

As soon as the larvae escape from the lower end of the eggs the "rafts" break up.

From personal observations I find that the eggs of both *C. pipiens* and *C. nigritulus* are laid soon after sunrise and also at dusk, especially when the weather is warm and still.

Professor Howard also found that *C. pungens* laid its eggs in buckets placed out at nights, the eggs being found at eight o'clock in the morning, and, as he says, were probably laid in the early morning, before daylight; but the exact time of course was not noticed.

Giles † states that the eggs are laid between five and six in the morning, and that the larvae escape in two or three days. This latter point I have not found to be the case (*vide* p. 54).

The female whilst depositing her eggs settles upon some small twig or leaf, holding on to it by her fore and mid legs, crossing the hind legs behind her, and drops the eggs between them, guiding them into position by their movements.

The eggs of *Culex* vary slightly in form in the different species. The most common type in *Culex* is, however, narrowed gradu-

* Bull. 25, New Se. U.S. Dept. Agriculture. p. 23. Howard, 1900.
† Hd.Bk. of Gnats. p. 83.

ally at one end and more or less bluntly truncated at the other, the broad end terminating in a minute fine point in one species sent me by Dr. Daniels (Fig. 14, b).

**Stegomyia ova.**—The only ova of *Stegomyia* that have been observed are those of *S. fasciata* and *S. notoscripta*. The former are laid singly, according to Dr. Daniels and Major Ronald Ross, on the water. In form they are ovoid, rather more pointed at one end than the other, and are surrounded by a series of little air-chambers (Fig. 14, d). Skuse describes those of *S. notoscripta* as being laid in boat-shaped masses.

**Panoplites ova.**—The only observation I have on the eggs of this genus is sent by Dr. Daniels, who kindly allowed me to reproduce a photo of the ova of the "Filaria-bearing" *Panoplites* of Central Africa. The eggs, unlike *Culex*, are laid singly and are of different form, being sharply contracted at one end, which becomes narrowly pointed (Fig. 14, a). They drift together very much in the same way as the ova of *Anopheles*. We thus get a different method of oviposition in these previously called *Culex*, which adds another reason besides scale structure for separating them as a distinct genus.

**Anopheles ova.**—With regard to the ova of *Anopheles* we knew but little until Professors Howard and Grassi worked out the life-history of *A. maculipennis*. Just recently Nuttall and Shipley * have issued a valuable paper on *Anopheles maculipennis*, in which the egg and larva are well figured and described. There is little doubt, I fancy, but that the ova are always deposited as others of the *Culicidae* on water. Meinert says nothing of them. Major Ross, I believe, states that in India he found the female *Anopheles* depositing their eggs not in water but on hard surfaces, but this, I think, was under unnatural conditions. Dr. St. George Gray, writing from Castries, St. Lucia, says that, "On Monday, 27th of November, I found in the same pool neither larvae nor pupae, but only pupal skins. During this time there had been no rain. A few days later there were some heavy showers, and on Monday the 4th of December I found in the same pool many larvae which had not yet changed. This appears to indicate that the eggs of *Anopheles* are not laid on the surface of the water, but near it, and are washed into the water by the rain." This seems to bear

* Journal of Hygiene, vol. i. no. 1, p. 45, &c.

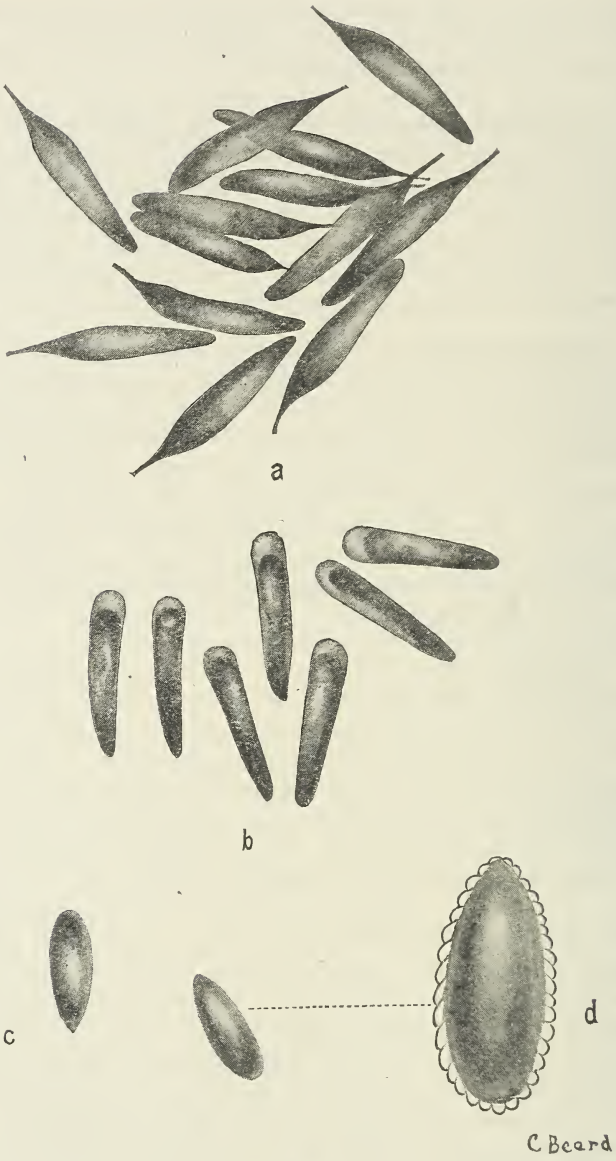



Fig. 14.

Ova of *Culicidae* (greatly magnified).

a, *Panoplites*. b, *Culex*. c and d, *Stegomyia*. d, Further enlarged to show air-chambers.

(From photographs by Dr. Daniels.)

out Ross's statement, but I do not think the normal habit can be to deposit the ova on land, although it may be done in dry weather under compulsion; but as a rule gravid females will retain their eggs until a suitable place to deposit them is found.

On the other hand, in the Report of the Malarial Expedition of the Liverpool School of Tropical Medicine (p. 19), it is said that, "The eggs appear to be laid singly on water, but cohere by their ends, forming typical triangular patterns, and also adhere to floating objects, the sides of the vessel, &c. We observed no facts indicating that they are ever laid on solid surfaces." There is little doubt but that they are only laid on the surface of the water. They will not retain their vitality for long if kept in dry earth.

Professor Howard, who has lately worked out the life-history of *Anopheles maculipennis* so completely, gives the following description of the ova: "The eggs are not attached together except that they naturally float close to each other, and there are from 40 to 100 eggs in each lot. The egg of *Anopheles* (Fig. 20) when seen from above is of a rather regular elliptical outline, the two ends having practically the same shape; seen from the side it is strongly convex below and nearly plane above; seen from below it is dark in colour, and when examined with a high power is seen to be covered with a reticulate hexagonal sculpturing. At the sides, in the middle, there appears a clasping membrane with many strong transverse wrinkles. Seen from above, the egg is black except for the clasping membrane which nearly meets in the middle line in the middle third of the body, but retires to the extreme sides for the anterior and posterior thirds. At each end the colour is lighter with a group of from five to seven minute dark circular spots. It is 0·57 mm. long."

Grassi also figures the ova of *A. claviger* (*i.e. maculipennis*) and those of *A. bifurcatus*, an interesting difference being that those of the latter are arranged in star-shaped groups, whilst those of the former are in more or less irregular lines (Fig. 20, III.).

Nuttall and Shipley give the measurement of the ova of *Anopheles maculipennis* as 0·7 to 1·0 mm. in length and 0·16 mm. at the greatest breadth, somewhat larger than that given by Howard (0·57 mm.). These observers state that when fresh laid they are white, but soon darken in colour to a grayish-black, and that "if the eggs are subject to much attrition, a delicate membrane splits off, which gives the surface of the

intact egg its reticulated appearance. Stripped of this membrane, the egg appears with a glistening black surface comparable to that of patent leather. One end of the egg is slightly blunter and more rounded than the other, and this contains the head end of the embryo." It seems that when the egg, as frequently happens, is drawn by capillary action a little way out of the water on to a leaf or some half-submerged object, the blunt end always points downwards, and thus the larva emerges into the water, and not into the air. The observations of Nuttall and Shipley do not confirm Grassi's statement regarding the position in which the eggs are found. They say, "In open pools in their natural state they seem to be invariably scattered;" and not arranged as Grassi describes.

**Corethra ova.**—*Corethra* deposit their eggs also on the water, still water being always chosen. They are laid a short time after the female leaves the pupa. The eggs are collected together in flat, round, jelly-like masses which float on the water, according to Meinert. The number of eggs, he says, may be from 100 to 150, and are most often arranged in a spiral line; these jelly-like masses of eggs vary from 2 to 4 mm. in width. Miall also says the female deposits her eggs on the surface of the water in a flat gelatinous sheet, the eggs being arranged in spiral lines.

With regard to *Mochlonyx*, *Psorophora*, *Aedes*, &c., I know nothing, and can find no references concerning their eggs or methods of oviposition.

## STRUCTURE OF CULICID LARVAE.

In structure the larvae of the different genera of the family *Culicidae* vary as much as the adults, as far as we at present know. In the old genus *Culex*, which contained by far the major proportion of the described species—and for that matter it does still—there is also seen to be considerable variation in form. These differences in some cases are, I believe, of generic importance, but the information I have at hand is not sufficient; many of the larvae are only mentioned under popular names, so that I cannot make sufficient use of the work so far done. But in one paper, by Captain James, can be seen two types of *Culex* larvae totally different from one another,

and which I think will be found to belong to two different genera—to *Culex* proper and another—probably my new genus, *Stegomyia*. Colonel Giles also sends me a figure of the larva of a *Stegomyia* which resembles Captain James's species (Fig. 16, III.).

The tracing of the life-histories will, I hope, be followed out by our numerous correspondents abroad, and photos of the prepared larvae and drawings from life taken, and the mature insects preserved with them, so that no mistakes can arise. In this respect we shall hope to receive great assistance from Dr. Lutz, who has made such valuable observations on a large number of *Culicid* life-histories.

Without entering into a minute detailed description and the internal structure of the larvae, which, in the case of *Culex*, can be found in Colonel Giles's book both externally and internally treated, the general external characters of the larvae are given for the purposes of identification. They can be divided into two groups, those with, and those without, a respiratory siphon. For still more detail the reader should study Meinert's writings,* and the papers by Nuttall and Shipley, by Grassi, and others mentioned in the Bibliography.

**Culex larvae.**—The *Culex* larvae come in the same group with *Mochlonyx*, *Aedes*, and *Uranotaenia*, namely, in the group with a respiratory siphon.

In *Culex* (Figs. 15 and 16, II.) the head is very large, but not quite so wide as the thorax, and separated from the thorax by a distinct groove. On each side is placed a large dark eye, and the surface ornamented with dark pigmented spots, which vary in different species, and also with patches of small, strong, bristly hairs. In the middle of the front of the head will be seen a number of bristles which arise from the mouth parts, by means of which the food is swept into the mouth. The antennae arise from processes near the eyes, and consist of a broad basal joint and a minute second joint, the former provided with a small bunch of bristles near the base and at the sides, and also with fine short spines on the second joint; the last joint ends in several processes, one a kind of flagellum, and two other smaller structures of a jointed nature, resembling hairs. The eyes are very prominent in *Culex*. The thorax is broader than the head, and much broader than any part of the abdomen. It varies in form in the different

* "Die Encephale Mygelarver," Vidensk. Selsk. 6. Raekke, Naturvidensk. og Mathem. Afd. iii. 4, 1886.

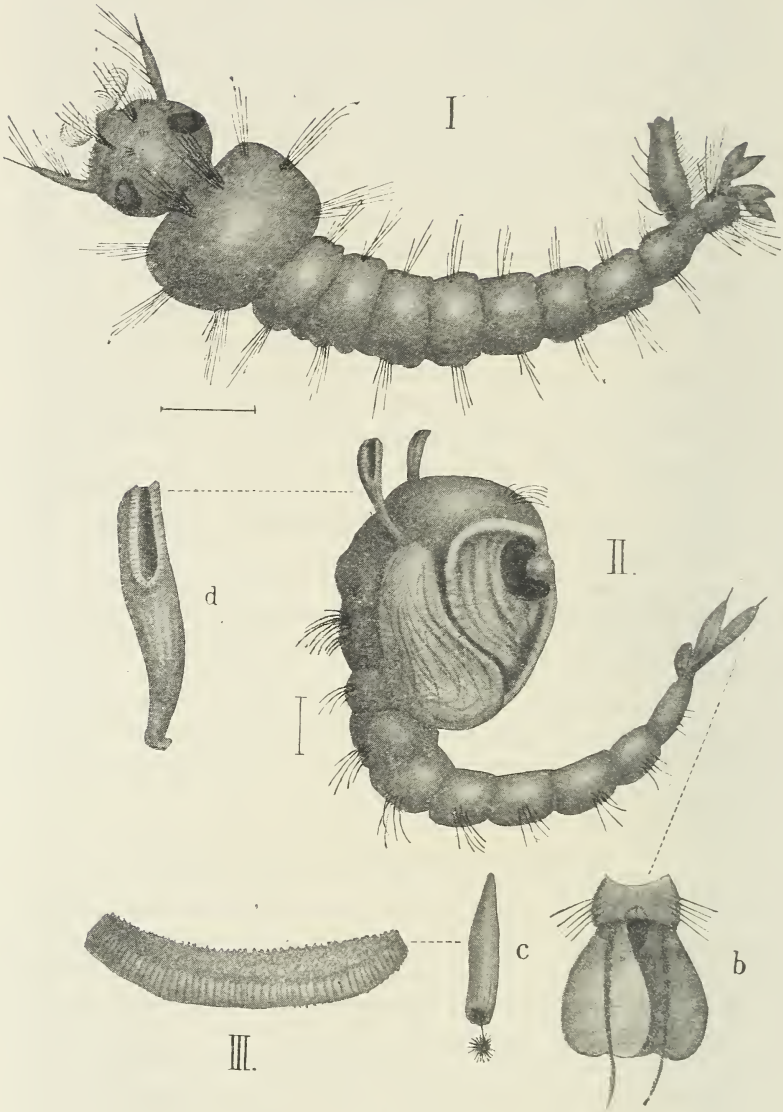



Fig. 15.

Life-history of *Culex*.

I. Larva (full grown; greatly enlarged). II. Pupa: d, enlarged respiratory siphon; b, enlarged caudal fins. III. Ova of *Culex*: c, further enlarged ovum.

species. It possesses three pairs of lateral tufts of hairs, which are supposed to represent the three metameres, the pro-, meso-, and metathorax. Each tuft springs from a little lump or tubercle, and the component bristles are themselves clothed with filaments. There are also other small tufts, two project ing forwards in front, and others arising from the terga. The abdomen is much narrower and longer than the thorax, and consists of nine segments, each being provided with a lateral tuft of bristles and other smaller hairs, both on the dorsal and ventral surfaces. These hairs may be single or in groups. From the eighth segment there arises on the dorsal surface a tube, the respiratory siphon, of varied length and breadth. In the filaria-carrying mosquito (*C. fatigans*) it is very long and narrow, as long as half the abdomen in some stages of the larva. In *C. annulatus* and *C. pipiens* it is as thick as the last abdominal segment. In this respiratory tube run the two tracheae. The end of the tube is provided with valved and guarded openings. The last segment bears on its venter the anus, which is surrounded by four foliate and delicate expansions, each being richly provided with air-tubes. A little in front of these fin-like processes are two tufts (lateral) of compound hairs, and there are also a number of hairs arising above the fin-like processes.

Four large pigment spots may be seen in the living larva, probably glands, with hepatic functions, lying internally. It is the tip of the respiratory siphon only that touches the surface film of the water, and the four anal plates (wrongly stated five by Miall *) do not touch the surface at all. Professor Howard, whose life-history of *Culex pungens* † is the best yet written, states that he believes "these gill flaps may be functional in the young larva, but that they largely lose their office in later life."

The chief characters, then, of *Culex* larvae are: (1) the large head, (2) still larger thorax, (3) the nine segmented abdomen, with the rather long siphon arising from the eighth segment, and the presence of four fin-like flaps at the end of the apical metamere. In colour *Culex* larvae are pale or deep dirty brown or straw coloured, some pale grey, others with a greenish tinge.

**Stegomyia larvae** (Fig. 16).—In a paper ‡ sent me by Captain James is a figure of a larva that he calls the larva of

* "Aquatic Larvae," p. 98.
† Bull. No. 4. New Series, U.S. Dept. Agri. (1896), p. 12.
‡ "Indian Medical Gazette," vol. xxxiv., December 1899.

the "small-tiger" mosquito. From the description at the end of the paper this term is evidently given to *Culex fasciatus*, which is amongst the mosquitoes Captain James sends. If this

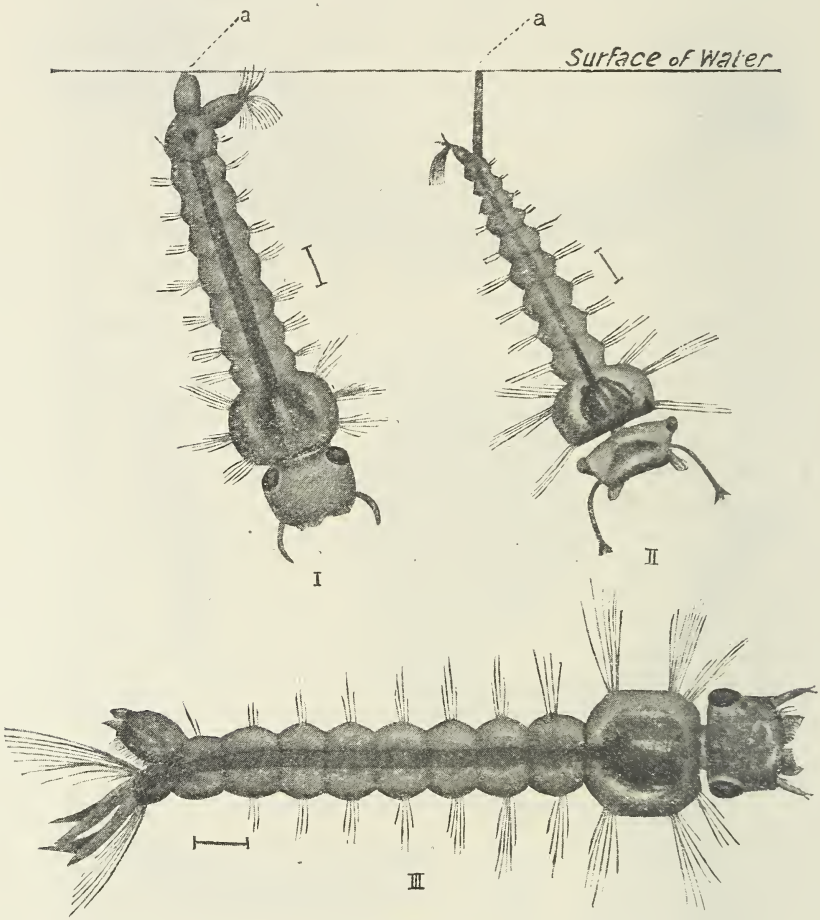



Fig. 16.
Larvae of *Stegomyia*.

I. Larva of Tiger Mosquito (*Stegomyia fasciata*?) ) (after James).
II. Larva of Filaria-bearing or Grey Mosquito (*Culex fatigans*, Wied.) (James).
III. Larva of *Stegomyia pseudotaeniata* (after Giles).

is so, this genus not only differs materially from *Culex* in the adult and egg stage, but also in the larval stage.

This larva (Fig. 16, I.) has the head more or less quadrangular,

and sometimes as large and as broad as the thorax. The abdomen is nearly the same width all the way down, but the chief difference is in the much shorter and broader respiratory siphon and its black colour. Colonel Giles's figure of the larva (Fig. 16, III.) of *Stegomyia pseudotaeniata* will also be seen to have the same characters, the respiratory tube only being about equal to one and a third segments in length.

**Aedes and Uranotaenia larvae.**—The only observations on *Aedes* I know of seem to show that the larvae are like *Culex*,* but smaller. Dr. Lutz sends me a rough figure and note on the larvae of *Uranotaenia*. The larva, he says, is very much like that of *Anopheles*, but has a short breathing tube, and lies obliquely in the water, something between *Anopheles* and *Culex* in position.

**Mochlonyx larva** (Fig. 19).—Meinert has given us a good description of the *Mochlonyx* larva. The full-grown larva is of a light brown colour, with greyish or reddish shades, with air-bags and tracheal stems showing through the upper surface, sometimes quite brown or almost golden in colour. On the opposite side of the thorax are found several dull white spots, and when the pupal period approaches the sides of the thorax also become white; the under side of the larva is greyish; the tail-fan and anal bristles and eyes are all nearly black. With the different changes of skin the head and anal tube come out quite white, but gradually darken again.

The head is broad, but not so broad as the thorax; it is much pinched in anteriorly; in front project four long, many-rayed bristles; the eyes are placed rather far back on the broad part of the head; antennae thick, one-jointed, and are fixed on to small projecting tubercles. They end in four long, bent bristles, not much longer than the antennae themselves. One bristle is very short, and there is also another short, thick jointed bristle. The mouth parts are well formed, the mandibles are strong, and bear not only teeth, but a variety of simple and compound hairs. The thorax is large, somewhat flattened, with a few fan-like bristles on the sides, much wider than the head or abdomen.

* I cannot find this reference, but it is on the authority of Baron Osten-Sacken, and probably refers to *Aedes fuscus*, of America and Canada.

The abdomen is round, with nine segments, the segments deeply constricted. The seventh metamere is very long, as long as the fifth and sixth together; the eighth is shorter, and bears the respiratory siphon on its upper surface. This siphon is short, about as long as the segment that bears it. It is pointed, and bears at the end a single simple pair of narrow bristles. The ninth has on its dorsal side a tolerably deep depression. There are but few fan-bristles on segments one to eight. A fan projects from the lower side of the ninth segment, and consists of more than thirty long bristles of compound structure. The ninth somite also bears four slender anal tubercles, with a pair of quite small bristles in the end.

I know of no other description except that of Meinert's from which the above has been compiled.

**Anopheles larvae** (Fig. 17).—*Anopheles* larvae differ from all those previously mentioned in that they possess no long siphon. They, like *Culex*, vary to some degree in the different species, but chiefly in colour and minor details, as one would expect.

The first good published description of *Anopheles* larvae is Meinert's, who worked with *A. maculipennis* and *A. nigripes*. Regarding *A. maculipennis* the following are the chief points in Meinert's description: "Ground colour is a light grass-green or yellow-green, with a broad dark central dorsal stripe, white in the middle, with six small oblique bands and four small spots at the hinder border of the first abdominal segment; the head is yellow with numerous black spots. The young larva is darker and more uniform in colour. The head is smaller than in *Culex* and of a more or less oval shape; in front are six feathered bristles in a row, the outer one on each side being the largest; there is also a single plumose bristle on each side in front; the mouth has also a distinct whorl organ as in *Culex*. The eyes are large, and form a somewhat elongated curved band of ocelli and pigment; the antennae are short and small and 2-jointed, rather elongate and conical, with a row of fine bristles on the inner edge and a little fan-like group of bristles on the outside; at the apex of the joint are two long leaf-shaped bristles and a couple of similar shorter ones, and also two long ones as fine as hairs. The whorl organs are more developed than in *Culex*, but much on the same plan. The thorax is much broader than the head, and is sometimes broader than long,

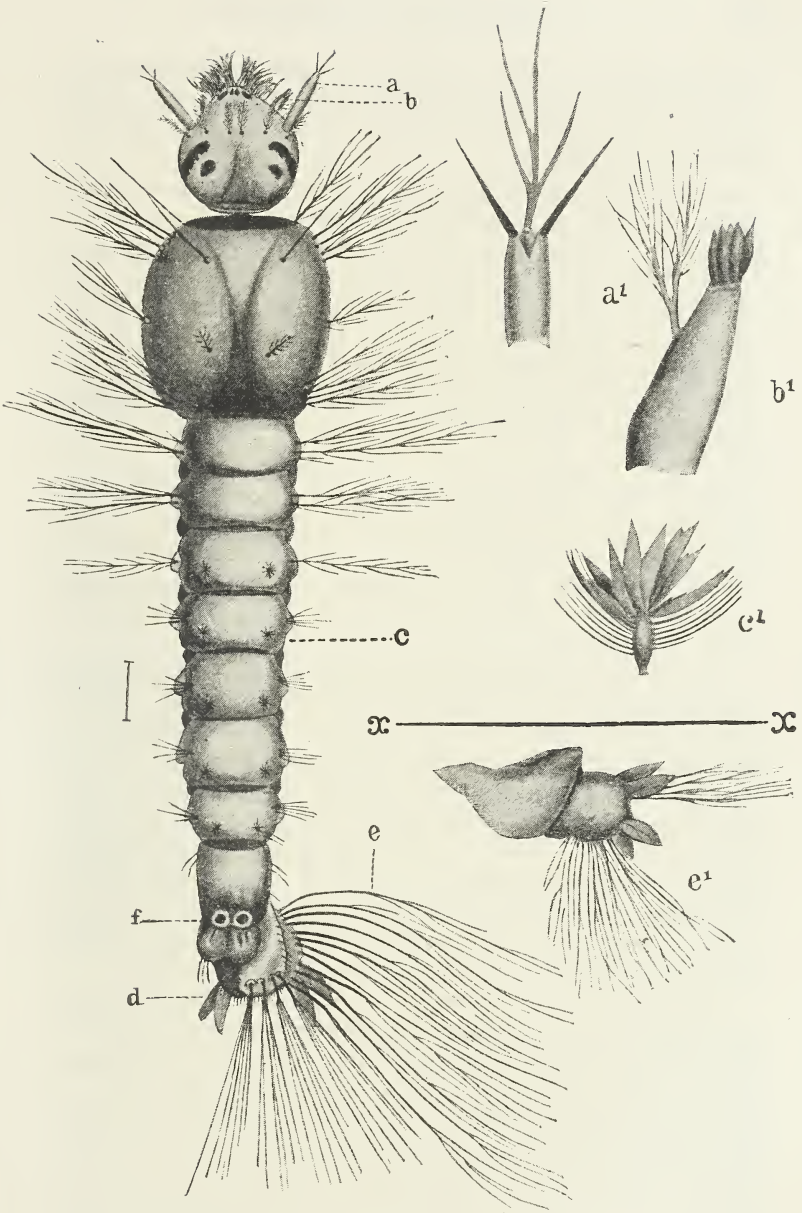



Fig. 17.

Larval stage of *Anopheles* (*bifurcatus*?) (greatly enlarged).

a = antenna ; a¹ = apex of antenna further enlarged ; b = maxillae palpi ; b¹ = maxilla palp greatly enlarged ; c=star-shaped dorsal organs ; c¹=the same further enlarged at the side d=caudal fins ; e = caudal fan ; e¹ = side view of apical end of larva ; f = the two spiracles ; x x = water-line.

flattened, and has a row of feathered bristles on its front edge; in the middle above the pleurae is formed another row of such bristles, and still further back three much longer feathered bristles on each side.

"The abdomen is rounded, and, like the preceding, of nine segments, which decrease in breadth backwards, but increase somewhat in length, the first three segments have long feathered bristles; those on the other somites are smaller; the eighth joint bears on its upper surface two small simply formed spiracles, each of which can be drawn back under a fold of skin at will; the ninth joint bears on its under side a row of long feathered bristles which form a swimming fan; there are four anal papillae rather slender and pointed; no anal hooks are present."

Grassi has pointed out that the two branched hairs found at the corners of the dorsal end of the head, and the two simple or slightly plumose hairs near the middle, are of specific importance, and by them he can detect the larvae of *A. maculipennis*, *A. bifurcatus*, *A. superpictus*, and *A. pseudopictus* (Plate IV. Grassi).

The mouth of *Anopheles* larva is made of a pair of mandibles, a pair of maxillae, and a small lower lip. The mandibles are one-jointed hard structures, with three curved stout bristles on one side near the apex, five teeth at the apex, and two brushes of fine hairs. The maxillae are provided with a distinct palp ending in several spines and a plate, and bear on the side a feathered bristle. Between the large basal piece of the two maxillae lies a small plate, the lower lip. The maxillae have many fine hairs. Nuttall and Shipley state that the palp ends in three spines and a plate; the specimens I examined had five spines, and may thus have been the larva of *A. bifurcatus*.

The thorax is much wider than the head in the adult, but in young larvae the head is broader than the following segments. The feathered bristles on the thorax seem to vary in different species. In *A. maculipennis* there are three feathered bristles on each side in front, three larger ones on each side behind, and four small median ones in two pairs on the dorsum, as well as single bristles laterally. In the figure (p. 31) the bristles are seen to be differently arranged. Nuttall and Shipley figure a small bifid process on each side of the thorax in *A. maculipennis*, which I cannot detect in the larva here figured.

The abdomen consists of nine segments. The first two

segments bear two branched bristles laterally, the third segment one pair of similar bristles; these act as balancers to the larvae when on the surface of the water; there are also four smaller hairs close to the base of the larger ones, three of these are much branched. On the third to seventh segments are a pair of curious stellate structures, called by Nuttall "palmate hairs," the stalks being short and the rays numerous; there seem to be no hairs beneath the rays in *A. maculipennis*, as shown in the specimen figured on p. 31 (*A. bifurcatus* ?). After the third segment, which has one feathered hair, the lateral hairs become simple, but the branched hairs on the dorsal surface become more conspicuous. The eighth segment bears the openings of the two respiratory tubes. On the ninth segment, at the end, opens the anus, and which bears remarkable hairs shown in Fig. 17. This anal segment also bears four soft clear papillae (d), which contain many tracheae. On the venter of this segment is the curious fan of hairs (e), which arise from two semicircular basal pieces. When stationary at the surface this "fan" hangs downwards. What its function is, is not known; probably it is locomotory.

The two respiratory openings (f) on the eighth segment are surrounded and supported by a complex structure.

Professor Howard gives an excellent description of *A. maculipennis* larvae in all stages, while he points out that the arrangements of the hairs on the larvae are entirely different to *Culex*. The branching of the hairs of *Anopheles*, and the little paired star-shaped tufts on the dorsum (Fig. 17, c and $c^1$), are entirely absent in all *Culex*.

Beyond detail Meinert's description still applies admirably to *A. maculipennis*. The detail of the plumed hairs, &c., is shown in the figure.

Grassi has also figured this larva (Studii di uno zool. sulla Malaria, Fig. 6, Tav. IV.).

Captain James gives a figure in his paper, previously quoted from, of an *Anopheles* larva, and says it differs from *Culex* in possessing no air-tube, and when very small the head is quite black, and it appears not unlike a small safety match floating on the water; when larger it is brownish in colour. This description and figure evidently refer to *A. Rossii*, Giles. When mature, the head is not much more than one-third the width of the large quadrangular thorax, which again is seen to be much wider than the abdomen; in other respects it seems to resemble very much in general character *A. maculipennis* and *A. bifurcatus*.

It will thus be seen that *Anopheles* larvae differ, and can be told from *Culex* by the relatively smaller head, the absence of any respiratory siphon, and the numerous paddle-like plumose bristles at the sides of the thorax and the first few abdominal segments. The latter structures act as balancers to keep the larvae level in the water when at rest. Other species are described further on. The bristles and hairs vary in number and form in the different species.

**Corethra larvae** (Fig. 18).—Of *Corethra* we have had many detailed descriptions. The larvae are noted for their crystalline appearance when young, and are even semi-transparent when mature; hence their popular name of "Phantom larvae." In some respects they resemble the "Blood Worms," or larval stage of the *Chironomidae*. The head is small, much more so than in any of the preceding genera, and is narrower than any other part of the body except the two last abdominal segments, elongated with parallel sides, the front part being contracted so much so that it is little more than half the width of the hind part; on each side, in a depression, arise fine bristles more or less curved, and just behind these, a knife-like plate dentated at its free extremity; the eyes are large, round and facetted,* and there is a smaller ocellus lying behind each large eye; the antennae are prehensile and are situated in front of the head, the basal joint bears five long somewhat bent bristles and also a sixth smaller bristle. The thorax is swollen, slightly more so behind than in front, laterally are a few small bristles cleft into rays at the ends; three on each side are distinct. The abdomen is composed of nine segments, which are longest behind; the first segment is very small, the second a little larger, the others increase until the seventh; the eighth is very small, and the ninth pointed; each segment up to the seventh bears one or two pairs of bristles, many rayed at their ends; on the venter of the ninth is a row of twenty-five long feathered bristles, which together form the "swimming fan"; there are also four long anal bristles and also four anal papillae, long and slender and unarmed; the anal hooks consist of two double oblique rows of hooks which surround the point of the anus like a wreath. There are four distinct respiratory sacs, situated as in *Mochlonyx;* they contain no air, but are full of serum. There are no spiracles at all, and

* When the larvae are first hatched the eyes are only small pigment spots (Miall).

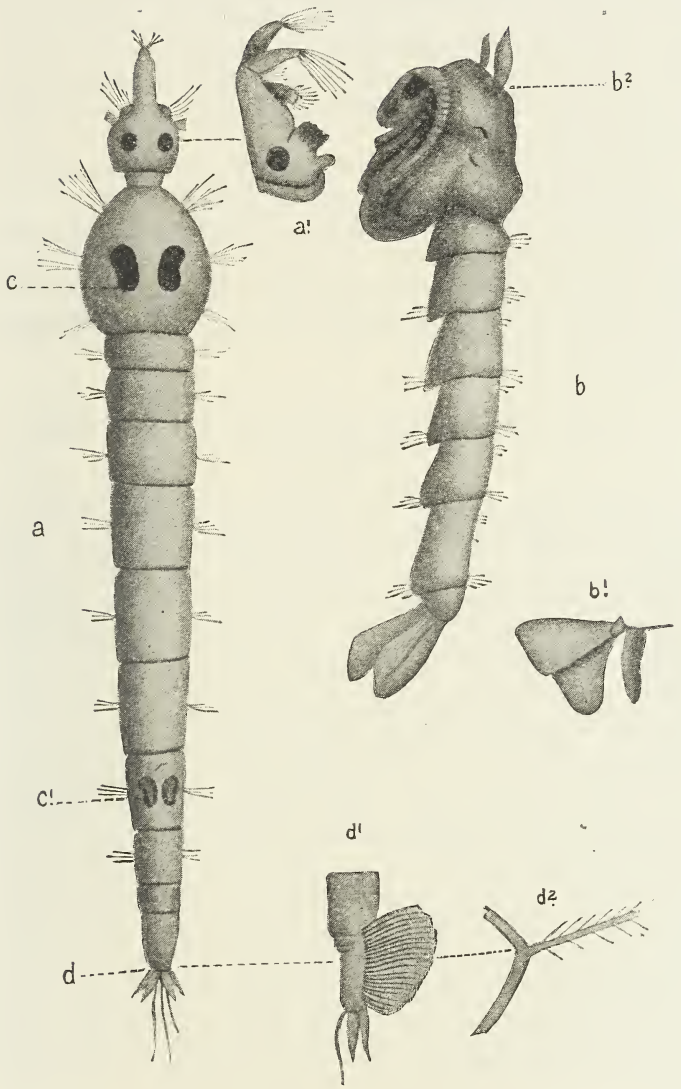



Fig. 18.

Larva and pupa of *Corethra* (greatly enlarged).

a, larva; $a^1$, enlarged lateral view of head; c and $c^1$, "floats"; d, tail; $d^1$, enlarged lateral view; $d^2$, still further enlarged ray of same; b, pupa; $b^1$, tail fin; $b^2$, air-tubes.

not until the larva has grown considerably are there any traces of air-tubes; by degrees they appear, however, and are at first filled with serum and later with air, which is derived, it is said, from the blood; at no period of larval life is there any direct communication with the external air. The four air-sacs simply serve as floats.

The species of *Corethra* in which the above characters have been noticed are *C. plumicornis* and *C. pallida.*

The above characters are sufficient to aid in identifying the genera of the larvae, but not enough is yet known of many of them to be of much specific importance. Grassi has given the details of *A. maculipennis, bifurcatus, pseudopictus* and *superpictus.* Colonel Giles of *A. Rossii.**

## BREEDING-GROUNDS OF THE LARVAE OF CULICIDAE.

All the larvae of *Culicidae*, as far as is known, are aquatic in habits and may be found in a great variety of positions. Each genus, however, has more or less a partiality for particular kinds of habitation, which, when we come to deal with the *Anopheles*, is of no little importance to note. With few exceptions *Culicid* larvae are fresh-water, but some few are found in salt water. Dr. Bancroft found the larvae of *C. marinus*, mihi, *C. annulirostris*, Skuse, *Mucidus alternans*, Westwood, &c., in salt water in Australia. Ficalbi has found the larvae of his *C. salinus* † living in the salt water of marshes, but says they can also exist in fresh water. Certain genera, such as *Anopheles*, prefer clear water, although I have found these larvae in foul water; others—*Culex*—may be found in putrid water, and I have one note stating that the larvae of *Culex pipiens* have been found in liquid manure. In the "Riviera Nature Notes" Mr. Hanbury describes how the hotel cesspools are the favourite breeding-ground of mosquitoes. None seem partial to running streams, although I have seen the larvae of *Anopheles maculipennis* in the Cam; and other records are given by Dr. Nuttall, referred to on page 37.

**Anopheles larvae.**—*Anopheles* larvae generally live in small, natural pools and puddles either stagnant or with a

* "Hand Book Mosquitoes," 2nd ed. 1901.
† This is only a variety of *C. nemorosus.*

constant or occasional trickle of water running through them; they seem to prefer shallow water, especially where there is a good growth of green algae. In most cases the breeding-pools of *Anopheles* are exposed to the sun, a fair amount of light being essential to their well-being. Meinert says that "*Anopheles* larvae appear in still or slightly rippled water with strong vegetation, as well in wooded regions as on heaths, but do not occur in shady woods, but must have sunshine and light, which their green colour indicates." I have seen the larvae of this genus in shallow ponds some twelve to fourteen feet across, but smaller pools and puddles are most sought after by them. I have also found them in abundance in rain barrels in my own garden in Kent. Most of these have proved to be *A. bifurcatus*, a few *A. maculipennis*.

In a paper * recently sent me by Dr. Nuttall, the localities in which *Anopheles* larvae have been found in Great Britain are summed up as follows: 41 captures in ponds; 36 times in ditches, in which the water had a scarcely perceptible flow; 15 times in ditches containing flowing water; 26 times in rivers and canals (Derwent, Orwell, Ouse, Thames, Lee, Cam, Mole, Exe, &c.); and 3 times in the back waters of rivers. Larvae were also captured six times in brackish water (twice in ditches, four times in pools), twice in water-logged boats, and twice in stone troughs. In only nine cases was it noticed that the water was dirty. Amongst the information collected by Dr. Nuttall, we find the following interesting notes: "One larva (*maculipennis*) caught in stream running through marsh and containing many prawns"; "Very many larvae in middle of the River Thames between island and shore."

In the recent Report on the Malarial Expedition to the West Coast of Africa the breeding-places of *Anopheles* are summarised at Freetown as follows: "Generally speaking, we found the larvae in small permanent pools, not liable to scouring. We did not find them in vessels, evanescent pools, pools liable to scouring, large collections of water, and running streams. The majority of the *Anopheles* pools were found in ditches by the side of roads and in certain localities where certain small streamlets ooze from the bases of the hills after rain; few were observed in the yards and gardens of houses." In no cases were the larvae found far from human habitations, even in pools most suited to them, but this must not be taken to mean that they

* "Studies in Relation to Malaria," I., Journ. of Hygiene, vol. i no. 1, 1901 (p. 11, reprint).

do not occur, although the genus is certainly most abundant in and around cultivated districts.

Most of the *Anopheles* puddles at Freetown contained green water-weeds and many small tadpoles and frogs, but none contained fish. Captain James, I.M.S., writing from Travancore, says that "there is only one rule with regard to the haunts of *Anopheles* larvae, and that is a negative one, viz., that they do not breed in pots or tubs of water, or in any pool which from its nature (*e.g.*, a pool in a rock or on very rocky ground) practically may be considered as a pot or tub."

In this part of India not only are the larvae found in puddles by the roadsides but in pools of water on fields or on open areas. They are especially common in the water covering rice-fields, and in any pool which may be left after a piece of ground has been newly dug up; they have been found in running streams and old wells. Captain James also finds that they may be found in plenty in the small pools which are left between the rows of earth in potato fields or of tapioca plants when planted in the same manner. The species of *Anopheles* Captain James sends and which he has worked at are *A. Rossii*, Giles, and a new species, *A. Jamesii*, mihi.

Christophers and Stephens also state (Rept. 3, p. 16) that in the less populated portions of part of Lagos, *Anopheles* breed in the furrows of small maize gardens, and in shallow earthenware vessels containing rain water.

Swamps seem favourable grounds in some parts for *Anopheles*. Mr. Christophers detected larvae in the swamps at Songo and Mabang, especially in small pools at the edges of the swamp, and in small isolated pools in the mud.* I have often found larvae in plenty in puddles and collections of water left after peat cutting in the Fens.

Dr. J. W. Stephens and Mr. S. R. Christophers, in a Report to the Malarial Committee of the Royal Society,† say that not only do *Anopheles* larvae exist in small pools, and in the wells at Freetown, but also in the pools by the sides of streams and in certain small drains, and that in the dry season, in the absence of rock pools, *Anopheles* breed freely in streams and drains. Outside the city, in the "bush," *Anopheles* larvae were present throughout the whole district. In the mountain streams wherever there were suitable pools multitudes of the larvae existed.

* These are a new species, *A. paludis*, Theobald.

† Malarial Com. Rept., Royal Society Trans., July 6, 1900.

Dr. Daniels (Rept. R. Soc., Dec. 1900, p. 26, &c.) records *Anopheles* larvae amongst grass growing in shallows at the edge of the river, and in grass-grown sandbanks well out in the stream. Similar observations were made by him at other parts of the Lower Shire River and Zambesi. This mainly applies to *A. funestus*, but the breeding-grounds are similar for other species, he says, often the same. Dr. Daniels also points out (p. 31) that they are abundant in the shallow pits, called "borrow pits," along the railways in East Africa.

Regarding the breeding-places of *Anopheles* in St. Lucia, Dr. St. George Gray, M.B., writes the following: "One day, whilst riding in a very heavy rain, I observed the roadside drains, which in hilly parts are a series of pools each overflowing into the one below. When a culvert or cross drain carried away the water from the side of the road, I observed that the first pool or two below the culvert did not always overflow in spite of the very heavy rain, and that many of them contained algae. These I thought should be good breeding-grounds for *Anopheles*, and the first chance I got I examined the pools, and the result was most interesting. In the very first pool I examined I found larvae that lay flat on the surface and which became mosquitoes with spotted wings, &c. In pool No. 2, about a quarter of a mile further down the same road, I found the same larvae and also larvae of mosquitoes which turned out to be *C. pipiens*.* Those (sent) marked 'St. Joseph' are bred from a roadside pool about four miles from Castries, in the Valley of the Grand Cul de Sac, a notoriously unhealthy district." In another letter this observer sums up his observations on *Anopheles* as follows: "The larvae are found in pools of stagnant water containing algae and especially green *slime*. I have also found them in slightly running water which contained plenty of green slime. They seem to attach themselves to the surface slime by means of their caudal extremities. They also conceal themselves in the meshes of the slime under water, and are then difficult to see, being green. I have found larvae of *Anopheles* in roadside pools, generally the first pool below a drain or culvert that carries the water away from the road, that is, the commencement of a new stream. I have not yet found them in the low-lying level valleys, but often on the first rising ground above the bottom land. Dr. Gatewood, surgeon on the U.S.S. *Lancaster*, tells me that in

* I have not seen *C. pipiens* in any West Indian collection; this is probably *C. fatigans*, which occurs there in abundance.

his native country, Virginia, the bottom lands are not considered malarious, but the first hills above them are extremely unhealthy. So far, my observations seem to bear out this view."

Nevertheless, although roadside and other puddles of small size in the sunlight and containing green algae afford the most suitable breeding-ground for these aquatic larvae, they are also found in small pools in open places in woods and fields and even stagnant pieces of water of considerable size. I have found them in rain barrels in England, and, in fact, in almost all collections of water of small size. Howard records such breeding-places in America as the following: "A small permanent stream running through woods, which had here and there broadened out into little shallows"; "pools about a disused spring; at the side of the spring were several more or less permanent pools of considerable depth (8 to 10 inches), and thirdly an old canal bed so nearly dried out after a season of drought that the water lay in small puddles." One *Anopheles* has been found breeding in sea water, by Dr. Bancroft in Deception Bay, Queensland. This was probably *Anopheles annulipes*, Wlk. Sir William MacGregor says they occur in salt and brackish water in British New Guinea.

Concerning the breeding-grounds of *Anopheles* in India, Colonel Giles writes in some notes sent me for publication as follows: "The situations in which I found the larvae entirely upset all the notions I had gathered from recent writings on the subject. I began of course by looking for the typical *Anopheles* pool of Ross, but such as I found never held any of the expected larvae, and the first place I met with them was in the garden of the Meerut Club, in the small irrigation tanks I have already described. (These tanks are small cemented brickwork structures, generally about a cubic foot square, placed at intervals along the small masonry channels which are used to irrigate nearly all gardens in the European quarters of Indian towns, their object being to store up water in convenient places for the gardener to use.—F. V. T.) Here they were present in enormous numbers, sometimes alone, but more frequently in company, and apparently on excellent terms with the larvae of *Culex fatigans*, Wied. It was, however, noticeable that, while the *Culex* larvae, for the most part, remained in the middle of the tanks, those of *Anopheles* generally kept themselves floating, with their heads touching its side walls, and so might easily be overlooked. In my subsequent wanderings, I met with *Anopheles* larvae in a variety of situa-

tions, but always these small irrigation tanks were the 'surest find,' and, further, I never met with them at any distance from human habitations. I have also met with *Anopheles* larvae in muddy pools of some size in brickfields, in the overflow from standposts in large cities supplied with a regular water supply, and even in a very shallow depression in the concrete surface of the platform of a bustling railway junction, also fed by a standpost. . . . The pools which may be found in roadside ditches are another very favourite breeding-ground for *Anopheles*. Some of the collections of water in which I have found them have been absurdly small, and would not suffice to fill a wash-hand basin. Far from being, as we have been led to expect, confined to a few marshy pools of moderate size, they are omnipotent, and seem to be capable of developing in water of very varying degrees of purity."

In another part of his paper he refers to the larvae of *A. Rossii* as follows: "I found their breeding-pool some three hundred yards off, beside one of the piers of the old bridge across the Goomti, which flows just beneath the house. The pool was but a few yards long by not more than six feet wide, and, though it did contain a certain amount of green filamentous vegetation, was extremely foul. Still it is the nearest approach to the *Anopheles* pool of the West African Malaria Commission that I have met with inhabited by the larvae. Typical pools of this sort I have indeed come across by dozens, but in no case have I met with the larvae in such pools."

Such are some of the valuable observations by a naturalist in whom I place the greatest confidence. My own observations on *Anopheles* in England entirely endorse what Colonel Giles says. I have found plenty of such pools as described in the West African Report in districts where *Anopheles* abound, but never a larva in them. It was not until I examined rain-barrels, cattle-troughs, and some large muddy pools that I found the larvae in any numbers in England.

Dr. Chalmers found the larvae of a small dark *Anopheles* (*A. Kumasii*), which is the cause of the fever in Kumasi from which the troops, &c., suffered so severely during the recent siege in all the swamps surrounding the town.

Sir William MacGregor tells us they breed in the brackish waters on the great western coast of British New Guinea.* They probably breed in the lagoon at Lagos. In fact, the typical *Anopheles* pool, of which we have heard so much, had best be forgotten.

* Journal Tropical Medicine, no. 27, vol. iii. p. 68.

From such information, received from all parts of the world, the verdict must be that *Anopheles* can and do breed almost anywhere where the flow of water is not too rapid, not only, as Colonel Giles says in his MS. notes sent me, near human habitations, but also far away from them. How is it possible, then, to destroy even an appreciable amount of the larvae? Anyone who has a *practical* economic entomological knowledge will know the extreme difficulty of keeping the many plant pests in check, much less extirpating them. This is because they often breed over a wide area, in woods and forests, and from thence attack our crops. The hop grower would stand some chance in England of destroying the hop-aphis by repeatedly spraying *all* the wild prunes in *all* our woods for a few years. Think what that would mean. Certainly financial ruin to all the growers. Theoretically, *Anopheles* could be stamped out by spraying all the water with paraffin, but when we recognise the enormous and varied area over which they breed, the absolute hopelessness of the task is at once apparent. Possibly malaria may be lessened by destroying the breeding-grounds of *Anopheles* around habitations and especially by paying attention to surface drainage.

**Culex larvae.**—The larvae of *Culex* not only differ in structure, but also very markedly in habits. Instead of almost exclusively inhabiting natural collections of water, they are particularly predisposed to water in artificial receptacles. In England, water-butts, cisterns, disused pots full of water, &c., are the favourite places for the larvae of many species, such as *Culex pipiens* and *C. nigritulus*. I have bred the latter species from the foulest water possible in old manure barrels; but the former seems to prefer clear water, teeming with minute animals and desmids. Like *Anopheles*, however, they prefer water of no great depth, and with more or less small animal and vegetable life in it. I have observed them in deep water once or twice in the Cam, but such is unusual, as also is it to find them where there are fish. Dr. Bancroft and Ficalbi both record the larvae of *Culex* in salt water; the former four species, including the new *C. marinus*, mihi, the latter one, *C. salinus* (Ficalbi).

Dr. St. George Gray, in one of his previously quoted letters, reports that he found *Culex* larvae in similar places to the *Anopheles*.

Captain James, writing of the "Filaria carrying mosquito,"

which I make to be *C. fatigans*, Wied., says that it is unlike *Culex* and like *Anopheles* in that it does not breed in pots and tubs, but in "quiet shady pools containing plenty of small green plants. It is, however, to be found in pools on open fields, in slowly-running streams, and in the water of rice-fields. Indeed, what has been said with regard to the haunts of *Anopheles* larvae applies to the larvae of this 'Filaria-bearing' mosquito."

Major Ross, in the Report previously quoted, says, with regard to *Culex* larvae, that they are found in tubs, pots, buckets, cisterns, empty oil cans, biscuit tins, sardine tins, gourds, flower pots, broken crockery, pottery and bottles, even in unbroken bottles thrown uncorked on heaps of refuse. "Occasionally, also, the larvae were found in hollows, in wells, pools by the side of the roads, and even in small runnels of water." Ross also refers to the larvae of a *Culex* of the *taeniatus* type; three of these came in the Sierra Leone collections, namely, *C. fasciatus*, Fabricius, *C. sugens*, Wied., and a new species, *C. Africanus*, mihi; but these I refer to a new genus, *Stegomyia*, which, judging from the larvae of the former species, have different characters in the larval stage to the typical *Culex*, and are referred to in the next paragraph. But as these species are mentioned only as *Culex* with the others, it is difficult to gather accurate information from reports. The "*taeniatus* type" * of Ross's Report are possibly the Tiger mosquitoes of James's valuable little paper, but the breeding-grounds do not tally. For instance, the West African Report says that "the larvae of *C. taeniatus* type were observed in hollows in rocks, on the top of Signal Hill, and also some of the same larvae in a hole in rock hundreds of yards from human habitations." James, in his paper, says, regarding the small "Tiger" mosquito, that it is pre-eminently the tub and chattie-breeding mosquito seldom found elsewhere.

In any case, we know that larvae of the typical *Culex* will breed in a great variety of places, both natural and artificial, but especially in artificial receptacles near human dwellings. But there are a large number of "non-domestic" *Culicidae* whose larvae are found in small pools, &c., in woods.

Dr. St. George Gray found *Culex fatigans* (called by him *C. pipiens*) breeding in wells, and destroyed them by the use of kerosene, but *Stegomyia fasciata* occurred as usual. It thus seems that the two types of the genera *Culex* and *Stegomyia* have different breeding-grounds as well as a different scale and larval structure.

* This should read *fasciatus*.

I have not sufficient evidence, however, to enter fully into the habits of the latter genus at present.

**Stegomyia larvae.**—The genus *Stegomyia* is formed on certain characters best seen in *S.* (*C.*) *fasciata* (p. 289). With regard to their larval habits I can record very little at present. According to Major Ross's report, larvae of the *taeniatus* type were observed in hollows and in wells. Captain James's Tiger mosquitoes I feel sure are *Stegomyias*, although the habits differ so widely from those observed on the West Coast of Africa. *Stegomyia fasciata* has been sent by Captain James, and is probably the species referred to in his paper.

**Corethra larvae.**—The beautiful transparent larvae of the *Corethra* may be found in all kinds of watery places; it matters not to these crystalline creatures whether the water is shallow or deep, clear or cloudy, stagnant or running, but it is especially in clear water that they occur. Their transparency, even when mature, evidently protects them from fish, for we find them in pieces of water and rivers teeming with fish, contrary to those of the *Anopheles* and *Culex*.

Meinert states that they may be found in pools half covered by weeds, in marl pits or small lakes, and he also found them in a dark forest hole, and in a small deep marshy hole without a trace of vegetation. Götze found the larvae first in a well, the surface of which was covered with duckweed, and observed that the larvae can live for hours in the strongest vinegar without being affected.

**Mochlonyx larvae.**—The only note I know regarding the larvae of *Mochlonyx* is that of Meinert's, who merely mentions, after describing the larvae, that they may be found in ponds, &c., in fields, and woods, and that they are especially found in ditches where the water is clear and the current nil, and also in water on inundated wood bottoms, filled with fallen beech leaves and traversed by a deeper ditch, and in patches of water overgrown with iris, and often in large troops with *Culex* larvae.

**Aedes larvae and allies.**—With regard to *Aedes* we know nothing. Osten-Sacken found them with *Culex* larvae, but merely states that they resemble those of *Culex* but are smaller.

Dr. Lutz in a letter informs me he has bred *Aedes squammipennis*, the type of my new genus *Aedeomyia*, and that the larvae are very characteristic; they were taken at a riverside. *Uranotaenia* he has also bred, and they occur, he says, in swampy regions.

**Other larvae.**—With regard to the other genera, *Megarhinus*, *Sabethes*, *Psorophora*, and the new genera I have described, I know nothing with regard to the larval breeding-grounds.

Professor Howard tells me he has recently made observations on the life-history of *Psorophora*.*

## HABITS AND FOOD OF CULICID LARVAE.

There are some marked differences between the habits of the various groups of mosquito larvae which I feel convinced, together with their more important structural peculiarities, will, when we know the life-histories better, help us greatly in the matter of a rational classification.

At present it is only with *Culex*, *Anopheles*, *Corethra*, *Mochlonyx* and *Uranotaenia* that we can deal, although Dr. Lutz has studied other types, such as my *Aedeomyia*, *Psorophora*, &c. The results of his studies, no doubt, he will soon publish.

**Anopheles larvae.**—*Anopheles* larvae are found lying in the water in a more or less horizontal position, lying, in fact, straight out, with the spiracles of the eighth segment just out of the water, the rest of the body, except a small portion of the thorax, beneath. The curious stellate dorsal processes (Fig. 17), however, I find, just touch the surface film, and I believe are partly to hold the larva up in its horizontal posture. In this position they lie between the threads of green slime, holding on to them, and being themselves often green, are very difficult to see. These larvae have an important aid also in holding themselves in this position in the long feathered bristles which stick out from the sides of the body.

This method of remaining close to the surface of the water, and almost parallel to it, is well described by Captain James in regard to *A. Rossii*, &c. "When looking down on them from above," he says, "they look like little bits of brown stick or thorns floating on the surface. When very small their heads

* *Vide* Appendix, Vol. II.

are quite black, and they appear not unlike very small safety matches floating on the water." The larvae often lie for a long time in this horizontal position, but now and then slightly moving themselves on by bending the body. When watched carefully, they are seen to be sluggish and dull in habits, very different to *Culex*, but when disturbed they dart down in the water and sink to the bottom, but soon, however, regain the surface, rising by quick bending movements of the body, in a series of jerks, but, as a rule, we see them moving from one place to another of the aquarium in an oblique direction, these jerky movements along the surface of the water being very characteristic. It is wrongly supposed, as pointed out by Meinert, that *Anopheles* larvae move horizontally as in *Corethra*. They sometimes may be seen lying on the floor of the pool, both on their venter and dorsum.

When disturbed the larvae wriggle tail first to the bottom of the water and there remain for a few minutes, when they ascend tail first to the surface again. I have noticed that they may remain beneath the water some time, both at the bottom and at the sides of the jars in which they were kept. About half an hour seems their limit, however, of submergence.

Like *Dixa* larvae they have the peculiar habit of being able to turn their head completely round; often when feeding they lie in the normal position but the head is turned upwards to the surface of the water. This movement is done very rapidly, and is always followed by violent movements of the vibratile organs surrounding the mouth, thus setting up a miniature whirlpool overhead. Their food is mostly of a vegetable nature, but all manner of small organisms are swept into the mouth by these whirling vibratile structures. They also to some extent show carnivorous habits, for Dr. St. George Gray in one of his communications states that in those he had under observation (*A. argyrotarsis*, Desvoidy) cannibalism sometimes occurred. Captain James reports that they can often be seen feeding on the small green plants in the water, which evidently form their chief diet.

Drs. Christophers and Stephens found that the food of *Anopheles* larvae, in the majority of specimens examined by them at Accra, consisted of an unicellular organism (protococcus?).

This is endorsed by Professor Howard, who noticed that his larvae flourished best on green algae. Mr. F. K. Woods, of the Division of Vegetable Physiology, found the algae to belong to the genera *Aedogonium*, *Cladophora*, *Spirogyra* and a few *Oscilaria*.

Later on they swallowed, amongst other things, particles of sand, the green slime off stones, and frequently even picking up quite a large sand pebble and then dropping it again.

Dr. Nuttall mentions the following plants found where *Anopheles* occur in England and Germany: *Ulva*, *Spirogyra*, *Lemna*, and various algae. They are also "found in accumulations of aquatic plants torn up from the bottom of rivers and accumulated in little bays and inlets along the banks of the stream."—(Daniels). They have been pointed out by various correspondents to be frequently found in company with *Culex* larvae.

**Culex larvae.**—*Culex* larvae behave in a very different manner, as well as being very different in structure, having a long respiratory siphon. Instead of lying horizontally at the surface they hang down vertically or slightly obliquely when at rest, the tip of the respiratory siphon being level with the surface film and the head hanging downwards. Directly they are in the least disturbed the larvae of *Culex* sink to the bottom, but soon arise by a slow upward movement, due to the buoyancy of their air-tubes, or by a series of sharper jerks. They will not remain below water for any length of time, but rise up as soon as they fancy the danger has past. Unlike *Anopheles*, they are very active, and can at once be told by these habits alone in the majority of instances; but Captain James, writing on the Filaria-carrying mosquito (*C. fatigans*, Wied.), tells us that the larvae, like the *Anopheles*, move at the surface of the water by horizontal jerks, but in shape and every other respect they are so unlike that there is no danger of confusing them with each other.

As far as my observations go on *Culex pipiens* and *C. nigritulus*, I have always noted that the young larvae lie almost at right angles to the surface for the first day or so of their existence. These so-called "wrigglers" soon grow, and become more and more active, darting about in sharp jerks in a zigzag fashion, or moving rapidly to the floor of the receptacle they are in. When resting the vibratile mouth parts are kept in constant movement; feeding, in fact, is incessant, breathing going on in an undisturbed way all the while through the siphon. The food swept into the mouth by the vibratile organs is very varied, consisting of algae and water crustacea, such as *Daphniae* and *Cyclops*. I have bred *C. nigritulus* almost exclusively upon flagellate protozoa, which seems a very favourite food. Carnivorous habits also exist in

*Culex*. Dr. Lutz writes me that the larvae of *C. Bigotii*, Bellardi, live amongst the larvae of *Heteronycha* and feed upon them. The larvae of this fine gnat were obtained by him in a hollow tree filled with water, and again in the town of Sao Paulo. They greatly resemble, he says, the larvae of *Psorophora ciliata*.

**Psorophora larvae.**—The latter larvae are also carnivorous, and prey very fiercely on other larvae of *Culicidae*, seizing them by the neck and devouring them. Even larvae of the same size will devour each other. (Dr. Lutz.)

**Aedes larvae.**—Of the characteristic habits of *Aedes* we know nothing. Dr. Lutz has taken the larvae of two of the allied genera, namely, *Aedeomyia* and *Uranotaenia*. Of the latter he says the larvae lie obliquely in the water, something between the position of *Anopheles* and *Culex*.

**Corethra larvae.**—*Corethra* has been studied to a great extent, so that we know more details of its life-history and habits than any other, with the exception of *Culex*. These so-called "phantom larvae" lie quite horizontally in the water, and remain perfectly motionless for some time. Suddenly the larva disappears, and we find it an inch or so further on. The movement is so rapid, the larva so transparent, that we cannot see it alter its position, which is done by a sudden lashing action of the body, described by Miall * as "resembling the jerk of an electric needle." They may lose their transparency, however, and then can be more readily seen. Like *Psorophora*, they are extremely ravenous, and feed off small crustacea and ephemera-larvae (Miall), off *Dixa* larvae, and even young fish and molluscous embryos; "nor do they even shrink from cannibalism," says Colonel Giles,† "smaller specimens of their own species being devoured with gusto if they come within reach of their jaws." Regarding feeding off *Dixa* and other dipterous larvae, Meinert states that in one case the *Dixa* larva filled up all the front part of the intestinal canal, and hung with its tail end half out of the mouth. Slabber (quoted by Meinert) gives an account of how these larvae devoured the weak spawn (spat?) of his gold fish, and instead of serving as nutriment to his "armed polyps," to his great annoyance swallowed them, and did not even

* "Nat. Hist. Aquat. Ins.," p. 114, 1895.
† "Hd.Bk. of Gnats or Mosquitoes," p. 87, 1900.

spare some *Planorbis* snails, but devoured them out of their shells.

These voracious larvae lie horizontally, often quite deep in the water, and rise and sink gradually and move slowly in a horizontal direction, except when darting on their prey. When the larvae wish to rise, the head seems more or less directed upwards. Now and then they may be seen floating on the surface of the water perfectly motionless.

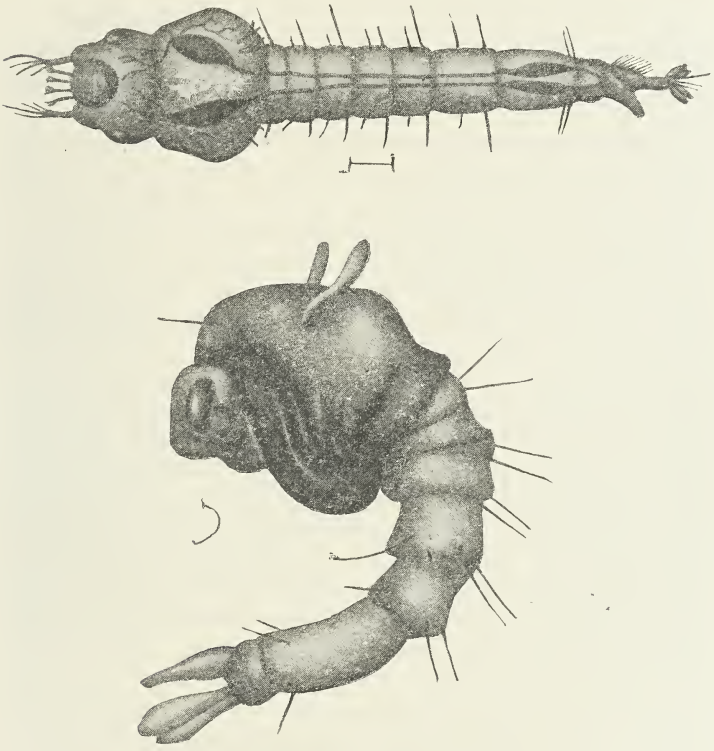


Fig. 19.
Larva and pupa of *Mochlonyx* (after Meinert).

**Mochlonyx larvae.**—*Mochlonyx* larvae seem only to have been observed by Meinert, who states that they are even more carnivorous than *Corethra*, especially attacking larvae and pupae of their own kind; and if such cannibalism is begun in a glass, nothing seems able to stop it, and often it ends with the

cannibal's own destruction. The position in the water is much like *Corethra;* they seldom come to the surface, but do now and then, and place their respiratory tube above the surface film and remain for a long time almost motionless. It often occurs in large troops, and is sometimes found with *Culex*.

It will thus be seen that there is some variation in habits, by noticing which we may tell anyhow *Culex*, *Anopheles*, and *Corethra* at once from one another, and that there is also variation in the habits of the different species in the genus *Culex* itself.

## THE EFFECT OF RUNNING WATER ON THE LARVAE.

Although we mostly find *Anopheles* and *Culex* larvae in still water, they can nevertheless live in running water. I have found both in the Cam, when the water was running at the rate of about half a mile an hour. Celli has made a number of measurements with regard to the velocity of water ensuring against the development of *Anopheles* larvae. It is stated that water must flow not under 1900 yards per hour to prevent their development.

Where water flows at and above this rate we may be sure neither *Anopheles* nor *Culex* can live. Can this knowledge be made of any practical use? Sir William MacGregor apparently thinks so, for he has said, regarding Lagos,* "One thing could be done; Lagos Island could be surrounded by a sea-wall that would render the current there generally too fast for the *Anopheles*." By such means no doubt *one* great source of generation of these pests might be obliterated, but as they breed in countless other places, would it be worth the enormous cost? Would not it be simpler to treat the affected human inhabitants?

## PUPAE OF CULICIDAE.

The pupae in the *Culicidae*, unlike the typical dipterous pupa, are active creatures, rising and falling in the water at will, but not to the same extent as do the larvae; they do not fall so easily, but descend by violent muscular contractions of the tail; they swim with ease, and reach the bottom of the butt or tank

* Journal Tropical Medicine, no. 27, vol. iii. p. 67.

with great rapidity. The pupa does not appear, however, to be able to remain under water except by great exertion; as soon as it ceases moving it floats up to the surface again. *Culicid* pupae, like the larvae, breathe the air through protruding spiracles, but these air-tubes, instead of being at the tail end as in the larvae, are placed on the dorsum of the thorax as two trumpet-shaped structures of somewhat different form in the different genera.

**Culex pupa** (Fig. 15).—In *Culex* the head of the pupa is placed underneath the large rounded thorax, and differs materially from the head of the larva; the mouth parts, labrum, labium, mandibles, maxillae and palpi, have become much elongated, as also have the antennae, which are seen in their sheaths lying above the thorax just beneath the wings; the eyes are large, oval, and prominent.

The thorax is largely developed, and shows the outline of the legs, which are partly hidden by the wings, except most of the first and part of the second, and above them the antennae, whilst the greater part is taken up by the large flat, short wing-cases, which extend downwards and backwards from the sides. Behind each of these is a small roughly triangular piece, the cover of the future halteres. On the surface of the dorsum of the thorax, arising just above or in front of the roots of the wing-cases, are the respiratory horns, which are structurally of generic importance. These trumpet-like structures are tubular and cylindrical, rather narrowed at their bases, free at one end, this end being open and quite unprotected, except for a number of fine hairs which project from the inner side of the tube; the opening is oblique, and there is a slight notch on the inner side. The cavity of these siphons communicates direct with the tracheal system. In the young pupa the legs, as seen through the leg cases, are unjointed, but by degrees all the joints are represented before the pupa reaches maturity. The abdomen is, like the larva, composed of nine segments, and is flattened dorso-ventrally. The eighth segment bears a pair of large fins (thin oval plates), each fin being supported by a hard mid-rib, which in some projects beyond the hinder border (Fig. 15). The ninth segment is small, and has the opening of the anus present on it, and also a pair of blunt processes, said to be larger in the male than in the female. On the abdominal segments are also numerous bristles, particularly on the last few segments. The

whole abdomen is flexible, and serves as the swimming organ. When at rest the pupa has the two oblique openings of the siphons parallel with the surface of the water, and just above the surface film.

According to Hurst,* the ninth segment corresponds to two or more segments. The same naturalist points out that "there is a large cavity between the lower and hinder portions of the two wings, below the hinder part of the thorax and first portion of the abdomen, and above the "mouth parts," which communicates with the cavity of the tracheal system by a pair of stigmata on the sides of the first segment of the abdomen. Other stigmata, though present, are closed." Air is, however, only taken in by the pupa through the two air-tubes arising from the respiratory trumpets.

The chief peculiarity, then, in the pupa of *Culex* is the presence of the two obliquely opened air-tubes or trumpets.

**Anopheles pupa** (Fig. 20).—In *Anopheles* the pupa is very much like *Culex*, but it is rather more compressed ; the siphons (a), however, form the chief difference, for they have a square truncated end, and are proportionately much shorter than in *Culex* (b). In colour the pupae of *A. maculipennis* may be either dull brown, grass-green or light yellow-green, with paler wing-cases and trumpets ; on each side of the fourth to the eighth segments is a black spot. They are just as active as in *Culex*. Professor Howard points out that when in the water the pupa of *Culex* is more vertical than that of *Anopheles*. No notes have been sent regarding the pupae of this genus, but presumably they vary in colour.

**Mochlonyx pupa** (Fig. 19).—In *Mochlonyx* the pupa again only differs slightly from *Culex*, but can be told at once by certain characters, of which the most important is the form of the air siphons. In this genus the trumpets are thin, rounded and pointed at the end ; the seventh segment is also very much larger than in *Culex* or *Anopheles*, and the abdominal bristles are more scanty.

**Corethra pupa** (Fig. 18).—Of quite different appearance is the pupa of *Corethra*, which is nearly straight, not curved as

* "On the life-history and development of a gnat (*Culex*)." An. Rept. and Trans. Manchester Micro. Society, 1890.

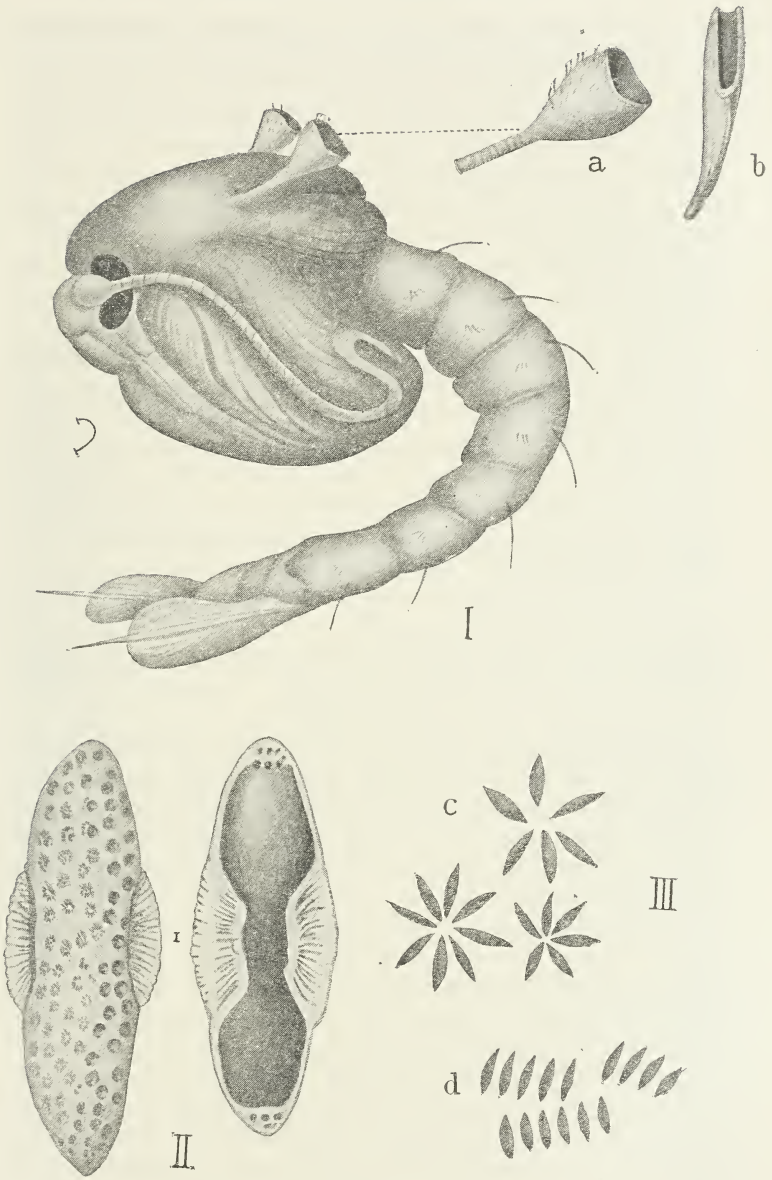



Fig. 20.

Genus *Anopheles*.

I. Pupa of *Anopheles maculipennis*: a, the respiratory trumpet; b, respiratory trumpet of *Culex*. II. Ova of *A. maculipennis* (greatly enlarged). III. d, ova of *A. bifurcatus*, as laid on the water; c, ova of *A. maculipennis*. (II. and III. after Howard and Grassi.)

in the preceding genera. The head, although large, is proportionately smaller than in *Culex*. On the thorax are two pointed air-tubes, perforated by a very narrow slit; the tail has four flap-like processes; the abdomen has a few tufts of chaetae both on the dorsum and venter. At first the colour is white and the creature transparent, though of a duller appearance than the larva; the pigment cells of the air-sacs of the larva remain and show through the skin; later the pupa becomes brownish with a broad, dark, double stripe down the mid-dorsal line and with two lateral stripes; the siphons are also dark-coloured and the eyes blackish.

The pupa of this genus can thus be told from those of the other genera by the straight abdomen and by the pointed air-tubes on the thorax. It remains upright in the water, often for a long time without showing the least movement. Now and then it may be seen rising to the surface and sticking its siphons out of the water, but never, as in *Culex* or *Anopheles*, remaining long in that position. It rises and sinks very slowly, thus again differing markedly from the pupa of other *Culicidae*.

## LENGTH OF THE EGG, LARVAL AND PUPAL STAGES OF CULICIDAE.

As in other groups of insects, so with the family *Culicidae;* the period of egg, larval and pupal life vary in each species. It is thus possible only to give a few brief summaries regarding the length of the various periods in their life-histories. In the various genera there is an uniformity of life-history with the exception of *Corethra*.

In *Culex* we find as a generality that the egg stage is very short. I have hatched *C. pipiens* larvae from the egg twenty hours after they were laid under natural conditions. Professor Howard, writing on *Culex pungens* in America, says that the eggs laid during the night or probably early morning hatched out readily in May at 2 o'clock in the afternoon of the same day, on warm days. In cooler weather they sometimes remained unhatched until the second day. Colonel Giles in his work says that *Culex* eggs take two or three days to incubate, but this is longer than usual, I fancy, anyhow in warm weather.

The larvae live, in the case of *Culex pipiens*, from two to four weeks, moulting their skin three times. The pupae I have kept

have hatched out in from two to eight days : Colonel Giles says five to ten days. In *Culex pungens* Professor Howard finds the larval life to be completed in a minimum of seven to eight days. The adults issue from the pupae when the latter are two days old. "This gives," says Professor Howard, "the minimum generation for this species as ten days, namely, sixteen to twenty-four hours for the egg, seven days for the larva, and two for the pupa." I have found that warmth greatly hastens development, and also the presence of plenty of food in the water. Some *C. pipiens* larvae kept in water rich in organic matter matured eight days sooner than another batch of the same larvae kept in pure spring water and fed scantily on infusoria, &c. Not only did the absence of food retard growth, but it made a difference of often nearly 1·5 mm. in the size of the specimens, those that had a scant supply of food being quite stunted.

I do not think therefore that any definite times can be given for the various stages, even in the same species, temperature and food having such a marked influence on them within certain limits. Howard found the eggs of *Anopheles maculipennis* took from three to four days to incubate; those laid in April four days, those in May three. The egg stage is given in Ross's Malarial Report (p. 19) as twenty-four hours (*in vitro*) for *Anopheles*. In the same report the larval life is given as probably from two to three days, considerably less, I should imagine, than is ever likely to take place; "but under unfavourable conditions," the report continues, "it may certainly extend to weeks." Professor Howard has found that in *A. maculipennis* it takes sixteen days to mature.

Nuttall and Shipley say the egg of *A. maculipennis* gives rise to the larva on the second or third day. The larval life, they say, lasts from eighteen to twenty-one days.

Dr. Lutz sends me the following note *re* the length of time taken by *Anopheles argyrotarsis*, Desv., to develop : "*Argyrotarsis* has been bred by me from the eggs ; it takes three weeks for total development in favourable temperature (25° C.)." The pupal stage of *A. maculipennis* is said by Meinert to last four or five days, a little less in warm summer weather. Howard says the pupal stage varies according to weather ; the minimum period during June was five days, although several specimens remained in this stage for ten days. The whole life cycle of this species common to Europe and America is twenty-four days. But heat

and cold accelerate and retard respectively the length of the various stages of *Anopheles*, just as in *Culex*, so that an approximate time can only be given.

During the past winter I found an abundance of *Anopheles bifurcatus* larvae of all sizes; they appear to grow at this time very slowly. I first noticed them on November 3rd, when some were quite small, others about one-fourth of an inch long; by December 22nd only two out of a hundred had pupated. Those kept indoors developed a little faster, but no pupae appeared until December 14th. This is the chief way that *A. bifurcatus* passes the winter. It does not seem to be usual for the larvae of *A. maculipennis* to occur during the winter in England; probably in mild weather the females, instead of hibernating, may deposit their eggs at once, thus producing a second brood, which would live through the winter and mature more rapidly in the spring. I noticed female *A. maculipennis* about as late as December 10th, and found a few larvae during the past winter.

In *Corethra* the larvae live through the winter, the larval stage extending from October or November until March or April of the following year. The pupal stage lasts only a few days; in spring Meinert found it to be from four to five days, but later in the summer scarcely four.

There is a second brood of larvae in the summer which develop more rapidly than the winter larvae, the period seldom exceeding six weeks. The first brood of flies commence in March and April, the second in August, September, and November, but occasional specimens are known to emerge in the intervening period.

## HABITS OF ADULT MOSQUITOES.

Mosquitoes present a great variety of habits, and certain species show great partiality for certain localities.

The genus *Megarhinus* almost exclusively inhabit deep tropical forests, and therefore do not often come under the term mosquito. They sometimes, however, leave their arboreal haunts and come into the haunts of man, for Dr. Lutz writes me from Sao Paulo that he had seen a *Megarhinus*, probably *M. haemorrhoidalis*, in the town of Rio.

That they sometimes attack man we gather from the fact that they have been sent in the collections to the Museum from

New Amsterdam, Australia, Ceylon, India, and Mashonaland. At one place at least *Megarhinus* is a troublesome mosquito, namely in S. India; regarding which Captain James writes me as follows: "Amongst the mosquitoes which are prevalent in the place where I am at present is a kind which the natives call the 'elephant mosquito.' It bites badly, and its bite is considered very poisonous." From Captain James's description it is evidently *M. immisericors*, Wlk., which occurs in Ceylon, India, and the Malay Peninsula. As one would expect from their brilliant coloration, *Megarhinus* are day fliers. *Anopheles* chiefly inhabit swampy regions and the neighbourhood of human dwellings. Our European *A. bifurcatus* I have found attacking people round woods, &c., but have never seen this species under cover; on the other hand, *A. maculipennis* is almost exclusively found indoors and in privies, the latter forming a favourite haunt. Numberless specimens of several distinct species have been sent from Malay, India, Africa, &c., taken in hospitals, houses, tents, &c., showing their domestic partialities, but many have also been sent (as *A. paludis*) from swamps and swampy country.

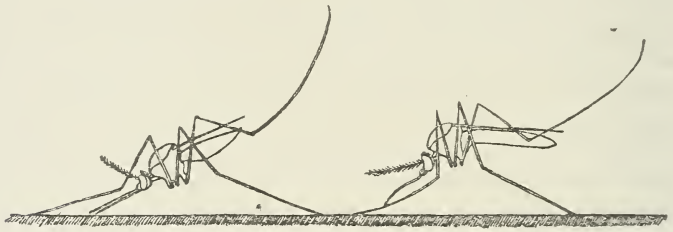
When at rest an *Anopheles* may be generally distinguished by its position from a *Culex*. Major Ronald Ross pointed this interesting habit out some time ago. *Anopheles*, when settled, generally rest with their proboscis pointed to the wall and their body at a considerable angle to the wall, resembling a "thorn fixed to the surface," whilst in *Culex* the insect's body is nearly parallel or the apex points to the surface (Figs. 21 and 22). Although this is a general rule, it is not invalid, for I have seen *A. maculipennis* settled just as in *Culex*, and *Culex pipiens* nearly at such an angle as the *Anopheles*. But in all cases the proboscis is on a line with the thorax and abdomen in *Anopheles*, whilst in *Culex* it is bent at an angle, as is clearly shown by Mr. Waterhouse's excellent diagram (Fig. 21). Colonel Giles has sent me photographs of these two genera resting, from which the figures on page 59 have been reproduced.*

In both cases the insect holds on to the wall or ceiling by the fore- and mid-legs only, the hind ones being free, and often moved about in the air like the feelers or antennae of a moth.

Female *Anopheles* are blood-suckers, but not exclusively so, for in our European species, *A. maculipennis*—often wrongly called *A.*

* Colonel Giles has brought back a new *Anopheles* from India which, when at rest, exactly assumes the position of *Culex*.

*claviger* on the Continent—this sanguinary habit is not exhibited at all, according to my experience, and I have lived for years where it is extremely common, some years appearing in great numbers, and every year in more or less abundance. Moreover, people who have stayed with me, who have been subject to severe annoyance from mosquitoes, have never been touched by them,



A. Resting position of *Anopheles* (left) and *Culex* (right) (after Waterhouse).

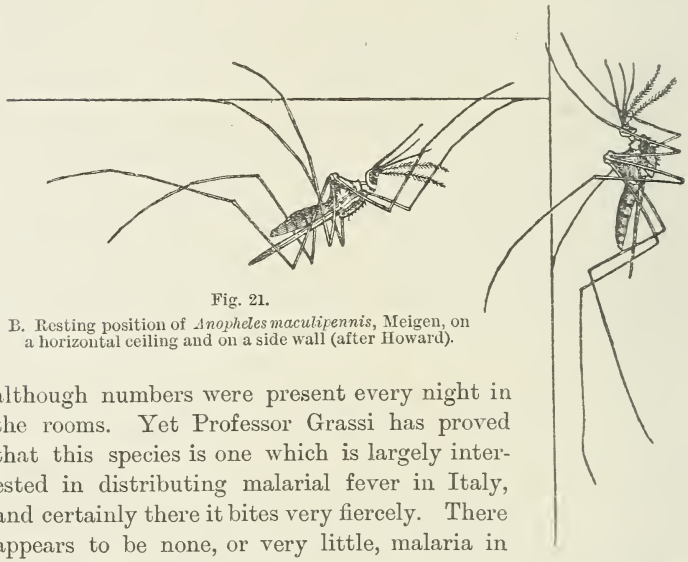
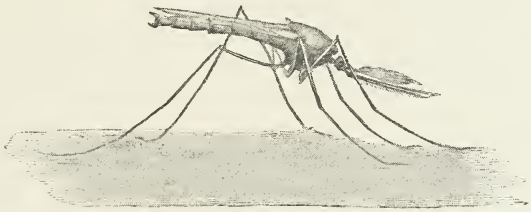


Fig. 21.

B. Resting position of *Anopheles maculipennis*, Meigen, on a horizontal ceiling and on a side wall (after Howard).

although numbers were present every night in the rooms. Yet Professor Grassi has proved that this species is one which is largely interested in distributing malarial fever in Italy, and certainly there it bites very fiercely. There appears to be none, or very little, malaria in England, and my investigations tend to show that this *Anopheles* does not bite here. May not this have some bearing on the dying out of this disease in our country, as well as the free use of quinine? On the other hand, *A. bifurcatus* and *A. nigripes* are both very voracious. The former I can verify from personal experience; the latter, Mr. Terry, of the British Museum, informs me is very annoying at Penzance, where

it seems to be common. Both *A. nigripes* and *A. bifurcatus* are malaria carriers, but are not nearly so abundant as *A. maculipennis* in England. The male *Anopheles* is not of a sanguinary nature.



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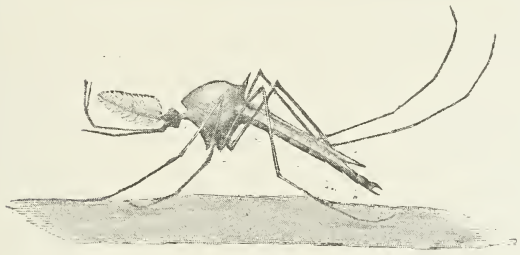

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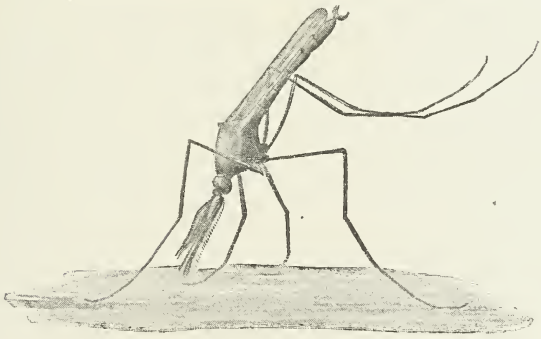

3.

Fig. 22.

*Anopheles* and *Culex* resting.

1 and 3. *Anopheles Rossii.* 2. *Culex fatigans.*
(Photographed from life by Lt.-Col. Giles.)
(Enlarged six times.)

In the genus *Culex* we find a great variety of different habits. Some species, like *C. pipiens* and *C. fatigans*, are almost exclusively house forms; whilst others, like *C. dorsalis* and *C. atratus*,

are outdoor species. Some, apparently, live chiefly in woods, others prefer dark lanes; but few seem to show any preference for sunlight.

*Stegomyia fasciata*, one of the most annoying and widespread mosquitoes, is a most vicious biter in the early afternoon, from about 1 to 3 P.M.; but Dr. St. George Gray adds, "I have caught them at all hours of the day, and even night." The majority of mosquitoes bite during the evening and night, from about an hour before sunset. This, however, is by no means always the case. Sir William MacGregor says *: "I first saw *Anopheles* on the afternoon of the first day we visited the west coast of British New Guinea. We all had sufficient experience of it before night, for it is not the case that *Anopheles* bites only at night, nor that its puncture is always painless." I have noticed that *A. bifurcatus* bites just as viciously during the day as at night. *Culex dorsalis*, often a pest in England, bites during the daytime. At Rochester, where I observed it in Colonel Newington's garden in August, it was attacking everyone, except myself, with severity, at four in the afternoon. Other species are day biters, and these, and such other points of interest, are mentioned with the description of each individual species. We must not be led away with the erroneous idea that *Anopheles* and *Culex* bite only at night.

When resting *Culex* are particularly fond of hiding under tables, chairs, &c., in the Tropics, from whence they come out and make repeated attacks on the ankles. Draperies of various kinds afford them protection during the hotter hours of the day, folds of bed-hangings and curtains being mentioned as the most favourite resorts. Regarding *Stegomyia fasciata*, Dr. St. George Gray writes in a letter to Mr. Austen (July 21, 1899), that "in the mornings it rests on the walls and clothing—especially dark clothing—where they are easily caught." Giles says mosquitoes have a tendency to leave houses to seek vegetable food at dusk, and again retreat to them shortly after sunrise. This statement does not tally with general information, but coming from such an accurate observer entitles it to respect. The majority of people will tell you that in the Tropics mosquitoes bite more of a night, hence the use of the invaluable mosquito curtain. Night is the time when both *Culex* and *Anopheles* cause most annoyance, from an hour or so before sunset to a short time after sunrise. But protection during

* Journal Tropical Medicine, Oct. 1900, p. 68.

those hours will not entirely save us from their annoyance, because certain species bite at other times, as, for instance, the world-wide *S. fasciata* and the European *C. dorsalis;* moreover, I have observed *Anopheles bifurcatus* biting in the daytime between 4 and 5 in the afternoon at midsummer, so that complete immunity from malaria cannot be obtained by shutting oneself up from an hour before sunset. The proper use of mosquito curtains when the majority of household pests attack, namely, at night, cannot fail, however, to very materially lessen the evil. One point brought out by two correspondents regarding the habits of *Culicidae* is very interesting; it is the preference mosquitoes, especially *Culex* and *Stegomyia*, have for dark or black clothing. In a despatch from Cayman Islands, Dr. G. Stuart Tait, Medical Officer, points out that "dark clothing has a marked attraction for mosquitoes, which may be because of the chemical employed in the manufacture."

From Dr. St. George Gray a similar note is sent. "I noticed," he says, "that they (mosquitoes) prefer to settle on dark clothes, as the black cassock of the priest and my blue serge trousers, whilst they would not alight on my light jacket. This morning I caught a few in my dressing-room all resting on dark clothes, whilst none were to be found on the light clothes." This I have recently noticed to be the case in some species in England. *C. dorsalis*, I noticed at Rochester, only settled on dark clothes, and I have observed frequently that *Culex pipiens* prefers to rest on a dark surface. Mr. J. S. Budgett writes me that when he was in the Upper Gambia he noticed "a very marked liking for settling upon certain colours. My clothes were hanging together upon pegs. *White* was avoided. *Darker* colours preferred. A great liking for a purple beaver hat was shown in preference to *black*, but of the latter colour there was little, and this was in exposed positions." Dark clothing should therefore be abolished as far as possible in all countries where mosquitoes are an annoyance.

Several observers have noticed that mosquitoes, especially *Anopheles*, are attracted to native huts by the odour the inhabitants emit. Stephens and Christophers observed that when natives slept in a tent used by Europeans that mosquitoes collected there. When Europeans used the tent two *Anopheles* were found in the morning; on the natives using the tent for two days sixty-two were found in the morning. Mr. Budgett also writes me that when in Gambia he partly attributed his immunity

from these pests to his tent being free from natives and pitched away from native huts. Grassi and others have pointed out that *Anopheles* are fewer in the upper stories of houses than lower down. It has also been noticed that people living in the upper stories of houses are more or less exempt from malaria. My experience is, however, that *Anopheles maculipennis* prefers the upper rooms of a house. This year I took ninety-five in the bedrooms and bathroom of my home on the first floor, but never saw one in any room on the ground floor. *Culex pipiens* occurred above and below.

The species I place in the genus *Panoplites*, including the *Taeniorhynchus taeniorhynchus* of Arribalzaga, the *Culex titillans*, Wlk., seems limited to riversides and swamps fed by running water (Dr. Lutz); they, unlike many mosquitoes, bite during the daytime, the bite being very painful.

Woods and spinneys harbour such species as *C. albifasciatus*, Macq., whilst the genus *Sabethes* is almost exclusively limited to the depths of forests, hence so few are found in collections. Of the habits of *Psorophora* I know little or nothing, but probably Dr. Lutz will enlighten us later on on this point.

*Aedes* do not generally attack man or animals, as far as previous observations go—*Aedes*, I mean, in the restricted sense. They are found especially in marshy spots, the borders of lakes and so forth. As, however, one species, *Aedes fuscus*, Osten-Sacken, has been sent in numbers from Canada amongst the instalments of mosquitoes received from J. M. Walker, I venture to think they may be blood-suckers. The members of the related genus *Uranotaenia* suck blood and live in swampy regions, so Dr. Lutz informs me, and so do the members of the new genera *Wyeomyia* and *Aedeomyia*. The former are almost entirely wood mosquitoes.

Very different are the habits of *Corethra* and *Mochlonyx*, which feed exclusively on vegetation, the adults being provided with only a short proboscis, more like that of the *Tipulidae* than that of the *Culicidae*. Unlike most *Culicidae* they inhabit the open country, heath and woods, and do not enter habitations at all. They are often to be found in great numbers along river banks and under the shade of overhanging trees, where their fragile bodies are protected from the wind.

## MOSQUITOES PROBABLY HIDING IN JUNGLE, WOOD AND FOREST DURING THE DAYTIME.

What becomes of a very large number of mosquitoes during the daytime? We certainly find many indoors, but by far the greater number must go elsewhere. In our common European species, *C. pipiens*, L., and *A. maculipennis*, Meig., I have noticed that they seem to disappear in the morning if the windows are left open, and that they may often be seen beating against the glass trying to enter the house in the evening. On collecting in a wood behind my house I found *C. pipiens* in numbers amongst the foliage of ash, oak and low shrubs, and also a few *Anopheles*. It therefore seems that some at least take shelter in woods during the daytime.

This view is also brought forward in an interesting despatch received from Lieut.-Col. Macree, from Dacca, which is appended here in full, as it contains other points of interest: "So far as Dacca town is concerned, I have never known any place where mosquitoes are so numerous, so vigorous and so persistent. At first sight it would seem (accepting the mosquito-malarial theory) as if every human being should be saturated with malaria. . . . Not a single species of the genus *Anopheles*, the spotted-winged variety, could be found. It is possible the latter may be more or less prevalent in the town during the rainy season, but at present (March) there are none." Further on in the despatch he says: "About a year ago two of the School Assistant Surgeons paid a visit to a village to the north of the town some five miles distant on the borders of the Bhawal Jungle, inhabited by some Manipuri political refugees, and had the curiosity to examine a large proportion of the villagers, finding a large percentage of them suffering from enlarged spleen, and showing many other signs of malarial poisoning. I resolved therefore to despatch Assistant Surgeon Jogessur Mookerjee, who had taken much trouble in making the collection, to this village, in the hope of finding the malarial mosquitoes, and was not disappointed. Two or three species of *Anopheles* were found here, but not in any large numbers. The Assistant Surgeon paid several visits to this village and seldom found any other variety of mosquitoes. The females largely preponderated. So he came to the conclusion that the insects returned to the

jungles during the day, returning from them towards night. Specimens of *Anopheles* were also found by him in other villages surrounded by jungle to the east of the town, where the people suffer much from malarial fever. It would seem as if this particular genus of mosquitoes clung to jungle."

It is quite possible that under certain conditions, such as the prevalence of forests and jungles near habitations, that these pests seek the shade and coolness there afforded during the hot part of the day, just as *C. pipiens* seems to prefer to take up its day habitation in shrubs and woods in this country.

This, however, does not fit in at all with Colonel Giles's statement, that "mosquitoes have a tendency to leave houses to seek vegetable food at dusk, and again retreat to them shortly after sunrise."

Mosquitoes are most annoying indoors at night, and they, anyhow in the case of our British species, come to the windows at dusk, instead of leaving the houses. By keeping all windows shut, from an hour before sunset until it is quite dark, the numbers entering the house can be greatly reduced.

## THE EFFECTS OF WEATHER ON MOSQUITOES.

*Culicidae*, like most insects, are very susceptible to changes in the weather. A certain amount of dampness seems almost essential to them at times, whilst a cold strong wind places them at a great disadvantage. After a good rainfall they often seem to appear in greater numbers than usual, no doubt because there are then formed pools in which they can breed, or vessels are filled in which the various *Culex* may deposit their ova. Regarding the effect of weather upon them, Mr. Tait, medical officer, writing from the Cayman Islands, says: "There are several expanses of brackish water throughout these islands which seem to favour the propagation of mosquitoes. A slight rainfall, followed by heat, appears to favour their increase, while a continuous shower or a high wind is destructive to them." Undoubtedly, a moderate rainfall filling up their breeding-places is essential to their increase; the pregnant females remain in a kind of dormant state until these conditions prevail.

Dr. Christophers found the *Anopheles* in numbers in native huts during the hot dry weather at Freetown, but they left to deposit their eggs as soon as the pools were ready after rains.

Heavy downpours would tend to wash or scour out small puddles and vessels, and so probably destroy large numbers of larvae and pupae; hence, after continuous rain, as Mr. Tait says, they may become much scarcer.

Possibly very prolonged frost may kill the larvae, but it does not affect them to the extent it is supposed to. This year (1901) a barrel in which *Anopheles* larvae were living was frozen over for a week in January, the ice being two inches thick. I naturally expected to find all the larvae dead, but not one seemed to be affected, and they are still (February) all growing slowly. This species (*A. bifurcatus*) lives over the winter, and hence cannot be affected by frost. Whether other species act in a similar way I do not know. When the temperature was 30° F. I found female *A. maculipennis* still active in an outhouse.

## PAIRING OF GNATS.

It is strange that so few observations have been made upon this subject. No doubt there are considerable differences in the various groups. Speaking generally, gnats pair towards evening. I have watched the process in *Culex pipiens*, but in no other species.

The males assemble in large numbers, flying about in clouds, scattered over a small area. In *C. pipiens* the male clusters that I have noticed were composed of from fifty to a couple of hundred individuals in small cloud-like groups, very similar to *Tanypus* and other *Chironomidae*.

On still evenings the females fly to the males and are at once seized by them, the two then floating away *in copulâ* from the rest. In one instance a small female *Anopheles maculipennis* flew into a cloud of male *C. pipiens*, and she was immediately seized and carried off.

The males of the *Culicidae* in general seem to avoid houses, &c., where the females go. I have never seen a male *C. pipiens* or of any other European species indoors. But in *Anopheles* the males, in the case of *A. maculipennis*, often come into houses, privies, and sheds, and breeding takes place there as well as out-of-doors, especially during the autumn.

## HOW MOSQUITOES PASS THE WINTER.

In tropical climates mosquitoes breed all the year round, with periods of rest, however, in the dry or hot season; but in temperate climates they breed mainly during the spring and summer months. In Arctic regions they probably behave much as in temperate climates, but are active for shorter duration. There is some variation, however, according to species in every land.

In North Europe two of the three *Anopheles* pass the winter months in the adult condition in a dormant or hibernating state. About the end of October but few *Anopheles* can be seen. From the beginning of October males will be noticed with the females; nearly all the *A. maculipennis* I have noticed late in the autumn have been gravid females. These seek some shelter as soon as the weather becomes cold, and lie up during the winter months in a dormant condition, appearing early in spring to deposit their eggs. Their winter quarters seem to be in crevices in outhouses, barns, and cellars. In very warm winters I have found this species at all times in the winter months in houses and sheds, and in some cases these females seem to deposit their eggs, so that we may get the larval state during the cold part of the year.

In tropical climates there is no doubt that a semi-hibernating state usually takes place during the dry season just as in Europe during the winter, both excessive drought and cold influencing them alike. "In the North-West Provinces of India and Punjab," says Colonel Giles, "although the winter air temperature does not fall as low as in Europe, the radiation at night is so powerful as to occasionally freeze the small collections of water most favoured by mosquitoes; in any case, to render them too cold for the survival of the larvae. In the hot weather, on the other hand, all small collections of water are so rapidly dried up that it is impossible for the females to find suitable places to deposit their eggs, and the power of resting in a quiescent condition is as necessary to the persistence of the species as it is during the winter of Lapland."

This does not appear to be always the case, as the appended more recent communication shows. This interesting note regarding the hibernation of *Anopheles* in the North-West Provinces of India is also from Lt.-Col. Giles.

"The climate," he says, "is fairly cold in the winter, falling as low as 55° F. in the house at mid-day at times. Up to the end of October, perfect *A. Rossii* and *A. Sinensis*, sub-sp. *nigerrimus*, are common, but by November 20 had quite disappeared, *nigerrimus* being the species most in evidence while they were becoming more and more scarce. It is noteworthy that a very large proportion of these last visitors were ♂'s. I sought in every corner and could nowhere find a single hibernating specimen.

"On the other hand, *Anopheles* larvae persist in large numbers in certain tanks in the open, where the water is warmed by the sun all day long, but such pools are necessarily rare, as unless they are so placed as to be fed with fresh water or are exceptionally deep they must dry up. There is a small cemented tank in my garden which I keep replenished for observation, and which still has numbers of larvae, but usually no pupae. However, the margin of temperature inimical to pupation must be a very narrow one, as, after a fall of rain, accompanied by cloudy nights, during which the night temperature could not fall to the usual minimum, the higher temperature sufficed to bring about the appearance of a few pupae. Now the rain had not perceptibly altered the depth of the tank, which indeed is filled periodically from the well, and so fluctuates much more from this than it could do from any shower, so that the occurrence has evidently no connection with the rain *per se*.

"These facts, I think, point to the conclusion that one of the plans whereby our local *Anopheles* secure the maintenance of the species through periods untenable to the imagines is by the persistence of larvae which are capable of surviving as such, but cannot pupate till the water grows warmer."

Further on in his letter he says that in the intense heat the *Anopheles* are rare, and supposes that they hide in sheltered places, as the larvae can then only be found in "specially situated pools when the water is cool."

We find that in *Culex* hibernation takes place just as in *Anopheles*. Cellars form a favourite place for *C. pipiens* to pass the winter. In one case they are recorded by Westwood as coming out in the winter in a house and causing annoyance,* but such is unusual; they hibernated, he supposed, in a chimney. Wade and others observed this hibernation of *Culex;* whilst in recent years more evidence regarding this point has come to

* Proc. Ent. Soc. London, vii. 1876, and p. xxi. 1872.

hand. I have observed them for many years hibernating in my own house, going into winter quarters in cellars, sometimes in October, at others in November, and appearing again in March or April. Now and then in warm winters I have found them, like *Anopheles*, flying about in December and January. The hibernating *Culex* are all pregnant females, the eggs developing during the spring. During the past year I kept some under observation; their bodies were thin when I took them from the cellar, but in about four weeks (April 22nd) they began to swell, and later they deposited fertile eggs. They had no meal of blood and yet they laid fertile eggs, all of which hatched out.

In cold regions they sometimes appear before the snow melts off the land. Von Hofmann * saw them appear in the Western Urals in June before the ground had begun to thaw. The *Culex* common on the Tundra, said to be *C. pipiens* (probably *C. nigripes*, Zetterstedt), hibernate under the moss. It may be taken as a definite law, I think, that *Culex* and *Anopheles* (except *bifurcatus*) normally hibernate during the winter months in temperate and Arctic regions, and that even in tropical and sub-tropical climates they pass a certain time in a semi-dormant state whilst favourable conditions for their increase are absent. Mr. Christophers, in his Report to the Malarial Commission, tells us † that "in the dry season in Sierra Leone the *Anopheles* exist in most parts of the town (Freetown) in dwellings, especially in overcrowded native huts and native quarters, ready to lay their eggs when pools appear." Amongst places in tropical climates where they have been observed in this semi-dormant state during the cold or dry weather must be mentioned curtain hangings and draperies generally (Giles). Moreover, the same observer states that such places form a favourite resting ground for mosquitoes during the hot parts of the day at the season when they are most annoying.

"The fact that mosquitoes hibernate would explain," says Mr. Nuttall, "the occasional occurrence of malaria in winter," ‡ especially when we know that they may come forth from their winter quarters at all times. *Mochlonyx* also probably hibernates, but of this and all other genera save *Corethra* we know little or nothing. *Corethra* passes the winter evidently entirely in the larval stage, the larvae either being half grown or nearly

* "Reisen," p. 183.
† Proc. Roy. Soc., July 6, 1900.
‡ Johns Hopkins' Hospital Reports, vol. viii. p. 112.

mature, and seem to be little affected by the hardest frosts. As they possess no air-tubes such as in *Culex* and *Anopheles* we can readily see that they suffer little inconvenience when the water is coated with ice.

## FOOD OF ADULT MOSQUITOES.

Until the researches of Manson, Bancroft, Ross, Grassi, and others proved the part played by the genera *Anopheles* and *Culex* in malaria and filariasis,* mosquitoes were only of importance on account of their annoying biting habits. Their thirst for blood is proverbial. Even in our own country one often hears outcries and wonderful statements regarding the arrival from abroad of hosts of mosquitoes. They are always with us to the number of twenty-six species, but it is apparently only some that have a thirst for blood, and those species only at certain times.

Members of the genera *Culex*, *Stegomyia*, *Panoplites*, *Uranotaenia*, *Wyeomyia*, and *Anopheles* have similar tastes. By far the most usual food is vegetable food. I have frequently seen *Culicidae* settled on *Compositae*, sucking the juices of the flowers, both males and females. Major Ross and others point out how they may be found and kept alive on banana slices. Dr. Bancroft has found that they can be kept alive on banana slices, but prefer fresh fruit. In the Report of the Malarial Expedition to West Africa this was confirmed. "In the evening," Major Ross says, "they (the mosquitoes) began to fly about and walk over the fruit, plunging their probosces into it in many places, so that the banana was sometimes covered with the gnats both male and female." From St. Lucia and other places their preference for banana has been recorded. In England I have observed *C. pipiens* in numbers feeding off decaying apples.

There is little doubt but that many species live exclusively on vegetable diet, or anyhow the blood of animals otherwise than man. Comparatively few must be the chances of *C. nigripes*, Zett., getting a meal of even vertebrate blood, much less human blood, in the Arctic Circle, yet these creatures abound, and also on the high plateau of India. That many *Culicidae* take the blood of invertebrate animals is well known.

* Journal Tropical Medicine, Nov. 1899.

During the past year I have had two generations of *Culex nigritulus* in an outdoor barrel which can have had no blood, except that of some *Chironomidae* that hatched out in the same receptacle.

Yet we find that some species apparently must have their meal of blood to deposit fertile eggs. In the previously-quoted Report by Major Ross on page 21 we find it stated that, "it seems that a meal of blood is necessary before fertilization." Naturally-fed gnats were found to invariably lay eggs after two or three days; those which were bred from larvae in captivity, and had been isolated and fed in test-tubes, *never* did so, although before being isolated they had long been in company with males. The inference is that fertilization takes place only after the female has been fed."

Lastly, it was observed, that "previously-fed and fertilized insects would lay a second batch of eggs after a second meal of blood without a second fertilization, but never laid a second batch of eggs without a second meal of blood. That is, one fertilization suffices for several batches of eggs, but one meal of blood for one batch of eggs only."

These observations agree with those made in India by Major Ross, and thus the following law may hold good for *some* of the *Culicidae* that feed on man, at least for a few of the commoner species—"*the insects require blood for the propagation of their species.*"

It does not follow because one insect lives in a certain way, that closely-related species need do the same, and the fact that both *C. nigritulus* and *C. pipiens* will oviposit fertile eggs without any meal of blood in Europe need not detract from the previously-quoted phenomenon. Some of those species which live with man may have acquired the habit of blood-sucking, which has become an essential feature of their life in regard to the maturity of the sexual organs in the female.

But after observations made during the last ten or twelve years on European *Culicidae* I feel bound to state that blood is not an essential for the majority of European species, and in this Professor Howard agrees in connection with the *Culicidae* of America. "Female mosquitoes are normally, without much doubt, plant feeders," says Professor Howard, "and the statement that not one in a million ever gets the opportunity to taste the blood of a warm-blooded animal is unquestionably an under-estimate."

Not only in the Arctic Circle, to which I have referred, but in America also are vast stretches of swampy land into which Professor Howard tells us warm-blooded animals never find their way and in which mosquitoes are breeding in countless numbers.

Sir William MacGregor tells us * that he camped "for weeks at a time in the mud and swamps of the western or *Anopheles* country (of British New Guinea), and yet left without any cases of fever." The reason is that for some hundred and fifty miles of coast there were no human inhabitants, which would seem to show that human blood diet is not necessary to the hatching of *Anopheles*.

With regard to these habits, with one or two exceptions it is the female alone that sucks blood. Ficalbi tells us that in *S. fasciata* (his *C. elegans*) the male bites as persistently as the female, and in a few other cases this has been noticed.

Why they should draw blood at all and what causes predominate this sanguinary habit are unknown. The statement previously quoted regarding the development of the fertile eggs must not, I think, be taken into too much account when we consider the subject in a wider sense, as large tracts of land exist where mosquitoes flourish and yet warm-blooded animals are absent. Certainly locality has nothing to do with this habit, for we notice mosquitoes to be just as annoying in Arctic regions, in parts where man has never been before, as in tropical climates. It is not heat alone that influences them, except that they breed more rapidly in warm than in cold weather, but in such creatures as *C. nigripes* quite as vast swarms occur on the snow-clad Himalayas and Arctic regions as those of *C. fatigans* and others in tropical climes.

That the *Culicidae* are phytophagous I fully believe; the blood-loving habits of the female and sometimes of the male are secondary acquired habits, which some species have developed more than others.

But besides sucking human blood and the blood of warm-blooded animals and vegetable fluids, *Culicidae* have been definitely observed drawing out the body juices of numerous invertebrates and cold-blooded animals. I have on two occasions seen small *Culicidae* (*C. nigritulus*) sucking at the body of Chironomus and other small Diptera. Professor Howard, in his interesting Report † sent me, states that the late Dr. H. A.

* Journal Tropical Medicine, no. 27, vol. iii. p. 63.

† Bull. 25, Dept. Agriculture, Entomology, p. 13. Howard (1900).

Hagen took a species of mosquito in the North-West which was engaged in feeding upon the chrysalis of a butterfly.

Mosquitoes are also stated to attack the heads of young fish, and in some instances to have killed them; and there are many records of their attacking birds and mammals.

The males are almost exclusively vegetable feeders. One habit of interest in the males is that mentioned by St. George Gray: "Male mosquitoes," he says, "are fond of wine, and every evening at dinner I see some on the stopper of the decanter or at the edge of a wine glass" (letter May 11, 1899).

## IMMENSE SWARMS OF MOSQUITOES.

Occasionally cloud-like masses of various *Culices* are seen. I remember twice having noticed dense swarms of them in the fens; in both cases the insects were male and female *C. cantans*. So abundant were they that the air was quite darkened by them. These insect-clouds were constantly moving up and down about ten to twelve feet above the ground. At times the noise they produced could be heard a quarter of a mile off, then it would suddenly cease for some time and commence again.

Mr. W. W. Smith * records a case in New Zealand where "a train passed through a wall of mosquitoes three-quarters of a mile in length, twenty feet high, and eighteen inches thick." This abnormal swarm was composed of *Culex* (*Uranotaenia*) *argyropus*, Walker.

A similar case of this extraordinary habit is recorded in the same Journal by Mr. J. W. Douglas †: "On every evening of the last ten days this road (Lewisham Rd., S.-E. London) has been invaded by vast hordes of large *Culices*—the air thick with millions of them, at times charging in close column up the road like a squadron of cavalry, at other times engaged in dancing up and down after the manner of their race." Others appeared in enormous swarms at the ends of the branches of one of the highest trees in the same road, rising in a column, "like smoke from a chimney, for a distance of some twenty or thirty feet." Mr. Haliday also records a similar occurrence, the species being his *C. detritus* (= *C. nemorosus*, var.). ‡ During the present

* Ento. Mo. Mag. p. 321, 1890.
† *Ibid.* p. 239, 1895.
‡ Ento. Mag. i. 151, 1883.

year I had reported that dense masses of gnats were seen along the Downs near Wye, appearing like columns of smoke in the valley, rising and falling. I did not see this, but visited the Down-sides the next day and found great numbers of male *C. pipiens* about in the evening, dancing in little clouds where they were sheltered from the wind.

Romolo Gessi Pascha, in his book "Seven Years in the Soudan," p. 47 (1892), speaks of "myriads of mosquitoes which obscured the air" at Meshra-el-Rek. If we go to the Arctic regions we get similar phenomena, for Dr. Lugger informs Professor Howard that Dr. Emile Bessels, of the Polaris Expedition, was obliged to interrupt his work in Davis Straits (latitude 72° N.) on account of the multitude of mosquitoes.

What these dense swarms mean I do not know. In those I have seen, and in the case recently reported, males were predominating. It may be these masses of gnats are males gathered together to attract the females, who are known to fly to the males to be fertilized in the genus *Culex*.

## NATURAL ENEMIES OF MOSQUITOES.

Nearly every insect has one or more natural enemies, but it is only now and then that they are of any great service in lessening the numbers of any particular pest. Natural enemies, nevertheless, tend to keep the equilibrium of Nature, and to restore it when upset, although we may not see any great change in this respect; but destroy the natural enemies, then one will soon find out the important part they play in the economics of life.

Mosquitoes, like all the rest of the insect world, have many such enemies, but few are of any real importance in connection with the destruction of these annoying insects. Among the most important enemies the mosquito has to fight against are fish; many kinds of fish devour with great avidity the "wrigglers" of *Culex*, hence we find but few of these aquatic larvae in water where fish exist. That they may be employed on a small scale with success to keep these pests in check may be gathered from the following quotation from one of Dr. St. George Gray's letters: "A friend of mine living near Chausée keeps down the mosquitoes by having a couple of tubs of fish in his yard. He says he has no mosquitoes now. I lived

in the same house five years ago, and at that time they were very numerous, and had a rather sharp attack of fever whilst living there."

Mr. Budgett informs me that during his last visit to the Upper Gambia he did not get fever as in the previous year, and this was doubtless because he drained the ground all round the house and had all the standing water in the house stocked with the fry of fish which he was observing. This does not apply to all fish, however, for Captain James, I.M.S., has found fish constantly in company with *Culicid* larvae in the ricefields of Southern India. Nuttall * records finding *Culex* and *Anopheles* larvae ten times in England in company with fish. Several notes from Cambridgeshire mention fish, tadpoles, *Asellus*, &c., in company with the larvae. At Clayhithe, in Cambridgeshire, larvae were found in a fish-pond containing small pike and inch-long roach and dace, so that these species cannot be considered inimical to the larvae. Colonel Giles, on the other hand, in Northern India, says he has never met with fish and the larvae of *Culicidae* in company, and points out that the ordinary golden carp, so common in ornamental tanks in Indian gardens, are so greedy of mosquito-larvae that they never allow them to survive in their company.

The subject of larva-feeding fish is one that should be worked out. Those species which are fond of such food might well repay for their introduction into tanks and pieces of water near human habitations, where the fish of the district are not of any use as mosquito destroyers. Concerning this subject, Professor Howard writes : "The use of the carp for this purpose has been mentioned in the preceding paragraph, but most small fish will answer as well. The writer knows of none that will be better than either of the common little sticklebacks, *Gasterosteus aculeatus* or *Pygosteus pungitius*. They are small but very active and very voracious. Mr. F. W. Urich, of Trinidad, has written me that there is a little cyprinoid common in that island which answers admirably for this purpose. This fish has not been specifically determined, but we hope to make an effort to introduce it into our Southern States if it proves to be new to our fauna. At Beeville, Texas, a little fish is used for this purpose, which is there called a perch. They soon eat up the mosquito larvae, however, and in order to keep them alive the people adopt an ingenious fly-trap, which they keep in their houses, and in

* St. Re. Mal. p. 12, I.

which about a quart of flies a day is caught. These flies are then fed to the fish" (Bull. 25, p. 54).

Birds and bats of course also devour *Culicidae* amongst other insects. One instance recorded in the "American Naturalist" (1880, p. 896) shows that the nighthawk takes large numbers, six hundred being found in the crop of one bird. Swallows, martins, flycatchers, &c., do no end of good in keeping the numbers down, especially the first two birds. I have frequently seen the swallow and house martins catching *Anopheles* as they were flying round and into my house towards the evening. No doubt bats which fly round houses also do much good; the lights from the windows attract large numbers of insects, and so the bats hunt in the "insect lines" round the house. Dragon flies (*Odonata*) have also been shown to be of much use in hunting and destroying Culicidae, especially in the larval state. *Vide* the Lamborn Prize Essays, "Dragon Flies *vs.* Mosquitoes" (Aaron, Weeks, Beutenmüller).

Larvae of the water-beetles of the families *Dytiscidae*, *Gyrinidae*, and *Hydrophilidae* also feed on mosquito larvae, as also do various aquatic Heteroptera.

## CULICIDAE ATTACKED BY FUNGI.

A fungus of the family *Entomophthorae* has been recorded as attacking the adult stage of certain mosquitoes. The species is *Entomophthora sphaerosperma* of Fresenius. According to Dr. Thaxter,* this fungus is peculiar in that it attacks widely different insects, except Orthoptera. Amongst Diptera it has been especially noticed in the Culicidae, and has been known to occur in an epidemic form. This fungus was described by Fresenius in 1856. It is also found in Europe. Another species,† *Empusa culicis*, Braun, very similar to the *Empusa musca* that attacks the "house-fly," also destroys *Culex* both in Europe and America. The infected host generally attaches itself to the under side of leaves, to stones, walls, and the sides of tanks and butts; the attachment is by threads which proceed from the mycelium in the body of the gnat. A third species ‡ is also recorded by

* Entomophthorae, U.S., p. 172, pt. ix., fig. 68, Thaxter; "Sylloge," VII., No. 974, Saccardo.

† *Unicellular algae*, p. 105, Braun; "Entomop.," U.S., p. 157, Thaxter; "Sylloge," VII., p. 969, Saccardo.

‡ "Entomop.," p. 166, Thaxter.

Thaxter as attacking small gnats (sp. ?) in North America, and called by him *Empusa papillata*, but these small gnats may not have been *Culicidae*. This latter parasite is confined to Diptera, and only found, we are informed, attacking minute gnats, particularly in the beds of mountain brooks on moist logs.

## CERTAIN WATER PLANTS INIMICAL TO THE LARVAE.

Colonel Giles has noticed in the Benares Public Gardens, where there are scores of small irrigation tanks, that both *Culex* and *Anopheles* larvae were present in every tank save those that were covered with a peculiar floating water plant, looking much like young lettuce, which is spoken of by the natives as *Jalkumi*. In the tanks so planted the water was alive with young leeches and nematodes, but not a single mosquito larva. When introduced into a tank containing mosquito larvae, however, the plants appeared to exercise no hostile influence on their development, and for this reason Colonel Giles concludes that the plants simply act mechanically in the same way as an artificial cover. The plants, in fact, simply hide the water from a mosquito when searching for a suitable place in which to deposit her eggs.

## THE GEOLOGICAL DISTRIBUTION OF CULICIDAE.

As far back as the Purbeckian Period we find traces of *Culicidae*.

Brodie * describes a wingless gnat, with legs and antennae well preserved, from the Purbeck rocks of England, and named by him *Culex fossilis*. This unfortunately is the only old record I know of, but it shows us that the family was represented as far back as the Secondary Period.

In the Tertiary ambers the mosquitoes are fairly plentiful. The genera *Culex* and *Mochlonyx* have been identified by Loew and Giebel both in America and Europe. From Aix and Utah the genus *Corethra* has also been recorded, whilst others have been obtained from the well-known beds at Florissant and in the Isle of Wight. Heyden also describes from Rott a species under the name *Culicites* in Tertiary strata.†

* "Fossil Insects," Brodie.
† Bull. No. 31, "Geolog. Survey," U.S.A. 1886, p. 91.

## THE GEOGRAPHICAL DISTRIBUTION OF CULICIDAE.

The family *Culicidae* is cosmopolitan. No matter whether we go into the Arctic Circle or to the Tropics, we find *Culicidae* in abundance, and life often made a misery by the vicious and persistent attacks of these insect pests. Although species are few in the Arctic Circle and cold regions bordering it, their numbers are often immense. In C. F. Hall's second Arctic expedition mosquitoes appeared in July in extraordinary abundance. From Greenland, Nansen writes : " Whole clouds of these bloodthirsty demons swooped upon my face and hands, the latter being at once covered with what might well have passed for rough woollen gloves." Then, after describing how they were pursued until nearly driven to frenzy by their attacks, he says—" Greenland is one of the countries of the world which is most visited by this plague."* In Lapland and other European countries they form a veritable scourge ; while in the North-West Provinces of America they appear in equal numbers and with equal ferocity, in some districts causing whole herds of horses and stock to stampede, so venomous are their bites, whilst many of the natives constantly move their habitations and herds so as to escape these dreaded pests. Judging from accounts given by travellers, I should say the mosquito is a more terrible nuisance in cold regions than in the tropics, but the following quotation will show how they treat travellers in hot climates.

" For some nights," writes D'Albertis † from New Guinea, " we have not been able to sleep, owing to mosquitoes and sand-flies. These small and almost microscopic insects are terrible enemies and put us to real torture. My people to defend themselves against their attacks sleep in an open place surrounded by great smoky fires." And again from the same country he writes, " Sand flies and mosquitoes torment us from morning until night."

Similar accounts could be given from most countries in the tropics, whilst even in temperate climes they at certain times and in certain places, such as the Alps, S. Norway, and parts of Italy, and even now and then in our own country, cause a good deal of suffering. *Culicidae,* then, with the exception, it seems,

* " The First Crossing of Greenland," vol. i. p. 397.

† " New Guinea," by L. M. D'Albertis, 1881, vol. i. p. 272, and ii. p. 242.

of a few small oceanic islands, are cosmopolitan, but I believe even in the small oceanic islands they will be found when carefully searched for. Some of the genera of this family have a more limited range than others.

The *Anopheles* occur in nearly every country, but they seem to prefer warm climates. Out of the forty-three species of *Anopheles* that I have seen, no less than twelve occur in India and the Malay Peninsula, five in South America, and four in the West Indies, whilst so far six species are recorded from West Africa; two of these species occur in the greatest abundance. From Europe we have certainly five and possibly six species, but with the exception of one (*A. maculipennis*) they have not a wide distribution and do not occur in any great numbers, such as we find *A. costalis* doing on the West Coast of Africa. Four species occur in Australia, where, anyhow in Queensland, they seem to be abundant.

Both the Indian and African *Anopheles* have a wide distribution on their own Continents. I feel sure that *A. barbirostris* occurs at Lagos as well as in Malay, but no other species is common to the two countries. *Anopheles Rossii* may be found from Ceylon to China, but does not occur in Africa, America, Australasia or Europe, for I think Grassi is wrong in looking upon it as a sub-species of *A. superpictus*.* Europe and North America have a species common to both Continents, viz., *A. maculipennis*, Meigen, and I feel sure the Asiatic *A. Sinensis* occurs as a sub-species (*pseudopictus*, Grassi) in Europe. But, speaking generally, the species of *Anopheles* are somewhat restricted in distribution.

*Culex* is a world-wide genus, occurring from the Arctic circles to the Equator, and is more or less abundant in all countries, both in species and numbers.

The genus *Psorophora*, in the restricted and modified sense, occurs only in the southern half of North America and in South America; the nearly allied new genus *Mucidus* on the West Coast of Africa, Malay Peninsula and in Australia. *Sabethes* so far has only been recorded from South America. The brilliant *Megarhinas* occur chiefly between latitude 40° N. and 40° S., especially in South America, but also in North and Central America, in Africa, India, Eastern and Western Indies and Australia.

The single species of the new genus *Toxorhynchites* occurs in

* Giles has recently shown their larvae to be quite distinct.

South Africa. *Aedes* are limited in number ; the few species that do occur are found in Europe, North America, Africa, and one probably in the West Indies. The genera closely related to *Aedes*, namely *Uranotaenia*, Arribalzaga, *Aedeomyia*, mihi, and *Haemagogus*, Williston, are found in the following countries : *Uranotaenia* in North and South America, Africa, West Indies, Australia, and New Zealand ; *Aedeomyia* in India, Australia, and South America ; *Haemagogus* is at present only recorded from the West Indies.

Of *Corethra* we know little, but the genus seems to be widely distributed, species having been recorded from North and South America, from Manila, India and Europe.

*Mochlonyx* is confined, as far as our present knowledge goes, to Europe.

Owing to mosquitoes being closely united to man and his habitations, it is not surprising that we find many species with a wide distribution. Amongst the latter may be mentioned *Culex* (now *Stegomyia*) *fasciatus*, Fabricius, which has been described under such a variety of names. This is certainly one of the commonest mosquitoes and one of the most annoying. Its distribution is best seen by examining the map (p. 292), the districts where it has been recorded and sent from being darkened ; the probability is that much of the intervening spaces still uncoloured will have to be filled in as more collections arrive.

It has so far been sent in numbers from South America (where it is known as *C. mosquito*), from Central America and the neighbouring West Indies ; it occurs in the Southern States of North America, both on the East and West coasts of Africa, as well as North Africa (Port Said) ; in India, both north and south, it is abundant, while in Malay its numbers are very great ; in Siam, as well as along the coast right through the East Indies, it may be constantly found ; away north through China, Formosa, and Japan it is to be observed in more or less abundance, whilst I trace the *C. Bancroftii* of Skuse from Australia to be no other than this widely distributed species. In Europe it certainly occurs in Italy under the name of *C. elegans* (Ficalbi), in Portugal and Spain under the name of *C. calopus* (Meigen) ; it is doubtfully recorded under the name *C. calopus* in England, and I have received specimens from Malta and Gibraltar. With the species closely allied to our common English mosquito *Culex pipiens*, Linn., namely *Culex fatigans*, Wied., we find much the same. A glance at the map (Fig. 183)

will show the wide area over which it is found, but *C. fatigans* shows more variation than *Stegomyia fasciata*, and perhaps has not quite such a wide northern spread.

It is not only on account of the wide area over which certain species are found that the geographical distribution of the *Culicidae* is of interest, but more especially on account of certain anomalies which some species present in regard to this distribution.

Who would expect to find living around and in the Himalayas European species? Yet such is the case. Major Giles sends me a specimen taken at Naini Tal of Noè's *Culex mimeticus*, and another of *Culex spathipalpis*, of Rondani, also *Culex annulatus*, which Major Lindsay found in the Punjaub. Still more remarkable is the fact that the Arctic species, *Culex nigripes*, Zett., occurs on the Himalayas at between 13,000 and 13,500 feet. Probably it occurs in the intervening tract of Siberia and Turkestan.

In *Mucidus alternans*, Westwood, we again get a curiously wide distribution in Natal and Australia. I have carefully examined specimens from both countries, and cannot detect the slightest difference between them.

*Anopheles*, however, seem more restricted in distribution, yet some cover a wide area. Grassi's *A. superpictus*, of Europe, I feel sure occurs in India;* our *A. maculipennis*, Meigen, is the same as *A. punctipennis*, Say, in America; whilst there is such a close resemblance between Grassi's *A. pseudopictus*, Van der Wulp's *A. annularis*, Wiedemann's *A. Sinensis*, and Giles's *A. fuliginosus*, from Europe, Malay Peninsula, China, and India respectively, that I can only look upon them as sub-species of *A. Sinensis*. We have thus to deal with insects which often have a very wide and strange distribution, but which in many respects can easily be accounted for. This wide distribution naturally gives rise to much local variation, and as the characters distinguishing species are often indistinct, the question as to whether any particular mosquito is a true species, or merely a local variety, is one of some difficulty to decide, unless one has a large amount of material to examine. The most constant characters I find in the scales, and hence have employed them largely in separating species from one another.

* Further examination has proved this to be incorrect.

## ALTITUDE NO SAFEGUARD AGAINST MOSQUITOES.

Although mosquitoes are found in greatest numbers in low-lying, swampy districts, they are nevertheless found at great elevations in considerable numbers. Altitude is not a safeguard against *Culex* and *Anopheles*, and therefore not a safeguard against fever. Koch found mosquitoes at 3,000 feet in fever communities in Java. Sir William MacGregor tells us they attacked his party in camp on Mount Scratchley at 1000 feet, and that they were very troublesome at 5,000 to 6,000 feet.

From India I have a note (accompanied by specimens (*C. nigripes*, Zett. ?) ) stating that the enclosed mosquitoes are most annoying in the Himalayas at an altitude of 13,000 feet : so that, if I am correct in the identity of the remains sent me from India, we have a single species with a vertical distribution of 13,000 feet, for we find this species at sea-level in Scandinavia.

## HOW MOSQUITOES ARE DISTRIBUTED FROM PLACE TO PLACE.

The dispersal of *Culicidae* takes place chiefly by artificial agencies, which alone can account for the extensive distribution of many of the species. Naturally they can be spread by the wind, but from observations I have made I do not consider that they are so to any extent, even for short distances. It is useless, I have found, to look for specimens on the wing when there is any breeze ; they are then found sheltering themselves under leaves, holding on to twigs and in other places equally sheltered, so that if these delicate creatures are so dispersed, it is of chance occurrence and undoubtedly rarely takes place. By dispersed I mean for some considerable distance, for they are no doubt now and then blown by light breezes some little way from their breeding-pools. With regard to this point, Dr. H. T. Fernald states that at Cold Spring Harbour, Long Island, with a north breeze, there are no mosquitoes. With a south breeze, on the other hand, they are often very troublesome, especially after a prolonged gentle wind of five or more hours' duration. There are no pools in the centre of the Island, and the mosquitoes are supposed to have been carried from the south shore, a distance

of some fifteen miles. I have seen the male swarms of *C. pipiens* wafted by the air, and it is not unlikely that some of them and a few females may be carried gently some little distance by that agency, but experience and observations have shown that it is of unusual occurrence. But there is plenty of evidence which goes to prove that when a breeze springs up the mosquitoes take immediate shelter, and appear again as soon as the wind drops. Hence a very popular and erroneous idea can be explained, namely, that mosquitoes are brought by the wind, carried from one place, that is, to another.

The distance of flight of both *Culex* and *Anopheles* is, I believe, very limited. Stephens and Christophers * state that they must have flown a distance of from 300 to 600 yards in one case from their breeding-ground, and again that the flies congregated in the native huts and villages in the bush along the Sierra Leone Railway, though there were no breeding-places distant less than a quarter of a mile. I do not think they will be found to disperse more than a mile at the most, except under very exceptional circumstances, such as being caught in a violent gust of wind, which they are unlikely to be, as they take shelter when a breeze appears.

Artificially they are spread by boats and railway trains. It is not at all an unusual thing to find mosquitoes on board ship, often in considerable numbers. It is especially the females that are found; these creatures may be taken hundreds of miles and then landed, and if pregnant they may deposit their eggs. They may also be spread in the larval stage in ships' tanks, especially formerly; by such means we can readily see how certain forms have spread over a large part of the globe, and we can thus account for such anomalies as that shown by *Culex maculicrura* and other species, which are found in widely separated localities, when those localities are bordering the sea.

On land we know well that certain species have followed the advance of the railway.

Skuse has shown that one common Australian species (*C. fatigans*, sub-sp. *Skusii*) has been spread by this means. Regarding this insect, Skuse† writes as follows: "Appears to have been introduced into this country, judging from the accounts of old colonists, and is possibly a variety of *C. ciliaris*, Linn. It may have been imported from Europe in the water tanks belonging

* Rept. Malarial Com. R.S.E., p. 10.
† Proc. Linn. Soc. N. S. Wales, 1889, p. 1717.

to some old sailing vessels. As the railway lines extend, so this mosquito reaches portions of the country often hitherto exempt from it, and it has been, and is being, communicated to other places along the coasts by water traffic."

Professor Howard * says: "There is a constant carriage inland from the marshy seacoast of very many mosquitoes." But by this he does not intend to convey the idea that they are carried by wind or that they fly to any great distance inland. There are other means of conveyance, and of these railway trains seem to be very important. "Many of the cars, as the writer knows from experience," says Professor Howard, "contain mosquitoes by hundreds. In this way unlimited quantities of mosquitoes are carried unlimited distances, and on emerging from the cars will start to breed even where mosquitoes are ordinarily rare, or would be rare under ordinary conditions. In this way even mountain resorts will get their supply of lowland mosquitoes. The writer knows of one instance in the Catskill Mountains, in New York, where the infection of a previously uninfected place could have been brought about in no other way."

These two modes of dispersal will explain to a very large extent the world-wide distribution of some mosquitoes, first their passage by water and their spread further and further inland by train.

But I cannot see how they can account for European species, such as *C. mimeticus* and *C. annulatus*, occurring in the North-West Provinces of India, and not, as far as we know, in any intervening places between there and their native home.

Were they to be found elsewhere between their single inland locality and the sea coast, or even abundant in some port, we could more readily imagine that they had been transported by such agencies; but as transport by rail can date back to no very great age it seems strange that in so short a space the land colony either at some port or neighbouring place and the intermediate ones should have died out, and it is impossible to believe that pregnant *C. mimeticus* or *C. annulatus* could have taken a sea voyage of some thousands of miles and then a long journey by train to the North-West Provinces, and established their species on a firm basis thousands of miles from their original home, Europe. We may of course still find these and other European species between the Himalayas and the coast,

* Bull. No. 25, "Mosquitoes of United States," p. 14.

but the extensive collections from India have none of these represented. They may have come *via* Central Asia, through Turkestan, Persia, and so to Europe, existing over all that region, from which we have had no specimens whatever, and I believe this will prove to be the case. The strange occurrence of the Arctic *C. nigripes* in the same locality can then also be explained by its uniform distribution through Central Asia and Siberia to the Arctic Ocean, and not by any artificial agencies, such as have largely accounted for the cosmopolitan character of certain well-known species in the maritime provinces over the world.

Nuttall and others in their papers, "Studies in Relation to Malaria," i. p. 9, refer to the dissemination along the course of rivers, down which the eggs, larvae, and pupae may be carried. These authors state that, "If present at the head waters of a stream the insects certainly are carried even down to the estuary, coming to maturity all along the course of the river wherever there is a backwater, a recess in the bank, or wherever the river water overflows into neighbouring ditches." This could only take place in a slow flowing stream.

## MOSQUITOES AS DISEASE CARRIERS.

The subject of the diseases with which mosquitoes are connected have been treated fully in such writings as Ross's, Grassi's, Nuttall's, Manson's and others, and need scarcely be referred to here. But as some notes of interest have been received regarding mosquitoes in connection with various diseases brief references are made to the subject. The chief diseases with which mosquitoes are connected are malaria, yellow fever and filariasis, and it is possible that other diseases may be transmitted from one individual to another by their agency.

**Malaria.**—With regard to malaria, the theory of Dr. Manson, in which the chief part is played by mosquitoes, has now been conclusively proved by Major Ronald Ross and Professor Grassi, and other observers who have added their quota to this all-important subject.

The researches of both Ross and Grassi show that it is the genus *Anopheles* which is the agent not only of transferring the malaria from one human being to another, but in which the

*Haemamaebidae* or blood parasites actually undergo part of their development.

Experiments conducted by both Ross and Grassi have shown that *Culex* does not act as an intermediary. Ross experimented with *Culex fatigans*, Wied., and found that the human malarial protozoan would not develop in it. Grassi has experimented with *Culex penicillaris*, *C. albopunctatus*, *C. pulcritarsis*, *C. vexans*, *C. Richardii*, *C. pipiens*, *C. nemorosus* and *C. annulatus*, all with negative results, and he also states that no *rôle* can be attributed to *C. hortensis*, *C. spathipalpis* or *C. fasciatus* (*elegans*), nor to *Aedes* or other blood-suckers as *Simulium*, *Ceratopogon* and *Phlebotomus*. On the other hand, he has shown that certain *Anopheles*, notably *A. maculipennis* (*claviger*), *A. bifurcatus*, *A. pseudopictus* (=*A. Sinensis*, sub-sp.), *A. superpictus* and *A. nigripes*, can distribute this disease. The common spotted-winged European species *A. maculipennis* is one of the chief *Anopheles* in spreading malaria in Italy. The Crescentic parasites of aestivo-autumnal fever have been found in *Anopheles maculipennis*, *superpictus*, *bifurcatus*, *nigripes*, *pseudopictus* and *Rossii*; the quartan parasites in *A. maculipennis* and the tertian in the latter as well as *A. bifurcatus*. Ross has shown that the parasites develop in *A. costalis*, Loew, and *A. funestus*, Giles, in Africa. Dr. Christophers has found the haematozoa in *A. paludis*, mihi. Ross also showed the parasites to occur in *Anopheles* in India, but I do not feel certain in which species. Captain James has shown it to occur in *A. Rossii*, Giles, and I believe Dr. Lutz has in *A. argyrotarsis*, Desvoidy.

In any case it is now conclusively proved that the human haematozoan causing malaria is transmitted from man to man, and possibly other animals, by the agency of certain species of the genus *Anopheles* in which the parasites undergo part of their development. The probability is that this does not take place in all *Anopheles* alike.

It is certainly very important that the *species* in which the malarial parasites develop should be known, and that all experiments should have this detail absolutely correct. The mere fact that *Anopheles* occur in a district, and that the germs are found in *Anopheles*, is not sufficient; the species must be accurately determined.

This point is very strongly urged in a letter to me from Dr. Daniels; his reason for attaching so much importance to this subject is that "the sequelae of malaria seem to vary greatly

whilst the parasites are indistinguishable." Dr. Daniels suggests that the species of the definitive host may have some influence, and points out the following interesting facts :—

1. *Anopheles maculipennis* (*claviger*) seems to be the chief and in some parts the only definitive host on the Mediterranean coasts and in Europe. In many of these parts black-water fever is unknown, is rare everywhere, and malarial neuritis and nephritis are also rare.

2. *Anopheles funestus* and *costalis* are the agents in tropical Africa south of the Sahara. Black-water fever is common (8 per cent. per annum of the Europeans get it in British Central Africa). Nephritis is rare or unknown. Neuritis is not very uncommon.

3. In British Guiana black-water fever occurs, but not more than perhaps in 1 in 5000 of the susceptible population. Neither *A. funestus*, *A. costalis* nor *A. maculipennis* are known there. Nephritis is common. (There are two common *Anopheles* in British Guiana, *A. argyrotarsis*, R. Desvoidy (= *A. albitarsis*, Arribalzaga), and sub-sp. *albipes*, mihi.—F. V. T.)

4. In the greater part of India black-water fever is unknown, and none of the above *Anopheles* are found there.* (The commonest species are *A. Rossii*, Giles, *A. Jamesii*, mihi, and *A. Sinensis*, Wied., and its varieties.—F. V. T.)

Black-water fever has not in any way been traced to a mosquito directly. The evidence goes to favour the view that black-water fever is dependent on malaria, but is not naturally mosquito-borne.

Whether the malarial germs can develop in *Culex* is extremely doubtful. Nearly all cases tested with *Culex* have produced negative results. In those experiments with *C. pipiens* and *C. nemorosus* which gave somewhat doubtful results little reliance can be placed. I can see no reason why *Culex* should not take an equal share with *Anopheles*, particularly when we know that the *Proteosoma*, Labbé, of crows, larks and sparrows is cultivable in members of the genus *Culex*. Ross found *Culex fatigans* played the intermediary part in the development of this bird haematozoan, and that they distributed the disease from bird to bird. This was proved in what Ross calls the grey mosquito (*Culex fatigans*), but he obtained negative results in *S. fasciata*, his "brindled mosquito." It certainly seems strange that these avian haematozoa can develop in *Culex*

* Colonel Giles has recently taken my *Albipes* in North-West India.

and yet the closely related human parasites cannot; possibly they may in other genera such as *Janthinosoma, Mucidus*, etc.*

When we examine the distribution of the *Anopheles* we find that it tallies very well with the chief centres of malaria. *Anopheles* are associated with swampy districts and marshes, and it is in these districts that malaria chiefly occurs; but they are often found in villages and houses, breeding in pools and so forth, close to them. The only district where malaria occurs, from whence collections have been received which contained no *Anopheles*, is Victoria. The specimens sent from the malarious district of the uplands of Victoria were *Stegomyia fasciata*, or, as it has been called in Australia, *Culex Bancroftii*, Skuse. Although no *Anopheles* have been sent from Mauritius, I find three species are found there; one is abundant in the parts of the island where malaria is most prevalent.† From parts of South America but few *Anopheles* have been received; but from such fever-stricken districts as the West Coast of Africa, the Malay Peninsula, and the West Indies, *Anopheles* have been sent in numbers; also from the north of South America (British Guiana, &c.). In fact, the whole distribution of the genus fits in well with the distribution of malaria. This subject has been more fully worked out for England by Dr. Nuttall, who tells me the distribution map of our three *Anopheles* corresponds with the old malarial district map he has prepared.

It is not in the province of this work to enter fully into this subject; but I may point out that considerable evidence has been collected showing how readily *Anopheles* breed in the small pools and puddles that collect after heavy rain on newly broken soil. Malarious outbreaks have often accompanied the breaking-up of soil and the formation of railroads, and can thus easily be accounted for by the opportunities given the *Anopheles* to breed in larger numbers than usual. An enormous percentage of the native population seems to contain the malarial parasites in their blood, although the disease does not affect them, so that the intermediary host has always plenty of opportunity to become infected, and so distribute the disease to healthy people.

Mr. Budgett writes me that he partly attributes his immunity from fever, during his recent Gambia visit, to living some way from native quarters and to other safeguards he

* Dr. Daniels has experimented with *Panoplites* and found the African species takes no part in malaria-carrying.

† Annual Report, Museum, Colony of Mauritius, 1898-99, p. 4.

adopted, such as working under a mosquito-curtain. There is no doubt that as long as the natives have this fever rife amongst them, Europeans mixing with them and living near their quarters will be subject to fever. I believe it will be found far more successful to attack the parasites in the natives with quinine than to destroy the mosquitoes. It is most important that all the new genera mentioned in this work, formerly treated as *Culex*, should be experimented with in connection with malaria.

**Filariasis.**—The mosquito also acts as the intermediate host of the small helminth known as *Filaria Bancroftii*, which causes a considerable mortality in tropical and sub-tropical countries. To Drs. Bancroft and Manson we owe the discovery of the wonderful life-history of this nematode worm.

This blood-worm undergoes developmental changes in the mosquitoes that have ingested human blood containing them.

Dr. Bancroft traced its development in what he calls *C. ciliaris*, L., really *C. fatigans*, v. *Skusii*, Giles. He found the parasites would not grow in *C. notoscriptus*, Skuse, *C. annulirostris*, Skuse, *C. commovens*, Wlk. (= *C. alternans*, Westwood), *C. vigilax*, Skuse (what Dr. Bancroft sends as *C. vigilax*, Skuse, is a new species, *C. marinus*, mihi), *C. nigorthorax*, Macq., *C. procax*, Skuse, and *A. musivus*, Skuse.

Captain James has shown it to develop in *Culex fatigans*, Wied., and also in *Anopheles Rossii*, Giles, so that both genera have the power of acting as secondary host to this blood-worm.

In nearly all those districts where this disease is prevalent *Culex fatigans*, Wied., occurs, so that probably it forms the chief host, although *Anopheles* and *Panoplites* are now known to act as host as well as *Culex*. A full account of this disease will be found in a paper by Dr. Nuttall in the "Encyclopædia Medica," vol. iii.

**Yellow fever.**—Finlay,* from 1881 to 1886, published papers dealing with yellow fever and mosquitoes; in these he puts forward the theory that mosquitoes played the chief *rôle* in the spread of yellow fever, and he considered that immunity to yellow fever might be produced by allowing mosquitoes which had sucked the blood of a yellow-fever patient to bite the individual to be protected. He worked with *C. fasciatus* and *C. cubensis*, Bigot, which is *C. fatigans*, Wied. But, regarding

* "Am. Journ. Med. Sci.," pp. 395–409, 1886, Philadelphia.

this, Dr. Nuttall writes*: "The experiments being made in a country where the disease is endemic makes any conclusions impossible regarding the reaction fever following on the mosquito-bites being due to the inoculation; it is probably simply a matter of coincidence."

Further observations on this subject are now being made and experiments conducted in a special laboratory in Cuba by the American authorities, which will probably show us that the older observations of Finlay are correct. Fresh interest was aroused in the mosquito theory and yellow fever by a paper read at a recent meeting of the American Public Health Association, at Indianapolis, by Surgeon Walter Reed and others. From experiments and observations made in Cuba, in the course of which Dr. Lazear died from yellow fever, apparently conveyed to him by an infected mosquito, the following conclusion is arrived at: "The mosquito serves as the intermediate host for the parasite of yellow fever, and it is highly probable that the disease is only propagated through the bite of this insect." I have heard since this first went to press that *Stegomyia fasciata* has been shown to be the host of the yellow-fever parasite.

Besides the above diseases in man and the disease in birds, which are clearly traced to mosquitoes, it is probable that these pests may carry other diseases. Major T. Birt writes from Gibraltar as follows: "The grey-legged mosquitoes (*C. pipiens*, Linn.) are prevalent day and night. The dove-coloured ones (*C. spathipalpis*, Rond.) only at sunset, night, and sunrise. I have found in both species a micrococcus much resembling that of Mediterranean fever, and a bacillus much like that of typhoid. In the 'grey leg' the micrococci are far more numerous than the bacilli; in the 'dove' the latter predominate, also amoebae and larger bacilli (putrefactive?); they are frequently found in water-closets."

The excreta of various insects feeding on cholera and plague germs has been found to be infected, and it is not improbable that many bacteria are carried by mosquitoes and passed into another individual. (*Vide* Nuttall's paper on "The Part played by Insects, &c., in the Propagation of Infective Diseases of Man and Animals."†)

The canine blood worm, *Filaria immitis*, has also been

* Johns Hopkins' Hospital Reports, vol. viii. p. 26.
† "British Medical Journal," September 9, 1899.

observed by Noè and Grassi to develop in *Anopheles maculipennis*. This hypothesis was instituted by Low. According to the two former observers, the distribution of canine *filariasis* corresponds with the geographical distribution of malaria and *Anopheles* in Italy.

Lastly, a word as to other *Culicidae* besides *Culex* and *Anopheles*. At present I am not aware that any experiments with malaria have been carried out with such genera as *Psorophora*, *Uranotaenia*, or the new genera *Wyeomyia*, *Deinocerites*, &c., all of which bite somewhat severely.

There is considerable difference in some of these genera in regard to structure, and they, or some of them, may possibly offer the same feeding-ground for malarial germs as *Anopheles*. In any case they are worth experimenting with.

One point that has struck me with regard to the absence of malarial germs in *Culex* is that the saliva, which I have found to be acid, may affect them. In a few experiments I have conducted with *Anopheles* I could get no marked reaction from the saliva, but in *Culex* there was a distinctly acid reaction. This is even more clearly seen in *Panoplites titillans*, Wlk., which has extremely acid saliva, so I am informed by Dr. Lutz. It may be that the saliva influences the malarial germs, and, varying in intensity in each species, may be not unsuitable for the existence of Proteosoma in *C. fatigans*.

The part possibly played by *Culicidae* in spreading such diseases as *Anthrax*, &c., will be found mentioned in Dr. Nuttall's valuable monograph previously quoted.

## THE TERM "MOSQUITO."

The term *mosquito* is the diminutive of the Spanish "*mosca*," a fly. It is also a common Portuguese word.

The spelling varies a good deal. Some authors spell it "musquito"; in older works it is often in the form "musketo," and, again, "musquetoe." But the generally accepted etymology is "mosquito." In Russia they are spoken of as "camari"; in Italy as "zanzare" or "zanzaroni"; the French speak of them as "moustiques," "maringouin," or "cousin"; the Germans as "Stechmücken"; whilst in our own country they are generally called "gnats." In America, besides being called "mosquitoes," they are spoken of as "gallinippers."

## OTHER INSECTS THAN CULICIDAE CALLED MOSQUITOES.

There are several other groups of Diptera which contain insects some of which bite, and which are then spoken of as mosquitoes; some of these have been sent in the various collections to the Museum. These will be dealt with at a later date.

Amongst the families which contain "false mosquitoes" are the *Simulidae*, *Chironomidae*, *Psychodidae*, and *Cecidomyidae*. The former has certain members of the genus *Simulium*, which are extremely annoying in the same way that *Culicidae* are. They are, besides being spoken of as mosquitoes, called "sand flies" and "black flies." *Simulidae* abound in all parts of the world, from Iceland to the Tropics, but are particularly abundant in the northern latitudes of Europe and in North and South America. Their mouth parts are as fully developed as in *Culex*, many causing extremely nasty wounds. Schonbauer* gives an account of one species, *S. columboschensis*, which is one of the greatest scourges to man and beast in the Bannat of Temeswar, in Hungary. In the United States and Canada the so-called "black flies" are *Simulidae*. One is a great scourge in the Adirondack region to human beings (*S. molestus*); and another, the buffalo gnat (*S. pecuarum*), a still greater scourge in some parts of the States. In the Southern States these "buffalo gnats" are also known as "turkey gnats." Cattle suffer terribly from them, their bodies, especially the orifices, being often literally covered, and drive the beasts frantic. The "grey gnat" of America is not a *Culex;* it belongs to one of the families of the *Chironomidae* called *Ceratopogon*.† These small flies are generally called "midges," and are often seen in cloudlike masses, hovering and dancing up and down. They are abundant pests in the West Indies. The females are very voracious bloodsuckers, and hence have earned in some parts the name mosquito. In America they are spoken of also as "punkies." They are particularly troublesome in the White Mountains, at the seaside,

* "Gesch. der Stadl. Kolumbatezermücken." 1795. Wien.
† "An Account of British Flies," vol. i. p. 196. F. V. T. 1892.

and along streams. I have found them extremely annoying both at Stalheim and Molde in Norway.

The genus *Phlebotomus* belongs to the family *Psychodidae*, the "owl midges," in which the wings are densely covered with hairs. This genus is not found in Britain. No British *Psychodidae* are blood-suckers, but some of the foreign *Phlebotomus* are very sanguinary in habits.

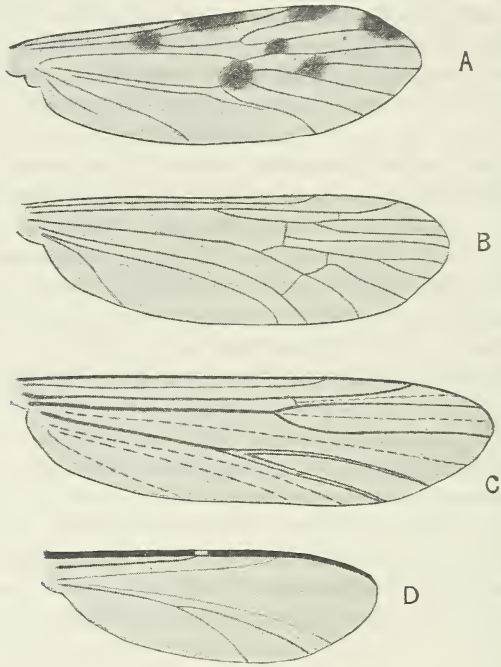


Fig. 23.

Wings of Diptera mistaken for Mosquitoes.

A. *Rhyphus*. B. *Trichocera*. C. *Chironomus*. D. *Lasioptera* (*Cecidomyidae*).

This latter genus has been experimented with in connection with malaria. Grassi, however, obtained only negative results.*

* "Studii di uno Zool. sulla Malaria," p. 192. Rome, 1900.

## FAMILIES WITH WHICH THE CULICIDAE MAY BE CONFUSED.

The only insects with which the mosquitoes of the family *Culicidae* can be confused are certain of the—

(i) *Cecidomyidae*,
(ii) *Chironomidae*,
(iii) *Rhyphidae*,
(iv) *Tipulidae*.

From the *Cecidomyidae* they can at once be told by their more complicated venation than in that family. In *Cecidomyidae* the venation is simple (Fig. 23, D), no fork-cells being present, and only four long veins at the most; so that a comparison of *Culex* with the scaly *Lasioptera*, &c., will at once enable the observer to separate them. In the majority of *Cecidomyia* the wings and body are hairy, not scaled.

From *Chironomidae* (C) they can be separated by the simpler venation, by their more sturdy structure, and the persistent occurrence of scales, which are absent in the *Chironomidae* or midges.

The *Rhyphidae* (A) have been sent me as *Culicidae* (*Anopheles*), but they present such marked differences both in general form and structure that no reference need be made to this family, as a figure is given. The *Rhyphidae* are quite harmless.

It is not infrequent to have small *Tipulidae* sent as mosquitoes. Numbers of the so-called Winter Gnats (*Trichocera*, B) have been received from Scotland and England, and other small *Tipulidae* from China and India (sp. ?). Some of the smaller members of this family bear a superficial resemblance to *Culicidae*, but when at rest their bodies lie parallel with the surface and upon it; in *Culex* the body is distant from the resting surface.

## THE GENERA OF CULICIDAE.

The original genera accepted and formed by Meigen, in 1818, for the *Culicidae* were *Culex*, *Anopheles*, *Aedes* and *Corethra*. The genus *Culex* was instituted by Linnaeus (Fn. Suec. 1790),

probably on *Culex pipiens*, L.; *Anopheles* by Meigen (Syst. Beschr. i. 10), 1818, also *Aedes* (i. 13) and *Corethra* (Ill. Mag. ii. 260). In 1844 another genus was added by Löw, namely, *Mochlonyx* (Stett. Ent. Zeit. 1844, 121).

Robineau Desvoidy, in his "Essai sur les Culicides" (Mém. de la Soc. d'Hist. Nat. de Paris, iii., in 1827), instituted the genera *Megarhinus*, *Psorophora*, and *Sabethes* for certain exotic species which had previously been included in the genus *Culex*. Meigen's and Linnaeus' genera have always been accepted, as has also Robineau Desvoidy's genus *Megarhinus*, but Wiedemann and others seem to have discarded *Sabethes*. Löw (Dipt. N. America, pt. i., p. 5, 1862) did not accept, it seems, either *Psorophora* or *Sabethes*, for he says in the above work, after referring to Desvoidy's genera, "the last two (*Psorophora* and *Sabethes*) being scarcely tenable." Nor does Williston give them in his table of genera of the *Culicidae* of North America (Man. of Families and Genera of N. A. Diptera, p. 22, 1896). In spite of not having been generally accepted by older Dipterologists, Lynch Arribalzaga (Dip. Argentina, pp. 38 and 66) has revived both *Psorophora* and *Sabethes*, and in this I quite agree, but the generic definitions I find have to be somewhat altered—in the main, however, the genera hold good. The only other genera formed for this large family were instituted by Lynch Arribalzaga in his excellent monograph of the *Culicidae* of the Argentine Republic, &c. In this he further divides off from the genus *Culex* four genera, *Ochlerotatus*, *Taeniorhynchus*, *Janthinosoma*, and *Heteronycha*. From the genus *Aedes* he separates some species under the generic name of *Uranotaenia*. Two of the four genera related to *Culex* I have been compelled to discard after trying hard to retain them, but in all cases the generic definitions failed when I examined other insects, undoubtedly closely related. The characters on which he founded these genera seem to be more specific than generic, and, if they were followed out, would occasion the formation of such a large number of genera from the old genus *Culex* that no single one would contain more than one or two species. The form of the ♂ palpi varies in nearly every species; in the ♀ there is not so much variation, but as they are often hidden completely in scales the joints cannot be counted, so that unless we have a number of specimens to break up we cannot see the jointing, and thus the character made of generic importance could not be always used in identification, whilst the structure of the ungues is even more versatile than

that of the male palpi. In his definition of the genus *Culex*, he gives the ♂ ungues as simple. *Culex pipiens* is undoubtedly the type of that genus, and in the ♂ the fore and mid ungues are both toothed, in fact it would come, and many others of the genus *Culex*, in his genus *Heteronycha*.

In the genus *Taeniorhynchus* Arribalzaga placed three species of perfectly different structure, namely, *T. taeniorhynchus*, Wied.,* *T. fasciolatus*, Arribalzaga, and *T. confinnis*, Arribalzaga. I have retained *T. fasciolatus* in this genus.

In *Ochlerotatus* the characters he gives applied to two species I have examined, but a third, evidently closely related to *O. confirmatus*, Arri., differed in several salient features.

The only other genus besides *Janthinosoma* which seems likely to be of service is *Uranotaenia*, which he has separated from *Aedes*, the first basal cell being materially shorter than in that genus, the proboscis of the male having long hairs towards the apex and that of the female with more or less long villosity.

Another genus has been formed by Williston for a single species that is found in St. Vincent, namely, *Haemagogus*, in which the palpi of ♂ and ♀ are five-jointed, a character by which the genus is at once separated from *Aedes*.

The old genera that I have retained are, then, *Culex*, *Anopheles*, *Aedes*, *Mochlonyx*, *Corethra*, *Megarhinus*, *Psorophora*, *Sabethes*, *Uranotaenia*, and *Haemagogus*, and in a modified form *Taeniorhynchus*, for one of Arribalzaga's species in that genus and others I have observed and *Janthinosoma*.

To these I now add the following genera: *Wyeomyia* and *Deinocerites* (the former is separated on account of having *chaetae* on the metanotum, a character found in no other *Culicidae*, except the new genus *Trichoprosopon*, *Deinocerites* on account of the peculiar elongated form of the second antennal joint); *Aedeomyia*, separated from *Aedes* on account of the broad wing scales; *Panoplites*, separated from *Culex* on account of the peculiar wing scales, somewhat like those of *Aedeomyia*; *Eretmapodite*, with the hind tarsi densely scaled, forming a kind of paddle-like termination; *Janthinosoma* has peculiar formed head scales densely scaled hind legs, and a pseudo-vein running through the first basal cell; *Stegomyia* and its sub-genus *Armigeres*, because of the curious flat-scaled or armour-like covering to the whole body, so strongly contrasted with the scale formation in *Culex* proper.

* This is Walker's *Culex titillans*, my *Panoplites titillans*.

Closely related to *Psorophora*, yet clearly distinct, is the new genus *Mucidus*, in which the posterior cross-vein is nearer the apex of the wing than the mid cross-vein and the wings covered with curious pyriform parti-coloured scales, as well as having head scales of a form found in no other member of the family.

The genus *Toxorhynchites* contains but a single species, but is very marked, the wings being much as in *Megarhinus*, which it generally resembles, but the palpi in the female are three-jointed.

Amongst *Anopheles* there is no doubt that the species described as *A. Grabhamii* should constitute a new genus, but I had only one bad specimen to examine, so leave it for a future date to describe.* The genera *Stegomyia* and *Panoplites* are clearly defined from *Culex*, so is *Wyeomyia* from *Aedes* and *Aedeomyia*, *Mucidus* from *Psorophora*, and *Toxorhynchites* from *Megarhinus*, but whether the others I have placed as genera, *Eretmapodites* and *Armigeres*, should rank as genera or sub-genera is a matter of opinion. *Eretmapodites* might possibly be merged in *Sabethes*, but in general appearance they approach *Culex*.†

*Janthinosoma* form a decidedly marked group, the hind legs having shaggy scales, and the hind tarsi are always white. *Armigeres* resemble *Stegomyia* in scale structure, but are much larger insects, and present quite a different superficial appearance, and their larvae differ. The genus *Trichoprosopon*, n. g., forms a most interesting group, in which not only chaetae, but squamae are present on the metathorax, and the clypeus, &c., densely hairy.

* Since I have received fresh material I have placed this pretty gnat in a distinct genus *Cyclolepteron* (*vide* Appendix, Vol. II.).

† *Eretmapodites* is clearly distinct, *Sabethes* being related to *Aedes* (*vide* Appendix, Vol. II.).

# SYNOPTIC TABLE

OF

# SUB-FAMILIES AND GENERA OF THE FAMILY **CULICIDAE**.

SECTION A.—Proboscis formed for piercing; metanotum nude.

a. Palpi long in the ♂.

*α*. Palpi long in both sexes, about as long as the proboscis, terminal joints spatulate or clubbed in ♂; 1st sub-marginal cell as long or longer than the 2nd posterior cell ..... sub-family ANOPHELINA

Wings usually spotted ..... Genus 1 *Anopheles*

*β*. Palpi long in ♂, shorter in ♀; 1st sub-marginal cell very small, much smaller than 2nd posterior cell; proboscis long, bent ..... sub-family MEGARHININA

Palpi 5-jointed in ♀ ..... Genus 2 *Megarhinus*

Palpi 3-jointed in ♀ (short) ..... Genus 3 *Toxorhynchites*

*γ*. Palpi short in ♀, long in ♂; 1st sub-marginal cell as long or longer than the 2nd posterior cell ..... sub-family CULICINA

*γγ*. Legs more or less densely scaled.

Mid cross-vein of wing nearer apex of wing than supernumerary; posterior cross-vein nearer apex than mid cross-vein; 3rd long vein carried into basal cell ..... Genus 4 *Sabethes**

Cross-veins as in *Culex;* scales of crown and occiput broadly spindle-shaped; hind legs densely scaled ..... Genus 5 *Janthinosoma*

Posterior cross-vein nearer base of wing than mid cross-vein; wings with thin scales; all legs densely scaled ..... Genus 6 *Psorophora*

Posterior cross-vein nearer apex of wing than mid cross-vein; wings with large pyriform parti-coloured scales ..... Genus 7 *Mucidus*

* This genus has to be removed to Section B, as the metanotum has chaetae, and the palpi are short in both sexes.

Posterior cross-vein nearer the base than the mid cross-vein; head clothed with flat scales; hind legs with tarsi in ♂ more or less densely long scaled; wing scales long and rather thick.....
Genus 8 *Eretmapodites*

γγγ. Legs uniformly scaled with flat scales.

δ. Head and scutellar scales all flat and broad.

Wings with small scales, both spatulate and linear; 3rd long vein not usually continued into basal cell; ♂ palpi nude or tufted, ♀ palpi short .....Genus 9 *Stegomyia*

Third long vein continued as an incrassation into the basal cell; ♂ palpi nude, long and thin; ♀ palpi longer than in *Stegomyia*.....
Genus 10 *Armigeres*

δδ. Scales of the head narrow and curved, with upright forked ones and flat lateral ones.

1. Second antennal joint small or moderate sized.

Scales of the wings small, lateral ones linear
Genus 11 *Culex*

Scales of the wings mostly very large, flat, broad, asymmetrical .....Genus 12 *Panoplites*

Scales of wings dense, lateral ones large, elongated oval or lanceolate.....Genus 13 *Taeniorhynchus*

2. Second antennal joint very long .....Genus 14 *Deinocerites*

aa. Palpi very short in ♂ and ♀, much shorter than the proboscis.....sub-family Aedeomyina

α. Palpi 2 or 3-jointed; non-metallic.

Wing scales large and flat; fork-cells normal .....
Genus 15 *Aedeomyia*

Wing scales small, linear like *Culex*; fork-cells normal .....Genus 16 *Aedes*

αα. Palpi 5-jointed; fork-cells normal; metallic Genus 17 *Haemagogus*

ααα. Palpi 2-jointed; fork-cells very small; with metallic spots of flat scales on the thorax .....Genus 18 *Uranotaenia*

Section B.—Proboscis formed for piercing; metanotum with chaetae; palpi small.

Proboscis rather or very long .....Genus 19 *Wyeomyia*

Section C.—Proboscis formed for piercing; metanotum with both chaetae and scales .....
sub-family Trichoprosoponina.

Palpi long in ♂, short in ♀ .....Genus 20 *Trichoprosopon*

Section D.—Proboscis short; not formed for piercing .....
sub-family Corethrina

Metatarsus longer than 1st tarsal joint .....Genus 21 *Corethra*

Metatarsus shorter than 1st tarsal joint.....Genus 22 *Mochlonyx*

# LIST OF SPECIES OF **CULICIDAE.**

NOTE.—Those marked with an asterisk are in the British Museum collection; those with a circle I have examined in other collections. A large number of new species have been added since this went to press.

Genus 1.—ANOPHELES.

**A. argyrotarsis.* Rob. Desvoidy.
= *A. albitarsis.* Arribalzaga.
* sub-sp. *albipes.* n. sub-sp.
**A. paludis.* n. sp.
**A. paludis.* var. *similis.*
**A. fuliginosus.* Giles.
**A. Jamesii.* n. sp.
*°A. Bigotii.* n. sp.
**A. Sinensis.* Wiedemann.
**A. Sinensis.* sub-sp. *pseudopictus.* Grassi.
**A. Sinensis.* sub-sp. *annularis.* Van der Wulp.
= *A. vanus.* Walker.
**A. Sinensis.* sub-sp. *Indiensis.* n. sub-sp.
**A. Sinensis.* sub sp. *nigerrimus.* Giles.
**A. barbirostris.* Van der Wulp.
**A. superpictus.* Grassi.
**A. Rossii.* Giles.
**A. costalis.* Loew.
**A. cinereus.* n. sp.
**A. annulipes.* Walker.
= *A. musivus.* Skuse.
*A. Masteri.* Skuse.
**A. squamosus.* n. sp.
**A. Pharoensis.* n. sp.
**A. maculata.* n. sp.
**A. Kochii.* Dönitz.
**A. punctulatus.* Dönitz.
**A. Lutzii.* n. sp.
**A. funestus.* Giles.
**A. Indica.* n. sp.
**A. Rhodesiensis.* n. sp.
**A. minimus.* n. sp.
**A. punctipennis.* Say.
= *C. hyemalis.* Fitch.
**A. maculipennis.* Meigen.
= *A. quadrimaculatus.* Say.
*A. claviger.* Fabricius.
**A. bifurcatus.* Linnaeus.
= *A. trifurcatus.* Fabricius.
*A. villosus.* Rob. Desvoidy.
*A. claviger.* Meigen. 1804. (?)
**A. Walkeri.* n. sp.
**A. nigripes.* Staeger.
= *A. plumbeus.* Haliday.
**A. Lindesayii.* Giles.
**A. crucians.* Wiedemann.
= *A. ferruginosus.* Wiedemann. (?)
**A. Grabhamii.* n. sp.

**A. stigmaticus.* Skuse.
*A. atratipes.* Skuse.
*A. pictus.* Loew.
*A. annulipalpis.* Arribalzaga.
*A. albimanus.* Wiedemann.
*A. annulimanus.* Wiedemann.
*A. ferruginosus.* Wiedemann. (?)
*A. Kumasii.* Chalmers.

Genus 2.—Megarhinus. Rob. Desvoidy.

**M. separatus.* Arribalzaga.
**M. haemorrhoidalis.* Fabricius.
**M. inornatus.* Walker.
**M. immisericors.* Walker.
= *C. regius.* Thwaites.
**M. Gilesii.* n. sp.
**M. speciosus.* Skuse.
°*M. purpureus.* n. sp.
**M. Portoricensis.* Von Röder.
**M. lutescens.* n. sp.
°*M. splendens.* Wiedemann.
°*M. ferox.* Wiedemann.
**M. longipes.* n. sp.
*M. subulifer.* Doleschall.
*M. Amboinensis.* Doleschall.
*M. trichopygus.* Wiedemann.
*M. Christophii.* Portschinsky.
*M. rutillus.* Coquillett.

Genus 3.—Toxorhynchites. n. g.

**T. brevipalpis.* n. sp.

Genus 4.—Sabethes. Rob. Desvoidy.

**S. remipes.* Wiedemann.
°*S. longipes.* Fabricius.
= *S. loculipes.* Rob. Desvoidy.

Genus 5.—Janthinosoma. Arribalzaga.

**J. posticata.* Wiedemann.
**J. musica.* Say.
= *C. Mexicanus.* Bellardi. (?)
**J. Lutzii.* n. sp.
**J. discrucians.* Walker.

Genus 6.—Psorophora. Rob. Desvoidy.

**P. ciliata.* Fabricius.
= *C. perterrens.* Walker.
*C. conterrens.* Walker.
*P. Boscii.* Rob. Desvoidy.
*C. molestus.* Wiedemann.
**P. Holmbergii.* Arribalzaga.
**P. scintillans.* Walker.
= *S. scintillans.* Walker.

Genus 7.—Mucidus. n. g.

**M. alternans.* Westwood.
= *C. commovens.* Walker.
*C. hispidosus.* Skuse.
**M. mucidus.* Karsch.
°*M. Africanus.* n. sp.
**M. scataphagoides.* n. sp.
*M. laniger.* Wiedemann.
= *C. laniger.* Wiedemann.

Genus 8.—Eretmapodites. n. g.

**E. quinquevittatus.* n. sp.

Genus 9.—Stegomyia. n. g.

**S. notoscripta.* Skuse.
**S. fasciata.* Fabricius.
= *C. fasciatus.* Fabricius.
*C. taeniatus.* Wiedemann.
*C. elegans.* Ficalbi.
*C. Rossii.* Giles.
*C. calopus.* Meigen.
*C. exagitans.* Walker.
*C. formosus.* Walker.
*C. frater.* Rob. Desvoidy.
*C. excitans.* Walker.
*C. viridifrons.* Walker.
*C. inexorabilis.* Walker.
*C. Bancroftii.* Skuse.
*C. mosquito.* Arribalzaga.
*C. implacabilis.* Walker.
*C. annulitarsis.* Macquart.
*C. Konoupi.* Brullé. (?)
*var. A, *Luciensis.* n. v.
*var. B, *Queenslandensis.* n. v.
**S. scutellaris.* Walker.
= *C. albopictus.* Skuse.
*C. variegatus.* Doleschall.
**S. sugens.* Wiedemann.
= *C. vittatus.* Bigot.
**S. Nigeria.* n. sp.
**S. Africana.* n. sp.
**S. terrens.* Walker.
**S. Grantii.* n. sp.
**S. sexlineata.* n. sp.
**S. Marshallii.* n. sp.
°*S. pseudotaeniata.* Giles.
°*S. gubernatoris.* Giles.
**S. argenteopunctata.* n. sp.
**S. minuta.* n. sp.
**S. crassipes.* Van der Wulp.
*S. signifer.* Coquillett.

Genus 10.—Armigeres. n. g.

**A. obturbans.* Walker.
= *C. ventralis.* Walker.

Genus 11.—Culex. Linnaeus.

**C. mimeticus.* Noè.
*C. hyrcanus.* Pallas.
**C. annulatus.* Schrank.
= *C. affinis.* Stephens.
*C. variegatus.* Schrank. (?)
**C. Ficalbii.* Noè.
**C. spathipalpis.* Rondani.
**C. longiareolatus.* Macquart.
**C. Bigotii.* Bellardi.†

† This will have to be removed from *Culex.*

*C. *Jamaicensis.* n. sp.
C. *glaphyropterus.* Schrank.
°C. *penetrans.* Rob. Desvoidy.
*C. *taeniorhynchus.* Wiedemann.
= C. *damnosus.* Say. (?)
*C. *microannulatus.* n. sp.
*C. *Vishnui.* n. sp.
*C. *annulus.* n. sp.
*C. *sitiens.* Wiedemann.
*C. *impellens.* Walker.
C. *tritaeniorhynchus.* Giles.
*C. *annulirostris.* Skuse.
sub-sp. *Bancroftii.* n. sub-sp.
*C. *sollicitans.* Walker.†
*C. *infula.* n. sp.
*C. *annulioris.* n. sp.
*C. *plumosus.* n. sp.
*C. *dissimilis.* n. sp.
*C. *hirsutipalpis.* n. sp.
°C. *albirostris.* Macquart.
C. *confinnis.* Arribalzaga.
*C. *Japonicus.* n. sp.
= C. *aureostriatus.* Doleschall. (?)
C. *aureostriatus.* Doleschall.
*C. *vittiger.* Skuse.
*C. *alboannulatus.* Macquart.
*C. *hirsutum.* n. sp.
*C. *vigilax.* Skuse.
*C. *marinus.* n. sp.
*C. *stimulans.* Walker.
*C. *cantans.* Meigen.
C. *maculatus.* Meigen.
C. *fumipennis.* Stephens.
C. *vexans.* Meigen.
= C. *articulatus.* Rondani.
C. *annulipes.* Meigen.
*C. *sylvestris.* n. sp.
*C. *testaceus.* Van der Wulp.
*C. *flavescens.* n. sp.
°C. *vagans.* Wiedemann.
*C. *caecus.* n. sp.
*C. *procax.* Skuse.
*C. *rubithorax.* Macquart.
*C. *occidentalis.* Skuse.
C. *flarifrons.* Skuse.
C. *maculiventris.* Macquart.
*C. *imprimiens.* Walker.
C. *terrens.* Walker.
C. *tibialis.* R. Desvoidy.
*C. *Walkerii.* n. sp.
C. *camptorhynchus.* Thomson.
*C. *Canadensis.* n. sp.
*C. *cingulatus.* Fabricius.
°C. *morsitans.* n. sp.
C. *leucacanthus.* Loew.
C. *puleritarsis.* Rondani.
*C. *pulcripalpis.* Rondani.
*C. *dorsalis.* Meigen.
C. *penicillaris.* Rondani.

† This will have to be removed from *Culex*.

**C. gelidus.* n. sp.
var. *cuneatus.*
*C. tarsalis.* Coquillett.
**C. albitarsis.* n. sp.
*C. longipalpis.* Van der Wulp.
**C. univittatus.* n. sp.
**C. quasiunivittatus.* n. sp.
**C. maculicrura.* n. sp.
var. A, *Sierraleonis.*
var. B, *Mombasaensis.*
**C. albifasciatus.* Macquart.†
**C. confirmatus.* Arribalzaga.†
**C. serratus.* n. sp.†
*C. fusculus.* Zetterstedt.
**C. iracundus.* Walker.
**C. pulcreventer.* Giles.
**C. lateralis.* Meigen.
**C. uncus.* n. sp.
*C. subalbatus.* Coquillett.
**C. atratus.* n. sp.†
*C. atripes.* Skuse.
**C. cinereus.* n. sp.
**C. nigrochaetae.* n. sp.
**C. pseudocinereus.* n. sp.
°*C. metallicus.* n. sp.
**C. Frenchii.* n. sp.
**C. longipes.* n. sp.
**C. Freetownensis.* n. sp.
**C. luteolateralis.* n. sp.
°*C. diversus.* n. sp.
**C. punctor.* Kirby.
**C. ornatus.* Meigen.
= *C. equinus.* Meigen.
**C. consobrinus.* Rob. Desvoidy.
= *C. inornatus.* Williston.
*C. pinguis.* Walker.
*C. impatiens.* Walker. (?) ‡
**C. nemorosus.* Meigen.
= *C. sylvaticus.* Meigen.
*C. guttatus.* Curtis. (?)
*C. provocans.* Walker.
*C. salinus.* Ficalbi.
var. 1. *salinus.* Ficalbi.
*var. 2. *luteovittata.* n. v.
*var. 3. *detritus.* Haliday.
**C. sagax.* Skuse.
**C. pervigilans.* Bergroth.
**C. australis.* Erichson.
= *C. crucians.* Walker. (?)
**C. nigripes.* Zetterstedt.
= *C. impiger.* Walker.
*C. implacabilis.* Walker.
°var. *sylvae.*
**C. hirsuteron.* n. sp.
**C. Spencerii.* n. sp.
*C. impudicus.* Ficalbi.
**C. ochraceus.* n. sp.
**C. trilineatus.* n. sp.

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† These will have to be separated from *Culex.*
‡ *Culex impatiens* is, I fancy, distinct.

*C. concolor.* Rob. Desvoidy.
*C. territans.* Walker.
*C. Salisburiensis.* n. sp.
*C. mediolineatum.* n. sp.
*C. inflictus.* n. sp.
C. rusticus. Rossi.
= C. punctatus. Meigen.
C. quadrimaculatus. Macquart.
C. hortensis. Ficalbi.
*C. scholasticus. n. sp.
C. modestus. Ficalbi.
*C. virgultus. n. sp.
*C. masculus. n. sp.
*C. viridiventer. (Giles MS.)
*C. pipiens. Linnaeus.
= C. vulgaris. L.
C. alpinus. L.
C. agilis. Bigot.
C. ciliaris. L.
C. communis. De Geer.
C. rufus. Meigen.
C. phytophagus. Ficalbi.
C. domesticus. Germar.
°C. quasipipiens. n. sp.
*C. Fouchowensis. n. sp.
C. nigritulus. Zetterstedt.
*C. restuans. n. sp. (Walker MS.)
*C. Zombaensis. n. sp.
°C. Reesii. n. sp.
°C. sericeus. n. sp.
*C. flavipes. Macquart.
= C. molestus. Kollar.
C. serotinus. Philipp.
*C. fatigans. Wiedemann.
= H. dolosa. Arribalzaga.
C. Macleayi. Skuse.
C. Skusii. Giles.
C. pallipes. Meigen.
C. pungens. Wiedemann.
*sub-sp. A, Macleayi. Skuse.
*sub-sp. B, Skusii. Giles.
C. linealis. Skuse.
°C. pusillus. Macquart.
C. fuscanus. Wiedemann.
C. bicolor. Meigen.
C. lutescens. Fabricius.
C. pallens. Coquillett.

Genus 12.—Panoplites. n. g.

*P. titillans. Walker.
= T. taeniorhynchus. Arribalzaga.
*P. pseudotitillans. n. sp.
*P. uniformis. n. sp.
*P. Amazonensis. n. sp.
*P. annulifera. n. sp.
*P. annulipes. Walker.
= C. dives. Schiner.
C. nero. Doleschall.
*P. Africanus. n. sp.
*var. A. reversus. n. v.

Genus 13.—Taeniorhynchus. Arribalzaga (modified, F. V. T.).

**T. fasciolatus.* Arribalzaga.
*°T. Richardii.* Ficalbi.
**T. tenax.* n. sp.
**T. ager.* n. sp.
**T. conopas.* Frauenfeld.
*°T. Annettii.* n. sp.
*°T. fulvus.* Wiedemann.
*°T. aurites.* n. sp.
**T. acer.* Walker.
**T. brevicellula.* n. sp.
**T. perturbans.* Walker.

Note.—Add *C. albopunctatus.* Rondani, and *C. triseriatus.* Say.

Genus 14.—Deinocerites. n. g.

**D. cancer.* n. sp.

Genus 15.—Aedeomyia. n. g.

**A. squammipenna.* Arribalzaga.
*°A. venustipes.* Skuse.

Genus 16.—Aedes. Meigen.

**A. fuscus.* Osten-Sacken.
**A. Butleri.* n. sp.
**A. nigricorpus.* n. sp.
**A. cinereus.* Meigen.
*A. perturbans.* Williston.
= *W. Grayii.* n. sp. (?)
**A. Pembaensis.* n. sp.
*°A. niger.* n. sp.

Genus 17.—Haemagogus. Williston.

**H. cyaneus.* Fabricius.
= *H. splendens.* Williston.

Genus 18.—Uranotaenia. Arribalzaga.

*°U. pulcherrima.* Arribalzaga.
**U. geometrica.* n. sp. (Lutz MS.)
*U. saphirina.* Osten-Sacken.
**U. annulata.* n. sp.
*U. Nataliae.* Arribalzaga.
*°U. domestica.* n. sp.
**U. pygmaea.* n. sp.
*°U. caeruleocephala.* n. sp.
**U. Malayi.* n. sp.
**U. Mashonaensis.* n. sp.
**U. minima.* n. sp.
**U.* (?) *argyropa.* Walker.

Genus 19.—Wyeomyia. n. g.

**W. Grayii.* n. sp.
**W. pertinans.* Williston.
**W. aranoides.* n. sp.
**W. longirostris.* n. sp.
**W. Trinidadensis.* n. sp.
**W. lunata.* n. sp.
*W.* (?) *microptera.* Giles.

Genus 20.—Trichoprosopon. n. g.

**T. nivipes.* n. sp.

Genus 21.—Corethra. Ratke.

°*C. nyblaei.* Zetterstedt.
°*C. pallida.* Fabricius.
*C. flavicans.* Meigen.
°*C. Asiatica.* Giles.
*C. punctipennis.* Say.
= *C. trivittata.* Loew.
**C. culiciformis.* De Geer.
°*C. fusca.* Staeger.
**C. plumicornis.* Fabricius.
= *C. crystallina.* De Geer.
*C. lateralis.* Latreille.
*C. Hafniensis.* Gmelin.
*C. Maniliensis.* Schiner.
*C. rufa.* Zetterstedt.
*C. obscuripes.* Van der Wulp.
*C. gibba.* Meigen.
*C. pallens.* Schiner.
*C. antarctica.* Hudson.
*C. pilipes.* Gimmerthal.
*C. Brasiliensis.* n. sp.

Genus 22.—Mochlonyx. Loew.

**M. velutinus.* Ruthe.
= *M. effoetus.* Haliday.
*M. culiciformis.* De Geer. (?)

## SUMMARY OF DESCRIBED SPECIES.

Total previously described *good* species, 164.

Species recognised and redescribed, 122.

Other descriptions, probably invalid owing to their shortness and the apparent absence of types, 25.

Described as distinct, but found to be synonymous with other species, 80.

New species described, 136.

Therefore the number identified and redescribed and the new species described in these volumes is 258. If to this we add the 42 species not yet identified, we get the total known number of *Culicidae*—300. I have still on hand a large amount of material containing roughly some 50 fresh species, received since this work has been in the press. The number of species will, no doubt, be considerably augmented when we receive collections from more uninhabited parts. *Megarhinus* and *Sabethes*, &c., probably occur in greater abundance in forests, and hence few have been received. The majority of species here described are those found in and around towns, or are known pests to travellers and traders.†

† Numerous fresh species are described in the Appendix to Vol. II.

# LIST OF SPECIES ARRANGED ACCORDING TO COUNTRIES.

Note.—Those marked with an asterisk have been examined by myself.

## 1. EUROPE.

**Anopheles Sinensis.* Wiedemann.
sub-species *pseudopictus.* Grassi. Italy, Spain.
**Anopheles superpictus.* Grassi. Italy, Spain.
**Anopheles maculipennis.* Meigen. General.
**Anopheles bifurcatus.* Linn. General.
**Anopheles nigripes.* Staeger. Scandinavia, to Italy.
(?)*Anopheles pictus.* Loew. (?)
**Stegomyia fasciata.* Fabricius. Italy, Spain, Portugal, England (?) Gibraltar.
**Stegomyia sugens.* Wiedemann. Corsica.
**Culex mimeticus.* Noè. Italy.
**Culex annulatus.* Schrank. General.
**Culex Ficalbii.* Noè. Italy.
**Culex spathipalpis.* Rondani. Italy, Gibraltar.
*Culex glaphyropterus.* Schiner. Austria, Italy.
*Culex penetrans.* R. Desvoidy. France.
**Culex cantans.* Meigen. Europe generally.
*Culex bipunctatus.* R. Desvoidy. France.
**Culex pulcripalpis.* Rondani. Italy, England.
**Culex dorsalis.* Meigen. Europe generally.
*Culex penicillaris.* Rondani. Italy.
*Culex pulcritarsis.* Rondani. Italy.
*Culex leucacanthus.* Loew. Kasan, Russia.
**Culex ornatus.* Meigen. Europe generally.
**Culex nemorosus.* Meigen. Generally.
**Culex nigripes.* Zetterstedt. Scandinavia, Arctic Circle.
*var. *sylvae.* England.
**Culex pipiens.* Linnaeus. Europe generally.
**Culex nigritulus.* Zetterstedt. Scandinavia, England.
*Culex annulipes.* Meigen. General.
*Culex impudicus.* Ficalbi. Italy.
*Culex rusticus.* Rossi. Germany, Russia, Italy.
*Culex hortensis.* Ficalbi. Italy.
**Culex lutescens.* Fabricius. Generally.
*Culex fusculus.* Zetterstedt. Scandinavia.
*Culex modestus.* Ficalbi. Italy.
*Culex vexans.* Meigen. General.
**Culex diversus.* n. sp. England.
*Culex albopunctatus.* Rondani. Italy.
**Taeniorhynchus Richardii.* Ficalbi. Italy, England.
**Aedes cinereus.* Meigen. General.
**Corethra pallida.* Fabricius. England.
**Corethra nyblaei.* Zetterstedt. Scandinavia.

*Corethra pilipes.* Gimmerthal. Riga.
**Corethra plumicornis.* Fabricius. Generally.
**Corethra culiciformis.* De Geer. Generally.
*Corethra flavicans.* Meigen. Germany.
*Corethra rufa.* Zetterstedt. Lapland.
*Corethra obscuripes.* V. d. Wulp. Holland.
**Corethra fusca.* Staeger. Denmark.
**Mochlonyx velutinus.* Ruthe.
(?)*Mochlonyx culiciformis.* De Geer.

NORTH AMERICA AND CANADA.

**Anopheles maculipennis.* Meigen. Canada and United States.
(?)*Anopheles nigripes.* Staeger. (?)
**Anopheles Walkeri.* n. sp. Canada.
**Anopheles punctipennis.* Say. United States and Canada.
**Anopheles crucians.* Wiedemann. Mississippi and Pennsylvania.
**Megarhinus Portoricensis.* Von Röder. Georgia. Miss.
*Megarhinus rutillus.* Coquillett. N. Carolina, Georgia, Florida.
**Megarhinus ferox.* Wiedemann. Colombia and Georgia.
**Psorophora ciliata.* R. Desvoidy. Texas, Atlantic coast, Georgia, &c.
**Stegomyia fasciata.* Fabricius. New Orleans, Savannah, &c.
*Stegomyia(?) signifer.* Coquillett. Columbia, B. N. America, &c.
*Culex tarsalis.* Coquillett. California.
**Culex Bigotii.* Bellardi. Mexico.
**Culex taeniorhynchus.* Wiedemann. Florida, Pennsylvania, Texas, Virginia, &c.
**Culex sollicitans.* Walker. United States, Atlantic seaboard.
**Culex cantans.* Meigen. Ontario, Manitoba.
= *C. conterrens.* Walker.
**Culex stimulans.* Walker. United States, Nova Scotia.
**Culex sylvestris.* n. sp. Ontario, Manitoba.
**Culex testaceus.* V. der Wulp. Ontario.
**Culex Canadensis.* n. sp. Ontario.
**Culex restuans.* n. sp. Toronto.
**Culex consobrinus.* R. Desvoidy. United States and Canada.
**Culex nigripes.* Zetterstedt. United States and Canada.
= *C. impiger.* Walker.
**Culex nemorosus.* Meigen. Toronto.
= *C. provocans.* Walker.
**Culex Spencerii.* n. sp. Manitoba.
**Culex fatigans.* Wiedemann. United States.
= *C. pungens.* Wiedemann. (?)
**Culex excrucians.* Walker. Nova Scotia.
(?)**Culex impatiens.* Walker. Hudson's Bay.
**Culex territans.* Walker.
*Culex annulatus.* Meigen. (?)
*Culex triseriatus.* Say.
*Culex pipiens.* Linnaeus. United States and Canada.
*Taeniorhynchus Richardii.* Ficalbi. Ontario.
**Janthinosoma musica.* Say. Indiana.
**Aedes fuscus.* O.-Sacken. Ontario.
*Uranotaenia saphirina.* O.-Sacken. Ithaca.
**Haemagogus cyaneus.* Fabricius. Pennsylvania.

CENTRAL AMERICA.

**Psorophora ciliata.* R. Desvoidy. Honduras.
**Stegomyia fasciata.* Fabricius. Honduras.

## WEST INDIAN ISLANDS.

**Anopheles argyrotarsis.* R. Desvoidy. St. Lucia, Jamaica, Antigua, Trinidad.
**Anopheles Grabhamii.* n. sp. Jamaica.
(?)*Anopheles albimanus.* Wiedemann. Hayti and Porto Rico.
**Megarhinus Portoricensis.* Von Röder. Porto Rico and St. Vincent.
*Psorophora ciliata.* R. Desvoidy.
**Stegomyia fasciata.* Fabricius. Grenada, St. Lucia, Jamaica, St. Vincent, Montserrat, and general.
**Stegomyia fasciata*, var. *mosquito.* R. Desvoidy. St. Lucia, Jamaica.
**Stegomyia fasciata*, sub-species *Luciensis.* n. sub-sp. St. Lucia, Demerara.
**Stegomyia sexlineata.* n. sp. Trinidad.
**Culex Jamaicensis.* n. sp. Jamaica, Antigua.
**Culex taeniorhynchus.* Wiedemann. St. Lucia.
**Culex confirmatus.* Arribalzaga. Jamaica, Trinidad.
**Culex scholasticus.* n. sp. St. Vincent, Grenada, St. Lucia.
**Culex fatigans.* Wiedemann. General.
**Culex atratus.* n. sp. Jamaica.
**Culex inflictus.* n. sp. Grenada.
**Janthinosoma posticata.* Wiedemann. St. Lucia.
**Janthinosoma Lutzii.* n. sp. Trinidad.
**Trichoprosopon nivipes.* n. sp. Trinidad.
**Deinocerites cancer.* n. sp. Jamaica, St. Lucia.
**Wyeomyia Grayii.* n. sp. St. Lucia, Grenada.
**Wyeomyia longirostris.* n. sp. Brazil.
**Wyeomyia pertinans.* Williston. St. Vincent.
*Aedes perturbans.* Williston. St. Vincent.
**Haemagogus cyaneus.* Fabricius. St. Vincent.
*Corethra punctipennis.* Say. Porto Rico.

## SOUTH AMERICA.

**Anopheles argyrotarsis.* R. Desvoidy. Rio de Janeiro, Argentine, British Guiana.
**Anopheles Bigotii.* n. sp. Chili.
= *A. punctipennis.* Bigot MS.
**Anopheles Lutzii.* n. sp. Sao Paulo, Rio de Janeiro.
*Anopheles annulipalpis.* Arribalzaga. Argentine.
**Megarhinus haemorrhoidalis.* Fabricius. Brazil, Argentine, Cayenne.
**Megarhinus Portoricensis.* Von Röder. Para.
**Megarhinus ferox.* Wiedemann. Brazil.
**Megarhinus longipes.* n. sp. Mexico.
**Megarhinus separatus.* Arribalzaga. Argentine.
*Megarhinus trichopygus.* Wiedemann. Brazil.
**Psorophora ciliata.* R. Desvoidy. Argentine and Brazil.
**Psorophora Holmbergii.* Arribalzaga. Brazil and Argentine.
**Psorophora scintillans.* Walker. Amazon region.
**Sabethes remipes.* Wiedemann. Amazon region.
**Sabethes longipes.* R. Desvoidy. Guiana.
**Stegomyia fasciata.* Fabricius. Brazil, Argentine, British Guiana, Demerara, Panama, &c.
**Culex Bigotii.* Bellardi. Rio de Janeiro.
*Culex fulvus.* Wiedemann. Brazil.
**Culex taeniorhynchus.* Wiedemann. British Guiana.
*Culex confinnis.* Arribalzaga. Argentine.
*Culex tibialis.* R. Desvoidy. Brazil.
**Culex serratus.* n. sp. Rio de Janeiro, British Guiana.

**Culex confirmatus.* Arribalzaga. Brazil, British Guiana.
**Culex albifasciatus.* Macquart. Brazil, Chili.
**Culex terrens.* Walker. Argentine, South America.
**Culex virgultum.* n. sp. Brazil.
**Culex fatigans.* Wiedemann. Argentine, Brazil, Demarara, Panama, British Guiana, &c.
**Culex cingulatus.* Fabricius. S. America.
**Culex flavicosta.* Walker. Amazon region.
**Culex flavipes.* Macquart. Chili, Uruguay, Brazil, Argentine.
**Janthinosoma posticata.* Wiedemann. Brazil, Argentine.
**Janthinosoma musica.* Say. Brazil, British Guiana.
**Janthinosoma Lutzii.* n. sp. Brazil.
**Janthinosoma discrucians.* Walker. Brazil.
*Janthinosoma* (*Culex*?) *oblitus.* Arribalzaga. Argentine.
**Taeniorhynchus fasciolatus.* Arribalzaga. Argentine, Brazil.
**Panoplites titillans.* Walker. Brazil, Argentine, British Guiana, Mexico.
**Panoplites Amazonensis.* n. sp. Lower Amazons.
**Panoplites quasititillans.* n. sp. Lower Amazons.
**Aedeomyia squammipennis.* Arribalzaga. Brazil, British Guiana, Argentine.
**Haemagogus cyaneus.* Fabricius.
**Uranotaenia pulcherrima.* Arribalzaga. Argentine, Brazil.
**Uranotaenia geometrica.* n. sp. (Lutz MS.) Brazil.
**Uranotaenia Nataliae.* Arribalzaga. Argentine.
**Wyeomyia lunata.* n. sp.
*Wyeomyia longirostris.* n. sp. Brazil.

## WEST AFRICA AND ISLANDS.

**Anopheles paludis.* n. sp. Sierra Leone.
**Anopheles costalis.* Loew. Sierra Leone, Lagos, Bonny, &c.
**Anopheles funestus.* Giles. Freetown.
**Anopheles cinereus.* n. sp.
**Anopheles barbirostris.* Van der Wulp. Bonny.
**Mucidus Africanus.* n. sp. Bonny.
**Mucidus mucidus.* Karsch. Whydah.
**Stegomyia fasciata.* Fabricius. Sierra Leone, Lagos, &c.
**Stegomyia sugens.* Wiedemann. Sierra Leone.
**Stegomyia nigeria.* n. sp. Bonny.
**Stegomyia Africana.* n. sp. Freetown.
**Culex dissimilis.* n. sp. Sierra Leone.
**Culex impellens.* Walker. Sierra Leone.
**Culex Freetownensis.* n. sp. Sierra Leone.
**Culex cinereus.* n. sp. Sierra Leone.
**Culex fatigans.* Wiedemann.
**Culex masculus.* n. sp. Sierra Leone.
**Culex* (?) *metallicus.* n. sp.
**Culex albitarsis.* n. sp.
**Taeniorhynchus Annettii.* n. sp.
**Taeniorhynchus aurites.* n. sp.
**Panoplites Africanus.* n. sp.
**Eretmapodites quinquevittata.* n. sp. Sierra Leone.

## EAST AFRICA AND ISLANDS.

**Mucidus mucidus.* Karsch. Delagoa Day.
**Stegomyia fasciata.* Fabricius. Mombasa, Pemba Island
**Stegomyia Grantii.* n. sp. Sokotra.

**Culex fatigans.* Wiedemann. Pemba Island, Mombasa.
**Culex Mombasaensis.* n. sp. Mombasa.
**Aedes Pembaensis.* n. sp. Pemba Island.

SOUTH AFRICA.

**Toxorhynchites brevipalpis.* n. sp. Natal.
**Mucidus laniger.* Wiedemann. Natal.
**Stegomyia fasciata.* Fabricius. Natal.
**Culex luteolateralis.* n. sp. Durban.
**Culex fatigans.* Wiedemann. Durban.
**Culex univittatus.* n. sp. Durban.
**Culex maculicrura.* n. sp. Durban.

NOTE.—*Anopheles* have been received from the Cape, but are not yet examined.

NORTH AFRICA.

**Anopheles Pharoensis.* n. sp. Cairo.
**Stegomyia sugens.* Wiedemann. Nubia.
*Culex maculiventris.* Macquart. Algeria.
**Culex pusillus.* Bigot. Egypt.
**Culex pipiens.* Linnaeus. Algeria.

CENTRAL AFRICA.

**Anopheles funestus.* Giles. Mashonaland, Zambesi, &c.
**Anopheles paludis*, mihi. Mashonaland.
**Anopheles Rhodesiensis.* n. sp. Mashonaland, &c.
**Anopheles squamosus.* n. sp. Mashonaland, &c.
**Anopheles cinereus.* n. sp. Mashonaland, &c.
**Anopheles superpictus.* Grassi. Mashonaland, &c.
**Anopheles costalis.* Loew. General.
**Anopheles Pharoensis.* n. sp. Mashonaland, &c.
**Megarhinus lutescens.* n. sp. Mashonaland.
**Stegomyia fasciata.* Fabricius.
**Stegomyia sugens.* Wiedemann. Mashonaland.
**Stegomyia Africana.* n. sp. Zambesi, Mashonaland, &c.
**Stegomyia argenteopunctata.* n. sp. Mashonaland.
**Culex fatigans.* Wied.
**Panoplites Africanus.* n. sp. Zambesi, Shire River, &c.
**Aedes Mashonaensis.* n. sp. Mashonaland.

INDIA.

**Anopheles nigerrimus.* Giles. Madras, Punjab, Calcutta, Quilon.
**Anopheles Jamesii.* n. sp. Quilon.
**Anopheles Sinensis.* Wiedemann.
*sub-species *fuliginosus.* Giles. Calcutta, Naini Tal.
*sub-species *Indiensis.* n. sub sp. Madras.
*sub-species *annularis.* Van der Wulp. Madras.
**Anopheles Indica.* n. sp.
**Anopheles Rossii.* Giles. Madras, Quilon, Calcutta, &c.
**Anopheles Lindesayii.* Giles. Punjab, Naini Tal.
**Megarhinus Gilesii.* n. sp. Sikkim.
**Megarhinus immisericors.* Walker. South India.
**Stegomyia fasciata.* Fabricius. Quilon, Calcutta.
*var. *mosquito.* R. Desvoidy. Calcutta.
**Stegomyia scutellaris.* Walker. Madras, Naini Tal, Calcutta, Ceylon.
**Stegomyia gubernatoris.* Giles.

**Stegomyia pseudotaeniata.* Giles. Naini Tal.
**Armigeres obturbans.* Walker. Quilon, Madras, Naini Tal, &c.
*Armigeres panalectros.* Giles.
**Culex mimeticus.* Noè. Punjab.
**Culex annulatus.* Schrank. Punjab.
**Culex spathipalpis.* Rondani. Naini Tal.
**Culex microannulatus.* n. sp. Quilon, N. W. Provinces, &c.
**Culex Vishnui.* n. sp. Quilon, Madras, Ceylon.
**Culex impellens.* Walker.
**Culex minimus.* n. sp. Quilon.
**Culex gelidus.* n. sp. Quilon.
**Culex viridiventer.* Giles. Naini Tal.
**Culex pulcreventer.* Giles. Naini Tal.
**Culex nigripes.* Zetterstedt. Himalayas.
**Culex concolor.* R. Desvoidy. Quilon, Naini Tal, Madras.
**Culex fatigans.* Wiedemann. General.
*Culex fuscanus.* Wiedemann. Kandy and Indian Continent.
(?)*Culex circumvolens.* Walker. Ceylon.
(?)*Culex contrahens.* Walker. Ceylon.
**Taeniorhynchus ager.* n. sp. Madras.
**Panoplites uniformis.* n. sp. Quilon.
**Panoplites annulifera.* n. sp. Quilon.
**Aedeomyia squammipenna.* Arribalzaga. Madras.
**Corethra Asiatica.* Giles.

## MALAY PENINSULA AND EASTERN ARCHIPELAGO.

**Anopheles Sinensis.* Wiedemann.
*sub-species *annularis.* Van der Wulp. Perak.
**Anopheles barbirostris.* Van der Wulp. Selangor.
**Anopheles Rossii.* Giles. Singapore, Perak.
**Anopheles Kochii.* Dönitz. Perak, Sumatra and Java.
**Anopheles punctulatus.* Dönitz. Perak, Sumatra and Borneo.
**Megarhinus immisericors.* Walker. Celebes.
**Megarhinus inornatus.* Walker. New Guinea.
**Megarhinus splendens.* Wiedemann. Java, Sumatra, Batavia, Singapore.
*Megarhinus subulifer.* Doleschall. Amboina.
*Megarhinus Amboiensis.* Doleschall. Amboina.
**Mucidus scataphagoides.* n. sp. Burma.
**Mucidus laniger.* Wiedemann. Java.
**Stegomyia fasciata.* Fabricius.
**Stegomyia scutellaris.* Walker. Singapore, Selangor, Siam, Perak, Celebes.
**Stegomyia crassipes.* Van der Wulp. Sumatra and Malay.
**Armigeres obturbans.* Walker. Singapore, Selangor, &c., &c.
**Culex sitiens.* Wiedemann. Perak.
**Culex infula.* n. sp. Perak.
**Culex impellens.* Walker. Perak.
*Culex longipalpis.* Van der Wulp. Sumatra.
**Culex caecus.* n. sp. Selangor.
**Culex imprimiens.* Walker. Amboina.
**Culex gelidus.* n. sp. Perak, Selangor.
**Culex bicolor.* Walker. Perak.
**Culex fatigans.* Wiedemann. Singapore.
**Culex flavidus.* Bigot. Perak, Selangor.
*Culex aureostriatus.* Doleschall. Amboina.
*Culex setulosus.* Doleschall. Java.
*Culex luridus.* Doleschall. Middle Java.
**Culex uncus.* n. sp. Selangor.
**Culex longipes.* n. sp. Singapore.

**Taeniorhynchus tenax.* n. sp. Perak, &c.
**Panoplites uniformis.* n. sp. Perak.
**Panoplites annulipes.* Walker. Selangor, Singapore.
**Aedeomyia squammipenna.* Arribalzaga. Perak.
**Aedes Malayi.* n. sp. Selangor.
*Corethra Maniliensis.* Schiner. Manila.

## CHINA AND FORMOSA.

**Anopheles Sinensis.* Wiedemann. Formosa, Hong Kong.
**Anopheles maculata.* n. sp. Hong Kong.
**Anopheles minimus.* n. sp. Hong Kong.
**Mucidus scataphagoides.* n. sp. Hong Kong.
**Stegomyia scutellaris.* Walker. Hong Kong, Formosa.
**Armigeres ventralis.* Walker. Hong Kong, Formosa.
(?) **Culex sollicitans.* Walker. Formosa. (?)
**Culex vagans.* Wiedemann. Foo Chow and Shanghai.
**Culex fatigans.* Wiedemann. Hong Kong. (General.)
**Taeniorhynchus conopas.* Frauenfeld. Formosa, Hong Kong.

## JAPAN.

**Stegomyia fasciata.* Fabricius. Tokyo.
**Stegomyia scutellaris.* Walker. Tokyo.
**Stegomyia Japonica.* n. sp. Tokyo.
*Culex subalbatus.* Coquillett.
*Culex pallens.* Coquillett.

## CENTRAL ASIA.

*Megarhinus Christophii.* Portschinsky. Amur.
(?) *Culex caspius.* Pallas. Caspian Sea.

## AUSTRALIA.

**Anopheles annulipes.* Walker. Queensland and N. S. Wales.
**Anopheles Masteri.* Skuse. Queensland and N. S. Wales.
**Anopheles atripes.* Skuse. } N. S. Wales.
*Anopheles stigmaticus.* Skuse. }
**Megarhinus speciosus.* Skuse. Queensland.
**Mucidus alternans.* Westwood. Queensland and N. S. Wales.
**Stegomyia notoscripta.* Skuse. Queensland, N. S. Wales, Adelaide.
**Stegomyia fasciata.* Fabricius. Queensland, N. S. Wales, Victoria.
var. *Queenslandensis.* n. v. S. Queensland.
**Culex annulirostris.* Skuse. Queensland, N. S. Wales.
**Culex alboannulatus.* Macquart. Queensland, Sydney, N. S. Wales, &c.
**Culex vigilax.* Skuse. Queensland, N. S. Wales.
**Culex rubithorax.* Macquart. S. Queensland, Tasmania.
**Culex procax.* Skuse. Queensland and N. S. Wales.
**Culex marinus.* n. sp. Queensland.
**Culex occidentalis.* Skuse. Victoria, W. Australia.
*Culex flavifrons.* Skuse. Brisbane, Australia, N. S. Wales.
*Culex camptorhynchus.* Thomson. Sydney.
**Culex sagax.* Skuse. Queensland.
**Culex Frenchii.* n. sp. Victoria.
**Culex fatigans.* Wiedemann.
sub-sp. *Skusii.* Giles.
sub-sp. *Macleayi.* Skuse.

**Culex vittiger.* Skuse. Queensland and N. S. Wales.
**Culex linealis.* Skuse. N. S. Wales.
*Culex atripes.* Skuse. N. S. Wales.
**Culex australis.* Erichson. Tasmania.
**Taeniorhynchus acer.* Walker. Queensland.
**Panoplites.* sp. (?). Queensland.
**Aedeomyia venustipes.* Skuse. Sydney.
**Uranotaenia pygmaea.* n. sp. Queensland.

## NEW ZEALAND.

*Culex albirostris.* Macquart.
**Culex pervigilans.* Bergroth.
**Culex australis.* Erichson.
**Culex iracundus.* Walker.
**Taeniorhynchus acer.* Walker.
**Uranotaenia argyropa.* Walker.
*Corethra antaretica.* Hudson.

## OCEANIC ISLANDS.

### Bermuda.

**Stegomyia fasciata.* Fabricius.
*Culex fatigans.* Wiedemann.
(No *Anopheles* occur.)

### Fiji.

**Anopheles.* sp. ? (remains.)
**Stegomyia scutellaris.* Walker.
**Culex fatigans.* Wiedemann.

### Mauritius.

**Anopheles paludis.* n. sp.
**Stegomyia scutellaris.* Walker.
*Culex annulitarsis.* Macquart. (Probably *S. fasciata.*)
**Culex fatigans.* Wiedemann.
(Four species of *Anopheles* occur.)

### Madeira.

**Culex longiareolatus.* Macquart.

# SECTION A.

PROBOSCIS FORMED FOR PIERCING; METANOTUM NUDE.

## SUB-FAMILY **ANOPHELINA.**

### GENUS 1.—**ANOPHELES.** Meigen.

(Syst. Beschr. (1818), i. 10, pl. x. figs. 5 and 6, Meig.; Dipt. N. d. Fr. 162 (1825), Macq.; Hist. Nat. d. Dipt. i. 32 (1834), Macq.; Dipt. Exot. Nouv. ou peu connus, i. 29 (1838), Macq.; List, Brit. Mus. i. 9, Dipt. Wlk. (1848); Fn. Austr. ii. 624 (1864), Schiner; Dipt. Neer. 329 (1877), Van d. Wulp; Bull. Soc. Ent. Ital. p. 221 (1896), and *Ibid.* (1899), Ficalbi; Proc. Linn. Soc. N. S. Wales, p. 1751 (1889), Skuse Dipt. Argent. p. 35 (1891), Arri.)

**Characters of the Genus.**—Head with both flat and narrow curved scales, but mainly covered with large upright forked scales (Fig. 9, E); palpi long in both sexes, usually about the length of the proboscis, 4-jointed in the ♀, 3-jointed in the ♂, but constrictions at the base apparently make the ♀ 5 or 6-jointed and the ♂ 4 or 5-jointed; in the ♂ the last two joints are short, thick, and often olive-shaped. Antennae 14-jointed, pilose in the ♀, plumose in the ♂, and 15-jointed.

Thorax with narrow curved or small spindle-shaped flat scales. Abdomen generally pilose, but sometimes with a few scales, and rarely with many (*A. Pharoensis*, mihi). Wings usually spotted, covered with small scales of normal form, spindle-shaped or inflated, with the first sub-marginal cell longer and narrower than the second posterior cell; both the second and third long veins run past the cross-veins into the basal cells, a character which I have noticed very marked in all species examined; in the ♂ the two fork-cells are short and their stems long, much as in *Megarhinus*. Legs long and thin, terminating in either simple or serrated ungues; hind metatarsi longer than the tibiae.

The two chief characters are the long palpi in both sexes, and the prolongation of the second and third long veins into the basal cells, and the shortness of the fork-cells in the ♂.

This is the second largest genus of *Culicidae*, containing forty-three species and several distinct sub-species and varieties. Thirty species had previously been described, but a number of these are doubtful species, others synonymous terms, and some not even *Anopheles*.

Of those described here, fifteen are new species, and three previously described (*A. annularis*, V. d. Wulp, *A. nigerrimus*, Giles, and *A. pseudopictus*, Grassi) are treated as sub-species of *A. Sinensis*, Wiedemann.

Although comparatively few in species, the number of individuals is often very great, especially in certain localities. *A. Sinensis*, sub-species *annularis*, occurs in great abundance in the Malay Peninsula, *A. costalis* and *A. funestus* in West and Central Africa, *A. maculipennis* in Europe, &c.

With the exception of *A. Sinensis* and its sub-species, *A. superpictus*, Grassi, *A. barbirostris*, Van der Wulp, *A. Rossii*, Giles, and *A. maculipennis*, Meigen, the species of *Anopheles* do not seem to have a wide distribution, such as we see in many of the genus *Culex*.* There is no reason why *Anopheles* should not be distributed artificially, just as in *Culex*, by means of ships and trains; and it may be that such has taken place, and that the introduced species have varied to some considerable extent. In *Anopheles annularis* from the Malay Peninsula there is some considerable variation in colour and banding. If this variation takes place in one area, it is reasonable to suppose that greater variation may have taken place when the insects have been transported to a new environment.

If this could be proved to take place, I might agree with Grassi's decision of taking *A. Rossii*, Giles, to be a sub-species of his *A. superpictus*, but the characters of *A. Rossii* are so very persistent and also of *A. superpictus* that at present I prefer to look upon them as separate species.† Quite the contrary is it in *A. Sinensis*, which we know *is* very variable, even in the same locality. *Anopheles* are blood-suckers, especially the females, the males very seldom feed off blood; our two common British

* Colonel Giles has recently found my sub-species *albipes* of *A. argyrotarsis* in India.

† Since this went to press the larvae of *Rossii* and *superpictus* have been shown to be quite distinct.

species, *A. maculipennis* and *A. bifurcatus*, are not nearly so sanguinary as members of the genus *Culex*. Some species, such as *A. maculipennis*, seldom attack animals or man, as far as I can gather, in England, and personally I have never known it bite any human being, although I live where it often occurs in great numbers. Yet in Italy Grassi tells us it is one of the chief factors in distributing malaria. Its near neighbour, *A. bifurcatus*, is at times most vicious in England. This genus, although of more practical importance than *Culex*, *Stegomyia*, &c., in connection with the *rôle* it plays in the spread of malaria, is not nearly so annoying as the members of the latter genera, which supply by far the greater number of our house-forms of "mosquitoes." *Anopheles* are not as a rule abundant domestic insects, but such species as *A. maculipennis*, *A. argyrotarsis*, and *A. Rossii* are found indoors in numbers. The females bite both day and night.

**Distribution of Anopheles.**—The distribution of *Anopheles* and malaria is a subject of great interest. Professor Nuttall tells me that in England the distribution of *A. maculipennis* and *A. bifurcatus* compares fairly well with the old distribution of ague. At the same time *Anopheles* occur in districts where no ague has existed.

In those countries where malarial fever is rife the collections of mosquitoes received by the Museum have always contained many *Anopheles*, with one notable exception, namely Victoria. For instance, they occur in very large numbers on the West Coast of Africa, in Central Africa, in large numbers in the Malay Peninsula, in certain of the West Indies, and in India.

It does not of course follow because *Anopheles* are present that malaria is present, but where the latter occurs *Anopheles* have in all cases but one been shown to exist in numbers. Amongst the small collection of mosquitoes sent from Victoria, no *Anopheles* are included, but a series of *Stegomyia fasciata* bears a label, "abundant in the malarious districts of the uplands of Victoria." Four species of *Anopheles*, however, occur in Australia, and may have been overlooked in this colony, particularly as the collection only contains three species, which number would probably be greatly increased on a further examination of the district. From Mauritius, where malaria is rife, the collection only contained a few poor specimens of *Culex*, but four species

of *Anopheles* occur in abundance, one species particularly along the coast, where the fever is most prevalent. In Bermuda and Barbados there is no malaria, and there seem to be no *Anopheles*.


Fig. 24.

As far as I can judge, I should say the prevalence of *Anopheles* tallies very well with the distribution of malarial fever. The districts from which they have been received and recorded are as follows :—

## DISTRICTS FROM WHENCE *ANOPHELES* HAVE BEEN RECEIVED AND RECORDED.

EUROPE :
- England (abundant), Scotland, Ireland, and Wales.
- Scandinavia.
- France.
- Austria.
- Germany.
- Italy (abundant).
- Holland.
- Russia.
- Spain.

ASIA :
- Bombay, Travancore, Madras, Calcutta (abundant).
- Punjab, Bengal, Oudh, &c.
- Ceylon.
- Straits Settlements (abundant).
  (Perak, Selangor, &c.)
- Singapore (abundant).
- Hong Kong.
- Mainland, China (abundant).
- Formosa (abundant).

EAST INDIES :
- *East Java.*
- *Celebes* (*Makessar*).
- Borneo.

AFRICA :
- Sierra Leone (abundant).
- Lagos (abundant).
- Bonny (abundant)
- Natal (scarce).
- Cairo.
- Mashonaland and Central Africa generally (abundant).
- Zanzibar.
- Pemba.
- Cameroons.
- Madagascar.

AUSTRALIA :
- Queensland (abundant).
- New South Wales.
- *Tasmania.*

NORTH AMERICA :
- Ontario.
- Manitoba.
- Pennsylvania.
- New Orleans, and most other districts in the States

SOUTH AMERICA :
- Brazil.
- Argentine.
- British Guiana (abundant).
- British Honduras (abundant).
- Lower Amazon region.
- Chili.

West Indies:
Jamaica (abundant).
St. Lucia (abundant).
Antigua (abundant).
Porto Rico.
Hayti.
Trinidad.
St. Vincent.

Oceanic Islands:
Fiji.
Mauritius.

They are also recorded from British New Guinea.

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# SYNOPTIC TABLE OF *ANOPHELES*.

## A. WINGS CLOTHED WITH MODERATE SIZED SCALES.

### 1. COSTA SPOTTED.

#### *A. Metatarsi and Tarsi banded.*

*a. Three posterior tarsi pure white.*

*A. argyrotarsis*, R. Desvoidy . Costa with four or more pale spots; last joint of fore and mid tarsi dark clay-coloured.

*A. paludis*, n. sp. . . . Costa with two pale spots; fringe with one pale spot at end of 5th long vein.

*A. fuliginosus*, Giles . . Costa black with three small white spots; wings very dark; fringe at apex black.

*A. Jamesii*, n. sp. . . . Costa with seven alternate black and yellow spots; 2nd and 3rd mid tarsi banded; fore metatarsus banded in middle; fringe at apex yellow.

*A. Bigotii*, n. sp. . . . Wings with three white spots on the dark costa; apical tarsal joint of fore legs pure white.

*aa. Two posterior tarsi pure white.*

*A. albimanus*, Wiedemann . Abdomen with large triangular basal patches.

*aaa. Posterior tarsi not pure white.*

*β. Costa with two pale spots.*

*A. Sinensis*, Wiedemann . . Cross-veins close together; base of 1st sub-marginal cell not under apex of sub-costal. Costal spots large.

sub-species 1. *pseudopictus*, Grassi — Cross-veins as above; base of 1st sub-marginal nearly under apex of sub-costal; costal spots small.

sub-species 2, *annularis*, Van der Wulp — Cross-veins far apart; base of 1st sub-marginal distant from end of sub-costal; apical fringe pale.

sub-species 3, *Indiensis*, n. sub-sp. — As above, but base of the 1st sub-marginal cell lies just under the end of sub-costal.

sub-species 4, *nigerrimus*, Giles — Abdomen with creamy basal spots to some segments.

*A. barbirostris*, Van der Wulp . Scales broader than former species; apical fringe mostly black; supernumerary and mid cross-veins close; posterior distant. Proboscis densely scaled.

*ββ. Pale costal spots, more than two.*

*A. superpictus*, Grassi . . Costal spots uniform; four large ones. Abdomen with dark brown hind borders to segments.

*A. Rossii*, Giles . . . Large costal spot, T-shaped.

*A. pictus*, Loew (?) . . . Two prominent yellow spots on dark costa, and one indistinct.

*A. costalis*, Loew . . . Three white spots on the dark costa; but tarsal bands involve both sides of the joints, a few pale spots on femora.

*A. cinereus*, n. sp. . . . Wings with three small white spots on the black costa; fringe brown with yellow patches. Legs long and thin, black; bases very pale.

*A. Lutzii*, n. sp. . . . Fore metatarsus with five black and white bands; two broad dark thoracic lines.

## *B. Femora and Tibiae banded and mottled.*

*A. annulipes*, Walker = *A. musivus*, Skuse . . Femora, tibiae, and tarsi banded. Proboscis dark in both ♀ and ♂.

*A. Masteri*, Skuse . . . Like above, but proboscis pale along apical half in ♀.

*A. squamosus*, n. sp. . . Thorax with white scales; pleurae with three white lines. Abdomen scaly with black lateral tufts.

*A. Pharoensis*, n. sp. . . Femora and tibiae mottled black and white, metatarsus and some tarsi with broad apical bands; last tarsal joint of hind legs pure white; abdomen scaly.

*A. maculata*, n. sp. . . . Last hind tarsal joint pure white; abdomen not scaly.

*A. Kochii*, Dönitz . . . Femora, tibiae, and metatarsus (hind) with white broken bands. Thorax pale with two dark eye-like spots. Wings pale creamy with small black spots; six on costa. Last hind tarsal not white.

*A. punctulatus*, Dönitz . . Wings much spotted. Thorax tessellated.

## C. *Metatarsi and Tarsi unbanded.*

*A. funestus*, Giles . . . Legs all black, except pale knee ring. Five interruptions on dark costa. Wing fringe spotted at each vein but the sixth.

*A. Indica*, n. sp. . . . Very like above, but wing fringe with three yellow patches only; cross-veins as in *Rhodesiensis*.

*A. Rhodesiensis*, n. sp. . . Wing fringe all brown, except at the apical spot; supernumerary and mid cross-veins in one line.

*A. minimus*, n. sp. . . . Wing fringe like *funestus*; cross-veins like *superpictus*.

*A. punctipennis*, Say = *A. hyemalis*, Fitch . A single broad interruption on the black costa, in the outer third, extending across greater part of wing as ill-defined band.

2. COSTA UNIFORMLY COLOURED.

*a. Wings spotted.*

*b. Metatarsi banded; tarsi unbanded.*

*A. maculipennis*, Meigen = *A. claviger*, Fabricius *A. quadrimaculatus*, Say . . Wings with four spots; pale band on apex of metatarsus.

*bb. Metatarsi and tarsi banded.*

*A. annulipalpis*, Arribalzaga . Tarsi white-ringed; last joints wholly white. Femora and tibiae mottled and banded black and white.

*bbb. Metatarsi and tarsi unbanded.*

*A. Lindesayii*, Giles . . Costa black; small apical white spot, veins grey and black scaled.

*A. atratipes*, Skuse . . . Costa black; 6 spots on the veins.

*A. crucians*, Wiedemann . . White spots on the brown veins. Last vein with 3 dark spots.

*aa. Wings unspotted.*

*A. bifurcatus* . . . . Tarsi dark, except ring on base of metatarsus. Length, 8–10 mm. = *A. villosus*, R. Desvoidy *A. trifasciatus*, Fabricius

*A. Walkeri*, n. sp. . . . Resembles above, but no central creamy scales to the head.

*A. nigripes*, Staeger . . Tarsi dark; no trace of the band on metatarsus. Length, 7½ to 8 mm.

*A. stigmaticus*, Skuse . . Wings unspotted, but with a dusky mark on stigmata.

## B. WINGS CLOTHED WITH SOME LARGE SCALES.

*A. Grabhamii*, n. sp.

Note.—The following I cannot recognise at all:—

*A. annulimanus*, Van der Wulp. I have not been able to recognise this species, described from a single ♂ from North America. No mention is made of the tarsi.

*A. albimanus*, Wied. "Fuscous, abdomen with large triangular grey spots, apices of tarsi snow-white" (A. Z. i p. 13, Wied.), Hayti. Also noted as found in Porto Rico by V. von Röler (Stett. Ent. Zeitung (1885), p. 338). I have not seen this species. My sub-species *albipes* might be the same, or it may be the type *A. argyrotarsis*, R. Desvoidy.

SPECIES (?) NOT RECOGNISABLE EXCEPT FROM TYPES.

*A. quinquefasciatus.* Say.
= *Culex impiger.* Walker (?).
*A. annulimanus.* Wiedemann.
= *Culex consobrinus.* Desvoidy (?).
*A. albimanus.* Wiedemann.
= *A. argyrotarsis.* Rob. Desv. (?).

1. ANOPHELES ARGYROTARSIS. Rob. Desvoidy (1828).

*A. albitarsis.* Arribalzaga (1891).
*A. albimanus.* Wiedemann (?).

(Essai sur les Culicid. p. 411, Rob. Desvoidy; Dipt. Argentina, p. 36 (1891) (= *albitarsis*).)

(Fig. 1, Pl. I.)

Thorax with mesonotum bluish-grey, with three more or less longitudinal lines and with pale scales over the mesonotum, and sometimes traces of two dark lateral spots. Abdomen dark dusky-brown, with a few creamy scales. Legs covered with dark scales, with some of the tarsi apically white banded; last three joints of hind legs pure white, and also apex of first; costa dark, with two distinct and several smaller pale spots.

♀. Head black, with white upright spatulate scales in front, black behind and at the sides, a tuft of white hairs projecting forwards between the eyes. Eyes black; antennae dark, with pale silky pubescence and brown hairs; basal joint dark, a few patches of white scales on the first few basal joints; palpi covered with long black scales, especially long towards the base; apex pure white, and there are also two narrow white rings on the apical ends of the joints; ventrally the penultimate joint has a number of yellowish-white scales, which sometimes seem to form almost a ring; proboscis clothed with short dark scales.

Thorax with a bluish-grey sheen, with three more or less distinct longitudinal lines, the middle one most distinct and of a purplish hue, with pale scales scattered over the mesonotum; scutellum dark towards the middle; metanotum deep brown; pleurae dark, with here and there frosty tomentum (there are traces of two dark lateral spots on the mesonotum, which are clearly seen in the St. Lucia specimens).

Abdomen dusky purplish-brown, clothed with creamy yellow scales, especially in the middle region of the segments; the

segments have lateral tufts of grey scales on the posterior borders, projecting from the sides; hairs long, deep bright brown; viewed with a pocket-lens the abdomen is almost black in ground colour; in other specimens dull yellowish reflections may be seen.

Legs yellowish, covered with dark brown scales; first two tarsi of the fore legs apically white, last two joints dark brown, fore metatarsi also with small pale apical bands; mid metatarsi and first two tarsal joints with minute apical yellow bands, last two indistinctly banded; in the hind legs the last three joints are pure snow-white, and also the apex of the first; ungues very dark.

Wings with the costa dark, with four distinct and several smaller white patches; there are also numerous patches of dark scales, which vary to some extent, over the wing areas; in the ♀, from which this description is taken, the fourth long vein is covered with pale dusky scales, whilst in a ♀ from St. Lucia it is creamy-white; halteres with pale stem and fuscous knob.

*Length.*—4 to 5 mm.

♂. Palpi dark brown, with scattered white scales, especially on the last swollen joints; hair-tuft pale; there is a pale ring at the apex of the apical and base of the penultimate joint; antennae brown, with brown plumes; proboscis brown and narrow. The white scales on the head extend nearly over the neck; scales on the thorax white; the larger ungues of the fore feet biserrated.

*Length.*—4 to 5 mm.

*Habitat.*—St. Lucia (St. George Gray, November 25); Rio de Janeiro (Dr. Lutz) (4. 7. 1899); Jamaica (Dr. Grabham) British Guiana (Rowland); Antigua (Forrest); Grenada (Broadway) (14. 2. 1900).

*Time of capture.*—Jamaica, November to March; July, in British Guiana.

*Observations.*—This is undoubtedly Arribalzaga's *A. albitarsis*. Arribalzaga's figure does not give the last tarsal joints of the fore and hind legs as white. There is no doubt that Robineau Desvoidy's *A. argyrotarsis* from Brazil and Arribalzaga's *A. albitarsis* are synonymous, in spite of the description of the former being inadequate, hence Arribalzaga's name must sink. Dr. Lutz agrees with my identity of this species. It is subject to variation; for instance, in the Brazilian specimens, the fourth long vein is dark scaled, whilst in the St. Lucia specimens

it is creamy scaled; the costa of the ♀ from Rio is also darker than the St. Lucia ones, one showing only two clear white spots, and there are also white scales at the base of the wing in this specimen. The pale costal spots vary from four to six.

In the ♂'s from St. Lucia there are also dark scales on the fourth long vein. One very distinct variety exists, which is described below as sub-species *albipes*.

Dr. Lutz calls it the "Spotted-winged Swamp-mosquito."

The bites of this species are not particularly irritating, nor is it very bloodthirsty. It enters houses, as well as being common in swampy localities. Arribalzaga, however, states that it is not often found in houses. Dr. Grabham bred it from roadside puddles in Jamaica.

Concerning *A. albitarsis*, Arribalzaga writes as follows:—

"It is found in El Paradero and Las Conchas, near Buenos Ayres. It is also found along the Paraguay River, but in smaller numbers. I have received some specimens collected by Dr. Holmberg in Formosa. The colour of this species varies according to the state of maturity in which the *Anopheles* is.

"The specimens just come from the pupal stage have all the parts that I point out as grey or dark brown, of a testaceous tint, and the palpi rings only just visible. The wings are apt to have the whole costal region densely covered with little scales, dark brown in colour, scarcely perceptible. The back part of the thorax is in many specimens of an uniform grey, but in the greater number you can always see three longitudinal lines.

"The bites of this species of *Anopheles* are slightly disagreeable, and it appears that it is not very sanguinary. I have never seen it in houses or elevated places. This induces me to think that this insect never goes far away from the marsh or swamp in which it has passed the larval and pupal stages."

1a. *A. albipes*, mihi. sub-sp.

(Fig. 3, Pl. I.)

This form resembles the type in all respects except that the last tarsal joint in the hind legs has a very distinct and persistent deep black basal band. The thorax is rather browner in some specimens, and there are only two white bands to the ♀ palpi. The fore legs have dark scaled femora, pale beneath,

with a small white knee spot, the tibiae dusky scaled and also the metatarsus above, pale below, apex white; the first two tarsi have yellow apical bands, the third dark, and the last clay coloured; mid legs with a white spot near the apex of the femora; mid tarsi not definitely banded, but with a faint pale band sometimes at the apex of the metatarsus; the hind legs are dark

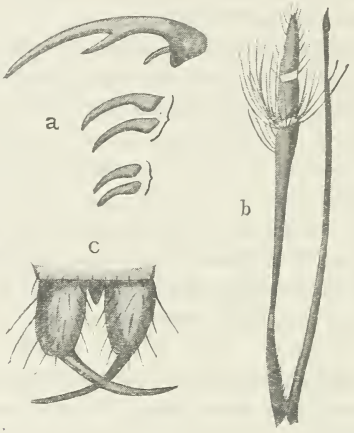



Fig. 25.
*Anopheles argyrotarsis*, sub-sp. *albipes*.
a, ♂ ungues; b, palpus and proboscis; c, genitalia.

brown, with the second, third, and apex of the first tarsal joints pure white, the last joint white, with a distinct black basal band; ungues as in the type. Wings much as in the type, but the pale scales are more yellow in colour.

*Length.*—♂ 3·5 to 4·5 mm.; ♀ 4 to 4·5 mm.

*Habitat.*—Jamaica (Grabham) (ϕ 7. 12. 1899, and 8. 2. 1900); British Guiana (Rowland); Rio de Janeiro (Lutz); Antigua (Forrest). India (Giles).

*Time of capture.*—November to March in Jamaica; July British Guiana.

*Observations.*—I at first described this insect as a distinct species, but I can find no structural differences of importance from the type after dissecting numerous specimens—hence can only look upon it as a colour variety. Like the type, it is subject to no little variation. The British Guiana specimens show more distinct tarsal banding and the palpi are yellowish-white at the end, with two small black rings.

Like the type, they inhabit the swampy bush and houses in common. Although it occurs along with the type it seems to keep more or less distinct from it, and occurs often apparently alone. A large series comes from Antigua, with a description of the larva, &c., from Mr. Forrest, which is appended below.

The larva of this species was found in a marshy-like stream, the surface drainage of a small sheltered valley, filled with a dense growth of Para grass (*Paniceum muticum*, Forsk.). The colour of the full-grown larva is variable, pale greenish-brown, or dark grey, or light brown with white patches. Head dark brown, with lighter markings. In the earlier larval stages the colour is usually dark grey, with a constant white marking on the prothorax like a collar behind the head. Their movements are most rapid and active under water, when they leave the surface to feed on a light green, fibrous-like alga. Mr. Forrest also sends the following description of the larva and pupa to Mr. Austen, of the British Museum :—

"*Larva.*—Head fairly rectangular, much narrower than the thorax, no constriction. Eyes on top, sloping from margin obliquely backwards, plumose bristle at antero-lateral margin on upper side. Antennae : Basal joint spiny, extremity consists of a bifurcated spine, stout, one-fourth length of basal joint. Maxillary palpi broad, flattened, one-half length of basal joint of antennae ; short spine at outer apical angle ; mouth whorls prominent ; clypeus very wide, four bristles near frontal margin as long as the whorls.

"Thorax : The plumose bristles incline slightly forward. Those on the prothorax are situated on frontal margin, and are slightly shorter than those on the meso- and metathorax, which latter are of equal length. Besides the laterals there are several rows on the dorso-lateral region. Large pigment granules are dotted over the tergal region of the thorax and abdomen.

"Abdomen : First three segments have plumose lateral bristles at right angles to the body, as long as those of the thorax, remaining segments have short simple bristles, not seen with the naked eye ; eighth segment has two spiracles on dorsum at the end of the two main tracheal trunks.

"*Pupa.*—Respiratory tubes : The hind margin is evidently brought to the surface ; it is fringed with fine hairs. Abdominal segments broad, flattened, segments seven and eight same length.

First segment very short, and has a large compound bristle on either side of the median line. Second and third segments have similar bristles, but much smaller, besides small simple ones. At the posterior lateral margin of each segment from the third back there is a stout spine, increasing in length backwards. On the posterior dorsal margin of each segment, from the fourth to eighth, there are three long single bristles on each side of the median line." Colonel Giles has taken this sub-species in India.

### 2. Anopheles paludis. n. sp.

(Repts. to Malarial Com. of Royal S. E. p. 75 (1900). F. V. T.)

Thorax dark brown, with dark longitudinal lines and yellow curved scales. Abdomen deep brown to black. Legs brown, with the apices of the fore and mid-metatarsi and first tarsal white, in the hind legs the last three tarsi white, and also the tip of the first tarsal. Wings with two small pale spots on the black costa, mostly deeply scaled.

♀. Head dark, with a few long white curved scales in front, upright white ones in the middle, and upright black ones at the sides, a tuft of yellowish hairs in front; antennae dark brown, almost black; basal joint dark, covered with white pubescence; verticils dark brown, the first three basal joints with a few white scales; palpi densely scaled with black scales, with four narrow rings of white scales; proboscis covered with black scales, yellowish at extreme apex.

Thorax dark brown, with greyish tomentum, longitudinally adorned with darker lines, with scattered yellowish curved hair-like scales; scutellum brown, with a dull purplish-brown tinge, and edged with chestnut-brown bristles; metanotum deep brown; pleurae dark brown, with a few pale reflections.

Abdomen steely black, with a few small, irregular, deep ochraceous marks in some lights, entirely covered with dark brown hairs, black in some lights.

Legs yellowish, with dark brown scales, the apices of the metatarsi and first tarsal joints of the fore- and mid-legs with a fine yellow band; hind-legs with the metatarsus very long and the extreme tip of the first tarsal joint white, the other three joints pure white, like *A. argyrotarsis;* the last tarsal joints of fore and mid legs slightly paler, of a somewhat ochraceous tinge in some lights; ungues equal and simple.

Wings very much like *A. Sinensis* ; veins clothed with yellow and black scales ; the costa dark, broken by two small yellow spots, one near the apex and the other about a third of the length from the apex, the apical spot extending on to the first long vein and the upper fork of the second long vein, the other spot passing on to the first long vein only ; there is a yellow spot further back on the first long vein, which does not, however, reach the costa ; fringe just as in *A. Sinensis.*

Fig. 26.
*Anopheles paludis.* n. sp. (X 9.)

*Length.*—5 to 5·5 mm.

*Habitat.*—Katmiga and Sierra Leone.

*Date of capture.*—January 27.

*Observations.*—With the hind legs destroyed this species looks like *A. Sinensis,* but the white hind-tarsi readily distinguish it. From *A. argyrotarsis* it can at once be told by the wings, which have the fringe with only one pale spot at the end of the lower branch of the fifth long vein, whereas in *A. argyrotarsis* there are several pale areas ; and there are never more than two costal spots in this species.

Dr. S. R. Christophers, who sends this species, says : " It occurs very infrequently, and we have been unable to obtain any males." It occurs widely distributed, but rarely, in the Sierra Leone swamps. This species has been shown on two occasions to contain sporozoates in the salivary glands, though caught about a quarter of a mile from any human habitation.

### 3. Anopheles paludis. Var. *similis.*

### = *A. Mauritianus.* Grandpre.

(Fig. 5, Pl. II.)

Thorax dark brown, with grey median sheen with dark longitudinal lines and scattered hair-like pale scales. Abdomen black, with ochraceous patches and brownish-golden hairs. Legs ochraceous, with dark brown scales and an ochraceous sheen ; fore- and mid-tarsi apically banded white, metatarsi banded with white basally and apically in the hind legs ; the last *two* tarsi all white, and most of the second, and also the apex of the first. Wing fringe all dark, no pale spot as in the type.

♀. Head dark brown to black, with a few white curved scales in front and a few white projecting hairs, white upright

forked scales in the middle, black or grey at the sides; eyes black, with a narrow silvery border; antennae dark brown, basal joint dark, pubescence white, verticillate hairs brown, basal and next few segments with white scales; palpi densely scaled with black scales, with two, three, or four rings of white scales; the apex usually white; the white scales are at the apices of the joints; proboscis black, densely scaled at the base, about as long as the palpi; in some the proboscis is slightly testaceous at the tip.

Thorax dark brown, with grey sheen in the middle, adorned with dark longitudinal lines, and with scattered pale creamy to yellowish curved hair-like scales; scutellum dark in the middle, paler at the sides, sometimes showing a testaceous tinge, at others a grey hue; border-bristles chestnut- to dark-brown; metanotum deep brown; pleurae brown, with a few greyish areas.

Abdomen deep black, with a slight ochraceous tinge in places covered with brown hairs.

Legs ochraceous, clothed with deep brown scales, with a bright ochraceous sheen in some lights; the apex of the metatarsi and first two tarsal joints of the fore- and mid-legs apically banded white, and also, to some extent, may be seen a white basal patch on the metatarsi. In the hind legs the metatarsi are broadly white banded at the base and apex, and the apex of the first is also banded white; the second is almost all white, save a small black basal band, last two pure white; ungues dark brown, equal and simple.

Wings densely clothed with black and yellow scales, the former predominating, so that the wings look sooty-black. The scales are broadish and spindle-shaped. The black scaled costa has two small white spots, one near the apex; this spot extends on to the first long vein and the upper branch of the first sub-marginal cell; the second costal spot just touches the first long vein. There are also small pale scaled areas on the lower branch of the first sub-marginal cell, on each of the branches of the second posterior cell, a few pale scales on the bases of the fork-cells, and on the third long vein. On the upper branch of the fifth are two small pale areas, the lower branch and stem being mostly pale scaled. The sixth pale scaled, with two black spots. Wing fringe entirely brown, the border-scales yellowish. First sub-marginal cell considerably longer and a little narrower than the second posterior cell; its base a little nearer the base of the wing than that of the latter; its stem about two-thirds the length of the cell. Stem of the second posterior cell longer than

the cell. Mid cross-vein short, lying a little nearer the base of the wing than the supernumerary cross-vein. Posterior cross-vein as long as the supernumerary, rather more than half its length distant from the mid cross-vein.

Halteres pale, with fuscous knob.

*Length.*—5 to 5·5 mm.

♂. Head brown, with a few curved white scales in front, white upright ones on the front and the middle; brown, tipped with ochraceous, on the occiput; on the nape a row of pale upright ones, and a tuft of white hairs projecting forwards between the eyes; antennae banded grey and testaceous; basal joint dark brown, testaceous inside, plume hairs flaxen; palpi dark brown, almost black, last two joints much swollen, with three irregular white bands on the apical portions, hair-tufts dark brown, another faint band noticeable towards the base; fore ungues unequal, the larger one with a distinct tooth, the smaller very minute, simple; mid and hind ungues equal and simple.

*Length.*—5 to 5·5 mm.

*Habitat.*—Salisbury, Mashonaland (Marshall) (79); British Central Africa (Daniels) (82); Gold Coast (Osborn Brown) (81); Mauritius (Bigot).

*Time of appearance.*—January, March, and October in Mashonaland.

*Observations.*—A number of specimens sent by Mr. Marshall from Mashonaland very closely resemble *A. paludis*, mihi, but they differ in several minor points, which are, I feel sure, of non-specific value. I therefore describe these Central African forms as a variety of the Sierra Leone species previously described. The chief points of difference are in (1) the leg banding and (2) the absence of the pale patch on the wing fringe. There is evident variation in the leg banding in the few specimens sent, but in no case is the second hind tarsal all white, as in *paludis*, nor do we find in *paludis* the basal banding seen in the Mashonaland specimens. This variety also occurs on the Gold Coast, differing in no ways from the Central African form.

Unfortunately I have not seen a ♂ of *paludis*, so the ungues, which often form a clue as to the identity of the species in the ♂, might prove that the colour variation here described is one of specific value, but I fancy the two forms are as nearly related as *A. Sinensis*, Wied., and *A. pseudopictus*, Grassi. I find a specimen undoubtedly of this variety in Bigot's collection from Mauritius.

4. Anopheles fuliginosus. Giles.

(Hd.Bk. of Gnats, p. 160 (1900), Giles.)

(Fig. 3, Pl. I.)

Thorax slaty-black, with darker longitudinal lines and with scattered flat spindle-shaped scales; legs dark, brownish-black, a pale band near the apex of the femora, a white apical band to the metatarsi and also the first two fore tarsi, the last three and apex of the first hind tarsi pure white; costa black, with four large and one or two small pale spots.

♀. Head black, with white upright forked scales in front and on the occiput, black behind and at the sides, and with dark brown bristles; antennae brown, with pale pubescence, basal joint deep to testaceous-brown, a few white scales on the basal joints; palpi clothed with long black scales with two white rings and an apical white joint; proboscis almost black, scaly.

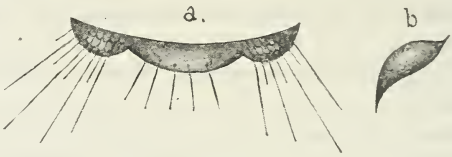



Fig. 27.
*Anopheles fuliginosus*, Giles.
a, Scutellum; b, scutellar scale from mid lobe.

Thorax slaty-black, with darker longitudinal lines, and with scattered, pale, spindle-shaped scales, a bunch of pale longer ones in front and a few dusky, projecting, spatulate ones at the sides in front, bristles black; scutellum deep slaty-black, with creamy-white scales, especially forming two lateral tufts, small black bristles on the mid-lobe, long ones at the sides; pleurae deep slaty-brown; metanotum deep brown to black.

Legs ochraceous, covered with dark scales and banded; femora ochraceous below, dark scaled above, an incomplete ochraceous band near the apex, which is black, except the extreme tip, which is snowy white; tibiae black scaled with a white apical spot; metatarsi black, with a broad white, apical band; fore tarsi with apical white bands to the first two joints, last two black; in the mid tarsi the second joint has only a minute apical band; in

the hind legs, the last three tarsi are pure white and there is also a broad band on the apex of the first tarsal and the metatarsus. Ungues small, equal, and simple. Wings with four prominent and one or two small snowy-white costal spots, rest of the costa jet black ; first long vein black, with four small white spots ; first sub-marginal cell considerably longer and narrower than the second posterior cell, its stem and fork dark scaled, except a patch towards the apex of the lower branch ; third long vein with a patch of yellow scales on the middle, rest of it black ; base of the small posterior fork-cell nearer the apex of the wing than the base of the first sub-marginal cell ; a pale patch on each branch of the fork, the remainder black scaled ;

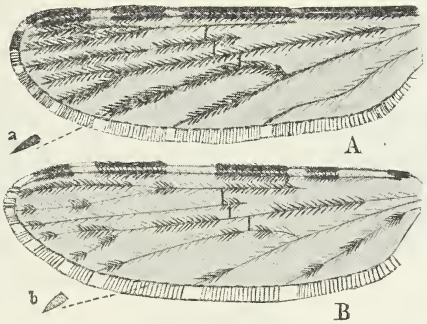



Fig. 28.

A. Wing of ♀ *Anopheles fuliginosus*, Giles.
B. Of the variety *pallida*, mihi.
a and b, Enlarged "border scales."
(X. 15.)

fifth long vein with two yellow patches on the upper branch and one long one on the lower, and a patch of yellow towards its base ; posterior cross-vein more than its own length distant from the mid cross-vein ; fringe black, except where the veins join the border, where it is yellow. Halteres with a pale stem and jet-black knob.

*Length.*—3·5 to 4·2 mm.

*Habitat.*—Chingelput, Madras (Captain Cornwall) ; Quilon (James) ; Punjab (Giles) ; Calcutta (Daniels) (7. 4. 1899) ; Behar, Bengal (Green) (88).

*Time of capture.*—Madras in March ; Punjab in June.

*Observations.*—This small mosquito is evidently closely related to *argyrotarsis*, but distinct from it, the wings differing considerably both in markings and in colour. It is called by Ross the

Small Dapple-Wing, and is said to be rare in Calcutta, but evidently common in Madras.

Experiments with human malaria (Crescent and Tertian cases) failed.

The actual specimens of the Small Dapple-Wing sent by Dr. Daniels were lost in transit. The type specimens in the British Museum were brought home by Ross and deposited by him, and are said to belong to the same species.

The specimen from which this description is taken belongs to Captain Cornwall, and was obtained in Madras. Captain James, I.M.S., writes regarding the larvae of this species that they are quite black, with a bright white spot in the centre of the back; whereas the common *Anopheles* larvae (*A. Rossii*) are light fawn or light brown. In lying flat at the surface of the water and in their movements they resemble those of the common species.

One specimen sent me by Captain Cornwall and others from Behar differ slightly in regard to the wing ornamentation, but I feel sure are only pale varieties of this dark species. The "border scales" in this variety, *pallida*, are yellow (B, b), instead of black (A, a).

### 5. Anopheles Jamesii. n. sp.

(Fig. 2, Pl. I.)

Thorax brown, with ashy-grey and creamy curved scales. Abdomen dark brown, with golden hairs and with golden-brown scales on the last few segments. Legs brown, fore femora with a few pale spots, tibiae spotted; fore metatarsus apically banded, and also with a median band, first and second tarsi apically banded, and in mid legs the metatarsus and first two tarsi apically banded; hind legs with femora and tibiae with an apical white spot, last three tarsi pure white and the apex of the first. Costa with four large and two small dark spots.

♀. Head brown, with white scales above, black at the sides; eyes black, bordered with a narrow rim of white; antennae brown, with white pubescence, basal joint dark brown; palpi black scaled with snow-white rings and white apical joint; proboscis black, with pale tip.

Thorax brown, with an ashy-grey sheen, and with creamy curved scales, white and longer in front; metanotum deep brown; pleurae dark brown.

Abdomen dark purplish-brown, with golden hairs all over

the segments, and with the last few segments with long golden scales.

Legs with femora dark scaled, with a few white spots; fore tibiae with numerous small white spots; fore metatarsi apically white, and with a faint white band in the middle; first and second tarsal joints apically banded; third and fourth dark; mid legs with the metatarsus and first and second tarsi apically banded; hind legs with the femora and tibiae with an apical white spot and small pale patches on them; last three tarsi pure white and also the apex of the first, ungues black.

Wings with creamy veins, and with four large and two small very dark costal spots, and fifteen small spots on the wing field, the whole of the apical fringe yellowish; anterior branch of fifth long vein much curved at the base.

*Length.*—3 to 3·5 mm.

*Habitat.*—Quilon, Travancore, S. India (James) (7. 3. 1900).

*Time of capture.*—February.

*Observations.*—A small *Anopheles* with similar hind tarsi to *A. argyrotarsis*, but clearly distinct on account of the leg banding and wing markings, as well as size. The banded mid-tarsi and the mid-banding of the fore metatarsus at once render it easy of identification, as well as the speckled tibiae and femora, otherwise very like Giles's *A. fuliginosus*.

### 6. Anopheles Bigotii. n. sp.

*A. punctipennis.* Bigot (MS. name).

Thorax dark brown, with four long lines of flat white scales. Abdomen black, with yellow scales above, white or creamy ones below. Legs brown, banded; an apical band on the metatarsus and first two tarsi of fore legs, last joint white; a pale ring on the hind femora; a broad apical one to the metatarsus, last three tarsi and apex of the first pure white. Wings with three white spots on the dark costa.

♀. Head brown with white curved scales, flat ones at the sides; antennae brown, the basal joint dark on one side, second joint rather long, about equal to two of the following, first seven joints with white scales; palpi brown scaled, the apex white, and also the apices of the other joints, *i.e.* with four white bands, base densely scaled; proboscis rather thin, brown.

Thorax dark brown, with four longitudinal lines of rather flat white scales, the two median ones being rather close

together; the scales of these lines become irregularly spread out across the mesonotum in front of the scutellum; there is also a line of white scales at the side of the thorax; scutellum deep brown with rather long flat scales; pleurae brown with white scales; metanotum brown.

Abdomen steely black, clothed rather densely with flat yellow scales above and white ones on the venter.

Legs rather pale brown, banded; fore legs with a broad white apical band to the metatarsus and first two tarsi, the third tarsal black, the last white; in the hind legs the femora have a pale imperfect ring before the apex, which is black; apex of the tibiae somewhat enlarged and very dark; metatarsus half as long again as the tibia, with a broad white apical band; apex of first tarsal narrowly white-banded, remaining three tarsi pure white.

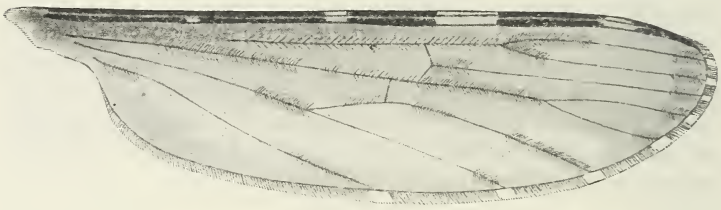


Fig. 29.
*Anopheles Bigotii.* n. sp.
Wing of the ♀. (X. 14.)

Wings with three clear white spots on the dark costa; the first long vein with a corresponding pale patch of scales under the apical spot, a longer patch under the median spot, and only a small trace near the third spot; the second long vein with a pale spot on its upper and a longer one on its lower branch; third long vein mostly pale scaled; a dark patch at each end; fourth with a pale patch on the stem and another at the base of the fork, and other pale scales on the branches; fifth long vein with three white patches on the upper branch, the lower branch white with a black apical patch, the stem dark just at the base of the fork; sixth vein with a broad white patch in the middle; fringe brown with a pale spot at the end of each vein; first submarginal cell considerably longer and narrower than the second posterior cell, its stem less than half the length of the cell; stem of the second posterior longer than the cell, its base much

nearer the apex of the wing than the base of the first submarginal cell; posterior cross-vein about its own length distant from the mid cross-vein.

*Length.*—6 mm.

*Habitat.*—Chili (Bigot).

*Observations.*—Described from a single ♀ in Bigot's collection, and now in Mr. Verrall's possession. The specimen bears the following in Bigot's writing, "*Anopheles punctipennis.* n. sp. 1874. Chili."

The MS. name Bigot gave it cannot stand, as Say has described an *Anopheles* under this name.

It is a very marked and beautiful species, with rather flat thoracic scales and many flat scales on the abdomen; the thoracic markings will readily separate it from any other white-legged species; the hind legs in the specimen are imperfect. It bears a superficial resemblance to my *A. paludis*, but the flat thoracic scales at once separate it.

### 7. Anopheles Sinensis. Wiedemann.

(Aussereurop. Zweiflüg. Insek. p. 547 (1828).)

(Fig. 146, Pl. XXXVII., and Pl. A.)

Thorax slaty-grey, with purplish longitudinal stripes and narrow pale golden scales and minute dark specks. Abdomen brownish-black and testaceous with long golden hairs and sometimes traces of pale apical borders. Legs brown, yellowish below; tibiae and tarsi with apical pale bands except the last two in the fore and mid-legs. (Banding may involve both sides of the joints.) Costa dark brown to black with two large yellow spots.

♀. Head blackish with white scales in front, black, tipped with grey behind; antennae brown with narrow pale basal bands to the joints, basal joint testaceous, with pale scales, which also occur on the next few joints; palpi densely scaled with long deep brown to black scales, with a white scaled apex and two white bands at the apex of the third and fourth joints; proboscis black; clypeus brown. Thorax slaty-grey with purplish-brown longitudinal stripes, with numerous small dark specks, adorned more or less with narrow pale golden scales; scutellum dull pale ochraceous or grey with the centre deep purplish-brown; metanotum deep clear purplish-brown to almost black; pleurae brown and silvery grey.

Abdomen with brownish-black and testaceous ground colour; in some specimens there is a narrow apical pale border to the segments, seen in certain lights; posterior segments mainly testaceous; all the segments are covered and edged with long golden hairs, the end ones particularly so.

Legs testaceous when denuded; covered with brown scales above, dark yellowish below; tibiae and tarsi, except the last, with apical pale bands (in some, both sides of the joints are involved); in the hind legs the metatarsus is longer than the tibia, and the first tarsal joint about half the length of the metatarsus; in the fore and mid-legs the last two tarsal joints show little or no banding; ungues equal and simple.

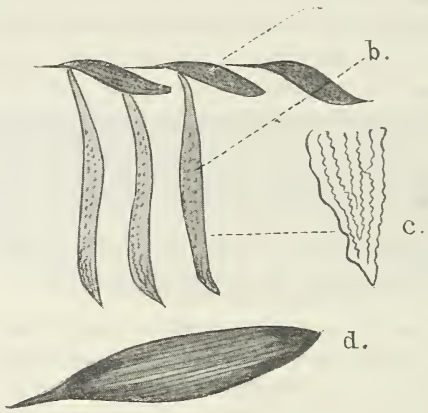



Fig. 30.

*Anopheles Sinensis*, Van der Wulp.

a and b, Scales of wing fringe; a = border scales; b = fringe scales; c = enlarged apex of b; d = scale from wing field.

Wings with the costa covered with dark brown to black scales, with two rather large prominent yellowish-white spots, which extend on to the first long vein; one spot is near the apex, the second where the sub-costal vein joins the costa; the veins are covered with light brown, dark brown, and creamy scales, the dark brown forming patches on the bases of the two fork-cells, where the veins join the wing border, at the base of the third long vein, and the base of the second long vein; three more or less distinct patches are present on the upper branch of the fifth and one near its base and a few on the apical part of its lower branch; two patches on the sixth, whilst the sub-costal and first

long vein have all brown scales except where the yellow costal spots are carried over them; fringe yellow at the apex, a small black patch separating it from the costal spot, a pale patch where the lower half of the fifth vein joins the border, all the rest dusky violet-black, except the "border scales" (Fig. 30, a), which are pale yellow in reflected light; first sub-marginal cell and second posterior cell of nearly equal length, base of the latter just a little nearer the base of the wing than that of the former; stem of the first sub-marginal about two-thirds the length of the cell; stem of the second posterior equal to that of the former cell; posterior cross-vein not quite half its length distant from the mid cross-vein; mid cross-vein a little nearer the base of the wing than the supernumerary; the posterior cross-vein slightly the longest of the three; base of the first sub-marginal cell some distance from the junction of the sub-costal with the costal. Halteres with pale stem and dusky knob.

*Length.*—5 mm.; proboscis, 2·5 mm.

*Habitat.*—Tamsui, Formosa (Dr. G. Mackay) (2. 8. 1899); China (Wiedemann); Foo-chow (Rennie) (84); Tai Po, Pokfulam, Lamma (Rees).

*Time of capture.*—June (Mackay), August (Rennie), October (Rees).

*Observations.*—A somewhat denuded series of this species has been received from Dr. Mackay, and which I think is clearly the *Anopheles Sinensis* described by Wiedemann from China. It is closely related to *A. annularis*, Van d. Wulp, and *A. barbirostris*, Van d. Wulp, but differs, I find, in the following points: (1) from *A. annularis* by having the cross-veins closer together, especially the posterior cross-vein being nearer the mid cross-vein, in the larger size of the two costal spots, and on account of the base of the second posterior cell being a little nearer the base of the wing than that of the first sub-marginal; lastly the basal joint of the antennae is testaceous instead of black; (2) from *A. barbirostris* it differs in having the apical fringe pure yellow, the presence of a pale spot on the fringe at the end of the lower half of the fifth long vein, the position of the cross-veins and the smaller size of the proboscis, and especially in the different form of the wing scales, which are shorter and broader in *A. barbirostris* (*vide* Pl. A.).

Since the above was written a series of this species has been received from Foo-chow, where, according to the collector, Mr. Rennie, it is rare, and another has been sent me by Dr. Rees from Hong Kong, but unfortunately again no males are present.

*Original description.**—Brownish, with the costa and puncta on the wings brown, the legs with whitish joints. Length $2\frac{3}{4}$ lines (German); ♂ and ♀ antennae and palpi brown; the latter in the ♀ appears thicker than the proboscis; thorax with a linear stripe in the middle and with deeper brown stripes on the sides; wings with light brown scales along the costa, with two, as it appears, constant interruptions; on the mid field of the wing are several brown points or spots.

*Habitat.*—China.

8. *Sub-species* PSEUDOPICTUS. Grassi.

*A. pictus.* Ficalbi.

(Venti Specie di Zanzare Ital. (1899), Ficalbi; Reale Accad. dei Lincei, Stud. d. u. Zool. sulla Malaria, p. 78 (1900), Grassi.)

(Plate A.)

Thorax bluish-grey with five longitudinal lines, with scattered hair-like golden scales; abdomen blackish-brown with golden hairs. Wings with two small, pale, costal spots on the dark costa and a pale spot on the first longitudinal nearer the base but *not reaching the costa*. Legs brown, apices of metatarsi and tarsi with a narrow pale ring.

♀. Head with white scales in front, brown scales behind, and at the sides, a tuft of white ones projecting forwards; eyes black, narrowly bordered with white; antennae brown, basal joint and others for about half the length of the antenna with white scales, pubescence white, verticillate hairs pallid; palpi covered with brown and purplish-brown scales, and with three minute rings of white scales and the apex white-scaled; there are also a few white scales along the whole length forming an indistinct line; proboscis dark brown with numerous fine hairs as well as scales. Thorax bluish-grey with a clear, dark median line the whole length of the mesonotum and with four other short paler lines, the mesonotum adorned with scattered, hair-like golden scales in front, which on the posterior half of the mesonotum are arranged in lines; scutellum the same colour and with similar scales; metanotum bluish-grey in some, light-brown in others; pleurae mottled with grey and brown; white scales at the bases of the legs. Abdomen blackish-brown with golden hairs, which are especially thick in the middle line of the abdomen.

* Aussereurop. Zweiflüg. Insek. p. 547, Wiedemann.

Wings with dark scales predominating, with two pale costal spots, both on the apical half of the costa ; nearer the base is a pale spot which does not reach the costa ; the fork of the second long vein is black scaled at its base and its stem, each of the branches of the fork having a small pale patch of scales ; the fourth long vein with the base of the fork densely black scaled, also the stem, which is most conspicuously black at the base ; the branches of the fifth with many black scales ; two distinct patches on the sixth. Fringe brown, pale at the end of the posterior branch of the fifth, like *A. Sinensis*, Wied., and *A. paludis*, mihi. Legs brown with joints paler, the tarsi being apically banded with a pale band, the last joint being black-scaled only. Ungues simple.

*Length.*—6 mm. ; proboscis, 3·5 mm.

♂. Palpi black with a dense tuft of golden-brown hairs, with one or two patches of white scales at the swollen end and an indistinct line of them along one side ; antennae pale brown, with chestnut-brown plumes and bright brown bands at the verticils. Abdomen with an ochraceous tinge in places. The genitalia (Fig. 31) has scales on the basal lobe, which is rather thick and broad.

The ungues of the fore legs are unequal, the larger one being provided with two teeth, a large one in the middle and a smaller one at the base, and also traces of a small third tooth at the base.

Fig. 31.

Sub-sp. *A. pseudopictus* (after Ficalbi). (X. 30.)

Male genitalia.

*Length.*—5 to 6 mm.

*Habitat.*—Italy.

*Observations.*—Three specimens of this sub-species were sent by Professor Grassi, who described it under the name of *A. pseudopictus*, n. sp. On comparing the specimens with Loew's description of *A. pictus*, I feel certain they are closely related, but Loew states that *A. pictus* has the fringe alternately black and white, which is certainly not the case in Grassi's species. (Probably Loew's species is another local sub-species of *A. Sinensis.*) Grassi's species is very closely related to *A. Sinensis*, differing from it only in size and the length of the first sub-marginal cell, which extends back to the junction of the sub-costal and costal.

It is probably, like *A. annularis*, merely a sub-species of *A. Sinensis.* I have separated this and the others as distinct sub-species from the positions of the cross-veins and the relative lengths of the fork-cells, &c. *A. pseudopictus* prefers the open

country, especially land covered with rushes. Although it is common in Italy, it does not occur in the adjacent islands.

Were it not for the description of the wing-fringe of *A. pictus* I should feel sure that Grassi's and Loew's species are the same, for the third costal spot can be seen on the first long vein in *A. pseudopictus*, and does not, as Loew says of *A. pictus*, reach the margin (costa) of the wing, but in Loew's species the internal fringe is formed by alternate patches of white and brown scales.

9. *Sub-species* ANNULARIS. Van der Wulp.
*A. vanus.* Walker.

(Notes, Leyden Museum, vi. p. 249 (♂), V. d. Wulp; Journ. Proc. Linn. Soc. Lond. iv. p. 91 (1860), Walker (= *vanus*).)

(Fig. 18, Pl. V.)

Like *A. Sinensis*, but the cross-veins are further apart, the costal spots smaller, the palpi and proboscis more scaly and of nearly equal length.

♀. Head black, with yellowish-white upright scales in front and black ones behind tipped with grey, deep black ones at the sides, a tuft of long white hairs projecting between the eyes; antennae dark brown, basal joint testaceous, almost black on the inside with pale grey scales; palpi covered with long brown

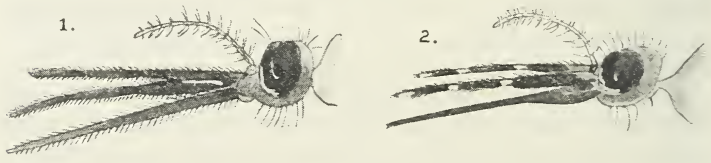



Fig. 32.
1. Head of *Anopheles barbirostris*. (X. 10.) 2. Head of *Anopheles annularis*.

scales, with three narrow bands of white scales on the last three joints nearly as long as the proboscis; proboscis densely covered with black scales, apex testaceous.

Thorax brown, dusted with frosty grey, with a narrow median line and broader lateral ones of a dull violet hue, and also two large oval, dark, lateral, eye-like spots, the whole covered with minute dark specks with scattered long pale hair-like scales, white in front, golden on the dorsum and behind;

pleurae dark brown with some grey markings; metanotum deep-brown; scutellum pale ochraceous grey, dark brown in the middle.

Abdomen shiny black with a dull violet tinge in some lights, with long golden-brown hairs. Legs dark yellowish-brown with dark brown scales, with a dull bronzy yellow reflection in certain lights; apices of the hind metatarsi and first three tarsal joints narrowly banded yellow, last joint dark brown; in the fore and mid legs the first two tarsi only are banded; hind metatarsi longer than the hind tibiae, first tarsal joint not one-half the length of the metatarsus; ungues equal and simple.

Wings with the costa covered with black scales, broken by two small yellow spots, the apical one distinct and extending on to the first long vein and the upper half of the fork of the second long vein; the second spot where the sub-costal joins the costa very indistinct, more or less extending on to the second longitudinal, rest of the wing-markings as in *A. Sinensis*, except that there is no pale patch on the fringe where the lower branch of the fifth vein joins the border; apical fringe yellow, but the black spot between it and the apical costal spot larger; cross-veins separate, the posterior longer than the mid, distant from it more than its own length, and *the supernumerary distant from the mid about two-thirds of its own length;* base of the first sub-marginal cell a little nearer the base of the wing than the base of the second posterior cell.

Halteres pale yellowish-brown with a fuscous knob.

*Length.*—4 to 5 mm.

♂. Palpi densely covered with black and grey scales at the base, less so on the remainder, apex with black and grey scales, truncated, antepenultimate joint deep black with a narrow border of white scales; penultimate joint with thin white border; hair-tufts brown; antennae banded with brown verticils. Ungues of the fore legs unequal, the larger one with two large teeth, and a trace of a third at the base; mid and hind equal and simple, the hind smaller than the mid and nearly straight.

*Length.*—3·8 to 4·5 mm.

*Habitat.*—Straits Settlements (Taipang, Perak), (L. Wray) (21. 11. and 22. 12. 1899); Madras (Captain Cornwall); Sambalpur, Central Provinces (D. O'C. Murphy) (99).

*Observations.*—This species differs very slightly from *A. Sinensis*, but it can be separated by the character of the cross-veins, which are all widely separate from one another, and there

is no pale patch on the wing-fringe, and the base of the first sub-marginal cell is a little nearer the base of the wing than that of the second posterior cell. The costal spots are also smaller, and the majority of the specimens are not so large as those from China. Van der Wulp thought it might be synonymous with *A. Sinensis*, and I am also of opinion that the two are mere local races. There is much variation in regard to the banding of the legs and palpi in this species, which is evidently very abundant in Perak. It answers so nearly to *A. annularis* that I adopt that name for this sub-species and apply *A. barbirostris* to the darker *Anopheles* from the same locality. Walker's *A. vanus* is evidently a ♂ of this, but the type is so denuded that it is difficult to say with certainty. The Sambalpur specimens have broad leg-bands involving both sides of the tarsal joints.

*Variability of the sub-species.*—The large series sent by Mr. Wray, from Taipang, shows considerable variation both in size and markings, one distinct variety being easily separated from them; this I call variety A, in which *the bands of the hind tarsi involve both sides of the joints.* In some these bands are narrow, in others very wide. Although this variety can easily be separated from the type, there are forms which can be placed in either, several specimens showing partial apical and basal bands, some on one or more joints only, whilst in others the banding is so small as to be scarcely perceptible. The palpi also vary in regard to the white bands.

*Original description.**

♂. Fuscous, thorax striped; the proboscis naked and black; palpi brownish, white banded; legs brick-red; tarsi banded white; costa of wings spotted white. Length, 4–5 mm.

♀. Blackish; thorax with a dark bluish dust and fine longitudinal, fuscous lines; pleurae light grey with black spots arranged in long rows. Antennae with light brown hairs; rostrum black; palpi fuscous, as long as the rostrum; base of the first and second joints and the whole of the apical joint white. Legs long and slender, testaceous; anterior tarsi with a ring of white on each joint; the long hind tarsi fuscous in the middle and with a white ring, wholly white towards the end. Veins of the wings with fuscous and white scales; costa alternately spotted with dark brown and white.

* Leyden Museum Notes, vi. 249, Van der Wulp.

10. *Sub-species* INDIENSIS.

Some specimens sent me by Captain Cornwall, from Madras, present certain differences in venation to *A. annularis*, but which are only of sufficient importance to found a sub-species on, as all the other characters are similar to the typical *A. annularis* from the Malay Peninsula. In this sub-species the two fork-cells are relatively much longer than in the type (Fig. 34), the base of the first sub-marginal cell being quite close to the first costal spot, that is close to the junction of the sub-costal with the costal; the fringe scales are also pale at the end of the lower branch of the fifth long vein, whilst the cross-veins resemble most nearly those of *A. annularis* (type).

The peculiarity in the venation of this variety places it very near the specimens sent by Professor Grassi and called by him *A. pseudopictus*, but it differs in regard to the relative positions of the cross-veins.

11. *Sub-species* NIGERRIMUS. Giles.
= the "Dapple-Winged Mosquito" of Ross.

(Hd.Bk. of Gnats, p. 161 (1900).)

♀. Head greyish-brown, with evidently white scales in front and greyish scales behind; eyes dark purplish-black, bordered with a slightly light band; antennae dark reddish-brown with white scales at the base and with a dark basal joint; proboscis long and covered with shortish dark scales; palpi with black apex.

Thorax dusted with silvery grey tomentum and with dul purplish-brown longitudinal stripes, with scattered pale shiny curved scales; scutellum pale; metanotum dark brown; pleurae dark brown, with slight hoary tomentum in places. Abdomen dark purplish-brown with pale mottlings on some of the segments. Posterior borders of the segments with a plain thin dark band, ventral surface dark brown with some basal white patches to some of the segments and with scattered white scales.

Legs yellowish, with dark scales, some of the tarsal joints apically pale. Wings very dark scaled, the costa broken by two small creamy-yellow patches; the majority of the scales on the second, third, and fourth longitudinal veins dark, the fifth with white and dark scales, and the sixth with a black patch near

the border and another further back, and many dark scales from this to the base. First sub-marginal cell longer and narrower than the second posterior cell, its base a little way in front of the costal spot.

*Length.*—4·5 to 5 mm.

*Habitat.*—Calcutta (Daniels) (7. 4. 1899); Naini Tal (Giles); Travancore (James).

*Observations.*—Three bad specimens only in the collection, for which Major Giles suggests the name of *nigerrimus* in his compilation on *Culicidae*. There is not sufficient material, however, to express an opinion definitely. It is very clearly related to *A. Sinensis*, of which it is no doubt a sub-species; *annularis* is its nearest relative, but it differs from it in that the scales of the wings seem to be less elongated; the apical fringe is also black, and there is a pale patch at the end of the lower half of the fifth long vein, thus bringing it near to *A. barbirostris* as well as to *A. Sinensis*, sub-species *annularis*.

This is one of the dapple-winged mosquitoes of Ross, the three specimens in the Museum having been presented by him.

Major Giles has also sent me recently a specimen from Naini Tal.

### 12. Anopheles barbirostris. Van der Wulp.

(Leyden Museum Notes, vi. p. 48.)

(Pl. A.)

Thorax deep greyish, with slaty reflections, dark longitudinal lines and minute black specks, with long scattered golden hair-like scales. Abdomen nearly black. Legs dark brown, with apical pale bands to the tibiae and tarsi. Costa black, with two small yellow spots on the apical half; apical fringe black, except between the second and third veins; scales more robust than in *A. Sinensis*. (*Vide* Plate A.)

♀. Head black, covered with black upright broad forked scales behind, grey at the tips, and with creamy white ones in front, a median bare space and a few projecting white and black bristles in front; antennae black, with pale bands, basal joints black; palpi densely covered with deep black scales, making them nearly as wide as the head, as long as the proboscis, all traces of the joints hidden by the dense scales.

Thorax deep greyish, with slaty reflections, deeper coloured thin longitudinal lines, and numerous dark specks covered with

scattered long golden hair-like scales; pleurae brown and ashy grey, with a few white scales; scutellum deep purplish-brown in the middle, paler at the sides, with very pale golden curved scales and long dark brown bristles; metanotum deep brown.

Fig. 33.
Head of *Anopheles barbirostris* on the left, of *A. annularis* on the right. (From photographs.) (X. 9.)

Abdomen much as in *A. Sinensis*. Legs testaceous, densely covered with dark brown scales, apex of the tibiae with a yellow band, also the tarsal joints, except the last; ungues equal and simple.

Wings (Fig. 34) densely covered with dark scales and a few pale ones; costa black-scaled, a small pale yellow apical spot and another still smaller and paler where the sub-costal joins the costa; the former just includes the scales at the tip of the first long vein and the tip of the upper branch of the second long vein; the second spot only on the costal vein; first sub-marginal cell longer and narrower than the second posterior cell, its base just a little nearer the apex of the wing, its stem equal to about two-thirds of its length, shorter than the stem of the second posterior cell, which is a little longer than the cell; base of the first fork-cell not near the second costal spot; mid cross-vein a short distance from the supernumerary; posterior cross-vein more than its own length distant from the mid; fringe black, with a pale spot at the tip of the third long vein and slightly paler where the lower branch of the fifth joins the edge; scales of the wing more robust than in *A. Sinensis*, those of the upper branch of the fifth being comparatively short and broad with an acuminate tip. Halteres jet black, slightly pale at the base.

*Length.*—5 mm.

*Habitat.*—Selangor (Wray); Upper Burma (Watson) (4. 94); Old Calabar (Annett).

*Time of capture.*—August in Upper Burma (Watson); April in Old Calabar (Annett).

*Observations.*—This *Anopheles* very much resembles *A. Sinensis* and the sub-sp. *annularis*, but it is much darker in colour and has more densely-scaled black palpi. Moreover, the scales of the wings are shorter and broader, and the apical fringe is deep black; the position of the cross-veins resembles *A. annularis*, but the supernumerary and mid are closer together, and the relative position of the bases of the fork-cells is different.

It is undoubtedly a distinct species on account of the differently shaped wing-scales, but is closely related to *A. Sinensis*, sub-sp. *annularis*, and sub-sp. *pseudopictus*, &c.

I think it must be the species Van der Wulp called *A. barbirostris* on account of its large palpi, which, when lying closed over the proboscis, give it a very striking appearance. That Van der Wulp describes the legs as testaceous and mentions no banding is of no account, as the specimen he described was probably rubbed and the legs denuded, and hence appeared unbanded and pale, whilst even in good specimens the leg-banding may be very faint.

Some specimens received by Dr. Annett, bearing on the labels Vice-Consulate, Old Calabar, differ in no respects from the Malay and East Indian specimens, except that they are rather darker in colour and the banding on the tarsi is less distinct, in some being practically absent, as described by Van der Wulp.

*Original description.*—"Fuscous; thorax faintly striped; proboscis and palpi very hairy; legs brick-red; halteres fuscous; costa of the wings fuscous, with two snow-white spots. *Length.*—5 mm. ♀. The straight projecting hairy palpi give this species a peculiar aspect, differing from our indigenous species of the genus. Dark brown. Rostrum and palpi longer than the head and thorax taken together; clothed with brown scaly hairs; joints of the palpi hardly distinguishable. Thorax rather long and narrow, somewhat lighter coloured than the head and abdomen, quadrangularly truncated in front, with indistinct longitudinal stripes on the upper part. Abdomen with pale incisions. Legs very long and slender, testaceous; femora a little enlarged towards the end when viewed in some directions, whitish at the tip. Halteres piceous. Veins of the wings with brown scales, which are accumulated towards the costa; a point of snow-white scales at two-thirds of the costa, and a similar point near the tip; the two furcate cells of equal length. *Habitat.*—Mount Ardjoeno, East Java (Hekmeyer)."

*Notes on the* Sinensis *Group.*

The species described by Wiedemann in 'Aussereurop. Zweiflügel. Insekten,' p. 547, in 1828, under the name of *Anopheles Sinensis*, came from China, and specimens that I have examined from there and Formosa clearly agree with the meagre description Wiedemann gives. This I take as the type of this group, which contains the *A. annularis* of Van der Wulp, described in the 'Leyden Museum Notes,' vi. p. 249, from Mount Ardjoeno, East Java. Van der Wulp states that his species may be identical with Wiedemann's *A. Sinensis*. The description will be seen to differ, in that the legs are said to be *testaceous* by Van der Wulp, and the description of the costa being alternately spotted with dark brown and white might suggest a different species. Notwithstanding these apparent differences, I concur in Van der Wulp's suggestion that *A. annularis* is the same species as Wiedemann's; but after examining specimens from Formosa, and Malay Peninsula and Archipelago, I have placed those from the latter places, namely, Van der Wulp's *A. annularis*, as a subspecies of Wiedemann's species, the differences having been previously pointed out (p. 144).

Walker's *A. vanus*, described in 1860 in the 'Journal of the Proceedings of the Linnæan Society of London,' iv. p. 91, is again closely related to *A. Sinensis*, and, as far as I can judge from the single ♂ type in the British Museum, is the same as the *A. annularis* of Van der Wulp, although I have never seen one of the latter with only basal tarsal banding (no such banding can now, however, be seen in the type), which in all other respects agrees with Mr. Wray's specimens from Taipang.

In 1845 Loew described an *Anopheles* from the coast of Asia Minor, opposite the Isle of Rhodes, under the name of *A. pictus* (in 'Dipt. Beiträge'), which answers in all respects to *Sinensis*, except that the fringe is alternately black and white; for this reason I consider it may be distinct, although evidently related to this group. As I have not seen a specimen with a similar fringe I cannot give an opinion.

In 1899 Grassi described a dark *Anopheles* from Italy, *A. pseudopictus*. On comparing this with specimens from China, Malay Peninsula, and India, I can detect no differences of specific importance when we consider the variability of members of this group. Head, thorax, abdomen, and legs agree with *A. Sinensis*, and also the cross-veins of the wings; but the lengths

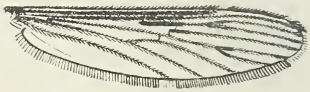
of the fork-cells differ, agreeing on the other hand with specimens of *A. annularis* from India in this respect. So similar are these insects that I take both with the Malay forms (*annularis*) to be sub-species of Wiedemann's *A. Sinensis*, and the probability is that Loew's *A. pictus* is the same.

Specimens brought back by Major Ross from Calcutta, deposited in the British Museum, and for which Major Giles suggests the name *nigerrimus*, agree in many respects with the former, but there are slight differences in the scales from them; but that point can only be settled when sufficient material is to hand, as the three types are too badly damaged to describe them *in toto*, and being types I am unable to dissect them to make pre-

Wing of *A. Sinensis*.

Wing of *A. annularis*.

Wing of *A. barbirostris*.



Wing of *A. Indiensis*.

Wing of *A. pseudopictus*.

Fig. 34.
Wings of *A. Sinensis* and allies. (X. 9.)

parations. I believe, however, it will prove to be a distinct sub-species, uniting *A. Sinensis* with Van der Wulp's *A. barbirostris*, which is again so closely related to *A. Sinensis* that it can only be separated by a microscopic examination of the wings, when the scales (Plate A) will be found to be considerably broader and shorter than in the former, whilst the apical fringe of the wings is black, the disposition of the cross-veins different, the border-scales all black, whilst in the former they are yellow, and the palpi and proboscis more densely black scaled and more prominent. Although closely related and presenting such similar outward appearances, I think it must be considered a distinct species on account of the structural peculiarity of the scales.

Unfortunately but few males of these mosquitoes have been sent, so that the important structure of the ♂ ungues has not been properly examined in any but *annularis* and *pseudopictus*, which agree with one another.

The chief differences of these two species, *A. Sinensis* and *A. barbirostris*, and the sub-species of the former, may be summed up as follows :—

*A. Sinensis.*

1. Proboscis longer than palpi.
2. White patch on border of wing below.
3. Wing (costal) spots large.
4. *Scales elongated.*
5. Cross-veins close together.
6. Border scales yellow.
7. Apical fringe all yellow.

sub-sp. *annularis.*

1. Palpi and proboscis nearly equal.
2. No white patch on border.
3. Costal spots small.
4. Scales as in type.
5. Cross-veins separate.
6. Border scales yellow.
7. Apical fringe yellow.

sub-sp. *Indiensis.*

1. 1st sub-marginal cell with base near 2nd costal spot at the junction of the sub-costal and costal veins.
2. Scales as in *annularis.*
3. Cross-veins separate.
4. Border scales yellow.
5. A pale patch on border of wing below.

sub-sp. *pseudopictus.*

1. 1st sub-marginal cell with base near 2nd costal spot at the junction of the sub-costal and costal veins.
2. Cross-veins close.
3. Scales as above.
4. No pale patch on border of wing below.

sub-sp. *nigerrimus.*

1. Base of the first sub-marginal cell just in front of the costal spot.
2. Apical fringe black.

*A. barbirostris.*

1. Bases of the two fork-cells nearly level.
2. Base of 1st sub-marginal cell not near junction of sub-costal and costal.
3. *Scales broader.*
4. No white spot on lower fringe.
5. Black apical patch to fringe.
6. Palpi unbanded.
7. Border scales black.

### 13. Anopheles superpictus. Grassi.

(Venti Specie di Zanzare Italiane, p. 87 (1899), Ficalbi; Reale Accad. d. Lincei Stud. d. uno Zool. sulla Malaria, p. 78 (1900), Grassi.)

(Fig. 11, Pl. III.)

Thorax brown, with white scales. Abdomen brownish-yellow, with distal darker borders. Legs dark brown, with apical white tarsal bands. Wings with four black spots on the yellow costa.

♂. The wings are clothed with black and white scales, the

black forming four distinct patches on the costal edge, the costa itself having also one or two additional black spots towards the base; each branch of the first sub-marginal cell is black-scaled towards the middle and at the tip; the stem has a few black scales on each side of the cross-vein; the third long vein has a few black scales at the tip and near its base; the fourth has two long black-scaled areas on its trunk, the upper branch of the second fork-cell also two, the lower branch one at the apex; the fifth, two patches on its anterior branch and one at the apex of the posterior branch; the sixth has a few black ones towards the base and a large number towards the apex; the scales are mostly long and thin; the middle cross-vein about its own length from the supernumerary cross-vein, and the posterior cross-vein also about its own length distant from the mid cross-vein (Fig. 36, 4); fringe apparently all dark except the apex.

Fig. 35.
*A. superpictus* (♂). (X. 9.)

Legs brown, tarsi apically banded, white, and also the tips of the tibiae, which are pale; fore ungues unequal, one large and double-toothed; the last tarsal joint has six or seven large spines at its base; other ungues simple.

Palpi brown, a broad white band at the base, and a narrow white apex; between the bands the palpus is almost black; proboscis brown, apex yellowish-white, narrow, very pointed; antennae banded brown and white, plume hairs silky brown.

♀. The ungues of the ♀ are equal and simple on all three legs.

*Habitat.*—Italy (Grassi and Ficalbi); Spain (Macdonald); India (Cornwall) (?); Salisbury, Mashonaland (Marshall).

*Observations.*—This species is represented in the collection by a single slide of head, wings, and legs sent by the describer of the species. Notes from the original description are therefore appended, although the wing-markings are sufficient to identify it:—"Proboscis nearly black, but whitish at the tip. Palpi of the ♀ nearly as long as the proboscis, nearly black, with white rings at the junction of the second and third, and fourth and fifth, as well as the entire terminal joint white. Nape black, with a median white tuft. Thorax with the dorsum browner at the sides, ornamented towards the middle with white scales; pleurae grey. Legs with the femora brownish, those of the first pair not proximally dilated. The remainder of the joints brownish-black,

with white rings at the tibio-tarsal and tarsal articulations affecting mainly the apices of the proximal joints. Wings light coloured and generally clear, spotted with yellowish-white and brownish-black, or black; the anterior margin black, completely interrupted by three light spots, so that the black portion is divided into four parts or elongated spots of not very unequal length; in addition to those an apical black spot and several of the longitudinal veins are black-scaled for various portions of their lengths, much as in *A. pseudopictus*, but not so densely. Abdomen very hairy, but without scales on either its dorsal or ventral surface; segments generally brownish-yellow, with darker hinder borders. Length, 7–8 mm."—(Ficalbi, 'Venti Specie di Zanzare Italiane.' Florence, 1899.)

Grassi states that his *A. superpictus* is found in houses, sheds, &c., like *A. maculipennis*, and that it is difficult to catch except when blood-sucking.

Captain Cornwall has sent me a ♀ from Madras, answering in some respects to Grassi's *A. superpictus*, but the tarsi are not banded, and the fringe has three yellow patches. I think it is a distinct species. At first sight *A. funestus*, Giles, would be taken for this species, but *funestus* has the supernumerary and mid cross-veins as in Fig. 36, 1, whilst they are different in *superpictus*, and the ♂ of *funestus* has the large ungues of the fore legs uni- not bi-serrated.

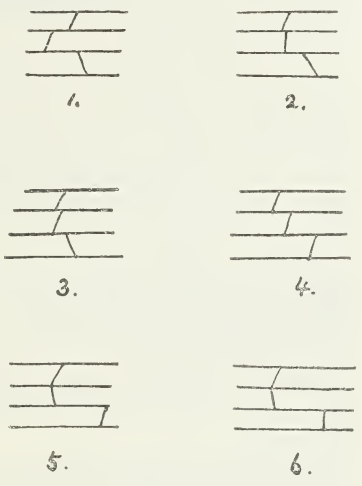



Fig. 36.

1. Cross-veins of *A. funestus*; 2. of *A. Rhodesiensis*; 3. of *A. Indiensis*; 4. of *A. superpictus*; 5. of *A. Rossii*; 6. of *A. costalis* (all ♀'s).

A number of *Anopheles* sent from Central Africa and the West Coast answer in all respects to the mounted *A. superpictus* sent us by Grassi, and I feel confident are his species.

Both *superpictus* and *funestus* occur side by side in Mashonaland, and the only way to detect them is by the different position of the cross-veins and the ♂ ungues.

### 14. Anopheles Rossii. Giles.

(Journ. Trop. Med. Oct. 1899; Hd.Bk. of Gnats, p. 149.)

(Figs. 9 and 10, Pl. III.)

Thorax pale yellowish-brown, with greyish reflections, and with a darker median line and scattered pale scales and hairs. Abdomen dusky, with a dense covering of ochraceous hairs. Legs yellow, with brown scales and yellow bands, both apical and basal, to the tarsi. Wings with a distinct T-shaped black costal spot and three other black spots in the ♀.

♀. Head blackish, with pale scales in front, and with a tuft of pale hairs projecting forwards, black scales at the top and sides; eyes black; antennae brown, with pale hairs and pubescence; basal joint ochraceous-brown, with a few creamy scales; proboscis dark brown, apex sometimes pale; palpi dark scaled, apically white, and with two other pale bands near the apices of the second and third joints; clypeus pale brown.

Thorax pale yellowish-brown to ochraceous-brown, with greyish reflections, with traces of a median line, covered with scattered pale scales and hairs; scutellum pale, sometimes dusky in the middle, with pale scales and brown bristles much as in *superpictus*; metanotum pale yellowish-brown to brown; pleurae with a dark line of spots above, pale below, with patches of pale scales.

Abdomen dusky, densely clothed with golden brown or ochraceous hairs, which are especially thick at the apex, giving it an ochraceous appearance.

Legs yellowish, with brown scales, and with pale apical and basal bands to some of the tarsi, except the last tarsus, which is always black. The tarsal scales are very dark, sometimes having a deep purplish-brown hue. Fore tarsi basally and apically banded yellow, except the last joint; metatarsus apically banded only; in some specimens there may be seen a very narrow basal, as well as apical, banding to the hind legs.

Wings yellowish, with the costa broken by four large patches of dark brown or black scales, and two or three smaller basal ones. The large middle spot has a small dark spot below in the centre, giving a T-shaped appearance to it. First sub-marginal cell a little longer and narrower than the second posterior cell, their bases nearly level with one another, that of the first sub-

marginal if anything nearer the base of the wing. The stem of the second posterior cell about the same length or a little longer than the cell. The posterior cross-vein nearly twice its own length distant from the mid cross-vein. Scales on the veins creamy-yellow, with small black patches, as follows: at the tips of all the veins, one on each branch of the first fork-cell, one at

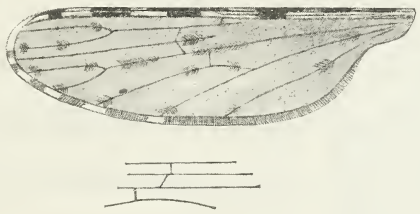


Fig. 37.
*Anopheles Rossii*, Giles.
Wing of the ♀ and cross-veins of the ♂ (right-hand wing of ♂). (X. 11.)

the base of the third long vein; two on the upper and one on the lower branch, and two on the stem of the fourth vein; three on the upper branch, one on the lower, and one near the base of the stem of the fifth vein; two spots on the sixth long vein of small size. Fringe yellow at the apex and at the ends of the fourth and fifth veins; remainder blackish.

*Length.*—4 to 6 mm.

♂. Palpi swollen at the end, yellow, with a broad black band at the base, a broad black band in the middle, and a small broken one near the apex of the same joint, and a narrow ring of black at the base of the last two joints; hair tufts short, pale; the base of the palpi densely black-scaled; proboscis dark brown, pale at the tip; antennae with silky golden-brown plumes. Wings marked much as the ♀, but in many ♂'s, especially in those from South India, there is a small additional spot beneath the second costal spot, besides the one forming the T, and in a few ♀'s I have noticed the same. First posterior cell a little longer and much narrower than the second posterior cell, its base if anything a little nearer the apex of the wing than that of the latter, its stem equal to the length of the cell, the same length as that of the second posterior cell; supernumerary cross-vein nearly its own length in advance of the mid cross-vein; posterior cross-vein at least twice its own length distant from the mid cross-

vein; fore ungues unequal, the larger one twice-toothed; mid and hind equal and simple, the mid rather the longer.

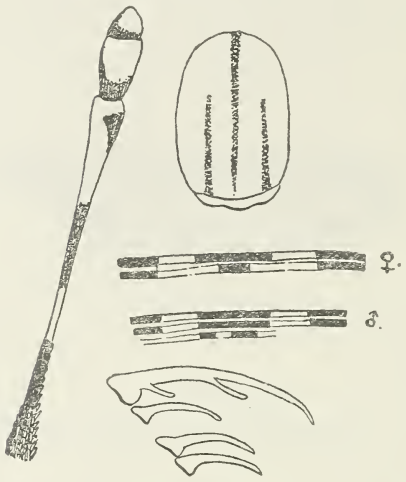



Fig. 38.
*Anopheles Rossii*, Giles.
Palpus of the ♂; thorax of the ♀; costal border of wing of the ♀ and ♂; fore and hind ungues of the ♂.

*Length.*—4·5 to 5·5 mm.

*Habitat.*—Calcutta (Daniels) (7. 4. 1899, 6. 3. 1899); Madras (Cornwall); Lucknow (Giles); Quilon (Travancore) (James) (7. 3. 1900); Singapore (Hanitsch) (22. 7. 1899); Perak (Wray) (22. 11. and 21. 12. 99); Behar, Bengal (Green) (88).

*Time of appearance.*—November and December to March in Madras; April at Lucknow (Giles).

*Observations.*—A distinct pale species, in which the mid costal spot has a dark patch on the first long vein beneath its middle, forming a distinct T-shaped spot. In some specimens a small additional black spot may be seen at the side of the stem of the T, and is nearly always present in the ♂. Grassi considers this species a sub-species of his *A. superpictus*, on what grounds I fail to see. In *A. superpictus*—at least in the type sent to the Museum by Grassi—the costal spots are uniform, no T-shaped spot being seen; but as that is only a colour variation, probably Grassi does not consider it sufficient; but there is considerable difference in the venation. In *superpictus* the posterior cross-vein is distant about its own length from the mid cross-vein; in *Rossii* it is twice its own length distant. In *superpictus* the veins

are dark scaled, with a few creamy spots; in *Rossii* they are yellow scaled, with a few minute black spots. In *superpictus* the apical fringe is black, and there are only three small pale areas to the fringe; in *Rossii* it is yellow, and there are four pale fringe spots. It differs from *A. costalis* by the wing not being dusky at the base. Variation in this species, of which I have examined a large number, is very slight. In some the costa is black at the root of the wing, in others broken by two small yellow spots. It also varies in general colour, some being much darker than others, and the wings become white, apparently with age, but the T-shaped costal spot is always very distinct. Major Ross calls this mosquito the Large Dapple-Wing. It was first described by Colonel Giles, in the 'Journal of Tropical Medicine' (October 16, 1899, p. 62), and since in his work on *Culicidae*. Dr. Daniels states that it is common in stables in Calcutta, and that it does not carry tertian and crescent stages of the malarial parasite.

Captain James has shown that in this species, with other *Anopheles*, the metamorphosis of *Filaria sanguinis-hominis* takes place (*Lancet*, August 11, 1900, p. 451).

It seems to be commonly distributed over India and the Malay Peninsula, and probably over the greater part of Southern China.

Although closely related to Grassi's *A. superpictus*, it is clearly specifically distinct, because of—

(i) the different positions of the cross-veins;
(ii) the T-shaped costal spot;
(iii) the presence of pale areas on the fringe; and
(iv) its more fawn-coloured hue.
(v) the different structure of the larva.

### 15. Anopheles costalis. Loew.

(Ent. Zeit. Berlin, p. 55 (1866).)

(Fig. 15, Pl. IV.)

Thorax dull brown, with yellowish hair-like scales, metanotum chestnut-brown. Abdomen almost black, with dense yellowish pubescence; legs brown, femora and tibiae mottled with yellow, tarsal banding involving more or less both sides of the joints; wings with four large and two small black spots on the costa, the remainder yellow; below the two large middle spots on the first long vein are two broken black spots, and under the other two, two entire black spots.

♀. Head brown, clothed with upright, rather broad white scales in front and on the occiput, similarly formed black ones at the sides, and a tuft of white hairs projecting forwards; antennae pale brown, with pale pubescence, basal joint bright brown, with white scales, which also extend on to the next few joints; palpi black-scaled, apical joint yellowish-white, and the apices of the two preceding also banded white, the bands being narrow; clypeus pale brown; proboscis thin, black, pale at the tip, as long as the palpi.

Thorax brown, with rather slaty and testaceous tints and a dusky median line, with numerous scattered, creamy-yellow, thin, curved scales and pale hairs; scutellum dark, with pale creamy scales almost white; metanotum chestnut-brown; pleurae deep brown, with a few ashy-grey patches. In denuded specimens there may sometimes be detected five rather darker lines on the thorax.

Abdomen black, with long golden hairs over the segments.

Legs with the femora and tibiae brown, spotted and mottled with yellow scales; in the fore legs the joints are broadly banded with yellow, the bands involving both sides of the joints, in the mid- and hind-legs these bands are not so marked, and only now and then partially spread on to the bases of the joints, the major part of the bands being apical. Ungues equal and simple.

Wings with four large and two small black spots on the costa, the two median large ones the longest; on the first long vein there is a black mark under the apical spot and two under the next costal spot and two under the next large one, a single one under the fourth; a black patch at the tip of each vein, and at the fork of the first sub marginal cell. On the stem of the first sub-marginal cell, just at the fork and under the third costal spot, is a small patch, another on each side of the mid cross-vein on the third vein, another at the fork of the fourth vein, and one on each branch of the second posterior cell, and another past the cross-veins; two on the stem of the fifth, with three on its upper branch and three on the sixth; first sub-marginal cell longer but little narrower than the second posterior cell, its base if anything a little nearer the apex of the wing than that of the second posterior, its stem about two-thirds the length of the cell; stem of the second posterior cell about equal in length to the cell; mid cross-vein

Fig. 39.
*Anopheles costalis*, Loew (♀).
(X. 9.)

not quite half its own length from the supernumerary ;* posterior cross-vein more than two and a half times its own length distant from the mid cross-vein ; fringe black with yellow patches where the veins join the border of the wing. Halteres with brownish stem and fuscous knob.

*Length.*—3 to 4·5 mm.

♂. Antennae yellowish-brown with darker plume hairs ; palpi dusky with numerous pale scales, swollen at the last two joints, apical joints chiefly white, the antepenultimate with a narrow pale apical band ; the hair-tufts brown, a little longer than the proboscis ; proboscis thin, dark brown, yellow at the apex.

Fig. 40.
Wing of *A. costalis*, Loew (♂). (X. 9.)
(The yellow patches on the wing fringe are not shown.)

Abdomen narrower than in the ♀, dark and pale yellowish-brown and silvery grey, a median brown dorsal line, a paler lateral line on each side, more or less pale basally and with very long hairs ; genitalia with yellowish scales. Wings much as in the ♀, but the fork-cells smaller.

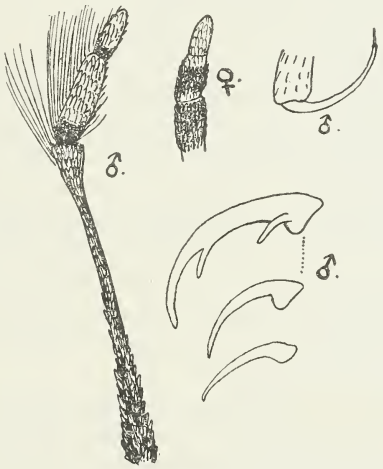



Fig. 41.
*A. costalis*, Loew.
Palpus of ♂ and ♀ (apical joints of latter only) ; fore and hind ungues of the ♂ and part of the ♂ genitalia.

* In some specimens it almost unites with the supernumerary cross-vein.

Ungues of fore legs unequal, the larger one twice-toothed.

*Length.*—2·5 to 3·5 mm.

*Habitat.*—Freetown, Sierra Leone (Austen); Bonny (Fagan) (21. 11. 1899); Lagos (Strachan, August) (99); Salisbury, Mashonaland (Marshall); Central Africa (Daniels); Mauritius (A. D. de Grandpre) (?).

*Time of capture.*—April and October in Mashonaland (Marshall).

*Observations.*—This seems to be one of the commonest and most widely distributed *Anopheles* in Africa, evidently occurring over the whole of Central Africa and the West Coast. Loew described it from Caffraria. According to Mr. Austen, the larvae are found in roadside puddles and also in puddles in the streets of Freetown. It also occurs in abundance in similar places at Lagos.

This species seems to be one the chief agents in spreading malaria on the West Coast of Africa. Dr. Daniels * says "it is found on the Zambesi and Lower Shire rivers, and in the northern part of Lake Nyassa, but he failed to detect it in the Shire Highlands and Upper Shire rivers. On the Uganda Railway it was found in places up to a height of 3000 feet. It is not found so abundantly in houses as *A. funestus*, even where, as at the north end of Lake Nyassa, the larvae are abundant, nor does it remain in the house in the same way. The larvae are often found with those of *A. funestus*, but it is also found alone in more stagnant water. It was one of the mosquitoes found in a tub on the sea coast at Chinde, at the mouth of the Zambesi. In some places this mosquito may be of importance, but as regards the interior (of Africa) it can be only of minor importance as compared with the *A. funestus*."

I have not seen any *Anopheles* from Mauritius, but A. Daruty de Grandpre, Superintendent of the Museum, says † there are three *Anopheles* found on the Island, and that "one of the smallest of these is very seldom found in elevated places, and has the same area of dispersion as malaria in Mauritius: this one has proved to be *Anopheles costalis*. The other species—the biggest one only found in elevated places—are very seldom met with on the seashore where malaria prevails. The smallest species of *Anopheles* (*A. costalis*) only begin to make their appearance in numbers in November and December. These species rarely

* R. S. E. Reports to Mal. Com. 3rd se. p. 35, 1900.

† An. Report Mus. Colony Mauritius, p. 4, 1898–99.

attack human beings during the day." I have not seen any *A. costalis* from Mauritius.

There is some little variation in this species; those from Bonny are much darker and larger than those from Freetown, whilst those from Central Africa seem to have rather longer wings.

The spots on the wings vary slightly, those on the first longitudinal varying as follows:—

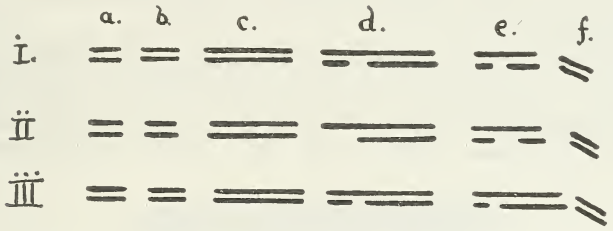



Fig. 42.

Variations in the markings on the costal border in *A. costalis*, Loew.

but in all cases the spots under *d* and *e* are broken up and not complete under the costal spots as in *A. superpictus*.

The chief character by which *costalis* can be identified is, however, the curious mottled appearance of the femora and tibiae.

From *A. tessellatum*, *A. maculata*, &c., it can be told at once by the absence of metatarsal banding.

### 16. Anopheles cinereus. n. sp.

(Fig. 7, Pl. II.)

Thorax with a broad grey median line with silvery-grey hair-like scales, dark brown on each side. Abdomen dark brown, the apical borders of the segments rather darker than the rest, covered with dull golden-brown pubescence. Legs long, thin, black, bases very pallid, knee spots and apices of tibiae pure white, apices of metatarsi and tarsi narrowly yellow banded on the fore and mid-legs. Wings with three white spots on the black costa; apex mostly yellowish-white; wing field mottled with black and yellowish-white; fringe brown with yellow patches.

♀. Head black, an ashy-grey border round the eyes, covered with thick, black, upright forked scales, except two white patches of them on each side of the middle line in front; a small

tuft of white hairs projects forwards between the eyes and also a few golden bristles; antennae brown, basal joint dark, base of the second joint testaceous, second joint rather long, equal to two of the following, the first few with white scales on one side; pubescence pallid; palpi quite straight, of nearly equal thickness throughout, but slightly dilated at the base owing to long scales, dark purplish-brown, with four white rings, the last apical, the three median ones involving both sides of the joints, apex with a brush of golden bristles; proboscis dark brown, thin, as long as the palpi.

Thorax with a broad ashy-grey line in the middle, dark brown on each side; on the grey central portion may be seen a median and two lateral chestnut-brown longitudinal lines; the median grey area covered with long whitish hair-like scales,

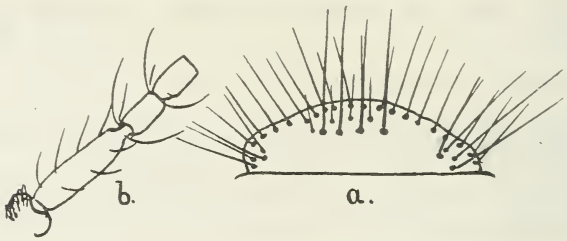



Fig. 43.
*Anopheles cinereus.* n. sp.
a, Scutellum of ♀; b, basal joints of the ♀ antenna.

which become a little golden-brown in front of the scutellum, and with three rows of brown bristles (most prominent near the scutellum), with a golden hue in certain lights; similar bristles adorn the dark brown lateral area of the mesonotum, especially over the roots of the wings; scutellum black, with grey sheen and a slight testaceous hue on the lateral lobes, border-bristles brown or golden-brown according to the light, very numerous, spreading on to the median lobe of the scutellum; metanotum deep brown; pleurae dull, paler brown.

Abdomen dark brown, the posterior borders of the segments darkest, covered with dull golden hairs.

Legs very thin, deep black, coxae and trochanters very pallid yellowish-white, greatly contrasted with the dark femora; apex of the femora and tibiae with a pure white spot, apices of the fore and hind metatarsi and tarsi with minute apical yellow bands, which seem absent in the mid-legs; last tarsal joint of all

three pairs rather paler than the rest, hind metatarsi longer than the tibiae; ungues black, equal and simple.

Wings with the costa black scaled, with three yellow spots and yellow and black apical fringe; the yellow spots extend on to the first longitudinal, which has also yellow scales at the base and a small spot in the middle, two small ones on the upper branch of the first fork-cell, one on the lower and one at the base, the greater part of the third vein pale with three black spots, two on the upper, one on the lower branches of the second posterior cell, and one at the base and another on the stem; two black spots on the upper and one on the lower branches of the fifth long vein, one at the fork, and another black spot near the base of the fifth vein; the sixth mostly pale with three black spots;

Fig. 44.

*Anopheles cinereus.* n. sp. (♀). (X. 9.)
(Reproduced from a photograph in which the markings do not show.)

first sub-marginal cell longer and just a little narrower than the second posterior cell, its stem not quite as long as the cell; stem of the second posterior longer than the cell; mid cross-vein about half its length distant from the supernumerary cross-vein; posterior cross-vein longer than the mid and one and a half times its own length from it; fringe yellow at the apex with two small dark spots, remainder brown, but the scales where the branches of the fourth and fifth join the border somewhat paler. Halteres pale yellow with fuscous knob.

*Length.*—5 to 5·2 mm.

*Habitat.*—Salisbury, Mashonaland (Marshall) (79); Zomba (Gray).

*Time of capture.*—June, Mashonaland; January, Zomba.

*Observations.*—Described from three ♀'s. At first sight they look like large *A. funestus*, but the clear pale bases to the legs separate it at once, as well as the large wings and the marked character of the jet-black legs with the white spots at the knees and apices of the tibiae.

### 17. Anopheles annulipes. Walker.
### *A. musivus.* Skuse.

(Ins. Saund. i. p. 433 (1850), *annulipes*, Walker; Proc. Linn. Soc. N. S. Wales, p. 1754 (1889), *musivus*, Skuse.)

(Fig. 12, Pl. III.)

Thorax brown, with slaty reflections and with scattered white and creamy scales and a few pale hairs. Abdomen fuscous, with dull yellow scales; legs, including femora and tibiae, much banded; wings with many small black patches of scales on the veins.

♂. Head black, with white scales in front and dusky scales behind; eyes dark; antennae dark brown, with bands of white scales and pale hairs; palpi slender and long, with white and brown bands; proboscis slender, covered with small dark scales, slightly longer than the palpi.

Thorax dark brown, almost black when denuded, with slaty reflections, indistinctly striped and with pale scales dotted over it; scutellum paler towards the edge; metanotum deep shiny black; pleurae blackish.

Abdomen dark brown, paler towards the edge, with yellow scales scattered over it, particularly at the pale edges, black ventrally. Femora and tibiae with numerous bands of black and yellowish-white scales, tarsi with pale bands both apical and basal.

Wings with four black spots along the costa and with numerous small patches of dark scales on the veins. Halteres testaceous at the base, with a pale stem and dark knob.

*Length.*—5 mm.

♀. Head black, with white scales on the vertex, black scales at the sides; two long tufts of white hairs projecting in front; antennae brown, with white pubescence; basal joint testaceous, first two joints with white scales. Proboscis brown; palpi with the last three joints with a broad white apical ring, the first and second joints with white patches of scales above. Thorax brown, with slaty-grey reflections, and with scattered white and creamy scales; scutellum yellowish at the sides, fuscous in the middle. Metanotum dusky. Abdomen fuscous, with dull yellow scales. Legs as in the ♂. In the wings the first sub-marginal cell is considerably

Fig. 45.
Wing of *A. annulipes*, Wlk. (♀). (X. 9.)

longer and narrower than the second posterior cell, its base nearer the base of the wing than that of the latter; the posterior cross-vein more than its length from the mid cross-vein.

*Length.*—5 to 6 mm.

*Habitat.*—Bupengary, Queensland (Bancroft) (8. and 29. 5. 1899); Elizabeth Bay, near Sydney (Masters and Skuse); Mt. Kembla, Illawarra, N.S.W. (Hamilton).

*Time of appearance.*—In Queensland in December (Bancroft), in N. S. Wales in February (Skuse).

*Observations.*—This is the larger of Skuse's two species, *A. musivus* and *A. Masteri*. The two however seem very closely related, and I should almost feel inclined to treat them as varieties of one another. The specimens of *Anopheles* received from Queensland from Dr. Bancroft are undoubtedly mostly this species, although they differ in one or two small details, notably the presence of apical and basal tarsal banding, but the leg, wing, and other ornamentation is so similar that they could not otherwise be treated than under this species.

As far as I can judge from the type of Walker's, *A. annulipes* (described in a short useless way in "Insecta Saundersiana," vol. i. p. 433, in 1850), it is the same as Skuse's *A. musivus*; hence Skuse's name must sink as a synonym.

### 18. Anopheles Masteri. Skuse.

(Proc. Linn. Soc. N. S. Wales, p. 1757 (1889).)

Like the former, but the sub-costal transverse vein is considerably beyond the middle of the auxiliary vein; proboscis of the ♀ brown at the base, pale at the apex, also smaller than the former species.

♀. Head black, with white scales in front and dusky scales behind, and a tuft of white hairs also in front; eyes black; antennae black, with white pubescence and white verticils; basal joint dark, with testaceous rim, first two joints with white scales; palpi banded with black and white scales, first joint dark scaled, second with a small white apical ring, third, fourth, and fifth nearly pure white, with narrow basal black rings, the second with a small patch of white scales in the middle on one side, the third with a larger patch nearer the base. Eyes black. Proboscis black basally, yellowish-brown towards the apical half, and with a dark apex.

Thorax with median and lateral dark lines, bluish-grey between, covered with scattered white scales and brown hairs, the latter pale in some lights; scutellum ochraceous, dark in the middle; metanotum dark brown; pleurae fuscous.

Abdomen dusky brown, with faint ferruginous posterior borders to the segments; clothed with golden hairs.

Legs with the femora, tibiae and metatarsi banded dark purplish-brown and white; first tarsal joint of the fore- and mid-legs with a minute white tip, *others with a very faint spot;* in the hind legs the metatarsi and all the tarsal joints except the last white-tipped, hind metatarsi with two narrow white bands.

Wings with the costa black, with three long white spots and three smaller ones towards the base. First sub-marginal cell much longer and narrower than the second posterior cell, its base a little nearer the base of the wing than the base of the second posterior cell; posterior cross-vein rather more than its own length distant from the mid cross-vein; veins with very dark scales forming small patches, remainder also covered with long scales, paler than the others, creamy white in some lights; the sub-costal transverse vein placed considerably beyond the middle of the auxiliary vein.

Halteres with pale stem and dark knob.

*Length.*—3·5 to 4·5 mm.

♂. Antennae ochraceous-brown with silky-brown plumes, ochraceous in some lights, brown in others; palpi dark brown, with patches of white on the upper side towards the apex; proboscis black. Male genitalia with white scales on the basal joints.

*Length.*—4·5 mm.

*Habitat.*—Bupengary, Queensland (Bancroft) (5. 12. and 8. and 29. 5. 1899); Blue Mountains, N.S.W. (Masters).

*Observations.*—Very like and closely related to the former, but the ♀ can easily be told from *A. annulipes* by the proboscis being paler at the tip. It is also smaller in size, and Skuse says that the sub-costal transverse vein is placed considerably beyond the middle of the auxiliary vein, whilst in *A. annulipes* it is situated *in* the middle.

19. Anopheles squamosus. n. sp.

(Fig. 6, Pl. II.)

Thorax black, with white scales, more or less arranged in lines; pleurae jet black, with three parallel white lines; abdomen black, scaly, with lateral tufts of black scales.

Legs dark brown, mottled and banded with creamy white. Wings with the costa black, with three small white spots in the middle, two smaller ones basally and two at the apex; veins black and yellow; fringe dark.

♀. Head deep brown, with long, thick, upright black scales, a few similarly shaped white ones in front; eyes black and

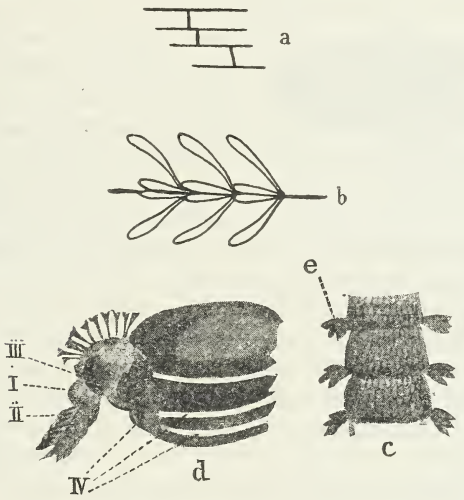



Fig. 46.

*Anopheles squamosus.* n. sp.

a, Cross-veins of the ♀; b, wing scales; c, abdomen with lateral scale tufts (e); d, side view of head and thorax; i., clypeus; ii., palpi; iii., head; iv., parallel white pleural lines.

silvery; antennae deep brown, basal joint deep brown, with white scales, also some on the next four joints; palpi densely scaled with deep brown scales which stand out from the surface like *A. Sinensis*, with a few white ones here and there forming also three narrow bands, one apical.

Thorax black, with flat white spindle-shaped scales more or

less arranged in lines and with black bristles; the lateral scales are longer and stand at right angles to the surface; scutellum black, with spindle-shaped white scales and black bristles; metanotum black; pleurae jet black, with three white horizontal lines (Fig. 46, d, iv.).

Abdomen black, covered with black and bronzy scales and a few dull ochraceous ones in the middle, each segment with a prominent lateral tuft of black scales (Fig. 46, c, e); the abdomen is densely hairy.

Wings with the costa deep black with three distinct very small white spots, two smaller basal ones and two small apical ones, some of these spots pass but very indistinctly into the first long vein; most of the veins dark scaled, the lateral scales being clavate (Fig. 46, b), always dark but paler on the white areas of the vein; the median scales are creamy white on most of the third long vein, the black forming three spots; a small patch on each branch of the second fork-cell, a large patch on each branch of the fifth vein, and another on the stem, and two large patches on the sixth long vein; fringe uniformly brown, the lateral scales even on the pale areas are very dusky, so that the creamy spots on the wing field do not show up very strongly; first sub-marginal cell much longer and a little narrower than the second posterior cell, its base nearer the base of the wing than that of the latter, its stem less than half the length of the cell; stem of the second posterior as long as the cell; mid cross-vein about half its length nearer the base of the wing than the supernumerary cross-vein, posterior cross-vein longer than the mid, more than its own length nearer the base of the wing (Fig. 46, a).

Fig. 47.
*Anopheles squamosus* (♀). (X. 9.)

Legs with the femora dark brown, tibiae and metatarsi of the fore legs mottled with numerous white scales, also the apex of the first and second tarsal joints of the fore- and mid-legs broadly white banded; hind legs with the femora swollen, dark brown with white patches, one large patch near the apex, the extreme apex white; tibiae mottled black and white; metatarsi apically banded, and also the next three tarsal joints, the last black. Ungues thick, deep black, equal and simple, smaller on the mid-legs.

*Length.*—5 to 5·5 mm.

*Habitat.*—Mashonaland (Marshall); British Central Africa (Daniels) (82).

*Time of capture.*—October (Marshall).

*Observations.* A very pronounced scaly species, not like any other *Anopheles* I have seen. It can at once be told by the white thoracic scales and the three white lines on the pleurae, and also by the densely scaled abdomen and mottled femora and tibiae and the pale bands on the tarsi involving both sides of the joints. The description is drawn from two excellently preserved specimens from Dr. Daniels and Mr. Marshall.

### 20. Anopheles Pharoensis. n. sp.

(Fig. 8, Pl. II.)

Thorax pale brownish, with a median dark line and a fawn-coloured line on each side, covered with yellowish-grey scales; abdomen brown, *covered with dense yellowish scales* and with lateral tufts of dark scales. Legs with the femora and tibiae banded and mottled, and the metatarsi and tarsi with broad apical white bands; last tarsal joint white. Costa with three large black spots and two smaller ones.

♀. Head with ashy-grey scales, a darker median line, and a tuft of long white hairs in front, projecting forwards. Eyes black, with a very faint thin paler border above. Antennae brown, with whitish hairs and pubescence. Palpi not quite so long as the proboscis, densely clothed with deep brown scales and scattered white ones on the dorsal surface, apices of the four last joints with distinct bands of white scales. Proboscis entirely dark brown.

Thorax covered with yellowish-grey scales, with a darker brown median line in front and a fawn-coloured bare line on each side, a distinct black spot laterally just before the middle, from each of which runs a bare fawn-coloured line backwards; scutellum with a few silvery scales; metanotum brown with cinereous reflections; thoracic bristles dark, pleurae and sternum dark.

Abdomen clothed with dense yellowish-brown scales (very dark brown when denuded), segments expanded apically, and slightly darker beneath the overlapping apical scales; two dense black tufts of scales at the end of the abdomen. The apical borders laterally have curious broad scales sticking outwards, giving the apical borders a still further expanded appearance.

Legs with the femora of a uniform yellowish-brown internally, externally with patches of black or dark brown and white scales forming one especially noticeable large patch of white near the end of the mid and hind femora, the anterior ones with more uniform yellowish-brown coloration; tibiae mottled with dark brown and white scales, especially above; metatarsi and first two tarsi of the fore legs apically banded white, last two joints black; metatarsus and first tarsal of the mid legs apically banded, the second tarsal with a small white apical spot; hind metatarsus and first three hind tarsi with broad apical white bands, last tarsal joint pure white; the greater part of the preceding one also white.

Wings with the black costa broken by one large and three smaller pale spots, pure yellowish white at the root; three distinct dark patches along the costa, the middle being the most conspicuous; veins clothed with yellowish-white scales and small patches of black scales, numbering about twenty; three on the sixth long vein, one near the base of the fifth, one at its fork, one at the tip of the lower branch of the fork, and three on the upper branch; two large patches on the fourth, which extend to the fork and an apical spot on each branch of the second posterior cell; three on the third longitudinal, one near its apex, the other two further back and close together; second longitudinal with one at its root, one on each branch of the fork at the base and two more on the lower branch. First longitudinal white, with one large and several small black spots. Fringe black except at the end of the veins, where it is yellow. Halteres pale with dark knobs.

*Length.*—8 mm.

♂. Antennae banded, with chestnut-brown plumes; palpi with the last joint very much swollen, partly covered with white scales, general colour brown; a white ring at the apex of the first joint and white scales on the next; hair tufts golden.

*Length.*—7 mm.

*Habitat.*—Cairo (Keatinge); Central Africa (Marshall).

*Time of capture.*—April in Mashonaland; January in Egypt.

*Observations.*—Two specimens of this insect, a ♂ and ♀, were sent by Dr. H. E. Keatinge from Cairo; they were taken in the neighbourhood of the town in the fayum, and were pointed out by Dr. Keatinge as probably a new species (letter to Mr. Austen, January 19, 1900). Dr. Keatinge writes me that the discovery of this species is due to Dr. Innes, Curator of

the Museum of the School of Medicine, Cairo, who has most kindly collected me fresh material of adult and larval stages. Another has also been received from Mashonaland. This African *Anopheles* answers very closely to the description of Arribalzaga's *A. annulipalpis*, but the wings have not a uniformly black costa as in that species, and for other reasons I take this African species to be a distinct insect from the one described by Arribalzaga from the banks of the Parana in the Argentine.. It is certainly the finest *Anopheles* we have, and is easily told by the densely-scaled abdomen and mottled and banded legs, and evidently comes close to the previous species.

It probably has a wide range, a female having been sent also from Central Africa.

### 21. Anopheles maculata. n. sp.

Thorax slaty-grey, with darker longitudinal lines and snowy-white scales; abdomen black, with yellowish hairs, very dense apically, giving the apex a distinct yellow tinge. Legs with the femora, tibiae and metatarsi banded with pale yellow; fore and mid tarsi with narrow yellow bands, hind tarsi with very broad white ones, last joint pure white. Wings yellow scaled, spotted with black, the costa with four large and two small basal spots; fringe black and yellow.

♀. Head dark brown, with black upright scales behind, grey at their tips, and white upright ones in front; a dense long tuft of snow-white hairs projecting between the eyes; eyes black and silvery; palpi black scaled, the last joint white, also the base and apex of the penultimate and the apex of the others, a few golden bristles at the apex; proboscis deep brown, apex testaceous; antennae paler brown, basal joints with white scales.

Thorax slaty-grey, with brown longitudinal lines, and a dark almost eye-like patch on each side of the mesonotum; covered with scattered, flat, snowy-white spindle-shaped scales (Fig. 48, e); some long white scales projecting in front over the nape and numerous golden-brown bristles in three main rows; scutellum slaty-grey, with flat white scales and golden border bristles; metanotum deep chestnut-brown.

Abdomen black, with pale golden hairs, which become very dense and bright golden at the apex of the abdomen; processes black scaled (d).

Legs with the femora, tibiae and metatarsi with broken pale

creamy bands and spots; in the fore legs the metatarsus has an apical pale band, and the first tarsal a basal and apical band, the second and third narrow basal bands; ungues equal, simple, small, curved; in the mid legs the first two tarsal joints have yellow apical bands, the last two are dark brown and unbanded, ungues equal, simple, small, and nearly straight; in the hind legs the first tarsal has a broad white apical band and a narrow

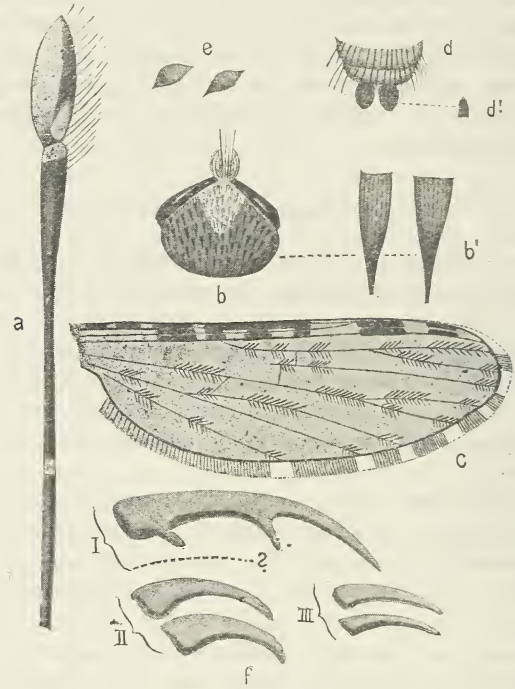



Fig. 48.

*Anopheles maculata.* n. sp.

a, Male palpus; b, head of ♂, and b¹, enlarged scales; c, wing; d, end of ♀ abdomen; d¹, scale from ♀ genitalia; e, thoracic scales; f, male ungues. (Greatly enlarged.)

median one, the second and third tarsal apical and basal white bands, the last tarsus pure white; the hind metatarsus longer than the tibia.

Wings with creamy-yellow scales and black spots; on the costa are four large and two small black spots, the latter at the base of the wing; the two apical spots are continued evenly on to the first long vein; under the third and largest spot are three

black spots on the first long vein and also another beneath the fourth spot; fork-cells short, the first sub-marginal a little the longer but no narrower than the second posterior cell, its base nearer the apex of the wing than that of the second posterior cell, its stem nearly as long as the cell; stem of the second posterior a little longer than the cell; supernumerary cross-vein nearer the apex of the wing than the mid cross-vein and somewhat longer; posterior cross-vein more than three times its own length distant from the mid cross-vein, sloping towards the base of the wing; the patches of black scales are disposed as follows: one spot near the tip of each vein, a long patch at the tip of the upper branch of the first sub-marginal, another near its base and two on the lower branch, three on its stem; one at the apex and two at the base of the third long vein; one large and one small on the upper branch of the fourth and two small ones on the lower branch, one long patch at its base and another nearer the base of the vein; two moderate sized and one small patches on the upper branch of the fifth, an apical one on the lower branch and another near the base of the fifth vein; three on the sixth vein; fringe brown, yellow where the veins join, border-scales brown, also yellow where the veins join; halteres with pale ochraceous stem and fuscous knob.

*Length.*—3·5 to 4 mm.

♂. Head with more white scales than in the ♀, palpi brown scaled, apical joint much dilated, rather acuminate, penultimate joint about the same length but much narrower than the apical joint, a patch of white scales at its apex and another at the base of the apical joint, which is white on one side; proboscis thinner than in the ♀, apex testaceous; antennae brown, with deep flaxen-brown plumes; ungues small, unequal in the fore legs, the larger one twice toothed; in the mid and hind legs the ungues are small, simple and equal.

*Length.*—3·5 to 4 mm.

*Habitat.*—Hong Kong (Rees and James).

*Time of capture.*—October (Rees); common in September (James).

*Observations.*—Described from several ♀'s and two ♂'s in Dr. Rees' collection, recently made in China. It is a small species, coming near *A. punctulatus*, Dönitz, but easily separated by its pure white last hind tarsal joint.

Captain James, I.M.S., while serving in the Chinese Expeditionary Force, has found this small *Anopheles* also, and sends me

an excellent description of it, and a note that "its larvae are to be found in the shallow pools and marshy ground on the granite soil near Hong Kong."

### 22. Anopheles Kochii. Dönitz.*

(Insecten Borse, 5 Jr. 18. 31 Jan. 1901. p. 36.)

(Fig. 16, Pl. IV.)

Thorax fawn-coloured, with two large, eye-like, black spots, the front with longish white, the rest with creamy curved scales. Abdomen ashy-brown, with long dull-golden hairs and tufts of black scales beneath. Legs banded and marked with dark brown and yellow, some of the tarsi basally banded with brown. Costa creamy yellow, with four black spots, numerous small black spots over the wing field.

♀. Head black, with a small tuft of white hairs, and white scales in front and blackish scales behind; eyes black; antennae silky white with pale hairs, basal joint pale ferruginous; proboscis yellow with dark scales at the base; palpi yellow and black at the base, then a small ring of white and black scales, then a band of yellow, followed by two broad bands of white, with narrow bands of blackish-purple between; the last joint pale yellowish.

Thorax pale fawn-coloured to pale brown with frosty tomentum, two very distinct, deep brown, eye-like spots, bordered with paler brown and with a median bright pale brown line, the front with longish white scales, the dorsum with creamy scales; scutellum pale at the sides, deep purplish-brown in the centre; hairs golden-brown; metanotum reddish-brown; pleurae pale brown, with large black spots.

Abdomen cinereous brown, with long dull-golden hairs and tufts of black scales beneath.

Wings with a yellowish tinge, the pale scaled areas very clear creamy yellow, the dark very deep sooty black; costa creamy yellow with four distinct black spots, the wing field with numerous small black specks formed by little groups of black scales.

Legs with the femora and tibiae banded and marked irregularly with dark brown and yellow scales; posterior metatarsi with white broken bands of scales, anterior and middle metatarsi with yellow ones; first tarsal joint banded basally and apically with creamy white, last three tarsi of the fore and hind legs all

* This species was described as *A. ocellatus*, but Dr. Dönitz's description appears before mine, hence his name takes precedence.

yellowish, those of the mid legs with dark basal scales. The last tarsal joint has often darker scales at the base, and also sometimes there is a pale band in the middle of the others.

*Length.*—3 mm.

*Habitat.*—Taipang, Perak, Straits Settlements (L. Wray) (22. 11. and 21. 12. 1899) ; Sumatra and Java (Dönitz).

*Observations.*—A very distinct and beautiful pale species, easily told by the two clear, dark, eye-like spots on the thorax, and the dark area on the scutellum, and the much banded legs and tarsal markings. Described from two ♀'s only.

### 23. Anopheles punctulatus. Dönitz.*

(Insecten Borse, 5 Jr. 18. 31 Jan. 1901, p. 37.)

(Fig. 148, Pl. XXXVII.)

Thorax brown with frosty-grey tomentum, two dark spots in front and another near the scutellum ; abdomen almost black with golden hairs ; costa yellow, with four large and four small black spots, wing field with very numerous dark spots. Legs yellow with dusky scales, banded ; fore tarsi apically and basally pale banded ; mid and hind tarsi apically pale banded only.

♀. Head black, with white scales in front, black scales behind and at the top ; eyes black ; antennae yellowish-brown with pale hairs, proboscis yellow with black scales towards the base and a small dark ring near the apex ; palpi black scaled at the base, then a small ring of white scales, then a broad ring of black, the remainder white, with two small rings of black ; the apical joint yellowish.

Thorax (Fig. 49, c) brown with frosty-grey tomentum, with two dark spots in front and a dark area near the scutellum, with minute dark specks, probably where hairs have been denuded ; scutellum dusky towards the middle ; metanotum dark brown ; pleurae dark brown.

Abdomen dark brown, almost black, with golden hairs.

Wings with four large and four small dark spots on the yellow costa, the three basal ones small, then a large one, then a small one, followed by three large ones ; wing field with numerous small patches of dark scales, base of the wing dark.

Halteres pure white.

* This species was described as *A. tessellatum*, but, like the preceeding, Dr. Dönitz's description has appeared first.

Anterior legs with the femora much swollen, yellow with dusky scales, showing more or less banding; tibiae yellow, with dark scales scattered about; metatarsus dark scaled at the base, white at the apex, and with several white bands towards the apex; first three tarsal joints apically and basally banded white, last apically white only; the femora and the tibiae of the mid legs as in the fore ones; metatarsus mostly black scaled, the apex banded yellow; tarsi all apically yellow banded; hind legs

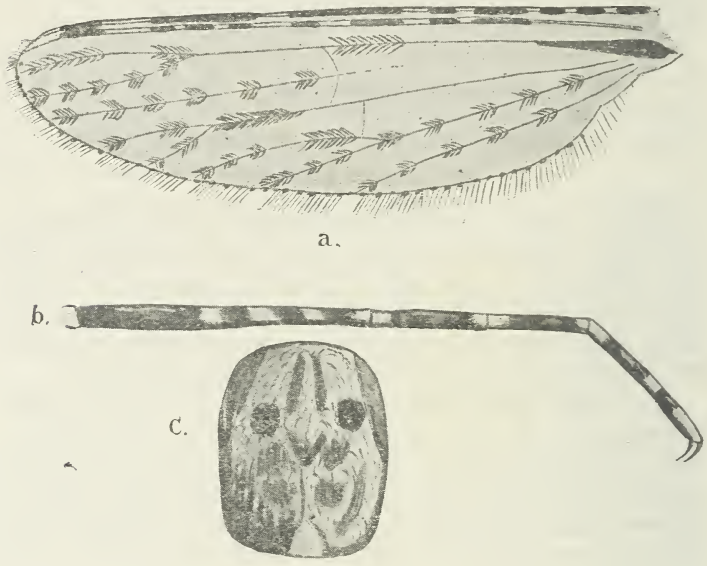



Fig. 49.
*Anopheles punctulatus.* Dönitz.
a, Wing of ♀ (X. 20); b, leg (hind); c, thoracic ornamentation.

with the tibiae more or less banded; metatarsus very long and banded, the apex white; and the tarsi apically whitish-yellow.

*Length.*—3·5 to 4 mm.

*Habitat.*—Taipang, Straits Settlements (L. Wray) (22. 11. and 21. 12. 1899); Sumatra and Borneo (Dönitz).

*Time of capture.*—May.

*Observations.*—Very like *A. Kochii*, but differs from it in the more tessellated appearance of the thorax and the more spotted nature of the wings. Described from a single ♀.

24. Anopheles Lutzii. n. sp.

(Fig. 147, Pl. XXXVII.)

Thorax bluish-grey, with two broad dark lines on the mesonotum and also a thin median line; sides of the mesonotum dark, covered with scattered pale scales and golden hairs; abdomen dark brown, with slightly darker basal bands and golden hairs; the metatarsi with basal and apical white bands and a pale median band on fore and mid legs, some or all of the tarsi apically white; wings with the black costa with three large and two small basal pale spots, with the veins mostly clothed with long dark scales.

♀. Head black, with white scales in front and black ones behind; eyes dark purplish-black; palpi with long black scales, the last three joints with small apical bands of white scales;

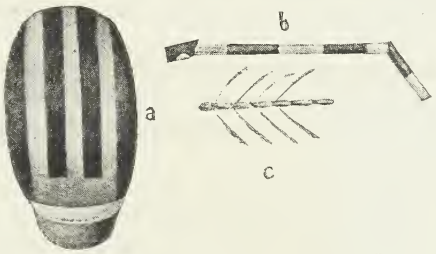



Fig. 50.
*Anopheles Lutzii.* n. sp. (X. 20.)
a, Thorax; b, metatarsus; c, wing scales.

proboscis thin, deep black, with the tip dull brownish-yellow; antennae brown, with white pubescence, brown hairs, and testaceous basal joint.

Thorax dusky bluish-grey, with two broad longitudinal dark lines, and a thin faint median one; the sides of the mesonotum darker, with scattered white scales and pale golden hairs; scutellum tawny, uniform in colour; metanotum deep brown; pleurae dark brown, with pale markings.

Abdomen deep brown, with golden pubescence and darker brown basal bands and ventral surface.

Legs with the coxae and trochanters white; femora and tibiae yellow, covered by dark scales, tibiae very dark-scaled at the apex, with a patch of white scales beneath; fore and mid

metatarsi banded with white and dark scales—five distinct bands, the base and apex white; hind metatarsus apically and basally white; tarsi of the fore legs with broad white apical bands, except the last two joints, which are mostly dark-scaled; in the hind legs the same, but the last two joints are apically white.

Wings with the costa black-scaled, with three distinct pale spots and two smaller, often indistinct, basal ones; first longitudinal vein with five black areas beneath those of the costa, the greater part of the veins covered with dark scales of considerable length. Fringe at the tip of the wing yellow, and also at the tips of the veins after the anterior branch of the fourth long vein. Halteres with pale stems and dark knobs. (The pale fringe areas are not shown in the figure.)

*Length.*—3 to 3·5 mm.

*Habitat.*—Rio de Janeiro (Lutz) (4. 7. 1899).

*Observations.*—Described from three specimens, all ♀'s, which can at once be told by the five white and dark bands on the fore and mid metatarsi and by the linear ornamentation of the thorax.

Dr. Lutz, who sent this species, did not refer to it in any way, merely stating it is one of the three *Anopheles* found at Sao Paulo and Rio; but in a recent letter he tells me it is not very common.

### 25. Anopheles funestus. Giles.

(Hd.Bk. of Mosq. p. 162 (1900).)

(Fig. 13, Pl. IV.)

Thorax dark brown at the sides, grey in the middle, with pale scales. Abdomen blackish-brown, with scattered pale hairs. Legs dark brown to black, with, now and then, narrow apical banding to metatarsi and tarsi. Wings with the black costa broken by very pale creamy spots, the wing-field mottled with black and pale creamy scales, and the fringe with yellow spots; mid cross-vein nearer the apex than the supernumerary and posterior cross-veins.

♀. Head black, clothed with white upright forked scales in front, black ones at the sides and behind, with a bunch of long white scales projecting in front between the eyes; eyes black, with a narrow white margin; palpi black, with a white apex and two white rings, the one nearest the apex sometimes involving both sides of the last two joints; proboscis black, tes-

taceous towards the apex; antennae dark brown, with pale pubescence, basal joint dark, the second with white scales.

Thorax dark brown at the sides, broadly grey in the middle, with almost white narrow scales, those in the middle of the mesonotum a little broader than the rest, and with golden hairs, with darker longitudinal lines along the pale median areas; scutellum darker in the middle than the sides; metanotum deep brown; pleurae dark chestnut-brown, with grey reflections often arranged as six spots.

Abdomen blackish-brown (bluish-grey when alive), with scattered pale hairs.

Legs dark brown to nearly black, with a few pale apical scales to the metatarsi and tarsi, often indistinct unless seen under the microscope; ungues equal and simple; hind metatarsi a little longer than the hind tibiae.

Wings with the black costa with six pale creamy almost white spots, the three apical ones extending on to the first long vein, remaining veins with patches of white and black scales as follows: one small and one large dusky patch on each of the branches of the first sub-marginal cell, the greater part of its stalk dark scaled, a dark patch at the base and apex of the third long vein, two dark patches on each branch of the second fork-cell, and the greater part of the root and stem dusky, two dark patches on the upper and one on the lower branch of the fifth vein, another at the fork and another at the base of the vein, two small dusky patches on the sixth; first sub-marginal cell considerably longer and a little narrower than the second posterior cell, its base much nearer the base of the wing than that of the latter, its stem rather more than half the length of the cell; stem of the second posterior cell a little longer than the cell; mid cross-vein nearer the apex of the wing than either the supernumerary or posterior cross-veins. Fringe black, with pale spots at the junctions of all the veins, except the sixth; apex mostly yellow, but with a black spot between the two branches of the first sub-marginal cell. Halteres pale, with a fuscous knob.

*Length.*—3 to 3·5 mm.

♂. Antennae blackish, with black verticillate hairs, paler in certain lights; palpi with the apex grey, followed by a narrow black and then a grey ring, the remainder black scaled.

Wings slightly different to the ♀; the first sub-marginal cell is twice as long as the posterior cell, and its stem much shorter than the cell; the posterior cell is very short, and very little

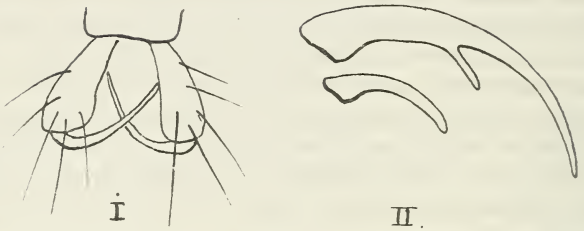



Fig. 51.
*Anopheles funestus*, Giles.
I. Male genitalia. (X. 50.) II. Fore ungues of the ♂. (X. 220.)

wider than the first sub-marginal cell. Ungues of the fore legs unequal, the larger with one tooth, the small very minute and simple, hind equal and simple.

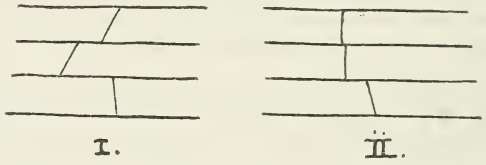



Fig. 52.
I. Cross-veins of *A. funestus*, Giles ; II. of *A. Rhodesiensis*. n. sp.

*Length*.—3 to 3·5 mm.

*Habitat*.—Sierra Leone (Austen, August, 1899); Mashonaland (Marshall) (79); British Central Africa (Daniels) (82); Lake Chilwa, B. C. A. (Gray) (20. 2. 1900); Zomba (Gray) (27. 5. 1900).

"The Highlands on each side of Lake Nyassa and in the whole length of the water system from the north end of Lake Nyassa down the Upper, Middle, and Lower Shire rivers and in their tributaries, down the Zambesi river and its Chinde mouth near the sea, a distance of some 850 miles. This *Anopheles* has also been identified by persons living on the Tanganika plateau, on the Zambesi and Congo watersheds, and as far up the Zambesi as the Lupata gorge" (Daniels). It also probably occurs on the higher reaches of the Congo and Nile, as well as the Zambesi, and the smaller rivers running to the east coast, and also the other fresh water lakes.

*Time of capture*.—In Mashonaland, in February, March, April, and June.

*Observations.*—This is a small, rather dark species, clearly related to *A. Rhodesiensis* and *A. superpictus*, but it can readily be told by the position of the cross-veins (*vide* Fig. 52); the fringe is also spotted, and thus can at once be told from *A. Rhodesiensis*. From *costalis* the absence of spotted femora will serve as a ready distinction.

Colonel Giles, who describes this species from Sierra Leone, says the tarsi are not banded; but, even in those that look unbanded to the naked eye, traces of banding may be found on the apices of the tarsi, whilst the Mashonaland specimens show the apical banding much more distinctly.

Dr. Daniels says (Mal. Rep. R. S. E., 2nd Se. p. 34) that *A. funestus* is the most numerous, the most widely distributed and the most persistent frequenter of houses. In one district, and that the most malarious, it is the only *Anopheles* found, and is more numerous than any of the *Culices* there present. "I have found this *Anopheles*," he says, "at points in the whole course of my journeys, extending to over some 1500 miles. Near the equator, rather more than 1° S., it was found in fair numbers in the cool season 5600 feet above the sea. Further south, 15°, it was found, but in very small numbers, at an elevation of 5000 feet, but is common there at 3000 feet. I have found it in numbers at sea level, from 1° to 18° S. . . . It thrives under climatic conditions where European vegetables are grown, as well as where the vegetation and products are purely tropical." The actual coast line is comparatively free from this *Anopheles*, as the river water there is brackish for a great part of the year.

There is no doubt that this *Anopheles* has a great deal to do with the transmission of malarial fever in Africa, and it seems to be far the most abundant species. Concerning this species, Dr. Daniels sends the following account:—

"The 'small dark' *Anopheles* in which 'Crescents' develop" (*A. funestus*, Giles).

"There is no entomologist here, and consequently the minute description of this mosquito will have to be made from dry specimens. When dry the mosquito appears so much shrivelled and distorted that some non-entomological observations of the fresh mosquito may be of interest.

"The name 'small dark' or 'little black' by which it is commonly called has probably been given to it on account of its being most commonly observed after feeding, and the distended abdomen, which then appears black, is the most conspicuous part

of it. When empty it is not particularly dark and certainly not black, but varies in tint not only according to the abdominal contents, blood or eggs, but with age and even in different individuals reared from the same batch of eggs.

"It frequents houses, but does not leave them in the daytime, but remains out of the breeze in hangings, clothes, and particularly in dark corners high up out of reach of the breeze from doors and windows. It feeds preferentially at night, especially in the early hours of the evening, but can and does feed at other times, even in daylight, both when free and in captivity. If allowed to feed to excess it voids fluid always stained with haemoglobin showing some haemolytic property of the saliva or digestive juices. This phenomenon occurs, but not constantly, with other mosquitoes.

"The blood in the stomach rapidly ceases to be the transparent red so marked in most *Culices* and appears in mass black and opaque, though unaltered red corpuscles are to be found more than twenty-four hours after feeding. Exclusive of the proboscis the mosquito measures 4 mm. The ♀ when the abdomen is distended with blood is even a little less.

"The thorax is dark brown with a yellowish tinge and no conspicuous markings; the under surface is a little lighter in colour. The abdomen is a dark bluish-grey, lighter at the junction of the segments. In some it is darker than others, and newly-hatched and very old mosquitoes are the lightest. Distended with blood it appears black, and distended with eggs much lighter. The legs are dark brown, lighter at the joints but without definite banding. The wings are 'dappled.' The proboscis in the ♀ is about 1·7 mm. in length; it has the usual thick appearance of the *Anopheles*. It is very dark brown, lighter at the tip and with two white bands across it. The lighter colour at the tip and the two bands are really on the palpi, but as in life they are in close approximation; the bands appear to extend right across without any break. They are not equally obvious in all positions. The antennae, about 1 mm. in length, are fine, and beyond jointing have no markings. In the ♂ the antennae are feathered, and so are the tips of the palpi, which are more definitely white than in the ♀. The palpi do not extend quite to the end of the proboscis."

26. Anopheles Indica. n. sp.

♀. Head black, with creamy-white and black upright forked scales, the pale ones in the middle; clypeus brown, basal joint of antennae pale ochraceous, remainder brown, with pale pubescence; palpi dark brown, with apex yellowish-white, and with two apical pale rings to the third and fourth joints; proboscis brown, testaceous at the tip.

Thorax pale ochraceous-brown, with pale golden hair-like curved scales and black bristles; scutellum very pale, almost grey, with a single row of long dark bristles and an inner row of short golden ones, and pale scales; metanotum pale brown; pleurae pale ochraceous-brown.

Abdomen dark shiny-brown, some of the segments with ochraceous reflections in the centre, densely clothed with golden brown hairs; venter pale ochraceous.

Legs very dark brown to almost black, a small yellow spot at the apex of the tibiae and the femora, coxae ochraceous; ungues equal and simple.

Wings with the costal border marked with four prominent black spots and a small basal one, separating five small clear yellow ones; the first, second, and third costal spots have similar black areas under them on the first longitudinal; the last has a black-scaled area commencing just under it, but is not similar in arrangement; veins clothed with mostly long dusky scales, a yellow patch at the base of the first fork-cell and the tip of its first branch, another at the base of the second fork-cell and at the tip of its second branch, also at the cross-veins, a long patch at the lower branch of the fifth, a small one on its upper branch, and one on the stem, and another towards the base of the sixth vein; first sub-marginal cell longer and narrower than the second posterior cell, its base nearer the base of the wing than that of the latter, its stem equal to the length of the cell, the fork diverging about the middle of the second black costal spot from the apex; stem of the second posterior cell much longer than the cell. Wing fringe dusky, with three yellow patches, namely, at the end of the lower branch of the fourth and the two branches of the fifth; posterior cross-vein behind the mid, not quite its own length distant. Halteres with almost white stem and dusky black knob.

*Length.*—3 to 3·5 mm.

*Time of capture.*—December in Madras.

*Observations.*—The above is the description of a ♀ from Madras, and is seemingly related to Grassi's *A. superpictus*, the wings, &c., being almost identical. The chief difference I can detect is, that in the Indian specimen the legs have no traces of tarsal banding, and the fringe has three yellow patches, which are absent in the type of Grassi's *superpictus*. The specimen was taken in a house near Madras, by Captain Cornwall. From *A. funestus* it differs in the position of the cross-veins.

### 27. Anopheles Rhodesiensis. n. sp.

(Fig. 14, Pl. IV.)

Thorax reddish-brown, with ashy-grey median reflections, with brown hairs. Abdomen brown, with basal and medial mottlings of dull ochraceous. Legs dark brown, very thin and long. Wings with the dark costa with three small clear creamy-white spots, and also a yellow apical spot; veins all brown scaled, except first long vein; fringe all brown.

♀. Head black, silvery-grey round the eyes and in the middle, clothed at the sides and on the occiput with narrow upright scales black in colour, with a median patch extending from the front to the nape, of broader white forked ones, numerous black curved hairs, and a tuft of white scales projecting forwards between the eyes; antennae brown, basal joint and base of the second joint bright testaceous; palpi dark brown, thin and straight, with three narrow yellow apical bands, antepenultimate and penultimate joints about equal; proboscis dark brown; eyes black; clypeus dark brown.

Thorax reddish-brown, with ashy-grey reflections in the middle, and with numerous short and longish curved brown hairs with a shiny tint in some lights; scutellum nude, pale brown, with grey reflections and two rows of border-bristles, the shorter bright brown, the longer dark brown; the metanotum brown; pleurae testaceous brown.

Abdomen brownish, with dull ochraceous markings at the base and on the middle of the segments, with numerous dorsal and lateral bristles.

Wings with the costal border dark brown, with three small white spots and a yellow apical spot; veins all clothed with pale brown scales, the median ones being elongated oval in form, the lateral ones long and thin: the white costal spots spread evenly

over the first long vein ; first sub-marginal cell longer and slightly narrower than the second posterior cell, its base a little nearer the base of the wing than that of the latter, its stem about two-thirds the length of the cell ; stem of the second posterior longer than the cell ; supernumerary and mid cross-veins very close together or united, the posterior cross-vein nearly its own length distant behind the mid ; wing fringe all brown, except at the yellow apical spot ; very long, thin, hair-like scales forming a border to the basal lobe, which is also edged and covered with short hooked hairs.

Fig. 53.

*Anopheles Rhodesiensis.* n. sp. (♀)
(Showing veins only.) (X. 9.)

Legs long and thin, dark brown ; the coxae deep testaceous ;

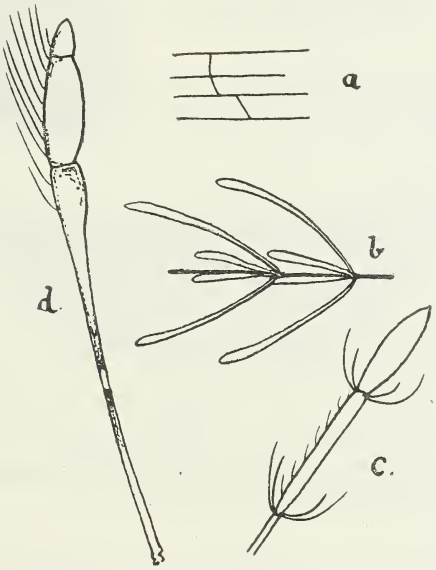



Fig. 54.

*Anopheles Rhodesiensis.* n. sp.

a, Cross-veins of ♀ ; b, wing scales ; c, apex of antenna of ♀ ; d, palpus of the ♂.

posterior metatarsus much longer than the tibia ; ungues equal and simple, those of the hind legs straighter than those of the fore and mid legs.

*Length.*—2·8 to 3·5 mm.

♂. Palpi deep brown, with a purplish tinge, the last two joints swollen into a distinct club, tipped with grey, and with brown plumes; antepenultimate joint very thin, swollen apically; antennae with flaxen plumes, the last joint swollen; scutellum simple, with fourteen very long brown border-bristles, and smaller ones forming a second row.

Abdomen thin; the pale areas more distinct, giving it almost a banded appearance, very hairy.

Wing markings like the ♀, only the white spots are larger and more distinct. Ungues of front legs very unequal, the larger one with a large blunt median tooth, the smaller claw very minute; mid and hind claws equal and simple, the hind ones nearly straight.

*Length.*—2·5 to 3 mm.

*Habitat.*—Mashonaland (Marshall); British Central Africa (Daniels).

*Time of appearance.*—April, in Mashonaland.

*Observations.*—This new species has been sent in numbers from Central Africa. It does not appear to occur on the coast.

At first sight one would take it for Grassi's *A. superpictus;* but the position of the cross-veins at once separates them, whilst the veins are not covered with black and pale scales, but dull grey scales.

It can thus easily be told from *superpictus.* It also bears some resemblance to *funestus;* but in *funestus* the wing fringe is marked with yellowish spots, and the wing veins are scaled with yellow and black, the costal border being more irregularly marked than in *Rhodesiensis;* moreover, in *funestus* the mid cross-vein is nearer the apex of the wing than either the supernumerary or the posterior cross-veins.

### 28. Anopheles minimus. n. sp.

Thorax slaty-grey in the middle with a deep-brown line on each side. Abdomen shiny black with yellowish hairs. Legs brown, unbanded. Wings with three nearly equal creamy spots on the black costa and an apical spot; fringe with a yellowish spot at the end of each vein except the sixth; cross-veins separate, supernumerary nearest the apex of the wing.

♀. Head black, clothed with black upright forked scales behind, and on the sides and over most of the occiput, a few grey and white and creamy ones in front, also some curved white scales and a few white hairs projecting forwards; proboscis deep brown; palpi deep testaceous clothed with black scales, a white ring towards the base (apical portion denuded), longer than the proboscis; antennae deep brown, testaceous at the base, with dark hairs and grey pubescence.

Thorax slaty-grey in the middle, deep brown at the sides, the median grey area with rather large round brown dots

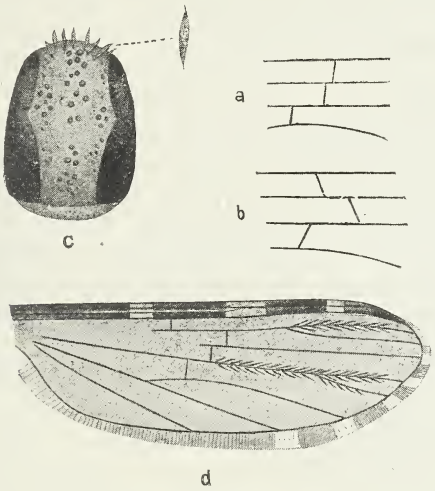



Fig. 55.

*Anopheles minimus.* n. sp. (♀).

a, Cross-veins; b, cross-veins of *A. funestus*; c, thorax of *A. minimus*; d, wing. (X. 18.)

(denuded); projecting over the head are some large white lanceolate scales; brown bristles over the roots of the wings; scutellum pale brown; metanotum deep brown; pleurae brown.

Abdomen deep shiny blackish-brown with golden-yellow hairs.

Legs testaceous-brown covered with deep brown scales, no trace of banding or pale knee spots; ungues equal and simple, those of the fore legs curved, those of the mid nearly straight; femora rather paler than the rest of the legs, and those of the fore legs rather swollen.

Wings with the black costa with three distinct nearly equal yellowish spots; apex yellow, forming a small apical spot; fringe brown with a yellow spot at the end of each vein, except at the end of the sixth; the middle of the three yellow costal spots is slightly the largest; all three spots are carried on to the first long vein; the apical spot also just touches the tip of the first long vein and the tip of the upper branch of the first fork-cell; second long vein and the fork entirely dark scaled; the third yellow in the middle, dark at the base and apex; the fourth mostly dark scaled; the fifth and sixth mostly dark scaled, a trace of yellow on the upper branch of the fifth; first sub-marginal cell considerably longer and slightly narrower than the second posterior cell, its base much nearer the base of the wing than that of the latter, its stem less than half the length of the cell; stem of the second posterior cell considerably longer than the cell and than the stem of the sub-marginal cell; the sub-costal joins the costal in the median yellow costal spot, some way from the base of the sub-marginal cell; supernumerary cross-vein nearly its own length in front of the mid cross-vein, which is longer than the supernumerary; posterior cross-vein a little longer than the mid, more than its own length distant from it; third long vein carried very prominently into the basal cell.

Halteres with grey stem and large cup-shaped black knob.

*Length.*—3 mm.

*Habitat.*—Pokfulam, Hong Kong (Rees).

*Time of capture.*—October.

*Observations.*—Described from a single ♀ in Dr. Rees' collection. Very like *A. funestus*, *Rhodesiensis* and *superpictus*, but from *funestus* it can be at once told by the disposition of the cross-veins and the darker scaled wings, from *Rhodesiensis* by the ornamented wing fringe and cross-veins, from *superpictus* by its darker hue and ornamented fringe.

The fork-cells also differ from all three, the stalk of the second posterior cell being relatively much longer. The meso-thorax has also numerous spots of a dusky hue. The straightness of the mid ungues is very marked and strongly contrasted with the curved fore ungues. It most nearly approaches *A. funestus* from Africa, but is a distinct species.

### 29. Anopheles punctipennis. Say
*C. hyemalis.* Fitch.

(Journ. Acad. Nat. Sc. Philadelphia, iii. (1823); Ins. N. Amer. ii. p. 39 (1869), Say; Circ. 40, 2nd se. p. 4, Dep. Agri. U.S.A. (1899), Coquillett.)

(Fig. 24, Pl. VI., and Fig. 145, Pl. XXXVII.)

Thorax deep chestnut-brown with slaty-grey tomentum in the middle, with pale golden hair-like scales. Abdomen dark brown with golden hairs; legs brown, except the coxae, the knees and tips of the tibiae. Costa black with two yellow spots.

♀. Head dark brown, covered with black upright scales, except a small patch of similarly shaped white scales in front; a tuft of white hairs projects forwards between the eyes; eyes black with a fine pale border; antennae brown, with brown hairs and pale pubescence, basal joint very slightly paler; palpi covered with brown scales, rather dense basally and showing a narrow grey band towards the base, a greyish tip and a broader band between, showing only in some lights, in others entirely brown; proboscis brown, with very small scales.

Thorax deep chestnut-brown, with a broad patch of silvery-grey tomentum in the middle, the dark chestnut-brown appearing as a stripe on each side, covered with pale-golden, hair-like scales; in the centre, in front, projecting over the neck, is a tuft of long creamy-white scales; the pale central area shows more or less longitudinal ornamentation; scutellum pale brown, slightly darker in the centre; metanotum deep brown; pleurae deep chestnut-brown with paler patches.

Abdomen dark brown to almost black, with scattered golden hairs, each segment bordered with long hairs of a similar colour; *at the base of the segments there seems to be a constant triangular swelling.* Ventrally the segments seem to be dull greyish basally, due to reflections on the integument.

Legs with the bases (coxae) almost white; femora, tibiae and tarsi covered with small dark brown scales; knees and tips of the tibiae yellow; tarsi with dull purplish and ochraceous reflections under the microscope.

Wings with the costa almost black with two yellow spots, one at the apex and another on the apical third of the wing, the apical spot involving the first long vein and the upper branch of the first sub-marginal cell, the larger spot passing into the first long

vein and the second long vein just before it branches ; there is also a patch of pale scale in the middle of each branch of the second fork-cell ; the sixth long vein is black scaled for about half its length, and again at the base, the middle being pale ; all the remaining veins with longish black scales ; first sub-marginal cell longer and narrower than the second posterior cell ; fringe black, except at the end of the second branch of the fifth long vein, where it is paler.

*Length.*—5 mm. ; of wings, 6 mm.

*Habitat.*—Lake Simcoe, Ontario (E. M. Walker) ; also New Orleans, New York (Fitch).

Professor Howard gives the following localities in the States : Massachusetts, Maryland, Columbia, New York, Illinois, Texas, New Mexico, Connecticut, New Jersey, Virginia, Kansas, and Baltimore. Jamaica is also given as a locality, but none have been received in collections at the Museum from there. A related species but quite distinct has just been received from the West Indies.

*Time of capture.*—September in Ontario ; February at Castleton ; September, October, and June in Massachusetts ; March and November in Maryland ; June and October in Columbia ; April and August in New York ; October in Illinois ; May, June, and October in Virginia.

*Observations.*—This American species very much resembles at first sight *A. Sinensis* and *A. barbirostris ;* it differs from both, however, in having no pale hairs on the apical fringe of the wings and the greater length of the wings as well as in the thoracic ornamentation. Wiedemann regarded this species as synonymous with his *A. crucians*, but it is quite distinct. The costa in *A. crucians* is uniformly dark, whilst in *A. punctipennis* there are yellowish-white spots as described above, and there are three black spots on the sixth vein in *A. crucians* instead of two as in this species. On the other hand, Fitch's *Culex hyemalis* is undoubtedly this insect. The type of *C. hyemalis* is in the British Museum collection. This insect has been taken when the temperature was 6° F.

This *Anophe'es* is known as the "winter mosquito," and is met with in the last days of autumn, and again for a short time in the first days of spring, and specimens are occasionally found throughout the winter months. A large winged variety seems to exist (Fig. 24, Pl. IV.).

30. Anopheles maculipennis. Meigen (1818).

*A. quadrimaculatus.* Say.

*A. claviger.* Fabr. (1805) (no type existed).

*Culex bifurcatus.* Meigen (1804) (?).

(Syst. Beschr. Europ. Zwei. Ins. i. 11, 2 (1818), Meigen; Ins. Lapp. i. 808, Zetterstedt; Hist. Nat. Dipt. i. 32, 2, Macquart; Brit. Ent. 210, 2, Curtis; Bull. Soc. Imp. Nat. Mosc. iii. 294, 2 (1845), Gimmerthal; Dipt. Scand. ix. 3468, 3, Zetterstedt; Ento. Mag. i. 148, Haliday; Dipt. Beitr. i. 4, 2, Löw; Fauna Austr. ii. 265, Schiner; Dipt. Neer. p. 330, Van der Wulp; Ins. Brit. iii p. 249, Walker; Bull. d. Soc. Ent. Italiana, 1896, p. 228, et 1899, p. 90, Ficalbi; Reale Accad. d. Lincei, S. d. u. Zool. sulla Malaria, p. 77, Grassi.)

(Fig. 17, Pl. V.)

Thorax brown, more or less dusky bluish-grey in the centre, with a thin central and lateral dark lines, deep brown at the sides, with scattered golden hair-like scales. Abdomen dark brown, sometimes with tawny-brown markings and dark apical bands, covered with much golden pubescence. Wings with the scales accumulated more densely in four spots: at the bases of the fork-cells, at the cross-veins, and at the base of the second long vein. Legs brown; femora and tibiae yellowish-brown below, small pale knee spot; metatarsi and tarsi dark brown.

♀. Head with two patches of creamy scales divided by a central line, the rest of the head with black scales, a small tuft of white hairs in front, borders of the eyes white; eyes deep purplish-black; antennae dark brown, with pale bands and with ferruginous basal joint, pale pubescence and brown hairs; proboscis brown; palpi yellowish-brown, with dense dark scales at the base, which is swollen, shorter than the proboscis.

Thorax brown, more or less dusky bluish-grey in the centre, with a thin central and lateral dark lines, with scattered golden hair-like scales, deep brown at the sides; scutellum tawny at the base, pale grey at the sides, with dark centre; metanotum deep reddish-brown; pleurae reddish-brown, with paler areas.

Abdomen deep brownish-black, with golden-brown hairs—in certain lights the segments are darkened apically. In some specimens the abdomen has tawny-brown mottlings at the base and the centre of the segments, and in others it is brown, with dark apical bands.

Legs with pale coxae; femora and tibiae yellowish-brown below, covered with dark brown scales above; knee spot yellow,

apex of the tibiae paler; metatarsi and tarsi slightly darker than the rest of the legs; ungues equal and simple.

Wings with the veins and margins clothed with narrow black scales, with four black spots formed by scales as follows: at the base of the first sub-marginal cell, at the base of the second posterior cell, near the base of the second long vein, and another at the base of the third long vein spreading over the three cross-veins; first sub-marginal cell a little longer and narrower than the second posterior cell, its stem half as long as the cell, its base nearly level with that of the second posterior cell; stem of the latter equal to two-thirds of the length of the cell; posterior cross-vein a little behind the mid cross-vein, the latter a little way off the super-numerary; apical fringe yellow. Halteres pale, with a black knob.

Fig. 56.
Wing of *A. maculipennis*, Meig. (♀). (X. 9.)

*Length.*—6 to 8 mm.

♂. Antennae banded, plume hairs brown, last joint darker; proboscis black to dark brown; palpi dark brown—the last two joints, which are swollen, have a number of short golden hairs internally and are yellow in colour, clothed with thick black

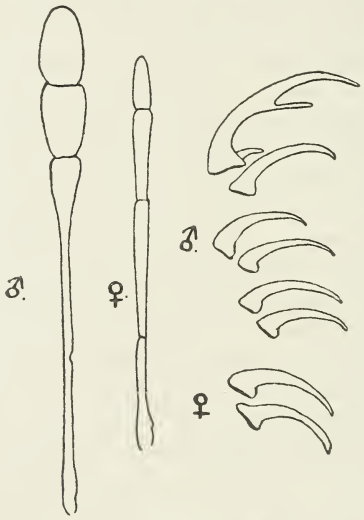



Fig. 57.
*Anopheles maculipennis*, Meig.
Male and female palpi (X. 12.); fore, mid and hind male ungues (♂); fore ungues of the female (♀). (X. 160.)

scales through which the yellow underground shows; the last joint is ovate.

Abdomen with the segments dark brown centrally and along the hind borders, yellowish-brown at the sides; apical segment and genitalia dark brown; in other specimens the abdomen is tessellated with ochraceous-brown in various ways, the hind borders being always dark. Ungues of the fore legs unequal, the larger with two teeth and a trace of a third near the base; the smaller minute, unserrated, mid and posterior simple, equal and small.

Fig. 58.
Male genitalia of *A. maculipennis*. (X. 50.)
(After Ficalbi.)

*Length.*—6 to 7·5 mm.

*Habitat.* — Europe, in the following countries: Scandinavia (Zetterstedt and self); Austria (Schiner); Germany (Meigen); Spain (Macdonald); Holland (V. d. Wulp); Russia (Gimmerthal); Italy (Ficalbi); England, and France. In Canada it has been found at St. Boniface, Manitoba, and Lake Simcoe, Ontario. It also occurs in New York, New Hampshire, Maryland, Illinois, Florida, Texas, Virginia, New Orleans, Connecticut, &c.

*Time of appearance.*—In England from March to May and again from June to December. The majority appear in July and August. Females only occur early in the year. E. M. Walker records it in July and September in Canada. It certainly often occurs during winter in Great Britain. In the United States it has been taken during most months of the year.

*Observations.*—This species, which is one of the largest of the genus, occurs very widely distributed over Europe. In England it is very common. I have taken it in most parts in considerable numbers, from Yorkshire to Dover. It appears, however, to be uncommon in North Wales, although I have taken it at Criccieth and Beddgelert. It may be found in the daytime settled inside outhouses and privies. It may be found as early as February, but not until the months of March and April in any numbers; these early ones are all females which have hibernated in cellars, roofs of outhouses and so forth. In June, July, and August both males and females appear, and now and then on to October. Females alone may be found right through the winter when the weather is mild in the south of England in small numbers.

Grassi looks upon this species as chiefly a domestic insect, and records finding them in houses, sheds, stables, and chicken coops. They are also found beneath bridges when the weather becomes cold in North Italy. Both Grassi and Ficalbi state that it occurs most frequently in flat land. Its food, both ♂ and ♀, according to my observations, is entirely vegetable, but Ficalbi states that it is very troublesome to animals and man in Italy, where it is very common, especially in small houses near water. I have never known this species attack human beings, and yet I have lived in districts where it often occurs in great numbers and other mosquitoes are troublesome. I have seen them settled on Compositae, sucking out the juices of the flowers, and I believe, in England anyhow, they are now seldom blood-suckers. In warmer climates they nevertheless seem to be sanguinary, the bite being said to be very sharp and irritating. Van der Scheer and Van Berlekom, who have recently studied an outbreak of malaria in Zeeland, found this species in houses, stables, &c., feeding on both human and animal blood. One-fifth of the insects examined contained malarial parasites in the stomach walls.

Professor Nuttall informs me its distribution in England agrees with the old malarious districts, an interesting feature when we remember how plentiful ague, a form of malaria, was in England at one time, and that now this mosquito seems to have given up its blood-loving habits.

According to Grassi, this is the species that is most concerned in the communication of human malaria in Italy. The ♂ makes a loud drumming noise, which I have never heard made by the ♀. Say's *A. quadrimaculata* is the same species as *A. maculipennis*. A large series has been received from E. M. Walker, collected in Canada, which agree in all respects with our European form. Sometimes the hibernating females have the wing spots quite denuded, and then resemble superficially *Anopheles bifurcatus*, L.

There is great variation in the size of *A. maculipennis*, as much as 2 mm. difference between specimens from the same locality. This may be noticed in the Canadian series as well as those taken in England.

The large series of this species that have been received from Mr. E. M. Walker were collected at and near De Grassi Point, Lake Simcoe, Ontario. They were nearly all taken on the window-panes in cottages near the lake and from a boat-house.

and were seldom seen elsewhere. A few were found in a wood of walnut, maple, oak, hickory, and other hard woods, and one from an open grassy marsh on the borders of a belt of hard wood. Their chief locality is, however, indoors, except when ovipositing.

*Synonymy.*—The first authentic name for this species appears to be Meigen's *A. maculipennis* (1818). On the Continent Ficalbi, Grassi, and others call the species the *A. claviger* of Fabricius (1805). This is wrong, for the following reasons: *Culex claviger*, Fabr. (Syst. Antl. 1800, p. 35), appears never to have existed as a type specimen. Baron Osten-Sacken states that Fabricius had no specimens at all (Ento. Mo. Mag. p. 282, 1900). The name *A. maculipennis* was adopted by Loew in 1845 (Dipt. Beit. i. p. 4). I prefer to take Meigen's description (in Syst. Beschr. 1818), as I now fail to connect his species of 1804 (Klassif. p. 5) with his *maculipennis* of 1818. Meigen first clearly states concerning his species in 1804, "Die Flügel sind ungeflecht" (p. 5). *Anopheles maculipennis*, as we now take it from his world-wide work started in 1818, has spotted wings.

31. Anopheles bifurcatus. Linnaeus (1758.)
*A. trifurcatus.* Fabr. (1792.)
*A. claviger.* Meig. (1804.)
*A. villosus.* R. Desv. (1828.)

(Fn. Suec. 1891, Linn.; Ins. Austr. 482, 982, Schrank; Spec. Ins. ii. 469, 2, Fabr.; Syst. Beschr. i. 11, 1, et vi. 242, Meigen; Dipt. N. Fr. 163, 1, Macq.; Ins. Lapp. 807, 1, Zett.; Dipt. Scand. ix. 3467, 1, Zett.; Ent. Mag. i. 151, Hal.; Dipt. Beitr. i. 3, 1, Löw; Fn. Austr. ii. 625, Schiner; Ent. Syst. iv. 401, 3 (*C. trifurcatus*), Fabr.; Klass. i. 5, 8, Meigen (= *C. claviger*); Syst. Antl. 35, 6, Fabr.; Dipt. Neer. 330, Van der Wulp; Bull. Soc. Imp. Nat. Mosc. iii. 294, 1 (1845), Gim.; Syst. Nat. v. 2887, 3, Gmel.; Mém. Soc. Imp. Nat. Mosc. iv. 129, Fischer; Bull. Ent. Soc. Ital. p. 225 (1896), Ficalbi; Reale Accad. d. Lincei, S. d. u. Zool. sulla Malaria, p. 81 (1900), Grassi.)

(Fig. 22, Pl. VI.)

Head with broad white upright scales in the front and forming a median line. Thorax chestnut-brown at the sides, grey in the middle with narrow median and lateral dark lines ornamented with lines of hair-like golden scales. Abdomen dark brown, some of the segments with the anterior parts bright

brown, with short golden-brown hairs and sometimes ochraceous-brown mottlings. Wings unspotted, the first sub-marginal cell longer and narrower than the second posterior cell, its base nearer the base of the wing than that of the latter. Legs dark brown, with ochraceous reflections.

♀. Head brown, with greyish tomentum, and small pale creamy curved scales in front, with a tuft of yellow bristles projecting forwards and pale yellow upright forked scales passing backwards as a broad band on each side of the central bare line, the forked scales at the sides black with dusky grey tips; a pale border along part of the eyes; antennae dark brown, basal joint bright ochraceous-brown on one side, dark brown on the other; proboscis nearly black; palpi ochraceous covered with blackish scales, which are densest at the base, a little longer than the proboscis; clypeus brown.

Thorax deep chestnut-brown at the sides, grey in the middle with a narrow median and two lateral brown lines; covered with long, curved, hair-like golden scales; pleurae testaceous and grey; metanotum ochraceous-brown with a median dark line; scutellum brown with dense border-bristles of a golden hue. Abdomen dark brown, some of the segments with their anterior parts brighter brown, in strong lights the abdomen looks steely-black; covered with short golden-brown hairs and sometimes mottled with ochraceous-brown.

Legs ochraceous covered with dark scales, coxae testaceous, also the base of the femora; knee-spot and base of the metatarsus pale; ungues equal and simple; when the legs are denuded they look entirely deep ochraceous. Wings brown, veins with deep to bright brown scales; first sub-marginal cell considerably longer

Fig. 59.
Wing of ♀ *Anopheles bifurcatus*, L. (♀).
(X. 9.)

and narrower than the second posterior cell, its stem a little more than half the length of the cell; second posterior cell with its stem as long as the cell, its base much nearer the apex of the wing than the base of the former cell; supernumerary and mid cross-veins parallel, the posterior cross-vein not quite its own

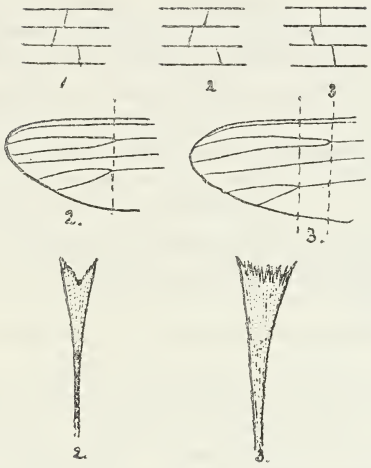


Fig. 60.

1. *Anopheles maculipennis*, Meig. 2. *Anopheles Walkeri*, n. sp. 3. *Anopheles bifurcatus*, L. (Cross-veins, fork-cells and fork-scales from the head.)

length distant from the mid cross-vein, the mid about half its own length nearer the apex than the supernumerary. Halteres with straw-coloured stems and the upper part of the knob black.

*Length.*—5 to 5½ mm.; with proboscis 8 to 8½.

♂. Head brown, with upright creamy scales in the middle and upright black scales at the sides, a dense creamy tuft of hairs projecting forwards; antennae brown with flaxen plumes, basal joint very dark brown; palpi brown, last two joints spatulate, hair-tufts golden-brown; proboscis brown.

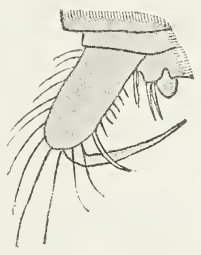


Fig. 61.

Genitalia of *Anopheles bifurcatus*. (X. 50.) (After Ficalbi.)

Thorax slaty-grey in the middle, dark brown at the sides, with a median thin brown line, and pale golden curved hair-like scales, a rather dense tuft of creamy ones in front over the head; scutellum bright brown; metanotum rather darker brown; pleurae pale brown with greyish markings.

Abdomen chestnut-brown and dark brown, the dark brown at the apices of the segments and also at the base and centre; a pale median line runs the whole length of the abdomen which has long, dense,

golden-brown hairs. Legs brown, ungues of the fore legs unequal, the larger with a prominent median tooth and a small blunt basal one; mid and hind ungues equal and simple.

Wings with the first sub-marginal cell much longer and narrower than the second posterior cell, its base much nearer the base of the wing than the base of the latter, its stem equal to about two-thirds of its length; stem of the second posterior cell a little longer than the cell; mid cross-vein nearer the apex of the wing than the supernumerary cross-vein; posterior cross-vein not quite its own length distant from the mid.

*Length.*—6 mm.

*Habitat.*—Europe, from Lapland to Italy and islands in the Mediterranean.

*Time of appearance.*—In England in April and May.

*Observations.*—This species resembles somewhat a worn *A. maculipennis*, but they can be separated by the slight difference in the venation; in this species the bases of the fork-cells are widely separate, whilst in *A. maculipennis* they are not far apart; the posterior cross-vein is parallel with the mid cross-vein, thus differing from the spotted-winged species.

Its nearest relative is *A. Walkeri*, mihi, which, however, differs in head ornamentation and in the venation, as shown in Figure 60.

The ♀ attacks human beings and is very persistent in sucking out the blood; it is much fiercer than the more common *A. maculipennis*. Ficalbi figures the ♂ ungues of the fore feet as tridentate. I fail to detect more than two teeth in the large claw, one tooth large and median, another small, blunt, and basal. It is possible that Ficalbi is dealing with another species and not Linnaeus' *A. bifurcatus*.

*A. bifurcatus* is rather difficult to catch on the wing. It remains some time attached to the person sucking blood, and may then be easily caught. Malarial parasites are known to develop in this species in Italy. I have chiefly found it in the neighbourhood of woods. The larvae are found in the winter; I have found them in rain barrels, and have hatched them out in April during the present year, but some larvae existed until May.

The ♂ is described from a specimen sent with the ♀ to me by Dr. Nuttall from Cambridgeshire.

*Synonymy.*—I think there is no doubt that Fabricius' *A. trifurcatus* is *A. bifurcatus*, and also Meigen's *claviger* of 1804. Robineau Desvoidy's *A. villosus* was probably a specimen of

this species. The original description of *A. villosus* runs as follows * :—"Similis *A. bifurcato*; abdomine villoso: L. 3 lines—Mas. et Fem. similis A. bifurcatus sed paulo major. Abdomen villosum praesertim in mari." Concerning this doubtful species Ficalbi says: "Non enumerata da altri questa specie lo è da Schiner, ed anch' io la enumererò, ma non senza chiedermi se per avventura non si tratti di puro e simplice *A. bifurcatus*."

*A. villosus* was described from Paris.

Fabricius' *A. claviger* never existed, and was probably a wrongly compiled description. In any case the wings were spotted, so it could not be the same as Meigen's *C. claviger* of 1804.

*Anopheles grisescens.* Stephens.

(Zool. Journ. xii. (1828).)

This species is probably a synonym of *A. bifurcatus* or a worn *A. maculipennis*. The original description is as follows :—

"Rufo-grisea abdomine concolore, thorace fascia dorsali albida, lateribus nigricantibus, alis submaculatis. Long. corp. 3½ l. Red-griseous; forehead white; thorax with broad, longitudinal, white band, edged on each side with dusky; pleurae rufescent; abdomen plain, griseous, not annulated; legs, palpi and antennae pale olivaceous; wings nearly immaculate, nervures pale yellowish. July, Ripley, Surrey."

32. Anopheles Walkeri. n. sp.

*A. ferruginosus.* Wiedemann (?).

(Fig. 20, Pl. V.)

Head with a patch of thin yellow curved scales in front and thin upright black ones on the occiput and sides. Thorax deep brown, with numerous curved hair-like golden scales. Abdomen dark brown to black with dense golden pubescence. Legs unbanded, brown. Wings unspotted, much as in *A. bifurcatus*, but the cross-veins differently disposed (Fig. 60).

♀. Head greyish-brown, with a patch of yellow curved scales in front ending in a tuft of yellow hairs between the eyes; behind are long upright black scales with grey tips, a broadish, central, bare line separating the scales into two portions; eyes purplish-brown with a hoary white border, most distinct at the

* "Essai sur les Culicides," Mém. d. l. Soc. d'Hist. Nat. de Paris, iii. (1827).

sides; antennae dark brown, greyish pubescence and black hairs, the first few joints have creamy scales, basal joint round and dark with a few pale scales; proboscis dark brown with some ochraceous reflections a little longer than the palpi; palpi dark brown with ochraceous reflections paler at the tips of the joints and at the apex, thickly scaled along the base; clypeus brown.

Thorax brown when viewed facing strong light, greyish-brown when pointing away from it, with four grey stripes, very clear in some lights on the denuded thorax, indistinct in others and in good specimens; the pale lines run as follows: two parallel ones in the middle running along about half the length of the mesonotum, the other two slightly curved, not far distant from the central ones and longer; the whole mesonotum covered with long, scattered, golden, curved, hair-like scales; scutellum pale greyish-brown; metanotum chestnut-brown with a narrow, dark median line; pleurae brown with grey tomentum.

Abdomen blackish-brown clothed with scattered golden hairs, when viewed facing the light shiny-black and metallic.

Legs long, ochraceous-brown with dark brown scales, especially towards their extremities, ventral surface of femora ochraceous-brown; there is also a pale knee-spot on all the legs and a pale spot at the end of the hind tibiae.

Wings with the veins edged with thin, longish, brown scales, mid cross-vein in advance of the supernumerary and posterior cross-veins, the latter distant from the mid more than its own length; stems of the two fork-cells about equal, first sub-marginal cell a little over twice the length of its stem and longer than the second posterior cell, base of the first cell a little nearer the base of the wing than that of the second posterior cell; fringe all brown.

Halteres with ochraceous stem and a large globular dusky knob.

*Length* of body, 5·5 to 6 mm., with proboscis, 10 mm.; of wings, 5·5; of hind legs, 12 mm.

*Habitat.*—Lake Simcoe, Ontario, Canada (E. M. Walker).

*Time of capture.*—September.

*Observations.*—This species closely resembles the European *A. bifurcatus*, but differs from it in regard to the head ornamentation, the browner appearance of the thorax and the relative positions of the cross-veins as shown in Figure 60. When viewed under the microscope in some lights there will be seen four grey

thoracic stripes which are also characteristic, especially when the thorax is rubbed. No males were unfortunately sent. All the specimens were taken from beds of reeds close to the low marshy shore of Lake Simcoe. I should not be surprised if this proved to be Wiedemann's *A. ferruginosus* (Auss. Zwei. Ins. p. 12, 1828) from New Orleans, there being a striking resemblance in the thorax.

### 33. Anopheles nigripes. Staeger (1839).
### *A. plumbeus.* Haliday (?) (1828).

(Fig. 21. Pl. VI.)

(Syst. For. o. d. i. Denmark Nid til fundne Dipt (1839); Dipt. Neer. ii. 3, p. 331 (1877), V. d. Wulp; Dipt. Beitr. i. 4, 2, Löw; Dipt. Scand. ix. 3467, Zett.; Kröj. Tidskr. ii. 552, Staeg; Fn. Austr. ii. 625, Schiner; Bull. Soc. Ent. Ital. (1896), p. 227, Ficalbi; Gnats, p. 175, Giles; Zool. Journ. xii. (1828), Haliday ( = *plumbeus*) (?).)

Thorax deep blackish-brown at the sides, the middle of the mesonotum frosty-cinereous; abdomen black, shiny, with golden-brown hairs. Legs black, except the coxae and bases of the femora and knee-spots, which are pallid. Wings unspotted, densely scaled with dark scales.

♀. Head black with a few white spindle-shaped scales in front, white upright forked ones in the middle and black forked ones at the sides; the scales on the head are few but large, a tuft of golden hairs projects forwards; antennae black with pale bands very indistinct, hairs black; palpi covered with deep black scales, just traces of grey at the apices of the two middle joints; proboscis black; clypeus black; thorax deep blackish-brown at the sides, with a broad median area of frosty-cinereous colour, with a faint median dusky line, which in front is bordered on each side by a few curved creamy-white scales, which become thiner and scarcer as they pass to the middle of the mesonotum, where they die out, rest of the mesothorax with a few scattered, pale golden, curved, hair-like scales, and with numerous longer pale golden hairs at the sides; scutellum black, with a few short golden hairs in the middle lobe and long dark ones on the lateral lobes; these hairs in some lights look fuscous; pleurae brown with slight cinereous reflections; metanotum deep brown to black.

Abdomen black, rather shiny, nude, but with numerous golden-brown hairs.

Legs very deep brown to black, coxae and bases of the femora pallid, knee-spot white, small; hind metatarsi a little longer than the tibiae; fore, mid and hind ungues equal and simple, small.

Wings rather dusky, densely black scaled, with sometimes purplish reflections, lateral scales long, rather thin; first submarginal cell considerably longer and narrower than the second posterior cell, its base much nearer the base of the wing than that of the latter; posterior cross-vein about twice its own length distant from the mid cross-vein, base of the wings pale; fringe deep brown.

Halteres with pale stem and deep black knob.

*Length.*—4 to 5 mm.

*Habitat.*—Northern Europe and North America. In England it has been taken at Penzance; it also occurs in Scotland, and I have taken a few in North Wales.

*Time of capture.*—July and September.

*Observations.*—This is a small very dark species which occurs mainly out of doors. Its dark colour readily separates it from any other European species, although some *bifurcatus* are seen to be very dark, the middle of the mesonotum is always more frosty-cinereous in *nigripes* and the veins more densely scaled. I have not seen a ♂.

It bites very viciously, and the bite is somewhat annoying. It usually occurs on the wing at dusk. Meinert has described the larva of this species as one of his type larvae of this genus.

I have taken this mosquito in the daytime by beating dense bushes where it seems to pass the day in North Wales. It does not appear to come indoors, but bites—Mr. Terry, of the British Museum, informs me—very viciously where he met with it in Cornwall.

I should say there is little doubt that Haliday's *A. plumbeus*, taken in the north of Ireland in July, is this species. His description is as follows :—

"Thorax lead-coloured, the sides with a blackish hue; abdomen dusky, margins of the segments paler, feet dusky; wings obscure, hyaline, nervures and scales blackish. In shady situations by running waters, a pair in July."—(Zool. Journ. xii. 1828.)

If this is so, Haliday's name must stand first, and *nigripes* sink as a synonym.

### 34. Anopheles Lindesayii. Giles.

(Hd.Bk. of Gnats, p. 166 (1900), Giles.)

(Fig. 19, Pl. V.)

Thorax ashy-grey in the middle, with a dark brown stripe on each side with three dusky median lines and golden hair-like scales. Abdomen black, with numerous pale and dark hairs. Costa black, with one creamy patch near the apex, veins mostly black scaled. Legs black; posterior femora with a broad white band in the middle.

♀. Head black, covered with black upright scales, except in the middle line in front, where the upright scales are narrower and white; antennae dark blackish-brown, basal joint black, the base of each joint marked by a narrow paler ring with the verticillate hairs arising from small black points, pubescence pale, hairs black; palpi and proboscis long and thin, about two-thirds the length of the whole insect, covered with long black scales with violet reflections.

Thorax ashy-grey, with a broad, deep chestnut-brown stripe on each side, a faint, narrow, median dusky line and an indistinct pale-brown one on each side of the latter; with scattered, pale golden, hair-like scales over the dorsum, a white patch projecting forwards over the neck, a few black bristles over the roots of the wings, sometimes showing brown, at other times silvery at the sides; scutellum greyish-brown, ochraceous at the sides, darker in the middle, with golden-brown border-bristles and narrow curved pale scales; metanotum deep purplish-brown.

Abdomen black, with numerous long black and pale hairs, quite brown in some lights; venter pale.

Wings with the veins mostly covered with black scales; the costa black, with one white to creamy-yellow patch near the apex; first sub-marginal cell longer and narrower than the second posterior cell; supernumerary and mid cross-veins in one line, posterior cross-vein about half its own length behind; two patches of yellow scales on the lower branch of the first sub-marginal cell, another at the apex of the third vein, one in the middle of the upper branch of the second posterior cell and two on the upper branch of the sixth vein; fringe, except at the costal spot, yellow; halteres with white stem and deep black knob.

Legs black, except the coxae, which are pallid, and the under-

side of the bases of the femora; the posterior femora have a broad clear white band in the middle of the joint; hind legs very long, the hind metatarsi longer than the tibiae; the hind femora at each end are quite black, showing up the median pale band very distinctly; in some lights the tibiae and tarsi have an ochraceous reflection. Ungues equal and simple.

*Length.*—4·5 mm.; of hind legs 10·5 to 11 mm.; of proboscis 3 mm.

*Habitat.*—Bakloh, Punjab (Captain Lindesay); Naini Tal (Colonel Giles).

*Time of capture.*—July.

*Observations.*—This marked species was described by Colonel Giles from a specimen sent him by Captain Victor Lindesay.

The type in the British Museum is in a very imperfect state, the present description being taken from a perfect specimen sent me by Colonel Giles from Naini Tal at the height of 7000 feet.

It can at once be told from all known *Anopheles* by the hind femora having a broad median white band.

Colonel Giles suggests that it is possibly the darker species which Major Ross originally found to convey human malaria, but of which he was unable to obtain a further supply of specimens. It is by far the most beautiful *Anopheles* I have yet seen. No male has been taken at present. Colonel Giles adds in some notes sent to me that he took the ♀ in his room, and that it seemed inclined to bite.

### 35. Anopheles crucians. Wiedemann.

*A. ferrugineus.* Wiedemann (?).

(Aussereurop. Zweiflüg. Ins. p. 12 (1828), Wiedemann; Circ. 40, 2nd se. U.S.A. Dept. Agri. p. 4 (1899), Coquillett.)

(Fig. 23, Pl. VI.)

Wiedemann's description of this species is as follows:—"Tawny, the thorax with three deeper tinted lines; the abdomen covered with grey hairs; the wings with dusky spots and costa. Length, $2\frac{1}{2}$ lines."

Coquillett, in his recent synoptic table of North American *Culicidae*, states that "the scales of the last vein are white, marked with three black spots; palpi marked with white at the bases of the last four joints," and without any spot on the costa, as seen in *A. punctipennis*.

Professor Nuttall sends me two ♀'s from America in spirit, which, although much damaged, show the two features mentioned by Coquillett very clearly, and so are readily separated from the *C. punctipennis* of Say.

*Habitat.*—United States, at the following places: District of Columbia (Pergande); Georgia; New Orleans (Veaye); Richmond, Va. (Slosson). Wiedemann says very common on the Mississippi, where it is very troublesome to travellers, and also gives Pennsylvania as a habitat.

*Time of capture.*—April in Columbia; June and November at New Orleans.

*Observations.*—Wiedemann was clearly wrong in identifying Say's species as his *A. crucians*, although they apparently occur in the same locality. Coquillett gives *A. ferruginosus* of Wiedemann as a synonym of *A. crucians*. "I strongly suspect," he says, "that the type of *ferruginosus* is a rubbed example of *A. crucians*, which was described from the same locality." This may possibly be the case, for Wiedemann's description agrees to some extent, but he specially refers to the difference from *A. crucians* in the legs being shorter. Professor Howard says this species seems to be rarer than the other two American species (*A. maculipennis* and *A. punctipennis*), and has been taken only in a few instances.*

### 36. Anopheles Grabhamii. n. sp.†

(Pl. A.)

♀. Head dark brown, with black upright forked scales behind and at the sides, a patch of grey ones in the middle of the head, a few white ones projecting in front, and a long tuft of white hairs spreading outwards; eyes metallic coppery; proboscis long and thin, brown; palpi brown, bright brown at the swollen end, with prominent scales at the base; basal joint of antennae dark brown.

Thorax silvery-grey, mottled with bright chestnut-brown, with two dark brown eye-like patches on each side towards the posterior half of the mesonotum, and a dark central line in front; a lateral tuft of dark, broadish scales on each side in front, and a patch of hair-like creamy ones in the middle, projecting over the neck; the whole mesonotum covered with scattered golden, curved, hair like scales; scutellum greyish at

* Notes, Mosq. U.S. Bull. 25, 2nd Se. U.S.A. Dept. Agri.p. 44 (1900).

† This species is now placed in a separate genus *Cycloleppteron*. (*Vide* Appendix, p. 312, Vol. II.)

the sides, brown in the centre; metanotum yellowish-brown in some lights, with purplish tinges in others. When viewed with a hand lens the thorax appears bright brown and grey, frosted with grey hairs, the median dark line showing plainly, and also the four lateral spots.

The abdomen is absent, and the legs too damaged to make anything of, but the remaining wing is perfect, and presents the following peculiarities: the costa is dark, with a small pale patch about one-third of the length of the wing from the tip. The apex is fringed with yellow scales, broken by three small blackish patches, the upper part of the yellow fringe appearing as a yellow, apical, costal spot. The veins are sparsely bordered with pale spindle-shaped scales, and scattered over the veins, at

Fig. 62.
*Anopheles Grabhamii.* n. sp.
Wing scales and larger fore-claw of the male.

wide intervals, are large, deep black scales totally unlike those of any other *Anopheles* (Pl. A). These scales are collected into a dense jet-black spot where the first long vein joins the auxiliary, the black spot of scales involving the second long vein as well. They are also collected rather thickly at the root of the fork-cells, especially of the first sub-marginal cell and elsewhere. The first sub-marginal cell is about the same length as its stem; its base nearer the base of the wing than that of the second posterior cell. The latter is very short and broad, only a little more than half the length of its stem. Posterior cross-vein about its own length distant from the mid cross-vein. The third long vein is carried only a minute distance past the posterior cross-vein.

*Habitat.*—Jamaica (Dr. Grabham) (24. 11. 1899). (Φ)

*Time of capture.*—November.

*Observations.* — Described from a single broken specimen. Sufficient remains, however, to show a very marked and peculiar species, which can at once be told from any other *Anopheles* by the large dark scales on the wings. This species probably will form a new genus when sufficient material comes to hand. The remains have been mounted on slide No. 27.

(Signs on label, K g t n. 1. xi. 99. Φ.) Since the above was in type I have received a perfect ♂ and ♀ (*vide* Appendix).

The following species have not been received, nor have I been able to see examples of them; references and descriptions are therefore added from the original sources:—

1. *A. stigmaticus.* Skuse. Australia.
2. *A. pictus.* Loew. Asia Minor.
3. *A. annulipalpis.* Arribalzaga. Argentine.
4. *A. albimanus.* Wied. Hayti and Porto Rico.

The two following, if distinct, are not identifyable, except from the original types:—

(?)5. *A. annulimanus.* V. d. Wulp. North America.
(?)6. *A. ferruginosus.* Wied. New Orleans.

### 37. Anopheles stigmaticus. Skuse.

(Proc. Linn. Soc. N. S. Wales, iii. p. 1759 (1889).)

♂ and ♀.—Antennae in ♂ about five-sixths the length of the palpi, brownish-ochreous; first joint of scapus black or dark brown; in the ♀ about four-fifths the length of palpi, dark brown with a whitish pubescence and brown verticils; first joint of scapus and basal half of second testaceous-brown. Head, ochraceous-brown, with golden-yellow hairs. Proboscis scarcely longer than the palpi, brown, almost black in the ♀. Palpi brown, almost black in the ♀. Thorax testaceous-brown, darker in ♀, with three longitudinal double rows of pale golden-yellow hairs; pleurae testaceous-brown in the ♂, fuscous in the ♀; scutellum ochre-yellow in the ♂; testaceous in the ♀, fringed with long golden-yellow hairs; metanotum testaceous in the ♂; very deep fuscous-brown in the ♀. Halteres deep brown, stem yellow. Abdomen in the ♂ twice the length of the thorax, shorter in the ♀; fuliginous-brown, levigate, clothed with golden-yellow hairs; ♂ forceps testaceous, densely hairy. Legs clothed with violet-brown scales; hind femora pale yellow for about four-fifths of their length; the fore and intermediate pairs pale yellow beneath only. Coxae ochreous or testaceous-brown. In the hind legs the metatarsus about one-seventh longer than the tibia. Wings in the ♂ the length of the thorax

and abdomen taken together, and in the ♀ the length of the whole body, hyaline, tinged with pale yellowish-brown at stigmatic region, the veins thickly covered with light brown scales, darker at stigmatic region. Sub-costal cross-vein situated about the middle of the auxiliary vein Auxiliary vein reaching the costa about opposite the mid cross-vein and considerably before the tip of the posterior branch of the fifth long. vein; second long. vein appearing to originate in the first basal cell opposite the base of the anal cell and some distance before the marginal cross-vein; third long, vein appearing to commence a short distance before the super-numerary cross-vein and before the tip of the sixth long. vein; middle cross-vein in the male situated somewhat before or exactly in line with the posterior cross-vein, in the ♀ beyond the latter a distance equal to its length, always situated beyond the supernumerary cross-vein a distance equal to its length; all about the same length; first sub-marginal cell considerably longer and narrower than the second posterior cell, the tips of the fork slightly convergent, its base situated opposite that of the second posterior cell.

| | | | |
|---|---|---|---|
| ♂ | Length | antennae . . . . | 2·02 mm. |
| | ,, | wings . . . . | 4·06 × 0·88 |
| | ,, | body . . . . | 4·56 × 0·76 |
| ♀ | ,, | antennae . . . . | 1·77 mm. |
| | ,, | wings . . . . | 4·06 × 0·88 |
| | ,, | body . . . . | 4·06 × 0·76 |

Blue Mountains (N.S.W.), 10 specimens.

Note.—Quite a distinct species; not sent in any Australian collection, and thus perhaps of local occurrence (F.V.T).

### 38. Anopheles atratipes. Skuse.

(Proc. Linn. Soc. N. S. Wales, iii. 2nd s. p. 1755, Skuse.)

Antennae about three-fourths the length of the palpi, dark brown almost fuliginous, with hoary pubescence and verticils; first joint of scapus black. Head fuliginous, adorned with white scales, intermixed with some black hairs and a tuft of long white parallel hairs stretching out from the vertex over the bases of the antennae. Proboscis and palpi densely and uniformly clothed with deep violet-black scales, the terminal joint of the latter very slightly tipped with white. Thorax primrose-brown, with a small roundish black spot laterally about the middle of its length and another immediately in front of the scutellum, traversed by three long, parallel double rows of moderately long black hairs intermixed with short slender shining white scales; lateral margins slightly testaceous with a few scattered white scales and some short white hairs above and in front of the origin of the wings; pleurae dark brown, somewhat marbled with testaceous; scutellum testaceous, with a dark roundish spot on the

apex, fringed with long black hairs, metanotum brown, halteres black, or very deep brown, the stem ochre-yellow. Abdomen about twice length of thorax, black, levigate, sparsely clothed with golden-yellow hairs (terminal joint more densely); lamellae of ovipositor black, fringed with short golden-yellow hairs. Coxae ochreous. Legs clothed with violet-black scales, femora and tibiae bright ochreous beneath and very slightly at the tips. Coxae pale ochreous without scales, slightly hairy. Wings length of the entire body, bright ochre-yellow at base, hyaline, veins very densely covered with scales, those on the costa, auxiliary, and first longitudinal veins black, the remaining veins with black and yellow scales arranged in alternate series, almost entirely black on the sixth long. vein. Six patches of black scales are prominent, situated at the following points: on the fifth long. vein mid-way between its origin and the base of its fork, at the base of the fork, at the bases of the second and third long. veins, the cilia on the costa between a point immediately above the tip of the first long. vein and immediately below the tip of the third long. vein pale yellowish or whitish, the remaining cilia violet-black with a light sericeous reflection. Auxiliary vein reaching the costa opposite the middle cross-vein, second long. vein beginning some distance before the marginal cross-vein; supernumerary and middle cross-vein opposite one another, situated beyond the posterior cross-vein a distance not equal to the length of the latter; post. cross-vein situated opposite the beginning of the third long. vein and considerably beyond the tip of the sixth long. vein; first sub-marginal cell longer but not narrower than the second posterior cell, its base situated a little before that of the latter; base of the anal cell lying a little before origin of second long. vein.

| | |
|---|---|
| Length antennae . . . | 1·77 mm. |
| Wing expanse . . . . | 4·18 × 0·84 mm. |
| Body . . . . . | 4·18 × 0·76 mm. |

*Habitat.*—Berowra (N.S.W.) January; Queensland, October (Bancroft, 106).

Note.—Another distinct Australian species with unbanded tarsi, but closely related to the former.

Whilst in the press specimens of this very distinct *Anopheles* have been received from Dr. Bancroft. I may add some details to Skuse's excellent description, namely, that the clypeus is trilobed, a very marked and peculiar character. The densely scaled palpi are scarcely white at the apex, and the scutellum has rather long pale scales on the posterior border and fifteen border-bristles rather far apart. It can easily be told from the former by the black and yellow wing scales and the prominent spots of black scales.

### 39. Anopheles pictus. Loew.

(Dipt. Beitr. (1845), Loew; Bull. Ent. Soc. d. Ital. xxviii. p. 232, Ficalbi.)

"Alis maculatis, femoribus anticis basi incrassatis. Long. corp. 3 lin. (6·5 mm.). Er gehört der südeuropäischen Fauna an; ich fing ihn etliche Mal an der, der Insel Rhodus gegen überliegenden Küste Kleinasiens, leider nur in männlichen Exemplaren. Ziemlich licht graubräunlich, der Thorax obenauf aschgrau mit feinen schwärzlichen Längslinien, zwischen denen er weiss-grau schimmert; vor dem querlinienformigen, bräunlich gelben, in der Mitte braunem Schildchen hat er einen flachen Eindruck der von der dunklen Mittellinie der Lange nach halbirt, von den nächstliegenden an den Seiten begränzt wird; die graue Farbe der Oberseite des Thorax ist an den Brustseiten durch eine braune gerade Längsstrime begränzt; unterhalb derselben haben die an meinen Exemplaren kahlen Brustseiten eine aus bräunlichgelb und gelbbraun gemischte fleckige Zeichnung und Schillern in gewisser Richtung weiss-fleckig, am lebhaftesten die Stelle zwischen den Hüften der vordersten und mittelsten Beine. Der Kopf ist aschgrau, am Augenrande schimmert er weisslich und die Stirne trägt vorn einem schmutzig weisslichen Haarbüschel. Die Fühler sind bräunlich mit bräunlicher Behaarung welche je nach der Richtung eine noch lichtere, so wie eine stellenweise schwärzliche Färbung zeigt. Das erste Tasterglied ist sehr kurz und von brauner farbe; das zweite länger, besonders an der Basis stark beschuppt so dass es dasselbst dicker erscheint; seine Farbe wie die der Schuppen ist ebenfalls braun, doch schimmern letztere auf der Oberseite desselben weiss; auch das dritte Glied hat eine braune Farbe, es ist länger wie das zweite, an der äussersten Basis verschmächtigt und lichter, gegen die Spitze hin verdickt und an derselben mit einem langen, braunlichen die Farbe verändernden Haarschopfe besetzt, seine Beschuppung ist mehr haarartig und zeigt einen besonders auf der zweiten Hälfte der Innerund Oberseite deutlichen weisslichen Schimmer, wie ihn auch die auf der Aussenseite der beiden letzten Glieder befindlichen Schüppchen haben; diese sind kürzer, etwa von gleicher Länge, breitgedrückt, braun, nach aussen gewendet, auf der Innenseite mit bräunlicher, auf dem vorletzten Gliede büschelformiger Behaarung. Der Hinterleib flachgedrückt, bräunlich, licht bräunlich behaart, auf Oberseite weissschimmernd mit verwaschener schwarzlicher Mittelstrieme; das letzte Glied desselben ist braun. Die Flügel sind glasartig, Adern und Randrippen theils mit braunen, theils mit weissen, gegenden Hinterrand hin so wie an diesem selbst mit mehr glasartigen Schüppchen besetzt; der Wechsel der braunen und weissen Schüppchen bildet eine schöne Zeichnung, es liegen namlich am vorderrand drei grosse braune Flecke; der erste, unfern der Flügelwurzel liegende verbindet sich zwar mit den zweiten am Vorderrande selbst, ist aber sonst durch eine weissliche Stelle von ihm getrennt; der zweite braune Flecke schickt an seinem äusseren Ende eine bogenförmige, der dritten Flecke durch eine kleine schneeweisse, an und auf dem Vorderrande selbst liegende Stelle

abgesondert; eine eben solche und eben so gelegene Stelle begränzt den dritten Fleck nach der Flügelspitze hin; ausser diesen Flecken sind die Adern an der Flügelspitze selbst braun beschuppt, diese jedoch weisslich gefranst; eben so finden sich an eizelneu Stellen der nach dem Hinterrande laufenden Längsadern braune Schüppchen, die indess au meinen beiden Exemplaren zu keiner deutlichen Zeichnung zusammentreten, eine Stelle auf der Mitte der letzten Langsader zeichnet sich durch sie aus. Die Beine, besonders die hintersten, sind von ausserordentlicher Schlankheit und zeigen, mit blossem Auge gesehen, eine gelblich schimmernde Farbe, die unter dem Vergossesungsglase ein brauneres Ansehen gewinnt, namentlich, erscheinen die beiden letzten Glieder der vordersten Mittelfüsse, so wie das letzte Glied der hintersten in gewisser Richtung dunkel braun; die Schienen-Spitze, so wie die Spitze der drei ersten Fussglieder zeigt in gewisser Richtung einen lebhaften lichtgelblichen Schimmer, was den Füssen dann ein geringeltes Ansehen giebt; ausgezeichnet ist die Bildung der Vorderschenkel, sie sind nämlich nicht, wie beiden anderen Arten, von gleich mässiger Dicke, sondern gegen ihre Spitze hin sehr verschmächtigt, gegen die Wurzel hin auffallend dicker, was ihnen indessen ihre schlanke, zarte Form nicht nimmt; an diesem Merkmale sind auch sehr verriebene Exemplare leicht zu erkennen."

*Locality.*—Asia Minor.

Note.—Loew described this species from the coast of Asia Minor, opposite the Island of Rhodes. It is recorded from England by Mr. Verrall, but is not in his collection, and I do not know the origin. It is also recorded from Spain (Macdonald).

This is clearly distinct from Grassi's *A. pseudopictus*, the wing fringe at once separating it. Probably it is also a subspecies of *A. Sinensis*.

### 40. Anopheles annulipalpis. Arribalzaga.

(El. Nat. Arg. i. 149, 1 (1878); Bol. d. l. Acad. Nac. d. Ciencias, iv. 114, 6, 10 (1883); Catal. de l. Dipt. &c. vi. 6, 10 (1883); Dipt. Argentina, p 37 (1891), Arribalzaga.)

(Description from Arribalzaga's 'Dipt. Argentina.')

"Fuscus; thorace badio-squamulato, obscure trilineato, palpis fuscis dense plumosis (♂), vel nigris, argenteo-annulatis (♀), pedibus tarsisque nigro-fuscis albo-annulatis, tibiis albo-argenteo-guttulatis (♂), vel pedibus nigris argenteo-annulatis (♀). Caput cinereum, frontem versus albo-pilosum. Antennae nigricantes fusco-pilosae (♀) vel fuscae, dense plumosae (♂). Palpi maxillares recti, nigri, argenteo-annulati (♀) vel fusci, sat dense villosi, apicem versus incrassati extrorsum divergentes (♂). Proboscis nigra, vel nigro fusca, apice albo. Oculi albo-marginati. Thorax suprâ fusco-castaneus, fere cervinus, longitudinaliter fusco-3-lineatus;

scutellum fuscum, fusco-setosum. Metanotum fusco-rufum. Pleurae obscure testaceae. Coxae flavidae. Femora nigra internè dilute flava, externe argenteo-semi-annulata. Tibiae nigrae albo-semi-annulatae (♀), vel fuscae, dense albo-argenteo-guttulatae (♂). Tarsi nigri vel nigro-fusci, albo-argenteo-annulati; articulo ultimo toto albo. Alae hyalinae sed nervuris reliquis alternatim aureo et nigro squamulatis confuse annulatis videtur. Abdomen fuscum, fusco vel flavido-fuscano-villosum. —Long. 7 mm.

"Hab. observ.: Resp. Arg. (Buenos Ayres, in Baradero et Las Conchas). (E. et F. Lynch A.)"

Concerning this species, Arribalzaga writes :—

"In April, 1878, I obtained a specimen (♀) of this beautiful species caught by my brother, but since then my collection has been enriched by not only some ♀'s but also by two ♂'s. It is a rare species even along the Paraná, from which river it seldom strays far away."

### 41. Anopheles albimanus. Wiedemann.

(Aussereurop. Zweiflüg. Ins. p. 12, Wiedemann; Stet. Ent. Zeitung, p. 338 (1885), V. von Röder.)

"Fuscous; abdomen with large, triangular grey spots; the wings with dark spots; apices of the tarsi snow-white. Length, $2\frac{2}{3}$ lines." "Apices of the palpal joints snow-white; each segment of the abdomen with a grey triangular spot, the apex of which is directed forwards. Costa of the wings dusky brown with yellowish intersections, which lie lengthwise; there are spots also on the inner edge and middle part of the wings, but much smaller."

Note.—I fully believe this must be *A. argyrotarsis*, but as the description differs slightly, and as I have seen no specimens from Hayti, I prefer to leave it as distinct until I see specimens from the locality where *albimanus* was described. (F. V. T.)

### 42. Anopheles annulimanus. Van der Wulp.

(Tijdschr. voor Ent. p. 127 (1867), Van der Wulp; Circ. 40, 2nd se. U.S.A. Dept. Agri. p. 4 (1889), Coquillett.)

"♂ Head dark brown; occiput with dense black hairs. Antennae whitish with brown rings, verticils light brown with yellow reflections, proboscis dark brown, one and a half times as long as the head and thorax, with lighter brown reflections above and at the tip; palpi brown, the two first joints deeper coloured; the second joint a little longer than the first, together as long as the antennae; the two last joints each as long as the

second, brownish yellow, together forming a flattened ellipse, sparsely beset with long hairs. Thorax; scutellum dark brown behind, with fine yellow hairs on the shoulders, near the root of the wings a small light grey border, which is somewhat bent outwards in the middle on either side; pleurae mostly clothed with light grey tomentum, abdomen proportionately short, grey-brown, hinder border of the segments dark brown, which is more obvious on the venter, where the ground colour is paler; claspers shorter than the last abdominal segment, with long curved points, abdominal tomentum moderately dense, blonde coloured. Legs dark brown, coxae and base of femora brownish yellow, apex of latter rather dark, so that the pale knee spot shows up more distinctly. Close to the base of the mid femora is a whitish ring, bounded on both sides by a deeper brown band; fore tibiae, except the basal third, whitish, with three darker brown rings, the last just before the tip, which is pale; the other tibiae are also white at the tips; hind legs long and slender, especially the tarsi, the first joint of which is a fourth longer than the tibia; halteres dark brown, stem and base paler than the knob. Wings longer than abdomen, with a slightly greyish tint; veins and scales brown; in the middle of the fore part of the wing, on the second long. vein, is a spot, and another a little further out above the small transverse vein; a second spot, both formed by accumulations of scales; upper basal cell longer than the lower."—North America.

Note.—Coquillett thinks this species does not belong to the genus *Anopheles* at all. The description, he seems to think, applies to a male *Culex consobrinus*, Desvoidy; but in this I can scarcely agree, and do not think such an authority as Van der Wulp would commit such an error. (F. V. T.)

### 43. Anopheles ferruginosus. Wiedemann.

(Aussereurop. Zweiflüg. Ins. p. 12 (1828), Wied.; Circ. 40, 2nd se. U.S.A. Dept. Agri. p. 4 (1889), Coquillett.)

"Ferruginous, abdomen fuscous, wings spotless.

"Antennae and palpi brown, the latter more dusky with a little white at the joints; thorax reddish-brown, but only in certain lights; if seen from behind whitish, and it then exhibits linear stripes, but looking backwards without stripes; abdomen dusky brown with yellowish hairs; veins of the wings with brown scales; halteres intense white with brown knobs; legs shorter than in *A. crucians*, brownish-black with yellowish femora." —New Orleans.

Note.—Coquillett strongly suspects that this is a rubbed specimen of *A. crucians*, but as Wiedemann points out the difference from that species, I cannot see that he is justified in

such a supposition. Nor do I think it synonymous with Say's *Culex quinquefasciatus*. On the other hand, I think it extremely likely my *A. Walkeri* is this species. (F. V. T.)

### 44. Anopheles Kumasii. Chalmers.

(*Lancet*, Nov. 1900.)

"It is a small black mosquito. The wings have four black spots on the costa separated by three yellowish spaces and distinct dark spots on the other veins scattered over the wing. The abdomen is black and not banded, but the posterior portion of each segment is darker than the anterior. The female is a small black mosquito 3·5 millimetres in length and having wings three millimetres long. The head is black with light-coloured hairs; the antennae have light-coloured joints; the palpi are black with three yellow marks; and the proboscis is black except at the apex. The thorax is slate-coloured with two dark lines dorsally and two slanting lines laterally. The hairs are light yellow. The wings are iridescent with four black spots on the costal margin and others scattered about on the veins. The four black spots on the costal margins are separated by yellowish spaces. Of these spots the first is the longest, extending along about one-third of the costal margin and the other three are much smaller. When examined closely these spots are seen to consist of two rows of dark scales situated on the costal margin and on the longitudinal vein directly below and parallel to it. In the first large spot these dark scales start from the junction of the wing and thorax on the costal margin, but on the vein only halfway along the line of costal scales. The abdomen is black without rings but with the posterior portion of each segment darker than the anterior. The legs are in general dark coloured; the femora are not yellowish at the base, and the tibiae are not yellowish on the outer side. The tarsi are ringed distally and proximally. The male is much the same as the female. Its length is four millimetres, and the length of the wing is three millimetres. Its habitat is in dwelling-houses in Kumasi, Ashanti, West Africa.

"Such is the brief and, I am afraid, imperfect description drawn from notes which I was able to bring from Kumasi in the march out. I regret that the times were not settled enough to make photographs of the mosquito in Kumasi. I was able to find its larvae on the margin of the marsh which nearly surrounds Kumasi."

Note.—The apical and basal banding of the tarsi seem to point to this being a new species. I have to thank the describer, Dr. Chalmers, who was through the siege of Kumasi, for this note of what I believe to be a new species. It might, however, be a variety of *A. funestus*. (F. V. T.)

## Sub-Family **MEGARHININA.**

### Genus 2.—**MEGARHINUS.** Robineau Desvoidy.

(Essai sur les Culicides, Mém. Soc. d'Hist. Nat. de Paris, iii. 1827, p. 412; Dipt. Exotica, i. pl. 1, fig. 1 (1838), Macquart; Proc. Linn. Soc. N. S. Wales, iii. p. 1720 (1889), Skuse; Règne Anim, v. 439; Cur et Latreille, p. 439 (1829); List of Diptera, Brit. Mus. i. 1 (1848), Walker; Dipt. Argentina, p. 31 (1891), Arribalzaga.)

Head clothed with flat scales only; thorax clothed with small spindle-shaped scales (Fig. 63, 9, c), rather broader ones at the sides and flat ones on the scutellum; abdomen clothed with flat scales densely packed (b); of a general brilliant and metallic colour. Proboscis long, curved downwards, often a little longer in the ♂ than in the ♀; antennae plumose in the ♂, in the ♀ pilose; in the ♂ the second joint is always very elongated and enlarged and densely scaled; palpi of the ♂ often a little longer than the proboscis; in the ♀ the same length or shorter; the ♀ palpi are 4 or 5-jointed; the apical joints seem to readily break off, so that the palpi seem short, and thus it is difficult to say if the specimen is a *Megarhinus* unless very carefully examined; in the ♂ the first joint is short, second longer, third and fourth long, of variable proportions; the last few (three as a rule) segments of the ♂ abdomen bordered laterally by dense hairs, often of brilliant colour; in the wings the fork-cells are very short, especially the first sub-marginal cell, the cross-veins being a long way distant from the bases of the cells, so that the stalks of the cells are very long; the supernumerary transverse is nearer the apex of the wing than the mid transverse, often six times its own length nearer the apex of the wing; mid and posterior cross-veins in one line or separate, or at an angle; wings not densely scaly, the scales along the costal borders, &c., often metallic (Fig. 67, a). Ungues of the ♀ equal and simple, of the ♂ unequal on the fore and mid and equal on the hind legs; the larger are always toothed.

This genus is the most beautiful of all the *Culicidae*, the greater number of its species are of brilliant coloration and have a curious caudal tuft of fine hair-like scales at the end of

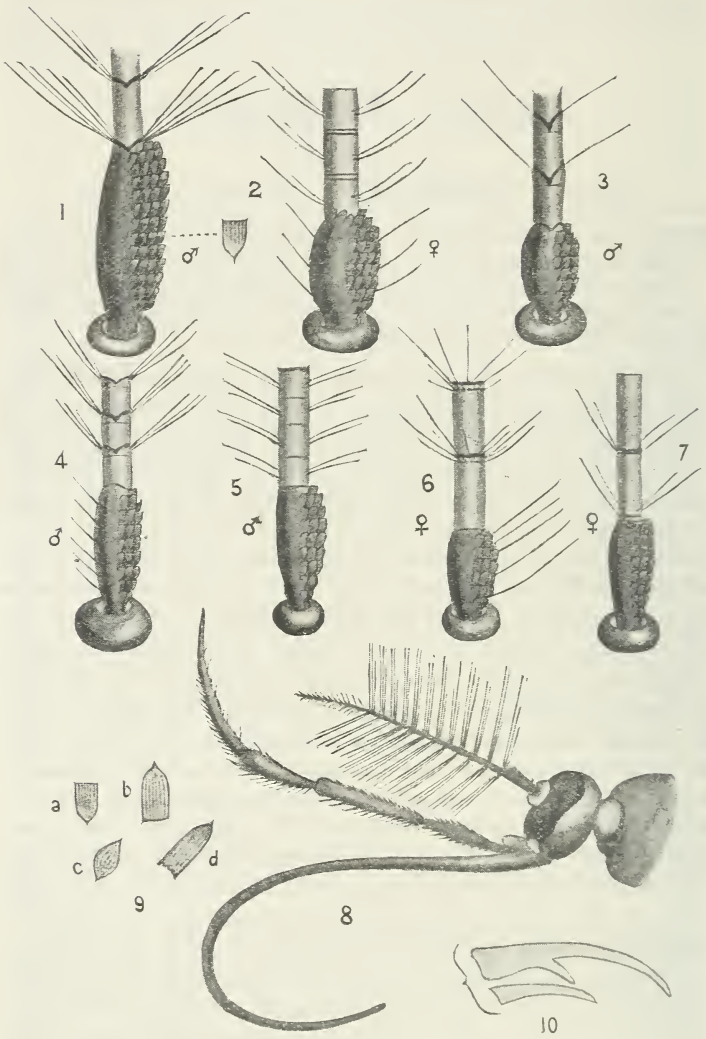



Fig. 63.

Genus *Megarhinus*.

1. *Megarhinus separatus* (♂). 2. *M. immisericors* (♀). 3. *M. inornatus*. 4. *M. Portoricensis* (♂). 5. *M. fercx* (♂). 6. *M. fercx* (♀). 7. *M. purpureus* (♀). 8. Head of ♂. 9. Scales: a, from base of antenna; b, from abdomen; c, from thorax; d, from base of thorax and scutellum. 10. Fore ungues of ♂. 1 to 7 = basal joints of antennae.

the abdomen on each side. The members of this genus cannot easily be confused with any others of the *Culicidae*, both on account of their larger size, brilliant coloration, and curious bent proboscis, whilst the palpi are always long in the ♂ and in the ♀, and are thus distinguished from my new genus *Toxorhynchites*, where the palpi of the ♀ are short and 3-jointed, but not nearly so short as in *Culex* and *Aedes*. It is erroneously supposed that they are not annoying to man and animals; several occasion severe irritation from their bites. Captain James, I.M.S., sends me the description of one (*M. immisericors*,

## Distribution of Megarhinus.

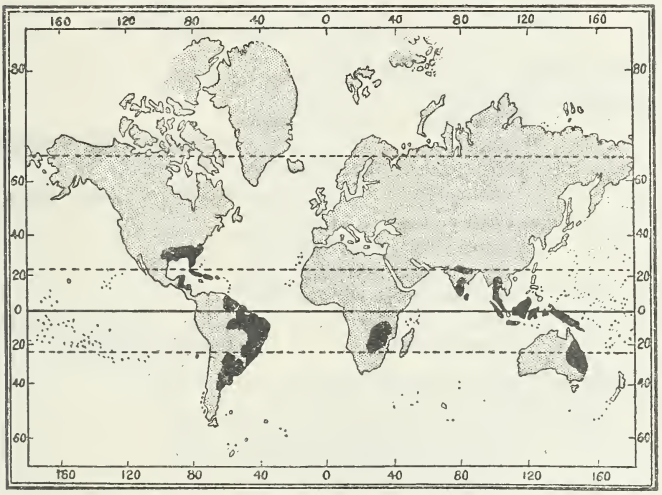



Fig. 64.

Wlk.) which is very troublesome in India; another comes in a collection from Mashonaland (*M. lutescens*, mihi), another (*M. speciosus*, Skuse) from Australia, and others have been received from New Amsterdam, amongst the collections of mosquitoes sent to the Museum. They are, however, not of much importance as mosquitoes, because they are not troublesome in habitations, being almost entirely sylvestrian in habits, and thus only annoying to travellers. The number of known species is small, fourteen only having been described, and to this number four new ones are added in this monograph.

The genus seems widely distributed in tropical and sub-

tropical climates, species having been recorded from N. and S. America, East and West Indies, Central Asia, India, Natal, Central Africa, and Australia. Specimens too denuded to identify have been sent from British Guiana and Zomba in British Central Africa. No less than six of the known species come from South America. The probability is that forest collecting would add many more species to this beautiful genus.

Nothing whatever is known of the life-history of these insects as far as I can find out.

At present the genus can only stand roughly, as I have had just enough material to find certain aberrations which may cause it to be considerably modified.

## SYNOPTIC TABLE OF **MEGARHINUS.**

A. Tarsi unbanded in ♂, banded in ♀.

(a) Caudal tuft red.

Third joint of palpus longer than 4th ..... *haemorrhoidalis.* Fabricius.

Third joint of palpus as long as the 4th ..... *separatus.* Arribalzaga.

(aa) Caudal tuft yellow and black.

Abdomen blue, purple and red; basal tarsal banding in ♀ distinct except on hind legs, where only the base of 1st tarsal is white ..... *inornatus.* Walker.

B. Tarsi more or less banded in ♂ and ♀.

(a) Caudal tuft black and yellow.

Abdomen blue and purple; 1st tarsal joint of fore and mid legs white, 2nd also of mid... *immisericors.* Walker.

Abdomen green and blue, with creamy-yellow lateral spots, 1st tarsal joint mostly white. *Gilesii.* n. sp.

Abdomen deep metallic blue, 1st segment green, with a yellow spot on each side; legs with the fore metatarsi and 1st tarsal white, in the mid the base of the metatarsus and all the 1st two tarsi white; in the hind legs the base of the metatarsus and all the 1st tarsal white... *speciosus.* Skuse.

* Since this was in the press, larvae and pupae of *M. Portoriccnsis* have been received.

Abdomen metallic purple, 1st segment peacock-blue, with apical lateral golden spots and golden venter; mid legs with 2nd and 3rd tarsi white beneath ..... *purpureus.* n. sp.

(aa) Caudal tuft steel-blue and white.
Abdomen steel-blue in ♂, green, blue and purple in the ♀; penultimate joint of hind tarsi white ..... *Portoricensis.* Von Roder.

(aaa) Caudal tuft yellow.
Abdomen golden green; 2nd tarsal joint of hind legs white ..... *lutescens.* n. sp.
Abdomen metallic green at the base, purple posteriorly; legs brilliant golden and green; fore metatarsus and 1st tarsus white ..... *splendens.* Wiedemann.

(aaaa) No caudal tuft visible.
Abdomen blue and green; thorax brown, with a blue median and lateral stripes; 1st and 2nd fore tarsi with a white band; mid with 3rd white, also 3rd in hind legs... *ferox.* Wiedemann.

C. Tarsi not banded with white.
No caudal tuft.
Thorax brown, with bronzy and green scales, green ones lateral; abdomen with metallic olive-green scales, 1st segment blue, venter golden *longipes.* n. sp.

### 1. Megarhinus separatus. Arribalzaga.

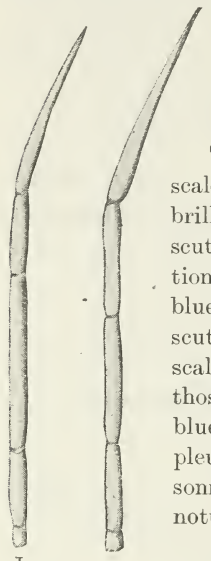
(Dipt. Arg. p. 33 (1891).)

(Fig. 27, Pl. VII.)

Thorax brown, with spindle-shaped, metallic bronze scales, azure blue over the wings; abdomen violet, purple and coppery red, caudal tuft red and black; legs unbanded in the ♂, in the ♀ the first hind tarsal and part of the second white.

♂. Head covered with small flat scales, brilliant metallic blue in front, duller behind, violet at the sides; eyes with a

golden sheen ; antennae with the basal joint nude, steel coloured, next joint densely scaled with long scales, many azure blue in colour ; this second joint is long, equal to about four of the following articulations, with short pilosity ; rest of the antennae brown, with dense brown plume-hairs, with a golden reflection in some lights ; palpi as long again as the antennae, metallic blue and purple, 5-jointed, the last joint long and pointed, penultimate joint short and thick, with a few short bristles, about one-third the length of the last, antepenultimate about the same length, slightly thicker the next half its length, and the first very small ; the four basal joints have golden scales below ; proboscis long, curved, covered with small bronzy scales.



I II

Fig 65.

Male palpi of I, *Megarhinus haemorrhoidalis* ; and II, *M. separatus*. (X. 12.)

Thorax brown, with small spindle-shaped scales, metallic bronze in colour, some with brilliant blue reflections ; those in front of the scutellum flat and showing azure blue reflections ; prothoracic lobes covered with flat azure blue scales, with a border of black bristles ; scutellum dull honey yellow, covered with flat scales, those on the lateral lobes azure blue, those on the mid lobe brown, but bright azure blue in some lights, border-bristles golden-brown ; pleurae ferruginous, with small white scales, some showing metallic violet reflections ; metanotum small, partly hidden, yellowish-brown.

Abdomen completely covered with flat scales, which, when examined facing the light, appear dark and bright almost metallic brown, but when the abdomen is pointed from the light, metallic purple, violet and coppery red, the caudal tuft composed of brilliant red dense hairs, attached chiefly to the sides of the sixth and seventh segments, last segment with a smaller tuft on each side below ; where the scales are denuded, ferruginous patches appear.

Legs moderately thick, covered with metallic blue and purple scales, looking quite black in some lights, the scales of the venter of the femora and tibiae being coppery in hue, in the fore and mid legs the metatarsus about half the length of the tibia, third tarsal joint small ; in the hind legs the metatarsus is as long as the tibia, and the third tarsus not small ; ungues of the fore and

mid legs unequal, the large one toothed; in the hind legs equal and simple.

Wings with the veins covered with small, but rather broad scales, some in the form of elongated triangles, brown, with here and there azure-blue ones; first sub-marginal cell very small and the branches widely divergent, its stem very long, joining the first long vein a little way past the supernumerary cross-vein; second posterior cell about twice the length of the former, its stem about twice as long as the cell and carried past the cross-veins into the basal cell; mid cross-vein small, some distance nearer the base of the wing than the supernumerary, posterior cross-vein long and joining the mid cross-vein; base of the wings bright ferruginous.

Halteres with ferruginous stem and fuscous knob.

*Length.*—10 to 11 mm., with palpi, 19 mm.

♀. Head with metallic green scales in the middle, blue in front and purple at the sides; antennae dark brown, basal joint rotund, small and nude, steely black, with grey reflections, rather longer than the first four joints of the palpi; palpi covered with steel-blue scales, the third joint nearly twice as long as the second, the latter about equal to the fourth (last missing); proboscis long coppery brown.

Thorax dark brown, covered with olive-green scales; prothoracic lobes with blue scales; pleurae brown, with silvery scales; scutellum and base of the mesonotum with flat azure-blue scales, a small dense tuft of brown bristles over the roots of the wings; metanotum chestnut-brown.

Abdomen with green, dark blue, purple, and then coppery-red scales, some white in the middle, with lateral, red, caudal tufts, sides with metallic golden and azure patches.

Legs metallic blue and purple; in the hind legs the first tarsal joint and part of the second are white; hind metatarsus not quite as long as the tibia; hind ungues simple and equal, fore and mid legs damaged; wings with the veins clothed with purple scales, dusky along the costal border, the first sub-marginal cell *very* small; mid and posterior cross-veins united, forming a widely obtuse angle; halteres pale, with slightly darker knob.

*Length.*—8 to 9 mm.

*Habitat.*—Para, Brazil (Walker); Cayenne; Chaco in Formosa; Argentina; Rio de Janeiro (Lutz); Lower Amazon (Austen, 96, 80).

*Observations.*—This species was instituted by Arribalzaga for a closely related insect to the following. I find the two, *M. separatus* and Fabricius' *M. haemorrhoidalis*, in the same series in the old British Museum collection under the name *haemorrhoidalis*. Although the resemblance is very striking, I think the two species are undoubtedly distinct, the distinguishing character being that the third and fourth joints of the palpi are nearly equal in this species, but in *haemorrhoidalis* the third is much longer than the fourth. It seems to be the commoner of the two species, specimens having been received from widely separate areas. I feel pretty sure that the ♀'s described here are of this species, although they were placed as unnamed distinct species in the collection by Walker. The two ♀'s differ slightly from one another, one having the basal half only of the first tarsal joint white.

A specimen from the Lower Amazon bears a label with "said to bite very badly" on it.

Arribalzaga's specimen was brought from Formosa (Chaco) by Dr. E. L. Holmberg. Arribalzaga says: "None of the specimens which I have examined have the slightest trace of the white silvery ring on the second tarsal joint seen in the two ♀'s (*haemorrhoidalis*) by M. Macquart." I have observed the white in *separatus* in the ♀ myself, but not in the ♂. But as the specific difference lies in the palpi no attention need be paid to minor details of colour. From Macquart's figure of the ♂ and ♀ he had evidently the two species before him.

### 2. Megarhinus haemorrhoidalis. Fabricius.

(Ent. Syst. iv. 401, 5 (1794), Fab.; Syst. Antl. iv. 25 (1805), Fab.; Dipt. Exotica, i. 6, Wied. (1821); Auss. Zwei. Ins. 2 (1828), Wied.; Hist. d. Dipt. Suit. Â. Buff. i. 33 (1834), Macq.; Mém. Soc. d'Hist. Nat. de Paris, iii. p. 412 (1827), Rob. Desv.; List Dipt. Brit. Mus. i. p. 1 (1848), Walker; Fn. Iruqui. Studi. Entom. p. 108, Rondani; Dipt. Argentina, p. 32, Arribalzaga.)

Very like the previous species, but with the third joint of the palpus longer than the fourth joint.

I have not seen a fresh specimen, but I find two broken specimens in the collection mixed up with the former species.

Fabricius' description is as follows:—

"Fuscous, abdomen at apex, with reddish cilia, very large for this genus; antennae very densely verticillate pilose; fuscous with the first joint nude,

glistening blue; head fuscous, glistening blue on the apex; thorax elevated, fuscous, with anterior margin and a spot in front of the wings glistening blue; abdomen fuscous, apex strongly rufous-ciliate; feet blue, metallic, femora testaceous beneath; antennae fuscous; palpi steel-coloured; frons and vertex glistening emerald green and copper; thorax steel grey and glistening green; pleurae ferruginous; scutellum dull yellow; abdomen steely with ferruginous spots on either side and forming an interrupted median line, sides with silvery spots, apex with blood-red cilia; venter silvery with yellowish tomentum; legs steely, femora silvery below."

*Habitat.*—South America.

### 3. Megarhinus inornatus. Walker.

(Proc. Linn. Soc. Lond. viii. p. 102.)

(Figs. 25 and 26, Pl. VII.)

Thorax dark brown, almost black, with bright bronzy scales, azure ones over the roots of the wings. Abdomen blue at the base, then purple, then coppery-red, with caudal tuft of black and orange hairs, white tufts anterior to it. Legs of ♂ purple, femora pale below; in the ♀ the tarsi are basally banded white and also the metatarsi in the fore and mid legs.

♂. Head dark brown, with flat metallic bronzy scales, becoming dark peacock blue in front and showing metallic coppery and red tints at the sides; palpi purplish, the penultimate joint half the length of the apical one; antennae brown, basal joint black, the second joint equal to one and a half of the following joints, scaled with metallic and yellowish scales; proboscis metallic black to purple.

Thorax dark brown, almost black, with bright bronzy scales, traces of azure ones over the roots of the wings; prothoracic lobes with azure flat scales; pleurae brown, with numerous white scales.

Abdomen livid, as described by Walker, when denuded, but covered with blue scales on the first two segments, brilliant purple on the next three, and the rest purple and coppery red; caudal tuft composed of a small white tuft on each side of the sixth, a dense one of a black and coppery hue on the seventh, and of an orange and then black colour on the eighth.

Legs with the femora pale below, remainder covered with purple and violet scales and dark bristles. Wings with the veins

ferruginous, metallic blue and azure scales on their roots and on the costal and first long. vein (denuded); the mid cross-vein small, not meeting the posterior cross-vein. Fore and mid ungues unequal, the larger ones with a single tooth, the smaller simple; hind ones equal.

*Length.*—11 mm.

♀. Head as in the ♂; antennae dark brown, basal joint chocolate brown with grey reflections, base of the second joint ferruginous; palpi covered with almost black scales, the apices of the second and third joints brilliant blue and violet; proboscis long and curved, with metallic purple and black scales.

Thorax much as in the ♂, traces of broad flat green and blue scales over the roots of the wings; scutellum with blue, violet and green scales, the latter towards the base; pleurae brown, with silvery scales in dense patches.

Abdomen covered with metallic blue and purple scales.

Wings with the veins clothed with azure-blue and brown scales; the mid cross-vein small, and some distance nearer the base of the wing than the posterior cross-vein.

Legs with tarsi banded with white scales; in the fore legs the metatarsus is all white except a small ring at its base, the first tarsal joint white on the basal half, remainder of tarsi purple scaled; in the mid legs the base of the metatarsus and the whole of the first tarsal joint pure white, and in the hind legs the base of the first tarsal joint only white; ungues equal and simple; the femora are pale ventrally.

*Length.*—11 mm.

*Habitat.*—New Guinea.

*Observations.*—Redescribed from two specimens in the British Museum, one presumably Walker's type of the ♂ described in Proc. Linn. Soc. Lond. viii. p. 102. A female is placed with it with broadly banded tarsi, the bands of white being basal. They both come from New Guinea, and are evidently a ♂ and ♀ of the same species. The caudal tuft is clearly yellow and black, although no mention is made of it in Walker's short description.

I am not certain if the ♀ has broken palpi or if they are 3-jointed, but fancy it is a *Megarhinus*.

4. Megarhinus immisericors. Walker.
*Culex Regius.* Thwaites.
the "Stinging Elephant Mosquito."

(Jour. Proc. Linn. Soc. Lond. iv. p. 91 (1860); et vii. p. 202.)

(Fig. 28, Pl. VII.)

Thorax black, with coppery-green scales and azure-blue ones over the roots of the wings. Abdomen bright metallic purple and blue, with bronzy, black and yellow caudal tufts, white lateral tufts in front. Legs purple, first tarsal joint mostly white, mid tarsi with two white bands.

♂. Head covered with flat azure blue metallic scales in front, coppery-red and green behind; antennae brown, with brown plumes, basal joint nude, steely black, second joint large, about equal to the two following, with metallic blue broad scales above, pale ones beneath, joints of the flagellum with pale narrow bands and flaxen-brown plumes, the verticils arising from the middle of the joints; palpi covered with deep metallic purple scales and with some white ones in the two basal joints, last joint about one-third longer than the penultimate, the penultimate and antepenultimate nearly equal; proboscis with purple and coppery scales.

Thorax black, densely clothed with coppery-green spindle-shaped scales, a patch of broader azure-blue ones over the roots of the wings and a few before the scutellum, a dense tuft of black bristles over the roots of the wings as well; scutellum entirely clothed with flat scales, brown, green and blue in some lights, those on the posterior border almost white, forming a white line in some lights, bristles black, border of the scutellum almost straight; metanotum small, dark brown; pleurae black, with white scales; prothoracic lobes with metallic blue scales.

Abdomen covered with bright metallic purple and blue scales, the sixth and seventh segments with bronzy and black lateral tufts, the eighth with golden yellow lateral tufts, small tufts of white hairs on the two preceding segments.

Legs metallic purple, the first tarsal joint almost entirely white, just a small dark apex and base.

Wings with the veins brown, and with metallic, azure and purple scales along the costal, sub-costal and first long vein.

*Length.*—11 mm.

*Habitat.*—Makessar in Celebes, Weigiou, Mysol and North Ceram; Ceylon, Travancore (James), Malay Peninsula, Nilghirri (Hampson); Trincomalie, Hot Wells (Yerburgh); and Ceylon (Green)

*Time of capture.*—Ceylon, in April (Green); Trincomalie, in July and August (Yerburgh).

*Observations.* — This species was described by Walker in 1860, and I believe that the specimen from which this description is taken is the type, although it will be seen to not entirely agree with Walker's description, which is appended below.

The specimen in the British Museum is still fairly well preserved and is here figured. I fail to see that the caudal tufts consist of dark metallic blue, &c., as described by Colonel Giles; * it is certainly black and golden. Walker's † description is as follows:—

"Male, black; head and thorax with metallic green scales; proboscis, palpi and legs purple; femora tawny beneath; middle tarsi with two white bands; hind tarsi with one white band; pectus silvery; abdomen blue, widening from the base to the tip, with small white tufts of hairs along each side; four larger black sub-apical tufts, two gilded apical tufts. Wings slightly greyish, blackish along the costa; veins black. Length of body, 5 lines, of wings 8 lines."

Besides the type, I have examined a number of other specimens, both ♂ and ♀, from various parts of Asia, where it seems to be a very plentiful species, occurring from Ceylon, through India, and down the Malay Peninsula to the East Indian Islands.

Captain James tells me it bites very severely in S. India, and that its bite is very poisonous. It is known to the natives as the "Stinging Elephant Mosquito." I believe Thwaites' *C. Regius* of Ceylon is this species.‡ Specimens of *immisericors* in the Hope Collection bear Thwaites' name on the labels and come from Ceylon. I have been unable to find his description of *M.* (*C.*) *Regius*.

* Hd.Bk. of Gnats, p. 130.
† Journ. Proc. Linn. Soc. Lond. iv. p. 61 (1860).
‡ Nat. Hist. of Ceylon, Tennant, p. 434 (1861).

5. Megarhinus Gilesii. n. sp.

(Fig. 33, Pl. IX.)

Thorax dark brown, with coppery scales, yellowish scales at the sides and white ones on the pleurae ; abdomen deep greenish-blue on the basal segments, blue on the apical segments, with creamy yellow lateral spots ; caudal tuft of orange and black. Legs in ♀ with the first tarsal joint mostly white ; fore legs unbanded in the ♂.

♀. Head dark brown, with brown and metallic coppery scales, a pale border round the eyes ; eyes black, with a golden-green tinge ; proboscis deep black, metallic ; palpi damaged, the basal joints covered with metallic purple scales ; antennae brown, basal joint black, with a rim of pure white scales, second joint testaceous, about equal to one and a half of the following joints.

Thorax dark brown, with spindle-shaped, coppery scales with a faint greenish tinge, more yellowish at the sides and in front ; pleurae black with white scales, which extend in front up into the sides of the mesonotum ; scutellum with small, flat, iridescent scales, becoming much larger at the sides and forming a white border along its posterior edge. Abdomen metallic-green basally, the last two segments violet-blue, with large yellow lateral patches, three in number, and also numerous creamy scales, forming more or less lateral patches on the first segment ; caudal tuft composed of orange and black scales, the black being central ; there are also small, pale, creamy, lateral tufts on other parts of the abdomen in front ; venter mostly creamy-yellow. Legs yellowish-brown with purple and coppery lustre, the front metatarsi and bases of the first fore tarsi appearing white in some lights, yellow in others ; in the mid legs the metatarsi and most of the tarsi with a white sheen in certain lights, and sometimes the tibiae seem bright pale golden ; in the hind legs the first tarsal only is white ; ungues equal and simple. Wings yellowish-brown, and present no noticeable deviation from a typical *Megarhinus*.

Halteres pale ochraceous.

*Length.*—10 mm.

♂. Antennae brown, with dark flaxen-brown plumes ; palpi and proboscis bronze ; abdomen purple and violet ; caudal tuft creamy, black and then orange ; basal joints of genitalia red ; fore legs deep bronzy-brown, no trace of banding ; mid legs with

a white sheen at the base of the metatarsi and first tarsal joints, hind legs as in the ♀ ; ungues of the fore and mid legs unequal, the larger one with a large tooth, the smaller simple; hind ungues equal, simple.

*Length.*—11 mm.

*Habitat.*—Upper Burmah (Watson); Sikkim (Dudgeon) (96, 233); Ceylon (Thwaites, taken in 1877, Hope Collection, Oxford).

*Time of capture.*—April in Burmah, June in Sikkim.

*Observations.*—Described from three ♀'s and a ♂ from Burmah and a ♀ from Sikkim. The latter specimen was taken at 1,800 feet altitude. The second and third palpal joints in the ♂ are nearly equal.

Giles referred to this as a probable new species in his "Handbook." I cannot identify it with any previous description. The green and blue abdomen of the ♀, with the creamy lateral spots, is very characteristic. The legs seem very changeable in different lights, but the white band on the hind legs is always clearly defined.

6. Megarhinus speciosus. Skuse. (W. Macleay, MSS.)

The following is Skuse's description taken from the Proc. Linn. Soc. N. S. Wales, p. 1722 :—

| | | |
|---|---|---|
| "♂.—Length of antennae | ... 0·160 inch | ... 4·06 millimètres. |
| Expanse of wings | ... 0·330 × 0·060 | ... 8·39 × 1·54 |
| Size of body | ... 0·440 × 0·080 | ... 11·17 × 2·02 |

Antennae brown, a little more than half the length of the palpi; basal joint black, with hoary reflections; second joint more than twice the length of the third, ornamented with some beautifully iridescent scales, the whorl of very long hairs situated about one-third from the apex. Head covered with brilliant margaritaceous scales, chiefly reflecting green; in a certain light appearing brown with a bright pale greenish line round the hinder border of the eyes. Proboscis (0·300 in.) somewhat longer than the palpi (0·285 in.), deep metallic blue, with a purplish reflection before the bend, brown beyond. Palpi deep metallic blue, with purplish reflections, the third joint ringed with golden-yellow at the apex (this is much more distinct underneath), and the fourth joint with a broader ring of the same beyond the middle. Thorax brown, the lateral margins and prothorax densely covered with pale greenish scales, the later with long brown hairs; hinder margin and scutellum richly adorned with brilliantly iridescent scales and long brown hairs; pleurae with a naked brown stripe from the origin of the wings to the scale-like

prothoracic projection, below this densely covered with silvery scales; metanotum brown, naked. Halteres ochre-yellow. Abdomen about twice the length of, but narrower than the thorax, flat, deep metallic blue, except the first segment, the latter green with a yellow patch on each side; fifth segment showing some golden-yellow laterally, sixth and eighth segments ornamented with a strong tuft of golden hair laterally, the seventh with black tufts; all the segments slightly bordered with golden hairs laterally; the first to third and fifth to seventh segments golden-yellow beneath with a metallic blue longitudinal stripe down the centre, fourth entirely metallic blue, and the terminal one brilliant pale green. Coxae clothed with silvery scales. Femora and tibiae metallic violet, the former golden-yellow beneath. In the intermediate and fore legs (the hind legs wanting below the tibiae in the specimen before me), the first joint of the tarsi white except at the base, and the second also except at the apex; the rest metallic violet. Wings longer than the abdomen, with a pale brownish tint anteriorly and along the fifth longitudinal vein, veins pale brown, cilia pale and short; weak reflections. Auxiliary vein joining the costa almost opposite but somewhat beyond the posterior branch of the fifth longitudinal; sub-costal cross-vein distinct, situated about mid-way between the origin of the anterior branch of the fifth longitudinal vein and the origin of the second longitudinal; fork of the latter very small, the tips of the branches slightly bent anteriorly; supernumerary cross-vein equal in length to the middle cross-vein; posterior cross-vein more than twice the length of the latter, rather sinuose, tip of the anterior branch of the fifth longitudinal vein joining the margin opposite the middle of the second posterior cell, a very prominent wing-fold running close to the posterior side of the fifth longitudinal for the whole of its length, and another on the anterior side in the anal cell.

*Habitat.*—Port Denison, Queensland (Masters).

*Observations.*—The above is taken from a single ♂ specimen whose hind legs are lost beyond the tibiae, and whose thorax is perhaps partly denuded. There is also a ♀ specimen in the Macleay collection taken by Mr. Masters about twenty years ago near Sydney; it seems to me to belong to this species, but it is too abraded to satisfactorily decide. I do not know of any other captures of specimens of this genus in Australia, and I have never yet had the fortune to see a living example of these evidently scarce and extremely magnificent insects."

Note.—Specimens of this species have been received from Dr. Bancroft from Queensland, but in too damaged a condition to make use of. Three other specimens, two ♂'s and one ♀, have also been received from Mackay, Queensland, from Mr. G. Turner, all in poor condition, but enabling me to complete Skuse's description of the hind legs.

The legs are, I find, ornamented as follows: the fore legs

have the femora and tibiae deep violet and blue, the metatarsus white, except just at the base, the first tarsal all white, the second, third, and fourth dark brown, a trace of white at the base beneath the second joint; in the mid legs the femora are steel-blue, green and violet, golden beneath; tibiae yellow scaled, black at the apex and base, the metatarsi with a broad white basal band, metallic black apically, first and second tarsal joints white, third and fourth small, the latter brown, the former brown with a white basal band; in the hind legs the femora are metallic black, blue, violet and golden beneath; tibiae very metallic purple, with a golden-yellow band in the middle; metatarsus brilliant purple, base with a narrow white band; first tarsal entirely white except just at the apex, last three joints dark metallic purple. Ungues in the ♀ all equal and simple; in the ♂ they are all unequal, the larger one with a tooth, which is shorter and blunter on the hind pair; the small ungues simple.

### 7. Megarhinus purpureus. n. sp.

(Fig. 35, Pl. IX.)

Thorax chestnut-brown, with a median azure-blue line and azure-blue scales at the sides, deep blue in front of the scutellum; scutellum with pale blue scales; abdomen metallic purple, first segment peacock blue, with apical lateral golden spots and golden venter. Legs dark, with some deep purple reflections, no white on fore legs, the mid feet have the second and third tarsi white beneath (hind tarsi missing). Wings with the supernumerary cross-vein about twice its own length from the mid cross-vein, and the posterior cross-vein joining the latter.

♀. Head with numerous azure-blue scales (partly denuded and mouldy); an azure-blue border to the eyes; the basal joint of the antennae black, with grey tomentum; second joint black scaled, large, equal to about one and a half of the following joints, densely pubescent; palpi purple and violet, apices of the joints pale mauve, only four distinct joints, the second joint a little more than half the third, the third about two-thirds the length of the apical joint, which is dark; proboscis dark, much curved.

Thorax dark brown, with chestnut-brown scales, darker in front than behind, a median azure-blue line, azure-blue scales at the sides of the mesonotum, especially prominent at the roots

of the wings, and brilliant blue and purple in front of the scutellum; sides of the mesonotum in front with a reddish-brown patch beneath the azure-blue band, then a grey-scaled patch, whilst in front lies the mauve-scaled prothoracic lobe on either side; scutellum brilliant blue scaled; pleurae yellowish-brown with white scales; metanotum pale chestnut-brown.

Abdomen brilliant purple, first segment pale peacock blue; the segments with apical golden lateral spots; ♀ venter dull golden; there are traces of yellow and black caudal ornamentation, yellow hairs on the penultimate, black on the apical segments.

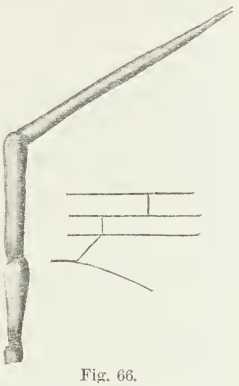


Fig. 66.
Palpus and cross-veins of *Megarhinus purpureus*.

Legs steel blue, with purple reflections; the mid legs with white on one side of the first and second tarsal joints; hind legs with the third and fourth joints absent, no trace of white on the front legs or remaining parts of the hind. In another specimen the third hind tarsus is white on one side, the last joint is absent; fore and mid ungues equal, simple, nearly straight.

Wings with a brownish tinge, steel-blue scales on the roots of the veins and on the costal border and first long vein; first sub-marginal cell very small; supernumerary cross-vein a little more than twice its own length distant from the mid cross-vein (nearer the apex of the wing); posterior cross-vein close to the mid cross-vein, long, sloping towards the base of the wing.

*Length.*—8 to 8·5 mm.

*Habitat.*—Amazon (Bates), 1861.

*Observations.*—Described from two ♀'s in the Hope Collection at Oxford University. It resembles *M. ferox*, but can at once be told by the abdomen being brilliant purple instead of steel blue, with apical yellow bands, and by the four, not five, jointed palpi. The venation also differs in regard to the position of the cross-veins.

8. Megarhinus Portoricensis. Von Röder.

(Ent. Zeit. Stetin, p. 337 (1885), Von Röder; Trans. Ent. Soc. Lond. p. 271 (1896), Williston.)

(Fig. 32, Pl. VIII.)

Thorax brown, with dull bronzy and golden-green scales, and one azure patch over the roots of the wings and at the sides. Abdomen steel-blue in the ♂, greenish-blue and purple in the ♀, with lateral, creamy white patches and golden venter. No traces of caudal tufts left (described as being steel-blue and white). Legs steel-blue, golden beneath the femora, penultimate tarsal joint white.

♂. Head dark brown, with a shiny white border round the eyes and with white scales at the sides of the head, two more or less distinct small azure spots in front and a few golden-brown bristles projecting forwards; antennae brown, the basal joint nude, black with cinereous lustre and a cinereous ring around the base, the second joint long, equal to three of the following, with numerous metallic and yellow scales; palpi rather thick metallic purple and blue; the penultimate as long as the last joint, the antepenultimate slightly longer than the penultimate; proboscis long, steely-black; eyes with a pale golden lustre.

Thorax brown, with small, bronzy and dull golden-green scales, an azure patch of flat scales over the roots of the wings, and those of the sides of the thorax with an azure reflection; prothoracic lobes covered with azure-blue scales; scutellum dark brown with white and azure-blue and bronzy scales; metanotum small, chestnut-brown; pleurae dark brown, with a large silvery-white patch above the coxae.

Abdomen covered with brilliant steel-blue scales above, creamy-white to golden patches along the sides, not showing above, venter bright, with pale golden scales; caudal tufts not present. Legs steel-blue to brilliant purple; femora golden beneath, hind legs long, the penultimate tarsal joint white, except a small dark basal spot; anterior and mid ungues steel-blue, unequal, the larger ones uniserrated; hind ones equal and simple, small.

Wings yellowish, with the costal, sub-costal, first long vein and the bases of the others with metallic violet scales; first sub-marginal cell very small and narrow; supernumerary cross-vein vertical, about five times its length nearer the apex of the wing

than the mid cross-vein, the latter small, forming a very obtuse angle with the posterior cross-vein; halteres with pale stem, pale scaled knob slightly fuscous inside.

*Length.*—9 mm.

♀. Head covered with bronzy, green and blue flat scales, the blue forming a border round the eyes; palpi long, with black scales showing purple reflections, the apices of the joints very brilliant mauve as in the ♂, a few silvery-white ones at the sides, second and fourth joints about equal, the third twice as long as the second (last joint missing); antennae brown, densely pilose, basal joint nude, black with cinereous reflections; eyes bronzy.

Thorax with greenish-coppery scales, prothoracic lobes with azure-blue scales, also over the roots of the wings and a few at the sides and at the back; scutellum covered with flat azure-blue scales; metathorax chestnut-brown; pleurae black with silvery-white scales.

Abdomen with the basal segments covered with green scales, the apical ones with blue and purple scales; there are also small, white, apical, lateral spots. Wings with azure-blue scales towards the base, mauve ones on the costa and first and second long veins towards the middle.

*Length.*—8 mm.

*Habitat.*—Georgia; St. Domingo, Para (Walker); Porto Rico (V. Röder); St. Vincent (Williston). Coquillett also gives Benoit, Mississippi.

*Time of capture.*—Mississippi in July.

*Observations.*—Described from two ♂'s and one ♀ specimen in the British Museum collection, evidently named by Walker; one was placed as *M. ferox*, Wied., from Georgia, another specimen I find unnamed from Para, and another from St. Domingo. The single ♀ rather damaged. The penultimate tarsal joint of the hind legs only is white in this species, and thus can be easily told from the closely related *M. ferox*, Wied., or *M. Gilesii*, mihi, or *M. immisericors*, Wlk.

### 9. Megarhinus lutescens. n. sp.

(Fig. 29, Pl. VIII.)

Thorax brown, with small dull bronzy scales above and broader mauve and green ones at the sides, and an azure patch over the roots of the wings; pleurae yellowish, darker in the

middle, with a line of silvery scales. Abdomen covered with golden-green scales, and with golden caudal tufts on the sixth and seventh segments. Legs black, with coppery-green and purple metallic reflections, and golden-yellow bases to femora; second tarsal joint of hind legs white.

♂. Head covered with flat bronzy-green scales, and a narrow line of blue ones in front; palpi covered with coppery-green and golden-green scales, dark mauve towards the apices of the joints, the extreme apices with a narrow mauve band, last joint all mauve; the first four joints yellow beneath, the apical one darker than the rest, the second and fourth joints about the same length, the third a little longer than the other two, apical joint more than twice the length of the penultimate joint; antennae brown, with dense brown plumes, basal joint steely-black with cinereous reflections, second joint equal to about three of the following, densely scaled; proboscis almost black with bronzy reflections.

Thorax dark brown, covered dorsally with small dull bronzy scales, laterally with rather broader flat mauve and green scales, a small azure patch over the roots of the wings; prothoracic lobes covered with flat scales, appearing bronzy-green in one light, mauve in another; scutellum ferruginous (denuded), but there are traces of green and blue flat scales, bordered with short golden-brown bristles; metanotum testaceous-brown; pleurae yellowish above and below, dark in the middle; the scales above and below are yellowish, those in the middle form a silvery-white irregular line.

Abdomen steely-black, densely covered with flat golden-yellow metallic scales, the sixth and seventh segments with dense lateral patches of deep golden hairs, the basal joints of the genitalia covered with golden-green flat scales, the claspers dark brown; venter golden scaled, a few scales with pale apple-green reflections in the middle of the sterna.

Legs black, with coppery-green metallic reflections when viewed in one light, purple in another; basal half of the hind femora golden yellow, bases of the fore and mid femora of a similar golden hue, in some lights there is a mauve knee-spot; the second tarsal joint in the hind legs nearly all white, there being a small dark apical band; fore ungues unequal, the larger one toothed, the smaller simple, in the mid and hind legs equal and simple.

Wings iridescent, scales at the base of the veins metallic

green, on the costa and on the first two long veins are azure and black scales; venation typical.

*Length.*—7·5 mm.

*Habitat.*—Salisbury, Mashonaland (G. A. K. Marshall) (79).

*Time of capture.*—June.

*Observations.*—Described from a single ♂ only in nearly perfect condition. This is a very beautiful species, with a great play of colours, the golden abdominal scales appearing like burnished brass in some lights, orange or yellow in others; the yellow caudal tuft and yellow body should separate it at once from other species.

(In the figure, Plate VIII., the dark apical band to the second hind tarsal joint is too broad.)

### 10. Megarhinus splendens. Wiedemann.

*Culex splendens.* Wiedemann.

(Dipt Exot. p. 7, Wiedemann; Zool. Mag. iii. 2, No. 1, Wiedemann; Reise de Novara. 31, Schiner; Dipt. de Mid. Sumatra, p. 8, Van der Wulp.)

(Fig. 31, Pl. VIII.)

Thorax black, with metallic golden and green scales; pleurae black, densely white scaled. Abdomen metallic green at the base, purple posteriorly, with dense golden-orange caudal tuft and white hairs laterally. Legs brilliant golden and green, apices of the joints rich green, metatarsi and tarsi partly white.

♀. Head brown, covered with pale green, blue and metallic coppery scales; antennae brown, basal joint black with frosty tomentum around its summit; second joint about the same length as the third, with creamy golden scales; proboscis metallic black, with iridescent scales; mesothorax black, with golden, brown, metallic green and blue scales, particularly brilliant over the roots of the wings, bright golden and green near the scutellum, which is covered densely with broad golden scales; pleurae black, with dense flat shaggy white scales; prothoracic lobes with pale green and metallic scales; scutellar bristles bright brown; there are also many long ones over the roots of the wings.

Abdomen brilliant metallic green, the apical segment deep violet, traces of a golden line on either side, and the anterior segments golden-brown in the middle in some lights; sides of

the abdomen with white hairs, caudal tuft dense, brilliant golden-yellow, almost orange.

Legs most brilliant, golden, and deep clear green and purple; fore legs with the femora and tibiae rich golden-green, pale golden beneath the femora; metatarsus and first tarsal white, second tarsal deep green; mid legs much the same but with more brilliant golden reflections and the basal part only of the metatarsus white beneath (rest missing); hind legs with brilliant golden femora and tibiae, deep metallic green at their apices; hind metatarsi golden at the base, then deep green (tarsi missing).

Wings brownish, with deep golden-brown veins; supernumerary cross-vein about four times its own length nearer the apex of the wing than the mid cross-vein, which is close to the long sloping posterior cross-vein. Halteres ochraceous, fuscous at the knob.

*Length.*—10·5 mm.

*Habitat.*—Java, Sumatra, Batavia (Wiedemann, Schiner, Van der Wulp); Singapore (Wallace).

*Observations.*—Described from a specimen so named in Bigot's collection. It is one of the most beautiful *Megarhina*s I have seen; unfortunately the legs are not perfect. I think there can be no doubt as to its identity. All three previous descriptions differ in some details, so that the minor differences I detect can be of no account when we consider the diverse shades of colours exhibited by each specimen of this genus when examined in different lights.

Wiedemann's original description is based on a ♂ specimen; it is as follows: "Antennae deep fuscous; palpi steely, made up of four nearly equal joints, the fifth subulate and destitute of hairs; head with metallic green and golden scales; pleurae whitish, shaggy; abdomen steely; bases of the segments violescent; venter golden on either side; laterally with whitish cilia; anal end with golden cilia; wings slightly yellow, with dusky-yellow veins; halteres yellowish; feet steely; bases of the femora yellowish and hairy. No white on the tarsi of the fore legs; the first and second joints of the mid and the second of the hind legs whitish." Schiner* and Van der Wulp† both note this species, but we cannot judge from the descriptions as to the identity.

The fact that there is white on the fore tarsi in Bigot's specimen need not be taken into account, as the tarsal markings are one side only, and can be easily overlooked.

* Reise d. Nov. Dipt. p. 31.
† Dipt. d. Mid. Sumatra, p. 8.

### 11. Megarhinus ferox. Wiedemann.

*Culex ferox.* Wiedemann.

(Aussereurop. Zweiflüg. Insect. p. 1, Wiedemann; Dipt. Exot. supp. ii. p. 7, Macquart.)

(Fig. 30, Plate VIII.)

Thorax bright chestnut-brown with a median azure-blue stripe, an azure-blue band laterally and a patch over each wing and on the prothoracic lobes; scutellum deep purple in the middle, pale azure-blue and pale apple-green on the lateral lobes in the ♀; no median azure-blue band in the ♂, nor is the middle of the scutellum deep purple; abdomen steel blue, the basal segment bright bluish-green, some of the apical segments with apical yellow bands; venter and sides partly dull golden yellow; anal segments with numerous yellow hairs. Legs metallic blue and purple, last two tarsi of the hind legs in ♀ and ♂ white and the first two tarsi in the fore legs, but apparently not in the ♂; fore and mid ungues of the ♂ unequal, the larger uniserrated; in the ♀ equal and simple.

♀. Head clothed with bright chestnut-brown flat scales, with a broad pale blue border round the eyes, with a distinct median furrow extending from between the eyes backwards across the occiput; antennae brown; basal joint black with frosty tomentum, second joint covered with dark brown scales about the same length as the third, which with the next few are very pale brown; proboscis with metallic blue, green and coppery scales; the remains of the palpi metallic green coloured, as also is the proboscis; eyes black with a coppery tinge.

Thorax black, densely clothed with rather long, flat, spindle-shaped bright brown scales, with a median line of bright azure-blue scales, and also azure-blue scales at the sides of the meso-thorax and in front, forming a broad border round it; a distinct blue patch over the roots of the wings, mixed with some green and brilliant golden-brown ones and dense golden-brown bristles; scutellum with the median lobe densely plated with flat deep purple scales, the lateral lobes with pale green and blue scales; border-bristles bright chestnut-brown; metanotum chestnut-brown; pleurae pale brown, with some dense patches of white scales. Viewed in some lights, the thorax looks deep metallic green, and in bad specimens the characteristic median blue line is absent.

Abdomen covered with steel-blue, grey, green and ochraceous scales as follows: first segment brighter than the rest, pale green and pale blue with a few golden scales, second, third and

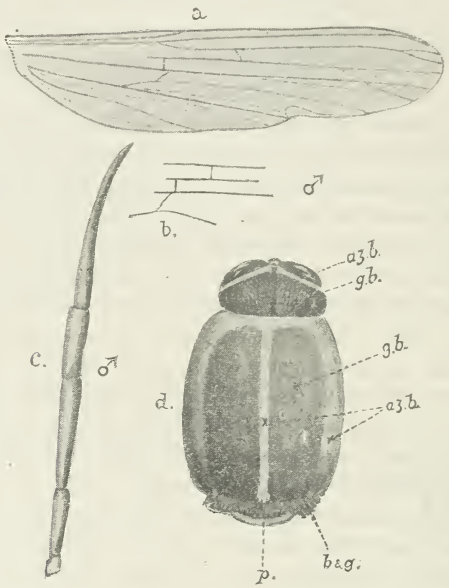



Fig. 67.

*Megarhinus ferox*, Wied.

a, Wing of ♀; b, cross-vein of ♂; c, male palpus; d, thorax; az.-b. azure-blue; g.-b. golden-brown; p. purple; b. and g. bronze and gold.

fourth steel blue, with deep green and brown scales; fifth with a broad band of ochraceous scales at the base, a narrow row of the same colour at the apex, deep green, blue and brown between; sixth and seventh metallic blue and purple, with a distinct bright ochraceous apical border; last segment brilliant deep blue at the base, bright yellowish at the apex; the sides of the segments are also rather bright ochraceous to golden; venter golden-yellow; apex with many yellow hairs, but not forming such a regular caudal tuft as is drawn in the Figure (Pl. VIII.); at the base of the abdomen ventrally is a dense patch of white scales.

Legs steel blue with coppery reflections; coxae light chestnut-brown with white scales; femora pale golden beneath, with a few peacock-blue scales dotted amongst the steel-blue ones; first and second tarsal joints of the mid legs white (rest absent); last two

tarsal joints of the hind pair white; ungues of the hind pair equal and simple.

Wings with brown veins and with a curious faint reduplication of the fifth long vein at the border; scales along the upper border blue; first sub-marginal cell very small; supernumerary cross-vein a long way nearer the apex of the wing than the mid cross-vein; posterior cross-vein long, sloping to the base of the wing, arising nearer the apex than the former; border much bent in at the junction of the fifth long vein with it; halteres with ochraceous stem and brown knob.

*Length.*—8 to 10 mm.

♂. Head like the ♀, but the median scales look dark when facing the light, similar to the ♀ when turned away from it; basal joint of the antennae black with grey tomentum, second joint large, about as long as the four following joints, densely covered with blue scales; remainder of the antennae brown, with rich brown plumes; palpi bright metallic blue and purple, the third joint a little longer than the second and fourth, the fourth thick with three spines on the inner and two on the outer side, apical joint longer than the two preceding, tapering to a point, black.

Thorax as in the ♀, but without the median blue line and with the mid lobe of the scutellum peacock blue instead of deep purple; the first segment of the abdomen is also peacock blue; the remainder deep steel blue; the fourth to seventh segments have apical yellow bands and also the apical segment; genitalia (denuded) brown.

Legs the same colour as in the ♀; fore legs without white tarsi; in the hind legs the third and fourth tarsals are white on one side only; fore ungues unequal, the larger uniserrated, the smaller simple; hind ungues equal and simple.

Wings with the supernumerary cross-vein much nearer the mid than in the ♀ and much longer; the posterior cross-vein nearer the base of the wing; the fold of the sixth long vein at the border more marked than in the ♀.

*Length.*—9·5 mm. (palpi 8 mm.).

*Habitat.*—Bogota (Bigot); Brazil (Macq.), Brazil (Bigot).

*Observations.*—Described from a ♂ and ♀ in the Hope Museum, Oxford. I have also examined specimens so named in Bigot's collection. I believe all three of his specimens were Macquart's.

There are discrepancies certainly in regard to the descriptions, but these are easily explained by the varied appearance in different lights and by the leg banding only being visible in certain positions of the legs. The chestnut-brown thorax with the azure-blue median line on the mesothorax in the ♀, the deep purple mid scutellar lobe, the venation and second antennal joint, however, readily separate it from allied species.

Specimens so named in the British Museum were *M. Portoricensis*. I have not found a specimen in the collections.

The species is evidently variable; in those I have examined in Bigot's collection the following slight differences may be noticed in the ♀: the palpi have metallic green, mauve and violet scales, black in some lights, with mauve and azure-blue apical bands to the joints, and are longer than the antennae by their last joint; the scutellum has azure-blue scales only; the greater part of the first and the basal part of the second fore tarsi silvery-white, the last two joints black; in the mid legs the third tarsal joint is also nearly all silvery-white; in the hind legs the white band begins on the third tarsal joint, which is all white.

The various discrepancies in regard to the white on the tarsi are due to the position in which the legs are set, the white not being in the form of true bands—may be hidden beneath or at the side of the legs, and so cannot be detected when the specimens are carded.

In Colonel Giles's book I find the following statement of interest: "In a ♂ specimen in the collection of H. V. Wiethem, of Hamburg, the tarsi, especially of the hind legs, are much prolonged, and of a clear steel-blue colour, the fourth joint being white; the tarsi of the not elongated middle legs have the third and fourth joints white; the front legs are broken." This is evidently *M. ferox*.

Macquart ("D. E.," Supp. II., p. 7) says: "R. Desvoidy and Wiedemann describe the second joint of the hind tarsi as silvery. We have observed a complete specimen in which the hind tarsi have the fourth and fifth joints silvery on the inner side, with a little black at the tip of the fifth. In the ♀ we have observed the fore tarsi have the second and third joints silvery on the anterior side; the middle ones have these two joints entirely so; the hind ones have also the fourth and fifth joints silvery."

The thoracic ornamentation is, I fancy, the best character in this species.

The description by Wiedemann of the abdomen as steely-grey and steel-blue seems inconsistent; but in certain lights, with the naked eye, the former hue can certainly be detected on the abdomen of Bigot's ♀ specimen.

### 12. Megarhinus longipes. n. sp.

(Fig. 34, Pl. IX.)

Thorax brown, with small bronzy and green scales, the green ones lateral. Abdomen covered with metallic olive-green scales; venter golden; first segment pale blue; apex yellow, with yellow hairs. Legs long and rather thick, iridescent, dull yellowish and brownish-black.

♀. Head clothed with flat, golden-brown scales behind, pale green ones in front; antennae brown, basal joints small and rotund, with greyish sheen; palpi with metallic green scales; proboscis coppery.

Thorax brown, with small bronzy and green scales, the green ones at the sides; prothoracic lobes with pale blue scales; scutellum clothed with pale brown scales, with golden and other reflections, those on the lateral lobe pale blue; pleurae brown, with dense masses of pale golden scales; metathorax dark brown.

Abdomen covered with bright, metallic, olive-green scales, the venter golden scaled; first segment with pale blue scales, and the apex yellow, with dense yellow hairs.

Legs long and moderately thick, in the fore legs the bases of the femora are yellowish; the remainder of them, the tibiae and metatarsi deep steely blue; the first three tarsal joints yellowish-white, the last blackish, in the mid legs much the same; hind legs, with the femora, pale at the base, deep blue at the apex, with a pale knee spot; tibiae golden, except at the base, where they are dark brown; metatarsus golden-bronzy towards the tip, first and second tarsal joints deep purplish-black, the apex of the latter joint white, last two joints lost; fore and mid ungues nearly straight, equal and simple.

Wings slightly dusky along the costal border, some of the veins with metallic purple scales; supernumerary cross-vein some distance nearer the apex of the wing than the mid cross-

vein, the latter joining and forming almost a right angle with the posterior cross-vein.

Halteres pale, with fuscous knob.

*Length.*—8 mm. (of mid legs 18 mm., of wings 9 mm.).

*Habitat.*—Mexico.

*Observations.*—Described from a single ♀ in the British Museum collection. It is a very distinct, rather iridescent, yellowish-looking, large species, with venation like a typical *Megarhinus*, but with no caudal tuft, with pale olive-green abdomen, except the first segment, which is pale blue. It shows considerable variation in colour when held in different directions, but its large size and general yellowish hue and absence of caudal tufts should at once separate it, as well as its long spider-like legs.

This species may belong to my genus *Toxorhynchites*, as I am not certain from a single specimen if the palpi are broken or not; they appear as if broken.

### 13. Megarhinus (?) subulifer. Doleschall.

(Nat. Tijdschr. v. Ned. Indie, xiv. p. 382.)

"Proboscis strongly built, long; thorax fuscous, with golden-green scales; the two last segments of the abdomen with dense lateral hairs, the three front segments metallic green, the rest blue; anus with golden-yellow hairs; legs black, all the tarsi broadly banded white; anterior margin of the wings blue scaled. Length, 2½ lines."

The two not particularly good species examined bear a strong resemblance to *M. amboinensis*, but may readily be distinguished from that species by the following characters. Palpi of the ♀ short, curved upwards, slightly hairy, and like the eyes and antennae black. Posterior border of the head metallic green; thorax high and oval, prothoracic lobes dark brown, ornamented with shining golden-green scales; scutellum and first three abdominal segments green. Last two segments of the abdomen armed on either side with long black hairs, mixed with a few white ones, 4th to 8th segments blue, the end of the abdomen with orange-coloured hairs. Legs black, long, not very hairy. In the fore and hind tarsi there is one white band, two to the middle pair. Wings shorter than the abdomen, with dark brown veins, the anterior border partly ornamented with green scales. Amboina, less common than *M. amboinensis*.—(Description from Nat. Tijdschr. v. Ned. Indie, xiv. p. 382.)

Note.—This species, if the ♀ palpi are short, not broken, comes in my genus *Toxorhynchites*.—(F. V. T.)

### 14. Megarhinus amboinensis. Doleschall.

(Nat. Tijdschr. v. Ned. Indie, xiv. p. 381.)

"♂. Palpi, proboscis and abdomen blue, thorax metallic golden-green, wings tinged with yellow; legs dark blue, with a ring of white on the first joint of the hind tarsi. Length, 4½ lines.

Head dark blackish-green; eyes and antennae black, the latter densely plumed; palpi and the proboscis steel-blue; palpi white between the second and third joints, slightly pubescent. Thorax dark green, with shiny golden scales, with long stiff hairs over the roots of the wings; abdomen flat, steel-blue, with long dense dark blue hairs on each side of the last three segments. Wings longer than the abdomen, yellowish, with tawny veins; legs long and thin, deep blue, not hairy, the first joint of hind tarsus white.

Amboina, found in the bush during the dry season, not uncommon."

### 15. Megarhinus trichopygus. Wiedemann.
### *Culex trichopygus.* Wiedemann.

(Auss. Zweiflüg. Ins. p. 4.)

"Thorax black, with greenish-gold scales; abdomen fuscous, with steel-blue scales, with the antepenultimate segment and those behind broader and hairy. Length, 3½ to 4½ lines."

"Antennae brown; palpi yellowish, opalescent-blue, with brassy scales below; last joint deep steel-blue; proboscis blackish-blue, tapering very much; head and thorax black, with greenish-gold and blue scales; pleurae and coxae brown, with silvery scales. Abdomen shiny brown, with pale steel-blue scales; venter with silvery and blue scales; antepenultimate segment broadened, fringed on each side; penultimate and last segments smaller, fringed with brownish-black hairs, which show violet-blue in certain lights; legs yellowish-brown, with steel-blue scales, silvery below. (Mid legs wanting.)"—Brazil.

### 16. Megarhinus Christophii. Portschinsky.

(Horae Soc. Ent. Rossicae, p. 122 (1883).)

"Proboscis long and black, distinctly shorter than the body; antennae fuscous, barely half the length of the proboscis, with scanty black hairs; their basal joints and border of the eyes with metallic blue scales; first to sixth abdominal segments ornamented with a shiny silvery transverse stripe; sixth provided with a tuft of black hairs, and the last two with long, fulvous marginal hairs on either side. Legs fuscous, bases of femora pale; first and second joints of the anterior tarsi, base of the first

joint and whole of the second and third joints of the middle and second of hind tarsi white; wings hyaline; halteres fuscous. Length, 5½ lines."—Amur (Central Asia).

17. Megarhinus rutillus. Coquillett.

(Canadian Entomologist, p. 43 (1896).)

" ♂. Head black, tomentum of occiput blue in the centre, white next the eyes; antennae brown, the first joint covered with blue tomentum on the outer side, that on the inner side silvery white; hairs of the antennae dark grey, their bases brown; proboscis and palpi black, covered with appressed blue, golden, and white tomentum; abdomen black, its tomentum blue, becoming violet at the tip; that on the lateral margins golden, venter with blue scales, mixed with a few golden ones; sides of the abdomen bearing a few short, pale yellow hairs; legs black, the tomentum mixed blue, violet and golden, that on the coxae and on the apices of the femora entirely golden; second joint and base of the third fore and mid tarsi, with the fourth joint and the base of the hind tarsi, white; one claw each of the fore and mid legs toothed, the others simple; wings hyaline, costal margin and veins brown, the scales blue and violet. ♀. As in the ♂, except that the first joint of the antennae is destitute of the blue and silvery tomentum; second, third, and base of the fourth joints of the fore and mid tarsi white; claws simple. Length, 7 to 10 mm."—North Carolina, Georgia, and Florida.

Note.—A figure of this species is given by Howard in his "Notes on the Mosquitoes of the United States" (Bull. 25, New Series, U.S.A. Dept. Agriculture, fig. 21, p. 46). In this the palpi are shown very short; probably they are broken off; if not, it comes in the genus *Toxorhynchites.**

Amongst other localities from which *Megarhinus* has been recorded is San Miguel, Panama. Osten-Sacken (Bio. Cent. Ameri. Dip. I.) records "two ♂'s, with the fourth joint of the hind tarsi white, except the tip."

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## Genus 3.—**TOXORHYNCHITES.** nov. gen.

Head clothed with flat scales; thorax with small, flat, spindle-shaped scales; abdomen with flat scales. Palpi in the ♀ three-jointed, the last joint long and rounded at the end, slightly curved at the apex; in the ♂ five-jointed; proboscis

* Mr. Coquillett writes me that this belongs to *Megarhinus*, not *Toxorhynchites*.

long and curved, as in *Megarhinus;* wing venation much as in *Megarhinus*, the supernumerary cross-vein nearer the apex of the wing than the mid cross-vein; ungues of ♀ equal and simple. Abdomen with a caudal tuft.

This genus resembles *Megarhinus* on the one hand and *Culex* on the other. From *Megarhinus*, however, it differs in the ♀ having short palpi. From *Culex* it differs in the wing venation, which resembles *Megarhinus*.

At present I have only seen one species that can definitely be placed in this genus, but I fancy Walker's *M. inornatus* may have to be placed here. I cannot make out, however, if the type of the ♀ *M. inornatus* has three-jointed palpi or if they are broken. So many ♀ *Megarhinas* have the palpi damaged that it is often difficult to say to which genus they belong. The single species of this genus comes from Natal.

### Toxorhynchites brevipalpis. n. sp.

(Fig. 36, Pl. IX.)

Thorax brown, covered with olive-brown scales, with a greenish tinge, and pale blue ones on each side. Abdomen deep metallic blue, with lateral white scales, and with white, black, and orange caudal tuft; legs metallic blue, base of mid metatarsus, and most of the first tarsal joint, pure white; in the hind legs base of first tarsal only white; fore legs uniform.

♀. Head clothed with flat, dark blue scales behind, bright blue in front; palpi three-jointed, thick, moderately long, about


Fig. 68.

Palpi of ♀ *Toxorhynchites brevipalpis.* n. sp.

I. Dorsal view. II. Lateral view.

Fig. 69.

Base of antenna of ♀ *T. brevipalpis.* n. sp.

one-fourth the length of the proboscis, bright purple; proboscis curved, thick at the base, gradually tapering to a point, deep purple at the base, bronzy towards the apex; antennae dark

brown; basal joint black, with cinereous reflections, nude, small; eyes bronzy.

Thorax brown, covered with olive-brown scales, with a greenish tinge, rather broader pale blue ones on each side, almost mauve in some lights; prothoracic lobes with pale blue to mauve scales, blue and green scales over the roots of the wings somewhat longer and flatter; scutellum deep brown, with flat greenish and blue scales; metathorax deep brown, pleurae black, with dense white scales.

Abdomen brilliant deep metallic blue, with a caudal tuft of white, black, and orange hairs; laterally are numerous white scales and white hairs in patches; venter steel-blue.

Legs metallic blue and purple, mid leg with the base of the metatarsus and greater part of the first tarsal joint, pure white; in the hind legs the base of the first tarsal only; fore legs uniformly coloured, ungues equal and simple.

Wings with some metallic blue scales to the veins, as long or longer than the body; veins testaceous, supernumerary cross-vein only about two and a half times its own length nearer the apex of the wing than the mid cross-vein; mid and posterior cross-veins join, forming a moderate angle; posterior cross-vein long.

*Length.*—8 mm.

*Habitat.*—Natal.

*Observations.*—Described from two ♀'s, one nearly perfect, in the old collection. They cannot be included in the genus *Megarhinus*, on account of the short ♀ palpi, yet the venation is just like that of the *Megarhinas*.

## Sub-Family **CULICINA.**

### Genus 4.—**SABETHES.** Robineau Desvoidy.*

(Essai s. l. tri. des Culicides (1827), Rob. Desv.; Brit. Mus. List, i. 1 (1840), Walker; Dipt. Arg. xi. p. 66 (1891), Arri.)

Head clothed with flat scales; thorax with flat scales; abdomen with small flat scales, palpi of the ♀ 3-jointed, in the ♂ 3-jointed (?); antennae 14-jointed, second joint small, the joints slightly increasing in length towards the apex, very pilose in the ♀, more so in the ♂; legs scaled, certain parts being provided with very long hair-like scales in the ♂; wings with rather broad scales (Fig. 70, c), first sub-marginal cell longer and narrower than the second posterior cell, the mid cross-vein nearer the apex of the wing than the supernumerary, the posterior nearer the apex still or parallel with the mid in the ♀, the third long vein carried through into the basal cell and continued to the root of the wing as a spurious vein.

The characters given by Robineau Desvoidy for this genus are not sufficient, so I have remodelled the genus, taking *S. remipes*, Wied., as the type.

The chief distinctive feature outside the scale ornamentation is the position of the cross-veins. Although the forward position of the posterior cross-vein is similar to *Mucidus* (p. 268), the wing scales at once stop the two genera from being confused with one another. The curious large patches of long leg scales in the ♂ occur again in the genus *Eretmapodites*, mihi, but the venation again readily separates the two genera.

There seem to be only two species, *S. remipes*, Wiedemann, and *S. longipes*, Fabr., which is considered by Arribalzaga to be the ♂ of the former, which is incorrect, there being a ♂ specimen of *S. remipes* in the British Museum collection. Walker's *Sabethes scintillans* cannot be included in the genus. It is distinctly a *Psorophora*. The members of this genus are purely sylvan in habits, and appear to be very uncommon.

Dr. Nuttall sends me a note and field sketch from Dr. Durham of a *Sabethes* in Para, which forms undoubtedly a new species.

* Fresh material given me by Dr. Durham necessitates this genus being remodelled. There are chaetae on the metanotum and the palpi are short in both sexes. *Sabethes* must therefore be removed to Section B. (*vide* Appendix for generic characters, etc., p. 345, Vol. II.)

1. Sabethes remipes. Wiedemann.

(Auss. Zweiflüg. Ins. i. p. 573 (1828), Wiedemann; Novara. Reise. Dipt, p. 31 (1868), Schiner; Hist. Nat. Dipt. i. 37, 18 (1834), Macquart.)

(Fig. 43, Pl. XI.)

Thorax black, with flat purple and blue scales; abdomen covered with deep blue scales, purple and coppery at the apex, silvery spots laterally, yellow ventrally. Legs steel-blue or purple, the mid legs with a dense mass of long scales forming a kind of paddle on the tibia and metatarsus.

Wings with rather large flat brown scales, violet along the costa.

♂. Head clothed with small flat steel-blue scales; eyes coppery; proboscis short, rather thick black, covered with small scales, with purple reflections, rather brassy beneath, swollen at the top; palpi (Fig. 70, b) very short, apparently 3-jointed, the basal joint large but short, the apical one very small dark-brown, with purple reflections; antennae brown, with mauve reflections, long and numerous densely pilose verticillate hairs; basal joint round and black, nude, second joint small, ferruginous, 14-jointed, the joints increasing in length apically (a).

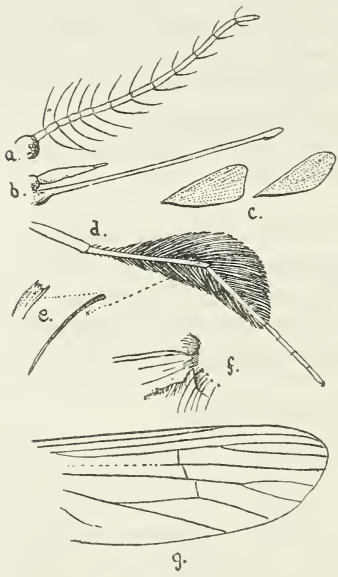


Fig. 70.

*Sabethe remipes*, Wied.

a, Antenna of the ♂; b, proboscis and palpi of ♂; c, wing scales; d, mid leg; e, enlarged scales of paddle; f, base of wing; g, apex of wing.

Thorax black, clothed with small purple and blue flat scales; scutellum dark in the middle, with ferruginous borders and azure-blue flat scales; over the root of the wings is a tuft of black bristles, and in front a tuft of dark scales; metanotum deep brown; pleurae dark brown with white scales.

Abdomen narrow, covered with flat blue scales, which become purple and coppery at the apex; venter yellowish;

laterally are silvery spots (only seen at the base in this specimen).

Legs with the coxae silvery, femora pale at the base, covered with scales which give them a steel-blue and purple hue in certain lights; in the mid legs the greater part of the tibiae are fringed with a dense mass of long deep bronzy hair-like scales forming a kind of paddle, which is continued on to the metatarsus, where the hair-like scales gradually decrease in size; fore and hind legs without the paddle of scales; in the hind legs the tibiae are curved upwards and the metatarsi are longer than the tibiae, the hind legs being long.

Wings with the veins clothed with rather large flat scales, brown on the body of the wing with violet reflections on the costal border; first sub-marginal cell longer and narrower than the second posterior cell, its stem rather more than a third of its length; base of the second posterior cell much nearer the apex of the wing than that of the first sub-marginal cell, its stem not quite as long as the cell; the mid cross-vein a little nearer the apex of the wing than the supernumerary, and the posterior nearer the apex still and much the widest of the three; the third longitudinal passes into the basal cell and is carried through it as a pseudo-vein, which is nude. Halteres long, stem yellow at the base, fuscous above and at the knob.

*Length.*—6 mm.

*Habitat.*—Amazon region.

*Observations.*—Described from a single ♂ in the British Museum collection in excellent condition. It might at first sight be mistaken for a female, for the antennae, although rather densely plumed, are not so densely as in other ♂ *Culices*. The wing venation is peculiar and characteristic. The "paddle-like" structures on the legs are built up of elongated scales, of similar type to the "upright forked scales" of the head, only longer.

Wiedemann's description of the ♂ is as follows:—

"Antennae brownish, proboscis and head steel-blue, with silvery scales below. Thorax and abdomen steel-blue, which especially in the latter shades off into a greenish tint; pleurae greenish gold; venter yellowish, with a silvery lustre, as also are the lateral edges of the base of the abdomen. Coxae silver scaled; legs of a fine steel-blue, in the mid leg the lower part of the tibia and the whole metatarsus is thickly fringed with long hairs, so as to form a sort of paddle with a flat surface and an egg-shaped outline. Front and hind legs entirely without fringes. Length, 2½ lines."—(From Auss. Zweiflüg. Ins. p. 573.)

Schiner * also notes a male from Brazil, in which the legs were not steel-blue but clear violet. This might be due to holding the insect in different lights.

2. Sabethes longipes. Fabricius.
*S. loculipes.* Rob. Desvoidy.
*Culex longipes.* Fabricius.

(Syst. Antl. iv. 400, 2 (1794), Fabricius; Ausseurop. Zwei. Ins. i. 11 (1828), Wiedemann; Essai s. l. tr. d. Culicides, Mém. d. l. Soc. d'Hist. Nat. de Paris, iii. (1827) (= *loculipes*), Desvoidy; Hist. Nat. Dipt. i. 36, 16 (1834), Macquart; Dipt. Exot. i. 34, 3, pl. 1, fig. 2 (1838), and Sup. i. 8, 9, pl. 1, fig. 2 (1848), Macquart; Dipt. Argentina, p. 67 (1891), Arribalzaga.)

(Fig. 141, Pl. XXXVI.)

Thorax black, with metallic coppery and iridescent scales; abdomen black, with coppery and metallic purple lustre; legs deep metallic purple and blue, the front pair with tibiae densely scaled, forming a small paddle, and also the metatarsus, first tarsal white beneath; the middle legs bare, the tibiae and metatarsi with a much larger-scaled paddle, and the first three tarsi white with long white lateral scales on the first tarsal joint; hind legs with apex of tibiae only densely scaled, first three tarsi silvery-white beneath.

♂. Head dark brown with metallic flat scales, mauve at the sides; antennae dark brown, basal joint almost black, with a grey rim; palpi very short, black scaled; proboscis of moderate length, curved, black scaled, metallic; eyes and clypeus black.

Thorax black, covered with small, spindle-shaped, flat, metallic and iridescent scales, chiefly showing azure blue, green and bronze reflections; scutellum also densely covered with flat blue and green metallic scales; metanotum dark brown; pleurae black, with dense flat white scales.

Abdomen black, covered with metallic coppery, green, mauve, and blue scales above; when held with the abdomen with its apex to the light, it looks deep green, when from the light more bronzy; venter white scaled.

Legs metallic purplish-black, with white markings; fore legs (Fig. 71, A) with the femora increasing in size towards the apex, metallic green at the base, remainder purple; tibiae purple,

* Reise d. Novara, Dipt. p. 31.

bare at the base, but with long rich-brown scales on each side for most of its length, forming a paddle-like extension ; metatarsus also with long scales on one side, gradually becoming smaller to the apex ; tarsi purplish-brown, the first joint snowy-white beneath ; in the middle legs (B) the femora are the same, but the tibiae have a much larger paddle of scales, those at the base of the paddle being snowy-white ; the scales also spread evenly along

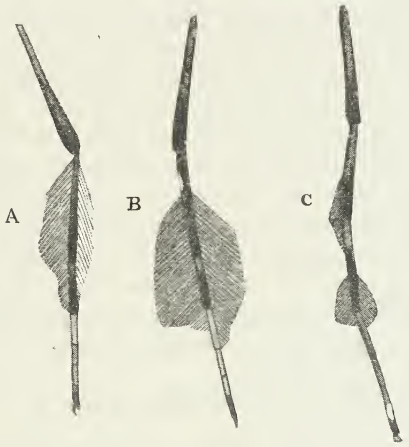


Fig. 71.
Fore, mid, and hind legs of *Sabethes longipes*, Fabr.

the metatarsi and become white on the first tarsal joint, where they graduate to a point at the apex ; first three tarsi snowy-white, with black bristles, the third partly brown at the apex, the fourth dark brown ; in the hind legs (C) there is a small mass of lateral scales at the apex of the tibia and at the base and apex of the metatarsi, that at the apex of the metatarsi being the largest ; tarsi brown above, last three white beneath ; ungues equal and simple.

Wings dusky, the veins clothed with broad flat scales, brown in colour ; middle and posterior cross-veins nearly in one line ; fork-cells long, the first sub-marginal cell longer and narrower than the second posterior cell, their bases about level, first sub-marginal cell two and a half times the length of the stem ; second posterior cell nearly twice the length of its stem ; fringe yellowish-brown, border scales dark ; halteres with a dusky stem and large black knob.

*Length.*—7 mm.

*Habitat.*—Amazons (Bates); Guiana (Macq.); Brazil (Wied.).

*Observations.*—The above description is from a nearly perfect specimen from the Amazons in the Hope Collection, Oxford University. It is quite distinct from *Sabethes remipes*, Wied. The type of this species is in the Royal Museum at Copenhagen, but it is only a remnant, without head or abdomen and with partly denuded legs.

There seems to be some confusion in the descriptions of this species, due partly to bad specimens and partly to the fact that the white on the legs is ventral, and hence may or may not be seen when the insect is mounted on cardboard. Fabricius says, "Legs long, with compressed ciliate tibiae and whitish apices to the tarsi." Wiedemann says the posterior tarsi are ciliate; Desvoidy, the tibiae and tarsi of the mid legs; Macquart says the tarsi have not white tips as described by Fabricius, probably because he did not examine the ventral surface of the legs.

*Synonymy.*—According to Macquart, it is the same as *Culex loculipes*, Desvoidy. Arribalzaga is certainly wrong in taking this species and *C. remipes* to be synonymous.

Description from Fabricius' Syst. Antl. :—

"Black, with a coppery lustre, with elongated legs; hinder tibiae ciliate. A little longer than *C. pipiens*, haustellum with apex a little thickened. Antennae strongly pectinate; thorax and abdomen black, with a slight coppery lustre; wings dark; legs long, with compressed ciliate tibiae and the tarsi white at their apices."

There is another ♂ in Frankfort Museum. In Macquart's Dipt. Exot. i. p. 34, we find the following :—

"Synonymous with *S. loculipes*, Desvoidy. Ill-described. According to Fabricius, its hind instead of its middle legs are ciliate; Wiedemann gives the posterior tarsi; Desvoidy the tibiae and tarsi of the mid pair. Fabricius and Wiedemann both described ♂'s, the one figured is a ♀; the tarsi have not white tips as described by Fabricius, and the bases of the femora and fourth and fifth tarsal joints are not yellowish. Moreover, that of the hinder is not snow-white as described by Wiedemann. Wings narrow, and do not exceed the abdomen in length."—Habitat (Guiana).

## Genus 5.—**JANTHINOSOMA.** Arribalzaga.

(Dipt. Argentina, p. 52, 1891.)

The following species, *J. musica*, Say, *J. posticata*, Wiedemann, and *J. Lutzii*, mihi, present such a marked different appearance to other *Culicidae* that I propose to retain them in Arribalzaga's genus. The head is covered with flat, rather broad, spindle-shaped scales and upright forked ones; the thorax with short, broad, spindle-shaped scales and also the scutellum; the palpi densely scaly, and the third long vein is carried on through the basal cell as a bare pseudo-vein; the ungues of the female are thick, serrated, and nearly equal; in the male those of the fore and mid feet are unequal, the larger one with two teeth, the smaller with one; on the larger claw the basal tooth is small and the long one blunt, on the smaller the tooth is basal.

The hind legs are densely scaled and give the insect a characteristic appearance. In colour the abdomen is more or less purple and golden or pale scaled beneath; male palpi long, longer than the proboscis by the two last joints.

Although there is no very marked structural difference between these three species and *Culex*, there are sufficient minor details which, taken together with their markedly different appearance, will separate them at a glance from that genus. Walker's *C. discrucians* falls in this genus also.

### 1. Janthinosoma posticata. Wiedemann.

*Culex posticatus.* Wiedemann.

(Auss. Zwei. Ins. p. 9, et Dipt. Exot. i. 43, 2, Wied.)

(Fig. 45, Pl. XII.)

Thorax brown, rather testaceous behind, with flat, spindle-shaped, bronzy and yellow scales. Abdomen steel-black with metallic violet scales, with basal triangular patches of creamy scales; venter yellow scaled. Legs dark brown with metallic steely and purple reflections, the last hind tarsal joint dull white, legs densely scaly. Wings with a brownish tinge.

♀. Head steely-black, with dense, golden, forked upright scales behind, a few flat rather broad, creamy ones in front and a few purplish and then creamy ones at the sides; eyes pale steel colour and black; bristles in front of the head black, two golden ones between the eyes; antennae brown with the basal

joint on the outside bright testaceous, dark on the inside, second joint also testaceous, but darker; palpi testaceous, covered with steely-black scales, the testaceous colour shows through at their base; proboscis metallic purple in some lights with creamy scales just at the base, brown in others.

Thorax shiny, purplish-brown in front, testaceous behind, with scattered, flat, spindle-shaped, bronzy black and yellow scales, the dark ones predominating, with three rows of black bristles, the median one ending before the bare patch in front of the scutellum; scutellum darker in the middle than at the sides, with flat, bronzy scales and black bristles; metanotum pale chestnut-brown; pleurae pale ochraceous-brown with numerous white scales. Abdomen when denuded steel-blue, covered with bright metallic purple scales, the first segment ochraceous with two patches of deep purple scales and golden bristles; posterior borders with golden hairs; laterally are triangular basal patches of creamy scales on each segment; venter nearly covered with yellow scales.

Legs covered with dark brownish-black scales, with metallic steely and purplish reflections, knee spots white, bases and venter of femora yellowish, last tarsal joint of the hind legs dull white.

Wings with a slight brownish tinge, scales brown, lateral ones moderately long and narrow; first sub-marginal cell very little longer and narrower than the second posterior cell, its stem equal to nearly half the length of the cell; stem of the second posterior cell nearly the same length and about as long as the cell; posterior cross-vein distant a little more than half its own length from the mid cross-vein.

Halteres with pale stem and fuscous knob.

*Length.*—5 mm.

*Habitat.*—Castries, St. Lucia (St. George Gray) (19. 7. 99); Argentina (Arribalzaga).

*Time of capture.*—August in St. Lucia.

*Observations.*—Described from a single female sent by Dr. St. George Gray, with note that it was taken at 7 P.M. in the Botanic Gardens, Castries.

It is evidently Wiedemann's *Culex posticatus* described from Mexico, and may be told from the allied *C. musicus*, Say, by the last tarsal joint only being white.

I cannot see the ungues properly in the single specimen sent, but one on each foot is in any case toothed; they are probably both equal and serrated.

2. Janthinosoma musica. Say.
*C. Mexicanus.* Bellardi (?).
*C. musicus.* Say.

(Jour. Acad. Nat. Sci. Phil. vi. p. 149.)

(Fig. 44, Pl. XI.)

Thorax metallic brown with scattered bronze and yellow spindle-shaped scales, rather more yellowish at the sides. Abdomen purplish with lateral patches of golden-yellow scales, venter partly golden-yellow scaled. Legs metallic purple and blue, the last two tarsi and the apex of the second tarsus white; hind legs densely scaly. Head bright honey-yellow with yellow scales.

♀. Head honey-yellow, covered with orange-brown scales, or, as Say describes them, "honey-coloured" scales, and a few yellow hairs projecting in front; eyes black with coppery reflections; antennae dark brown, basal joint and base of the second joint pale reddish-brown, verticillate hairs brown; palpi dark brown in some lights, brilliant violet or purple in others, densely scaled; proboscis dark brown, covered with scales and with metallic purple reflections.

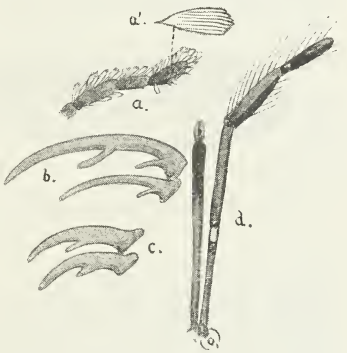


Fig. 72.

*J. musica*, Say.

a, Female palpus, and a', enlarged scale; b and c, male fore and hind ungues; d, male palpi and proboscis.

Thorax deep metallic brown with purplish reflections, with scattered yellow and bronze, flat, spindle-shaped scales, more densely yellow scaled at the sides, and with dark, almost black, bristles; scutellum ochraceous-brown, dark brown in the middle and sides, with a few scattered yellow and dark flat scales (evidently a little denuded); metanotum shiny chestnut-brown; pleurae brown with a large patch of creamy-white scales.

Abdomen deep purplish-brown above when viewed pointing from the light, when pointing to the light very brilliant metallic violet and purple, the denuded surface appearing steel-black, the first segment and part of the second are testaceous; laterally are patches of yellowish scales, especially on the last four segments; each segment has also a row of yellowish-brown hairs on

the posterior border; ventrally there is a triangular patch of yellow scales on each segment, the apex touching the base of the segment, the base of the triangle being parallel with the posterior border of the segment; the first segment is entirely yellow scaled beneath.

Legs metallic blue and purple, in some lights almost brown, the two last tarsi of the hind legs and the apex of the second pure white. Femora on the ventral surface yellowish, in some specimens the anterior femora have an apical pale spot, in others it is absent, but the mid and hind femora have one almost white and then a few yellow scales; tibiae, metatarsi, and tarsi of fore and mid legs dark scaled with metallic reflections; tibiae of the hind legs very much swollen apically, densely scaled, metatarsus and first tarsal joint also densely scaled; apex of the second and whole of the third and the fourth tarsi pure white; the hind legs are long, and the scales sticking out from the joints give them a very thick appearance. Ungues (Fig. 74)

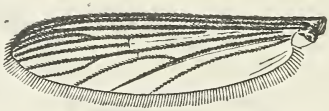

Fig. 73.
Wing of *Janthinosoma musica*, Say (♀).
(X. 9.)

Fig. 74.
*Janthinosoma musica*, Say.
Female ungues.

nearly the same size, but of slightly different form, a tooth present on each. Wings with a brownish tinge and with brown scales; first sub-marginal cell slightly longer and narrower than the second posterior cell, its branches curved, stem about one-half less than its length; stem of second posterior cell not quite as long as the cell itself; posterior cross-vein about its own length behind the mid cross-vein; fringe brown.

*Length.*—5 to 5·5 mm.; of hind legs 12 mm.

♂. Antennae dark brown, banded with broad, pale, verticillate hairs, brown, basal joint very globular, deep black; proboscis black with steely reflections; palpi very much longer than the proboscis, black, with a metallic blue and purple tinge, with two pale yellowish bands, one near the base, another about a third of the length from the base; hairs black.

Ungues of the fore and mid feet unequal, the larger with two teeth, the smaller with one tooth; on the large claw the basal

tooth is small and the long one blunt; on the smaller claw the tooth is basal.

*Length.*—4·8 to 5 mm.

*Habitat.*—Rio de Janeiro (Moreira and Lutz); British Guiana; Indiana (Say); South Amazon (Austen).

*Time of capture.*—Rio de Janeiro, November (Moreira).

*Observations.*—This seems to be an abundant South American species, which Dr. Lutz calls the Big Wood Mosquito. It stings, says Dr. Lutz, in the daytime.

It is a beautifully brilliant insect when in good condition and may at once be known by its long, thick scaled, hind legs with white tarsi as described. Although Say only mentions the two last hind tarsi being white, there is no doubt whatever of these South American specimens being the same as his *C. musicus* from Indiana, described in the "Journal" of the Academy of Natural Science of Philadelphia (ii. p. 149). Wiedemann's *C. posticatus* (Dipt. Exot. i. 43, 2) from Mexico is not the same as *C. musicus* of Say, the last tarsal joint only being white in *C. posticatus*. In the Museum collection is a specimen of this mosquito labelled *C. putaneus*, N. America; I cannot find any reference to this name, and imagine it was only a MS. one of Walker's.

### 3. Janhtinosoma Lutzii. n. sp.

(Fig. 46, Pl. XII.)

Thorax black, with flat spindle-shaped bronzy-black scales in the middle and flat spindle-shaped creamy-yellow ones forming a broad line on each side of the mesonotum. Abdomen brilliant blue and purple, an apical yellow patch extending nearly across each side of the segment and pale golden ventral bands. Legs metallic purple, bases of the femora broadly pale yellowish; last two joints and apex of the antepenultimate tarsi of the hind legs white.

♀. Head clothed in the middle with curved and small flat irregular golden scales and ochraceous upright forked ones, purple at the sides; palpi and proboscis brown, with brilliant metallic purple reflections; antennae brown.

Thorax black, with black and bronzy spindle-shaped scales, each side of the mesonotum with golden-yellow spindle-shaped scales forming broad yellow lateral bands with straight borders to the median dark area; scutellum dark brown, with small bronzy-black spindle-shaped scales; metanotum black; pleurae dark brown, with creamy-yellow flat scales.

Abdomen steely-black, covered with brilliant metallic blue and purple scales, becoming dusky towards its apex, with lateral apical golden patches to the segments, more or less triangular in form, the base of the triangles being parallel to the apical borders of the segments; first segment dark, with dusky scales and long golden-brown hairs; venter purplish, with golden scaled apical cross-bands.

Legs metallic purple in some lights, brown in others; coxae dark with yellow scales; fore and mid femora yellowish at the base below, hind femora with a broad yellow basal portion; knee spot pale; last two tarsi of the hind legs creamy-white, also the apex of the antepenultimate joint; ungues of the fore and mid legs uniserrated.

Wings with a brownish tinge; veins clothed with brown scales, those at the base of the wing with purple reflections; lateral scales long, rather broader than in *Culex*, apices convex; first sub-marginal cell longer and narrower than the second posterior cell, its base nearer the base of the wing; its stem rather less than one-third the length of the cell, shorter than the stem of the second posterior cell, which is not quite as long as the cell; posterior cross-vein shorter than the mid cross-vein, not quite its own length distant from it.

Halteres with pale stem and fuscous knob.

*Length.*—4 to 5 mm.

*Habitat.*—Itacoatiara, Lower Amazon (Austen); Rio de Janeiro (Lutz).

*Time of capture.*—February (Amazon).

*Observations.*—Specimens of this species have been received from Dr. Lutz and were named by him *Janthinosoma discrucians*, Wlk. I have compared them with the type in the British Museum and find they do not agree. It is clearly a new species, which can easily be told from Walker's *Culex discrucians* by the last two hind tarsi and the apex of the antepenultimate one being white and by its larger size. In *C. discrucians* "the base of the fourth joint is adorned with a pale yellow band," and is so figured by Arribalzaga (Plate IV., fig. 6). *C. discrucians* is a *Janthinosoma* (*vide* Appendix).

It might also be confused with *J. musica*, Say, but the honey-coloured head in that species and the non-ornamented thorax should at once separate them. From *J. posticata* it can be told by the last tarsal and apex of the penultimate one only being white in that species.

Dr. Lutz writes me that "it occurs in damp woods and shady river shores. It stings in the daytime. The larva is green. Common in Brazil."

4. Janthinosoma discrucians. Walker.
(*Vide* Appendix.)

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## Genus 6.—**PSOROPHORA.** Robineau Desvoidy.

(Essai sur les Culicides, Mém. d. la Soc. d'Hist. Nat. de Paris, iii. p. 412 (1827), R. Desv.; Dipt. Arg. Revista d. Museo d. l. Plata, p. 38 (1891), Arri.; Règ. An. p. 440 (1829), Latreille.)

Head covered with small broad curved scales and upright forked ones; mesothorax with curved scales in the middle with short broad scales laterally; abdomen with small flat spatulate scales; antennae rather short in both sexes, in the ♂ the two last joints elongated as in *Culex;* palpi (Fig. 77) short in the ♀, long in the ♂, longer than the proboscis in the ♂, five-jointed, the first (or basal) joint very small, the third long, slightly enlarged apically; the fourth and fifth joints thick, the two nearly equalling the third in length; in the ♀ the palpi are four-jointed, but short, never more than one-half the length of the proboscis; the first and fourth joints are very small, the third longer than the second. According to Desvoidy and Arribalzaga, the palpi of the ♀ are five-jointed, but I have failed to detect the second small basal joint figured by Arribalzaga. The proboscis is short and rather thick in the ♂; longer and bent in the ♀. The prothoracic lobes are said to have lateral appendages which protect the stigmata of that segment. Wings with the scales rather long and thin; first sub-marginal cell short, only a little longer than the second posterior cell; the posterior cross-vein close to the mid cross-vein, but always a little nearer the base of the wing than the mid. Legs with the apices of the femora and the tibiae and to some extent the metatarsi with long scales; ungues of the ♀ all equal, thick, with a large distinct tooth to each, in the ♂ the fore and mid claws unequal, the larger one twice as long as the smaller and with two teeth, the smaller with one tooth or simple; hind claws equal and single toothed.

This genus was instituted by Robineau Desvoidy in 1827, and

again renewed by Lynch Arribalzaga in 1891; Colonel Giles retains it, and states that after examining the type in the Jardin des Plantes he thinks that its peculiarities deserve generic value. In this I quite concur, but I cannot, I must say, find in any specimens the prothoracic processes, my material being too limited to make any detailed dissections. The great length of the ♂ palpi, the densely long scaled legs, the position of the cross-veins and the form of the two fork-cells readily separate species of this genus from those of *Culex* and *Mucidus*, whilst the arrangement of the thoracic scales is very distinct.

The form of the ♂ palpi differs somewhat in the two species I have seen.

There are no printed records of the life-history of any member of this genus, but Dr. Lutz tells me in his valuable letters that "the larvae are carnivorous, and prey very ravenously on other larvae of *Culicidae*, seizing them by the neck and devouring them. Even larvae of the same size will devour each other."

This genus is not only represented by few species but its distribution is very limited for the family of *Culicidae*. So far

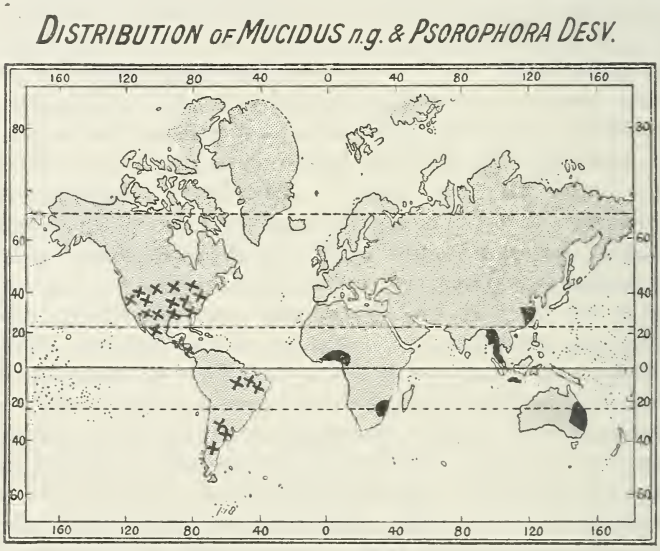


Fig. 75.

as records go, and information sent to the Department and to myself by correspondents, the genus *Psorophora* only occurs on

the American continent from the United States down to the Argentine Republic.

Three species have previously been described: *P. ciliata*, R. Desvoidy, *P. Boscii*, R. Desvoidy, and *P. Holmbergii*, Arribalzaga.

The second, I fancy, is synonymous with *P. ciliata*.

To these I now add Walker's *Sabethes scintillans*, which is undoubtedly a *Psorophora*.

## 1. SYNOPTIC TABLE OF SPECIES.

Fuscous, clothed with yellowish and pale scales (7–8 mm.) ..... 1 *ciliata*. Fabricius.

Fuscous, clothed with dark scales, black in general appearance ..... 2 *Holmbergii*. Arribalzaga.

Fuscous, clothed with brown scales, apices of hind femora white, very densely scaled..... 3 *scintillans*. Walker.

### 1. Psorophora ciliata. Fabricius (1794).

*Culex ciliatus*. Fabricius.

*Culex perterrens*. Walker.

*Culex conterrens*. Walker.

*P. Boscii*. Rob. Desvoidy (1827).

*Culex molestus*. Wiedemann (?).

(Ent. Syst. iv. p. 401 (1794), Fabr.; Syst. Antl. p. 38 (1804), Fabr. (= *Culex ciliatus*); Dipt. Exoti. p. 36 (1821), Wied.; Auss. Zwei. Ins. i. 3, 5 (1828) Wied.; Dipt. Exoti. p. 11, Sup. iv. (1838), Macq.; Dipt. Brit. Mus. i. p. 2 (1848), Wlk.; Ins. Saund. p. 431, Wlk. (= *C. perterrens*); Dipt. N. Amer. Cat. 18, Osten-Sacken; Dipt. Arg. Rev. d. l. Mus. d. l. Plata, p. 40 (1891), Arri.)

(Fig. 37, Pl. X.)

Thorax fuscous, with a median and lateral rows of narrow curved golden scales, sides of the mesonotum paler, with short white broad scales. Abdomen brown, with dull creamy-white scales. Legs densely scaly, metatarsi and tarsi basally pale banded, especially on the hind legs; the scales of the leg standing out from the surface.

♀. Head testaceous brown, with a few rather broad curved white scales and brown and golden narrow forked upright ones, brown and golden bristles in front and a bare line in the centre of the head; antennae brown, with the basal joint testaceous and the base of the second joint bright testaceous; palpi bright ochraceous, with scattered black scales which are very thick at the top, giving it a deep black appearance; proboscis testaceous,

dark at the tip, with black and pale scales scattered over it; clypeus bright testaceous; eyes dark, with a silvery sheen.

Thorax fuscous, with a broad median row of narrow curved golden scales and a narrow lateral row of the same on each side, intervening spaces bare and showing as two median fuscous lines; sides of the mesonotum paler, with short broad white scales which pass on to the dorsum posteriorly and flank the median golden-scaled line, also a median and two lateral rows of black bristles and numerous other dark bristles at the sides; scutellum testaceous, with scattered pale scales; metanotum testaceous, with purplish reflections; pleurae testaceous, with dense scattered grey scales.

Abdomen dark brown, with numerous flat, dull, creamy-white scales, with pale dusky golden hairs above and below.

Legs pale testaceous; the femora with only a few small dark scales except at the apices, which have a dense tuft of long black scales; tibiae also with long outstanding black scales; metatarsus and first and third tarsal joints of the hind legs pale yellowish-white at the base, the apical parts being thickly scaled with dense black scales, the last joint scarcely showing any basal banding; in the fore and mid legs the banding is not so distinct, and the metatarsi are pale testaceous; the hind metatarsi are equal to about two-thirds of the length of the tibiae; ungues large, equal, and with a distinct tooth.

Wings slightly yellowish-brown with brown scales rather long in form; the first sub-marginal cell short, its stem nearly equal to the length of the cell; second posterior cell broader and shorter than the first sub-marginal cell, its stem slightly longer than the cell, its base a little nearer the apex of the wing than that of the first sub-marginal cell; posterior cross-vein about half its length distant from the mid cross-vein; fringe brown.

Halteres pale ochraceous, with a deep fuscous knob.

(♂. In the ♂ it is said that the abdomen is darker than in the ♀ and with dense woolly hairs on either side.)

*Length* of ♀.—8 to 9 mm.

*Habitat.*—Texas (Howard); Shreveport, U.S.A. (Mally); Carolina (Fabricius); Georgia (Wiedemann and Walker); Atlantic Coast (Osten-Sacken); Honduras (Walker); Argentina (Arribalzaga) and Brazil (Dr. Lutz). The following American localities are also given by Howard: Dorchester, Massachusetts; Washington (Cluttenden); Westfield, N.J. (Johnson); Illinois (Mason); Kentucky; Lincoln, Nebraska (Bruner); Los Angelos,

California (Coquillett); Florida; New Orleans (Veazle). Dr. Lutz writes that it is more common in Rio, but is also found in Sao Paulo and Santos.

*Time of capture.*—October in Shreveport (Mally).

*Observations.*—The type of this species is in the Jardin des Plantes and is much worn. Walker's *Culex perterrens* and *C. conterrens* are this species, but I am not certain of Wiedemann's *C. molestus*, that authority having apparently described two *C. molestus*.

It is a very distinct insect, which cannot well be confused with any other of the *Culicidae*, and may be taken as the type of the genus *Psorophora* of Desvoidy, which I propose to retain. The densely scaled legs and its general tawny colour should at once enable the collector to identify it. It nevertheless presents a close superficial resemblance to some *Mucidus*, but can at once be told from that genus by the narrow wing scales and unmottled wings, as well as the different venation.

There is a specimen in the Museum labelled by Walker *Culex centaurus*. This is probably only a MS. name of Walker's.

Robineau Desvoidy described another *Psorophora*, *P. Boscii* from Carolina. I believe that this is only a small pale *P. ciliata* which occurs in that State. Desvoidy said it resembled *ciliata*, and that it is troublesome and common, and spoken of as "mosquito" by the natives. Arribalzaga writes concerning this species in the Argentine as follows: "Is variable in size and colour. It often happens that the tarsal joints are scarcely visible, whilst in other cases they are very apparent. I have noticed that they never have the ferruginous dorsal band on the abdomen which Macquart refers to (Hist. Dipt.). This species is not uncommon in the lower delta of the Parana, and the habits are seemingly wild in the perfect stage. But where *P. ciliata* is most common and causes much annoyance is in the great woods of El Chaco. The great number of specimens brought from that district by Dr. Holmberg and the stories told by people who have travelled there prove it to be very abundant. I have never seen it, nor believe that it occurs in marshes and swamps which are unwooded" (Dipt. Arg. p. 41).

Description from Mém. d. l. Soc. d'Hist. Nat. de Paris, iii. p. 413, 1827 :—

"*P. Boscii*, R. Desvoidy.

Like *P. ciliata*, but smaller, and generally pale yellow. Thorax rather dusky, abdomen less so; legs dusky yellow."

2. Psorophora Holmbergii. Arribalzaga (1891).

(Rev. d. Museo d. l. Plata, Dipt. Arg. p. 40 (1891).)

(Fig. 38, Pl. X.)

Of a general blackish appearance.

Thorax shiny black, with a central line of small golden scales and with silvery scales on each side, back part of mesothorax with a few scattered white and golden lateral scales. Abdomen deep dusky brown, almost black, with dark yellowish-brown scales dorsally, whitish below. Legs dark, clothed with long and short black scales, bases of tibiae and tarsi paler, testaceous. Wings dusky black, with deep brown scales.

♀. Head deep testaceous behind, black in front, covered with white scales, with a tuft of golden hairs directed forwards in front and a few black bristles. Eyes coppery red. Antennae dark brown, with basal joints deep testaceous. Proboscis testaceous, covered with black scales which are particularly thick at the tip and long at the base. Palpi testaceous, long, covered with black scales, especially at the tips.

Prothoracic lobes testaceous with black hairs. Thorax shiny black, with a central line of golden scales and with silver scales on each side of the thorax, back part of the dorsum with scattered central white and a few golden lateral scales, scutellum dark testaceous with white scales, bristles golden in some lights, black in others. Pleurae with scattered grey scales. Abdomen dusky, with yellowish-brown scales dorsally, white scales beneath and with black hairs. Coxae and femora testaceous, the latter densely clothed with long black scales at the tip, especially in the mid and hind legs; tibiae and tarsi of the fore legs testaceous with black scales tibiae of the mid and hind legs with the scales long, but bare and pale testaceous at the base forming a pale band; tarsi of mid legs with small black scales, the metatarsus and first tarsal joint pale at the base; in the hind legs the tarsi, especially the metatarsal joint, densely black scaled, with a basal ring of pale testaceous and also a pale ring on the second and third joints.

Wings dusky black, with metallic reflections and with thin dark brown scales. First sub-marginal cell very slightly longer and a little narrower than the second posterior cell; posterior cross-vein close to the mid cross-vein. Wings testaceous at the

base with a little tuft of long black scales beneath. Halteres deep testaceous.

*Length.*—8 mm.

*Habitat.*—Rio de Janeiro, Parque do Musen (Carlos Moreira) (11. 5. 99), and Chaco in Formosa, Argentina (Arribalzaga).

*Observations.*—Senhor Moreira sends a single ♀ in excellent preservation; its dark black colour readily distinguishes it from the more common *P. ciliata*. The species was described by Arribalzaga in 1891, and appears to be of rare occurrence, for only a single specimen has been received, and Dr. Lutz has not met with it in Brazil.

I do not think there is any doubt but that the specimen here described is Arribalzaga's *C. Holmbergii*, although the description does not apply in all detail. Arribalzaga's specimen may have been slightly rubbed, whilst the one sent by Senhor Moreira is in perfect condition; the legs, however, instead of being white banded, have the basal bands pale testaceous.

### 3. Psorophora scintillans. Walker (1848).

*Sabethes scintillans.* Walker.

(Brit. Mus. List, Dipt. i. 1 (1848).)

(Fig. 39, Pl. X.)

Thorax black, with dusky brown curved hair-like scales in the middle and flat white spindle-shaped ones at the sides. Abdomen black, with brown scales with bright violet-blue reflections, first two segments velvety brown, the apical one tinged with metallic green, sometimes with white apical lateral patches. Legs black, with dense long dusky scales with purple and brassy &c. reflections, apices of hind femora white, metatarsi and tarsi not so densely scaled as the femora and tibiae, except the hind metatarsi. Wings dusky yellowish-brown.

♀. Head black, clothed with small flat scattered white scales and black upright ones and black bristles; antennae dark brown, the basal joint deep ferruginous, nude; base of the second joint also ferruginous; clypeus black, rather elongated; palpi long, rather more than one-third the length of the proboscis, four-jointed, the penultimate joint longer than the first two. I can scarcely be sure of the presence of a fourth apical joint; it is probably hidden in scales; basal joint very small, all the

joints covered with black and metallic purple scales; proboscis prominent, curved as in *Megarhinus*, black with metallic purple, blue and green reflections.

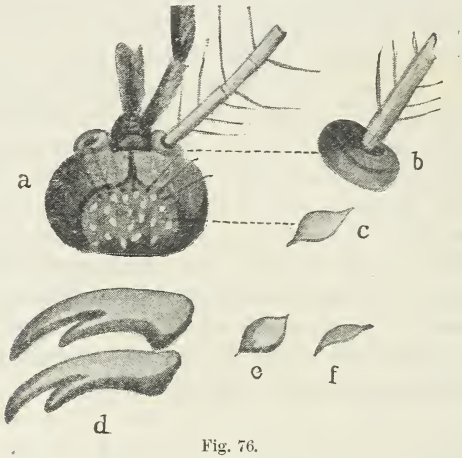


Fig. 76.

*Psorophora scintillans*, Wlk. (♀).

a, Head of ♀; b, enlarged antennal base; c, head scale; d, ungues; e, thoracic scale; f, scutellar scale.

Thorax shiny black, with narrow curved hair-like scales in the middle and small flat white spindle-shaped curved ones at the sides, with black bristles at the sides and golden ones in front of the scutellum, the latter black with golden border-bristles; metanotum dark brown; pleurae blackish brown with grey scales.

Abdomen black, with bright violet-blue scales and black border-bristles, velvety brown on the first two segments and with greenish scales on the apical segment. Some specimens show white apical lateral patches.

Legs black, with dense long scales which show purple, violet, mauve and brassy reflections in certain lights; apices of the hind femora white scaled; the metatarsi and tarsi are not so thickly scaled as the rest of the legs, but on the hind legs the metatarsi are densely scaled; ungues of the fore and mid and hind legs equal, toothed, the hind ones straighter than the others.

Wings with a dusky yellowish-brown tinge; the veins clothed with small flat median and long lateral scales brown in colour; first sub-marginal cell a little longer and narrower than

the second posterior cell, its stem nearly equal to its length, and the same length as that of the second posterior; posterior cross-vein about half its length distant (nearer the base of wing) from

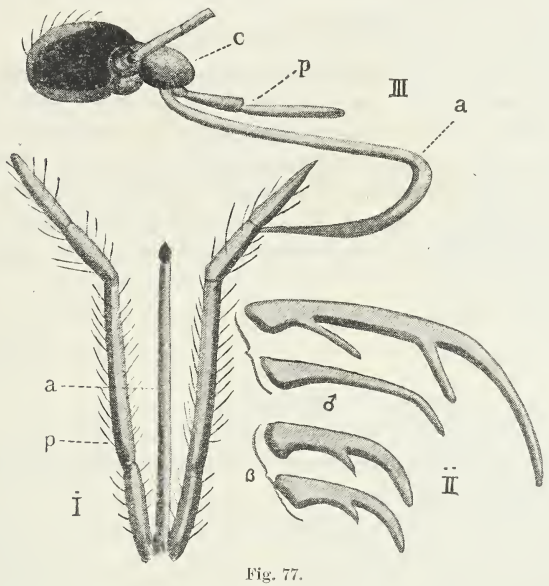


Fig. 77.

*Psorophora scintillans*, Wlk. (♂).

I. Male proboscis (a) and palpi (p) (the small basal joint is not shown). II. Fore and hind ungues of ♂. III. Head: c, clypeus; p, palpi; a, proboscis of the ♀ (the small apical joint of the palpus is not shown).

the mid cross-vein; the incrassation of the wing fold forming a clear unscaled vein; fringe brown; halteres with a yellowish-brown stem and fuscous knob.

*Length.*—7 to 9 mm.

♂. Palpi five-jointed, long, covered with scales that appear black in some lights, purple and blue in others, the last two apical joints of about equal length, the penultimate slightly the longer, the second from the base about two-thirds the length of the middle joint, basal joint small; hairy, those hairs on the antepenultimate joint the longest; antennae banded brown and grey with dark brown plumes, flaxen at the apices, basal joint deep chestnut-brown, a few small black scales projecting from the second joint in the type; proboscis short, ending just past the fourth palpal joint, dark brown bronzy reflections.

Wings with the fork-cells shorter than in the ♀ and the posterior cross-vein nearer the mid cross-vein. Ungues of fore and mid legs unequal, the larger one with two long teeth, the smaller untoothed, the hind ones equal and toothed.

*Length.*—6·5 to 8 mm.

*Habitat.*—Amazon region, Para (Walker).

*Observations.*—Described from three nearly perfect specimens and one remnant in the old British Museum collection; it is a very dark insect, at first sight resembling *Mucidus*, but its venation and scale structure show it to be a *Psorophora*. Walker's type of *Sabethes scintillans* is in the Museum, and the above description of the ♂ is partly based on it. There is also a ♂ in the Hope Collection, taken by Bates in the Amazons.

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## Genus 7.—MUCIDUS. nov. gen.

Head clothed with narrow curved, forked upright, and long twisted scales (Fig. 80).

Thorax with narrow curved scales and long twisted, apically expanded scales as in the head.

Abdomen with dense scales, which stand out, and give it a ragged appearance.

Wings covered with broad pyriform scales, many of which are parti-coloured (Plate B). Palpi of the ♀ half as long as the proboscis; antennae of the ♀ 14-jointed, including the basal joint, of the ♂ 15-jointed; palpi of the ♂ five-jointed, a little longer than the proboscis. Wings with the venation much as in *Culex*, but the *posterior cross-vein is nearer the apex of the wing than the mid cross-vein.*

Legs banded, densely scaled with projecting scales; fore and mid ungues of the ♂ unequal, the larger with two, the smaller with one tooth; hind ungues equal, small, toothed; in the ♀ all the ungues are small, equal, thick, and with a short thick tooth.

The members of this genus are large species, and present a curious mouldy appearance. The genus is represented in Australia, Burma, India, Java, and the West Coast of Africa (Fig. 75). Nothing is known of the life-history. The chief

generic characters are the position of the posterior cross-vein, the form of the wing scales, and the curious bent scales on the head and thorax. These large mosquitoes bite rather viciously.

## TABLE OF SPECIES.

A. Proboscis with ochraceous and yellow scales—no white apical band.

α. Wing fringe with 8 pale yellow spots.

β. Stem of second posterior cell shorter than the cell ..... *alternans.* Westwood.

ββ. Stem of the second posterior cell longer than the cell..... *scataphagoides.* n. sp.

α. Wing fringe with 7 pale spots ..... *mucidus.* Karsch.

αα. Wing fringe with 5 pale spots ..... *Africanus.* n. sp.

AA. Proboscis white banded at apex ..... *laniger.* Wiedemann.

### 1. Mucidus alternans. Westwood (1835).

*Culex alternans.* Westwood (1835).

*Culex commovens.* Walker (1848).

*Culex hispidosus.* Skuse (1889).

(Ann. Soc. Ent. Fr. iv. p. 681, and Trans. Ent. Soc. Lond. iii. p. 384, Westwood (= *alternans*); Ins. Saund. Dipt. p. 432, Walker (= *C. commovens*); Trans. Linn. Soc. N. S. Wales, p. 1726 (1891), Skuse (= *C. hispidosus*).)

(Fig. 41, Pl. XI.)

Of a general mouldy appearance. Thorax yellowish-brown, with white spots as follows: three in front near the head, three in the middle, irregular patches at the sides, and one in front of the scutellum. Abdomen blackish, covered with ochraceous, yellow, white, parti-coloured scales, the white forming more or less basal bands, and a spot on the middle of the segments. Legs densely clothed with ochraceous, parti-coloured and white scales, banded with white. Wings with the veins densely covered with parti-coloured yellowish-white scales, fringe alternately dark and white.

♀. Head brown, with a patch of white scales in the middle and on each side, a pure white edge to the eyes, ochraceous scales between the white patches, and two tufts of yellow hairs projecting forwards; eyes black, purple in some lights; antennae ochraceous, bases of the joints dark, basal joint bright ferruginous,

with a few white scales, verticillate hairs brown; proboscis broad, bright ochraceous yellow, with numerous black scales at the tip and others at the base; palpi covered with parti-coloured ochraceous and deep purple scales and pure white ones, the dark colour predominating at the basal parts, the yellow in the middle, and the white scales at the tip.

Thorax densely clothed with yellowish-brown, curved scales and white spots, formed by groups of pure white scales, longer and broader than the rest, a median and two lateral rows of bristles, and numerous dark bristles at the sides; the white spots are as follows: three in front against the head, three very clear ones in the middle, and broken masses of white scales at the sides, and another small patch just in front of the scutellum; scutellum ochraceous brown, with white scales; metanotum brown; pleurae darker brown, with numerous white scales.

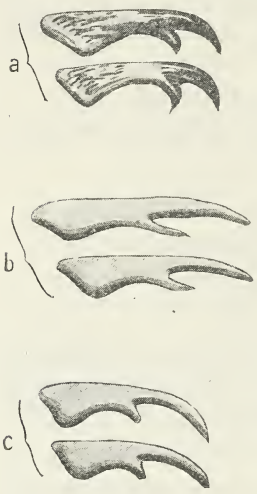


Fig. 78.
Female ungues of *Mucidus*.
a, *M. alternans*, Westw.; b, *M. scataphagoides*. n. sp.; c, *M. Africanus*. n. sp.

Abdomen deep purplish-black to brilliant purple, depending on the light, covered with bright ochraceous yellow, white and parti-coloured scales, the white scales forming more or less basal bands and a white median spot to each segment, especially posteriorly; each segment has also an apical border of pale hairs; first segment nude, with only a patch of white scales in the middle, and numerous fine pale hairs; the white scales at the bases of the abdominal segments spread out laterally and form distinct lateral spots; on the venter the abdomen is broadly, basally banded with white scales, the parti-coloured ones forming only narrow apical borders.

Legs thickly clothed with ochraceous, parti-coloured, and white scales, which stand up from the surface more than usual, all the joints banded; fore femora not very distinctly banded, tibiae with three white bands, metatarsus with two, the first two tarsal joints with basal white bands, last two unbanded; in the mid legs the femora are white at the apex, and have one distinct white band and two white patches below, not forming bands; tibiae and tarsi as in the fore legs; in the hind legs the tarsi are

all basally white. Ungues thick, short, uniserrated; the ungues, which are equal on all the legs, have spines on their sides.

Wings with the veins densely covered with large, particoloured and yellow and white scales, the fringe alternately black and white; the majority of the scales are half purple and half yellowish-brown, but on the costa and first longitudinal, just over the base of the fork-cell, the scales are plain yellowish-white, forming a distinct spot; there are also white scales,

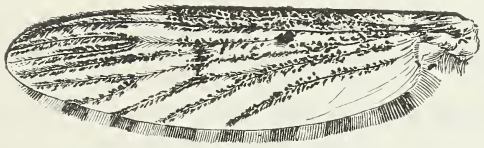

Fig. 79.
Wing of *Mucidus alternans*, Westw. (♀). (X. 9.)

forming spots at the base of the fork-cells, on their stems, a dusky spot over the cross-veins and at the base of the second long vein, where it joins the first; posterior cross-vein a short distance in front of the mid cross-vein and much longer; first sub-marginal cell longer and narrower than the second posterior cell, their bases about level and their stems, which are white scaled, shorter than the cells and nearly equal in length. The surface covered with very minute bristles.

Halteres ochraceous.

*Length.*—7·5 to 8 mm.

♂. Head with white and ochraceous scales and long yellow hairs, border of the eyes white scaled. Antennae ochraceous, with narrow darker rings, plume hairs black at the base on the inside, the remainder silky, ochraceous; apical joints dark; palpi with ochraceous ground colour, the first two joints and ends of remaining joints covered with dark scales, the bases white scaled, hairs silky ochraceous and brown; proboscis yellow, with black apex and black scales on the base.

Thorax with curved yellowish, and numerous long white scales, giving it a frosty and mouldy appearance; the yellow scales are especially noticeable as a large patch at the sides in front and as a median stripe, and also again at the back of the mesonotum; scutellum clothed with white scales; metanotum brownish yellow.

Abdomen much as in the ♀, but with more frosty-white scales; claspers yellowish.

Legs as in the ♀, but the scales are longer, and stand out more from the surface. Front and mid ungues unequal, the large one with two teeth, the smaller with only one tooth; in the hind claws both are equal, small, and with a single tooth.

*Length.*—7·5 mm.

*Habitat.*—Bupengary, S. Queensland (Bancroft) (5. 12. 99); Hexham Swamp, near Newcastle and Richmond, N.S.W., Mt. Kembla, Illawarra, N.S.W. (Skuse and Hamilton); Natal (Walker).

*Time of appearance.*—In Queensland in April, September, October, and November (Bancroft); Illawara, N.S.W., January (Hamilton).

*Observations.*—Westwood's type of *C. alternans* is in the Hope Collection, Oxford; I have carefully examined it, and find it to be the same as Walker's *C. commovens* and Skuse's *C. hispidosus*. The remnant of Walker's type is in the British Museum collection. A good series of specimens has been sent by Dr. Bancroft from Queensland.

This large mosquito is a day-flying species found in the bush. It is known in Queensland as the Scotch Grey and in New South Wales as the Hexham Grey. A second consignment from Dr. Bancroft were bred from larvae in sea water, with sp. g. 1025, and also from fresh water. It is subject to considerable variation in colour.

### 2. Mucidus mucidus. Karsch.

*Culex mucidus.* Karsch.

(Ent. Nachr. p. 25 (1887) (*Culex mucidus*).)

(Fig. 42, Pl. XI.)

Of a mouldy appearance. Thorax yellowish-brown, with yellowish-brown and irregular thread-like white scales, like mycelia of a fungus. Abdomen with brown and white scales, many standing up from the surface, the long white ones predominating on the apical segments and forming a median line in front. Legs yellowish, femora and tibiae densely scaled with dark and white scales, banded, metatarsi and tarsi yellowish, brown and white scaled, bases of the tarsi white, apices yellow. Wings with brown, white, and parti-coloured scales; costa more uniform than the former species.

♀. Head yellowish-brown, with long straggly white scales forming a median line and a few dotted over the whole surface,

numerous black and brown upright forked scales, a narrow white border round the eyes, and numerous golden bristles projecting forwards; antennae yellowish-brown, the basal joint with a tuft of white scales and a few brown scales on the second joint; palpi densely clothed with brown and white scales, the white greatly predominating, especially towards the tip, a few parti-coloured ones also present and a few large black bristles; proboscis covered with golden-yellow squamae, and with numerous brown ones towards the base.

Thorax yellowish-brown, with numerous, narrow, hair-like curved scales of a pale yellowish-brown colour, and with numerous, long, irregularly scattered white ones (expanded apically), in lines and groups over the surface, and with numerous golden bristles, which form three median rows, and others laterally; scutellum densely clothed with long white scales and with a border of dense golden bristles; metanotum yellowish-brown; pleurae brown, with numerous white scales.

Abdomen clothed with brown and white scales, many of which stand up irregularly from the surface; the white scales form a broad, broken, median line on the first few segments and predominate on the remainder.

The legs, except the metatarsi and the tarsi, are densely scaled; the fore femora are yellowish, with long dark scales, white scaled at the apex, and with traces of white scales forming bands at the base and middle; mid and hind femora very similar, but the white bands more distinct in the mid ones; fore tibiae densely scaled, a narrow white band at the base, broadly white at the apex, mid tibiae with the white apical band smaller, hind tibiae with the white band smaller still, and an additional narrow white one in the middle; fore and mid metatarsi and tarsi with short yellow scales in the hind legs; the metatarsi are white at the base, then yellow scaled, mixed with brown, and then densely brown scaled; the four tarsal joints are clothed with long white scales, except at their apices, where they are yellow; ungues of the fore and mid legs equal, toothed, and dark brown.

Wings with the veins clothed with brown and white and a few parti-coloured scales; the costa more uniformly coloured than in *M. alternans*, Westwood, a creamy patch at the end of the sub-costal; the fringe dark, with seven white patches; posterior cross-vein a little nearer the apex than the mid cross-vein; first sub-marginal cell a little narrower and much longer than the

second posterior cell; the supernumerary and mid cross-veins nearly in a straight line.

*Length.*—8 to 8·5 mm.

*Habitat.*—Whydah, W. Africa; and Delagoa Bay.

*Observations.*—This species is closely related to *M. alternans*, Westwood, but differs in the leg markings, the presence of seven instead of eight pale spots on the wing fringe and in the ornamentation of the wings, there being no yellow patch on the costa and no white band running across from it to the fourth long vein.

It has also a much greater preponderance of white scales, which give it a curious mouldy appearance, much more striking than in *M. alternans*. The specimen bears a label with the following: "A specimen from the Swan River in the Berlin Museum, mentioned by Karsch (Ent. Nachr. 1887, p. 26), is either identical with or closely allied to this species. E. E. A. 9 iii. 1897." The specimen from which this description is taken came from Whydah, and the register of the Museum shows it was "collected by Fraser, and purchased in 1853 from Cumming."

### 3. Mucidus Africanus. n. sp.

(Fig. 140, Pl. XXXV. and Pl. E.)

Thorax dusky greyish-brown with shaggy tomentum; abdomen dark brown, with median and lateral patches of long shaggy white scales on the first few segments, the apical segments being mostly white scaled; legs with the femora mostly dark scaled, the tibiae deep black on the basal half or more, white on the apical part; metatarsi and tarsi ochraceous, scales smaller, making them look nude on the fore and mid legs. Ungues equal, thick, serrated (Fig. 80). Wings with only five pale spots on fringe and with apex of the veins deep blackish.

♀. Head brown, with shaggy white twisted scales, some spatulate, especially forming a white median line; upright forked scales numerous, jet black, much wider apically than in other species of this genus; a narrow pale border round the eyes and golden-brown bristles projecting forwards between them; antennae yellowish-brown, with narrow deep brown bands at the verticils, basal joint with a dense tuft of white scales on the inside; palpi densely clothed with scattered white and jet-black scales; eyes black.

Thorax greyish-brown, with two paler median parallel stripes when denuded, covered with rather long curved grey scales and with patches of long twisted scales in front and before the roots of the wings, their heads being spatulate, with dense black and golden-brown bristles laterally; scutellum pale brown to brown, with narrow thin curved scales on the mid lobe, with long twisted spatulate ones on the lateral lobes and a few also on the median, all pure white in colour; metanotum deep chestnut-brown; pleurae deep brown, with white scales.

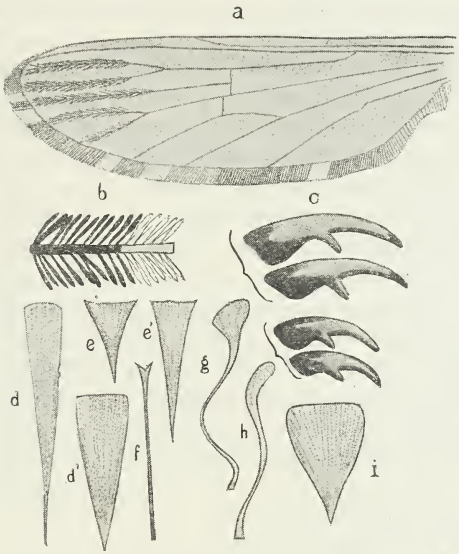


Fig. 80.

*Mucidus Africanus.* n. sp. (♀).

a, Wing of ♀; b, tibial scales; c, ungues of fore and hind legs; d and d′, leg scales; e, e′, abdominal scales; f, head scale; g, scutellar scale; h, second form of head scale; i, wing scale. (Greatly enlarged.)

Abdomen deep ochraceous-brown, covered with deep brown, black, white, and parti-coloured ochraceous and black scales, as follows: the first segment with flat white scales, some almost triangular in form, and with numerous golden-brown hairs; the second to fourth segments are mostly deep brown scaled, with a median and basal lateral patches of pure white; the remaining segments are mostly snow-white, but the fifth and sixth have a few large fan-shaped scales, deep black at their apices.

Legs ochraceous-brown, covered with brown, black, and white

scales, the black largely predominating; femora mostly clothed with dark scales, a few white, and with a white ring round the apex and a few black chaetae; there are also numerous outstanding parti-coloured scales, black at the apex; tibiae of fore legs with dense shaggy jet-black scales on the basal half or two-thirds, the apical portion with pure white scales; in the mid and hind legs the black scales cover the greater part of the tibiae; metatarsi and tarsi of the fore and mid legs not densely scaled, thin ochraceous in colour; in the hind legs there are scales standing more or less from the surface, the basal ones, on the second tarsal and partly on the first, white; ungues equal, uniserrated, thick, more curved than in *M. scataphagoides*, not nearly so blunt and thick as in *M. alternans*.

Wings with broad spatulate scales, mostly parti-coloured, those on the fork-cells and apical half of the third longitudinal black; there are also a few dark scales dotted over the other veins amongst the paler parti-coloured ones, especially along the costal and first longitudinal vein; fringe mostly dark, very black at the apex, with five irregular-sized pale patches, two small ones near the apex, between the third long vein and the upper branch of the second posterior cell, a longer pale patch on each side of the upper branch of the fifth, and another rather faint one nearer the base of the wing; first sub-marginal cell considerably longer and narrower than the second posterior cell, its stem equal to about half the length of the cell; stem of the second posterior cell as long as the cell; cross-veins normal, the posterior rather nearer the mid perhaps than usual.

*Length.*—7 to 7·5 mm.

*Habitat.*—Asaba, W. Africa (Annett).

*Time of capture.*—August.

*Observations.*—A number of this species have been sent me by Dr. Annett. It can at once be told from others of the genus by the simplicity of the leg banding, the tibiae being half black scaled and half white. The nude appearance of the fore and mid metatarsi and tarsi is also characteristic, whilst the ungues and wing scales clearly differ from the other species. The wing fringe and the black-scaled apices to the fork-cells and third long vein are also very noticeable characters. Although the scales somewhat differ in form from the type, yet they present the same general appearance, and the wing venation clearly shows the species to come in this genus. It appears to be common in parts of the west coast of Africa.

4. Mucidus scataphagoides. n. sp.

(Pl. E.)

Thorax with dense grey mouldy hue, with a yellowish-brown patch on each side, having the appearance of the head of an insect. Abdomen yellowish-brown, with a white median tuft of scales on the first four segments, remainder mostly white-scaled. Wings with similar fringe to *M. alternans*, but the stem of the second posterior cell much longer; legs banded with white and yellowish-brown; ungues of the ♀ equal, thick, uniserrated, not as thick as in *M. alternans*, and of different form (Fig. 78).

♀. Head yellowish-brown, with a white-scaled border round the eyes, with numerous long irregular white scales in the middle, which form a denser median line, dense white scales laterally and numerous long thin yellowish upright forked scales, numerous pale ochraceous bristles projecting forwards and a row of very pallid, rather flattish ones over the eyes; eyes coppery-red and black; antennae ochraceous, with narrow dark bands at the verticils, apical joints dark brown, basal joint bright ochraceous, with a tuft of white scales on the inside; proboscis ochraceous, with brown scales at the base, the middle with projecting ochraceous and white scales, and the apex with flatter bright ochraceous scales; palpi ochraceous, with projecting white scales and a few parti-coloured dark brown and white; clypeus bright ochraceous yellow.

Thorax brown, densely clothed with long white woolly-like scales, except on two brown eye-like patches on the anterior half of the mesonotum, where the scales are short, not so white, and few in number; the white mouldy scales are particularly dense on each side of the mesothorax, in front, and also just before the base of the wings, there are also very numerous thick golden-brown curved hairs; scutellum pale brown, with long twisted white scales, some with spatulate extremities, the majority clavate at the apex, with brown border-bristles; metanotum chestnut-brown; *pleurae pale brown, with one large and several small deep brownish-black spots.*

Abdomen densely clothed with very bright ochraceous-yellow, white, and parti-coloured yellow and brown scales, the latter at the sides; the white scales form more or less a median line on the first few segments, the apical segments being densely white scaled, some of these median scales are flat, others long and

spatulate, increasing in length near the apex of the abdomen; there are also dense lateral tufts of long spatulate white scales at the bases of the segments; the first segment is ochraceous, with median patches of flat white scales and numerous golden hairs, which are also abundant over all the abdomen.

Legs ochraceous, banded with ochraceous yellow and brown parti-coloured and white scales, the scales being at a considerable angle to the legs; the apices of the parti-coloured scales are dark brown, and these form two bands on the hind femora, tibiae, and metatarsi; the tibiae have three white bands, one basal, another median, and the third apical; the metatarsus, a basal and a median white band; the tarsi are basally white; the mid and fore legs are much the same; ungues equal and uniserrated, rather thick, much straighter than in *M. alternans*.

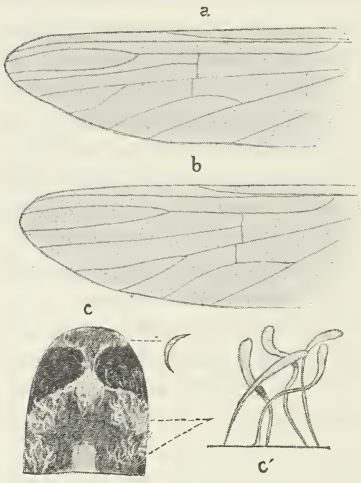


Fig. 81.

*Mucidus scataphagoides*. n. sp.

a, Wing of ♀; b, wing of *M. alternans*, Westwood; c, thorax, and c', enlarged thoracic scales.

Wings with venation much as in *M. alternans*, but the stem of the second posterior cell is longer, not shorter than the cell; the third long vein is also very close to the second long vein; the posterior cross-vein is nearly as long as the mid and the supernumerary together; the branches of the first sub-marginal cell are also more curved than in *M. alternans*. The fringe has eight distinct pale patches like *M. alternans*.

*Length*.—6·5 to 7 mm.

*Habitat*. — Burma, &c. (Watson); Moradabad, N. W. P., India (Close).

*Time of capture*.—September (N.W.P.).

*Observations*.—Colonel Giles sends me two excellent specimens of this new *Mucidus*. They were received by him from Major Close, I.M.S., and are, as he suggests in some notes and despatches sent me, identical with some specimens in the British Museum from Burma (Watson Coll.). The note sent *re* this species is as follows: "They only appeared for about a week in September,

and occurred in the Police Hospital at Moradabad, N.W.P., and bit the patients very viciously." Major Close put a ♀ that had recently bitten in a test tube, placed on the slant, with some water in the bottom. She deposited a number of eggs separately, but when transferred to water they did not hatch out.

It is clearly distinct, and may at once be told by the curious thoracic ornamentation, the anterior part of the thorax looking just like a butterfly's head, the brown lateral spots resembling the eyes. The venation differs from *M. alternans*, which it most approaches, and from *M. mucidus* it can be told by the additional spot on the wing fringe, as well as other structural details. The name was suggested by Colonel Giles.

5. Mucidus laniger. Wiedemann (1821).
*Culex laniger*. Wiedemann.

(Dipt. Exoti. p. 9.)

Entirely covered with woolly hairs, variegated with white and fuscous.

♀. Proboscis yellow, with a white band at the apex, palpi with white and fuscous lanugo; bases of the antennae yellow, the flagella whitish; head covered with fuscous lanugo, with a median stripe and two continuous stripes on the pleurae, white; abdomen white, with a fuscous band on the apex of each segment. Wings with the veins with fuscous and white scales, the internal margin ciliated alternately fuscous and white; halteres whitish. The ground colour of the legs is yellow, but is, like the body, covered with white and fuscous lanugo; there is no white in the anterior tarsi, but in the hinder their apices are white; the tibiae of the front legs are white at their bases and apices, whilst those of the middle and hinder are banded white; the femora of the fore legs have three, and of the hinder and middle four white bands.

*Length.*—4 lines (German).

*Habitat.*—Java.

Note.—This is evidently distinct from any species I have seen, and clearly comes in this group. The apical fuscous bands to the abdomen should separate it from the other species. At present I have not seen any Javanese species.

## Genus 8.—ERETMAPODITES. nov. gen.

Head clothed with flat and upright forked scales; antennae of the ♀ fourteen-jointed, of the ♂ fifteen-jointed, the last two joints long; palpi of ♀ four-jointed; of the ♂ long and thin, five-jointed, basal joint small; third and fourth joints nearly equal; apical joint about two-thirds the length of the penultimate joint; palpi pointed, no hair tufts. Mesothorax clothed with narrow curved hair-like scales; scutellum with flat scales on the mid lobe. Abdomen densely scaled with broad flat scales. Fore and mid ungues of ♀ equal, and each with a small tooth; fore ungues of ♂ unequal, the larger thick, simple, the smaller one thin, and with a single tooth; mid ungues unequal, the larger one stout, the smaller very thin, both simple; hind ones equal and simple, small. Last two tarsi of the hind legs in the ♂ densely scaled, forming a distinct "paddle" in one species. Wings with the first sub marginal cell longer and narrower than the second posterior cell, stem of the latter considerably longer than the cell; venation practically as in *Culex*.

Two species only occur so far. The chief distinguishing features, besides the squamate structure, are the long thin hairless palpi and the ungues.

Nothing is known of its life-history, except that Mr. Austen bred the gnats from larvae in old tins and bottles full of water. There is no continuation of the third vein as a pseudo-vein into the basal cell, as in *Armigeres*. The two species are very closely related and occurred together.

### 1. Eretmapodites quinquevittatus. n. sp.

(Figs. 47 and 48, Pl. XII.)

Thorax bright ferruginous brown, with six golden scaled lines, dividing five darker ferruginous lines. Abdomen black, the last two segments with brilliant silvery-metallic scales, five lateral silvery-white patches. Legs black, with a white knee spot, pale bases to the femora, and with the hind tarsi in the ♂ densely scaled, forming a dark broad paddle. Wings transparent, with dark brown scales.

♀. Head densely scaled with brilliant burnished silvery scales, and with black upright forked scales behind; clypeus, palpi, and proboscis black; palpi of moderate size, thickly scaled; antennae

dark brown, with narrow pale bands ; basal joint black, with a few small ochraceous scales ; second joint testaceous, with black and ochraceous scales.

Thorax ferruginous-brown when denuded, covered with bright golden-yellow and chocolate-brown narrow curved scales, as follows : a median and two lateral chocolate-brown longitudinal stripes, separated by golden-yellow ones, the latter six in number, and the golden-yellow scales meeting round the front of the mesonotum, the five dark lines showing in great contrast to the six yellow ones ; the space in front of the scutellum is yellowish, with a few curved black scales, numerous black bristles over the roots of the wings ; scutellum yellowish, with curved scales at the sides, flat black ones on the mid lobe, with a central patch of silvery ones, and long brown bristles ; metanotum clear yellowish-brown ; pleurae clear yellowish, with a line of burnished silver scales and three brilliant silver spots, one over the root of each leg.

Abdomen dorsally black, with dull metallic violaceous reflections (in some lights), the last two segments with brilliant silver and metallic scales, always most distinct on the apical segment, laterally there are five diagonal white patches, sloping backwards ; posterior borders of the segments with short golden hairs ; venter covered with brilliant creamy-yellow scales, the last three or four segments with an apical border of long black scales, projecting over the following segment.

Legs with the coxae yellowish ; bases and the basal half of the femora yellow below, remainder of the legs black, with bronzy reflections, except a small white knee spot on the mid and hind legs ; hind metatarsus not quite as long as the hind tibia ; legs densely scaled, but the scales lying flat ; ungues of the fore legs equal, uniserrated, the tooth about the middle of the claw ; those of the mid legs also equal and toothed ; of the hind small, equal and simple.

Wings covered with dark brown scales, especially dark along the costal border, the lateral scales rather shorter and thicker than usual ; first sub-marginal cell considerably longer and a little narrower than the second posterior cell ; its stem equal to two-thirds the length of the cell, its base nearer the base of the wing than the base of the second posterior cell ; stem of the short second posterior cell considerably longer than the cell ; the sixth vein nude near the border of the wing ; supernumerary and mid cross-veins meet at a considerable angle, posterior cross-vein

distant from the mid cross-vein a little more than its own length; fringe brown.

Halteres with ochraceous stem, with a line of black scales down one side, and with a black knob, the black scales having violaceous reflections.

*Length.*—5·5 to 6 mm.

♂. Head as in the ♀; proboscis long, thin, black; palpi not as long as the proboscis, black, with purple and sometimes bronzy reflections, very thin; penultimate and antepenultimate joints about equal; the apical joint two-thirds the length of the penultimate, second short, first very small; the apical joint ends in one long and several smaller bristles. Antennae banded with broad grey bands and narrow pale brown ones, basal joint black; plumes deep brown, last two joints brown.

The thorax is not so distinctly ornamented as in the ♀, and the scutellum has a very clear patch of flat silvery scales on the mid lobe, surrounded by flat black ones, and has black and

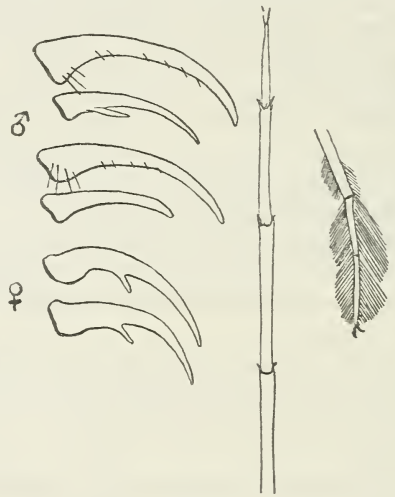


Fig. 82.

*Eretmapodites quinquevittata.* n. sp.

Fore and mid ungues of the ♂; fore ungues of the ♀; palpus and apical tarsi of hind leg of the ♂.

golden curved squamae on the lateral lobes. Abdomen narrower than in the ♀, but expanding apically; penultimate segment with a broad silvery apical band; the five white lateral spots more distinct than in the ♀, apical segment black, genitalia

testaceous, with black bristles and a few dusky scales. Legs with the coxae yellowish, femora and remainder all black, knee spot only to the hind legs, where it is broad, *the last two tarsal joints densely scaled with long black scales*, giving them a "paddle-like" appearance. Fore ungues unequal, one very thick, untoothed, the smaller one thin and serrated; mid unequal, neither toothed, the large one very broad; hind equal, small, simple.

Wings with the first sub-marginal cell very much longer than the second posterior cell, about two and a half times longer than the stem; posterior cell with the forks widely divergent and the stem much longer than the cell; posterior cross-vein rather more than its own length distant from the mid cross-vein.

*Length.*—5·5 mm.

*Habitat.*—Sierra Leone (Austen, September, 1899) (99, 267); Old Calabar (Annett).

*Time of capture.*—August and September (Austen), May (Annett).

*Observations.*—Described from a series brought back by Mr. Austen from the West Coast of Africa. The specimens were bred from larvae found at Freetown, in water in an old tin and bottle. The thoracic ornamentation and the curious paddle-like appearance of the hind tarsi of the male will at once distinguish this species.*

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### Genus 9.—**STEGOMYIA.** nov. gen.

Palpi short in the ♀, long in the ♂, four-jointed in the ♀, and five-jointed in the ♂.

Head clothed completely with an armour of broad flat scales; mesothorax covered with either narrow-curved or spindle-shaped scales; scutellum *always* with broad flat scales to the middle lobe, and usually with them present on the lateral lobes (Fig. 9, A); abdomen completely covered with flat scales, banded or unbanded, with white lateral spots. The ♀ palpi are small, never more than one-third of the length of the proboscis; those of the ♂ are long, or longer than the proboscis and usually nude.

Wings with similar venation to a typical *Culex*, but the fork cells short.

* The second species, *E. Austenii*, will be described in the third volume.

This genus includes several *Culices* which present quite a different appearance to all the others, save a few of the banded proboscis group of *Culex*, such as *Culex taeniorhynchus*. They are stoutly built insects, mostly black and white in colour, with usually banded legs and banded abdomen. The flat head scales give them a very different appearance to *Culex*, whilst the flat scutellar scales will separate the females from other *Culices* with flat scaled heads, such as *Aedes*, *Deinocerites*, &c. The genus includes the world-wide *Culex fasciatus*, and the closely related *C. scutellaris*. The larvae (Fig. 16) of certain species of this genus

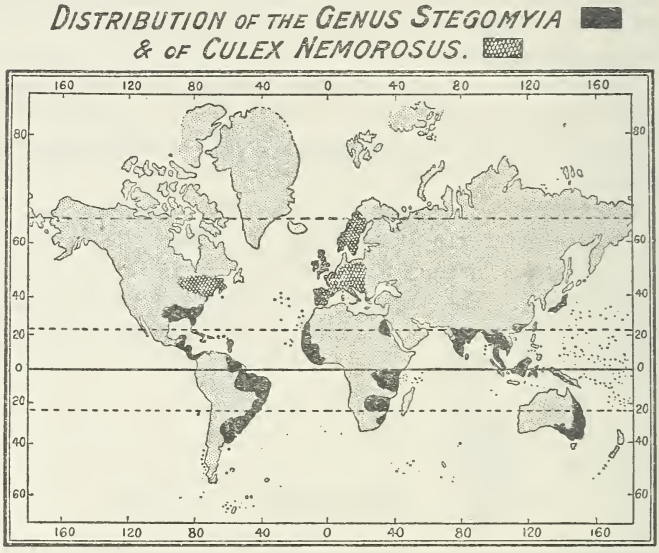


Fig. 83.

have been roughly described and figured by some correspondents, and seem to breed in very similar places to *Culex*. The adults are in most cases very vicious biters, both by day and night in some cases. One of the members of this genus, *C. fasciatus*, is being experimented with in Cuba by the American Commission on Yellow Fever, and is the agent by which the germs of this disease are spread. The genus is represented in most tropical and sub-tropical countries, and one species (*C. fasciatus*) occurs in the warmer parts of South Europe.

The eggs of *S. fasciata* are laid separately, not in "rafts" as in *Culex*.

## SYNOPTIC TABLE OF GENUS STEGOMYIA.

A. Tarsi basally banded white.

(a) Proboscis banded.

Thorax with narrow median silver line and lateral curved lines and two short yellow ones in front ..... *notoscripta.* Skuse.

(aa) Proboscis unbanded.

Thorax with two median parallel pale lines and lateral curved pale lines, ungues of ♀ toothed ..... *fasciata.* Fabricius.

Lateral lines not strongly bent; ungues of ♀ simple..... *signifer.* Coquillett.

Thorax with a single median silvery line and lateral curved lines..... *scutellaris.* Walker.

Thorax with four silvery spots..... *sugens.* Wiedemann.

Thorax with two short parallel lines in front and a white spot on each side ..... *Nigeria.* n. sp.

Thorax with two lateral oblique white side bars ..... *Africana.* n. sp.

Thorax with two broad patches of white scales on each side in front... *terrens.* Walker.

Thorax with a median thin white line and lateral bent one, and another below on each side, abdomen with basal white bands and oblique white lateral lines ..... *Grantii.* n. sp.

Thorax brownish-black, with two median parallel yellowish lines, and two pairs of lateral pale curved lines on front of mesonotum..... *sexlineata.* n. sp.

B. Tarsi apically banded.

Thorax with four silvery spots on the mesonotum, and traces of a third smaller pair..... *Marshallii.* n. sp.

C. Tarsi apically and basally banded.

Thorax much as in *notoscripta* ..... *pseudotaeniata.* Giles.

Thorax sooty, with a round anterior median and four lateral snowy spots at corners of mesonotum..... *gubernatoris.* Giles.

D. Tarsi unbanded.

(b) Abdomen unbanded, with basal white lateral spots.

Thorax deep brown, four brilliant white spots on dorsum, and two lateral pairs..... *argenteopunctata.* n. sp.

Thorax deep umber brown, with two small spots on the mesonotum, and traces of two median parallel pale lines ..... *minuta.* n. sp.

(bb) Abdomen with apical pale bands.
Thorax unadorned, except for pale scales over the roots of the wings *crassipes.* Van der Wulp.

1. Stegomyia notoscripta. Skuse (1889).
*Culex notoscriptus.* Skuse.

(Proc. Linn. Soc. N. S. Wales, iii. p. 1738 (1889).)

(Fig. 52, Pl. XIII.)

Thorax umber-brown or black, with a median silvery line, two lateral curved lines and two short yellow lateral ones between them and the median line in front; abdomen black, with basal white lateral patches, and more or less distinct basal white bands; legs black, some of the tarsi with basal white bands, last joint of hind legs pure white, wings with brown scales.

♀. Head black, with black scales, some upright forked ones, a patch of yellowish-white scales in the middle behind and a silvery-white border to the eyes; bristles black; antennae black, with pale pubescence and black verticillate hairs; palpi black scaled, with the apex pure silvery-white; proboscis black, with a pure silvery-white band in the middle, slightly testaceous at the base; mesothorax deep umber-brown to almost black, with numerous bronzy-black flat spindle-shaped scales (under a hand lens it looks velvety umber-brown); there is a narrow median silvery-white line which expands round the bare patch in front of the scutellum, a long curved one on each side, a short one on each side of the median line in front, and another short one on the outside of each of the curved lines behind; scutellum brown, with a basal band of pure silvery-white, composed of a single row of flat broad scales, a few also on the mid lobe; bristles black, there being five in the middle lobe; pleurae paler brown than the rest, with six large and several smaller patches of white scales; metanotum pale brown; mesonotum beset with numerous long black bristles.

Abdomen covered with black scales with purplish reflections, each segment with a basal lateral patch of silvery-white scales,

and a few white scales on the base of the segments every here and there; posterior borders with golden-brown scales; first segment deep ochraceous, with ochraceous and black scales, and numerous golden hairs. Legs with the coxae pallid, femora black, pale at the base and down one side with a silvery-white line in front and a white apical spot; tibiae black, also with a pure silvery-white line along its length; metatarsi black, with broadish basal white bands; in the fore legs the first tarsal joint with a basal white ring, remainder black, and in the mid legs there is a trace of basal white banding on the second joint as well; in the hind legs all the tarsi have a broad basal white band, save the last, which is pure white except for a patch of brown scales below at the apex; front ungues equal, with a single tooth on each, mid and hind equal and simple, the latter very small.

Wings with the veins covered with black scales, their apical terminations with long thin lateral scales and shorter broad ones also lateral; first sub-marginal cell considerably longer and narrower than the second posterior cell, its base almost level with that of the latter, if anything a little nearer the base of the wing; stem less than one-third of the length of the fork-cell; second posterior cell about one and a third times the length of its stem; posterior cross-vein twice its own length distant from the mid cross-vein; fringe grey. Halteres with pale stem and black knob.

Fig. 84.

Wing of ♀ *Stegomyia notoscripta*, Skuse. (X. 9.)

*Length.*—4 to 5 mm.

♂. Head covered with black scales with a border of silvery-white ones round the greenish-golden eyes, a patch of ochraceous scales in the middle at the back of the head, and a row of black bristles projecting forwards. Antennae brown, banded, verticils silky brown, basal joint with a small patch of silvery white scales; palpi ochraceous-brown, sparsely covered with dark brown scales basally, becoming jet black towards the apex, last two joints with broad basal bands of pure white scales; proboscis black, with a band of pure white on the base of the apical half.

Abdomen like the ♀, but with a distinct basal band of ochraceous and white scales, the silvery lateral basal spots not so distinct on the anterior segments; genitalia brown.

Legs as in the ♀, but the basal band on the second tarsal joint of the mid legs is often not visible; ungues of fore and mid

legs unequal, the larger one toothed with a long tooth, the smaller with a short one nearer the base, hind ones equal, with a trace of a small central tooth.

Wings with the first sub-marginal cell longer and much narrower than the second posterior cell, the cell about one and a half times the length of the stem; stem of second posterior cell not quite as long as the cell, about the same length as that of the former cell; bases of the cells nearly opposite; posterior cross-vein about one and a half times its own length distant from the mid cross-vein.

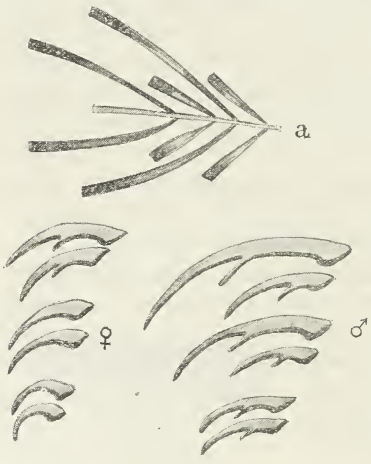


Fig. 85.
*Stegomyia notoscripta*, Skuse.
a, Wing scales; and ♀ and ♂ ungues.

*Length.*—4·5 mm.

*Habitat.*—Queensland (Dr. Bancroft); Adelaide, New South Wales, generally distributed (Masters and Skuse).

*Time of appearance.*—July, in Queensland (Bancroft); October, in Adelaide; in New South Wales, Skuse says from September to January.

*Observations.*—A very distinct species, easily identified by its thoracic ornamentation and banded proboscis. A widely distributed mosquito in Australia, which causes a very painful wound. According to Skuse, it occasionally comes into the house in the daytime.

The larvae are said by Skuse to swarm in water-butts and garden tanks from December to March. In the hot weather the larvae are hatched from the boat-like mass of (nearly three hundred) eggs in about twenty-four hours, and the perfect insects emerge in from three weeks to a month.

A small variety exists in the Blue Mountains, New South Wales (Skuse). The specimens from Adelaide are larger than those from Queensland sent by Dr. Bancroft. The New South Wales specimens seem slightly the largest, but as in many *Culicidae* there is considerable variation in size.

The "egg rafts" occur in this species, and thus it forms an exception to the rule in *Stegomyia*.

2. Stegomyia fasciata. Fabricius (1805).

*C. fasciatus.* Fabricius (1805).
*C. calopus.* Meigen (1818).
*C. taeniatus.* Wiedemann (1828).
*C. elegans.* Ficalbi (1896).
*C. Rossii.* Giles (1899).
*C. exagitans.* Walker (1856).
*C. formosus.* Walker (1848).
*C. frater.* Desvoidy (1827).
*C. excitans.* Walker (1848).
*C. viridifrons.* Walker (1848).
*C. inexorabilis.* Walker (1848).
*C. Bancroftii.* Skuse (1886).
*C. mosquito.* Arribalzaga (1891).
*C. annulitarsis.* Macquart (1848).
*C. impatibilis.* Walker (1860).
*C. Konoupi.* Brullé (?) (1832).
*C. zonatipes.* Walker.

(Syst. Antl. 36, 13 (1805), Fabr.; Aussereurop. Zweiflüg. Insec. p. 8 (1828) (= *fasciatus*), Wiedemann; Aussereurop. Zweiflüg. Insec. p. 10 (1828), Wiedemann (= *taeniatus*); Bull. Soc. Ent. Ital. p. 251 (1896), Ficalbi (= *C. elegans*); Jour. Trop. Med. p. 64 (1899), Giles (= *C. Rossii*); Dipt. Argent. Revista d. Museo d. l. Plata, p. 60, fig. 2, pl. iii. Arribalzaga (= *C. mosquito*); Proc. Linn. Soc. N. S. Wales, iii. p. 1740, Skuse (= *C. Bancroftii*) (1886); Ins. Saundersiana, p. 430, Walker (= *exagitans*); Dipt. Insects Brit. Mus. pt. 1, p. 4 (1848) (= *inexorabilis*); (*ibid.*), p. 4 (= *formosus*); Brit. Mus. List, i. p. 4 (1848), Wlk. (= *excitans*); B. M. List, p. 3, Wlk. (= *viridifrons*); Syst. Beschr. Zwei. i. p. 3 (1818), Meigen (= *calopus*); Dipt. Exotica, i. Macq. (= *annulitarsis*) (1848); Bull. Soc. Ent. Ital. p. 251 (1896), Ficalbi (= *calopus*); Journ. Proc. Linn. Soc. iv. p. 91 (1860), Wlk. (= *impatibilis*)); Proc. Linn. Soc. Lond. v. p. 229, Walker (= *zonatipes*).

(Figs. 49 and 50, Pl. XIII.)

Thorax dark brown to reddish-brown, with two median parallel pale lines and a curved silvery one on each side, a small line in front between the two median ones. Abdomen black, with white basal bands and lateral spots. Legs black, with basal white bands, last joint of hind legs pure white.

♀. Head densely clothed with broad flat scales, black and grey on each side, a white patch in the middle in front extending back to the neck, a white patch on each side, a thin white border to the eyes; the scales at the back of the crown with an ochraceous tinge in some lights, long black bristles projecting forwards; eyes black, with silvery patches in some specimens; antennae blackish, with narrow pale bands, basal joint black, with a patch of white scales on the inside (appearing as two small white spots with a lens), second joint sometimes pale testaceous at the base, pubescence and verticils dark brown; palpi black scaled, the last joint with pure silvery-white scales inside and on the tip, sometimes entirely white.

Thorax dark brown, covered with reddish-brown, pale golden and creamy curved scales, ornamented as follows: a pure-white, broad curved band on each side, curved inwards about the middle of the mesonotum and continued back as a thinner pale line to the scutellum, two thin parallel pale scaled lines between, extending about half way across the mesonotum and more or less on to the scutellum, a short white line in front between these two, a white spot on each side of the thorax in front near the neck; scutellum with a thick row of white scales and with three tufts of bristles; metanotum brown; pleurae dark brown with several patches of silvery scales.

Fig. 86.
*Stegomyia fasciata*, Fabr.
Female ungues.

Abdomen dark brownish-black, with basal bands of white scales; first segment densely clothed with creamy scales and edged with pale hairs; sides with patches of white scales forming more or less flat triangular patches.

Legs with the femora with the bases yellowish, dark scaled towards the apex, extreme tip pure white, ventral surface partly covered with white scales; tibiae black; metatarsi with basal white bands; fore tarsi with the first joint basally white, rest black; mid tarsi the same; hind tarsi all basally white, except the last joint, which is pure white, penultimate joint mostly white with black apex; fore and mid ungues both toothed and hind without teeth.

Wings with the veins clothed with very long narrow brown scales, and short median broad dark brown ones; first sub-marginal

cell longer and but slightly narrower than the second posterior cell, base of the former a little nearer the base of the wing than the latter; posterior cross-vein about one and a half times to twice its length distant from the mid cross-vein.

Halteres ochraceous, sometimes the knob is slightly fuscous.

*Length.*—3·5 to 5 mm.

Fig. 87.
*Stegomyia fasciata* (♀).
(Queensland.) (X. 9.)

♂. Darker than the ♀.

Head black, with white scales in front and in the middle; antennae brown, with paler brown bands, sometimes almost white, basal joint jet black with a large tuft of pure white scales, plumes brown; palpi black with four white basal bands; proboscis black; thorax marked as in the ♀, but much darker, and the white scales clearer and more silvery.

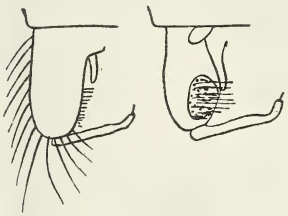

Fig. 88.
*S. fasciata* (= *elegans*) (after Ficalbi).

Abdomen with the first segment with creamy scales, bases of the second to fifth segments white, fifth to eighth with clear white lateral spots; these spots also occur on the front segments, but quite at the sides.

Legs as in the ♀. Fore claws unequal, the larger one with a short blunt tooth, smaller one untoothed; mid ungues unequal, untoothed; hind equal, untoothed.

*Length.*—3 to 4·5 mm.

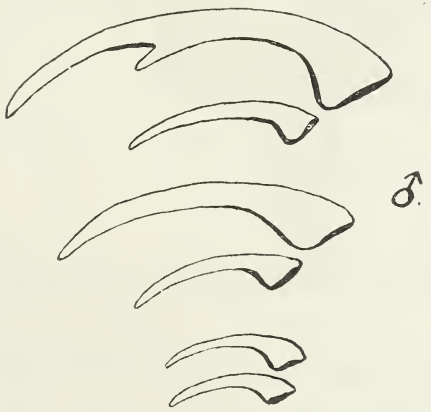


Fig. 89.
*Stegomyia fasciata*, Fabr. Male ungues.

*Habitat.*—Quilon, Travancore, S. India (James) (6. 2. and 7. 3. 1900); Calcutta (Daniels); Singapore (P. de Fontaine) (2. 8, 12. 7. and 30. 7. 1899); Madras (Goodrich) (12. 12. 1899);


Fig. 90.

Grenada, West Indies (W. E. Broadway) (14. 2. 1900); St. Lucia (Gray) (25. 6. 1899, and Galgay, 21. 12. and 21. 9. 1899); Jamaica (Grabham) (7. 12, 15. 9, and 24. 11. 1899); Kingston, Jamaica (Powell); Jamaica (F. Crundall) (15. 9. 1899);

St. Vincent) (25. 5. 1899); New Amsterdam, British Guiana (E. Rowland) (4. 4. 1899); British Honduras (Brit. Mus. Coll.); Panama (Mallet) (22. 9. 1899); Para, Brazil (W. A. Churchill) (11. 2. 1899); Demerara (Quelch) (16. 6. 1899); Rio de Janeiro (Lutz); Sierra Leone (Austen); Lagos (Austen); Nairobi, Zanzibar (Mackinder); Durban (Christophers) (7. and 11. 1. 1899); Senegambia (Rees) (78); Belize; Upper Burma (Watson); Bermuda (E. Harvey) (16. 8. 1899); Tokyo, Japan (C. H. B. Wood) (3. 8. 1899); Gibraltar (Birt) (22. 9. 1899); Italy (Ficalbi); Savannah (Wiedemann); Georgia, U.S.A. (Howard); Queensland (Bancroft); N. S. Wales (Skuse); Victoria (French); Mashonaland (Marshall); Mombasa (J. O. McKay) (76); Spain (Schiner); Portugal (Meigen, Macquart, &c.); England (Stephens (?)); Cuba, Porto Rico (Fabricius).

Regarding America generally, Professor Howard writes me: "It is found in considerable numbers in the southern portions of this country, and as far north on the Atlantic coast as Virginia beach, Virginia."

*Time of capture.*—Brazil (Churchill, March 13 and 19); Sierra Leone, Lagos (Austen, August); Durban (Christophers, January 7 to 11); Japan (August); Bermuda (Harvey, July); Jamaica (Cundall, August); Gibraltar (Birt, August); Queensland (November); Grenada (February); Belize (September); Burma (December); Mashonaland (April).

*Observations.*—This is a very distinct and common species, easily told by the thoracic ornamentation and by the last hind tarsal joint being white. It is almost cosmopolitan, but does not appear to occur in cold regions. As one would expect, it is subject to considerable variation in colour and size, especially in regard to the colour of the thorax. Major Ross speaks of it as the Brindled Mosquito, Captain James as the Tiger Mosquito, and this I find the most general popular name.

*Fasciata* is one of the most troublesome and annoying mosquitoes in tropical and sub-tropical climates; both ♂ and ♀ bite, according to one correspondent (McKay). The bite is very irritating. This is one of the mosquitoes that forms the intermediate host of the haematozoon *Filaria Bancroftii*, although it also occurs in *C. fatigans*, Wiedemann, and in *Anopheles*, as has recently been shown by Captain James.

The Yellow Fever parasite is disseminated by this gnat.

St. George Gray in a letter to Mr. Austen says: "*Culex taeniatus* (= *fasciatus*) is a most vicious biter in the early

afternoon from about 1 to 3 p.m., but that in the morning they rest on the walls and clothing, especially dark clothing, where they are easily caught. You will observe, he says, that I have caught them at all hours of the day and even late at night."

Dr. Lutz calls this insect the Spotted Day Mosquito.

*Synonymy.—S. fasciata* has, I find, been described under at least sixteen different names. I believe at least two others can be added to this long list of synonyms, but without seeing the types one cannot possibly say. The following I have verified by personal examination: *C. calopus*, Meigen; a specimen so named from Portugal is in Bigot's collection, now in Mr. Verrall's possession; it is much worn, but cannot be mistaken. Mr. Verrall has also other *S. fasciata* from Portugal. Meigen described the species from that country, it being in bad condition. The type of *calopus* is in the Jardin des Plantes in poor condition, but recognisable as *fasciata*. *C. exagitans*, *formosus*, *zonatipes viridifrons*, *excitans*, and *inexorabilis*, all of Walker, are the same; the types of these spurious species are in the old British Museum collection, all in a bad state, but nevertheless sufficient remaining to show them all to be this cosmopolitan species, in spite of the discrepancies shown in his various descriptions, due mainly to imperfect or rubbed specimens.

*C. mosquito* of Arribalzaga is clearly *fasciata* from the figure in his work. *C. Bancroftii*, Skuse, is also *fasciata*, the species being very common in Australia.

Ficalbi described the same insect under the name *C. elegans*, and Giles under the name *C. Rossii*.

I fancy *C. Konoupi* of Brullé is only this species, but I cannot trace the type. Desvoidy's *C. frater* was proposed for Wiedemann's *fasciata*, Desvoidy considering Wiedemann's specimen to be distinct from Fabricius'; the difference in the descriptions being due to Fabricius taking the palpi for the proboscis.

Fabricius in 1805 (Syst. Antl. 36, 13) described *C. fasciatus*. "The thorax transfixed by too thick a pin, but shows a light stripe, which appears snow-white in certain lights," says Fabricius. Probably this line was one of the four lines seen in typical specimens of what is generally taken as Wiedemann's *taeniatus*. There were no hind legs to the specimen; the other parts agree well with *taeniatus*, except the abdomen is described as being "lighter brown," which does sometimes happen in rubbed specimens.

What has generally been taken to be Fabricius' species in Cuba

by American observers is Wiedemann's *taeniatus*, so Professor Howard writes me; and as there is only one species of this kind found in the West Indies, I feel sure that *taeniatus*, Wiedemann, must sink as a synonym of *C. fasciatus*, Fabricius.

Wiedemann's *C. taeniatus* was described also from evidently rubbed specimens (A. Z. I. p. 10). His description of the thorax is as follows: "The denuded thorax of the males brown, of the undenuded ♀'s brownish, with three brown stripes, the middle one linear and smaller, the suture snow-white on either side."

In all other respects the description agrees with the cosmopolitan species received at the Museum, the ornamentation of the thorax, as in numbers of specimens I have seen, being very easily destroyed. Wiedemann himself suggested that his *taeniatus* might be no more than a variety of Fabricius' species. Wiedemann's specimens came from Savannah.

*Variation of the species.*—There is much variation in this species, both in size and colour of the thoracic scales. In this way no doubt some confusion has arisen, but after examining some hundreds of specimens I can detect no structural difference in those from various parts of the world. Dr. Bancroft sends some from Queensland under the name *C. Bancroftii*, which have certain peculiarities in some specimens, such as the thoracic scales being golden-brown and the abdomen with apical yellow bands, all stages existing from one or two yellow apical scales to distinct bands; this is described as a distinct variety (*Queenslandensis*).

Others occur, such as *mosquito*, *Luciensis*, &c., referred to in the following pages. Such numbers of this species have been received that I may have overlooked a few that are separate.

### Stegomyia fasciata.

var. *mosquito*. R. Desvoidy.

(Fig. 50, Pl. XIII.)

There is little doubt in my mind, after examining a large number of specimens, that Desvoidy's *Culex mosquito* is only a variety of *C. fasciatus*. From St. Lucia, Calcutta, &c., numbers of specimens in excellent condition have been received which answered to Desvoidy's description of *C. mosquito*; but variation of the thoracic markings in all degrees could be found, hence I take the species that answer to the

description of *mosquito* to be merely varieties of the cosmopolitan *S. fasciata.*

*Mosquito* differs from the type *fasciata* in that the thorax is only marked by the semilunar, silvery, lateral stripes, and the scales of the mesonotum are rather more rusty-red (Fig. 50, Pl. XIII.).

In some specimens examined by a lens no traces of any other ornamentation could be found on the mesonotum, but on examining with a microscope, light scales might be seen indicating the two thin parallel median lines of *fasciata*, in fact between the type and variety *mosquito* all stages could be found.

*Habitat.*—This variety I have noted from St. Lucia, Jamaica, and Calcutta.

*Time of capture of "mosquito."*—Jamaica and St. Lucia, July and August (2 P.M.).

*Observations.*—*C. mosquito* has been rightly placed as a synonym of *C. fasciatus.* Desvoidy described it from Cuba, where it is very troublesome in the rainy season, and named "mosquito" by the natives.

It is, like *S. fasciata*, an indoor species, being often found in bedrooms. Lewis refers to *C. mosquito* in India, in his paper on Filariasis in the Proceedings of the Asiatic Society of Bengal, 1871, pp. 89–93. Giles thinks he referred to Skuse's *C. albopictus*, which, as I have pointed out, is *C. scutellaris*, Walker. As this variety of *fasciata* occurs in India it is most probable that Lewis was quite right in his identity.

The *C. mosquito* of Desvoidy is figured by Guérin and Percheron's "Genera des Insectes," Diptères, pl. 2, and is a ♂, but it shows all the legs banded with white, as is also stated to be the case in the subsequent description; possibly this figure is partly imaginative, for Desvoidy (Essai, p. 407), in his description of the species, says, "feet black, joints of fore tarsi with silvery bands," evidently referring to some of the joints only if the feet are black, and this is what we find in *fasciata* and its varieties.

It must not be confused with the *Culex mosquito* of Arribalzaga, which is a typical *Stegomyia fasciata.*

STEGOMYIA FASCIATA.

var. *Luciensis*, mihi.

(Fig. 50, Pl. XIII.)

These specimens resemble *S. fasciata*, and are probably merely a variety of that species.

They differ, however, in having a very clearly defined black band at the tip of the last tarsal joint, whereas in *S. fasciata* the last tarsal joint is always pure white.

*Habitat.*—Demerara, Georgetown (Quelch) (16. 6. 1899), a ♂ and ♀ ; also from St. Lucia.

*Time of appearance.*—Demerara, March and May (Quelch).

*Observations.*—In all respects the specimens received from Demerara and St. Lucia agree with *S. fasciata*, with the exception that the last tarsal joint of the hind legs is apically banded black. A similar variation is seen in *Anopheles argyrotarsis*.

STEGOMYIA FASCIATA.

var. *Queenslandensis*, mihi.

Specimens of a peculiarly marked *S. fasciata* were sent by Dr. Bancroft, under the name of *C. Bancroftii*, Skuse.

They form a very distinct variety in regard to coloration, but as I can detect no structural differences from this world-wide gnat, I think they should be considered merely varieties of that species, which occurs in the same neighbourhood.

♀. Differs from the type first in that the mid lobe of the scutellum is covered with a patch of deep purple scales, and secondly, in regard to the abdominal ornamentation, which has both basal and apical yellowish-white scales, and also an irregular broad line of the same down the dorsum ; in one specimen the entire abdomen is covered with creamy scales.

*Length.*—4·5 mm.

*Habitat.*—Bupengary, South Queensland.

*Time of capture.*—November.

3. Stegomyia scutellaris. Walker (1859).

*C scutellaris.* Walker.

*C. albopictus.* Skuse.

*C. variegatus.* Doleschall.

(Journ. Proc. Linn. Soc. Lond. iii. p. 77 (1859), Wlk.; Indian Museum Notes, iii. 5, p. 20, Skuse (= *C. albopictus*); Natuurkundig. Tijdschr. v. Ned. Ind. xvii. p. 77, Doleschall.)

(Fig. 53, Pl. XIV.)

Thorax black, with a median silvery stripe; abdomen with silvery white basal bands; legs black, tarsi basally white banded, last joint of the hind legs pure white.

♀. Head with a patch of dark scales on each side, separated by a broad band of silvery-white scales, which form a bright spot in front, and with a silvery-white border to the eyes, and another patch on each side of the head; eyes partly black and golden; antennae dark brown, faintly paler banded at the joints, with a tuft of silvery scales on the basal joints, forming two distinct spots; palpi black with a silvery white apical joint; proboscis black.

Thorax black, covered with black scales, and fine, rather dull brown, hairs; a distinct, clear, silvery line in the middle from the front to about two-thirds of the way across the mesonotum; scutellum edged with silvery scales; metanotum dark brown; pleurae black with numerous silvery-white spots. Abdomen covered with black scales, the bases of the segments with a band of silvery scales which spread out laterally, most noticeable on the fourth and fifth segments, forming distinct lateral patches; ventral surface also with white scales.

Legs black, the femora with silvery knee spots and pale beneath for part of their length; tibiae black; metatarsi with broad white basal bands; in the fore and mid feet the first tarsal joint is basally white, the others black; in the hind legs all the tarsi with broad, white, basal bands, except the last, which is pure white. Front claws untoothed. Wings with the veins covered with long brown scales and a double row of short darker ones; first sub-marginal cell short, slightly longer and narrower than the second posterior cell; posterior cross-vein some distance behind the mid cross-vein. Halteres with pale testaceous stem and dusky knob.

*Length.*—4·5 to 5 mm.

♂. Thorax, abdomen, and legs like the ♀. Antennae banded black and white, the basal joint black with a large patch of silvery-white scales on the inside; plumes deep brown; palpi long and thin, not plumed, black, with two broad white bands towards the base and a white spot underneath at the base of the last two joints; proboscis black; fore and mid ungues unequal, the larger with one large tooth, the smaller simple; hind ones small and simple, equal.

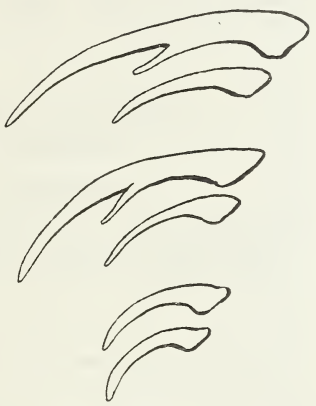

Fig. 91.
*Stegomyia scutellaris*, Walker.
Male ungues.

*Length.*—4 to 4·5 mm.

*Habitat.*—Singapore (Rafflesian Museum) (4. 9. 1899); Hong Kong (Ford) (27. 9. 1899); Selangor (A. L. Butler) (28. 10. 1899); Upper Burma (Watson); North Borneo; Mauritius (Sir Charles Bruce) (22. 11. 1899); Tamsui, Formosa (Mackay) (2. 8. 1899); Fiji (Black) (30. 12. 1899); Japan (Wood); Celebes (Walker); Ceylon (Bartholomew) (12. 12. 1899); Madras and Naini Tal, India (Giles and Cornwall); Siam (Skeate); Amboina (Doleschall); Sombalpur, C. P., India (D. O'C. Murphy) (99); Foo-Chow, China (Rennie) (9. 8. 1900) (84).

*Time of capture.*—Singapore, July (July 27, 1899); Ceylon, November; Upper Burma (March).

*Observations.*—This is a very common mosquito, with a wide distribution in Asia. It is a common species in the Straits Settlements, being the second commonest mosquito in Selangor (A. L. Butler). Ford records its larvae as being abundant "in standing water near houses 500 feet above the sea." It is a great nuisance at Calcutta (Skuse). Skeate also evidently took it in abundance in Siam, for numbers are in the collection sent me by Dr. Sharpe.

It is a very marked species, with a clear silvery mid dorsal line. Walker's type of *C. scutellaris* is in the British Museum in good condition.

*Synonymy.*—Skuse's *C. albopictus*, described in the Indian Museum Notes, iii. 5, p. 20, is certainly this species, every character agreeing with Walker's type of *C. scutellaris*, which

occurs commonly in India. Doleschall's *Culex variegatus* is evidently the same as *C. scutellaris*; Doleschall described it from Amboina, where it is one of the most troublesome mosquitoes throughout the year, common in houses. Watson's specimen from Upper Burma is very small.

4. Stegomyia sugens. Wiedemann (1828).

*C. sugens.* Wiedemann.

*C. vittatus.* Bigot (1861).

(Auss. Zweiflüg. Insec. p. 545 (1828), Wied.; Ann. Soc. Ent. d. Fr. S. 4, t. 1 (1861), Bigot (= *vittatus*); Bull. Soc. Ent. Ital. p. 257 (1886), Ficalbi (= *vittatus*).)

(Fig. 51, Pl. XIII.)

Thorax dark brown, with reddish-brown scales and four silvery spots, two on each side of the mesonotum. Abdomen black, with basal white bands and white lateral spots, apical segment with a pure white central spot. Legs black, banded white, tarsi basally banded white, last hind tarsal joint pure white.

♀. Head black, clothed with flat fuscous scales on the occiput, with a median line of white rather broad curved scales, a silvery-white border round the eyes, a distinct patch of white scales on each side, with black, upright forked scales dotted about over the back of the head; eyes slightly golden, and coppery; antennae brown, very narrowly banded, a small white patch of scales on their dark basal joint; palpi black scaled, the last joint densely white scaled, bristles black; clypeus dark brown, with two patches of white scales; proboscis dark brown, in some a few pale scales may be seen in the middle.

Thorax covered with narrow, curved, deep reddish-brown scales, with a few scattered creamy ones, especially in the middle, those at the sides a slightly deeper reddish-brown; there are also four silvery spots, two on each side, wide apart; scutellum with four silvery-white spots, composed of white, curved scales, two central, and one on each side, with a central and two lateral patches of dark border-bristles; a patch of dark bristles also arise over the root of each wing, and project backwards; metathorax fuscous; a few white patches of scales on the pleurae, and two groups of grey bristles; when denuded the mesothorax shows longitudinal lines.

Abdomen deep black, with six basal pure white bands, the last segment with a pure white central spot; white lateral spots also present; first segment densely black, and white scaled; posterior border of the segments with golden hairs; venter white banded.

Legs black, banded with pure white as follows: anterior femora with snow-white apical ring, and another a short distance from it, with scattered white scales, most abundant ventrally, with black bristles, which form a distinct group round the apex; tibiae black, with pale bristles, and a faint trace of a band towards the basal half in one specimen; first three tarsal joints basally banded white, the white bands rather narrow, last two joints dusky yellowish-black; mid femora and leg generally like the anterior, but the white tibial band more distinct; posterior femora white beneath, especially towards the base; tibiae with a broad white band; metatarsus and next three tarsal joints basally white; third tarsus with only a minute black apex in some specimens, last joint pure white; in some specimens the metatarsus is only basally white above; fore and mid ungues equal, uniserrated; hind equal and simple.

Wings with brown scaled veins, the scales rather long and narrow, costal vein rather dark; first sub-marginal cell slightly narrower and longer than the second posterior cell, its base nearer the base of the wing than the base of the latter; both fork-cells are rather short, the second particularly so; posterior cross-vein more than twice its own length distant from the mid cross-vein; the second, third and fourth and lower branch of the fifth veins with long lateral scales. Halteres with pale stem and fuscous knob.

*Length.*—4·5 mm.

♂. Head much as in the ♀; antennae with broad plumes, basal joint showing as a white ring, pale banded; palpi longer than the antennae and proboscis, with four white bands; proboscis deep brown.

Thorax with four grey stripes, the two median fairly broad, lateral ones thin and short, the four white spots seen, as in the female, but in the two specimens before me not so distinct (probably denuded); scutellum, &c., as in the ♀.

Legs as in the ♀, but the posterior femora have much more white basally, and the anterior tibiae are rather more distinctly banded. Ungues as figured on page 302.

*Length.*—4·3 mm.

*Habitat.*—Freetown, Sierra Leone (E. A. Austen); Mashonaland (Marshall); Corsica (Bigot); Nubia (Wiedemann).

*Time of capture.*—October in Freetown (Austen).

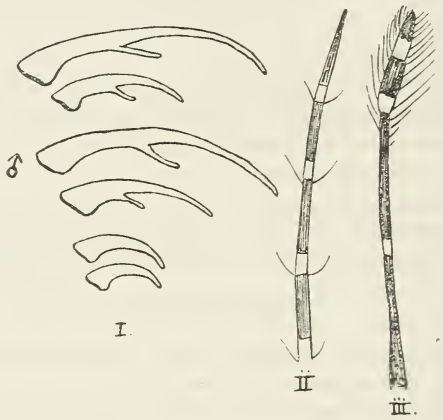


Fig. 92.

I. *Stegomyia sugens*, ungues of ♂. II. Male palpus of *S. sugens*. III. Male palpus of *S. Marshallii*.

*Observations.*—Two specimens of each sex were brought back from Sierra Leone by Mr. Austen. It is a species easily identified by the four white or silvery thoracic spots. It is undoubtedly Wiedemann's species, described by him from Nubia. It seems to be a widely distributed African species, as numbers have also been sent from Mashonaland, and, in all probability, it will be found to occur in many other parts of Africa, from Nubia southwards. The larvae are found in roadside puddles, according to Mr. Austen, who bred the species at Sierra Leone.

Wiedemann does not mention the last tarsal joint of the hind legs being white, but I have seen specimens in which this is almost absent.

*Synonyms.*—This species is the same as Bigot's *C. vittatus*, described from Corsica, which has basal white abdominal bands, not apical, as Colonel Giles states (Gnats or Mosq. ii. p. 228). The type of *vittatus* is in excellent preservation in Bigot's collection, now in Mr. Verrall's possession, who has kindly placed his specimens at my disposal.

5. Stegomyia Nigeria. n. sp.

(Fig. 56, Pl. XIV.)

Thorax deep brown, with black scales, two short median pale lines in front of the mesonotum, and a white patch on each side. Abdomen black, with narrow basal white bands and a white spot on each side; venter white scaled. Legs dark brown, tarsi basally white banded, the last in the hind legs all white, and also most of the penultimate joint.

♀. Head black, with a narrow patch of white scales in the middle; palpi black, with white scales at the tip, and a few long bristles; proboscis black, antennae dark brown; basal joint black, with a tuft of white scales, forming two white spots just below the eyes, and on each side of a small tuft of white down projecting between the eyes, which are black and reddish, with a very narrow border of white scales.

Thorax dark brown in some lights, deep black in others, covered with a felt of deep black scales, like *C. vigilax*, a few creamy scales in front of the scutellum; two thin, short, parallel, narrow rows of yellowish scales in front on the mesonotum, and a patch of brilliant white scales on each side, just showing above; scutellum blackish-brown, with a few broad white scales; metanotum deep chestnut-brown; pleurae bright chestnut-brown, with several patches of brilliant white scales.

Abdomen black, with narrow basal bands of white scales. The black scales have a purplish tinge in some lights, a basal white spot on each side, especially on the basal segments. Venter with numerous white scales. Coxae with silvery-white scales; fore legs brown, pale at the base, dark towards the tarsi; mid legs with a white spot (not a band) at the base of the metatarsus and first tarsal joint; hind legs, with the base of the metatarsus and first two tarsi, basally white banded, the third tarsus nearly all white, and the fourth all white; hind tibia much swollen at the apex.

Wings with brown veins and scales, testaceous at the base, scales long; first sub-marginal cell about twice as long as its stem, longer and narrower than the second posterior cell, whose stem is about equal to its length; posterior cross-vein nearly three times its own length distant from the mid cross-vein; first long vein much curved in the middle; fringe brown.

*Length.*—4·5 mm.

*Habitat.*—Bonny, West Africa (J. P. Fagan) (21. 11. 1899).

*Time of capture.*—October.

*Observations.*—A single ♀ only of this species received, in good condition, but some of the legs, unfortunately, came off in examination, and are separately preserved.

It can be distinguished by the thick felt of dark scales over the thorax, with the two very narrow and short yellowish vittae in front, and the small brilliant white patch on each side of the mesonotum, and the silvery puncta on the pleurae; the bend in the first long vein is also characteristic.

### 6. Stegomyia Africana. n. sp.

(Fig. 54, Pl. XIV.)

Thorax black, with a bar of white scales directed upwards on each side of the front of the mesonotum, and another small bar in front of the wings. Abdomen black, unbanded, with white lateral spots; venter white scaled. Legs black, tarsi more or less banded white, second hind tarsus nearly all white, thus forming a very broad white band to the hind legs.

♀. Head black, with a pale spot of scales on the crown, and with long dark bristles; eyes golden green (in the sun); antennae pale brown; basal joints large; proboscis deep brown, unbanded; palpi dark brown, last joint with large pure white scales.

Thorax apparently denuded, dark shiny-black, showing metallic reflections in the light, a distinct bar of white scales on each side of the front half of the thorax directed upwards, black bristles laterally, especially close to origin of wing, near which is a small patch of white scales; pleurae with four distinct and one indistinct silvery spots.

Abdomen dorsally unbanded, dark dusky-brown, rather shiny, with a few patches of scanty scales laterally; ventrally are seen a few scattered white scales that may indicate banding (probably much denuded).

Legs black; anterior legs with a pale basal band on the metatarsus and first tarsal joints; middle pair with the same banding, but rather more distinct and whiter; hind pair with the bases of the metatarsus and first tarsal joint narrowly banded white, second joint nearly all white, a small dark apical band, third joint with very small basal white band, last joint dark.

Wings covered along the veins with brown scales and with brown fringes. Halteres white, with black knobs.

*Length.*—4·5 to 5 mm.

♂. Head as in the ♀; proboscis dark brown; palpi black, with the bases of the second and third joints broadly banded white, the fourth and fifth joints with small white basal bands ventrally. Antennae with brown plumes, a distinct white spot at their base. Thorax as in the ♀, but the white band at the root of the wings more distinct, and with a white patch of scales in the middle, near the head, which looks almost like the remnant of a median white line; a line of white scales also on the edge of the scutellum. Abdomen brownish-black above, with two white spots on the last segment but one, which is laterally enlarged—the whole abdomen with long, bright yellowish-brown hairs, laterally with distinct white patches of scales. Legs, &c., as in ♀. Fore and mid ungues unequal, both simple, the larger one of the mid legs straighter than that of the fore legs; hind ungues small, equal, and simple.

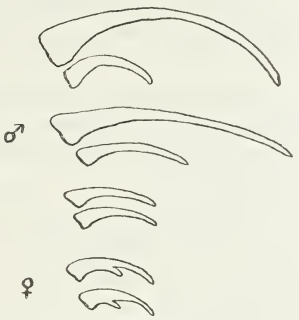


Fig. 93.
*Stegomyia Africana.* n. sp.
Ungues of the fore and mid legs of the ♂ and fore ungues of the ♀.

*Length.*—4·5 mm.

*Habitat.*—Sierra Leone (Austen, September, 1899) (99, 267); Mashonaland (Marshall); Lagos (Strachan); Old Calabar (Annett); Zomba, B.C.A. (Daniels and Gray).

*Observations.*—A very distinct species, which I cannot trace to any previous description. The two white lateral thoracic oblique bars and peculiar leg banding should identify it at once. It seems to be a very common species in the above-named parts of Africa. It may be easily confused with *S. fasciata*, but the ♂ ungues at once separate it.

### 7. Stegomyia terrens. Walker (1856).

(Ins. Saund. p. 429.)

Thorax chestnut-brown, with a broad patch of white scales on each side in front, and a median pale line. Abdomen brown, with metallic reflections and scattered golden-orange scales, five

distinct white lateral spots, and two on the penultimate segment. Legs, with the first tarsal joint all white, and others with basal bands.

♂. Head brown; eyes bordered with white scales; proboscis, palpi, and antennae deep chestnut-brown; plumes deep silky-brown; palpi brown, with no trace of banding.

Thorax chestnut-brown, with a broad patch of white scales on each side in front, and a median pale line, some golden lateral hairs; metanotum chestnut-brown.

Abdomen brown, with metallic purple reflections and golden-orange scales scattered over it, with five distinct white lateral spots, and two white spots on the sides of the penultimate segment.

Legs brown, basally banded white; metatarsus of the hind pair basally white, the apex also a little white, a broad brown band in the middle; first hind tarsal joint all white, second basally white, last two apparently dark brown.

*Length.*—6 mm.

*Habitat.*—South America.

*Observations.*—Redescribed from Walker's type in the Museum. This is the only specimen I have seen. Walker's description conveys no idea of the insect; his description, taken from 'Insecta Saundersiana,' is as follows:—

"Brownish, with a silvery-white tomentum; proboscis slender, straight, as long as the palpi. Antennae with whitish reflections; thorax with two brown stripes; abdomen blackish, very pubescent on each side, with silvery-white bands beneath; legs blackish; femora with white tips; tibiae partly with white reflections; tarsi with white bands; wings greyish; veins brown, slightly ciliated; halteres testaceous, with brown knobs. Length of the body, three lines; of the wings, five lines."

### 8. Stegomyia Grantii. n. sp.

(Fig. 55, Pl. XIV.)

Thorax chestnut-brown, with a narrow median line of white scales forked in front of the scutellum, then a fine curved lateral pair, and another pure white line below on each side. Abdomen black, with well-defined narrow basal white bands, which bend obliquely and form a straight oblique white line on each side of the segments; venter white scaled. Legs black, with pure white

lines and white basal bands to the hind tarsi; bases of some of the fore and mid tarsi pale.

♀. Head black, with two median lines of white scales meeting in a point in front, expanding backwards; border of the eyes white scaled, and a line of pure white scales between the eyes; eyes silvery; antennae brown, with pale bands; basal joint black, with a border of pure white scales; base of the second joint reddish-brown; palpi covered with black and white scales, the tip being white scaled.

Thorax bright chestnut-brown, covered with very fine scales almost like little hairs, a thin but very distinct median line of white scales which forks round a bare patch just in front of the scutellum, a fine curved line on each side, starting from the side of the thorax near the head and about the middle, bending in and running down the dorsum of the mesothorax to the scutellum; there is also another lateral white line below on each side; scutellum chestnut-brown, bordered with white scales and with black bristles; metanotum chestnut-brown; pleurae chestnut-brown, with white scales.

Abdomen covered with black scales, showing a dull purplish tinge, and a few traces of ochraceous coloration in some lights, each segment with a narrow but very distinct basal band of white scales, which turns off at an obtuse angle on each side, forming a straight lateral oblique line on each side of the segments; on the last two segments the white scales of the venter come up as a narrow line and join the oblique lateral stripes; posterior borders edged with pale golden hairs.

Legs black, with white lines and bands, as follows: fore femora and tibiae, with three white lines of scales running the whole length, one ventral, the other two lateral; base of the fore metatarsus white, also with white lines; tarsi black, slightly paler at the base, owing to the absence of scales; mid legs very similar, but the bases of the first two tarsal joints rather more distinctly pale; hind legs, with the bases of the femora, quite pale, and bases of the first and second tarsi broadly banded white; last two tarsal joints lost. Ungues of the fore and mid legs small, and not toothed.

Wings with rather long, narrow, brown scales on the veins; first sub-marginal cell very little narrower or longer than the second posterior cell, the stem of the latter only about half the length of the cell; posterior cross-vein about one and a half times its own length distant from the mid cross-vein.

*Length.*— 5 mm. (not including proboscis).

*Habitat.*—Sokotra (Grant).

*Time of capture.*—December.

*Observations.*—Described from a single ♀ specimen brought back by Mr. Grant from Sokotra, where, he tells me, it is very troublesome. It resembles in a most striking manner *C. spathipalpis*, Rond., the thoracic markings and head being similarly marked; but the peculiar abdominal banding, the perfect white lines on the black legs, the posterior cross-vein being close to the mid cross-vein and smaller, and the entire absence of wing spots, separate it at sight; moreover, owing to the head and scutellar scales being flat, it is clearly separated from *spathipalpis*, and comes in this genus, and yet its superficial appearance is very similar.

### 9. Stegomyia sexlineata. n. sp.

Thorax deep brownish-black, with two median parallel yellow scaled lines and two pairs of lateral pale creamy curved lines on the front of the mesonotum. Abdomen deep brown, with narrow pale creamy basal bands and pure white lateral spots, the last two segments with pure silvery-white basal bands. Legs deep brown; metatarsi and some of the tarsi with basal white bands; knee spot and also a spot on the femora pure white; ungues of ♀ equal and simple.

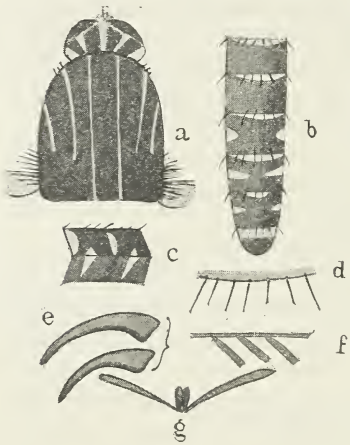


Fig. 94.

*Stegomyia sexlineata.* n. sp. (♀).

a, Head and thorax; b, abdomen; c, side view of abdomen; d, border-bristles of abdomen; e, ungues of ♀; f, border scales; g, wing scales.

♀. Head deep brown, covered with flat black scales, with a median and lateral lines of creamy scales and with dull white scales at the sides; the scales of the median creamy line are of rather different form to those of the rest of the head, numerous black bristles projecting forwards and inwards and a few at the sides; projecting forwards in the middle line between the eyes are a few yellowish bristles; on the back of the head are a few small black upright forked scales. Antennae

deep black, unbanded, the basal joint with silvery-white flat scales; clypeus black; palpi black scaled, the apices of the last two segments being white scaled above, and there are also a few white scales on their whole upper surface; proboscis rather long and thin, deep black.

Thorax deep brownish-black to almost jet-black, densely covered with narrow curved scales, applied to the surface somewhat closely; those on the major area are deep brownish-black, there are two median nearly parallel creamy-yellow scaled lines, which extend right back to the scutellum and which become almost white before reaching it, then two pairs of lateral curved lines of similar colour which die out about the middle of the mesonotum, the innermost pair being slightly the longer; just beneath and in front of the roots of the wings is a white scaled spot and numerous pale bristles projecting over their roots; scutellum brown, with *small* flat black scales, and a few grey ones on the middle of the mid lobe; posterior border-bristles rather pale, five to the mid lobe; metanotum deep chestnut-brown; pleurae black, with patches of pure white scales.

Abdomen steely black, covered with dusky brownish-black scales; first and second segments unbanded, the third to the sixth with narrow creamy basal bands, the seventh and eighth showing pure silvery-white basal bands, the seventh rather incomplete, all the segments with pure silvery-white lateral spots, which show dorsally on the fifth to seventh segments; these lateral spots are median and their scales rather project ventrally; posterior border-bristles pale golden-brown, longest at the sides of the segments; venter black, the white lateral spots, however, showing very prominently on the venter when the abdomen is empty.

Legs with the coxae dark with some white scales; femora deep brownish-black, white scaled at the base and partly beneath, apex pure white, and there is also a pure white round spot on one side on its apical half; tibiae deep brownish-black with pallid bristles; metatarsi basally white, those of the hind legs but little more than half the length of the hind tibiae; first tarsal joint of the fore and mid legs basally white, remainder black, in the hind legs the first and second tarsi are broadly banded with white at their base (the banding is apparently not always complete), last two tarsi black; ungues equal and simple.

Wings rather dusky brown, the veins clothed with brown scales, the lateral ones long but rather broader than in *Culex*;

fork-cells short, the first sub-marginal cell a little longer and narrower than the second posterior cell, their stems about equal and their bases about level; the stems equal to about two-thirds of the length of the cells; sub-costal joins the costal some distance from the bases of the fork-cells and almost level with the supernumerary and mid cross-veins; posterior cross-vein nearly twice its own length distant from the mid cross-vein; fringe brown, rather paler at the base, posterior border scales deep brown, rather long and narrow. Halteres with ochraceous brown stem, fuscous knob with grey scales.

*Length.*—4 mm.

*Time of capture.*—December (Urich) (102).

*Habitat.*—Trinidad, at Agua Santa.

*Observations.*—Described from a single perfect ♀ in beautiful condition. It forms quite a distinct species, coming near *S. notoscripta*, Skuse, in thoracic ornamentation, but clearly distinct from it in arrangement and also by the absence of the proboscis band and head ornamentation. I have seen no specimens from elsewhere.

### 10. Stegomyia Marshallii. n. sp.

Thorax dark chestnut-brown, with four silvery spots on the mesonotum and others on the pleurae; there are also traces of a small third pair on the dorsum; silvery scales on the scutellum and on the head; abdomen of ♀ dark brown, unbanded, with silvery lateral spots; in the ♂ some of the segments with basal silvery bands, others with white spots; legs brown, with apical silvery bands to the joints. Palpi of the ♂ with the last two joints very short; ungues of the ♀ blunt, equal, uniserrated in the fore and mid legs; equal, simple in the hind legs.

♀. Head black, covered with bronzy-black scales in the middle, two silvery-white patches in front on each side divided by a dull purplish and dusky ochraceous mass of flat scales, behind are some grey curved scales and numerous upright black forked ones; palpi short, covered with deep brown scales and bristly at the ends; antennae, including the basal joint, deep brown, the latter with bright silvery-white scales forming two white spots; proboscis bronzy-brown. Thorax almost black, covered with deep bright brown narrow curved scales, with four large clear spots of rather broader silvery-white scales, and two further back on the mesonotum not so distinct; pleurae deep

to bright chestnut-brown, with silvery patches of flat scales; scutellum brown, with silvery flat scales; metanotum deep chestnut-brown.

Abdomen covered with brown scales, some of the apical ones being ochraceous brown, the scales appearing slightly metallic under the microscope; border-bristles bright golden, there are also lateral silvery spots; venter brown scaled.

Legs brown, coxae brown, each with a small spot of silvery scales; femora pale ochraceous at the base and ventrally, apex dark brown, with a silvery-white spot just before the apex and the tip pure white scaled; tibiae dark brown, with an apical white band; metatarsi brown, with an apical white band, fore and mid tarsi brown; in the hind legs the metatarsi and tarsi are apically white banded, the last joint being pure white; fore and mid ungues equal, blunt, and each with a blunt tooth; hind ones equal and simple.

Wings with brown scales of typical form; first sub-marginal cell considerably longer and narrower than the second posterior cell, its base nearer the base of the wing, its stem about one-third the length of the cell; stem of the second posterior cell not quite as long as the cell, posterior cross-vein about twice its own length distant from the mid cross-vein; border-scales deeper brown than the fringe; halteres with pale ochraceous stem and slightly fuscous knob.

*Length.*—3·5 to 4 mm.

♂. Palpi brown, with three pale rings, the two apical ones on the bases of the two last joints, the last two joints are short, about equal, and together not much more than half the length of the antepenultimate joint; apex of antepenultimate and the last two have long black hairs and bristles; antennae banded brown and dull brownish-grey, with deep flaxen-brown plumes. On the thorax are also a few broad silvery scales in front of the scutellum, and there is a silvery-white patch of scales at the root of the wing on the costa; the border-bristles of the scutellum are deep black, five to the mid lobe and six smaller ones between.

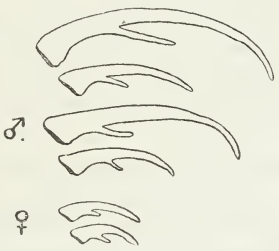


Fig. 95.
*Stegomyia Marshallii.* n. sp.
Ungues of the ♂ and fore ungues of the ♀.

Abdomen of similar colour to the ♀, but the third, fourth and

eighth segments have basal white bands, the fifth, sixth and seventh lateral white basal spots, which have a tendency to unite and form basal bands, there are also traces of the same on the second segment; first segment deep ochraceous, with two patches of dark scales in the middle; genitalia deep brown. Legs as in the ♀, but the metatarsal bands in the fore and mid legs small or absent; ungues of fore and mid legs unequal, both toothed, the hind one equal.

*Length.*—4 mm.

*Habitat.*—Salisbury, Mashonaland (G. A. K. Marshall) (79).

*Time of capture.*—February and March.

*Observations.*—Specimens sent by Mr. Marshall resemble very strongly *S. sugens*, Wied., but they differ in having the leg banding apical and in the structure of the ♂ palpi (Fig. 92). The thoracic ornamentation is however very similar. The species, judging from the number sent, is common in Central Africa.

### 11. Stegomyia pseudotaeniata. Giles.

(The Entomologist, p. 192, July, 1901.)

Thorax dark brownish-black, with a narrow white median line, a lateral curved line, and a small straight white line on each side of the median one in front, and another on each side behind, outside the curved line and in the second curve. Abdomen black, with narrow basal white bands. Legs black, with white bands, which involve both sides of the joints. Proboscis unbanded. Wings with a patch of white scales at the base on the costa.

♀. Head black, with flat black scales, a narrow border of curved white scales round the eyes, and another narrow white median line, and black bristles projecting forwards; eyes black and silvery; clypeus black; palpi black, with white scales at the tip, and a few white ones at the apex of the penultimate joint; antennae dark brown, basal joint dark brown, with a few white scales; proboscis black, unbanded.

Thorax black, covered with narrow curved black scales closely applied to the surface, with a narrow median line of white scales, which form a fork round the bare space in front of the scutellum, a narrow open S-shaped white line on each side, a short yellow one between the median and lateral curved line on each side on the anterior part of the mesonotum, and a white one on each side posteriorly between the curved line and the root of the wing; there is also a linear patch of white scales in front of the

root of the wings, and numerous short thick black bristles; scutellum brown, the lateral lobes with small black scales, the median lobe with white scales at the base, black ones apically

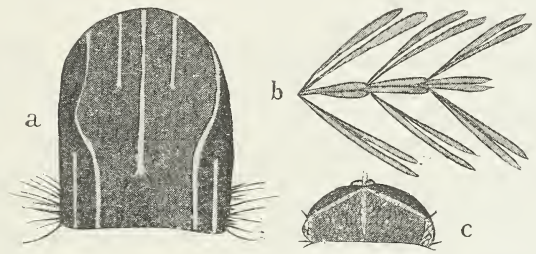


Fig. 96.

*Stegomyia pseudotaeniata*, Giles.

a, Thorax; b, wing scales; c, head of ♀.

(these scales are more of a flat spindle shape than normally in this genus); border-bristles of the mid lobe irregular in arrangement and size, nine in number; metanotum deep brown; pleurae deep brown and black, with long patches of white scales.

Abdomen steely-black, with deep black scales and narrow basal bands of white scales; first segment brown, with black scales; posterior border-bristles long, pale golden-brown.

Legs with the coxae dark brown; femora black, with a white ventral line and white knee spot; tibiae black, with a white apex and white line beneath; fore metatarsus and base of the first tarsal joint white, remainder of fore tarsi black; in the mid legs the base and apex of the first tarsal are white, and the base of the second, the remainder black; in the hind legs the banding is more distinct; hind metatarsi about two-thirds the length of the posterior tibiae; fore and mid ungues equal, apparently minutely uniserrated.

Wings rather long, with brown scaled veins, the *costa having a long basal patch of white scales;* scales of the veins rather dense, the median ones rather long, the lateral ones long and rounded at the apex, rather thicker than in *Culex;* first sub-marginal cell longer and narrower than the second posterior cell, its base a little nearer the base of the wing than that of the second posterior cell, its stem rather more than half the length of the cell; stem of the second posterior cell equal to two-thirds the length of the cell; posterior cross-vein about one and a half times its own length distant from the mid cross-vein; sub-costal

vein joins the costal just before the base of the first sub-marginal cell. Halteres with a pale ochraceous stem and fuscous knob, with a few grey scales.

*Length.*—4·8 mm.

*Time of capture.*—May.

*Habitat.*—Naini Tal, India (7000 feet; Giles). Colonel Giles says Lower Himalayas (6000–8000 feet), Bakloh, Punjab, as well as Naini Tal.

*Observations.*—Described from a single ♀ sent over by Colonel Giles. It bears a very strong resemblance to *Stegomyia notoscripta*, Skuse, but is certainly distinct, and can at once be told by the unbanded proboscis. The tarsal banding which Colonel Giles points out as a distinguishing character will not hold good, as I have seen the Australian species with the white scales passing on to the apices of the joints. There are also structural differences of considerable importance from *S. notoscripta*, especially in connection with the wing scales. A noticeable character in this species is the long patch of white scales at the base of the costa.

I have not seen a ♂, but Giles gives its length as 3·1 mm. The species is not common; it occasionally enters houses and bites. "I have met with the larvae," says Colonel Giles, "in very shallow depressions in the cemented tanks round a house, in the bottom of which was only a little sand, just tinted with green algae, in perfectly clean rain-water.

"The *larvae* (Fig. 16, III.) are 8 mm. long and very dark tinted, the head being so black that the eyes cannot be distinguished. The antennae are very short, and, with the exception of some terminal specialised short bristles, are also naked, and not, as usual, indistinctly two-jointed, with tufts at the constriction. The spiracle is extremely short, not half as long as the anal tubercles, and no longer than an average abdominal segment. With the exception of the large thoracic tufts, the bristles are not distinguishably compound. In the water they hold themselves nearly vertical to the surface.

"The *pupae* are also intensely black."

### 12. Stegomyia gubernatoris. Giles.

(The Entomologist, p. 194, July, 1901.)

Thorax sooty, with a round anterior median and four lateral snowy spots at the corners of the mesonotum. Abdomen black,

with large snowy lateral spots and a minute terminal median spot on the last segment; venter sooty. Legs with the tarsi banded at each end.

♀. "Head sooty-black, the nape with a minute median line, a delicate border to the eyes, and a pair of small lateral spots behind them, snowy white. Antennae, proboscis, and palpi entirely black; the former, with the second, no longer than the succeeding joints. Thorax sooty, with snowy spots arranged as below. In front there is a large median spot, which is prolonged at the sides into a pair of lateral bars, in front of which are, scarcely perceptible, separate humeral spots. There is a similar pair of short lateral transverse bars at the posterior corners of the mesonotum, besides which the pleurae and coxae are plenti-

Fig. 97.
*Stegomyia gubernatoris* (♀). Giles.

fully speckled. The posterior border of the metanotum (this is evidently the scutellum—F. V. T.) with three tufts of bristles. Wings hyaline; the veins with black scales; auxiliary vein (= sub-costal) joining the costa a little external to the middle transverse vein; second longitudinal vein springing from the first, only a trifle internal to the posterior transverse, and placed distinctly more than their united length ontside it; anterior fork-cell (= first sub-marginal cell—F. V. T.) somewhat longer and narrower than the posterior, but having a somewhat longer stem, which is about two-thirds as long as the cell. Halteres with white stems and black knobs, their roots protected by

distinct membranous tegulae. Legs black, with the exception of a fairly broad white band at the base of the posterior femora, and smaller patches on the under surface of the other femora; there are large white knee spots; and two broad bands, one placed on the base of the first tarsal joint (= metatarsus—F. V. T.) and apex of the tibia, and the second on the apex of first and base of the second tarsal (the first tarsal here = the metatarsus—F. V. T.); in the fore legs there is a faint ring on the next articulation.

"Abdomen sooty-black, each segment having a pair of broad lateral basal snowy spots. There is also a minute median spot on the dorsum of the last visible segment. Venter uniformly sooty-black.

"*Length of wing.*—3 mm. (? F. V. T.)

"*Habitat.*—Taken in Government House, Allahabad."

Note (F. V. T.).—This is evidently a very distinct species, and from its description I feel certain it must come in my genus *Stegomyia*. The so-called first tarsal joint in Giles's description is what I call the metatarsus; he has evidently mistaken the *scutellum* for the metanotum. The figure is also reproduced from a rough sketch by Colonel Giles.

Since the above was written I have seen the type, and find it is a true and very well-defined *Stegomyia*.

### 13. Stegomyia argenteopunctata. n. sp.

(Fig. 133, Pl. XXXIV.)

Thorax deep rich brown, with two pairs of brilliant silver spots on the dorsum and two lateral pairs, and five on the pleura; scutellum with three silver spots. Abdomen deep blackish-brown, unbanded in the ♀, with white basal lateral spots, which nearly meet in the ♂ to form basal bands. Legs dark brown, tarsi unbanded; knee spot silvery-white, apex of tibiae white, and also a white bar near apex of femora; ungues in ♀ equal and simple; in ♂ the fore and mid unequal, both the fore ones toothed; in the mid legs the larger are simple, the smaller uniserrated; hind ungues equal and simple.

♀. Head almost black, covered with flat black scales and bluish-white ones as follows: a patch of bright bluish-white ones on each side over the eyes, separated by a broad median black patch, another patch on each side of the head, and some dull bluish-white ones on the occiput, a pure white patch

between the eyes; over the occiput are also a few black upright forked scales; palpi ochraceous, with black scales; clypeus black; proboscis deep bronzy-brown, black towards the apex, minutely hairy; antennae brown, basal joint dark brown inside, deep testaceous outside, base of the second joint pale testaceous, a few black scales on the second joint; hairs and pubescence deep brown.

Thorax black, with small bright umber-brown curved hair-like scales, with four spots on the front half of the mesonotum of flat silvery scales, and two lateral pairs, also flat white scales on the prothoracic lobes; there are also a few flat white scales on each side of the bare space in front of the scutellum; three rows of black bristles on the mesonotum, and a small number over the roots of the wings; scutellum brown, with a thick median and lateral tufts of flat silvery-white scales and black border-bristles; metanotum deep chestnut-brown; pleurae paler brown, with five round white puncta in two rows, three in the upper and two in the lower, composed of flat white scales.

Abdomen deep brown, with small basal lateral white spots, and with golden-brown border-bristles; venter dark brown.

Legs dark brown to black, bases pale, coxae of the first and second pairs with a patch of white scales, apex of the femora and tibiae with a ring of silvery-white scales, also a white bar near the apex of the femora; metatarsi and tarsi unbanded; ungues of the fore and mid legs equal, uniserrated, of the hind legs simple.

Wings with brown scales; the first sub-marginal cell longer, but little narrower than the second posterior cell, its base slightly nearer the base of the wing than that of the second posterior cell; its stem equal to nearly half the length of the cell, a little shorter than the stem of the latter; second posterior cell a little

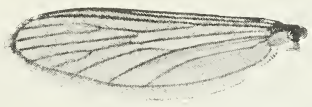

Fig. 98.
*Stegomyia argenteopunctata.* n. sp. (♀).
(X. 9.)

longer than its stem; mid cross-vein in front of the supernumerary cross-vein; posterior cross-vein about the same length as the mid, distant from the latter about its own length; fringe brown, costal border very dark brown, almost black; halteres with a dusky yellowish-brown stem and fuscous knob.

*Length.*—4 to 4·2 mm.

♂. Head much like the ♀, but with a few narrow curved scales in the middle; palpi brown, unbanded, the two last joints nearly equal, with brown and flaxen hair tufts, apex of the antepenultimate joint black, with a few black bristles; apical joint narrower than the penultimate; basal joint distinct, small; traces of a faint band on the antepenultimate joint; antennae banded grey and brown, with deep brown and flaxen hairs.

Abdomen narrow, the basal lateral white patches spreading on to the dorsum, and in some segments they almost meet, but never quite join, so as to form basal bands; densely hairy.

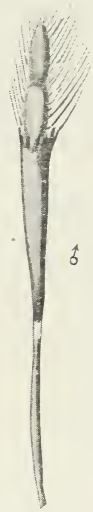

Fig. 99.
*S. argenteopunctata.*
Male palpus.

Fig. 100.
*Stegomyia argenteopunctata.*
Fore and mid male ungues.

Ungues (Fig. 100) of the fore legs unequal, both uniserrated; of the mid also unequal, the larger one simple, the smaller uniserrated; hind ungues equal and simple.

*Length.*—4·3 mm.

*Habitat.*—Salisbury, Mashonaland (Marshall) (79).

*Time of capture.*—January, February, and March.

*Observations.*—Described from two ♀'s and a ♂. This species bears a striking resemblance to both *S. vittatus*, Bigot, and *S. Marshallii*, mihi. The thoracic ornamentation is very similar, but the unbanded legs and the peculiar ungues of the ♂ should at once separate it from the allied species.

### 14. Stegomyia minuta. n. sp.

Thorax dark brown, with umber-brown narrow curved scales and two small white spots on the mesonotum, and traces of two minute narrow, pale, parallel median lines. Abdomen unbanded, dark brown, with basal white lateral spots. Legs brown, tarsi unbanded, apex of femora with a pale spot, a white band at the apex of the tibiae, especially the hind pair; ungues of the ♀ equal and simple.

♀. Head dark brown, clothed with flat dark brown scales, with a patch on each side converging to the nape, and another lateral patch lower down, upright black forked scales in the middle, and long black bristles projecting forwards over the eyes; the flat median scales show a brighter brown tint in some lights; palpi and proboscis black, the former densely scaled; antennae dark brown, basal joint deep ferruginous, base of the second joint ferruginous.

Thorax deep brown, covered closely with small hair-like curved scales of a rich brown tint, ornamented with two spots of white scales before the middle of the mesonotum, and two more or less regular lines of scattered white scales in the middle, a few white ones in front, and one or two scattered over the surface; scutellum with flat white scales; metanotum chestnut-brown; pleurae dark brown, with patches of white scales.

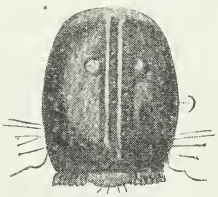

Fig. 101.
Thorax of *S. minuta.* n. sp.

Abdomen covered with dusky black scales, unbanded, but each segment with small basal lateral white spots, and with rather long golden border-bristles.

Legs brown, the mid and hind femora with distinct white apices, absent in the fore legs, tibiae also with a white apical band, most prominent in the hind legs; ungues small, equal, and simple.

Wings with brown scales; fork-cells rather short; first sub-marginal cell a little longer, but no narrower than the second posterior cell, not quite twice the length of its stem; its base nearly level with that of the second posterior cell, if anything, a little nearer apex of wing; stem of the second posterior cell nearly as long as the cell; middle and supernumerary cross-veins meet at an angle; posterior cross-vein

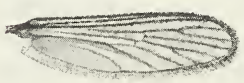

Fig. 102.
*Stegomyia minuta.* n. sp. (♀). (X. 9.)

longer than the mid, about one and a half times its own length distant from it; fringe brown, costal margin very dark.

Halteres with a pale stem and fuscous knob.

*Length.*—1·8 to 2 mm.

*Habitat.*—Salisbury, Mashonaland (Marshall) (79).

*Time of capture.*—March.

*Observations.*—One of the smallest mosquitoes, about 2 mm. in length. Its small size, characteristic thoracic ornamentation, unbanded abdomen and tarsi will at once separate it from all other *Stegomyias*. The mid scutellar lobe of the single ♀ that I have examined was partly destroyed by the pin, but traces of the broad scutellar scales could be seen, and they were markedly present on the lateral lobes.

### 5. Stegomyia crassipes. Van der Wulp.

*Culex crassipes.* Van der Wulp.

(Dipt. der Midden Sumatra, p. 9.)

(Fig. 134, Pl. XXXIV.)

Thorax reddish-brown, with bronzy narrow curved scales; pleurae dark brown, with numerous broad white scales; abdomen brown, with yellow apical bands; venter pure white, with four triangular black lateral patches, which show on the sides of the abdomen, and traces of a fifth. Legs unbanded, dark brown, femora pale at the base; ungues of the fore and mid legs of the ♀ equal, uniserrated; of the hind legs simple. Wings with a yellowish tinge, and with the base of the second posterior cell nearer the base of the wing than that of the first sub-marginal cell.

♀. Head covered with flat creamy scales in the middle, white ones round the eyes, forming a narrow border, the rest of the head covered with flat black scales and a few upright forked black ones; clypeus black, with small flat white scales dotted over it; proboscis greyish-brown at the base, black at the apical end, extreme apex testaceous; palpi rather long, black, as long or longer than the head, thin, last joint apparently very long, but there may be a small apical joint hidden in the black scales; antennae dark brown, the basal joint ferruginous on the outside, black inside, with small white flat scales; base of second joint bright ferruginous, with small creamy scales, hairs blackish.

Thorax deep reddish-brown, rather shiny, with scattered curved bronzy scales and a few rather broader white ones over the roots of the wings; scutellum with flat creamy-white scales; metathorax deep brown; pleurae brown, with numerous scattered flat white scales.

Abdomen brown, the apical borders of the segments with broad yellow bands; apical segment black; venter pure white,

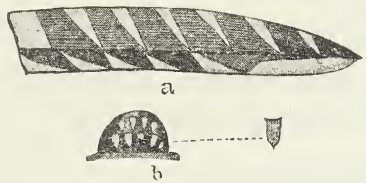


Fig. 103.

*Stegomyia crassipes*, Van d. Wulp.

a, Side view of abdomen; b, clypeus and scales.

with four lateral triangular black spots and traces of a fifth, the broad end of the black spot being apical; posterior borders of the segments with very small pale hairs.

Legs with the coxae yellowish, with two rows of white scales; femora grey beneath, brown above, knee spot yellowish, not very marked; tibiae, metatarsi and tarsi dark brown; ungues of the fore and mid legs equal and uniserrated.

Wings with a yellowish tint; veins with yellowish-brown scales, which are rather larger on the first, second and fourth longitudinal veins; first sub-marginal a little longer and narrower than the second posterior cell, its base nearer the apex of the wing than that of the latter; its stem nearly as long as the cell, stem of the second posterior cell as long as the cell; posterior cross-vein shorter than the mid cross-vein, a little more than its own length distant from the latter; fringe yellowish-brown, rather darker towards the base; halteres ochraceous.

*Length.*—4·8 mm. (Van der Wulp gives 4 mm. ♀.)

*Habitat.*—Thayetmyo, Upper Burma (Watson) (94. 4); Soeroelangoen (Van der Wulp).

*Time of capture.*—August (Burma).

*Observations.*—A single ♀, sent by Mr. Watson from Burma, is undoubtedly Van der Wulp's *Culex crassipes*, although there are certain differences, which probably are due to the denuded state in Van der Wulp's specimen. The essential features of the

insect agree, however, especially the characters of the reddish-brown thorax, apical abdominal banding, and the base of the first sub-marginal cell being nearer the apex of the wing than that of the second posterior cell. It is strange, however, that Van der Wulp did not mention the white scaled venter, unless it were denuded, when it would be dusky in hue. The dark lateral spots on the venter are very distinct, and should serve at once, with the apically banded abdomen, to separate it from all other *Stegomyias*.

16. S. SIGNIFER. Coquillett.

(Canadian Ent. xxviii. p. 43.)

*Habitat.*—District of Columbia.

*Time of capture.*—June.

"Evidently very similar to *C. fasciatus*, Fabr., but differs in having untoothed ungues in the ♀, and, according to Coquillett, by the silvery lateral stripes not being so curved, and it has the tarsal joints banded at both ends."

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## GENUS 10.—**ARMIGERES.** nov. gen.

Head clothed with flat scales and a few upright forked ones; thorax with narrow curved and long almost hair-like scales; scutellum with flat scales only. The wings have the third long vein continued on, into, and through the basal cell as a distinct unscaled line, and the sub-costal and first long vein densely scaled with rather broad scales. Fore and mid ungues of the female equal and toothed, hind equal and untoothed; in the male those of the fore feet are very unequal, both toothed; in the mid legs both ungues smaller, very nearly equal, both toothed; hind equal (and simple?). Comparatively large species with unbanded legs and abdomen, but the latter with lateral spots. Palpi of the ♂ thin with no hair tufts, of the ♀ rather longer than in *Stegomyia*. Antennae in the ♂ large densely plumed, more than half the length of the proboscis. This genus differs from *Stegomyia* in general appearance, being longer, with unbanded tarsi and abdomen, and the palpi are very pointed and provided with bristles only, and no hair tufts in the ♂. The larvae are very peculiar (*vide* p. 326).

1. Armigeres obturbans. Walker (1860).
= *Culex obturbans.* Walker.
*Culex ventralis.* Walker.

(Proc. Linn. Soc. Lond. iv. p. 91 (1860), et v. p. 144 (= *ventralis*).)

(Fig. 57, Pl. XV.)

Thorax black, covered with bronzy scales in the middle of the mesothorax and with creamy-white ones all round forming a broad pale band. Abdomen black with large white triangular lateral spots, last segment white. Legs black, bases and venter of the femora pale, almost white.

♀. Head covered with flat scales, those around and between the eyes creamy white, those on the crown dusky, those at the sides creamy white, dark-brown bristles projecting in front; palpi deep black with a purplish tinge; proboscis deep black; antennae brown with narrow pale bands at the verticils, basal joint black with grey tomentum on the outside and a dense tuft of white scales on the inside, base of the second joint testaceous; clypeus dark brown.

Thorax black, covered on the dorsum of the mesonotum with curved, bronzy brown scales and narrow curved, creamy to pure white ones at the sides, and pale brown in front of the scutellum, where they become very much longer and lanceolate; scutellum clothed with flat scales, dull creamy white on the lateral lobes, dusky with violet reflections in the middle; six large brown bristles arising from the middle lobe on the posterior border and some smaller ones between, others from the lateral lobes; metanotum chestnut-brown; pleurae light brown, with numerous patches of pure white scales extending to the coxae.

Abdomen covered with dusky black scales with violet reflections, with six lateral, triangular white patches which extend to the middle of the segments; venter with broad, basal white bands and narrow black apical ones, apical segments white scaled with short pale hairs to the posterior borders.

Legs black, with violet reflections in some lights, coxae brown, femora white beneath; hind metatarsi a little shorter than the tibiae; knee spot small, creamy white.

Ungues of the fore legs equal, each with a single sharp tooth, those of the mid also toothed, and the hind equal and simple.

Wings with the veins clothed with brown scales, the lateral ones moderately long and their tips convex. First sub-marginal cell very little longer and considerably narrower, its base nearer the apex of the wing than that of the second posterior cell, its stem about two-thirds the length of the cell, stem of the second posterior more than two-thirds the length of the cell; posterior cross-vein more than its own length distant from the mid cross-vein and somewhat longer.

Fig. 104.
Wing of *Armigeres obturbans*, Wlk. (♀). (X. 9.)

Halteres with ochraceous stem, knob partly fuscous and ochraceous.

*Length.*—6·5 to 7·5 mm.

♂. Head much as in the ♀; palpi narrow, deep black, with deep violet reflections, bristly, the apex of the penultimate joint with two black bristles, apex of the last joint with several black bristles, no hair tufts; clypeus dark brown; proboscis black; antennae, with the basal joint black with numerous white scales on the inside, following few joints more or less ochraceous, remainder banded dark brown and grey, plumes dark brown.

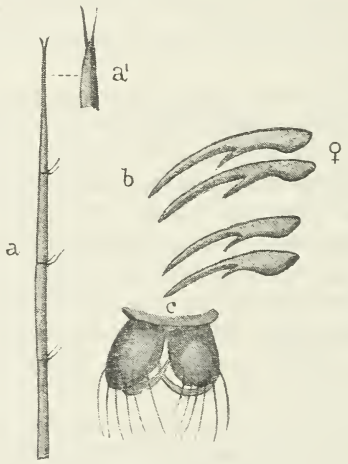


Fig. 105.
*Armigeres obturbans*, Wlk.
a, Male palpus; a', apex of same; b, fore and mid female ungues; c, male genitalia.

Thorax densely clothed with dark brown, narrow curved

scales, sides of the thorax with a broad line of creamy-white scales; pleurae dark brown, with patches of white scales; scutellum with broad, flat, white scales and dark brown border bristles; metanotum brown.

Abdomen much as in the ♀, but with more golden hairs and with two white spots on the last segment; ♂ genitalia with purplish black basal joint and brown claspers.

Wings much as in the ♀, but the fork-cells shorter.

Ungues of fore and mid legs unequal, the larger claw with a single large tooth, the smaller with a small more basal tooth; the mid ones rather smaller than the fore, both toothed towards the base, and more nearly equal; hind small, equal, and simple.

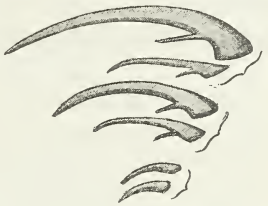

Fig. 106.
Male ungues of *Armigeres obturbans*, Wlk.

*Length.*—5·8 to 6·3 mm.

*Habitat.*—Perak (Wray) (22. 11. and 21. 12. 1899); Naini Tal (Giles); Madras (Cornwall); Travancore (James); Selangor (Butler) (28. 10. 1899); Singaporè (25. 7. 1899); Hong Kong (8. 1. 1900); Tinghai, Formosa (8. 1. 1900); Foo Chow (Rennie) (84); Morzufferpur, Behar, Bengal (Green) (88).

Walker gives Amboyna as a locality, also Makassar in Celebes, Waigiou, Mysol, and North Ceram.

*Time of capture.*—January in Madras.

*Observations.*—This seems to be an abundant Asiatic species, being very common from the Straits Settlements along the Chinese coastline, and also in Continental India.

The thorax seems to be ornamented in fresh specimens, but soon becomes worn. The type is in the British Museum.

Walker's type of *C. ventralis* is also in the Museum collection. I have examined them both, and cannot see any differences of specific value. *A. obturbans* varies to some extent in different localities, especially in the colour of the scutellar scales; some have them all purplish black; Major Giles' from Naini Tal have them mostly creamy white, others white and black. The pale scales surrounding the mesonotum also vary in colour; sometimes they are almost white, at others creamy yellow; there is also a slight variation in the position of the posterior cross-vein in regard to its distance from the mid cross-vein, as in the common European *Culex pipiens*, but very slight. In some specimens there is a more or less distinct line of rather broader creamy

scales in the middle of the mesonotum, which spreads out to form a patch in front of the scutellum, and also a more or less distinct lateral line on its posterior half. In Foo Chow it is common in the native quarters (Rennie).

Captain James, I.M.S., notes that the larva of this mosquito is large, and has a characteristic whitish woolly appearance. It rests perpendicularly to the surface, and further has very large and characteristic swimming fans. It breeds chiefly in pots and tubs of dirty water in the open and under trees. It is very rare to find the mosquito in houses, though it is not uncommon in woods. In a later letter from Hong Kong Captain James tells me he has taken this species in his tent.*

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## Genus 11.—**CULEX.** Linnaeus.

(Linn. Syst. Nat. (1735), Linnaeus; Fn. Suec. 1890, pl. x. figs. 1–4 (1761), Linnaeus; Zweiflüg. Ins. i. 1 (1818), Meigen; Gen. Crust. et Ins. iv. 256 (1809), et Hist. Nat. d. Crust. et d. Ins. xii. 284 (1802), Latreille; Dipt. Exot. 6 (1821), Wiedemann; Mém. Soc. d'Hist. Nat. de Paris, iii. (1827), Rob. Desvoidy; Hist. Nat. d. Ins. i. 33, 2 (1834), Macquart; Dipt. Exot. p. 29 (1838), Macq.; Ins. Brit. Dipt. iii. p. 243 (1851), Walker; Brit. Ent. xii. 537 (1835), Curtis; Dipt. Scand. (1850), Zetterstedt; Fn. Austr. ii. (1864), Schiner; Dipt. Neer. 323 (1877), Van der Wulp; Bull. Soc. Ent. Ital. xxvi. 315, et Revis. Sist. d. fam. d. Culicidae Europ. p. 224 (1896), et Venti Spe. d. Zanzare Ital. p. 98 (1899), Ficalbi; Dipt. Arg. p. 57 (1891), Arribalzaga; Trans. Linn. Soc. N. S. Wales, p. 1724 (1889), Skuse.)

The genus *Culex* of Linnaeus contained all the gnats in which the ♀ palpi are short and the ♂ long, until Arribalzaga in 1891 separated off certain genera (*Heteronycha*, *Janthinosoma*, *Ochlerotatus*, and *Taeniorhynchus*).

This, the only essential character of the old genus, necessitated placing an enormous number of species in one group, and many of those species present very marked differences.

Such a large number of insects grouped together is very embarrassing when trying to identify a species. I therefore sought for some character or group of characters by which the old genus *Culex* could be split up; ungues and palpi are so varied in closely-related species, and the joints of the latter so very difficult to see in fresh specimens, that I at once discarded

* Lieut.-Colonel Giles has two fresh species in the genus.

them as of any further use otherwise than specifically. The male genitalia again vary so much in closely-related gnats that they I found useless, but in the scales I observed great variations and great uniformity in certain groups of mosquitoes, and thus I have adopted them for generic and sub-generic characters in breaking up this genus. The result is that it is reduced to some extent, but still retains a very large number of species, which will probably be still further isolated on more careful examination.

As Linnaeus' genus was doubtless founded on *Culex pipiens* I have retained all those gnats in this genus which present the same squamose characters as that species.

The characters of the genus *Culex* as here retained are as follows: palpi of the ♀ short, three or four-jointed; of the ♂ long, three-jointed; constrictions at the bases may give the ♀ a four or five-jointed and the ♂ a five-jointed appearance; the last joint in the ♀ is usually large; the male may have the last two joints swollen, much as in *Anopheles*, or they may be narrower and the last pointed. The antennae, like those of the preceding genera, are pilose in the ♀, plumose in the ♂, and are composed of fourteen joints in the ♀, fifteen in the ♂, the last two in the male being long and thin.

Head ornamented with narrow curved scales over the occiput, and upright forked scales especially thick on the back of the head, flat scales on the sides (Fig. 9, B); thorax with narrow curved hair-like or spindle-shaped scales; scutellum with narrow curved or spindle-shaped scales only; abdomen with flat scales; wings with small median scales to the veins and more or less thin linear lateral ones to some or all of the veins. In the wings the first sub-marginal cell is longer and narrower than the second posterior cell, and the posterior cross-vein is always nearer the base of the wing than the mid cross-vein. The scales may collect in certain areas and form spots (*C. annulatus*), or the wing itself may be tinged (*C. mimeticus*). The ungues of the ♀ are equal, simple or uniserrated, of the ♂ unequal on the fore and mid legs, the larger uni- or biserrated, the smaller uniserrated or simple.

The genus contains a large number of species, the essential characters being—

(i) Short palpi in the ♀, long in the ♂.

(ii) Head with narrow curved and forked upright scales on the occiput only; never flat scales over the top of the head as in *Stegomyia*.

(iii) Narrow curved or spindle-shaped scales on the scutellum; never broad flat ones.

(iv) Wing veins with median scales and long thin lateral ones on some or all of the veins.

These characters are clearly seen with a strong hand-lens, but are best examined under the microscope with a $\frac{2}{3}$in.-power lens.

The groups of species may be primarily tabulated as follows :—

I. Wings Spotted.

A. Spots along the costa.
B. Spots on the wing field.

II. Wings Unspotted.

α. Legs banded.
β. Proboscis banded.
A. Legs basally banded.
AA. Legs basally and apically banded.
ββ. Proboscis unbanded.
δ. Legs basally banded.
δδ. Legs apically banded only.
δδδ. Legs apically and basally banded.
δδδδ. Legs with the two last hind tarsi white.
δδδδδ. Legs banded on the tibiae; tarsi unbanded.
αα. Legs unbanded.

Although this is not a natural grouping, it aids very materially in identifying species in this still large genus.

## SYNOPTIC TABLE OF SPOTTED-WINGED CULEX.

### I.—WINGS SPOTTED.

A. Spots along the costa.

| | | |
|---|---|---|
| Proboscis banded ..... | *mimeticus.* | Noè. |
| Proboscis unbanded ..... | *Hyrcanus.* | Pallas. |

B. Spots on the wing field.

α. Abdomen with basal pale bands; tarsi banded.

β. Thorax not ornamented.

| | | |
|---|---|---|
| Wing spots five; mid ungues of ♂ with larger tooth twice- and smaller once-toothed ..... | *annulatus.* | Schrank. |
| Wing spots indistinct, like above species, but mid ungues of ♂ both twice-toothed | *Ficalbii.* | Noè. |

ββ. Thorax ornamented.
Thorax with lines of white scales; wing spots three; legs spotted ..... *spathipalpis.* Rondani.
Wings with four spots; fork-cells very long ..... *longiareolatus.* Macquart.

αα. Abdomen with basal pale bands; tarsi unbanded.
Wing spots four or five ..... *glaphyropterus.* Schiner.

ααα. Abdomen with apical pale bands.
Wings with five spots; palpi of ♂ filiform, not spatulate as in *annulatus* ..... *penetrans.* R. Desvoidy.
Wings with three long yellow and three long black costal spots; large species, with apical abdominal bands enlarged in the middle ..... *Bigotii.* Bellardi.

αααα. Abdomen with apical triangular pale spots.
Wings with one small spot at base of third long vein ..... *Jamaicensis.* n. sp.

### 1. Culex mimeticus. Noè (1899).

(Boll. d. Soc. Ent. Italiana, xxxi. p. 240, Firenze (1899).)

(Fig. 63, Pl. XVI.)

Thorax brown, with dark stripes, and with golden curved scales. Abdomen brown, the segments with pale almost white basal bands, venter white. Legs brown, bases of the femora white; metatarsi and tarsi basally white banded, slight apical bands as well. Wings spotted with brown and yellow along the costa, yellow spots three in number.

♀. Head frosty-grey, with flat white scales at the sides and creamy curved scales over the occiput, and with upright forked creamy scales behind; proboscis with a broad creamy band on the apical half, dark brown basally, almost black apically, and somewhat expanded; palpi dark blackish-brown; apex white; antennae brown; basal joint of antennae ferruginous, one side dark, the other brown, base of second joint ferruginous. Thorax brown, with two median darker parallel lines in front, and two indistinct lateral patches behind when denuded, covered with scattered golden curved scales in front, almost white ones behind, in front of the pale brown scutellum; metanotum brown; scutellum pale brown, with creamy curved scales and long brown border-bristles;

pleurae testaceous-brown, with deep purplish-brown patches, and some white scales.

Abdomen steely in some lights, brownish in others, covered with deep brown scales (which appear dull purplish in some lights under the two-fifth power), each segment with a basal band of dull white scales, and a few short golden hairs on their posterior borders; first segment ochraceous, with deep purplish reflections along the apical border and in the middle; venter white scaled.

Legs with the femora pale creamy ventrally from the base to nearly the apex, which is entirely black; the white ventral scales have a pale violet tint in some lights; tibiae brown, the pale knee spot involving their bases; apices of the tibiae also pale scaled in the hind legs; the metatarsus and first two tarsal joints are apically and basally yellow, the basal bands being the largest, the last joint unbanded, together with the preceding, yellowish-brown in colour.

Wings spotted; three yellow spots along the costal border, the rest of the costa being deep brown; wing ornamentation as follows: a small yellow spot on the costa near the apex, which passes on to the tip of the first longitudinal vein, then follow brown scales, which form with the first longitudinal a brown spot, another pale spot ending where the sub-costal joins the costa, which also extends on to the first long vein, then a long brown spot involving unequally the sub-costal and first long veins, then a small pale diagonal spot running across the three, the rest of them being dark scaled; remainder of the wing brown scaled, except the apex of the upper branch of the first sub-marginal cell, the greater part of the third long vein, the upper branch of the fifth, and a band extending from the second spot across the bases of the two fork-cells; first sub-marginal a little longer and the same width as the second posterior cell, their bases not quite level; their stems nearly equal; stem of the first sub-marginal equal to half the length of the cell; posterior cross-vein about twice its own length distant from the mid cross-vein; fringe brown, except between the two forks of the fifth long vein. Halteres ochraceous.

Fig. 107.
Wing of *Culex mimeticus* (♀). (X. 9.)

*Length.*—5 to 6 mm.

*Time of capture.*—Punjab, in March.

*Habitat.*—Italy (Grassi); India, Punjab (Lindesay).

*Observations.*—A very distinct gnat, which evidently mimics the *Anopheles superpictus* of Grassi in regard to the wing ornamentation. It is found in localities in Italy where *A. superpictus* abounds.

Major Giles sends me a specimen, collected by Major Lindesay at 6,000 feet in the Punjab, which resembles the Italian form exactly, only the head and thoracic scales are more of a bright golden-brown (probably the specimen sent by Grassi was faded). It has thus evidently a very wide range. It was described first by Noè, in 1899. Ficalbi mentions the species, but I have not been able to obtain the original description. Professor Grassi kindly sent the Museum one ♀ ; the other was lent me by Major Giles to examine.

### 2. Culex Hyrcanus. Pallas (1771).

(Reisen durch das Russisch. Reich. (1771).)

A grey species, rather hirsute, with a fuscous line down the abdomen ; wings with black spots along the costal margin. Described by Pallas in 1771. Found near the Caspian Sea; not since recorded. In company with *C. Caspius* (Pallas), but less common and vicious.

Note.—I have been unable to trace the type of this species, and have not seen any species that answers exactly to it. It is very probably Noè's species.

### 3. Culex annulatus. Schrank (1776).
*C. affinis.* Stephens (1825).
*C. variegatus.* Schrank (1781).

(Beitr. zur Naturgesch. 97, 70 (1776); et Ins. Austr. 984 (1781), Schrank; Ent. Syst. iv. 400, 2, et Syst. Antl. 35, 4, Fabricius; Syst. Beschr. i. 4, 2, et Klass. i. 2, 1, Meigen; Dipt. n. d. France, 160, 1; et Suit. i. 35, 12, Macquart; Ins. Lapp. 806, 1; et Dipt. Scand. ix. 3640, 8, Zetterstedt; Fn. Austr. ii. 626, Schiner; Dipt. Neer. 325, Van d. Wulp; Ins. Brit. Dipt. iii. p. 246, Walker; Vent. Sp. Zan. Ital. p. 139 (1899), Ficalbi; Zool. Journ. N. 1 (1825) (= *affinis*) Stephens.)

(Fig. 58, Pl. XV.)

Thorax deep brown, with scattered curved golden scales in front, rather paler behind, and forming a faint line on each side, pleurae golden-brown. Abdomen dark brown, with basal white

bands to the segments, second segment with a median white scaled line; venter creamy-white, with black lateral spots (five or six). Legs dark brown; femora pale at the base and beneath, and with a broad pale ring near the apex, also one on the tibiae; metatarsi with pale basal and median bands, some of the tarsi basally ringed white. Wings with four dusky spots of scales, two at the bases of the fork-cells, one at the cross-veins, another at the end of the second long vein.

♂. Head dark brown, with scattered grey spindle-shaped scales, golden-brown hairs projecting forwards between the eyes, and a narrow pale border to the eyes; antennae with the basal joint dark below, testaceous above, with a dense border of pale creamy scales on one side, remainder banded brown and grey; the plume-hairs brown, except at the base, where they are bright flaxen, the last two joints dark brown; palpi black scaled, with four prominent pale rings, the one at the root pure white, the other three yellowish, the two apical ones involving both sides of the joints, the antepenultimate joint with a long brush of brown hairs, flaxen at their base, the last two with shorter dense blackish hairs, pale yellowish at the pale rings; proboscis covered with ochraceous scales, darker at the base and apex, variable in hue.

Thorax deep brown, covered with scattered golden curved scales in front, silvery scales of the same form behind, the paler scales also forming a faint lateral line passing forwards, those at the sides golden-brown, but narrower than those in front; scutellum with silvery-grey scales; metanotum bright chestnut-brown; pleurae bright brown, testaceous towards the root of the wings, with white scales.

Abdomen with the segments covered with dark brown scales, each segment with a basal band of white scales; the second segment also with a median line of white scales; first segment pale ochraceous, with a purplish-black patch in the middle of the base, a median line and an apical border of the same colour; last segment with mostly pale scales; the whole abdomen covered with long pale golden hairs; ventrally it is covered with creamy coloured scales in the centre, with five or six black apical lateral spots.

Legs with the femora pale at the base and beneath, with scattered dark brown scales above, becoming black near the apex, *the black portion preceded by a broad yellowish ring*, knee spot distinct; tibiae covered with black and white scales, the former predominating, a white apical ring and a slightly pale line on one side; the metatarsi with a pale basal band, and a broad median

one ; in the fore and mid legs the first two tarsal joints are basally white ringed ; in the hind legs the first three—the banding being broad ; last joint of the hind and last two of the fore and mid legs black, but in some specimens a narrow white basal band

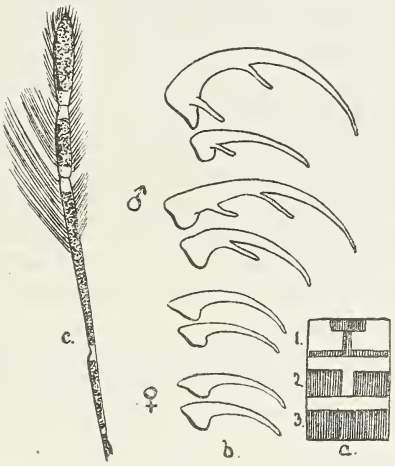


Fig. 108.

*Culex annulatus.* Schrank.

a, First three abdominal segments ; b, ungues of the ♂ and ♀ ; c, palpus of the ♂.

may be seen on the third tarsal joint, which is very small in the fore and mid legs ; ungues of the fore and mid legs black, unequal, the larger one with two teeth, the smaller one with a single tooth ; those of the hind legs small, simple, nearly straight (*vide* Fig. 108).

Wings with brown scales, which form four dark spots by their concentration at the bases of the two fork cells, at the cross-veins, and at base of the second long vein, sometimes the spot at the cross-vein is apparently divided into two ; first sub-marginal cell longer and narrower than the second posterior cell, its base nearer the apex of the wing than that of the latter ; the stem of the former cell equal to about two-thirds of the length of the cell, and equal in length to the stem of the second posterior cell, the latter equal to the length of the cell ; cross-veins very nearly in one line ; scales at the bases of the veins purple, those on the base of the first long vein also with some white ones.

Halteres with deep ochraceous stem and black knob.

*Length.*—9 to 12 mm.

♀. Head with narrower, creamy, curved scales, with deep ochraceous yellow upright forked ones behind, and with numerous golden-brown bristles, and a narrow line of pale scales round the eyes; proboscis darker than in the ♂, and the palpi are dark brown, with a pale spot in the middle, and white scales at the apex; antennae brown, the basal joint bordered with yellow scales, and with creamy rings at the base of the verticils. Wings with five brown spots, due to accumulations of brown scales, the spots placed as follows: at the base of the two fork-cells, the base of the second long vein, and two at the cross-veins, which often look as one, owing to their unition; first sub-marginal cell considerably longer but very little narrower than the second posterior cell, its base nearer the base of the wing than that of the latter; stems of the two fork-cells nearly equal; that of the second posterior perhaps a little the longer, that of first sub-marginal equal to about half the length of the cell, that of the second posterior nearly equal to the length of the cell; the scales on the costa and roots of the veins black, those on the costa mixed with scattered white ones. Ungues equal and simple.

*Length.*—10 to 13 mm.

*Habitat.*—Common throughout Europe, from Scandinavia to Italy, and also occurs in India (Punjab). Osten-Sacken records this species from North America. The following note occurs on *C. annulatus* *: "Mexico. Ciudad in Durango, 8100 feet (Forrer). A single ♀ from Ciudad agrees very well with this species."

*Time of capture.*—In Punjab, in November; in Europe, in April, May, June, and on to October.

*Observations.*—It is one of our largest mosquitoes, and seems to be subject to some variation, according to Ficalbi. Ficalbi also says that this species feeds off the juices of plants, and does not attack animals or man.

The *Culex penetrans* of Desvoidy is thought by Giles and Ficalbi to be a variety of this species; it has not been noticed by any other observer since he described it in 1827; but Desvoidy expressly states that it differs from *C. annulatus* in having filiform palpi in the male, and the abdominal banding being apical, not basal. I prefer to look upon it as a distinct species. *C. affinis*, Stephens, and *C. variegatus*, Schrank, are synonymous.

* Biolog. Centrali Americana, Dipt. vol. i. p. 5, and Cat. Dipt. N. America, p. 18.

On the other hand, Noè's *Culex Ficalbii* I make quite a distinct species.

A single ♀ specimen of *C. annulatus* was sent to Major Giles by Captain Victor Lindesay, I.M.S.; it was taken at Bakloh, Punjab, at 5000 feet above the sea. Major Giles noticed the resemblance between this specimen and the European *C. annulatus*. I have made a minute examination of it, and can see no difference from Schrank's species.

Major Giles also sends me another specimen taken at Bakloh, a ♂, which answers also in all details, including the fore ungues—the mid have gone. It cannot easily be confused with any other species, except *C. Ficalbii*, Noè, and *C. glaphyropterus*, Schiner; from the latter it can be told by its banded legs, which are uniform in *C. glaphyropterus*. From *C. Ficalbii* it can be told by the position of the cross-veins, &c., referred to in dealing with that species.

I have taken this insect at all seasons of the year, especially during the autumn, and usually in privies and outhouses. It clearly hibernates both in the ♂ and ♀ state during the winter.

Stephens's type of *C. affinis* is in the Hope Museum, at Oxford.

### 4. Culex Ficalbii. Noè (1899).

(Boll. d. Soc. Ent. Italiana, xxxi. p. 231 (1899).)

(Fig. 59, Pl. XV.)

Thorax brown, darker at the sides, with lateral, parallel lines and a thin median one covered with pale golden curved scales, rather paler at the sides. Abdomen brownish-black, with basal bands of yellowish white; no white median line to the second segment as in *C. annulatus* (Fig. 109, B). Legs dark brown, femora pale beneath, apices of tibiae yellowish-white, metatarsi with yellowish apical and basal scales, tarsi basally pale, some apically as well, banding most distinct on hind legs. Wing spots indistinct. Mid ungues of the ♂ both twice-toothed.

♀. Head dark brown, covered with scattered, curved, creamy-white scales, and with black, upright forked ones, two small patches of projecting golden-brown bristles and a few long black ones in front, flat white scales at the sides of the head; eyes deep purplish-black; antennae with the basal joint tes-

taceous, the next two joints brown, the remainder blackish, with pale pubescence; palpi testaceous, densely scaled with black and ochraceous scales, and with long black bristles and ochraceous scales only at the apex; proboscis thickly clothed with black and pale ochraceous scales, those at the apex being mostly black and with small black bristles; clypeus brown.

Thorax brown, darker at the sides, with traces of longitudinal ornamentation in the form of two median parallel lines pale outside and dark inside, and a thin median dark line, the whole covered with pale golden curved scales, which become rather broader and paler at the sides and paler in front of the scutellum; three rows of black bristles on the mesonotum and a tuft of the same over the roots of the wings; scutellum broad, with curved silvery scales, *the border with long black bristles and shorter golden-brown ones;* metanotum chestnut-brown; pleurae testaceous, with numerous white scales.

Abdomen covered with deep brownish-black scales, with a basal band of yellowish-white scales to each segment, and with a row of pale golden bristles on their posterior borders; the first segment ochraceous brown, with a purplish apical border, which extends across the middle of the segment, on the centre of the apical border is a small tuft of creamy scales, the whole densely hairy; venter covered with pale creamy scales and with five large, lateral, basal patches of ochraceous scales.

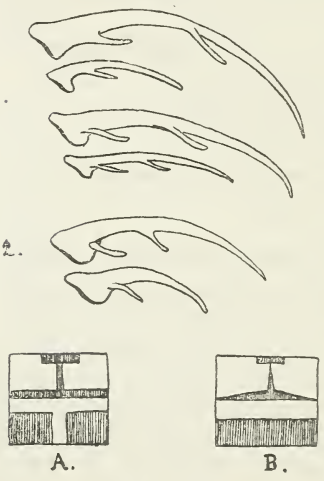


Fig. 109.

First and second abdominal segments of *Culex annulatus* (A) and *Culex Ficalbii* (B); 1, fore and mid ungues of *Culex Ficalbii*, 2, of *Culex annulatus*.

Legs with the coxae testaceous, with a large tuft of white and black scales and rather long bristles; femora covered with black scales above with a few white ones, white below, and with a yellow knee spot; tibiae similarly coloured, the apices yellowish-white, metatarsi black, the bases and apices with yellowish-white scales, hind metatarsi not nearly as long as the hind tibiae; first fore tarsal joint pale at each end, the other three only at the base; mid tarsi the same, but

deep coloured, hind very similar, but the banding rather more distinct, and the first two tarsal joints with a small apical patch of yellow scales ; ungues equal and simple.

Wings with the veins thickly clothed, with rather long dark brown scales, those on the costa and first long vein being broader and metallic purple in some lights ; first sub-marginal cell a little longer, but the same width as the second posterior ; both very long, the former quite one-third the length of the wing, their bases nearly equal ; the stem of the first sub-marginal cell about one-fourth the length of the cell, equal in length to that of the second posterior cell ; posterior cross-vein nearly its own length distant from the mid cross-vein, scales slightly accumulated at the bases of the fork-cells. Halteres ochraceous, with deep fuscous knob.

*Length.*—6 to 6·5 mm. ; of proboscis, 4 mm.

♂. Head blackish, with curved, spindle-shaped, creamy scales, with black upright forked ones behind, ochraceous towards the middle, golden bristles in the middle in front, and black ones towards the sides ; proboscis bright ochraceous, with a violet tinge at the apex ; antennae banded black and white, and with a narrow black band on the white in addition ; verticillate hairs deep brown, basal joint deep testaceous ; palpi ochraceous yellow on the basal half, with two small bands of dark scales, the expanded apical portion covered with almost black scales (the testaceous ground colour showing through), hair tufts almost black (last joint missing).

Thorax dark brown, covered with scattered, curved, narrow, spindle-shaped, creamy scales and a few bronzy ones, almost white round the bare patch before the scutellum ; scutellum and bare space in front pale ochraceous brown ; metanotum pale chestnut-brown.

Abdomen testaceous, covered with deep, dusky-black scales, each segment with a basal band of pale yellow scales ; first segment pale, with a median purple line and purplish-black apical border and basal patch, and an apical median patch of white and dark scales and long lateral golden hairs ; hairs of abdomen deep golden brown.

Legs much as in the ♀, but the banding is fainter, scarcely any trace of it on the last two tarsal joints of the fore and mid legs. Ungues black, fore and mid unequal, the large one twice- and the small once-toothed on the fore legs ; in the mid the smaller one has two teeth, one very thin and pointed.

Wings with the fork-cells about the same length, the first sub-marginal a little narrower, base of the second posterior a little nearer the base of the wing than that of the first sub-marginal, their stems nearly equal, about two-thirds the length of the cells; posterior cross-vein about half its length distant from the mid cross-vein. Halteres with white stem and fuscous knob.

*Length.*—8 mm.

*Habitat.*—Italy (Grassi and Noè).

*Observations.*—Described from a male and female sent by Professor Grassi. This large gnat forms a very distinct species. Giles says: "Noè's new species *C. Ficalbii* is said to differ from *C. annulatus* only in the absence of a white ring on the distal third of the femora, but this hardly appears sufficient basis for the institution of a new species," and he places it as a synonym of *C. annulatus*, not having evidently seen the species.

Noè's species as sent (named) to the Museum by Professor Grassi differs from *C. annulatus* in the following respects: the fork-cells of the ♀ are much longer in proportion; their stems are relatively shorter, and the posterior cross-vein more distant from the mid-cross vein than in Schrank's species; in the ♂ there is no white median line to the second segment, so very characteristic of *C. annulatus*, the palpi are much more ochraceous, but above all is to be noticed the structural peculiarity in the mid tarsi, namely, the two teeth to the smaller claw. Neither ♂ nor ♀ shows any definite wing spots, although the scales are a little closer at the bases of the fork-cells, so I include the species in the spotted-winged group as it is so near *C. annulatus*.

Concerning this species, Ficalbi, in his most recent paper,* says as follows :—

"Ali debolmente, ma evidentemente macchiate per accumulo disquamette; tarsi albo annulati con anelli evidenti solo alla base degli articoli; ginocchii chiari; femori, a differenza del *C. annulatus* e del *C. spathipalpis*, senza anello nel terzo distale. E una specie molto grossa, potendo raggiungere le dimensioni del *C. annulatus* (lunghezza, media da 10 a 12 mm.). Fin ora fu trovata solamente a Macarese ed a Pato."

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* Venti Spec. Zan. Ital. (1899), p. 176.

5. Culex spathipalpis. Rondani (1886).

(Dipt. Ital. Prodro. vol. i. (1886), Rondani; Bull. Soc. Ent. Ital. p. 242 (1890); Venti Spec. Zan. Ital. p. 146 (1899), Ficalbi.)

(Fig. 60, Pl. XV.)

Thorax umber-brown with a median line of white scales, a bent white lateral line and another more indistinct on each side below. Abdomen yellow scaled, with scattered black ones which form patches or may predominate; basally banded white, the bands extending backwards in the middle of the second and third segments and produced laterally; subject to some variation in arrangement. Legs dark, femora, tibiae and metatarsi with lines of white spots or stripes, metatarsi and some of the tarsi basally white banded. Wings with more or less distinct patches of scales, three in number.

♀. Head almost black, with two median curved lines of white scales, which unite in front and behind and pass as a white line between the eyes; there is also a line of snow-white scales bordering the eyes; bristles dark brown, arising in numbers from the two black bare spaces between white scaled areas, and at the back of the head are a few brown upright forked scales; antennae brown, with pale pubescence, basal joint testaceous, with snow-white scales, as have also the second and third joints on the inside; palpi black, with a few white scales, pure white at the apex; proboscis black; clypeus testaceous.

Thorax umber-brown, with thin hair-like bright umber-brown scales, and shows a dark central line when denuded; over this is a median line of white scales which passes back close to the scutellum, where it forks round a small bare space; this line originates in a clear white central spot in front; on each side is another curved line of white scales, which bends in over the mesonotum about the middle and runs back to the scutellum; beneath these is another indistinct line of a similar colour, two small white spots are seen in front formed by white scales on the two prothoracic lobes; there is also a white patch of scales over and just before the wings; numerous black and pale golden bristles at the sides; scutellum with white scales; metanotum chestnut-brown; pleurae pale yellowish, with three more or less distinct bands of white scales formed by a continuation of the white scales on the coxae.

Abdomen with yellow scales, amongst which are scattered black ones, which in some places predominate, forming dark patches; each segment has a basal white band, extending backwards in the middle on the second and third segments and produced laterally down the sides (Ficalbi says that "of the second segment produced at its lateral termination into short longitudinal lines"); in the third to seventh segments the yellow scales are more dense in the middle, forming more or less roughly shaped triangular areas; ventrally the abdomen is covered with pale flaxen scales with a few scattered dark ones.

Legs—coxae yellowish with white scales; femora pale at the base, yellow at the apex and with a ragged yellowish band more or less broken before the apex, the remainder black with two lines of white spots, which may apparently coalesce and form two white lines; tibiae striped with black and white, the white speckled with black; metatarsus black, with a fine white streak and white basal band; tarsi black, first two of the fore and mid legs basally white and also the first three of the hind legs; ungues equal and simple.

Wings with the veins covered with rather long brown scales, the upper surface of the costa white; on the wing field are three distinct spots caused by the accumulation of a few dark scales, namely where the second long vein arises from the first, at the anterior and mid cross-veins, and at the fork of the fifth long vein; there are also indications of spots at the bases of the forks of the second and fourth long veins; first sub-marginal cell about the same width and but little longer than the second posterior cell, its stem about equal to half the length of the cell and about the same length as the stem of the second posterior cell, base of the latter cell slightly nearer the base of the wing than that of the first sub-marginal; posterior cross-vein considerably longer and situated about half its length distant from the mid cross-vein; fringe brown. Halteres with ochraceous stem and dusky knob.

*Length* of ♀, 7 mm.; proboscis 4 mm. Rondani gives the length as between 11 and 15 mm., including the proboscis.

♂. I have not seen a ♂,* so append Ficalbi's description. Proboscis black, longer than the palpi by half the length of the end joint of the latter; antennae with the first joint brown, bordered with white, second mostly white, and the rest of the

* Since the above was written I have been able to examine a ♂ from India, and find it agrees with the ♀, and has very characteristic ungues.

antennae mostly brown. In the abdomen the segments are white for the anterior fourth and the rest black speckled with hazel, saving a median triangular hazel area with the apex forwards, most distinct on the middle segments; the last segment with white scales predominating; ventrally ivory-white,

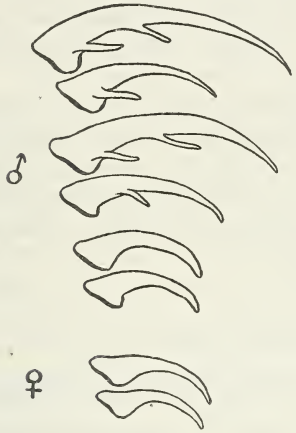


Fig. 110.
*Culex spathipalpis*, Rondani.
Male and female ungues.

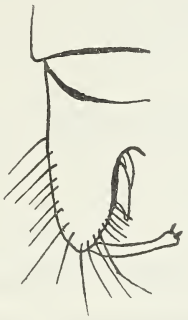

Fig. 111.
*Culex spathipalpis*, Rondani.
Male genitalia (after Ficalbi).

bluish in places, with traces of black at the sides and also to a less extent in the middle, especially on the fourth, fifth and sixth segments; more slender than ♀. Ungues of the fore and mid legs unequal, both rather thick, the larger with two, the smaller with one tooth; hind ones equal and simple, thick.

*Length.*—9–11 mm. (including proboscis).

*Habitat.*—Gibraltar (Major Birt); throughout the greater part of Italy and its larger islands (Ficalbi); India (Giles).

*Time of capture.*—September in Gibraltar. June and July in India.

*Observations.*—Two ♀ specimens of this beautiful species have been received from Major Birt from Gibraltar, where it is common and troublesome, and is known as the "Dove Mosquito." Regarding this and another species (*C. pipiens*), Major Birt writes as follows:* "As a matter of curious interest rather than a

* Report to Sir Henry Jackson, K.C.M.G., Colonial Secretary, Gibraltar (September 9, 1899).

statement of sound scientific value, I would remark that I have isolated from the two main varieties labelled 'grey leg' and the 'dove,' a micrococus much resembling that of Mediterranean fever and a bacillus of much the same characters as the *B. typhorus*, but until I have leisure to make further research no importance or worth can be attached to their discovery." Ficalbi, on the other hand, has not found it to suck blood, and believes it to feed on the juices of plants. He has observed its larvae in the depth of winter.

Major Giles sends two specimens from Naini Tal, India, taken at an altitude of 7000 feet in June and July in a bath-room. These Indian specimens differ only from the Gibraltar ones in having the basal white abdominal bands more symmetrical with no lateral expansions; in all other points they agree. The male ungues are just as Ficalbi describes.

### 6. Culex longiareolatus. Macquart.

(Dipt. Exot. i. p. 34, Macquart; Hist. Nat. des Iles Canaries, Berthelot.)

Thorax brown, covered with narrow curved golden-brown scales and broader creamy ones forming a median line on a dark ground and a curved lateral line on each side. Abdomen with the basal parts of the segments yellowish-brown, apical portions black, last two segments quite black, covered with creamy and dull brown scales, the pale scales forming basal pale bands. Legs yellow-brown, a line of white scales on the fore tibiae, metatarsi and tarsi with basal white bands; femora with scattered brown and grey scales. Wings with four spots of scales.

♀. Head brown, with creamy curved scales, a narrow white border round the eyes, flat white scales at the sides of the head and with black bristles; palpi brown, with scattered white scales; proboscis yellowish-brown, black towards the apex, long, the labella rather elongated; antennae dark brown, the basal joint and subsequent two or three joints with white scales on their inner sides.

Thorax brown, covered with narrow curved golden-brown and rather broader curved creamy scales as follows: the pale scales forming a median line on a dark ground and a curved lateral line on each side, of moderate breadth; scutellum brown, with creamy curved scales and long brown border-bristles;

metanotum yellowish-brown; pleurae chestnut-brown, with creamy-white scales.

Abdomen with the basal part of the segments yellowish-brown, the apical black, the last two segments quite black; covered, but not densely, with dull creamy and very pale brown scales, the creamy ones at the bases of the segments and showing up more distinctly on the black posterior segments; rather long lateral golden-brown hairs.

Legs yellowish-brown; femora with scattered brown and grey scales; fore tibiae brown-scaled with a line of white scales, not visible in those of the mid and hind legs; metatarsi and first two tarsi with basal pale bands, most distinct on the hind feet; ungues equal and simple.

Wings with the veins clothed with rather long narrow scales, which are more densely collected in four patches, forming four spots, namely at the bases of the fork-cells, at the supernumerary and mid cross-veins and at the base of the second long vein; the two fork-cells are long, the first sub-marginal longer but about the same width as the second posterior, their bases nearly level; second posterior cell long, its stem equal to half its length; stem of the first sub-marginal equal to one-third of its length; posterior cross-vein sloping towards the base of the wing, about half its own length distant from the mid cross-vein; halteres ferruginous, with a fuscous knob.

*Length.*—6 to 6·5 mm.

*Habitat.*—Madeira.

*Observations.*—Described from two specimens in the British Museum collection. One shows the abdomen steely-black all over, with yellow scales, but differs in no other respects from the one here described except that the mid leg banding is not so distinct. Very closely related to *C. spathipalpis*, if not identical.

### 7. Culex Bigotii. Bellardi.*

(Mem. R. Acad. Torino, se. 2, T. xxii. p. 200.)

(Fig. 62, Pl. XVI.)

Thorax dusky yellow at the sides, dark brown on the dorsum, with pale golden curved scales, the dark dorsum appearing as a dark median broad line which expands into a brown spot in front of the scutellum. Abdomen blackish-brown, with yellow basal

* This species will have to be removed from *Culex*, and will form the type of a new genus.

bands which become swollen in the middle. Legs dark brown; all the joints apically and basally banded. Wings with the costa yellow, with three long black spots; veins also marked with black and yellow-scaled areas.

♀. Head brown, covered with golden-brown forked upright scales on the front and occiput, then black ones on each side, and then again flat creamy scales, giving the sides of the head a pale appearance; beneath the mass of upright scales on the crown are a few thin curved scales of a pale golden-yellow; projecting in front are golden-yellow hairs; eyes coppery-red, on their border a narrow pale band of scales; antennae dusky yellowish-brown, basal joint yellowish, but dusky on one side, base of second joint also yellowish; palpi yellowish, black at the base, with a broad black dorsal band before the apex and with black scales dotted over the yellow ones, except at the apex, which is pure yellow; proboscis yellow, black scaled at the base and with a black band at the apex, extreme tip pale; clypeus dark brown.

Thorax dusky yellow at the sides, dark brown on the dorsum, covered with short curved pale-golden scales, arranged so as to leave the brown of the dorsum showing as a darker broad line in front, which widens out behind into a broad mass, and on each side in front as a brown oblong spot; pleurae yellow, with blackish markings and two patches of creamy scales; scutellum densely covered with pale curved scales; metanotum dark chestnut-brown.

Abdominal segments covered with deep blackish-brown scales, the apical borders having a band of pale scales, which become swollen in the middle, forming a large pale mass in the centre of each segment of the form shown in Fig. 112; venter pale, the first segments with a black V-shaped mark, the apical ones with a dark central line; posterior borders of the segments clothed with golden hairs.

Fig. 112. *Culex Rigotii*, Bellardi. Abdominal banding.

Legs dark brown, all the joints pale yellowish, that is banded at each end, including the femora.

Wings spotted, the costa yellow, with three long black spots which pass on to the first long vein, which is mostly black-scaled save the apex and a spot under the basal costal spot; second long vein black-scaled, except a pale spot on the upper branch of its fork; third long vein pale, with black scales at the base and close to the apex; fourth black-scaled, with two pale-scaled spots on

each branch of the fork; fifth with black-scaled stem and pale fork; sixth pale; first sub-marginal cell much longer but about the same width as the second posterior cell, the stem about one-third the length of the cell; stem of the second posterior cell equal to about the length of the cell; posterior cross-vein situated about half its own length distant from the mid cross-veins, all three pale. Fringe alternately black and white.

Halteres pale ochraceous.

*Length* of body 9 mm., of proboscis 4 mm., of wings 17 mm.

*Habitat.*—Rio de Janeiro (Dr. Lutz) (4. 7. 1899); Mexico (Bellardi).

*Observations.*—Described from two ♀'s received from Dr. Lutz in fair condition. These he calls the Great Spotted Mosquito. A very clear and beautiful species of the spotted-winged group.

Dr. Lutz writes me that the larvae of this mosquito resemble greatly those of *Psorophora ciliata;* he has raised them on different occasions. Once he found them in a hollow tree in some water in which were larvae of *Heteronycha*, upon which they seemed to be living.

Although he has never taken the insect on the wing he has observed it sucking the blood of a stork during the night.

He adds in his letter that "I think *C. fulvus*, Wied., and *C. costalis* (?), given as found in Brazil, might be badly-preserved specimens of *C. Bigotii.*"

I do not know *C. costalis*, but I find a specimen in Bigot's collection that is evidently *C. fulvus*, Wiedemann, and quite distinct. The apex of the wings is brownish—not spotted in *C. fulvus.*

### 8. Culex Jamaicensis: n. sp.

(Fig. 61, Pl. XVI.)

Thorax dark brown, with four round patches of creamy scales and a few pale ones before the scutellum. Abdomen dark brown, with pale scaled apical bands, those of the second segment forming a triangular pale patch, the next four with the patches broken in the middle; last segment black; venter mostly yellow-scaled. Wings with black and white scales; a small black spot at the third long vein. Legs brown, banded, and speckled with yellowish scales; tarsi basally banded white.

♀. Head brown; occiput with scattered curved cinereous scales and black upright forked ones, white and black flat ones at the sides of the head and numerous black bristles; clypeus

chestnut-brown; eyes silvery; antennae brown, basal joint large, pale brown, arising from a dark area; first and second joints with apical grey scales; palpi brown, with some yellowish scales, white at the apex, with moderately long dark bristles; proboscis black at the tip and slightly darker at the base, the middle with yellowish scales thickly spread over the brown surface.

Thorax very dark brown, with long brown hairs and with deep coppery-brown curved scales and a few black bristles; four round patches of creamy scales and a few of the same colour in front of the scutellum; the latter with pale curved scales and deep brown border-bristles; metanotum deep brown; pleurae with patches of grey scales.

Abdomen black, the first segment with a few apical creamy scales and long yellowish-brown hairs; second segment with a distinct creamy patch of apical scales forming a triangle with its base parallel with the apical border; next four segments with the creamy patches of scales broken in the middle, on the fourth and fifth segments the patches forming two quite separate lateral spots; last segment mostly black; ventrally covered with pale yellow and brown scales with a few black marks.

Wings with the veins covered with black and white scales; a distinctive character is that the base of the third longitudinal where it meets the cross-veins forms a very small deep black spot. Halteres pale testaceous.

Legs banded and speckled with yellow scales; fore femora black, with a pale ring near the apex and with scattered yellow scales, pale underneath; knee white; tibiae black, spotted with yellow scales; metatarsus with a basal and median band of yellow; first two tarsi basally white banded, remainder black; in the mid legs the markings are the same, but there is a trace of banding on the third tarsus, and the femora are whitish beneath except at the apex; in the hind legs all the tarsal joints are basally banded and the ring of the femora is more distinct, whilst ventrally they are like those of the mid legs. Mid and hind ungues equal and simple.

*Length.*—5·5 mm.

*Habitat.*—Jamaica (Grabham) (8. 2. 1900).

*Time of capture.*—December.

*Observations.*—A very distinct species, easily recognised by the black speck on the wing, the curious banding and mottling of the legs and the adornment of the abdomen.

It was bred by Dr. Grabham from larvae collected along Spanish Road, Kingston.

### 9. Culex glaphyropterus. Schiner (1864).

(Faun. Austr. Die Fliegen, ii. p. 628, 10, Schiner (1864); Venti Specie di Zanzare, p. 144 (1899), Ficalbi.)

This species was described by Schiner from Austria, and redescribed in 1899 by Ficalbi.

"The wings are spotted as in *Culex annulatus*, but the legs are unbanded; thorax brownish-yellow, with golden tomentum and four dark longitudinal lines; abdomen nearly black, the segments with basal white bands; ♂ palpi dark, swollen at the end, pale at the base, but

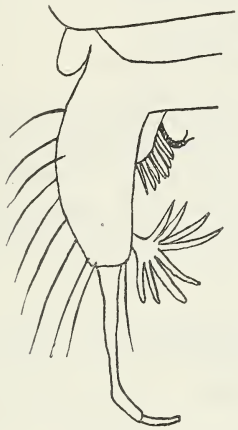

Fig. 113.
*Culex glaphyropterus* (after Ficalbi).
Male genitalia.

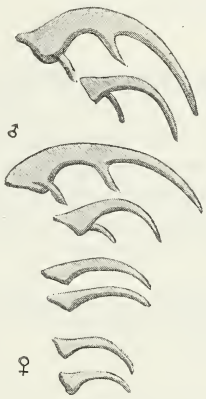


Fig. 114.
Male and female ungues of *Culex glaphyropterus* (after Ficalbi).

otherwise not adorned; in the ♀, according to Ficalbi, they are brownish, with a small conical fourth joint, and according to the latter authority the thorax has two indistinct lateral border lines of golden scales on a reddish-brown ground colour. Length, 9 mm.

"The ungues of the male are unequal in the fore and mid legs, the larger one twice-toothed, the smaller once; hind ungues and those of the ♀ equal and simple."

Note.—I have not seen this species; it reads very much like *C. annulatus*, but must be quite distinct, for the tarsi are non-banded, and there are other minor differences, but the ♂ ungues are evidently very like those of *C. annulatus*; there is also a slight difference in the ♂ genitalia shown in Ficalbi's figures, Nos. 69 and 71.

10. Culex penetrans. R. Desvoidy (1827).

(Essai sur les Culic., Mém. de la Soc. Nat. Hist. de Paris (1827).)

This evidently resembles *C. annulatus*, but differs in the ♂ palpi being more filiform and the antennae shorter and more plumose.

It was described from France and has not since been noted, but is undoubtedly a distinct species.

II.—WINGS UNSPOTTED.

*α. Legs banded.*

*β. Proboscis banded.*

The following species constitute the banded-proboscis section of the genus *Culex*. Most of them seem very closely related and form a very natural group, but, except for the banding of the proboscis and their general appearance, I cannot see any character of such importance as would entitle their removal from *Culex* even to a sub-genus.

## SYNOPTIC TABLE OF SPECIES WITH BANDED PROBOSCIS.

A. Legs with tarsi basally banded only.

(a) Abdomen with basal bands and sometimes lateral spots.

α. Thorax with no special ornamentation.

β. Thorax clothed with narrow curved golden or golden-brown scales.

γ. Abdomen with lateral white spots as well as basal bands.

Legs with basal white bands, abdominal spots large, ♀ fore ungues toothed..... *taeniorhynchus.* Wiedemann.

Leg bands yellow, abdominal lateral spots small, ♀ fore ungues simple ..... *microannulatus.* n. sp.

$\gamma\gamma$. Abdomen basally banded but no lateral spots.

Abdomen with narrow basal yellow bands, last segments with apical and basal banding; head with ochraceous scales, no white flat lateral ones; fore ungues of ♀ equal and simple; of the ♂ unequal, both toothed *Vishnui*. n. sp.

Abdomen with narrow basal bands only; hind legs with basal banding very faint, darker than *Vishnui* ..... *annulus*. n. sp.

Abdomen with narrow yellow basal bands only; no banding on hind tarsi; bases of fork cells separate ..... *sitiens*. Wiedemann.

Mid and hind legs with a broad yellow band involving both sides of tibio-metatarsal joint *impellens*. Walker.

$\gamma\gamma\gamma$. Abdomen with narrow basal pale bands, no mention of white lateral spots; proboscis with three pale bands ..... *tritaeniorhynchus*. Giles.

$\beta\beta$. Thorax with bronzy-black spindle-shaped scales ..... *annulirostris*. Skuse.

(aa) Abdomen creamy yellow with quadrangular black patches on each side ..... *sollicitans*. Walker.

AA. Tarsi with banding involving both sides of the joints.

$\alpha$. Thorax unadorned.

$\beta$. Abdomen banded apically.

Thorax with black scales; proboscis with additional pale band near the apex..... *infula*. n. sp.

$\beta\beta$. Abdomen with basal pale spots.

Abdomen with basal median triangular creamy spots and apical lateral ones.

Thorax with bronzy-brown and golden-brown curved scales, paler ones on each side of mesonotum ..... *annulioris*. n. sp.

Abdomen with basal semicircular yellow patches, second to fourth bent in in middle; white median lateral spots (♂) ..... *plumosus*. n. sp.

$\beta\beta\beta$. Abdomen banded basally.
Thorax golden scaled; proboscis of ♀ indistinctly banded; in ♂ distinctly ..... *dissimilis*. n. sp.

$\alpha\alpha$. Thorax adorned.

$\beta$. Abdomen with basal white bands and also bands at the apices of the last three segments.
Thorax black with yellowish scales, with a dorsal grey vitta, with a white sub-dorsal undulating line on each side ..... *tarsalis*. Coquillett.

$\beta\beta$. Abdomen with basal median pale creamy or yellow patches.
Thorax with deep golden-brown scales and two creamy sealed spots ..... *hirsutipalpis*. n. sp.

Note.—*C. albirostris*, Macquart (p. 382), position doubtful.
*C. confinnis*, Arribalzaga (p. 382), position doubtful.

### 11. Culex taeniorhynchus. Wiedemann (1821).

(Dipt. Exot. p. 43 (1821); Ausseurop. Zweifl. Ins. p. 6, Wiedemann (1828).)

(Fig. 68, Pl. XVII.)

Thorax dark brown, covered with fairly close golden-brown curved scales. Abdomen black, with basal bands of creamy-white scales and pure white lateral spots. Legs dark brown; tarsi and metatarsi with basal white bands, last hind tarsus pure white; tibiae with a few yellowish spots; fore and mid ungues of ♀ toothed; proboscis banded white in the middle.

♀. Head with golden and creamy scales forming a ground-work, with numerous black upright forked scales all over the occiput, with two patches of flat creamy scales at the sides, separated by a patch of dark purplish-black scales; the inner patches of creamy scales bend round to the borders of the eyes; there are also numerous black bristles projecting in front; eyes silvery; palpi yellowish, with scattered black scales at the base and towards the apex, extreme apex covered with white scales: bristles black; proboscis dark brown, with a creamy-white band about its middle—this band varies from ·5 to ·3 mm., and is, if anything, placed a little nearer the base than the middle; antennae brown, with testaceous basal joint and base of the

second joint, faint pale bands at the verticils, pubescence pale, verticillate hairs dark brown; clypeus bright ferruginous brown.

Thorax very dark purplish-brown, with a greyish sheen in some lights, covered with fairly close, scattered, golden-brown, curved, hair-like scales much brighter in front than behind, and some black bristles in three rows; scutellum deep purplish-brown with testaceous patches and black bristles with golden hair-like scales; metanotum chestnut-brown; pleurae deep brown with patches of white scales.

Abdomen densely covered with deep purplish-black scales, each segment with a narrow basal band of pale yellowish-white scales, which do not quite extend across the segments, also with

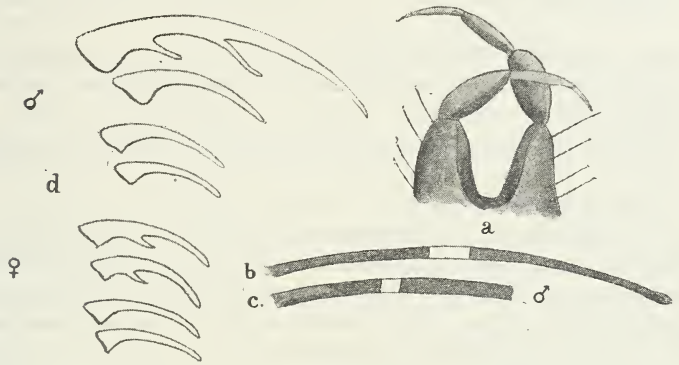


Fig. 115.

*Culex taeniorhynchus*, Wiedemann.

a, Male genitalia; b, female proboscis; c, male proboscis; d, fore and hind ungues of male and female.

pure white lateral spots; each segment bordered posteriorly with a row of golden hairs; ventrally the abdomen is similarly coloured to the dorsum.

Fore legs dark brown, lower surface of the femora yellowish, tibiae with a yellow apex and a few small yellow spots down one side, bases of first and second tarsal joints white, last two joints black; ungues equal, each with a tooth; mid legs with the femora black above, creamy coloured below, a pure white knee spot; tibiae black, spotted with yellow scales, metatarsus basally white banded, also the first two tarsal joints, ungues toothed; in the hind legs the metatarsus and first three tarsal joints are basally white-banded, the last joint pure white, otherwise like

the mid legs; femora with black bristles, tibiae with pale bristles; hind ungues simple.

Wings with brown scales, the lateral ones on the veins being long and thin; first sub-marginal cell longer and but slightly narrower than the second posterior cell, its stem about half the

Fig. 116.
Wing of *Culex taeniorhynchus*, Wied. (♀). (X. 9.)

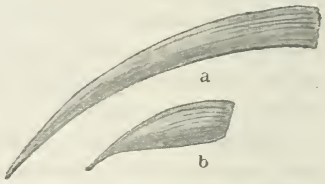


Fig. 117.
Wing scales of *Culex taeniorhynchus*, Wied. a, Border of veins; b, mid vein scales.

length of the cell; posterior cross-vein about the same length as the mid cross-vein and situated rather less than its own length distant from it.

Halteres ochraceous, but with a few dark scales at the top and numerous white scales on one side of the stem.

*Length.*—5 to 5·8 mm.

♂. Head with more creamy-yellow to brown scales in front than in the ♀, and the upright forked scales are yellow; antennae brown, with pale bands and bright silky-brown plumes; palpi black, with four white bands, and with bright chestnut-brown tufts on the last two joints and on the top of the ante-penultimate joint, the last joint slightly shorter than the penultimate, the latter about half the length of the ante-penultimate joint, the white bands are basal; proboscis thin, with a very narrow pale band towards its basal third.

Abdomen narrow, with yellowish basal bands to the first few segments, the rest white, and the last two or three with white lateral spots; densely clothed laterally with golden-brown hairs.

Legs as in the ♀; ungues of the fore and mid legs unequal, the larger one twice-toothed, the hind equal and simple. Male claspers with the basal joint brown, with long dark brown hairs, swollen and pale underneath, second joint small and swollen, testaceous, claspers small (Fig. 115).

*Length.*—4·8 to 5 mm.

*Habitat.*—New Amsterdam, British Guiana (Dr. Rowland, September, 1899); St. Lucia (Dr. Gray) (25. 5. 1899); Florida (Howard); Honduras (Walker); Brazil (Wiedemann). Coquillett

writes me this species is not found north of Florida and Mexico.

*Time of capture.*—British Guiana in February and July, St. Lucia in May.

*Observations.*—Common in houses. Many of the specimens sent by Dr. Rowland from New Amsterdam were taken in the hospital.

The specimens sent from St. Lucia by Dr. Gray were taken on the reclaimed land in the Botanic Gardens at Castries at 6.30 P.M. In these specimens the tarsal banding is not so clear as in those specimens from New Amsterdam, and the posterior cross-vein is a little more distant, but as the position of this vein is by no means staple in Culex it cannot be taken as of any specific importance, nor the magnitude of tarsal banding. A large series of this species has been sent from the north of South America and a specimen also from the United States.

*Synonymy.*—I feel confident, in spite of certain discrepancies, that this is Wiedemann's *Culex taeniorhynchus*, and not the species so called by Arribalzaga. Schiner (Reise der Novara, p. 31) evidently identified *taeniorhynchus* correctly, and noticed the black costal border.

In the British Museum collection Walker placed this species under the name *taeniorhynchus*, but with it he also placed (unless, as I feel confident, the specimens have been wrongly returned after examination) a *sollicitans* and a *titillans*. Professor Howard sent two specimens as *taeniorhynchus*, one *sollicitans*, which is figured by him under the name *taeniorhynchus*, and a true specimen of Wiedemann's species. *C. damnosus*, Say, is also probably this species.

### 12. Culex microannulatus. n. sp.

(Fig. 69, Pl. XVIII.)

Thorax brown, covered with curved, golden-brown scales and with three rows of dark bristles; abdomen dark brown, with basal greyish-white bands. Legs brown, with small yellow basal rings and a small white band at the apex of the femora.

♀. Head brown, covered all over with creamy-brown curved scales and with long, upright, dark brown ones interspersed; the pale scales form a distinct narrow pale border to the eyes. Eyes purple; antennae brown, basal joint testaceous; palpi covered with dark scales, but white at the tip and tawny at the base, with a few long dark hairs; proboscis covered with dark scales and with a broad yellowish-white band about the middle.

Thorax dusky-brown, covered with scattered, curved, golden-brown scales and three rows of black bristles; when denuded there are seen a dark median and lateral lines and the bristle bases as small dark spots; scutellum brown with creamy scales; metanotum deep brown; pleurae paler than the dorsum, with patches of white scales. Abdomen covered with dusky-brown scales, with narrow basal bands of white scales and the posterior borders with golden hairs; the two basal segments have the basal white bands enlarged in the middle in some specimens, the other segments also have this slightly developed; ventrally the abdomen is chiefly covered with white scales. The abdomen looks deep brown, with grey basal bands under a hand-lens.

Legs brown, with metatarsi and some of the tarsi with

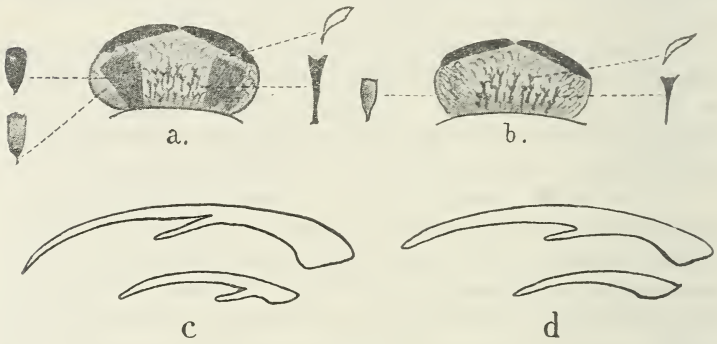


Fig. 118.

a, Head of *Culex Vishnui*. n. sp.; b, head of *Culex microannulatus*. n. sp.; c, fore ungues of the ♂ *Culex Vishnui*; d, fore ungues of the ♂ *Culex microannulatus*.

minute basal yellow bands, fore legs with the femora covered with black and a few white scales and a white ring at the apex; tibiae covered with dark scales, yellowish-white at the apex; metatarsus and first three tarsal joints dark with narrow yellowish basal bands, last joint paler; mid legs similar; hind legs with the base and apex of tibiae narrowly pale, also the metatarsi and first two tarsi; last two tarsi unbanded, or faintly so, dark scaled, ungues equal, simple.

Wings covered with rather long brown scales, first submarginal cell narrower than the second posterior cell, the stems of both shorter than the forks; posterior cross-vein about three times its own length distant from the mid cross-vein.

Halteres ochraceous, with a few black scales at the top.

*Length.*—5 mm.

♂. Palpi dark scaled with pale apex, and two narrow and two broad pale bands, the base with a very narrow pale ring; apical tuft dark brown; antennae banded, plumes dark chestnut-brown. Proboscis swollen towards the end, with a pale yellow band. The white basal banding of two of the last abdominal segments spreads out laterally; the penultimate segment mostly white. Anterior and mid claws unequal, the larger one with a large tooth, the smaller simple.

*Length.*—5·2 mm.

*Habitat.*—Quilon, Travancore, Southern India (James) (7. 3. 1900); Madras (Cornwall).

*Time of capture.*—January and February.

*Observations.*—Described from a good series sent by Captain James from Southern India. It is evidently closely related to the former species, but can at once be told by its browner colour, with the more yellowish and smaller leg banding, and by the ♀ ungues being untoothed.

The species seems to be common in Southern India, and occurs in the North. Captain Cornwall has given me a single specimen from Madras.

Lieut.-Col. Giles says it is common in the N.W. Provinces, and persists in a tolerably active state throughout the cold weather, and was in Shahjuhanpur the only species that attempted to bite during December. The pupae have a relatively short air-tube, and can by this character be easily distinguished from those of *C. fatigans*, which were the only species of *Culex* whose larvae were to be found in his garden tanks at this season. These notes he sends under the heading of *C. impellens*, Walker, but on examining the specimens I find they exactly agree with my *C. microannulatus*, there being no distinct tibio-metatarsal band as seen in *C. impellens*, and they are not so dark. They bite very viciously.

### 13. Culex Vishnui. n. sp.

(Fig. 66, Pl. XVII.)

Thorax brown, with fawn-coloured scales, two more or less distinct median lines and a thin central one formed by a row of bristles. Abdomen deep brown, basally banded with pale yellow, some of the apical segments with a narrow row of apical yellow scales as well. Legs brown, tarsi darker, narrowly basally

banded with yellow; ungues of ♀ equal, simple. Head with ochraceous scales and a dark lateral patch.

♀. Head covered with small, curved, pale ochraceous scales, and with similarly coloured upright forked ones, a few small white ones bordering the eyes and a patch between them in front; there is also a dark lateral patch of flat scales; antennae brown, with bright testaceous basal joint and basal half of the second joint; palpi dark brown, with a few pale scales at the top; eyes purple; proboscis deep ochraceous, covered with dark brown scales, apex pale, a broad yellow band at the base of the apical half, rather enlarged towards the tip.

Thorax brown, covered with fawn-coloured, curved scales, which are paler in front of the scutellum and in front of the

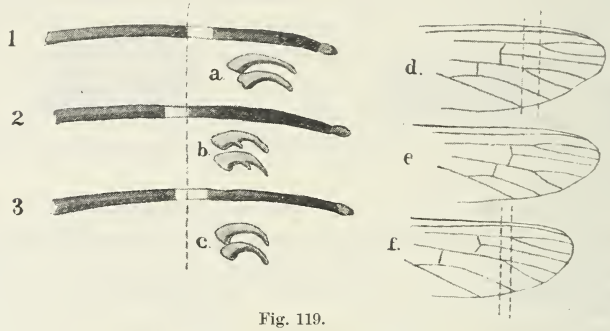


Fig. 119.

1. *Culex annulirostris*, Skuse, sub-sp. *Bancroftii.* n. s. sp.
2. *Culex taeniorhynchus*, Wied.
3. *Culex Vishnui.* n. sp.

a, b, c = ungues; d, e, f = apices of the wings.

roots of the wings, with two parallel, bare, dark, longitudinal lines in the middle, three rows of black bristles, one median and forming a rather dark central line, and a number over the roots of the wings; scutellum ochraceous, with pale curved scales and dark brown bristles; metanotum pale ochraceous brown; pleurae pale ochraceous.

Abdomen covered with deep brown scales, each segment with a broad basal band of creamy-white to yellow scales, last segment white-scaled; the last few segments may have an apical single row of pale scales as well, so that the banding involves both sides of some of the segments; bristles of the posterior border pallid; venter with the segments with pale ochraceous scales, with narrow blackish apical borders.

Legs brown, tarsi dark, pale banded basally, ventral surfaces of femora greyish, knee spots dull white; tibiae brown, with ochraceous reflection towards the tips; metatarsi of mid and hind legs with a narrow, yellowish, basal band, those of the hind legs equal in length to the tibiae; first three tarsi of all the legs basally pale banded, those of the hind legs with the bands whiter and more distinct; ungues simple.

Wings with the veins clothed with long, thin, brown scales; first sub-marginal cell a little longer and narrower than the second posterior cell, its stem equal to about half the length of the cell, its base a little nearer the apex of the wing than that of the second posterior cell; post. cross-vein more than twice its own length distant from the mid cross-vein, the upper branch of the fifth forming a sharp angle where it joins the cross-vein.

Fig. 120.
Wing of ♀ *Culex Vishnui.* n. sp. (X. 9.)

Halteres pale ochraceous.

*Length.*—3 to 4·5 mm.

♂. Head dark brown, with pale scales and whitish flat ones at the sides; antennae banded black and white with umber-brown plumes; palpi banded yellow and black, the second joint

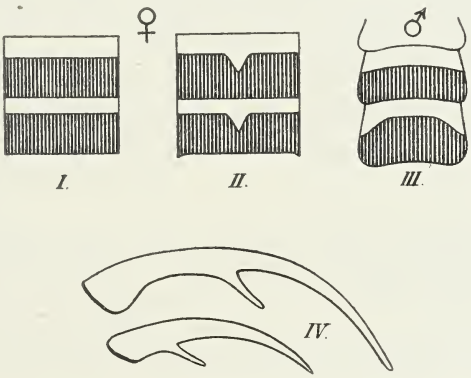


Fig. 120A.
*Culex Vishnui.* n. sp.
I. and II. Two forms of abdominal ornamentation in ♀; III. same in the ♂; IV. fore ungues of the ♂.

apically yellow, the third yellow in the middle; the fourth and fifth narrowly yellow at the base, hairs brown; proboscis with a yellow band as in the ♀. Abdomen narrow, with the basal

bands of whitish scales spreading out laterally on the last few segments.

Ungues of the fore legs unequal, both with a single tooth towards the base, that of the smaller one minute, a comb-like process between; those of the mid leg very similar, but more unequal.

Wings with the first sub-marginal cell longer and narrower than the second posterior cell, its stem less than half the length of the cell; posterior cross-vein nearly twice its length distant from the mid cross-vein.

*Length.*—3 to 4 mm.

*Time of capture.*—November and December in Madras; February at Quilon; November in Ceylon.

*Habitat.*—Quilon, Travancore (James); Madras (Cornwall); Ceylon (Bartholomew) (27. 12. 1899).

*Observations.*—This species varies to some little extent, but not sufficiently to form any definite varieties. Those from Quilon are rather paler than those from Madras, and some show more thoracic ornamentation than others. In one Madras specimen there is a small curious bare horseshoe-shaped patch on each side of the thorax. The Madras specimens have also the thoracic scales of a more golden tint. Some of the Quilon specimens have the yellow abdominal bands with a median prolongation. Another noticeable difference is that the upright head scales may be dark brown as well as ochraceous, and this perhaps might constitute a distinct variety of the species.

Amongst the material received from Ceylon were a number of small banded-proboscis species, which resemble *Vishnui* in all respects, but they are very small and rather darker in colour.

This species closely resembles *Culex microannulatus*, but can be told by its smaller size, its more fawn-coloured thorax, and by the ungues of the ♂ having the smaller claw of the fore and mid feet toothed, whereas in *microannulatus* it is simple, and the palpi have only three narrow pale bands, not four as in that species.

### 14. Culex annulus. n. sp.

Thorax dark brown, with narrow curved pale yellowish scales, nearly white in front of the wings; proboscis with a distinct white to creamy band in the middle; abdomen dark brown, with basal creamy-white bands; venter dull yellowish;

legs brown, with narrow basal pale rings to fore and mid tarsi, not so clear in the hind legs; ungues of ♀ equal and simple.

♀. Head dark brown, with narrow curved creamy-white scales on the occiput and venter, flat white ones at the sides and numerous rather broad brown upright forked ones behind; eyes deep purplish-black, with silvery reflections and a pale border; antennae dark brown; palpi almost black, very scaly, a few dull grey scales at the apex, and a few black bristles at the base; proboscis deep brown, with a broad yellowish-white band rather towards the apical half.

Thorax dark brown, with traces of two paler parallel longitudinal lines, covered with narrow curved pale golden scales on the sides of the mesonotum (the dorsum denuded in all five specimens), and probably all over it; just in front of the root of the wings the scales are white, and also in front of the scutellum; a few black bristles project over the base of the wings; scutellum pale brown, with eight border-bristles to the median lobe; the lateral lobes with the mamillae of the bristles very prominent, apparently four on the outer row and three on the inner; metanotum chestnut-brown; pleurae very pallid, almost grey, with a black spot in the middle and some creamy-white scales.

Abdomen black and shiny when denuded, covered with deep brown scales and with basal bands of creamy scales, the bands swelling out rather in the middle, and in gorged specimens are almost white in colour; first segment with two patches of black scales; posterior border-bristles deep golden-brown; venter mostly covered with dull creamy-white scales, the apical corners of the segments being dark.

Legs with the coxae and venter of the femora grey, remainder dark brown, the metatarsi and tarsi with narrow pale yellow bands, chiefly basal, but involving, to some extent, both sides of the joints, last joint in the fore and mid legs unbanded; ungues small, equal and simple.

Wings with brown scales and brown fringe; the median scales of the veins broadish and long, arranged mostly in a double row, the lateral ones thin, moderately long, and slightly curved at their base; at the apex of the first long vein the broad scales are wider than elsewhere; first sub-marginal cell much longer and a little narrower than the second posterior cell, their bases nearly level; stem of the first sub-marginal about half the length of the cell, stem of the second posterior cell equal to about two-thirds the

length of the cell; the two stems nearly equal; mid cross-vein a little nearer the apex of the wing than the supernumerary cross-vein; posterior cross-vein longer than the mid, nearly three times its own length distant from it; sub-costal joins the costal just before the base of the sub-marginal cell; border-scales of the fringe dark brown. Halteres grey at the base, upper part of the stem and knob brown.

*Length.*—3·5 to 3·8 mm.

*Habitat.*—Lamma (Stanley); Tai Po, Pokfulam, Hong Kong.

*Time of capture.*—October.

*Observations.*—Described from several ♀'s in Dr. Rees's Hong Kong collection. It resembles to some extent *Culex Vishnui*, but is rather darker, and the thoracic ornamentation differs. The posterior cross-vein is very far back, and the hind legs show only traces of banding, whereas the banding is most marked in the posterior legs of *Vishnui*.

### 15. Culex sitiens. Wiedemann (1828).

(Ausseurop. Zweiflüg. Ins. p. 544.)

Thorax dark brown, with scattered, golden, curved scales, rather more pallid in the centre; abdomen deep brown, with narrow, basal, ochraceous bands; venter ochraceous. Legs brown, with small basal pale bands on the fore and mid legs; hind tarsi unbanded.

♀. Head brown, with pale creamy curved scales close to the surface, and with numerous black upright forked scales, a small patch of flat white scales on each side. Antennae dark brown, with white pubescence and brown verticillate hairs, basal joint and base of the second joint pale testaceous; palpi short, thick, blackish-grey at the extreme tip; proboscis brown, almost black towards the apex, but the extreme apex yellowish, a yellow band *towards the base of the apical half.*

Thorax dark brown, with scattered, curved, golden scales, which seem to be more pallid in the centre in front of the scutellum, which is dark brown with scattered curved, golden scales and a border of black bristles; metanotum brown; pleurae pale brown with white tomentum under the wings and a single patch of white scales over the middle legs. Abdomen covered with deep brown scales, the base of each segment with a narrow band of ochraceous scales, except the first segment, which has a

patch of dark scales in the centre and long golden hairs, and the second with a patch of basal ochraceous scales; posterior edges of the segments with golden hairs; venter deep ochraceous, covered with creamy coloured scales.

Legs with the femora with scattered dark brown and dusky yellow scales above, pale yellowish-grey below and at the sides, with a distinct row of bristles on the under surface, tibiae covered with brown scales with a slight ochraceous reflection, a faint yellowish spot at the apex; fore metatarsi and bases of the first two front tarsi with narrow yellow basal bands, a trace of one being seen on the third tarsal also in some specimens; the

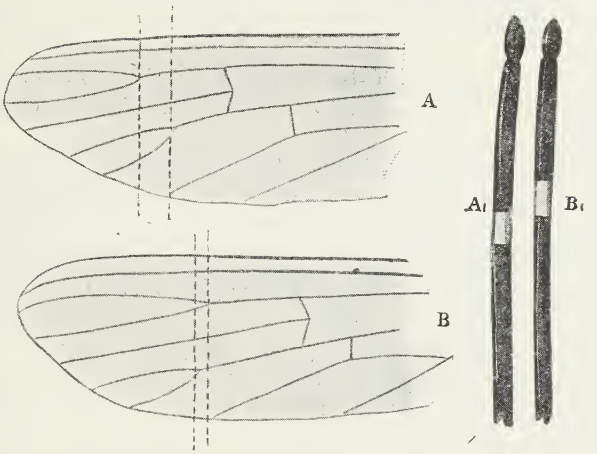


Fig. 121.

A, Wing, and $A_1$, proboscis of *Culex annulirostris*, Skuse; B, of *Culex sitiens*, Wied.

mid legs very similar; hind legs without any basal banding; hind tibia a little longer than the metatarsus; ungues equal, simple.

Wings with the veins covered with short and long brown scales; the first sub-marginal cell longer and slightly narrower than the second posterior, its base nearer the base of the wing than that of the latter; posterior cross-vein twice its own length distant from the mid cross-vein.

Halteres with stem pale at the base, remainder and knob fuscous.

*Length.*—3 mm.

*Habitat.*—Taipang, Perak (Wray) (22. 11. and 21. 12. 1899).

*Observations.*—I do not feel certain as to whether this mosquito from the Straits Settlements is distinct from those from India that I have called *C. microannulatus*, but the absence of leg banding in the hind legs at once separates it; more especially will be noticed that the base of the first sub-marginal cell is much nearer the base of the wing than in that species. In this respect it resembles *Culex Vishnui*, but the latter is much paler and has distinct leg banding to the hind tarsi, and the abdominal banding is both apical and basal.

This must be Wiedemann's *C. sitiens*, described from Sumatra. With the exception that the hind legs are unbanded, this species applies very well to Wiedemann's description, and as the next species answers to the other banded-proboscis form from this region, namely *C. impellens*, Wlk., I retain Wiedemann's name for this species, in which the bases of the fork cells are *not* level. Wiedemann's specimen was very defective. His description is as follows:—.

"Black, with proboscis and abdomen and legs with bands of white. Length $2\frac{1}{4}$ lines. Colour of the body brownish-black; under side of the head and extreme tarsi yellowish; proboscis with a clear yellowish-white band a little beyond the middle. On the thorax there appear in certain lights two thick, brighter stripes lying together. Bands on the abdomen very clear, on the venter they are closely united and more distinct. Wings with brownish-black scales; femora with yellowish appearance; knees and all the other articulations white."

Giles is not correct, I fancy, in placing either Williston's banded-proboscis form or Walker's *C. impellens* as synonyms. The next species is Walker's *C. impellens*.

### 16. Culex impellens. Walker.

(Proc. Linn. Soc. Lond. iv. 91.)

Thorax dark brown, covered with pale golden curved scales. Abdomen covered with dusky-brown scales and with basal white bands. Legs brown, the mid and hind legs with a pale band involving the tibio-metatarsal joint; tarsal banding basal. Bases of the fork-cells nearly level.

♀. Head with creamy curved scales in front and a patch of flat white scales at the sides, ochraceous forked upright scales in front, with similarly shaped black ones behind, especially

laterally, with pale golden bristles in front. Eyes purplish, with a coppery lustre. Palpi black, with a few white scales at the tip. Antennae brown, with pale pubescence and brown hairs, basal joint and the base of second joint pale testaceous; proboscis black, with a pale band at the base of the apical half.

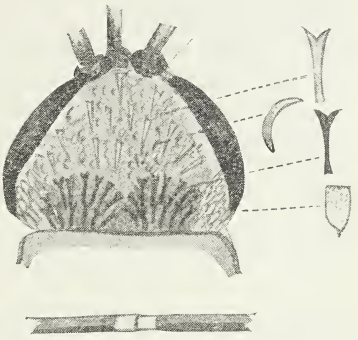

Fig. 122.

Head of *Culex impellens*, Walker, and tibio-metatarsal jointing of leg.

Thorax dark brown, covered with pale golden, curved, hair-like scales; scutellum dark brown, with pale curved scales; metanotum dark brown; pleurae brown, with a patch of pale scales over the mid legs.

Abdomen covered with dusky purplish-brown scales, each segment with a narrow basal band of dull white scales, and their posterior borders with pallid hairs; venter with pale yellowish scales forming basal bands to the segments.

Fore legs with a pale knee spot and a yellow spot at the apex of the tibia; mid legs with a pale band at the tibio-metatarsal joint, involving both sides of the joint and traces of basal banding on the first two tarsal joints; hind legs with a pale spot at the end of the femora and base of tibiae, *a distinct band on the tibio-metatarsal joint*, a small band at the base of the first two tarsi, with a very faint trace on the third.

Fig. 123.

Wing of ♀ *Culex impellens*, Walker. (X. 11.)

Wings with the first sub-marginal cell a little longer and narrower than the second posterior cell, their bases about level; posterior cross-vein nearly three times its length distant from the mid cross-vein.

*Length.*—4·5 mm.

*Habitat.*—Perak (Wray); N. W. Provinces, India (Giles).

*Observations.*—Described from a single ♀ sent by Mr. Wray. It is closely related to *C. sitiens*, but can at once be told by the bases of the two fork cells being nearly level, whereas in *sitiens* that of the first sub-marginal is much nearer the base than that of the second posterior. The head ornamentation also differs a little, and the strongly-marked tibio-metatarsal band on the mid and hind legs seems very characteristic.

I feel sure this is the same as Walker's *Culex impellens*, described from Makessar in Celebes. All that remains of the type, however, are thorax and wings, and they answer to these specimens. I have only seen a single ♂.

### 17. Culex tritaeniorhynchus. Giles.

(The Entomol. p. 192, 1901.)

Wings unspotted. Tarsi minutely basally banded, pale ochreous. Thorax unadorned, fuscous. Abdominal segments fuscous, with rather narrow yellowish-white basal bands. Proboscis with three ochreous bands.

Head fuscous; eyes with a barely perceptible whitish margin; nape fuscous, with a few whitish hairs. Antennae fuscous, minutely banded white in the ♂. Proboscis fuscous, with three separate ochreous bands, one forming the tip; the second sharply defined and much broader, beyond the middle; the third less sharply defined, especially in the ♀,

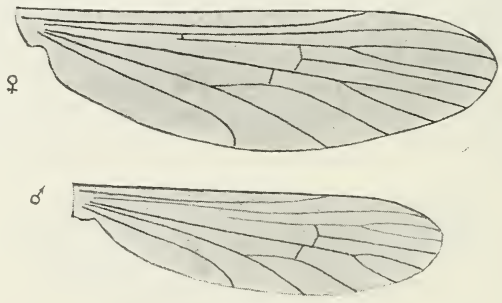


Fig. 124.
Wing of ♀ and ♂ *Culex tritaeniorhynchus*, Giles.
(after Giles).

midway between the large broad band and the base. Palpi of ♂ considerably longer than the proboscis, exceeding it by more than the length of the markedly subulate terminal joint, fuscous, with minute white basal bands to the last three joints; ♀ exceptionally minute, nearly black, with an indistinct greyish tip.

Thorax fuscous, with golden-brown tomentum, unadorned. Wings hyaline, with nearly black scales. Auxiliary vein joining the costa a little

in front of the base of the anterior fork-cell and slightly behind the tip of the anterior branch of the fifth longitudinal; supernumerary and middle transverse veins in one line, and fully their united length outside the posterior transverse. Fork-cells both narrow and of nearly equal width, but the anterior the longer. Their stems short, the posterior being a little the longer, so that the base of the corresponding cell is slightly outside that of the anterior fork-cell. Halteres pale yellow. Legs fuscous, the tarsi with minute ochreous basal bands to all the joints; first posterior tarsal longer than the corresponding tibia in both sexes. Abdomen fuscous, with rather narrow yellowish-white basal bands to the segments, broader in the middle than laterally, especially on the anterior segments.

*Length* of wing of ♂ 2·4 mm.; of ♀ 3 mm.

*Habitat.*—India.

*Observation.*—A minute species, of generally dusky tinting and proportionately long legs.

Note.—I have not found this species in the collections sent me by Lt.-Col. Giles, but I have seen one specimen from India that resembled this triple-banded proboscis gnat, but on examination it proved to be *C. Vishnui*, with the proboscis rubbed, so as to resemble two extra bands.

### 18. Culex annulirostris. Skuse (1889).

(Proc. Linn. Soc. N. S. Wales, p. 1737 (1889).)

Thorax deep brown, with flat bronzy spindle-shaped scales. Abdomen black, with basal white bands. Legs black, femora pale beneath and at the base, metatarsi and tarsi with basal pale bands. Proboscis banded white.

♀. Head dark brown, clothed with pale curved scales, white at the sides and forming a narrow border round the eyes, and with scattered black upright forked ones on each side and pale upright forked ones in the middle in front; eyes deep purple, almost black; clypeus dark brown; palpi deep brown, with the apex pale owing to the white pubescence; antennae dark brown, basal joint deep testaceous brown; proboscis deep brown, with a broad white band near the middle.

Thorax deep brown, with curved flat bronzy spindle-shaped scales, with a slight golden-brown tinge in some lights; three longitudinal dark lines seen plainly on the denuded mesonotum; scutellum brown, paler than the mesonotum; metanotum brown; pleurae umber brown, with pale hairs.

Abdomen covered with black scales, the segments with basal

bands of pure white scales, and bordered posteriorly with golden hairs; venter with broad white scaled basal bands.

Legs with the fore femora black scaled above, white scaled below, and with an apical white spot; fore and mid tibiae black, slightly pale at the base, forming with the femoral speck a white knee spot, hind tibiae with white apical scales and dilated at the apex; metatarsi and first two tarsal joints pale at the base, quite white in the hind legs; hind metatarsi the same length as the tibiae; ungues equal and simple.

Wings with the veins covered with brown scales, the lateral ones long and slender on most of the veins; first sub-marginal cell a little longer and slightly narrower than the second posterior cell; stem of the former a little more than half the length of the cell; base of the second posterior cell a little nearer the base of the wing than that of the first sub-marginal, its stem rather more than half the length of the cell; posterior cross-vein twice its own length distant from the mid cross-vein; fringe brown.

Halteres ochraceous, slightly fuscous at the tip.

*Length.*—4·5 mm.

♂. Head with creamy upright forked scales on each side in front, dusky ones behind, a bare line in the middle; grey and brown flat scales at the sides; antennae brown, with pale bands and dark silky-brown plumes; palpi dark brown, with two broad basal pale bands and two narrow ones to the apical joints, the one broad band corresponds in position with the proboscis band; proboscis banded in the middle, expanded towards the apex, which darkens and then becomes paler, not so long as the palpi. Ungues of fore and mid legs unequal, both serrated, the smaller with a minute tooth; hind ones equal and simple.

Wings with rather blunter and broader lateral scales to the veins than in the ♀; both fork-cells short, the base of the second posterior cell nearer the base of the wing than that of the first sub-marginal cell; stem of the latter equal to the length of the cell; stem of the second posterior not quite so long as the cell; posterior cross-vein nearly twice its own length distant from the mid cross-vein and somewhat longer.

*Length.*—4 to 4·5 mm.

*Habitat.*—Bupengary, Queensland (Dr. Bancroft) (29. 5. 1899 and 8. 5. 1899); Blue Mountains (Masters); Berowra, New South Wales (Skuse).

*Observations.*—A number of specimens with a banded proboscis have been received from Dr. Bancroft from Queensland; some of these he has labelled *C. annulirostris*, Skuse. *C. annulirostris* is the only species with an annulated proboscis described from Australia, Skuse having taken two ♀'s in New South Wales. The series I have examined do not show any marked variation, and answer in so many respects to Skuse's description that I take them to belong to that species. They differ, however, in the following respects, but, until I see specimens from New South Wales exactly answering his type, it is best to retain his name for the Queensland form.

The scales on the head in Dr. Bancroft's specimens are not yellow; the thorax has bronzy scales, with sometimes a slight golden-brown tinge, with pale scales behind. Skuse says, "rather densely covered with yellow scales and hairs," but in all other respects the descriptions agree.

The leg banding is rather variable in intensity, and the halteres seem to be either entirely ochraceous brown or with a dusky knob.

The simple ungues in the ♀ and the greater distance of the posterior from the mid cross-vein will at once distinguish it from the closely-related *C. taeniorhynchus*, Wied.

Sub-species *Bancroftii*.

A very distinct and handsome specimen has also been sent by Dr. Bancroft, represented by a single ♀. The head is brown, clothed with pale yellowish curved scales, black upright forked ones behind and at the sides, and a central line of pale creamy curved scales, whilst the flat ones at the sides are quite white; the palpi have a white patch at the apex.

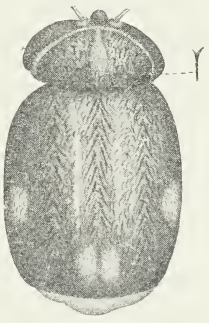

Fig. 125.
Head and thorax of sub-sp. *Bancroftii*.

The thorax differs from the type in having, in addition to the flat spindle-shaped bronzy scales, a few dark yellowish ones every here and there, and with two patches of white curved scales in the middle, in front of the scutellum, and another patch just over the roots of the wings. The posterior cross-vein seems to be a little more distant from the mid cross-vein than in the type. Ungues, &c., however, just the same.

*Habitat.*—Bupengary (Dr. Bancroft).

*Observations.*—I can detect no structural difference in this specimen from *C. annulirostris*, in spite of its peculiar ornamentation on the thorax, except a slight variation in the position of the posterior cross-vein.

### 19. Culex sollicitans. Walker (1856).

(Insect. Saund. p. 427 (1856), Walker; Cir. No. 40, 2nd se. U.S.A. Dept Agri. (1899), Howard.)

(Fig. 64, Pl. XVI.)

Thorax dark brown, covered with thin, golden, curved scales; pleurae dark brown, densely clothed with white scales. Abdomen dark brown, with a median yellow-scaled line, basal whitish-yellow bands and white lateral spots, the dark scales forming a black quadrangular patch on each side of the segments. Legs ochraceous, mottled with black and white scales; mid and hind metatarsi with pale basal bands, also the tarsi; in the hind legs the last joint is almost all white. Wings with brown and almost white scales. Proboscis with a yellow median band.

♀. Head brown, with dense golden, curved, hair-like scales, which project in front between the eyes as a dense tuft of hairs, a few flat ochraceous scales at the sides towards the back with small, thin, golden scales in front, sides of head blackish; antennae testaceous at the base, black for the remainder; basal joint with ochraceous scales; proboscis black, with a distinct yellowish-white band in the middle; palpi covered with dark brown scales and with a white apex; eyes silvery.

Thorax almost black, thickly covered with golden-brown, thin curved scales; scutellum similarly covered, and with bright, golden-brown bristles on the border; metanotum chestnut-brown; pleurae dark brown, *densely clothed with white scales.*

Abdomen with creamy white to yellow scales, forming a central broad line and with basal white bands, with a dark brown to nearly black quadrangular patch on each side of the central mass of pale scales; there are also white scales laterally on some of the segments; venter clothed with pale creamy scales; golden hairs to the posterior borders of the segments.

Legs ochraceous, mottled with black and white scales, knee spots white; fore metatarsi without a basal white band, mid

and hind with a pale basal band, quite white in the hind legs, and with two blackish bands, one apical; mid and fore tarsi with a broad, white, basal band, except on the last joint, which is pale; in the hind legs the basal bands are more distinct and whiter, and the last joint is white.

Wings with testaceous veins and pale brown scales; the latter do not show in all lights; first sub-marginal cell longer and narrower than the second posterior cell, its stem about half the length of the cell; stem of the second posterior cell rather more than half the length of the cell; posterior cross-vein about its own length distant from the mid cross-vein. Halteres testaceous, with slightly fuscous knob.

*Length.*—6 mm.

*Habitat.*—United States. Howard gives the following localities for America: Avalon, Anglesea, and Atlantic City, N.J.; Far Rockaway, Amergansett, and on the beach at Staten Island, N.Y.; Chesapeake Beach, Maryland; St. Augustine and Charlotte Harbour, Florida; and Galapagos Islands (Snodgrass) (?), Jamaica (Johnson) (?). Tamsui, Formosa (C. Ford, January 8, 1900) (?).

*Observations.*—Two ♀'s sent by Professor Howard, one bearing a label with the following: "June, 1875, Beverley, Massachusetts (Burgess)"; the other "Collection, C. V. Riley." These two ♀'s in fair order were sent with a true *C. taeniorhynchus*, Wied., under that name. The species is, however, very distinct and not in any way connected with Wiedemann's *C. taeniorhynchus*. Walker's type is in the British Museum, and is certainly a very well-defined species. The markings of the abdomen, the mottled scales on the wings (seen only in certain lights), and the difference in the scales of the head will at once separate it from any neighbouring species. A figure in Circular No. 40, second series, United States Department of Agriculture, Division of Entomology, gives a good idea of this species, but is wrongly named *C. taeniorhynchus*. Coquillett and Arribalzaga's synonymy is, therefore, wrong, and *C. sollicitans* must stand as a distinct species. Professor Howard is "inclined to believe that this species is more or less specifically the sea-coast mosquito of the Atlantic seaboard; it is able to breed and prefers to breed in the brackish swamps which are occasionally overflowed at high tide" (Rept. Mosq. U.S. Bull. 25, p. 28).

Say described a gnat under the name *Culex damnosus* from Pennsylvania, hundreds of miles north of Florida. *C. sollicitans*

ranges north of Florida, hence Mr. Coquillett thinks *damnosus* and *sollicitans* are the same.

A damaged specimen, of what is evidently this species, has been received from Formosa from Mr. Ford. It resembles the species from North America, as far as I can judge from its damaged condition, but the banding on the tarsi is not noticeable with a hand-lens, but under the two-third power traces of it are seen, the basal scales reflecting white in certain lights; the banding of the proboscis is also not so distinct except under the microscope, when the middle scales appear to form quite a white band. This specimen was taken in January at sea-level, but on such slender evidence I feel disinclined to place it as this species, although it bears a strong superficial resemblance.

### 20. Culex infula. n. sp.

Thorax black, with scattered black scales and a few pale golden ones in front. Proboscis with two pale bands. Abdomen dark brown, with apical bands of yellow scales, especially prominent on the apical segments. Legs dark brown; fore and mid metatarsi basally and apically banded yellow, and also apical and basal banding to the tarsi.

♀. Head black, with a few pale golden scales and numerous black upright forked scales; eyes dull silvery; palpi black, thick, with a few pallid hairs at the top; antennae dark brown; clypeus dark brown; proboscis black, with a pale yellowish band in the middle and a narrow pale band before the apex.

Thorax black, with scattered black scales, a few pale golden ones in front, and with black bristles, especially thick just in front of the roots of the wings, and traces of paler longitudinal lines; scutellum black, with traces of black scales, slightly testaceous in some lights, with slight darkening at the sides; metanotum pale chestnut-brown; pleurae brown.

Abdomen covered with dark brown scales, *with apical bands of yellow scales*, scanty in front, but very pronounced behind; first segment pale ochraceous, with golden hairs; each segment with a border of golden hairs posteriorly; ventrally the abdomen is clothed with yellow scales.

Legs with yellowish coxae; femora ochraceous, with thickly-

* Mr. Coquillett has just written me that he finds *C. taeniorhynchus* occurs much further north than Florida, and adds, "You are evidently correct in assigning *damnosus* as a synonym of *taeniorhynchus*.

scattered dark scales; tibiae dark scaled, with a few scattered yellow ones; *fore and mid metatarsi basally and apically banded with yellow*, also the first and second tarsal joints, the third faintly so, the fourth entirely dark scaled; in the hind legs the metatarsi are the same, but the remaining joints are absent. Ungues simple.

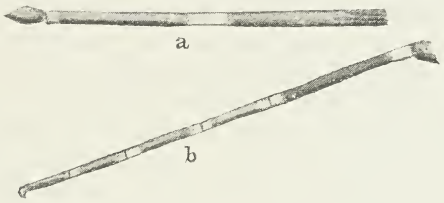


Fig. 126.
*Culex infula.* n. sp.
a, Proboscis; b, fore leg.

Wings with a slight yellowish tinge, the veins clothed with brown scales, the lateral ones moderately long; first sub-marginal cell narrower and longer than the second posterior cell; the posterior cross-vein nearly twice its own length distant from the mid cross-vein; all the cross-veins very faint; the root of the wing is pallid, but has a distinct round dark spot. Halteres with a pale stem and a brownish knob.

*Length.*—5 mm.

*Habitat.*—Taipang, Perak, Straits Settlements (L. Wray, jun.) (22. 11. and 21. 12. 1899).

*Observations.*—Described from a single ♀ sent by Mr. Wray, unfortunately with the hind tarsi gone. It may at once be told from the other "banded proboscis" species by the small vitta just before the apex of the proboscis, as well as the broader central one, the basal and apical metatarsal and tarsal banding, and the dark round spot at the root of the wings.

### 21. Culex annulioris. n. sp.

Thorax umber-brown, with bronzy-brown and golden-brown narrow curved scales, with a few pale scales on each side of the mesonotum and scattered over it. Abdomen deep fuscous-brown, with basal median triangular creamy spots, and apical lateral creamy spots. Proboscis with a broad clear creamy band in the middle. Legs brown, femora mottled with pale scales; pale banded

at the tibio-metatarsal and tarsal joints, chiefly basal, but involving more or less both sides of the joints. Fore ungues of the ♀ uniserrated, equal; hind ones equal and simple; ungues of the fore and mid legs in ♂ unequal, uniserrated.

♀. Head brown, with narrow curved pale creamy scales, upright forked bright brown ones in the middle, darker ones at the sides, laterally are flat pale scales along the eyes, but dark behind; eyes deep purplish-black, with narrow pale creamy scaled borders; clypeus dark brown; proboscis very dark brown at the base, black at the apex, with a broad, well-defined pale yellow median band; palpi densely scaled with black scales and a few grey ones, white scaled at the apices; antennae brown, with narrow pale bands at the verticils, hairs dark brown, basal joint dark brown, deep ferruginous on the outside; base of second joint dull ferruginous.

Thorax deep umber-brown, with narrow curved bronzy scales and a few creamy-yellow ones, especially in front of the mesothorax, and dotted over the whole surface; there are also small narrow hair-like black scales in front of the scutellum, like those on the

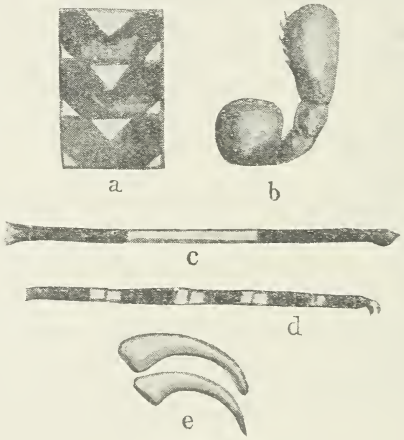


Fig. 127.

*Culex annulioris.* n. sp.

a, Abdominal ornamentation; b, clypeus and palpus (♀); c, proboscis; d, hind leg; e, hind ungues of the ♀.

mid lobe of the scutellum; over the roots of the wings are numerous long black bristles, and in front of them long golden-brown bristles; scutellum brown, darker in the middle, with narrow black scales on the middle lobe and a few pale ones, also

a few pale scales on the lateral lobes, border-bristles deep chestnut-brown, eight to the mid lobe; metanotum deep umber-brown; pleurae umber-brown, with two patches of creamy scales.

Abdomen steely-black when denuded, covered with dusky-black to deep brown scales, each segment with a triangular basal patch of creamy-yellow scales, and with apical lateral patches of yellow scales; posterior border-bristles golden-brown; first segment with two median patches of black scales, separated by a few white scales.

Legs with the coxae pale ferruginous-brown; femora and tibiae with dark brown scales and scattered grey ones, giving a mottled appearance; femora somewhat pallid beneath, apex with a yellowish-white spot, metatarsi and tarsi dark brown, the base of the former a little paler, the other joints banded, the pale yellowish-white bands involving both sides of the joints, banding not distinct on the last two joints; ungues of fore legs black, rather thick, equal, uniserrated; of the hind legs equal and simple; femora and tibiae with a few bristles.

Wings with the veins with brown scales and brown fringe of typical form; the first sub-marginal cell longer, very slightly narrower than the second posterior cell, their bases nearly level; both cells long; stem of the first sub-marginal less than one-third the length of the cell, about equal to the stem of the second posterior cell, posterior cross-vein a little more than twice its own length distant from the mid cross-vein; base of the wings testaceous. Halteres with a pallid stem and fuscous knob, with a few small dull grey scales.

*Length.*—6 mm. (proboscis 2·5 mm.).

*Habitat.*—Salisbury, Mashonaland (Marshall) (79).

*Time of capture.*—February.

*Observations.*—Described from a single female in good preservation except the legs. This banded proboscis species can at once be distinguished by the abdominal ornamentation, which is very marked and peculiar. The proboscis band is more defined than in any species I have seen.

### 22. Culex plumosus. n. sp.

(?) the ♂ of *C. annulioris*, mihi.

Thorax dark brown, with bronzy-brown curved scales. Abdomen brown, with basal yellow patches, the second to fourth bent in in the middle, the others semicircular; white lateral spots median

in position. Ungues of fore and mid legs unequal, the larger with two large teeth, the smaller uniserrated. Legs brown, with apical and basal banding. Proboscis with a narrow yellow band.

♂. Head almost black, the occiput covered with curved pale creamy scales and with black upright forked ones; laterally the head is covered with numerous dull ochraceous scales, whilst projecting forwards between the eyes are several bright golden bristles; antennae long, densely plumed, longer than the proboscis; basal joint very large, bright ferruginous, remainder yellowish-grey, banded with narrow brown bands, densely plumed with bright flaxen hairs; penultimate joint as in the former species, with long dense hairs, apical joint darker, also with short hairs; palpi with the penultimate joint black, unbanded, rather swollen, the antepenultimate with a broad yellow band at the apex, and another in the middle; brown bristles and hairs on the penultimate, none on the apex of the antepenultimate; proboscis brown, expanded apically, with a narrow deep yellow band in the middle.

Thorax deep brown, covered with scattered narrow bronzy-brown curved scales, and with a few somewhat more pallid ones; in front of the mesothorax, projecting over the nape, are two median tufts of short stiff brown bristles, and also some lateral ones (Fig. 129); there are also numerous black bristles over the roots of the wings; scutellum with a few narrow curved creamy scales, especially on the lateral lobes, the median lobe with jet-black scales, curved and narrow, a few of these also occur on the lateral lobes and also on the mesonotum, in front of the scutellum; border-bristles bright brown; metanotum deep chestnut-brown; pleurae dark brown, with some yellowish scales and dark bristles.

Abdomen ochraceous-brown, covered with deep brown scales, and with basal yellow patches not forming complete bands; those on the second, third and fourth segments bent in in the middle, those on the remaining segments with curved borders, each segment has also a median white patch on each side; first abdominal segment pale ochraceous, densely black scaled in the middle, and with numerous long golden hairs; posterior borders of the segments with short hairs; lateral hairs long bright brown.

Legs with the coxae pale brown, with some dusky scales; femora ochraceous at the base and beneath, covered with brown scales above, apex yellow, numerous thick spines and bristles

towards its apex; tibiae dark brown, with yellow apex, black hairs and golden spines; metatarsi and tarsi dark brown, with pale apical and basal banding; hind metatarsi as long as the hind tibiae, also with golden spines; fore and mid ungues unequal, the larger one with two large teeth, the smaller with one small tooth, hind ungues equal and simple (?).

Wings with a yellowish-brown tinge, the veins partly denuded, but those that remain have the median scales single or double rowed, flat and broadish, deep brown; first sub-marginal cell a little longer and much narrower than the second posterior

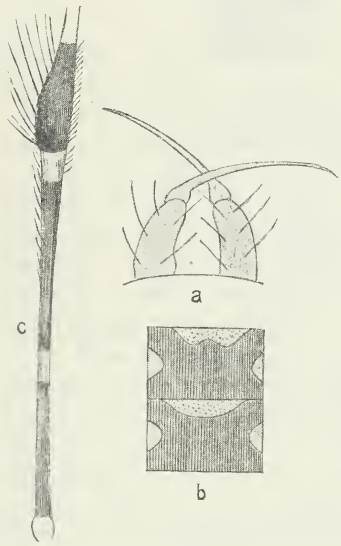


Fig. 128.

*Culex plumosus.* n. sp.

a, Male genitalia; b, abdominal ornamentation; c, male palpus (damaged).

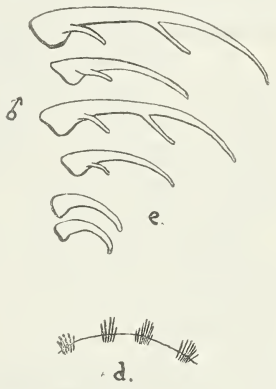


Fig. 129.

*Culex plumosus.* n. sp.

e, Ungues; d, bristle tufts on thorax.

cell, its stem longer than the cell; second posterior cell broad, much shorter than its stem; posterior cross-vein about the same width as the mid cross-vein, and about half its length distant from it.

Halteres with pale stem and fuscous knob. Basal joints of the genitalia narrow, hairy, claspers long and thin.

*Length.*—6·5 mm.

*Habitat.*—Salisbury, Mashonaland (Marshall) (79).

*Time of capture.*—March.

*Observations.*—Described from a single ♂ only. I cannot connect this with either of the two former species, although it presents certain striking similarities. It might be the male of *C. annulioris*, but the median white lateral spots and the differently formed basal patches seem to separate it from that species. The ungues are very marked, and separate it at once from *C. hirsutipalpis*.

### 23. Culex dissimilis. n. sp.

(Fig. 67, Pl. XVII.)

Thorax dark brown, with hair-like golden scales. Abdomen dark brown, with basal pale semicircular bands, and white lateral patches on the last few segments. Legs pale ochraceous, with brown scales, the ground colour showing through in places; metatarsal and tarsal banding involving both sides of the joints.

♀. Head brown, with a few creamy-white curved scattered scales and a few brown upright forked ones, and broader pale scales at the sides; eyes deep purplish and coppery; antennae brown, with pale pubescence and dark brown hairs; basal joint brown; palpi covered with almost black scales; clypeus deep black; proboscis black, with traces of a pale median band.

Thorax dark brown, covered with scattered golden, curved, hair-like scales, a paler bare space apparently in front of the scutellum, numerous black lateral bristles, and a row of large black bristles on each side of the bare space; scutellum pale brown, with a border of black bristles (six in number) arising from tubercles; metanotum olive-brown; pleurae brown, with two patches of white scales.

Abdomen covered with deep brown scales, with here and there a bright ochraceous tinge, the base of each segment having a semicircular patch of creamy-white scales, not always forming a complete band, except in the last two segments, in which it nearly does so (Fig. 130, a); the first segment is almost white, with two small dark patches of scales in the middle; posterior borders of the segments with golden bristles; venter with mostly creamy-white scales; there are also traces of white lateral patches on the last few segments.

Legs pale ochraceous, with brown scales scattered about, allowing the ground colour to show through; base and apex of the metatarsi and first tarsal joints pale, and the base of the second

tarsal joints, giving a banded appearance, the bands thus involving both sides of the joints ; hind legs showing no trace of banding in one specimen, but three distinct pale bands in another, involving both sides of the joints.

Wings with the veins edged with moderately long brown scales ; the first sub-marginal cell a little longer and narrower than the second posterior cell, its base a little farther from the

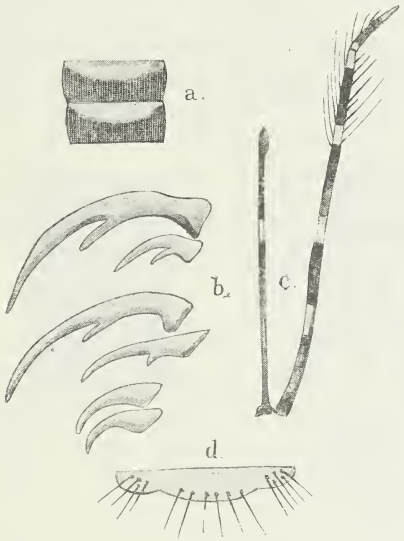


Fig. 130.

*Culex dissimilis.* n. sp.

a, Abdominal ornamentation ; b, ungues of the ♂ ; c, male palpus and proboscis ; d, male scutellum.

base of the wing than that of the latter ; the stems shorter than the cells, that of the posterior cell only about half the length of the cell ; posterior cross-vein longer than the mid cross-vein, and distant from the latter about its own length. Halteres pale ochraceous.

*Length.*—4 mm.

♂. Head as in the ♀ ; palpi longer than the proboscis, dark brown, with four white bands, the second from the base being the broadest, the two apical ones narrower and not so clear, the tip with a small apical (fifth) pale band ; hair-tufts brown ; proboscis dark brown, with a pale band towards the basal end of the apical half.

Abdomen narrow, densely hairy, basal bands very similar to the ♀; hairs pale; claspers pale brown.

Legs as in the ♀, but the deep yellow banding more distinct; fore and mid ungues unequal, the larger one with a large tooth, the smaller with a small one; hind claws small and equal.

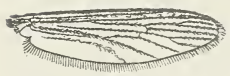

Fig. 131.
Wing of ♂ *Culex dissimilis*.
(X. 9.)

*Length.*—4 mm.; of palpi, 3·8 mm.

*Habitat.*—Freetown, Sierra Leone (Austen, 1899, 267 and viii., 1899).

*Obse vations.*—Described from three ♂'s and two ♀'s, bred from larvae collected from water-butts and drains, at Mt. Clurcol, Freetown, by Mr. Austen, on the 9th of September. In the ♂'s, at least what I take to be the males, the proboscis has a distinct band; they were bred at the same time and from the same butts and puddles as the ♀'s described here. They might be mistaken for *Culex masculus*, but differ materially, as pointed out in the description of that species.

### 24. Culex hirsutipalpis. n. sp.

Thorax brown, covered densely with deep golden-brown scales and some pale creamy ones, the latter forming two more or less distinct spots on the mesonotum, scale ornamentation somewhat arranged in lines, the middle being somewhat darker than the rest of the thorax. Abdomen dark brown, with small, semi-circular, basal median yellow patches and yellowish-white basal lateral patches. Legs dark brown, tibio-metatarsal and tarsal joints with creamy-white bands involving both sides of the joints. Proboscis deep brown at the base, black at the apex, with a broad yellow band. Female ungues equal and simple.

♀. Head brown, with pale creamy curved scales on the occiput, flat white ones at the sides, with numerous black, upright forked ones behind and at the sides, ochraceous ones in the middle in front; a narrow pale border round the eyes; eyes black with a silvery sheen; palpi black scaled, with a few grey ones, especially at the apices; clypeus dark brown; proboscis dark brown at the base, broadly banded with ochraceous in the middle, apical portion rather expanded, black, extreme tip testaceous.

Thorax dark brown to almost black, clothed with narrow curved golden scales, with two eye-like spots of pale creamy scales on the mesonotum, pale creamy scales in front of the

scutellum and over the roots of the wings; there are also three rows of black bristles and numerous long black ones over the roots of the wings and smaller ones laterally; the median line of the mesothorax is rather darker than the rest, and there are also traces of two bare lateral lines, often indistinct; the lateral lines of bristles form two tufts just before the scutellum; scutellum brown, with narrow curved pale scales and border-bristles almost black; metanotum deep brown; pleurae brown, with cinereous reflections and white scales.

Abdomen ochraceous, covered with dusky-black scales, each segment with a basal median semicircular patch of yellow scales, which in some segments spread out and form narrow basal

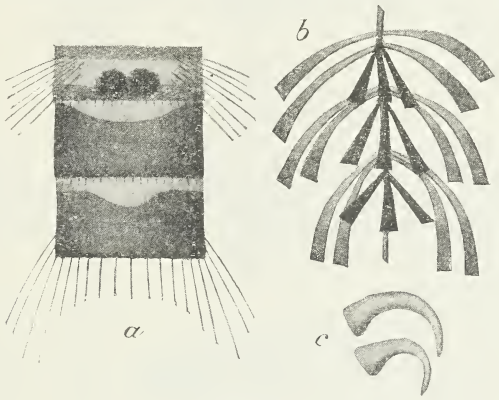


Fig. 132.

*Culex hirsutipalpis.* n. sp.

a, Abdominal ornamentation; b, wing scales; c, fore and hind ungues of ♀.

bands; each segment has also a basal lateral white spot; posterior borders of the segments with golden-brown bristles, short in the middle, long at the sides; first abdominal segment ochraceous, with two patches of black scales and long hairs.

Legs with coxae brown and ochraceous, with patches of white scales; femora brown, pale beneath, apex white scaled, bristly; tibiae black, with a line of white scales beneath, apex a little dilated and pale scaled; hind tibiae about the same length as the hind metatarsi; metatarsi black, a narrow pale basal ring and a more distinct apical one; first and second tarsi of the fore legs apically and basally banded, third basally banded, fourth unbanded, with an ochraceous tinge; mid tarsi similar to the fore tarsi; hind tarsi all more or less apically and basally banded;

ungues of all three pairs of legs equal, simple, rather small and moderately curved.

Wings with brown scales, the median ones rather loose and expanded, the lateral long ones rather thick (Fig. 132, b); first sub-marginal cell considerably longer and narrower than the second posterior cell, its base nearer the base of the wing than that of

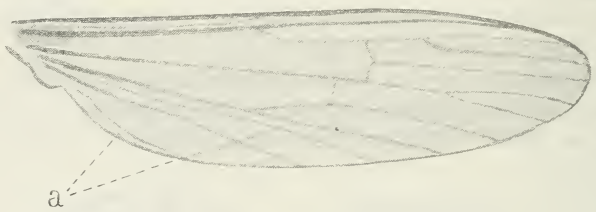


Fig. 133.
Wing of *Culex hirsutipalpis* (♀).
a, Very prominent wing folds. (X. 18.)

the second posterior cell; its stem short, about one-third the length of the cell; shorter than the stem of the second posterior cell; posterior cross-vein about its own length distant from the mid cross-vein; halteres ochraceous.

*Length.*—5 mm.

♂. Head brown, with narrow grey curved scales on the occiput and upright brown ones, sides of the head with flat creamy scales and some lateral dark ones; eyes bordered with narrow curved grey scales; proboscis dark brown, much expanded apically, with a narrow, clear-yellow scaled median band, hirsute at the apex; palpi dark brown, longer than the proboscis by the last two joints, apical joint with a narrow yellow apical band and a very broad basal one, as long as the penultimate joint, which is also yellow at the base, the antepenultimate joint has also a broad pale band and a narrow one towards its base, the last two joints and the apex of the antepenultimate with long, dense, thick black hairs; antennae brown, with dull grey bands and brown plumes, the last two joints brown, densely but finely hirsute (Fig. 134, b).

Thorax brown, covered with pale, curved, ochraceous scales on the anterior two-thirds, the remainder of the mesonotum being darker; dense, short, black bristles over the roots of the wings; scutellum brown, with narrow pale curved scales, seven black bristles to the median lobe and about seven large ones to each of the lateral lobes; pleurae dull pale brown, with grey

reflections, a few white and yellow scales and a row of black bristles; metanotum brown.

Abdomen dusky brown, the second to sixth segments with basal yellow bands, expanded in the middle line; the first segment rather ochraceous, with two patches of black scales; on the sixth and seventh are two apical patches of yellow scales, and on the eighth a distinct apical band; posterior borders and sides with long brown hairs.

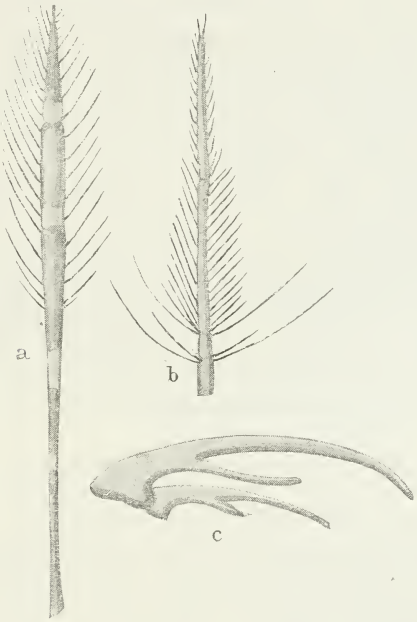


Fig. 134.

*Culex hirsutipalpis.* n. sp.

a, Male palpus; b, apex of antenna; c, fore ungues of the male.

Legs ochraceous, with brown scales, knee spots yellow; base of the metatarsi and first two tarsi ochraceous, the pale bands also involving the apex of the preceding joints, the third tarsal joint longer than the second, the fourth short, the larger claw more than half the length of the joint; in the mid legs the third tarsal joint is also banded, the band involving the apex of the second, fourth joint about one-third longer than the larger unguis; in the hind legs the bands involve all the tarsal joints,

ungues small, equal and simple, whilst those of the fore and mid legs are unequal and uniserrate.

Wings with brown veins and scales; first sub-marginal cell a little longer and slightly narrower than the second posterior cell, their bases about level, both cells fairly long; stem of the former about equal to half the length of the cell, of the latter to about two-thirds of its length; posterior cross-vein more than its own length distant from the mid cross-vein, the costa, sub-costal and first long vein with rather broad flat scales, the so-called sixth and eighth veins of Austen's pamphlet (the incrassations) very distinct. Halteres with pale stem and fuscous knob.

*Length.*—5·5 mm.

*Habitat.*—Salisbury, Mashonaland (Marshall) (79).

*Time of capture.*—February.

*Observations.*—Very similar in general appearance to *C. plumosus*, but differs in the ungues of the ♀ being simple instead of serrated, and in the ♂ ungues being uniserrated, whereas in *plumosus* the larger unguis of the fore and mid legs is biserrated; the proboscis band is also less marked, and the ♂ palpi differ. A single ♂ and ♀ only sent by Mr. Marshall.

Although the ♂ presents certain differences in appearance, I think it must belong to this species.

### 25. Culex albirostris. Macquart.

(Dipt. Exotica, Supp. iv. p. 10.)

"Proboscis white, except at the base and tip, where it is black. Abdomen with the hinder borders of the segments white, tarsi blackish, with a white ring at the base of each joint.

*Length.*—2 lines ♀.

*Habitat.*—New Zealand."

Note.—No banded-proboscis forms have been sent from New Zealand. I am not sure, from the description of this species, whether the abdomen is basally or apically banded. It may possibly be the *Culex annulirostris* of Skuse.

### 26. Culex (?) confinnis. Arribalzaga.

(Dipt. Argentina, La Plata, p. 49 (1891).)

"Very like *Taeniorhynchus taeniorhynchus*, Arribalzaga, but of smaller size and darker colour, while the band on the proboscis is broader, but differs especially in the form of the wing scales. The

broad white proboscis band extends from near the base to the middle; legs fuscous, fore femora sparsely decorated with scattered white scales, with a narrow white band a little before the apex; tibiae speckled white externally, uniformly coloured inside; knees white; fore and mid tarsi with the first three, and the hinder with four, or all the joints with basal white bands; metatarsi distinctly shorter than tibiae. Abdomen dark fuscous, with coffee-coloured scales above and narrow whitish bands; greyish below.

*Length.*—4·5 to 5 mm.

*Habitat.*—Chaco in Formosa, Argentina."

Note.—In some respects this might be the *C. taeniorhynchus*, Wiedemann, but as I have seen no banded-proboscis forms of *Culex* from lower south than British Guiana, except *Panoplites titillans* and *Taeniorhynchus fasciolatus*, I cannot possibly say. I believe, however, that *taeniorhynchus*, which is so common at New Amsterdam, will be found to occur farther into South America. Dr. Lutz has sent me two specimens which he considers *C. confinnis*, but I have been unable to satisfactorily determine them. I fancy from the description it is a *taeniorhynchus* allied to *T. fasciolatus*.

### *ββ. Proboscis unbanded.*

#### *δ. Legs basally banded.*

In this section will be seen a number of species of more or less different appearance; two main types, however, will be noticeable, namely a dark coloured group with white banding, Nos. 1 to 6, and those in which the basal leg banding is pale creamy and fainter, and which in many respects are scarcely separable from the next section, in which the banding is apical and basal.

LEGS BASALLY BANDED.

*α.* Thorax ornamented, covered with narrow curved scales—

*β.* Abdomen with traces of banding and with white lateral spots; thorax with five golden lines ..... *Japonicus.* n. sp.
= *aureostriatus.* Doleschall (?).

*ββ.* Abdomen mostly grey scaled; thorax with five lines of pale golden grey scales on a deep brown ground ..... *vittiger.* Skuse.

$\beta\beta\beta$. Abdomen with basal white patches; lines of dull white scales on thorax; femora with a white ring near apex — *alboannulatus*. Macquart.

$\beta\beta\beta\beta$. Abdomen with basal pale bands, and two dull yellow apical spots on fifth and sixth segments.
Thorax with a broad median pale scaled area and four pale spots ..... *hirsutum*. n. sp.

$\alpha\alpha$. Thorax not ornamented—

$\gamma$. Thorax covered with spindle-shaped flat scales.
Abdomen with basal white bands and apical bands posteriorly ..... *vigilax*. Skuse.

$\gamma\gamma$. Thorax covered with narrow curved scales.

$\delta$. Abdomen with basal and apical banding; fore and mid ungues of ♀ equal, uniserrated.
First four segments with broad basal bands, last two with yellow apical borders; lateral white spots ..... *marinus*. n. sp.
Basal and apical bands to the last three segments and basal lateral yellow spots. Legs broadly banded — *cantans*. Meigen.
Legs narrowly banded ..... *rexans*. Meigen.
Abdomen yellowish in hue..... *annulipes*. Meigen.
Basal abdominal bands bent in in the middle, last two segments with apical bands also ..... *sylvestris*. n. sp.
Legs with first tarsal only with a pale band; abdominal banding mostly basal with traces of pale apical scales ..... *testaceus*. V. d. Wulp.

$\delta\delta$. Abdomen completely covered with ochraceous scales, no banding; legs with very broad basal yellow bands (of similar form to *cantans*)... *flavescens*. n. sp.

$\delta\delta\delta$. Abdomen basally banded.
Thorax clear brown, with golden-brown curved hair-like scales; legs brown, with yellowish reflections and broad basal pale bands ..... *vagans*. Wiedemann.
Thorax brown, covered with tawny scales; fore and mid ungues of ♀ uniserrated; leg banding minute... *caecus*. n. sp.
Thorax black, with dark brown and golden curved scales, ungues simple and equal in ♀; bases of fork-cells level, small size (3·8 mm.) ..... *procax*. Skuse.

Thorax bright chestnut-brown, with narrow curved golden scales, and four rows of bristles; abdomen with regular white bands; ungues of ♀ equal, unserrated in fore and mid legs ..... *rubithorax.* Macquart.

Abdomen with curved basal white bands and basal white spots; thorax with hair-like scales, and three rows of bristles ..... *occidentalis.* Skuse.

Like the above, but wings with yellow scales as well as brown ..... *flavifrons.* Skuse.

δδδδ. Abdomen with basal and apical banding and a median yellowish-grey line ..... *maculiventris.* Macquart.

δδδδδ. Abdomen with bands on some of the segments only.

Bands showing on the second and third segments, basal white lateral spots distinct ..... *imprimiens.* Walker.

δδδδδδ. Abdomen unbanded, with white lateral spots.

First tarsal joint all white ..... *terrens.* Walker.

Tarsi black, with honey-coloured joints; first joint (= metatarsus) with yellow ciliae; thorax black with grey tomentum ..... *tibialis.* Desvoidy.

### 27. Culex Japonicus. n. sp.

*Culex aureostriatus.* Doleschall (?).

(Fig. 70, Pl. XVIII.)

Thorax deep reddish-brown, with three median, nearly parallel, narrow golden stripes, and on each side a lateral curved golden-scaled line.

Abdomen black, with basal white bands.

Legs black, femora pale at the base, tarsi with basal white bands.

♀. Head dark brown, with a narrow row of broad white curved scales in the middle; flat black ones and then flat white ones on the crown and sides; eyes black, bordered with a thin line of white scales; palpi and proboscis dark brown; antennae brown, with minute white pubescence, very faintly banded with minute pale bands.

Thorax dark reddish-brown, with three median nearly

parallel stripes clothed with golden scales, the central one forked posteriorly, surrounding a clear brown space in front of the scutellum: on each side is also a lateral curved golden-scaled line. Over the root of the wing is a bunch of bright reddish-brown bristles directed upwards, other black bristles are also on the thorax; metanotum deep chestnut-brown, pleurae with silvery-white puncta.

Abdomen black, with evidently the remains of white basal banding, posterior border of each segment with a band of pale bristles and with white lateral spots. Ventrally with basal white bands and white hairs.

Wings with black scales; testaceous at the roots. First sub-marginal cell longer than the second posterior cell, its stalk only about half as long as the fork. Halteres with dark knobs and pale stems. Posterior legs with a tuft of bristles at the base, coxae and trochanters white, femora pale beneath near the base, dark brown above, then completely brown except at the tip, which has a distinct yellowish-white ring; tibiae clothed with deep black scales; metatarsi and also the first two tarsi with basal white bands, about equal to half the length of the joints, last two tarsal joints black; mid legs with a broad white knee spot, and the metatarsi and first tarsal joint basally white banded, other tarsi black; fore legs black with a pale knee spot.

*Length.*—5 to 6 mm.

*Habitat.*—Tokyo, Japan (C. H. B. Woods) (8. 3. 99).

*Time of capture.*—June and July.

*Observations.*—Described from a series sent by Mr. Woods from Japan, all ♀'s. It is an easily recognised species by the five narrow golden-scaled thoracic lines. I have some little doubt as to whether or not these Japanese mosquitoes are the *Culex aureostriatus* of Doleschall, described by him from Amboina; but as he states that the hind borders of the abdominal segments of *C. aureostriatus* are white, the hind legs with four white tarsal bands and the two side stripes of the thorax oblique, and not running the whole length of the thorax, I provisionally take them as belonging to a distinct species, until I see Doleschall's type or have the opportunity of examining the Amboina mosquitoes. A description of *C. aureostriatus* is here given:—

### 28. Culex aureostriatus. Doleschall.

(Natur. Tijdsch. v. Ned. Ind. Deel xiv. p. 385.)

"Black, the dorsum of the thorax marked with five glittering golden lines, three parallel and an oblique one on either side; abdominal segments bordered white; wings hyaline, with black scales; hind tarsi long, marked with white.

*Length.*—1¾ lines.

"♀. Proboscis relatively large, straight, porrect and curved upwards. Antennae and eyes black, the back of the head grey. Thorax not very convex, moderately broad, black, with equally wide, parallel, longitudinal stripes, reaching from the anterior border to half the length of the thorax, of a shiny golden colour; behind these is a pair of oblique lines of similar colour, extending from near the middle outwards and forwards. Abdomen black and cylindrical, with a bluish lustre; the hind border of each segment pure white, broader on the sides than in the middle. The legs slightly hairy, slender and black, the posterior much longer than the anterior, with four white tarsal bands; upper half of hind femora pure white. Wings as long as the abdomen, veins black scaled.

*Habitat.*—Amboina, in dwelling-rooms."

### 29. Culex vittiger. Skuse.

(Proc. Linn. Soc. N. S. Wales, p. 1728 (1889).)

(Fig. 139, Pl. XXXV.)

Thorax with pale golden-grey scales and four prominent deep rich brown stripes; abdomen mostly covered with dull golden-grey scales, which are more or less scanty on the middle of the basal segments, giving them a banded appearance; legs brown, with narrow basal pale bands on the fore and mid, and broad ones to the hind tarsi, the hind metatarsi mostly pale, with a small apical black band. Wings with yellowish-brown scaled veins, tinged with testaceous along the costa; fork-cells very short.

♀. Head brown, clothed with rather long, loose pale curved scales in front, and with similar ochraceous ones behind, and with numerous thin upright forked ochraceous ones over the occiput; the flat scales on the genae very small; eyes deep purplish-black; antennae with the basal joint bright ochraceous, with numerous black hairs, second joint mostly testaceous, the apex just darkened, the next three or four joints more or less testaceous except at the base, remainder dark brown; clypeus dark brown; palpi long, the apical joint mamilliform, the

penultimate moderately long, antepenultimate a little longer than the penultimate, second about as long as the penultimate, rather enlarged; when denuded, testaceous; covered with ochraceous and brown scales, allowing the testaceous ground colour to show through; apex with very dark brown scales, all the joints with dark bristles.

Thorax deep blackish-brown, with broad lines of narrow curved very pale golden-grey scales and four broad lines of similar bronzy-black scales, with brown bristles which are more or less golden over the roots of the wings, a bare space in front of the scutellum; scutellum deep brown, with pale golden-grey, narrow curved scales, rather dense on the mid lobe, with numerous rich golden-brown border-bristles; metanotum deep bright brown; pleurae deep brown, densely covered with flat greyish-white scales.

Abdomen deep brown, the segments mostly covered with pale ochraceous and grey scales, with some dark ones on the middle of


Fig. 135.
*Culex vittiger*, Skuse.
a, Apex of ♀ wing; b, ♀ palpus.

the anterior segments, giving a banded appearance; there are also a few white lateral ones, basal on some, median on other segments; venter with pale ochraceous scales, with black scaled apical borders, the black scales appearing as black apical patches at the sides when viewed dorsally; posterior border-bristles short.

Legs brown, ochraceous at the base, and the metatarsi and tarsi basally pale banded, the fore and mid metatarsi with only narrow apical black bands, the tarsi small and with narrow basal pale bands, the pale bands decreasing in size from the first to the last tarsal joint; hind legs with the banding more distinct; all the joints more or less bristly; fore, mid and hind ungues equal, large, uniserrated.

Wings with typical deep yellowish-brown *Culex* scales, the scales on the base of the veins ochraceous and brown; fork-cells very short; first sub-marginal cell longer and about half the

width of the second posterior cell, which is very short and broad, its stem equal to nearly two-thirds the length of the cell; stem of the second posterior as long as the cell; posterior cross-vein not quite its own length distant from the mid cross-vein; fringe brown, with rather long dark border-scales; the costal border somewhat yellowish, and the scales of the sub-costal very pale yellow; there is a tinge of brown on the wing field at the cross-veins.

Halteres ochraceous-brown, slightly dusky at the knob.

*Length.*—6 mm.

*Habitat.*—S. Queensland (Bancroft) (106); New South Wales (Skuse).

*Time of capture.*—April.

*Observations.*—Described from three ♀'s sent by Dr. Bancroft. It is one of the most marked and beautiful of the Australian *Culicidae*, and can at once be told by the four broad, deep rich brown lines on the mesothorax and the pale golden-grey scaled intervening spaces; the four dark lines are due to the dark surface being clothed with bronzy-black scales. The abdomen is also peculiarly marked, the median darker banding to the segments being more pronounced in some specimens than in others. The palpi are distinctly five-jointed and large even for a *Culex*.

No males have been received.

Skuse only describes the ♀. These specimens were received from Dr. Bancroft whilst the work was in the press. Skuse gives the following localities and note :—

"*Habitat.*—Port Denison and Wide Bay, Queensland (Masters); Gosford, N.S.W. (Skuse), February.

*Observations.*—Probably occupying the bush country all along the east coast."

### 30. Culex alboannulatus. Macquart.

(Dipt. Exot. p. 10, 4th Supp. Macquart; Proc. Linn. Soc. N. S. Wales, p. 1732, Skuse.)

(Figs. 73 and 74, Pl. XIX.)

Thorax deep umber brown with white and golden scales, the former arranged in lines and patches, a small oblique line on each side in front, two others further back, patches in front of the scutellum and over the roots of the wings. Abdomen dark brown, with incomplete basal white bands and indistinct

lateral spots. Legs dark brown, a white garter-like band near the apex of the femora; metatarsi and tarsi with white basal bands.

♀. Head brown, covered with golden and white scales, the white scales especially in the middle, and a small patch of flat white ones on each side; behind, on each side of the middle line, is a patch of dark brown or black upright forked scales, which also pass forwards; eyes purplish black, with silvery lustre; antennae dark brown, with faint narrow pale bands, basal joint and base of second joint testaceous; palpi black scaled with the fourth joint with a ring of white scales at the base and the small apical fifth joint also white scaled; proboscis dark brown, with a few grey scales towards the base, apex quite black.

Thorax deep umber brown, with white and golden scales in the majority of specimens, showing no ornamentation, but, when fresh, the white scales are seen to be symmetrically arranged; a central very narrow bare line runs back to near the scutellum, where it ends in a bare spade-shaped patch, which has two patches of narrow curved white scales in front, and two of white scales at the base near the scutellum, a small oblique line of pale curved scales on each side in front and traces of two others farther back, and which, according to Skuse, in fresh specimens, are hook-shaped, as shown in his figure; there is also another patch above the root of the wings on each side; scutellum testaceous brown, with three patches of pale, thin, curved scales; metanotum deep brown, testaceous at the sides; pleurae dark reddish-brown, with patches of white scales.

Abdomen covered with deep brown almost black scales, with sometimes pale brown reflections, the bases of the segments each with a patch of white scales, not quite forming a band; sometimes, according to Skuse, the white scales are entirely absent; posterior borders and sides with yellowish hairs; in some specimens there are indistinct white lateral spots, the lateral white spots being centrally disposed; venter brown, with thick white basal bands.

Legs with the femora pale at the base, dark scaled towards the apex; *just before the apex, which is very dark, is a pale or white band,* extreme tip yellow to almost white; tibiae covered with purplish-black scales with pale hairs; fore metatarsi with basal pale bands, also the first two tarsal joints, last two with purplish-black scales only; mid legs the same; hind legs with their metatarsi and first three tarsal joints very broadly banded

with white at the base; hind metatarsi a little shorter than the tibiae. Fore, mid, and hind ungues equal, toothed.

Wings with the veins covered with dark brown scales, some of which are moderately long; first sub-marginal cell longer and narrower than the second posterior cell, its stem equal to a little more than half its length; that of the second posterior cell not quite equal to the length of the cell; posterior cross-vein nearly twice its own length distant from the mid cross-vein.

Halteres with ochraceous stem and pale fuscous knob, sometimes all ochraceous.

*Length.*—5 to 5·5 mm.

♂. Antennae light brown, with pale silky brown plumes, basal joint black; palpi dark brown, with two broad, basal, white bands on the second and third joints, and with white ones also to the last two, hairs dark brown, gold and yellowish; abdominal segments with white basal bands, the last segment often with two white spots; claspers black; laterally there are numerous golden hairs, which also occur along the posterior borders of the segments. Fore ungues of the ♀ unequal, the larger uniserrated, the smaller simple.

Fig. 136.
*Culex alboannulatus*, Macq.
Fore ungues of the ♂.

*Length.*—5 to 5·5 mm.

*Habitat.*—Bupengary, Queensland (Bancroft) (5. 12. 1899); Sydney (Thomson); Woronora and Blue Mountains, N.S.W. (Skuse and Masters); the Eastern Coast (Macquart).

*Time of appearance.*—In New South Wales, Skuse gives October to January as the time of appearance. Captured in July in Queensland (Bancroft).

*Observations.*—This species is subject to some variation, according to Skuse. The thoracic markings, which are very characteristic, soon go, only quite fresh specimens showing them. It cannot, however, be mistaken even with a denuded thorax for any other Australian species I have seen. I cannot agree with Skuse in placing Thomson's *C. camptorhynchus* as a synonym of this gnat. It resembles *C. vigilax*, but the thoracic scales are narrow curved and golden-brown, whilst in *C. vigilax* they are flatter, spindle-shaped, and bronzy-black, and the ungues differ. The pale band on the femora at once separates it.

### 31. Culex hirsutum. n. sp.

(Fig. 80, Pl. XX.)

Thorax dark chestnut-brown, with dull creamy scales forming a broad median line and four creamy spots. Abdomen dark umber-brown, with basal yellowish-white bands and with two large dull yellow apical spots on the fifth and sixth segments; venter mottled with black, yellow and white scaled patches. Legs with broad basal white bands, femora, tibiae and metatarsi hirsute, bases of the femora pale, remainder black, with a few pale scales. Ungues of ♂ unequal on the fore and the mid legs, the larger uniserrated, the smaller simple.

♀. Head with narrow curved grey scales in the middle, which are yellow in front between the eyes, forming two rows with a bare space between; laterally are first a patch of flat dark scales, then flat creamy-white ones, then a few dark and pale flat ones, more or less mixed; the occiput is covered with scattered, black upright forked scales and the eyes bordered with pale creamy ones; between the eyes are two rows of golden bristles projecting forwards; palpi short, dark brown, with numerous pale scales at the apex; antennae with the basal joint testaceous and dark brown with numerous pale yellow scales, next few joints rather testaceous, remainder brown; proboscis covered with ochraceous scales, black at the apex, and a few black scales at the base, especially beneath.

Thorax dark brown, covered with deep chestnut-brown, narrow curved scales, ornamented as follows with pale creamy scales of similar form: a broad rather indistinct median line and a pair of round spots on each side of it, also a few pale creamy scales at the sides of the mesonotum, the posterior pair of spots sometimes irregular in form, numerous black bristles which become brighter brown over the roots of the wings; pleurae brown with patches of small flat white scales; scutellum paler brown with narrow curved pale scales, eight bristles to the median lobe and numerous ones to the lateral lobes; metanotum deep chestnut-brown.

Abdomen covered with dusky umber-brown to black scales, with basal bands of yellowish-white scales, which spread out laterally, forming more or less lateral patches; the first segment is ochraceous, with a median patch of dull white and brown scales and numerous golden-brown hairs; in the second segment

the basal band sends a median process down the segment; on the fifth and sixth segments are two large, apical, pale yellow patches of scales, which extend nearly to the basal bands, posterior borders with pallid bristles; the last segments dark brownish-black, unbanded; venter marked with black, white and yellowish-scaled patches.

Legs with pale coxae with dull yellow scales; femora pale grey at the base and below, dark brown towards the apex, with scattered pale scales, and a crown of white scales at the apex; tibiae with a white basal band, remainder dark brown, mottled with pale yellow scales; metatarsi dark brown, with scattered pale scales and a basal band of white scales, the first three fore tarsi black with basal white bands, last joint dull yellowish-brown; mid tarsi with the banding more distinct and the last joint paler than the rest, yet showing signs of basal banding; on the hind legs the basal banding is still broader; ungues of the fore and mid legs equal, uniserrated, teeth basal; femora, tibiae and metatarsi with large chaetae.

Wings with the veins covered with deep brown scales of typical *Culex* form; both fork-cells rather short; first sub marginal a little longer and narrower than the second posterior cell, its base just a little nearer the base of the wing than that of the latter, its stem equal to rather more than half the length of the cell; stem of the second posterior cell about two-thirds the length of the cell; posterior cross-vein rather more than its own length distant behind the mid cross-vein; costal border dark brown, almost black; basal lobe of the wing with long pale hairs, second lobe with a row of black scales. Halteres pale ochraceous.

*Length.*—4 to 4·5 mm.

♂. Head black, with a few curved white scales in front and on the crown, black and white flat scales at the sides and numerous black upright forked ones; the black side scales form two black spots, and some of the front upright scales have an ochraceous tinge; palpi (Fig. 137, a) dark brown with a basal yellowish band, another broad yellow band near the middle and a narrow pale band at the base of the last two joints, the penultimate joint about half as long again as the last joint, both slightly swollen, hair tufts on the last two brown; proboscis ochraceous brown with brown scales, dark at the apex; antennae banded brown and grey, with dark flaxen-brown plumes, the last two joints very long and thin (Fig. 137, b).

Abdomen with the basal bands pure white, narrower than in the ♀ and densely hairy, the hairs being deep golden-brown ; there are no traces of apical pale patches. Wing bare, just as in the ♀, but the fork-cells are shorter, the stem of the first sub-


Fig. 137.
a, Palpus, and b, apex of antenna of *Culex hirsutum*. n. sp. (♂).

marginal being as long as the cell, that of the second posterior considerably longer, and the supernumerary and mid cross-veins meet at a more acute angle. Ungues of the fore and mid legs unequal, the larger with a single tooth about the middle, the smaller simple ; hind ungues equal and simple.

*Length.*—4 to 4·5 mm.

*Habitat.*—Salisbury, Mashonaland (G. A. K. Marshall) (79).

*Time of capture.*—February and March.

*Observations.*—Described from a series sent to the British Museum by Mr. Marshall ; a distinct banded-legged form, easily told when fresh by the thoracic ornamentation and the abdominal apical spots in the ♀.

### 32. Culex vigilax. Skuse.

(Proc. Linn. Soc. N. S. Wales, p. 1731 (1889).)

(Fig. 72, Pl. XVIII.)

Thorax deep brown, with *black and bronzy spindle-shaped scales.* Abdomen dark brown to black, with a purplish tinge, white basal bands, the last few segments with a yellowish tinge. Legs dark brown; bases of the metatarsi and tarsi broadly white banded; femora with scattered yellow scales.

♀. Head dark brown, with long, black, upright forked scales in the middle, pale curved scales beneath, with a dark patch of flat scales on each side between two pale patches of similar shaped scales; eyes purplish-black; palpi black, with white scales at the apex; antennae dark brown, basal joint dark testaceous, base of the second joint paler testaceous; proboscis black above, deep ochraceous from near the base to half the length below, base and apical half black.

Thorax deep brown, densely covered with curved metallic black and bronzy spindle-shaped scales closely applied to the dorsum, giving a satiny appearance, with a few scattered golden-yellow curved ones; scutellum almost black, with a testaceous tinge along the hind border in some lights, and with a few curved yellowish scales; metanotum black; pleurae deep purplish-brown, with a few patches of white scales.

Abdomen covered with dark brown scales, the anterior borders of the segments having a band of white scales (*i.e.* basal bands), those of the last two or three segments with a yellowish tinge; first segment with scattered white scales and long golden hairs; ventrally the abdomen is covered with white scales, except the anterior borders of the segments, which are dark, and on some of the segments is a small white lateral spot.

Fig. 138.
*Culex vigilax*, Skuse.
Fore and hind ungues of the ♂.

Legs with the coxae with white scales; femora covered with deep purplish-black scales, with a few scattered pale ones; white scales predominate on the ventral surface of the mid and hind femora, very slightly on the fore femora; knees golden yellow; tibiae purplish-black, with a few scattered yellow scales; metatarsi

with a pale basal band; first two tarsal joints of the fore and mid legs with a narrow basal white band, and showing faint narrow basal bands, in some specimens, on the last two joints; hind tarsi all basally white banded; in the fore and mid tibiae and tarsi the under surface has an ochraceous tinge.

Fig. 139.
*Culex vigilax*, Skuse (♀). (X. 9.)

Wings with brown-scaled veins, testaceous at the root, scales long and short; mid cross-vein about the same length as the posterior cross-vein, situated not quite its own length in front of it; first sub-marginal cell a little longer and narrower than the second posterior cell.

Halteres ochraceous, a little darker at the top.

*Length.*—5 to 5·5 mm.

*Habitat.*—Bupengary, Queensland (Bancroft) (5. 12. 1899).

Skuse also gives Gosford, Kiama, and National Park, New South Wales; also Brisbane, Queensland (Bancroft and Tryon).

*Time of appearance.*—November to February.

*Observations.*—The specimens sent by Dr. Bancroft are undoubtedly *C. vigilax* of Skuse; but some slight differences occur, namely, the basal joint of the antennae is not "ochraceous-brown or ochraceous," but dark testaceous, and the mid cross-vein is scarcely any larger than the posterior cross-vein. It can be easily separated from the other Australian "banded-leg" species by the flat spindle-shaped bronzy scales on the thorax, and is of rather stouter build.

### 33. Culex marinus. n. sp.

(Fig. 75, Pl. XIX.)

Thorax black, with fawn-coloured and thin brown curved scales. Abdomen dark brown, with basal white bands to four segments, and distinct white lateral spots on the two towards the apex, the last two segments with narrow yellowish apical borders as well. Legs brown, the metatarsi and tarsi basally white banded; femora paler brown, white beneath.

♀. Head black, with scattered white curved scales and black upright forked ones, with flat black and silvery scales at the sides; eyes black and silver; antennae dark brown, with a dark basal joint, which is pale yellowish at the top; base of

second joint also pale yellowish ; palpi testaceous, covered with black scales, pure white at the apex ; proboscis covered with dark scales, with a few scattered grey ones along the middle and basal part ; in some specimens the proboscis has a distinct very broad yellowish band.

Thorax black, with fawn-coloured and brown thin curved scales ; scutellum dark brown, slightly testaceous at the sides, with chestnut-brown curved scales and bright chestnut-brown

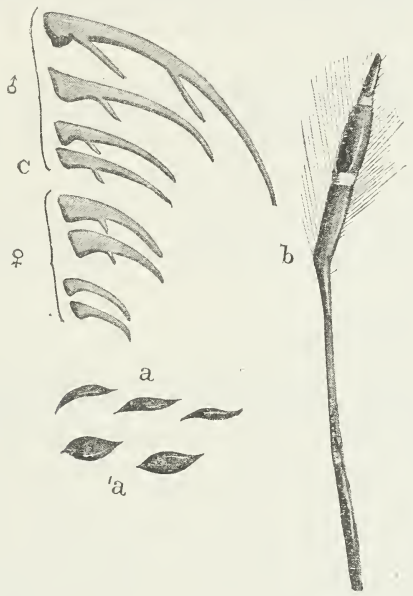


Fig. 140.

*Culex marinus.* n. sp.

a, Thoracic scales ; 'a, thoracic scales of *C. vigilax*, Skuse ; b, palpus of the ♂ ; c, ♂ and ♀ ungues.

bristles ; metanotum chestnut-brown ; pleurae dark brown, with patches of white scales.

Abdomen deep brownish-black, covered with brownish-black scales, dull purplish in some lights ; the first four segments with a broad basal band of creamy-yellow to almost white scales, the two following with creamy-white lateral spots, and the last two with creamy-yellow apical borders ; laterally are white central spots on most of the segments, which show above towards the apex ; first segment with two patches of dark scales and a few

scattered flat light ones, and numerous golden hairs; venter black, with scattered white scales.

Legs covered with black scales, with bronzy reflections; femora paler, with scattered white scales at the base and under side, a distinct white knee spot to all the legs; tibiae black, with white scales below and pallid hairs; base of all the metatarsi with a pale band, quite white in the hind legs; first two tarsi of the fore and mid legs with a narrow basal white band; all the hind tarsi basally white; hind metatarsi one-third less than the hind tibiae; ungues of the fore and mid legs equal, each with a tooth; of hind legs equal, but simple.

Wings with the scales deep brown, except those of the first long vein, in which there are numerous white scales as well; fork cells short, the first sub-marginal a little longer and narrower than the second posterior, their bases about level; stem of the first sub-marginal cell rather more than half the length of the cell; stem of the second posterior cell not quite as long as the cell; posterior cross-vein about its own length distant from the mid cross-vein.

Halteres ochraceous.

*Length.*—4·5 to 5 mm.

♂. Head black, with pale golden curved scales and black and brown narrow upright forked ones, sides densely covered with flat white scales. Antennae banded, plumes silky-brown and dull yellow, the top joints of the antennae dark; proboscis dark brown, quite black towards the tip; palpi almost black, the penultimate joint and apex of the antepenultimate swollen, the apical joint thinner, faint basal pale bands on the last two joints, hair-tufts yellow. Abdomen with basal white bands, the last segment unbanded, but with a few white scales, the antepenultimate with the basal band expanded laterally, and with yellow apical scales; densely golden haired. Ungues of fore feet unequal, the larger one with two teeth, the smaller with one; hind ungues equal, each with a single tooth.

*Length.*—4·8 to 5 mm.

*Habitat.*—Queensland (Dr. Bancroft) (71).

*Time of capture.*—July.

*Observations.*—This species resembles *C. alboannulatus* very closely, but it can be told by the hind tarsi being *all* basally white-banded, whilst in *C. alboannulatus* the last tarsal joint of the hind legs is entirely black; the ungues also differ from *C. alboannulatus*.

It is also evidently closely related to, but clearly distinct from, Skuse's *C. occidentalis*, which has the first joint of the scapus ochraceous, the eyes bordered behind by a narrow line of golden-yellow scales, and the first sub-marginal cell considerably longer and narrower than the second posterior cell.

The species with which it is most likely to be confused, however, is *C. vigilax*, Skuse, but an examination of the thoracic scales will at once separate it, the scales being narrow curved ones, not flat and spindle-shaped as in Skuse's species.

Some of the specimens sent by Dr. Bancroft were bred from salt water.

### 34. Culex stimulans. Walker.*
### *C. cantans.* Meigen.

(Brit. Mus. List, Dipt. p. 4.)

Thorax brown, densely clothed with golden-brown curved scales. Abdomen brown, with basal bands of yellowish-white scales, and also traces on the apical borders; the basal bands spread out laterally, last two segments with many pale scales. Legs brown, with an ochraceous tinge, with basal pale bands to the tarsi, quite white in the hind legs.

♀. Head dark brown, with dull golden curved scales, a few dark upright forked ones and a few black bristles in front, yellower at the sides; antennae dark brown, with basal joint and base of second joint bright testaceous, a few pale scales on the basal joint, pubescence white; palpi testaceous, with dusky scales and black bristles; the bright testaceous colour shows distinctly, except at the apex, where the scales are denser, with two narrow bands of white scales towards the base in one specimen; proboscis dark brown; clypeus deep purplish-brown; eyes deep purple and silver.

Thorax brown, densely covered with golden-brown curved scales, with two rows of black bristles on the mesonotum and black bristles over the wings; scutellum brown, with pale curved scales and bright golden bristles on the posterior border; metanotum chestnut-brown; pleurae chestnut-brown, with one large patch of pale scales.

Abdomen covered with deep dusky-brown scales with purplish reflections, and with basal bands of creamy-white scales, the

* Since this went to press I find *C. stimulans*, Walker, is the same as *C. cantans*, Meigen.

bands involving the apex of the preceding segments, there often being a few white scales on the apical borders; these bands of pale scales spread out laterally, especially that on the third segment from the end; the last two segments with pale scales dotted all over them; first segment brown in the middle, dark ochraceous towards the sides, scales dusky-white; each segment bordered posteriorly with dull golden-brown bristles; venter covered with pale ochraceous scales, almost white.

Legs brown, with an ochraceous tinge; femora very dark at the apex above, with white knee spot; tarsi dark brown, almost black, with narrow basal pale bands; in the hind legs the basal bands are very wide, and whiter than in the fore and mid legs; ungues equal and uniserrated.

Wings with the veins covered with long brown scales; first sub-marginal cell slightly longer and narrower than the second posterior cell its stem equal to about half the length of the cell; second posterior cell with its base about level with the base of the former, and its stem about equal to that of the sub-marginal cell; posterior cross-vein about its own length distant from the mid cross-vein.

Halteres with ochraceous stem and fuscous knob.

*Length.*—5·5 to 6 mm.

*Habitat.*—United States (Andover, Howard), Nova Scotia (Walker).

*Time of capture.*—June and July.

*Observations.*—Besides Walker's type, Professor Howard has sent three specimens from the United States. Closely related to *C. cantans*, if not identical.

This description is from two fairly fresh specimens from Professor Howard, although one was taken as long ago as 1867.

Description from B. M. List, Walker :—

"♀. Body brownish-red; head and chest clothed with yellow hairs; proboscis and antennae dark brown; each segment of the abdomen with a band of yellow hairs on the fore border, and on the hinder a few long yellow hairs; femora pale brown with black tips; tibiae darker brown; tarsi black, the base of each joint yellow, with tawny tips.

*Length* of the body, 2¼ lines; of the wings, 5 lines."

35. Culex cantans. Meigen (1818).
*Culex stimulans*, Walker.
*Culex maculatus.* Meigen (1818).
*Culex fumipennis.* Stephens.

(Syst. Beschr. i. 6, 6, Meigen; Dipt. N. d. Fr. 160, 2, Macq.; Ins. Lapp. 866, 3, Zett.; Dipt. Scand. ix. 3461, Zett.; Fn. Austr. ii. 627, Schiner; Dipt. Neer. 326, Van der Wulp; Ins. Brit. Dipt. iii. 246, Walker; Bull. Soc. Ent. Ital. p. 258 (1896), Ficalbi; Syst. Beschr. i. 6, 7 (= *maculatus*), Meigen.)

(Fig. 78, Pl. XX.)

Thorax dark brown, covered with narrow reddish and golden-brown curved scales, which become paler and rather broader just before the scutellum and at the sides of the mesothorax, a few also scattered about. Abdomen dark brown, with pale basal bands, which may spread out laterally on some of the segments; the last few may have traces of apical banding as well, the last segments sometimes mostly pale scaled. Legs dark brown, mottled with paler scales, metatarsi and tarsi with broad basal pale bands.

♀. Head dark brown, with creamy-yellow curved scales over the occiput, and ochraceous and black upright forked ones, with flat creamy squamae at the sides, and also a small dark patch; a clear creamy border to the eyes and a small tuft of golden-brown bristles between them; antennae brown, basal joint and the three following joints bright testaceous, basal joint dark on the inner side with a few creamy scales, the next few joints also with a few scales; palpi bright brown, covered with black scales and a few white ones here and there and with black bristles; proboscis testaceous, covered with dark brown scales, becoming nearly black at the apex, with a few scattered pale ones especially towards the middle.

Thorax dark brown, covered with golden-yellow and golden-brown curved hair-like scales, which become slightly broader just before the scutellum and at the sides of the mesonotum; in some specimens these scales may be seen scattered about over the whole surface, and may collect into an indistinct round spot on each side or as a pale line; scutellum brown, with curved, creamy, or golden-yellow scales, with golden-brown bristles on the posterior border of the mid lobe in a double row and numerous ones on the lateral lobes; metanotum deep brown; pleurae brown, clothed with patches of broad creamy-white scales and a few patches of short pale hairs.

Abdomen blackish-brown, with narrow, pale basal bands of yellowish-white scales which spread out more or less laterally, forming in some specimens almost a pale yellow lateral irregular line; the apical segments have pale scales on their apical borders, which sometimes form almost distinct apical bands; posterior borders of the segments with long golden bristles; venter white scaled.

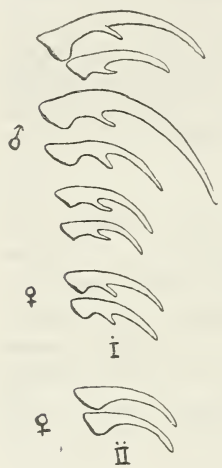

Fig. 141.

I. Ungues of ♂ and ♀ *Culex cantans*. II. Hind ungues of the ♀ *Culex annulipes*. (♂ ungues after Ficalbi.)

Legs with the coxae yellowish-white; femora yellowish-white at the base, with blackish and ochraceous scales, chiefly the latter below, mottled with both above, quite black near the apex, knee spot yellow; tibiae covered with black and pale creamy scales scattered indiscriminately, the dark scales especially collected at the apex: metatarsi similarly coloured, fore and mid metatarsi with small pale basal bands, the hind ones with broader basal bands; hind metatarsi about two-thirds the length of the tibiae; first two of the fore tarsal joints basally white banded, last two almost black; in the mid legs the first three are basally banded, but the third only slightly; in the hind legs the basal banding is paler and broader, all four joints being broadly banded, but the last sometimes only faintly so; ungues of the fore (Fig. 141, I) and mid legs equal and toothed, those of the hind legs simple (II).

Wings with veins covered with brown scales with a few paler ones along the costa; first sub-marginal cell a little longer

Fig. 141A.

*Culex cantans*, Meigen (♀). (X. 9.)

and narrower than the second posterior cell, its base slightly nearer the apex of the wing than the base of the second posterior, its stem about half the length of the cell; stem of the second posterior cell not quite as long as the cell; supernumerary

and mid cross-veins almost in a straight line; posterior cross-vein distant about its own length; fringe brown.

Halteres entirely pale ochraceous.

*Length.*—6 to 7 mm.

I have not seen a ♂, so append a few remarks from Ficalbi.

♂. Palpi with annular yellowish marks on the middle joints, brush fuscous with yellow reflections; proboscis yellowish, more or less brown, black at the apex. Thorax dorsally red-brown with two faint brown lines, limited with brilliant white tomentum; pleurae generally brownish, speckled yellowish and with white patches opposite the coxae; scutellum yellowish-white; coxae yellowish at the base and beneath, browner distally, quite brown above; knees with small yellow spots; tibiae brownish, blackish at the ends; first tarsal joint brownish, distally nearly black for some length, with a small, yellowish basal ring; the other joints brown with broad, basal, yellowish rings, except the last, which is narrow; ungues of the fore and mid legs unequal, of the hind legs equal and small, all provided with a single tooth. Abdomen with yellowish tomentum laterally; dorsally very dark brown with basal yellowish bands on the segments, expanding backwards somewhat laterally; forceps very long.

*Total length.*—9 mm. (evidently including the proboscis).

*Habitat.*—Germany (Meigen); Austria (Schiner); Scandinavia (Zetterstedt); Russia (Gimmerthal); England (Walker, Verrall, &c.); Italy (Ficalbi); Canada (E. M. Walker, at Lake Simcoe, Toronto, Ontario) (66); and Manitoba (W. I. Spencer) (19. 1. 1900); India (Giles).

*Time of appearance.*—June and onwards in Europe; June and July in Canada.

*Observations.*—I have found a single specimen of a ♀ only in the new collection in the Museum, from Major Yerburgh, taken at Ledbury, and one is deposited by myself from Cambridge. The description is mainly based on these two specimens, but numerous other British examples have been examined in Mr. Verrall's and other collections. The type is in the Jardin des Plantes. Meigen's figure (Syst. Beschr. i. 6, 6) shows the two cross-veins well in one line: a good character in the species, but I have seen specimens in which they seem to be at a very obtuse angle, so much so that they look in one line when examined in certain directions, at a great angle in another direction. It is subject to some variation, but I do not think it can be confused

with any other European banded-legged form from the speckled appearance of the legs and the venation in the ♀. I make *C. vexans* and *C. annulipes* its nearest allies, both with very narrowly instead of broadly banded legs. In *C. annulipes* the ungues are equal and simple, but in *C. vexans* they are toothed, but narrower than in *C. cantans*. Numerous ♀'s, sent by E. M. Walker from Canada, were identified as Walker's *C. stimulans*, a badly described species from the United States. These, after repeated examination, are found to be the same as *Culex cantans* of Europe. It is common in rich woods and swamps in Canada, and was taken from the borders of various marshes and swamps, and one from the interior of a cottage near Lake Simcoe. A single specimen from Stony Mountain, Manitoba, is slightly larger than the Ontario specimens, and has more whitish-yellow scales scattered about over the abdomen, and the thoracic ornamentation is also more marked; the two paler lines end in front in small rounded masses of pale scales, and the space in front of the scutellum has also more pale scales, whilst the bristles of the scutellum are darker, in fact it more closely approaches the British form than those from Ontario. Many of these Canadian specimens have numerous pale scales on the apical segments, in one or two the segments appearing almost entirely pale coloured. Dr. Price of Conoor has taken it in India at an elevation of 6000 feet, in the Nehilgerry Hills.

*Synonymy.*—I feel certain that the species described by Meigen under the name *maculatus* (S. B. i. 6, 7) is only a male of *C. cantans*. From examination of an excellent series from Canada and the type, Walker's *C. stimulans* is also synonymous. Stephens's *C. fumipennis* is this species.

### 36. Culex vexans. Meigen (1830).

*Culex articulatus.* Rondani (1872).

(Syst. Beschr. vi. 241, 16, Meigen; Dipt. Scand. ix. 3464, Zett.; Isis (1831), 1203, 50, Ruthe; Fn. Austr. ii. 627, Schiner; Dipt. Neer. 325, V. d. Wulp; Bull. Soc. Ent. Ital. 258 (1896), Ficalbi, and Venti Specie Zan. Ital. p. 125 (1899), Ficalbi; Sp. Ital. d. Gen. Culex, Bull. Soc. Ent. Ital. (1872), Rondani (= *articulatus*).)

I have not seen this species. The specimens I have previously taken for it in England are a new species.

The following are notes gathered from Ficalbi, who has worked this species out in detail (Venti Spec. Zan. Ital. p. 125).

♀. Head brown, with yellowish scales; palpi brownish-black, with a small fourth joint, with a few pale scales; proboscis yellowish-brown, darker at the base and tip; antennae brown. Thorax unadorned, with pale golden scales; pleurae with patches of white scales. Abdomen brownish, with basal white bands, narrowed in the middle. Wings with yellowish-brown veins. Legs with the coxae brownish, with white scales; femora brown, yellowish at the base and beneath; tibiae slightly spinose, brown; the first four tarsal joints with narrow pale bands. Ungues equal, all with a single tooth.

♂. In the male the palpi are brownish-black, longer than the proboscis, and pale at the base of the joints; the fore and

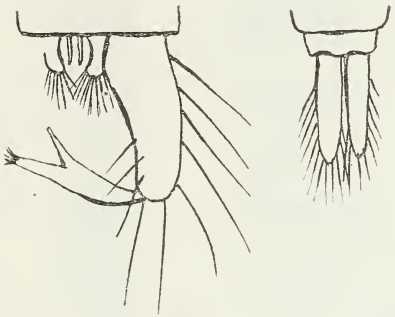

Fig. 142.
*Culex vexans*, Meigen.
Male genitalia and female processes (after Ficalbi).

mid ungues are unequal, the hind equal; all have a tooth, the mid ones are of different form to the fore. The last joint of the male claspers is bifid (Fig. 142).

*Length.*—About 7 mm.

*Habitat.*—Scandinavia (Zetterstedt); Russia (Gimmerthal); Austria (Schiner); Germany (Meigen); Holland (Van der Wulp); Britain ? (Walker, Verrall).

*Observations.*—This banded-legged species should be easily identified by the golden-scaled thorax and the toothed ungues in the ♀. It is recorded as British by Verrall in his list, but his specimens have simple ungues, and I have not been able elsewhere to detect its presence. Ficalbi states that Rondani's *Culex articulatus* is synonymous, having examined the specimens left by Rondani.

### 37. Culex annulipes. Meigen (1830).

(Syst. Beschr. vi. 241, 15, Meigen; Dipt. Scand. ix. 3462, 10, Zett.; Fn. Austr. ii. 627, Schiner; Dipt. Neer. viii. 346, Van der Wulp; Ins. Brit. Dipt. iii. Walker.)

"Proboscis rather yellowish, darker at base and apex; palpi of ♂ yellowish, with the apices of each joint darker, with brown specks and tomentum; in the ♀ very brown; nape and thorax of the ♀ rather brownish, ferruginous, with two faint darker converging lines and paler scales at the margin; pleurae speckled whitish; abdomen dorsally uniformly light yellow; wings with the veins ferruginous; the fork-cells with their branches longer than their stems, the hinder stem the shorter; legs generally yellowish, femora yellow, speckled black above; tibiae and tarsi light yellow, the joints of the latter nearly black at the apex, with three or four white basal bands, progressively narrower in the lower joints, the last joint sometimes quite black."

*Length.*—10 to 12 mm.

*Habitat.*—Austria (Schiner); Germany (Meigen); Russia (Ginmerthal); Sweden (Zetterstedt); Holland (V. d. Wulp); England (Walker and Verrall).

*Observations.*—I have been unable to find a specimen of this species in England, but it is recorded by Verrall in his list of British Diptera.

Ficalbi gives a few additional details from some ♀'s received by him from Germany. Meigen and Schiner both state that it is near *C. cantans*, but is more ferruginous.

Ficalbi's description of the abdomen as being uniformly light yellow should at once make its identity an easy matter.

### 38. Culex sylvestris. n. sp.

(Fig. 138, Pl. XXXV.)

Thorax deep brown, with thin golden scales, pale in front of the scutellum. Abdomen with dusky brown to black scales, with basal bands of pure white, bent in in the middle, last two segments with apical white bands as well. Legs brown and black, femora pale beneath and at the base, the metatarsi and some or all of the tarsi with narrow pale basal bands. Fore and mid ungues of the ♀ equal, uniserrated; hind equal, simple.

♀. Head dark brown, densely clothed in the middle with pale golden curved scales and numerous upright forked ochraceous ones in front, similar black ones behind; at the sides of the head is a patch of flat black, then flat white scales; antennae dark brown, basal joint dark testaceous, base of the second joint bright testaceous; palpi black scaled, the apex with white scales; clypeus dark brown; proboscis with very dark brown scales, becoming jet black at the tip.

Thorax deep brown, covered with thin curved hair-like golden scales, which become almost white in front of the scutellum, with four rows of black bristles and with a tuft of dark

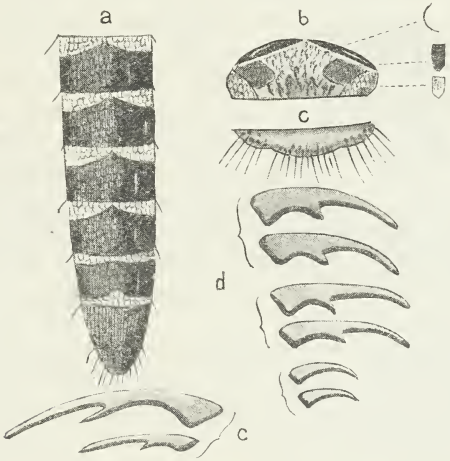


Fig. 143.

*Culex sylvestris.* n. sp.

a, Abdomen of ♀; b, head and enlarged scales of ♀; c, scutellum; d, ungues of ♀; e, fore ungues of ♂.

brown bristles over the roots of the wings; scutellum deep brown, with pale curved scales and with a complex row of median border-bristles; pleurae umber brown, with patches of white scales; metanotum chestnut-brown.

Abdomen steely-black, covered with dusky deep purplish-black scales, the base of each segment with a band of pure white scales bent in at the middle, the last two segments with apical white bands, the penultimate one with apical and basal, the apical expanded in the middle; first segment deep ochraceous, with light and dark scales and three patches of pale hairs; posterior borders of the segments with short pale golden hairs;

venter with broad basal white bands and narrow apical lateral ones, middle of the venter mostly white scaled.

Legs with the coxae pale ochraceous; femora white beneath and at the base, dark brown above towards the apex, knee spot pale yellowish; tibiae dark brown above, pale ochraceous beneath; metatarsi and tarsi black above, pale beneath, with narrow pale basal bands on all the joints in the hind legs, but not on the last two tarsi on the fore and mid legs; ungues of the fore and mid legs equal, each with a single tooth, those of the mid legs straighter than those of the fore, hind ones equal and simple.

Wings with brown scales, the lateral ones long and thin; first sub-marginal cell longer and a little narrower than the second posterior cell, about two and a half times the length of its stem, which is shorter than the stem of the second posterior cell, base of the first sub-marginal cell nearer the base of the wing than that of the second posterior cell, stem of the latter about two-thirds the length of the cell; posterior cross-vein about its own length distant from the mid cross-vein.

Fig. 144.
Wing of ♀ *Culex sylvestris.* n. sp. (X. 9.)

Halteres with pale stem and fuscous knob.

*Length.*—4·5 to 5 mm.

♂. Head dark brown, with pale golden curved scales over the crown, black upright forked ones behind, with flat white scales at the sides; eyes black and silvery; antennae banded, brown and dusky white, plumes silky brown; proboscis covered with black scales; palpi black scaled, the base of the third joint with a broad white band, its apex dilated, fourth also dilated, its base with a narrow ring of white scales, hair-tufts deep brown. Abdomen banded much as in the ♀, but much narrower, and the bands more contracted in the middle, so that it looks almost like two lateral spots, densely hairy, hairs pale golden; ♂ genitalia almost black. Ungues of the fore and mid legs unequal, the larger with a distinct tooth, and the smaller also with one at the base, hind ungues equal and simple.

*Length.*—4·5 mm.

*Habitat.*—Ontario, Canada (E. M. Walker) (66); Manitoba (W. I. Spencer) (19. 1. 1900).

*Time of capture.*—July and September.

*Observations.*—A very distinct species, easily told by the abdominal banding and the head ornamentation from any other

mosquito I have seen. It is apparently a wood species. The specimens bear the following notes on the labels: "Rondeau Provincial Park, Kent Co., Ontario, from the interior of a sandy wood of white pine with a few hard woods"; "From grass and low herbs in a wood of sugar, maple, aspen, balsam and fir"; "From the interior of a wood of walnut, maple, hickory, oak, and many other hard woods." Another: "Taken at night in oak grove near Lake Simcoe." A single ♀ also received from Stony Mountain, Manitoba, has a small apical patch of white scales on the fourth segment.

### 39. Culex testaceus. Van der Wulp.

(Tijdschr. voor Ent. p. 128 (1869).)

Thorax brown, with creamy curved scales and golden hairs at the roots of the wings. Abdomen covered with dusky black scales, with creamy ones at the bases and a few at the apices and on the middle of the segments. Legs bright testaceous with small brown scales, tibiae also with creamy scales on the hind pair; first tarsal joints with a white band only, others dark brown. Wing veins testaceous.

♀. Head dark brown, with pale curved scales in the middle, black upright ones behind, and flat creamy ones at the sides; antennae testaceous, with narrow pale bands; palpi testaceous, black scaled at the apices; proboscis testaceous, with brown and creamy scales, black at the apex and dusky at the base; clypeus chestnut-brown.

Thorax brown, with the shoulders yellowish-brown, covered with pale, curved, creamy scales, golden hairs at the roots of the wings; scutellum brown; metathorax pale brown; pleurae deep testaceous with white scales.

Abdomen mottled with yellowish-brown and steely black, covered with deep, dusky, purplish-black scales, with creamy-yellow ones at the bases and a few at the apices of the segments, and one or two dotted here and there amongst the dark ones (much denuded); first segment mottled steely black and yellowish-brown with white scales; venter mostly yellowish-brown, a few dusky white scales remain (much denuded).

Legs bright testaceous, the fore and mid pairs with small dark brown scales scattered over them; in the hind pair the tibiae have numerous creamy scales and a few black ones, also

the metatarsi; the first tarsal joint has a basal band of white scales, the remainder and other tarsal joints clothed with dark scales; fore, mid and hind ungues equal, black, both toothed.

Wings tinged with yellow and *with testaceous veins;* first sub-marginal cell longer and narrower than the second posterior cell, its stem equal to half the length of the cell, its base about level with that of the latter cell; stem of the posterior cell equal

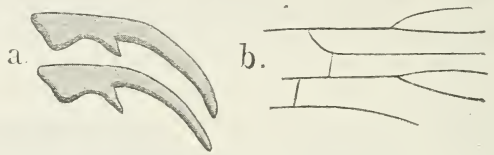


Fig. 145.
*Culex testaceus*, V. d. Wulp.
a, ♀ ungues; b, cross-veins.

in length to the cell and to the stem of the first sub-marginal; posterior cross-vein a little longer than the mid cross-vein, situated from it about its own length distant, supernumerary cross-vein curved; halteres with a pale stem and fuscous knob.

*Length.*—6 mm.

*Habitat.*—Westshore, Lake Simcoe, Ontario (E. M. Walker).

*Time of capture.*—September.

*Observations.*—A single ♀ of this species, sent by E. M Walker, taken "in a swamp, densely wooded with alder, ash, &c., with a few white pine and spruce"; not in very good condition, but sufficient to add various details to Van der Wulp's original description. The indistinct creamy-white bands at the base of the hind metatarsi and first tarsal joints, composed of pale scales, showing more distinctly in some lights than in others, are very characteristic, and should serve to identify the species at once, as well as the testaceous veins.

### 40. Culex flavescens. n. sp.

Thorax golden scaled; abdomen entirely covered with ochraceous scales; legs brown, with the tarsi and metatarsi very broadly basally banded, pale ochraceous.

♀. Head densely covered with narrow golden-yellow curved scales, upright brown and black forked scales; antennae yellowish at the base, brown apically, basal joint bright ochraceous; palpi ochraceous with brown scales; proboscis unbanded.

Thorax brown, densely covered with curved hair-like golden scales; scutellum brown, with narrow curved pale golden scales, the mid lobe with several rows of long golden-brown bristles; metanotum chestnut-brown; pleurae ochraceous.

Abdomen densely clothed with ochraceous scales, with a few black ones dotted about in one specimen; coxae ochraceous; femora ochraceous; tibiae pale brown; metatarsi very pale ochraceous and also the tarsi, with black apices, giving them a broadly basally pale banded appearance.

Wings scaled much as in *C. pipiens*, first sub-marginal cell longer and narrower than the second posterior cell, the bases of the two fork-cells nearly level; second posterior cell rather short and broad; posterior cross-vein not quite its own length distant from the mid cross-vein; stem of the first sub-marginal cell not quite as long as the cell, stem of the second posterior cell as long as the cell.

Ungues of the fore and mid legs thick, uniserrated, equal.

*Length.*—6 mm.

*Habitat.*—Unknown.

*Observations.*—Described from four old specimens in the Hope Collection at Oxford. Three were named *Culex lutescens*, one *Culex flavescens*. There are no data attached. They are certainly not *C. lutescens*, Fabr., for the tarsi are banded, whilst in *C. lutescens* the tarsi are brown. They resemble in form *Culex cantans*, but the abdomen is densely clothed with ochraceous scales, and the metatarsi and tarsi are really pale ochraceous with narrow black apical bands.

### 41. Culex vagans. Wiedemann.

(Auss. Europ. Zweiflüg. Ins. p. 545.)

Thorax clear brown, with golden-brown scales; abdomen brown, with white basal bands; legs brown, with yellowish reflections and with broad basal white bands; wings with the fork-cells short, with brown scales; fore and mid ungues equal, uniserrated.

♀. Head deep brown, with narrow golden curved scales, brown upright forked ones and flat creamy ones at the sides; eyes black and silvery; palpi with dark brown (nearly black) scales, white scaled at the apex and with two other imperfect white scaled rings; antennae deep brownish-black, base of the second joint ferruginous-brown; proboscis ochraceous, black at the apex.

Thorax deep clear brown, with narrow golden hair-like curved scales, rather paler in front of the scutellum, and with numerous black curved bristles; scutellum clear brown, with narrow pale curved scales, the border-bristles of the mid lobe in two rows, the outer large, irregularly disposed (apparently nine in number), and an inner row of much smaller ones; metanotum brown; pleurae brown, with darker patches and spots of flat white scales, a creamy scaled patch above.

Abdomen steely-black and ochraceous brown when denuded, covered with fuscous brown scales, each segment with a white basal band, the second to the fifth with a few ochraceous yellow scales on the apical borders, the last two segments with the apical ochraceous bands wide and very prominent; posterior border-bristles pallid brown; venter pallid at the base, mostly white and ochraceous, with narrow black apical bands; there are also long white lateral basal spots extending nearly along each segment.

Legs ochraceous with brown scales, which show almost yellow reflections; femora dull yellowish at the base; first and second tarsal joints very narrowly banded with yellow at the base in the fore legs, more distinctly so in the mid; in the hind legs there are prominent broad pale creamy basal bands to the metatarsi and first two tarsi (last two joints missing); ungues of the fore and mid legs equal, uniserrated, the fore claws rather thicker than the middle ones.

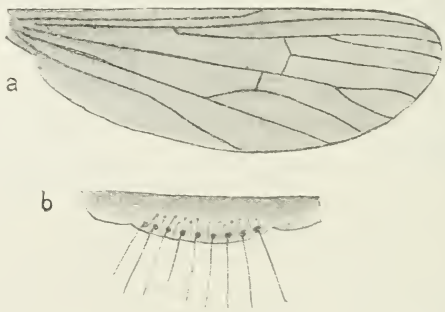


Fig. 146.
*Culex vagans*, Wied.
a, Wing, and b, scutellum of ♀.

Wings with a slightly yellow tinge along the costal border; scales brown, the lateral ones long and thin as in the typical

*Culex*; both fork-cells short, the first sub-marginal longer and narrower than the second posterior, its base nearer the base of the wing than that of the second posterior cell; stem of the sub-marginal equal to about one-third the length of the cell, stem of the second posterior more than two-thirds the length of its cell; posterior cross-vein about its own length distant from the mid cross-vein. Halteres with a pale reddish-brown stem, slightly darker knob, covered with dull creamy-brown scales.

*Length.*—5 mm.

*Habitat.*—Hong Kong, Shanghai (Lindesay, per Giles); China (Wiedemann).

*Time of capture.*—October.

*Observations.*—Redescribed from a single ♀ sent me to see by Lt.-Col. Giles and in his collection.

The species was described by Wiedemann from China. A specimen so labelled in the British Museum collection is not this species, and is too denuded and broken to take any notice of, except to point out that it was *not vagans*.

This banded-legged species has very short fork cells in the ♀, which, together with its basal white abdominal bands, long white lateral spots and curious yellow reflections on the legs, will at once separate from all known Chinese species.

Lt.-Col. Giles, in notes on the species sent me, points out that the basal joints of the antennae are whitish; upon microscopic examination I find this is due to some white powder dusted over the specimen.

The specimen was taken by Captain Lindesay.

### 42. Culex caecus. n. sp.

(Fig. 77, Pl. XX.)

Thorax dark brown, with bright tawny curved scales; pleurae chestnut-brown with three distinct white patches. Abdomen dark blackish-brown, with narrow basal whitish bands. Legs dark blackish-brown, with narrow basal white bands. Scutellum with rather broad scales to the lateral lobes, and at its base and the head with distinct dark lateral patches. Fore and mid ungues of ♀ uniserrated.

♀. Head with pale greyish scales in the middle, with numerous long upright black forked scales, a black patch on each side bordered with creamy scales, which pass down the sides

of the head ; eyes purplish-black with a silvery lustre, with a slight pale border ; clypeus and palpi brown ; antennae brown, with the first two joints bright yellowish ; proboscis brown, slightly darker at the tip.

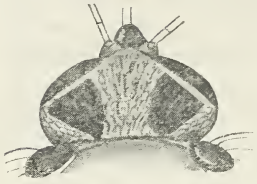

Fig. 147.
Head of *Culex caecus*. n. sp.

Thorax dark brown, covered with bright, tawny, narrow curved scales, four rows of black bristles on the mesonotum, two median and two lateral ; scutellum paler, with broadish white scales on the lateral lobes and narrow ones on the median, with a few broader ones at the base (Fig. 148, a) ; seven distinct brown hairs on the median lobe of the scutellum, numerous ones on the lateral lobes ; metanotum pale brown ; pleurae pale ochraceous with three large patches of greyish-white scales ; prothoracic lobes very distinct.

Abdomen densely covered with dark brownish-black to almost pure black scales, each segment with a basal band of pale creamy-white scales, and their posterior borders edged with

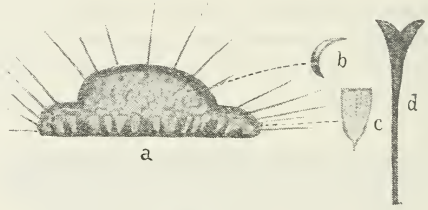


Fig. 148.
*Culex caecus*. n. sp.
a, Scutellum ; b and c, scutellar scales ; d, fork scale of head.

pale, almost white hairs ; laterally white scales form a patch on each segment, and they become very abundant below, the greater part of each segment being covered by them.

Fore legs covered with dark purplish-black scales, the femora white scaled beneath, knee spot pale, metatarsi and tarsi very dark, the former and the first tarsal with a pale basal ring ; mid legs the same, but the second tarsal has also a minute white ring ; hind legs with the metatarsi and all the tarsi with narrow basal white bands ; fore and mid ungues with small basal tooth (the hind ones not visible in the specimen).

Wings covered with dark brown scales, the apical portions of the second to fifth veins with long lateral scales as well as broader median scales, which also extend down the stalk of the first long vein; first sub-marginal cell about half the width of the second posterior cell and much longer, its stem about the same length as the cell, as also is that of the second posterior cell; posterior cross-vein about its own length distant from the mid cross-vein.

*Length.*—5 mm.

*Time of capture.*—November.

*Habitat.*—Selangor (Butler) (28. 10. 1899); Klang Mangrove Swamps.

*Observations.*—A very distinct species, with tawny scaled unadorned thorax, pale pleurae, dark abdomen basally banded with creamy scales and with minutely banded legs. I know of no other species from the Straits Settlements that can be confused with it. I have not seen the male, a single ♀ only being sent by Mr. Butler. The prothoracic lobes are very distinct. I have only placed it provisionally in this genus.

### 43. Culex procax. Skuse.

(Proc. Linn. Soc. N. S. Wales, p. 1742.)

(Fig. 76, Pl. XIX.)

Thorax black, with a few brownish-black and dull golden scales. Abdomen blackish, with basal white bands. Legs dark brown, femora pale beneath; metatarsi and tarsi basally white ringed. Small sized, 3·8 mm. Ungues equal and simple in ♀.

♀. Head black, with a few pale curved silvery scales in front and the middle, and with broad flat white scales forming lateral patches, with a few broad dark scales at the sides as well forming a small dark spot; antennae very dark brown, with narrow pale bands; palpi black scaled with a few grey ones; proboscis deep ochraceous, broadly black at the tip and at the base.

Thorax black, with a few brownish-black and dull golden curved scales; scutellum brown; metanotum deep brown; pleurae deep umber-brown, with a few white scales.

Abdomen black scaled, with narrow basal bands of white scales; venter black, with a few white scales.

Legs dark brown, with the under-sides of the femora pale; tibiae brown, with a yellowish reflection in certain lights; metatarsi basally pale banded; first three tarsi of the mid and all four of the hind legs basally white ringed; ungues equal and simple.

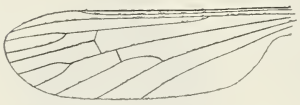

Fig. 149.
Wing of ♀ *Culex procax*, Skuse.

Wings with brown scales, the lateral ones long, costa dark brown; first sub-marginal cell short, much narrower and a little longer than the second posterior cell; their bases opposite; their stems nearly equal; mid cross-vein a little longer than the posterior cross-vein, situated from it about its own length distant; fringe grey; halteres ochraceous.

*Length.*—3·8 mm.

*Habitat.*—Bupengary, Queensland (Bancroft) (5. 12. 1899); Gosford and S. Clifton, N.S.W. (Skuse).

*Time of appearance.*—December to February.

*Observations.*—Redescribed from a single ♀ sent by Dr. Bancroft from Queensland; it answers in so many respects to Skuse's *C. procax* that I feel sure it must only be a local variety of that species.

The differences are ones of colour. Skuse's specimen had a light umber-brown head, adorned with golden scales, and this one has a black head with pale scales. Skuse also describes the thorax as red-brown, but in Dr. Bancroft's specimen it is almost black. Beyond these differences, the insect answers exactly to *C. procax*, and I take it to be a mere local variation of that species. Skuse states that it is a day-flier. It is the smallest known Australian *Culex*. The two clear white spots, one on each side of the head, and its small size, seem to be the most characteristic features.

### 44. Culex rubithorax. Macquart.

(Dipt. Exot. 4th Supp. p. 9 (1850), Macquart; Proc. Linn. Soc. N. S. Wales, p. 1735 (1896), Skuse.)

Thorax bright chestnut-brown, with golden curved scales and four double rows of brown bristles. Abdomen dusky purplish-black, with narrow, basal, creamy-white bands, last segment unadorned, white lateral spots, some showing on the dorsum. Legs dark brown to black; metatarsi and some of the tarsi with basal pale bands.

♀. Head black, with a narrow border of thin golden curved scales around the eyes, then a broad band of black flat scales, then golden curved ones behind, and a few flat creamy ones at the sides, some golden curved ones also forming a central mass towards the eyes, with dark and golden-brown upright forked scales; eyes silvery; antennae dark brown, basal joint and base of second joint ochraceous; palpi testaceous at the base, black at the top, with black scales; proboscis black, the apex and base and down the centre and sides of the mid region with ochraceous and brown scales; clypeus dark brown.

Thorax bright chestnut-brown, with scattered golden curved scales, with four double rows of brown bristles; scutellum chestnut-brown, with golden scales and brown bristles; metanotum chestnut-brown, with a purplish patch on each corner of the base; pleurae chestnut-brown, with patches of white scales; prothoracic lobes with flat black scales and black bristles.

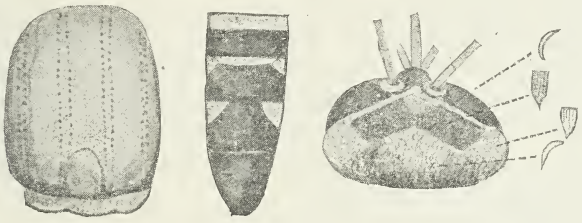

Fig. 150.
*Culex rubithorax*, Macq.
Thorax, apex of abdomen, and head.

Abdomen clothed with dusky, purplish-black scales, each segment with a narrow basal band of creamy-white and with white lateral spots, the last segment unmarked, the two preceding with the white spots showing on the dorsum and with very faint basal banding; each segment with a row of golden bristles on their posterior borders; venter white scaled, with some apical black scales.

Legs with the femora ochraceous, with dusky scales, pale beneath, and a minute yellow knee spot on the hind legs; tibiae black, with golden bristles; fore metatarsi and tarsi black scaled, the former and the first tarsal joint faintly pale at the base; in the mid legs the basal bands a little more distinct, and a trace on the second tarsal joint; hind metatarsi and tarsi basally pale banded, metatarsi shorter than the tibiae; ungues

of the fore and mid legs equal and with a single tooth, hind claws equal and simple.

Wings with the veins brown-scaled, except at the roots, where the scales are deep purplish-black; first sub-marginal cell a little longer and much narrower than the second posterior cell, its stem a little more than half the length of the cell; stem of the second fork-cell about the same length, not quite so long as the cell; posterior cross-vein a little more than its own length distant from the mid cross-vein; lateral scales of the apical portions of the veins long and narrow and blunt at the summit; halteres pale ochraceous, with slightly fuscous knob.

*Length.*—5 mm.

*Habitat.*—South Queensland (Dr. Bancroft) (71); Tasmania (Macquart).

*Time of capture.*—September (September 1, 1899).

*Observations.*—Amongst the large collections sent by Dr. Bancroft are some specimens labelled by him *C. vigilax* (?); these are evidently Macquart's *C. rubithorax*; they resemble *C. occidentalis*, Skuse, but the first sub-marginal cell is only slightly longer than the second posterior cell, and also there are four rows of black bristles on the mesonotum, not three, as in *C. occidentalis*, nor is the tarsal banding so distinct. The head ornamentation is peculiar, and seems to apply to an *Aedes*, but I have not sufficient material to be certain.

Macquart's original description is as follows:—

"♀. Thorace testaceo. Abdomine nigro, incisuris albidis. Pedibus flavidis; tarsis fuscis albo-annulatis.

"Proboscis tawny, black at the base and extremity, sometimes entirely black. Palpi black, tawny at the base; front brown, with a grey pubescence. Antennae black; thorax reddish-testaceous (denuded). Abdomen black, more or less shining, with a greyish-white pubescence about the incisions. Legs rather pale tawny; posterior femora sometimes black within their posterior third; posterior tibiae brownish-black; tarsi black, sometimes yellowish; the first three joints with a white ring at the base, narrow and sometimes indistinct to the anterior and intermediate pairs, large to the posterior. Wings rather limpid; veins normal, covered with small black hairs.

"Five ♂ specimens, of which one has the tarsal rings nearly absent.—Tasmania.

*Length.*—2½ lines."

This ♀ was evidently a rubbed specimen, from the description, and from the statement that the thorax was denuded.

### 45. Culex occidentalis. Skuse.

(Proc. Linn. Soc. N. S. Wales, p. 1729 (1889).)

(Fig. 71, Pl. XVIII.)

Thorax bright deep reddish-brown, with thin hair-like, golden scales. Abdomen dusky black, each segment with a narrow, yellowish-white, basal patch—not a distinct band, and also basal, lateral, white spots. Legs brown, femora white at the base and beneath, metatarsi and tarsi with basal yellowish-white bands, broadest on the hind legs; tibiae with golden bristles and pallid hairs.

♀. Head brown, with long golden-yellow curved scales in the middle and bordering the eyes, and between them a band on each side reddish-brown in colour, composed of dark curved scales; the back of the head clothed with golden curved and upright forked scales, a patch of pale creamy flat scales on each side, and then a patch of flat black scales; palpi black scaled, the apex white, and also a ring of white scales at the base of the fourth joint; antennae dark brown, with pale pubescence and pale rings, basal joint testaceous with yellow scales, basal half of the second joint also testaceous; proboscis black.

Thorax bright deep reddish-brown, with numerous thin hair-like, curved, golden scales; scutellum pale testaceous, with golden-yellow scales, paler than on the mesonotum, and long

Fig. 151.
*Culex occidentalis*, Skuse.
Abdominal banding and ♀ ungues.

brown bristles to the posterior borders; metanotum reddish-brown; pleurae reddish-brown, with patches of creamy-white scales.

Abdomen covered with dusky black scales, each segment with a narrow white basal patch, scarcely to be called a band,

somewhat curved, and each segment bordered with golden bristles; there is also a small white basal spot on each side of the segments; venter covered with creamy-white and dark scales.

Legs with the coxae chestnut-brown, with a few white and black scales; femora white at the base and beneath, black towards the apex, and mottled at the base above and at the apex below with black and white scales, extreme apex yellow; tibiae deep brown to black; fore metatarsi and first two tarsal joints of the fore and mid legs basally banded yellowish white, the bands being much more distinct in the mid than in the fore legs, last two joints black; in the hind legs the metatarsi and the first three tarsal joints have very broad, white, basal bands, the last only being black; tibiae with a few golden bristles and a line of smaller pallid hairs; hind metatarsi about one-third shorter than the hind tibiae. Ungues of the fore and mid legs thick, equal and uniserrated.

Wings longer than the abdomen, the veins very densely covered with brown scales; testaceous at the base; first submarginal cell longer and narrower than the second posterior cell, its base a little nearer the base of the wing than that of the latter, its stem about two and a half times shorter than the cell; stem of the second posterior cell about one and a half times less; posterior cross-vein situated about its own length distant from the mid cross-vein and a little longer than the latter; mid cross-vein almost under the junction of the sub-costal and costal.

Halteres ochraceous, with the knob fuscous on one side.

*Length.*—5 to 6 mm.

*Habitat.*—Victoria (French); King George's Sound, Western Australia (Masters).

*Time of capture.*—October, in Victoria.

*Observations.*—Skuse described this species from a single specimen obtained by Mr. Masters, and apparently previously described in some MSS. notes by W. Macleay. Five specimens have been received at the Museum from Victoria in a collection sent by the Victorian Government, prepared by Mr. French, mainly from the higher lands of Victoria.

It is a very distinct species, with bright reddish-brown thorax, pleurae, &c., and dark abdomen banded basally, and with dark legs, and basally banded metatarsi and feet.

Some specimens have been received from Victoria from Dr. Bancroft that answer very closely to this species, and which I take to be a variety of it. *C. occidentalis* varies in size

considerably; the ornamentation and coloration also seem to vary.

*Variety A.*—No trace of banding on the last four segments of the abdomen, and with scattered yellow scales on the last few segments. More or less of a median dark line showing on the thorax; remainder normal. (Dr. Bancroft, Healesville, Victoria. 106, 21. 10. 1900.)

There is some resemblance to *C. rubithorax*, Macq., but the head ornamentation differs as well as the wing venation, and the presence of three instead of four rows of black bristles on the thorax will at once separate the two species.

### 46. Culex flavifrons. Skuse.

(Proc. Linn. Soc. N. S. Wales, vol. iii. p. 1735 (1889).)

Ground colour of thorax red-brown, densely gold-scaled; pleurae red-brown, with several small white-scaled spots; scutellum densely gold scaled; metanotum light red-brown. Abdomen violet-black scaled, narrowly white banded in front, densely fringed with golden hairs; venter white scaled. Femora dark violet above at the apex, thickly powdered with white scales, beneath pale yellowish; genua bright yellow; tibiae and tarsi dark violet; tibiae and metatarsi somewhat whitish beneath; all tarsal joints white ringed at the base, but indistinctly so in the fore and mid legs; hind tibiae one-fifth longer than metatarsi. Wings densely clothed with violet-brown scales, *sparingly intermixed with yellowish scales.*

*Length.*—4·56 in ♀; 5·08 in ♂.

*Habitat.*—Blue Mountains, N.S.W. (Masters); Victoria Park, Brisbane (Tryon).

*Time of appearance.*—November to January.

Note.—This species seems to differ very slightly from *C. occidentalis*, which has been received from Victoria. The only apparent differences I can detect from actual specimens of *C. occidentalis* and the description of *C. flavifrons* are that in the latter the wings have some yellow scales, and that the relative length of the hind tibiae and metatarsi differs.

### 47. Culex maculiventris. Macquart.

(Dipt. Exotic. Supp. i. p. 7.)

"Thorax black, with rufous tomentum; abdomen black, with both anterior and posterior borders of the segments, and a dorsal line of a

greyish-yellow. Legs yellowish, with black tarsi and a little white at the base of each joint.

*Length.*—2 lines."

A very distinct species, with wings covered with white and brown scales and characteristically marked abdomen. The type is in the Jardin des Plantes.

The specimen came from Algeria.

### 48. Culex imprimiens. Walker.

(Proc. Linn. Soc. v. p. 144.)

Thorax brown, with pale golden, narrow curved scales; abdomen black, with traces of pale basal bands and with white lateral spots; legs brown, with basal pale bands to metatarsi and tarsi.

♀. Head absent; thorax bright chestnut-brown, with narrow curved, pale golden scales; scutellum and metanotum bright chestnut-brown; pleurae chestnut-brown with some white scales.

Abdomen black, covered with dusky black scales, two segments, the second and third, show a trace of pale scales along the base; there are also basal white lateral spots; venter creamy white, the apical borders of the first three basal segments dark.

Legs with the coxae pale brown, also the femora at their base and beneath, remainder of the legs dark brown, the base of the fore metatarsi and first tarsal joint with a narrow pale basal band; in the hind legs the pale bands are wider; ungues of the fore feet equal and uniserrated.

Wings with the fork-cells rather short, the first sub-marginal, being a little longer and narrower than the second posterior, their bases nearly level; stem of the former not quite as long as the cell, of the latter a little longer; posterior cross-vein about twice its own length distant from the mid cross-vein; the third long vein is continued through the basal cell as a pseudo-vein; halteres with pale stem and fuscous knob.

*Length.*—6·5 mm.

*Habitat.*—Amboina.

*Observations.*—Redescribed from Walker's type in the British Museum. The head is absent, but beyond that the specimen is in moderate condition. The bright chestnut-brown thorax, with

the golden scales and the banding of the abdomen apparently only being on the second and third segments, make this a fairly easily recognisable species.

### Culex terrens. Walker.

(Ins. Saund. p. 429.)

Thorax chestnut-brown, with a broad patch of white scales on each side in front and a median pale line; pleurae with numerous patches of white scales, reddish-brown; metanotum chestnut-brown; some golden hairs on the mesothorax.

Head brown; eyes black, bordered with a line of white scales. Proboscis, palpi and antennae deep chestnut-brown. The plumes of the male antennae deep silky brown. No traces of banding on the palpi. Abdomen with metallic purple reflections and golden-orange scales scattered over it, with five distinct white lateral spots and two white spots on the sides of the penultimate segment. Covered with dense golden-brown hairs.

Legs brown, metatarsi of the hind pair basally white, apex also white, a broad black band towards the middle, first tarsal joint all white, second basally white, last two dark brown.

*Length.*—6 mm.

*Habitat.*—South America.

*Observations.*—I have only seen the type in the British Museum, from which this description is taken. It can at once be told by the peculiar tarsal banding on the hind legs. No one could identify it from Walker's description, the chief character in the legs not being noticed.

### 49. Culex tibialis. R. Desvoidy.

(Mém. de la Soc. Hist. Nat. de Paris, iii. p. 404 (1827).)

"Thorax black, with grey tomentum; abdomen black (with grey tomentum?), unbanded; femora of the colour of honey, black and hirsute at the apex; tibiae intense black, robustly ciliate; joints of the tarsi honey-tinted, black at the apices; first joint of the tarsi with yellow ciliae.

*Length.*—4 to 6 lines.

*Habitat.*—Brazil."

Note.—Arribalzaga does not mention this among his Argentine species, nor has it occurred in the Brazilian collections sent

by Dr. Lutz and Senhor Carlos Moreira. I cannot trace the type. The description might apply to many species I have seen if compiled, as was probably the case, from a rubbed specimen. I expect, if the type were found, it would prove to be *C. cingulatus*, Fabr.

50. Culex (Stegomyia?) Walkeri. n. sp.

Thorax chestnut-brown, with a broad greyish-white scaled area on each side of the mesonotum. Fore and mid legs apparently unbanded, pale at the base of the femora; base of the metatarsi and first two tarsal joints of the hind legs banded with white. Abdomen brown, showing traces of white basal banding.

*Length.*—4 mm.

*Habitat.*—Jamaica.

*Observations.*—The above is a note I made on a specimen in the old collection at the British Museum, labelled *C. fasciatus*, F. It is certainly not *fasciatus*, and is quite distinct from any known species. Nothing approaching it has been received from the West Indies. It is in poor condition, and is probably a *Stegomyia;* the marked thoracic ornamentation should at once render its identity easy. If a true *Culex* its position in the table (p. 383) would be after *C. Japonicus*, mihi. The head and scutellum are too damaged to say definitely to which genus it belongs, so it is placed provisionally in *Culex*.

END OF VOL. I.



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