

## **Historic, Archive Document**

Do not assume content reflects current scientific knowledge, policies, or practices.



reserve  
En 83R

AUTHOR'S EDITION.

---

---

THE  
INSECTIVOROUS HABITS  
OF THE  
ENGLISH SPARROW.

By C. V. RILEY, Ph. D.

---

[Extracted from Bulletin No. 1, Division of Economic Ornithology and Mammalogy,  
United States Department of Agriculture, entitled "The English Sparrow in  
America."]

---

---





AUTHOR'S EDITION.

---

---

THE  
INSECTIVOROUS HABITS  
OF THE  
ENGLISH SPARROW.

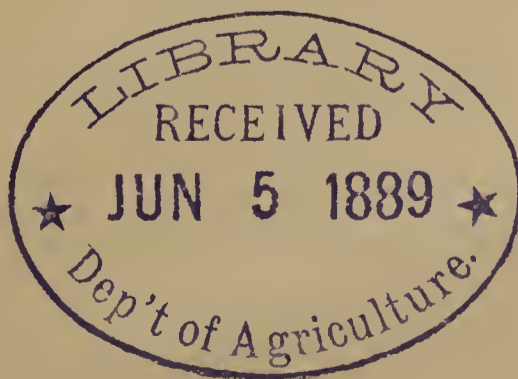
By C. V. RILEY, Ph. D.

---

[Extracted from Bulletin No. 1, Division of Economic Ornithology and Mammalogy,  
United States Department of Agriculture, entitled "The English Sparrow in  
America."]

---

---





INSECTIVOROUS HABITS OF THE ENGLISH SPARROW (*Passer domesticus*).

By C. V. RILEY.

## REPORT OF MATERIAL EXAMINED IN 1887.

The facts contained in this report are based upon the stomach contents of the English Sparrow submitted by Dr. C. Hart Merriam for examination and opinion, these having been separated by him from a much larger number (522 in all) examined in the Ornithological Division and found to contain no insects. By stomach contents is included not only what is taken from the crop, but also that taken from the gullet and the mouth. I have first given a list of the specimens examined according to Dr. Merriam's card catalogue number and including the insect material examined and identified. Next I have given a succinct statement of the habits of the insects concerned, arranged according to orders, and finally a summarization of the results, and a survey of other work in the same line both in Europe and America.

My method of examination has been, first, to have the material carefully examined by some one of my assistants according to their special knowledge, and particularly by Mr. Otto Lugger and Mr. Th. Pergande, and then to verify their determinations and to study and determine more closely whatever was questionable or undeterminable. In this way the accuracy of the determinations has been fully assured, and I have not been under the necessity of appealing to specialists outside of the Division. A determination is sometimes based on a mere fragment, and in all cases where an interrogation still remains it is because of the imperfect condition of the specimens, which would make specific reference little more than guess-work. To the gentlemen mentioned, as also to Mr. Barrows and Dr. Fisher, of the Division of Ornithology, I take this occasion to express my thanks for aid and interest shown in the work.

## STOMACH CONTENTS.

No. 16.—Young male; July 7, 1885, Sing Sing, N. Y. Contents: Two chrysomelid larvæ (small larvæ of unrecognizable species).

No. 97.—Adult female; July 25, 1885, Sing Sing, N. Y. Contents: One snout-beetle (*Sphenophorus zeæ*); wings of a small Chrysomelid, and jaws of a caterpillar.

No. 123.—Adult female; July 28, 1885, Sing Sing, N. Y. Contents: Remains of a small hymenopterous insect and pieces of one *Aphodius* sp.

No. 152.—Young male; August 4, 1885, Sing Sing, N. Y. Contents: Three Hymenoptera (*Myzine 6-cincta*); one large locust (*Caloptenus differentialis*); two pupæ of small locusts (*Caloptenus* sp.).

No. 195.—Adult male; August 10, 1885, Sing Sing, N. Y., three young Orthoptera, viz, *Xiphidium* sp., *Caloptenus* sp., *Tettix* sp., one *Colaspis flavida*.

No. 196.—Young male; August 10, 1885, Sing Sing, N. Y. Contents: Two snout-beetles (*Sitones* sp.).

No. 201.—Adult female; August 10, 1885, Sing Sing, N. Y. Contents: Very small pieces of a curculionid beetle.

- No. 202.—Young male; August 10, 1885, Sing Sing, N. Y. Contents: Pieces of two snout-beetles (*Sphenophorus zœæ*).
- No. 216.—Female; August 10, 1885, Sing Sing, N. Y. Contents: One *Aphodius granarius*.
- No. 289.—Young male; August 20, 1885, Sing Sing, N. Y. Contents: Small pieces of a hemipterous insect.
- No. 1552.—Female; May 9, 1885, Taunton, Mass. Contents: One elytron of *Aphodius granarius*.
- No. 1593.—Male; June 16, 1885, Taunton, Mass. Contents: Four large larvæ of a *Lachnosterna* sp. and two small snout-beetles (two heads and tip of one elytron).
- No. 2131.—Adult female; August 3, 1886, Washington, D. C. Contents: One snout beetle (*Sphenophorus parvulus*).
- No. 2132.—Adult female; August 3, 1886, Washington, D. C. Contents: One arctiid (*Hyphantria cunea*) with eggs; two pairs of jaws of cut-worms (fam. Noctuidæ).
- No. 2133.—Adult female; August 3, 1886, Washington, D. C. Contents: One snout-beetle (*Sphenophorus parvulus*).
- No. 3360.—Male; March 19, 1886, Sugar Grove, Ohio. Contents: Broken pieces of *Aphodius fimetarius*.
- No. 5523.—Adult female; May 2, 1887, Washington, D. C. Contents: Piece of legs of an Ichneumonid; one snout-beetle (*Sphenophorus parvulus*).
- No. 5526.—Young male; May 16, 1887, Washington, D. C. Contents: Part of the leg of a *Lachnosterna*; one Hymenopteron (*Tiphia* sp.).
- No. 5528.—Young female; May 20, 1887, Washington, D. C. Contents: Several pieces of *Lachnosterna*, apparently *fusca*.
- No. 5529.—Young male; May 20, 1887, Washington, D. C. Contents: Several pieces of *Lachnosterna*, apparently *fusca*.
- No. 5532.—Young male; May 28, 1887, Washington, D. C. Contents: One spider (*Tarentula* sp.); one snout-beetle (*Sphenophorus parvulus*); two ants (*Solenopsis* sp.); one Hymenopteron (*Tiphia* sp.); one minute Hymenopteron (*Xylaspis* sp.).
- No. 5533.—Adult male; May 28, 1887, Washington, D. C. Contents: One snout-beetle (*Sphenophorus parvulus*); one spider (*Lycosa scutellata*).
- No. 5536.—Male; June 2, 1887, Washington, D. C. Contents: One snout-beetle (*Sphenophorus parvulus*); five flea-beetles (*Chætocnema denticulata*).
- No. 5537.—Female; June 2, 1887, Washington, D. C. Contents: Two spiders (legs), not recognizable; two snout-beetles (*Sphenophorus parvulus*); two flea-beetles (*Chætocnema denticulata*).
- No. 5538.—Female; June 2, 1887, Washington, D. C. Contents: Several specimens of snout-beetles (*Sphenophorus parvulus*).
- No. 5542.—Female; June 2, 1887, Washington, D. C. Contents: Two pupæ of the blue-bottle fly (*Musca cæsar*).
- No. 5544.—Female; June 2, 1887, Washington, D. C. Contents: One snout-beetle (*Sphenophorus parvulus*); pieces of the larva of a Homopteron, apparently *Erythro-neura*.
- No. 5545.—Young male; June 3, 1887, Washington, D. C. Contents: Pieces of numerous spiders; three snout-beetles (*Sphenophorus parvulus*); one Hymenopteron (*Tiphia* sp.).
- No. 5548.—Young male; June 7, 1887, Washington, D. C. Contents: Small pieces of a *Lachnosterna*; one snout-beetle (*Sphenophorus parvulus*).
- No. 5549.—Adult female; June 7, 1887, Washington, D. C. Contents: One snout-beetle (*Sphenophorus parvulus*).
- No. 5636.—April 21, 1887, Rockville, Conn. Contents: Remains of two beetles (*Diplotaxis* sp. and *Aphodius fimetarius*).
- No. 5662.—Young female; June 15, 1887, Washington, D. C. Contents: One flea-beetle (*Chætocnema denticulata*); traces of an Hymenopteron, apparently *Tiphia*.



- No. 5665.—Young male; June 16, 1887, Washington, D. C. Contents: One Hymenopteron (only very small pieces).
- No. 5676.—Adult female; June 21, 1887, Washington, D. C. Contents: Six houseflies (*Musca domestica*), with numerous eggs.
- No. 5693.—Young female; July 12, 1887, Washington, D. C. Contents: One Hymenopteron (only very small pieces, apparently of *Tiphia*).
- No. 5701.—Adult female; July 13, 1887, Washington, D. C. Contents: Eleven flea-beetles (*Chætocnema denticulata*); one *Colaspis flavida*.
- No. 5705.—Young female; July 13, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 5712.—Young female; July 14, 1887, Washington, D. C. Contents: One leg of a longicorn beetle (*Liopus* sp.); parts of a Hymenopteron (*Myzine 6-cincta*); legs of a minute Hymenopteron; one leg of a spider.
- No. 5713.—Young female; July 14, 1887, Washington, D. C. Contents: Very small pieces of a Hymenopteron (*Myzine 6-cincta*); several flea-beetles (*Chætocnema denticulata*).
- No. 5720.—Young female; July 15, 1887, Washington, D. C. Contents: Numerous pieces of Hymenoptera (*Myzine 6-cincta*); traces of a Heteropteron.
- No. 5916.—Adult female; August 9, 1887, Washington, D. C. Contents: Two snout-beetles (*Sphenophorus parvulus*).
- No. 5917.—Adult female; August 9, 1887, Washington, D. C. Contents: Two snout-beetles (*Sphenophorus parvulus*).
- No. 5924.—Young male; August 9, 1887, Washington, D. C. Contents: Many flea-beetles (*Chætocnema denticulata*); legs of a snout-beetle (*Sphenophorus parvulus*).
- No. 5940.—Young male; August 11, 1887, Washington, D. C. Contents: One flea-beetle (*Chætocnema denticulata*); traces of a Hymenopteron (*Myzine 6-cincta*).
- No. 5941.—Young male; August 11, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 5945.—Young male; August 12, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 5946.—Young female; August 12, 1887, Washington, D. C. Contents: Two small Noctuid larvæ; 1 snout-beetle (*Sph. parvulus*); 5 flea-beetles (*Chætocnema denticulata*); 1 *Myzine 6-cincta*.
- No. 5951.—Young male; August 12, 1887, Washington, D. C. Contents: One snout-beetle (*Sph. parvulus*); 1 Hymenopteron (*Myzine 6-cincta*).
- No. 5953.—Adult female; August 12, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 5954.—Young male; August 12, 1887, Washington, D. C. Contents: One leafhopper (*Erythroneura* sp.)
- No. 5967.—Adult female; August 13, 1887, Washington, D. C. Contents: One leafhopper (*Erythroneura* sp.); 2 ants (*Brachymyrmex heeri*, female).
- No. 5970.—Female; August 13, 1887, Washington, D. C. Contents: Three flea-beetles (*Ch. denticulata*); 3 Hymenoptera (*Myzine 6-cincta*).
- No. 5971.—Female; August 13, 1887, Washington, D. C. Contents: Two Hymenoptera (*Myzine 6-cincta*); remains of 1 ant.
- No. 5972.—Male; August 13, 1887, Washington, D. C. Contents: Pieces of the leg of *Lachnosterna*; 2 Hymenoptera (*Myzine 6-cincta*).
- No. 5973.—Young male; August 13, 1887, Washington, D. C. Contents: One leg of mole-cricket (*Gryllotalpa* sp.).
- No. 5975.—Young; August 15, 1887, Washington, D. C. Contents: Four ants (*Monomorium pharaonis*); several Hymenoptera (*Myzine 6-cincta*).
- No. 5976.—Young; August 15, 1887, Washington, D. C. Contents: Five ants (*Monomorium pharaonis*); 1 Hymenopteron (*Myzine 6-cincta*).
- No. 5977.—Young male; August 15, 1887, Washington, D. C. Contents: Small pieces of several Hymenoptera (*Myzine 6-cincta*).

- No. 5982.—Female; August 15, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 6000.—Young female; August 16, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 6004.—Adult male; August 17, 1887, Washington, D. C. Contents: Small pieces of a few ants; species not recognizable.
- No. 6007.—Young male; August 17, 1887, Washington, D. C. Contents: Very small pieces of a Hymenopteron.
- No. 6010.—Female; August 17, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 6012.—Female; August 17, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*); and 5 jaws of some cut-worm (Noctuid larva).
- No. 6015.—Adult female; August 17, 1887, Washington, D. C. Contents: One Lepidopteron (*Hyphantria cunea*).
- No. 6018.—Female; August 17, 1887, Washington, D. C. Contents: Two snout-beetles (*Sphenophorus parvulus*); tarsus of a *Lachnosterna*.
- No. 6021.—Male; August 18, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*, male).
- No. 6025.—Female; August 18, 1887, Washington, D. C. Contents: Three specimens of bee (*Halictus* sp.); one Hymenopteron (*Myzine 6-cincta*).
- No. 6026.—Female; August 18, 1887, Washington, D. C. Contents: One Hymenopteron (*Tiphia*?).
- No. 6087.—Male; August 19, 1887, Washington, D. C. Contents: Legs of Hymenopteron (Ichneumonid?).
- No. 6088.—Young male; August 19, 1887, Washington, D. C. Contents: Many specimens of Hymenoptera (*Myzine 6-cincta*).
- No. 6089.—Adult female; August 19, 1887, Washington, D. C. Contents: One snout-beetle (*Sphenophorus parvulus*); two small jaws of caterpillar?
- No. 6090.—Female; August 19, 1887, Washington, D. C. Contents: Two small bees (*Halictus* sp.).
- No. 6091.—Female; August 19, 1887, Washington, D. C. Contents: One Hymenopteron (*Tiphia* sp.).
- No. 6092.—Female; August 19, 1887, Washington, D. C. Contents: Two Hymenoptera (*Myzine 6-cincta*).
- No. 6093.—Female; August 19, 1887, Washington, D. C. Contents: One Hymenopteron (*Tiphia* sp.); one ant (not recognizable).
- No. 6108.—Young female; August 20, 1887, Washington, D. C. Contents: Three Noctuid larvæ (*Laphygma frugiperda*).
- No. 6109.—Young female; August 20, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*); one *Psocus* sp.
- No. 6110.—Young female; August 20, 1887, Washington, D. C. Contents: One Hymenopteron; one flea-beetle (*Chaetocnema denticulata*).
- No. 6112.—Female; August 20, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 6134.—Young female; August 22, 1887, Washington, D. C. Contents: Remains of several locusts in pupa state (*Caloptenus* sp.); remains of one Hymenopteron (*Myzine 6-cincta*).
- No. 6141.—Male; August 23, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).
- No. 6151.—Male; August 24, 1887, Washington, D. C. Contents: One flea-beetle (*Chaetocnema denticulata*).
- No. 6153.—Male; August 24, 1887, Washington, D. C. Contents: One Hymenopteron; very small pieces of elytra of a Heteropteron.
- No. 6161.—Female; August 24, 1887, Washington, D. C. Contents: One Hymenopteron (*Myzine 6-cincta*).

No. 6162.—Female; August 24, 1887, Washington, D. C. Contents: One lepidopterous larva (*Crambus* sp.).

No. 6163.—Female; August 24, 1887, Washington, D. C. Contents: Parts of one Hymenopteron (*Myzine 6-cincta*).

No. 6164.—Female; August 24, 1887, Washington, D. C. Contents: One Hymenopteron (*Tiphia* sp.).

No. 6204.—Young female; August 26, 1887, Washington, D. C. Contents: One Noctuid larva (*Lamphygma frugiperda*); One Perlid; one Psocus; four small ants (*Monomorium pharaonis*).

No. 6229.—Female; August 29, 1887, Washington, D. C. Contents: One Hymenopteron (*Tiphia* sp.); one flea-beetle (*Chætocnema denticulata*).

No. 6256.—Female; September 3, 1887, Washington, D. C. Contents: Very numerous specimens of flea-beetles (*Chætocnema denticulata*).

No. 6267.—Female; September 5, 1887, Washington, D. C. Contents: Remains of several small locusts, the species not recognizable.

### HABITS OF THE INSECTS CONCERNED.

#### Order HYMENOPTERA.

HALICTUS sp.—Contained in Nos. 6025 and 6090.

There are numerous species of these small bees (fam. *Andrenidæ*) throughout the United States. They excavate cells in the soil of grassy fields, which cells are reached by a perpendicular burrow from six to twelve inches in depth. Each cell is filled by a lump of pollen the size and shape of a pea, upon which a single egg is deposited. The transformations take place within this cell. The mature insects feed upon pollen, are agents in fertilizing flowers, and therefore rather beneficial than harmful to man. As they are quite slow in their motions, especially in early morning or after a rain, they are readily captured.

TIPHIA sp., without much doubt *inornata* Say.—In ten stomachs, viz, Nos. 5526, 5532, 5545, 5662, 5693, 6026, 6091, 6093, 6164, and 6229 occur the remains of a *Tiphia*, family *Scoliidæ*. All the remains are in such a condition that the species can not be recognized with certainty, especially as they are separated on very trifling characters.

The life-history of *T. inornata* is recorded by me (6th Rep. Ins. Mo., 123). The black and rather hirsute wasp frequents flowers in open places. The females are enabled by their strong legs to dig into the soil, which they do in search of food for their offspring. This food consists of the larvæ of May-beetles (fam. *Scarabæidæ*), the so-called "white grubs," that of *Lachnosterna fusca* being particularly attacked. An egg laid upon or near the grub soon produces the wasp larva, which bodily devours its victim, leaving only the brown and horny head, which is almost invariably found fastened to the outside of a fine silken cocoon of a gold-brown color, and composed of many layers, made by the mature larva for transformation. *Tiphia* is therefore beneficial to man, and from the fact that it burrows in open places, such as lawns, gardens, and meadows, it is easily discovered by birds.

MYZINE SEXCINCTA Fab.—This brightly colored wasp, a member of the family *Scoliidæ*, occurred in the contents of many of the stomachs. The identification was made easy by the fact that the birds had chiefly taken the males which have a peculiar anal armature, consisting of three strong chitinous spines, too hard to be ground up or broken by the numerous pebbles almost always present in the stomachs. In no less than thirty cases, viz, Nos. 152, 5705, 5712, 5713, 5720, 5940, 5941, 5945, 5946, 5951, 5953, 5970, 5971, 5972, 5975, 5976, 5977, 5982, 6000, 6010, 6021, 6025, 6088, 6092, 6109, 6112, 6134, 6141, 6161, and 6163, either one, two, or several specimens were found.

This species of *Myzine* is very common throughout the Atlantic States and is usually seen flying low over sandy places. Its life-history has not been recorded, but we may safely infer for it a parasitic habit similar to that of *Tiphia*.

One reason why the Sparrows have been able to secure so many specimens of this

wasp is to be found in a peculiar habit which the latter possesses. During rainy or dark days and also towards evening, many specimens congregate and sleep together upon stems of low herbaceous plants by securely fastening their mandibles into the stems, and in this condition they are easily secured.

ANTS.—In eight stomachs specimens of various species of ants were found.

No. 5532 contained 2 ants belonging to the genus *Solenopsis*, family *Myrmicidæ*. These small ants live in open places, forming nests of various sizes below the surface of the soil, in which they store food, usually the seeds of various kinds of grasses.

No. 5967 contained 2 females of the minute *Brachymyrmex heeri*, Forel, family *Formicidæ*. These ants are always found under stones and the females were probably caught while swarming and away from their nest.

Nos. 5975, 5976, and 6093 contained, together, thirteen specimens of the very small yellow ant (*Monomorium pharaonis* Linn.), family *Myrmicidæ*. These ants are very often troublesome in our houses, but are found as well in open places, in gardens, or fields. They are almost omnivorous, and eat all kinds of food found in the house and field, thus causing injury, though more frequently great annoyance, as it is very difficult to eradicate them if once domiciled.

Nos. 5971, 6004, and 6093 contained each the remains of one ant, too much broken and distorted to enable identification.

ICHNEUMONIDS.—The stomachs Nos. 5523 and 6087 contained each the broken legs of a hymenopterous insect apparently belonging to the family of *Ichneumonidæ*. The pieces are too small to enable one to even judge the genus. The *Ichneumonidæ* are well known to check the too rapid increase of plant-feeding insects.

HYLASPIS sp.—In No. 5532 was found one of these very peculiar and minute insects. It is a member of the family *Cynipidæ* and of the subfamily *Figitiinæ*, and is closely allied to *Hylaspis americana* Ashm. This little Hymenopteron belongs to the parasitic *Cynipidæ*; it has never been raised from its host, but is very likely parasitic upon the larvæ of a Sawfly.

UNDETERMINED HYMENOPTERA.—In the stomachs of Nos. 123, 5665, 5712, 6007, 6110, and 6153 were found the remains of as many Hymenoptera. These remains consist of very small pieces of the legs or abdominal segments too much broken or ground up by the accompanying sharp gravel to permit identification.

#### Order COLEOPTERA.

DIPLOTAXIS sp.—In stomach No. 5636 were found small pieces of a beetle belonging to this genus, allied to the chafers and destructive to vegetation. The species of *Diplotaxis* are never, however, very numerous. Nothing is known of the life-history of the genus.

APHODIUS FIMETARIUS L.—Three specimens of this beetle were found in stomachs Nos. 123, 3360, and 5636. The species is common to Europe and North America, and both larva and perfect beetle feed in the excrement of various animals and may be thus considered beneficial. The female beetle also stores some of the dung in burrows and deposits an egg upon the same, the larva hatching therefrom developing on the food thus stored up.

APHODIUS GRANARIUS L.—Two specimens of this beetle were found in stomachs 216 and 1552. This common species also occurs in Europe and North America, and has a very similar life-history.

LACHNOSTERNA, evidently FUSCA.—In the stomachs of 5526, 5528, 5529, 5548, 5972, and 6018 were found pieces, usually joints of legs, of the above beetle, and in stomach 1593 occurred four large larvæ of this beetle. It is not possible from the character of the fragments to determine the species of this rather difficult genus, but as some of the Sparrows were killed in the grounds of the Department of Agriculture, where *fusca* abounded at the time, and the parts otherwise correspond, the probabilities are all in favor of their belonging to this common species.

These beetles, produced from the well-known White-grubs, are sometimes very inju-

rious to our forest and shade trees, chiefly the oaks, and in certain years strip them entirely. The greater damage, however, is done by the larva to strawberry plants, lawns, and meadows. As the beetles retire during the day in the ground and are often but slightly covered with soil, they are easily captured.

LIOPUS sp.—The leg of one specimen of this Longicorn beetle was found in stomach 5712, not sufficient to determine the species. All the species live in the smaller dead branches and twigs of various forest trees, chiefly of hickory and oak. They are not found in healthy and living wood.

COLASPIS BRUNNEA Fab.—Two specimens of this beetle were found in stomachs 195 and 5701. It is very abundant throughout the Atlantic region of the United States and extends as far southwest as Arizona. It occurs in various forms, some of which have been distinguished by name. The variety *flavida* is distinctly distinguished by its bright-yellow color and prominent elevated ridges between the deeply punctured sutures; *costipennis* is a southern form and has the ridges tinted with metallic green. It riddles the leaves of the wild and cultivated grape-vine, greedily devours the leaves of strawberries, and is found upon a multitude of wild plants such as the *Potentilla*. Its life-history is recorded in my Third Annual Report on the Insects of Missouri (1871, pp. 81–84) and Fourth do. (1872, p. 34). The larva feeds on strawberry roots, among which it can be found all through the fall, winter, and spring months; assumes the pupa state in June, and the beetles appear during that month and continue to issue in decreasing numbers till toward fall.

CHRYSOMELID.—Very young larvæ, not recognizable with certainty, were found in stomach 16.

CHÆTOCNEMA DENTICULATA Ill.—Specimens of these beetles (about 40) were found in 12 different stomachs, viz: 5536, 5537, 5662, 5701, 5713, 5924, 5940, 5946, 5970, 6110, 6151, and 6229.

This beetle is very common in grassy places, and is found upon all kinds of low, herbaceous plants. Its life-history is not known, but we are justified in assuming that the larva is either a leaf-miner or subsists upon roots. From the fact that the beetle is numerous and that its life-history has not yet been discovered, it can hardly be classed among noxious insects.

Wings and legs of a small chrysomelid were found in stomach 97, but not of sufficient size to determine the species.

SITONES sp.—Stomach 196 contained two mutilated specimens of a snout-beetle of the above genus too much broken to identify specifically. This genus occurs all over the Northern Hemisphere, and the species are very difficult to classify if not perfectly fresh. Many of the North American species occur also in Europe, and are, perhaps, introduced. The life-history of several of these insects is known in Europe and the larvæ of some of them are said to make a cocoon like that made by *Phytonomus*; but the larvæ of most of them lead a subterranean life, and chiefly about the roots of clover and allied plants, sometimes doing more or less damage. The life-history of *Sitones flavescens* Allard is recorded by Mr. Webster in my last Annual Report (for 1886) as United States Entomologist (p. 580.) It occurs in autumn in the beetle state perforating the leaves of White Clover. The larva, of the usual Curculionid shape, is found among the roots of White Clover, and also bores into the crown, thus checking the growth of the plant or killing it outright. The pupa is found in a snug little cell amongst the roots.

SPHENOPHORUS PARVULUS.—Quite a number (at least 25) of the remains of this species were found in 19 different stomachs, viz: Nos. 2131, 2133, 5523, 5532, 5533, 5536, 5537, 5538, 5544, 5545, 5548, 5549, 5916, 5917, 5924, 5946, 5951, 6018, and 6089.

So far as known the species all burrow in the stems or roots of plants and, if numerous, do much damage to young corn. The life-history of *S. parvulus*, according to Mr. Lugger's observations and my own unpublished notes, is as follows: The mother beetle always selects the flower-stem of grasses and lays one or more eggs just above the second knot, which at this place is very soft and tender. The slit

made for the reception of the egg looks as if made with a saw, and particles of the torn fiber usually adhere to the spot. The plant becomes dwarfed and usually dries. The larvæ feed on and transform to perfect beetles among the matted roots. The life-history of the larger species, as *S. 13-punctatus* and *S. sculptilis* (stomachs 202 and 97 contained 3 of this species) and *S. robustus*, are given in my reports (Ins. Mo., III, p. 60, *ff*, and Rep. U. S. Ent. for 1881-'82, p. 138, *ff*).

Unrecognizable pieces of several small snout-beetles were found in stomachs 201 and 1593. In the latter two heads and the tip of one elytron could be recognized; in the former only small pieces of elytra.

#### Order LEPIDOPTERA.

**HYPHANTRIA CUNEA.**—A single specimen of this species was found in each of the stomachs 2132 and 6015. The caterpillar, usually called the "Fall Web-worm," is one of the worst defoliators of our city shade trees, and is fully treated of in my last Annual Report (for 1886) and in Bulletin No. 10 of the division.

**LAPHYGMA FRUGIPERDA.**—Larvæ of this species were found in stomachs Nos. 6108 (which contained 3) and 6204 (which contained 1).

It is sometimes very abundant, and because of its resemblance to the genuine Army Worm was named the "Fall Army Worm" in my Third Report on the Insects of Missouri (1870). It is a very general feeder, and in some seasons becomes quite destructive. It is fully treated of in my Annual Report to the Department for 1881-'82.

**CRAMBUS** sp.—Stomach No. 6162 contained a larva of a species of *Crambus*, but not in a condition to determine the species.

Many species of this genus of moths are found throughout the United States, confining their attacks chiefly to the various kinds of wild and cultivated grasses and only occasionally proving injurious. The larvæ subsist upon the roots, and form in the soil galleries lined with silk. The full life-history of *C. vulgivagellus* is given in my Report as United States Entomologist for 1881-'82.

**PYRALID.**—Stomach No. 2132 contained a small female moth belonging to the family *Pyralidæ*, but the material was insufficient to permit determination even of the genus. The species of the family feed, as a rule, on vegetation, and some are injurious to cultivated crops.

**JAWS OF CATERPILLARS.**—The contents of Nos. 97, 2132, 6012, and 6089 show 11 jaws that belong to lepidopterous larvæ.

#### Suborder HETEROPTERA.

Very small pieces of the elytra, or thorax, of a species of the suborder Heteroptera were found in stomachs 289, 5720, and 6153. It is impossible to even identify the genus, but the pieces appear to be derived either from a *Podisus* or a *Euschistus*, both containing useful insects, which destroy numerous caterpillars by sucking them to death.

#### Suborder HOMOPTERA.

**ERYTHRONEURA** sp.—Stomachs Nos. 5954 and 5967 contained two specimens of a little Leaf-hopper belonging to the above genus.

Species of this genus are very numerous in our meadows, gardens, fields, and vineyards, and in the latter case do much damage.

Stomach No. 5544 contained one larva of a Leaf-hopper.

#### Order DIPTERA.

**BLUE-BOTTLE FLY** (*Musca cæsar* Linn.).—The pupæ of two, perhaps three, specimens of a Blow-fly occur in stomach No. 5542. They were evidently picked up with the partially-digested grain found in the droppings of a horse. The species, in rapidly removing decayed matter, renders good service to man and must be considered bene-

ficial. Its larvæ or maggots feed in all kinds of offal and putrid matter, and when full-grown contract to coarctate pupæ which are usually found in the ground, but frequently in the manure itself.

HOUSE-FLY (*Musca domestica*).—Stomach No. 5676 contained six house flies, and numerous more or less mature eggs of the same. The larvæ or maggots feed entirely upon decaying animal and vegetal matter.

#### Order ORTHOPTERA.

XIPHIDIUM sp.—A single young specimen of a species of the above genus of Meadow Grasshoppers was found in stomach No. 195.

The members of this genus of the *Locustidæ* are all distinguished by their small size and by a nearly straight ovipositor. Like their near relatives, the Katydid, they feed chiefly upon leaves of various kinds, but do not refuse succulent insects, as young caterpillars. The genus is common in our fields and gardens, where their shrill noise is frequently heard during the late summer or fall. They make longitudinal punctures in the pith of plants for the reception of the slender, elongate eggs.

GRYLLOTALPA sp.—One leg of the Mole-cricket was found in stomach 5973. Members of this genus are usually considered noxious, because they raise ridges in constructing their subterranean galleries, thus exposing the roots of grass and other plants. Yet their food consists very largely of other insects. The Mole-crickets are characterized by their enlarged fossorial fore feet, which recall those of the mole in shape, being stout, short, flattened, and armed with very hard and pointed projections.

CALOPTENUS sp.—Three undoubted pupæ of a small species of Caloptenus, probably of *femur-rubrum*, were found in stomachs Nos. 152 and 195. Also several unrecognizable remains of perhaps the same species in Nos. 6134 and 6267. This species, so closely allied to its Western relative, the destructive *C. spretus*, is more or less numerous every year, though it does but slight damage compared with its Western congener.

In stomach 152 a large specimen of *Caloptenus differentialis* was found. This is one of the largest of our common locusts. The First and Second Reports of the United States Entomological Commission are devoted to these destructive locusts.

TETTIX sp.—The remains of a single specimen of this small locust were found in stomach 195. This Sparrow had evidently acquired a taste for orthopterous insects, as three specimens of three different genera were eaten by it.

The species of this genus are all relatively small, and though common in many localities, are not known to occasion any great damage to our crops. Most of them are found along the edges of our forests and orchards between the dead leaves, and are well protected in such places by their dark brown or gray color, which resembles that of their surroundings.

#### Order NEUROPTERA.

PERLID.—Stomach No. 6204 contained the remains of a neuropterous insect which belongs to the family *Perlidae*.

Members of this family spend their early stages in rivers under stones. The adults are frequently found resting on leaves in low damp places. Since the introduction of the electric light for illuminating our streets large numbers of these insects are attracted thereto.

PSOCUS sp.—Two specimens of *Psocus* were found in stomachs Nos. 6109 and 6204. *Psocus* species are numerous and found almost anywhere. They are sometimes very numerous in our yards and gardens, hiding between and under all kinds of rubbish, but are essentially innoxious. The species found can not be determined, owing to its poor condition. It is remarkable that both escaped the grinding action of the numerous pieces of gravel in the stomach. Some species feed upon dry vegetal substances and lichens, while a few are found only in houses, and feed upon dry animal matter.

## ARACHNIDA.

SPIDERS.—A number of spiders, represented mostly by the legs, were found in five different stomachs, viz: Nos. 5532, 5533, 5537, 5545, and 5712. The remains of two species could be identified.

LYCOSA SCUTELLATA in No. 5533. This spider belongs to the wandering spiders, the members of which do not make a silken web to catch their food, but capture it by swiftness or by lying in ambush. It is quite abundant, frequenting fields, meadows, and gardens, and hides either under a stone, piece of wood, or any kind of rubbish, or dwells in holes made in the ground. As a general rule the female carries her egg-bag with her, and the newly-hatched spiders crowd upon the back of their mother until able to shift for themselves.

TARENTULA sp. occurred in No. 5532. This species has the same life history as the *Lycosa scutellata*, and occurs abundantly in similar places.

The habits of both are predaceous.

## SUMMARY FROM THE FOREGOING STATEMENTS.

It thus appears that of the one hundred and two stomachs submitted, ninety-two contained, besides gram, seeds, and gravel, the remains of insects, *i. e.*, ninety-two out of a total of five hundred and twenty-two examined or seventeen and six-tenths per cent. Ten stomachs only of those examined by me contained no insect remains. As a general rule the amount of animal food was but small compared with the vegetal food and gravel.

All of the principal orders of Hexapoda are represented in the remains recognized, as also some Arachnids, as follows:

	Stomachs.		Stomachs.
Hymenoptera .....	59	Neuroptera .....	3
Lepidoptera .....	8	Orthoptera .....	9
Hemiptera .....	6	Coleoptera .....	53
Diptera .....	2	Arachnida .....	5

All the insects found are species frequenting open lawns, gardens, parks, and similar places, and almost always found upon or near the ground. This may be partly explained, however, by the fact that, as Mr. Barrows informs me, more than five-sixths of the Sparrows which contained insects were shot in the Department grounds. They are all common and abundant and easily caught by the Sparrows whilst seeking vegetal food in their usual haunts.

The presence of a large amount of gravel, composed chiefly of such hard material as quartzite, and the angular scales of hard-burned brick, obtained from sidewalks, has the tendency to destroy the softer parts of the insects. Various seeds, when partly digested, greatly resemble the chitinous parts of insects, and are apt to mislead when imbedded in the glutinous material derived from the ground-up portion of grains or when covered by small particles of straw, which are always present, and which in course of time become so transparent by constant grinding and digestive action that they look like the wings of small insects. Pieces of the discolored leaves of the Mullein (*Verbascum thapsus* Linn.),



distinguishable by the stellate hairs upon their surface, are also readily mistaken for pieces of the elytra of some beetles and true bugs.

As may be gathered from the statement of their habits the insects taken from the Sparrows in question are represented most numerous by what may be called innoxious species, *i. e.*, species which do no particular harm to the agriculturist and, directly, but little good. Most of the Hymenoptera and the Arachnida, however, are indirectly beneficial, as are several of the Heteroptera. Even among the Coleoptera the innoxious outnumber the noxious species, and the good done by the birds in destroying the few Orthoptera and Lepidoptera is about counterbalanced by the number of species taken which are directly or indirectly beneficial to the farmer.

When it is considered that during the very year in which most of these birds were shot the shade trees of Washington were suffering from several insect defoliators, and that out of the four different species but two specimens of one of them, viz, *Hyphantria cunea*, were taken by the Sparrows, there can be no more eloquent comment on the bird's uselessness in protecting vegetation from insect injury. Not a single specimen of the Imported Elm-leaf Beetle, the Bag Worm, or the White-marked Tussock-moth was taken in any stage, and these facts correspond entirely with what I have stated in Bulletin No. 10, Entomological Division, published last year. In this connection it may be of interest, as Dr. Merriam has alluded to the subject at length in his report of last year, to repeat a letter, bearing on this particular point, which I wrote to Dr. Elliott Coues in 1878, and which, published, I believe, in one of the reports of the District Commissioners, has been lost sight of by naturalists. It shows the replacement of *Paleacrita* by *Orgyia* through the Sparrow's instrumentality, just as, four years earlier, Le Conte had shown, through similar agency, the replacement of *Ennomos* by *Orgyia*. It is as follows:

ANENT THE ENGLISH SPARROW.

MY DEAR DR. COUES: I notice by a recent article in one of our morning papers that Prof. T. M. Brewer, of Boston, Mass., has addressed a letter to our District Commissioners on the subject of the English Sparrows, in which he seems to animadvert pretty strongly on the position which you have taken in reference to this sparrow question. I do not fully know what recommendation with reference to this bird you have made to the Commissioners, nor do I wish to enter into the controversy that has been for some time going on between the bird's condemners and defenders; but there is an entomological phase of the question, which appears to be entirely overlooked by the latter class.

The English Sparrow was introduced ostensibly as a means of freeing the shade trees of some of our New England cities, and especially the elms, of that rather annoying pest, the well-known Canker-worm, and, more particularly, the species which I have designated as the Spring Canker-worm (*Paleacrita vernata*), to distinguish it from another species long confounded with it, but occurring later in the season. It is well known that this Spring Canker-worm was for many years a grievous nuisance, not only because of the injury it did to elms and other shade trees, but because it was continually spinning down upon persons who happened to be passing under infested trees. Its annoyances and injuries were, however, confined to some five or

six weeks of the early part of the growing season, nothing being seen of it during summer and fall, as the worm descended into the ground to undergo its transformations. On account of the apterous nature of the female moth, the injuries of the species are also easily prevented, since tarred bandages or troughs of oil around the trunk of a tree will prevent her ascent as she issues from the ground in early spring. Such troughs were, indeed, at one time in such common use for this purpose in Boston, Cambridge, and Philadelphia that when, some years ago, the elm trees in Baltimore were found to be defoliated, the authorities at once ordered them to be similarly treated. The city fathers found out afterwards that they had paid dearly for their haste and want of special knowledge in that their trees were suffering, not from the Canker-worm, but from an Imported Elm-leaf Beetle (*Galeruca californiensis*), which, having wings in both sexes, was not affected by the troughs. But, to come back to the Sparrows. They did, according to report, accomplish some good in clearing off the Canker-worm, though during late visits to Cambridge and other cities adorned with grand old elms, I found the tarred bandages still in use, thus indicating that our imported "Spatz" was not a perfect antidote for the evil. The interesting point, however, to which I wish to call your attention is that while the Canker-worm has been kept more or less in check by the activity of these saucy little birds, another insect, formerly scarcely noticed, has taken its place. Not only during the spring months, but throughout the growing season, the people are now annoyed by the hairy larva of the White-marked Tussock-moth (*Orgyia leucostigma*), there being several generations annually. This is a prettier creature to look at, but it has the same unpleasant faculty of dropping upon passers-by as had the plainer Canker-worm. The female is also like that of the Canker-worm, wingless, but the transformations of the species take place *above* ground, and she lays her eggs upon the outside of her cocoon, so that there is no such simple and available preventive in this case as in the other. Moreover, the Tussock-moth is much the more general feeder, and occurs on some trees which the Canker-worm never affected. As a consequence, this hairy worm has in many places become a greater scourge than was formerly the Canker-worm. It not only defoliates the trees, but covers and defaces them with its cocoons, which it also plasters upon fences, railings, and even houses.

I have been quite interested in observing the unprecedented multiplication of this hairy worm since the English Sparrow became so abundant, and we may well ask, in the expressive language of the time, "does protection protect?" There is nothing very surprising in these facts, because they are very much what naturalists expected. You can not encourage the undue multiplication of any one species of animal without causing a decrease of some other species, and the opposite of this proposition holds equally true. The hairy larva spoken of is distasteful to the Sparrow. The multiplication of this bird, in causing a decrease in the Canker-worms, presents a wider field for the Tussock-moth, and diminishes the competition in the struggle for existence which this last, like all creatures, is subject to. The same increase of the Sparrows necessitates a decrease of the native birds, some of which, doubtless, fed upon the Tussock-moth, and notwithstanding Professor Brewer's assertion to the contrary, I think the evidence shows such to have been the case.

Believe me, yours, very truly,

C. V. RILEY.

WASHINGTON, D. C.,

December 16, 1878.

It were premature to generalize from the study of the material so far examined, which I hope is but the beginning of a more extended study. For this purpose it is desirable that stomachs should be obtained from as many different parts of the country as possible, and especially during the spring of the year, when the bird probably takes the largest part of its insect food. Exact location and date are very essential, as this Spar-

row is known to vary its habit according to season and circumstance. The 17.6 per cent. of the stomachs examined at the Department which contained insect food is probably larger than it otherwise would be, had it not been the custom, as Mr. Barrows informs me, of himself and Dr. Fisher, in shooting the birds, to choose rather those which were not feeding in the road. I do not know of any fact that more strongly indicates the relative uselessness in destroying injurious insects of the Sparrow as compared with many native birds which it drives away, than by a comparison of the insect food taken by a single Cuckoo (*Coccyzus americanus*). The stomach contents of a single female (Dr. Merriam's record No. 6333) shot in Washington, June 22, 1887, contained about 250 half-grown Web-worms (*Hyphantria cunea*) of the first brood, 1 large Cerambycid beetle (*Romaleum atomarium*) and its eggs, 1 large plant-bug (*Nezara hiliaris*), and 1 Snail (*Helix alternata*), while in bulk the contents in this case rather exceeded the combined insect contents of the 522 Sparrow stomachs examined.

Considering how common the bird has been for centuries in Europe, and now is in most parts of the world, it is remarkable that so few thorough investigations into its insectivorous habits have been made, by which I mean a proper determination and analysis of the insects themselves from an agricultural standpoint.

The results of studies that have been made by others are somewhat contradictory, some examiners finding a large percentage of insect remains, others finding none; but in no instance that I am aware of has there been any attempt to analyze the nature of the insect food from the standpoint of beneficial or injurious to the farmer and fruit-grower.

#### SURVEY OF LATER WORK DONE IN EUROPE.

George Roberts, in *Hardwicke's Science Gossip*, 1883 (p. 217), mentions Mr. A. Willis, of Sandas, as having made a series of examinations of the stomachs of Sparrows in 1882. In 87 stomachs insects were found in only 8 cases, and he concludes that the bird is a superabundant and injurious species, and that it is the bounden duty of men to take all possible means to lessen its ever-increasing numbers.

From the "evidence submitted to the select committee on (British) wild birds protection," obtained in 1873, many interesting points about the habits of the House Sparrow can be learned. As far as actual dissections are concerned it seems that comparatively few were made, and some of the other statements are but vague. The following is a résumé of the dissections:

The statements of Mr. Champion Russell (p. 12) have been published in book form and will be mentioned later.

Prof. Alfred Newton, M. A., F. R. S., in a prophetic way, thinks that persons introducing the Sparrows into new places will soon find out their mistake.

Mr. C. O. Groome Napier thinks them the most objectionable English

bird. He mentioned an exhibition of 100 stomachs of young Sparrows by Dr. Edwards Crisp before the British Association at Birmingham in 1865. Not 5 per cent. of them contained insect food.

Rev. J. Pemberton Bartlett opened the crops of the young, and found that at certain times they were full of insects, while at other times they contained only vegetable food, or a mixture of both.

Mr. George Swaysland killed many nestling Sparrows, and generally found grubs in their stomachs, or little beetles that run across the foot-paths.

Mr. John Cordeaux opened the crops of 35 young Sparrows of various ages, and on an average found two parts of soft grain and one part of insects.

Mr. James Pertwee says the Sparrow is utterly bad. His gooseberry and currant bushes have their leaves eaten up, notwithstanding the numerous Sparrows in close vicinity.

An important European work to be mentioned in this connection is "The House Sparrow," by an ornithologist, J. H. Gurney, jr., including chapters by "a Friend of the Farmers," Col. C. Russell; and "The English Sparrow in America," by Dr. Elliott Coues. (London: William Wesley & Son, 1885.)

Mr. Gurney gives in a tabular form the results of many dissections made during a whole year, both of adult and juvenile specimens. He writes: "To give a summary of this table in a few words, it may be said that about 75 per cent. of an adult Sparrow's food during its life is corn (meaning wheat and small grains) of some kind. The remaining 25 per cent. may be divided as follows:

	Per cent.		Per cent.
Seeds of weeds.....	10	Caterpillars .....	2
Green peas.....	4	Insects which fly.....	1
Beetles.....	3	Other things .....	5

"In young Sparrows not more than 40 per cent. is corn, while about 40 per cent. consists of caterpillars, and 10 per cent. of small beetles. This is up to the age of sixteen days. Where green peas abound, as in market gardens, they form a much larger proportion of the Sparrow's food than the 4 per cent. here stated." He further states that young Sparrows in the nest are generally fed on caterpillars and other insects, particularly in August, yet a good many were opened in June and July without finding such food. He feels sure that, while very young, their diet is quite as much unripe grain and vegetable matter as caterpillars.

Col. C. Russell collected Sparrows from a wide extent of country to examine the contents of their stomachs. He found that the Sparrows destroyed even fewer insects than he had supposed. "The food in the old ones was almost all corn during the whole year; green peas were also found in them in summer; and in May and June, when corn is scarce, a few wild seeds, chiefly of grass. No insect has been found by me in a Sparrow between September and March. I have not often found

one at any season (particularly between June and March) in a Sparrow old enough to feed itself, and have very seldom found any number of insects in one even when corn could scarcely be got." Speaking broadly, he continues: "It may be said that, unless very near houses and roads, Sparrows take no insects in the fields. Fifty old Sparrows, and young ones which could feed themselves, were killed one summer about my buildings and garden, with food in their crops. This food, carefully examined (as in all cases, with a lens), was found to be corn, milky, green, and ripe, and sometimes green peas from my garden; only two small insects were found in the whole number. The food in them has been much the same every year. On the whole, the deduction from the food test during fifteen years seems to be that the Sparrows are useless, and that the insects which would be given to their young by them if they were allowed to live in numbers about my premises would be so much food taken, when they most want it, from better birds which live entirely, or nearly so, on insects, and thus keep them, especially caterpillars, down so effectively in the absence of Sparrows that, when a chance pair of these come and build, there are few of their favorite sorts for them."

Dr. Schleh, of Herford, Germany, in his "Nutzen und Schaden des Sperlings im Haushalte der Natur," as quoted by E. Ingersoll in *Science* (Vol. VII, p. 80, January 22, 1886), says that young Sparrows, while in the nest and for a week after having left it, subsist entirely on insects, grubs, etc. Two weeks after leaving the nest their food still consists of 43 per cent. of animal food; a week later of 31 per cent., and after that age of only 19 per cent. As soon as independent they prefer seeds." He is one of the few authors who believe the Sparrow to be beneficial, but, so far as I can learn, he assumes all insects to be noxious.

#### REVIEW OF WORK DONE IN NORTH AMERICA.

Peter Henderson, of Bergen City, N. J., in his book on "Practical Floriculture," says (p. 173) that in the summer of 1866 acres of young rose bushes were attacked by slugs (*Selandria*) and *Aphis*, but that in 1868 a whole army of thousands of English Sparrows acted as volunteer exterminators. One Sparrow was shot, and his crop contained seeds, *Selandria*, and *Aphis* in great abundance. No one has a higher appreciation of Mr. Henderson's practical knowledge of gardening and the nursery business generally, but knowing how often the rose slug and the rose *Aphis* disappear suddenly in summer time from natural causes, my old-time friend will pardon a doubt as to whether the Sparrow deserved the full credit which he gives it.

My late friend, Dr. John L. LeConte, in 1874 gave an interesting account (see abstract Proc. Am. Asso. Adv., vol. 23, p. 44) of the replacement of *Ennomos subsignaria*, a span-worm that had been very injurious to shade trees in Philadelphia and other cities, by *Orgyia leucostigma*, through the Sparrows eating the former and avoiding the latter, just as

in the letter already quoted I subsequently showed to be the case with *Paleacrita* and *Orgyia* through the same agency.

Dr. John Dixwell dissected the stomachs of 39 Sparrows shot at the height of the canker-worm season in Boston, with the result (*Boston Daily Advertiser*, March 7, 1878) that no insects were found.

Dr. H. A. Hagen, in an article published in the *American Agriculturist* for May, 1878, fully discusses the question of the bird's usefulness, quoting various old European writers *pro* and *con*, as T. F. Bock in 1784, F. M. Bechstein in 1795, as well as later writers like C. W. L. Gloger. Dr. Hagen argues strongly in favor of the bird from a utilitarian standpoint, but brings forth no new positive evidence of an original character.

Dr. C. J. Maynard, in the *Scientific Farmer* for March, 1879, records the results of fifty-six dissections made from September 17 to October 10, all of the birds having been shot in the city of Boston, and including both young and old. He gives a very full statement, together with a description with illustrations of the structure of the stomach of the Sparrow, and it is somewhat surprising that he found no insect remains in these fifty-six stomachs.

In *Forest and Stream* (Vol. XII, p. 424, July 3, 1879) is quoted a statement of the Elizabeth (N. J.) Journal, to the effect that the English Sparrows had been observed eating immense numbers of winged ants. It mentions another observation where a Sparrow had eaten a maimed hornet.

The same journal (Vol. XXIX, p. 164, September 22, 1887) states that web caterpillars (doubtless *Hyphantria* is meant), having become exceedingly numerous upon a Virginia Creeper in Sing Sing, N. Y., entirely denuded it and so exposed the roosts of the Sparrows that the birds had to give way and move their quarters.

In the *American Naturalist* (Vol. XV, pp. 392-393, 1881), Prof. S. A. Forbes, of Illinois, who has done the best work of any one in America on the relation of birds to insects, dissected twenty-five Sparrows killed during the month of September, in 1879 and 1880. He found the fragments of grain picked up on the streets, the seeds of a few of the commonest grasses, and traces of three locusts, the latter perhaps six per cent. of the food consumed. At the same time thirty per cent. of the food of the Robin, twenty per cent. of that of the Catbird, and ninety per cent. of that of the Bluebird consisted of insects.

Dr. B. H. Warren, of West Chester, Pa., in an essay read before the West Chester Mic. Soc., September 4, 1879, stated that of the autopsies of seventy-five Sparrows, made in 1878, seventy-three revealed solely grain and vegetable material. In the other two cases, the stomachs, which were distended with wheat, contained each a Coleopterous insect not specifically identified.

To disprove the claim that sparrows are graminivorous only in winter, when in order to sustain existence they are obliged to live on a grain

diet, he examined during the months of March, April, May, and June fifty specimens, of which number forty-seven showed cereal and vegetable food, one contained a single (unidentified) Coleopterous insect in conjunction with an abundance of wheat, and the two remaining birds were void of any nutritious matter.

He also examined the stomachs of one hundred and fourteen English Sparrows, between March 1, 1879, and June 12, 1882. Only five of these stomachs contained any traces of insects. These were:

No. 12, March 3, 1879.—One beetle (undetermined). No. 58, May 23, 1880 (young).—Apterous insects (unidentified). No. 74, September 13, 1880 (male adult).—One potato-beetle (probably *Doryphora 10-lineata*). No. 75, September 3, 1880 (male adult).—Diptera (unidentified). No. 112, June 12, 1882 (female adult).—Two diptera and three aptera (unidentified).

Mr. Charles Dury has given in the Cincinnati *Commercial Gazette*, of May 6, 1883, the results of the dissection of over fifty English Sparrows. One of the sparrows was killed April 28 in a cherry tree covered with insects; but the distended crop contained nothing but grain, and one infinitesimal portion of the skin of a Hemipterous insect. Five sparrows were killed by him March 25 in the Zoological Garden; they were found filled with grain and seed, and three contained minute portions of beetles. In all the others no insect remains were found.

Mr. Barrows has collected a number of records, of which the following have been submitted to me, as among the more reliable:

Mr. James Fletcher, Ottawa, Canada, examined about a dozen Sparrows, which were shot in the early part of March, before the beginning of spring weather; none of the specimens contained any food other than bread or crushed grain from horse droppings.

Dr. W. S. Strode, of Bernadotte, Fulton County, Ill., made a number of dissections during the months of August and September, 1887, the report of which has been sent in to Dr. Merriam. He found no insects. During the first half of August the food was made up almost entirely of wheat and rye, and occasionally a few weed seeds. In September grapes were the principal food; the Sparrows would insert their bills, suck out the juice and pulp, but discard the seeds.

One other instance, much more recent, of the study of the food-habits of this bird should be mentioned before I conclude. It is an examination of a large number of stomachs by Mr. W. Brodie, the results of which have been presented before the biological section of the Canadian Institute and published in separate sheet. Mr. Brodie found that out of forty-three stomachs taken from August 20 to September 13, twenty-seven contained remains of locusts, or so-called grasshoppers, and out of three hundred and seven stomachs in all collected from May 7, 1881, to September 20, 1887, one hundred and thirty-two contained insect remains, including for the most part locusts (fifty-eight cases, not including birds which he fed with them), among which the *Ædipoda carolina* and *Caloptenus femur-rubrum* were recognized. In four cases Coleoptera were found and referred to Carabidæ, and in seven others a

Geometrid larva not identified; in two others the pupa of a Dipteron and small Lepidopterous larvæ, and in two others spiders—none of the species identified.

My assistant, Mr. Otto Lugger, reports to me that during the month of May, 1883, in Baltimore, Md., he dissected twelve English Sparrows. They were all killed in the yard of his house, which is situated in the outskirts of the city, and at that time was in the close vicinity of many trees. The climbing roses in this yard, as well as in those of the neighboring gardens, were badly infested by one of the rose-slugs (*Selandria*), and the sparrows, which were in the habit of resting upon the bars supporting the roses, were killed to ascertain whether or not they had eaten any of the slugs. The dissections revealed no trace of these, and only the legs of two flies (*Muscidæ*) were discovered. The great bulk of food consisted of grain and flower-seeds of various kinds, taken from the very same yard. The only large pea eaten by the birds contained, snugly inclosed, a pea-weevil (*Bruchus pisi*).

The above constitute all the more reliable dissections that have been made; but Dr. Merriam has gathered together and submitted to me a very large number (five hundred and ninety-one) of reports not based on dissections, and made by persons who in some instances had seen the Sparrows feeding upon insects; in others not. It is exceedingly difficult to analyze these reports, which will be duly published by him.

Of these five hundred and ninety-one reports two hundred and sixty-seven are mainly favorable to the Sparrow, in the sense that all insects eaten are considered injurious; one hundred and thirty eight are unfavorable; one hundred and eight are indeterminate, and seventy-eight correspondents believe that insects are only eaten by the bird when forced to do so.

The following summary, prepared by Mr. Barrows, will convey a very good idea of the character of these reports. Only the more definite reports have been selected, and mainly those in which some attempt had been made to identify the insects, including also a certain number of dissections:

Kills canker-worms in large numbers.—A. C. Sheldon, New Haven, Conn.; R. D. Camp, New Haven, Conn.; W. B. Barrows, Middletown, Conn.

Does not kill cabbage-worms.—W. Holmead, Mount Pleasant, D. C.

Eats moths of fall web-worms.—J. Halley, Washington, D. C.

Feeds upon cabbage-worms, flies, ants, etc.—W. A. Porter, Alpharetta, Ga.

As a destroyer of caterpillars, it is a failure.—Hon. W. A. Harris, Atlanta, Ga.

Prefers Crickets and Grasshoppers.—Th. B. Lumpkin, Buena Vista, Ga.

Never touches Cabbage-worm or Cotton-worm.—J. H. Barnes, Griffin, Ga.

Probably eats many Bot-flies.—Dr. D. Berry, Carmi, Ill.

Feeds its young with insects for seven or eight days after hatching.—Jabez Webster, Centralia, Ill.

Eats an occasional Tobacco-worm and Grasshopper.—G. B. Holmes, Fernwood, Ill.

Seen to catch Army-worms by the thousand.—Charles Becker, Freeburgh, Ill.

Have not noticed it eating Army-worms or other injurious insects.—A. Gierschner, New Athens, Ill.



Carefully watched, where insects abound, but none eaten.—D. W. Brattin, Brazil, Ind.

Takes Cabbage-worms for its young.—Edw. Yenowine, Edwardsville, Ind.

Prefers moths to caterpillars.—Dr. W. Weber, Evansville, Ind.

Eats Potato-bug larvæ and Cabbage-worms to a small extent.—A. B. Ghere, Frankfort, Ind.

Eats Tent-caterpillars, Fall Web-worm larvæ, and Cabbage-worms.—W. H. Ragan, Greencastle, Ind.

Feeds upon Cabbage-worms.—George B. Byrum, Laconia, Ind.

Eats *Cicada septendecim* and grasshoppers (*Melanopus femur-rubrum*).—F. M. Webster, La Fayette, Ind.

Eats caterpillars.—James N. Payton and John B. Mitchell, New Albany, Ind.

Cabbage-worms destroyed, but not more than by other birds.—W. R. Stratford, Vevay, Ind.

Eats Leaf-rollers and beetles.—Dr. L. Millar, Belleview, Iowa.

Destroys large numbers of Codling-worms, larvæ of beetles and *Aphidæ*.—Howard Kingsbury, Burlington, Iowa.

Attacks a wounded grasshopper.—D. Y. Overton, Burlington, Iowa.

Destroys immense numbers of insects and worms of all kinds.—Max Kruskopf, Marshalltown, Iowa.

Eats the Bot-fly, Horse-fly, Melon-bugs, Grasshoppers, etc.—W. E. Dingman, Newton, Iowa.

Eats Canker-worms.—J. S. McCartney, Garnett, Kans.

Destroys Codling-moths and millers.—M. A. Page, Garnett, Kans.

Not seen to eat insects; does not touch the Maple-worm.—B. F. Smith, Lawrence, Kans.

Does not molest Maple-worms, even about its nest.—Dr. Charles P. Blachly, Manhattan, Kans.

Constantly on the ground in quest of insects.—Dr. W. S. Newlon, Oswego, Kans.

Eats Chinch-bugs, Army-worms, Grasshoppers, etc.—H. Heemey, Severance, Kans.

Trees filled with worms which the English Sparrows did not touch.—J. B. Stockton, Toronto, Kans.

Eats larvæ of every description, except those of Potato-beetle.—J. A. Terrell, Bloomfield, Ky.

Twenty-seven stomachs examined without finding bug or worm.—Postmaster, Bowling Green, Ky.

Feeds young on moths of hairy caterpillar.—Thomas S. Kennedy, Crescent Hill, Ky.

Eats Cabbage-worms especially.—E. W. Weathers, Elkton, Ky.

Catches Tobacco-moth and other moths and butterflies.—D. L. Adair, Hawesville, Ky.

The white caterpillar on shade trees has been nearly exterminated.—J. B. Nall, Louisville, Ky.

Eats army-worms, Cut-worms, and caterpillars on shade trees in large numbers.—A. P. Farnsley, Louisville, Ky.

Have dissected them often, but found no insects.—W. B. Berthoud, Baratavia, La.

Does not eat the Cotton-worm.—W. C. Percy, jr., Black Hawk, La.

“Insects remain undisturbed in its very roosting trees.”—L. E. Bentley, Donaldsonville, La.

Eats *Orgyia* caterpillars and many other insects.—George H. Berry, North Livermore, Me.

Does not eat *Orgyia*.—Everett Smith, Portland, Me.

Fifteen birds dissected, but only two contained animal food, and this was fragments of spiders.—N. C. Brown, Portland, Me.

Eats white-ants, flies, Cicadæ.—Otto Lugger, Baltimore, Md.

*Orgyia* and Canker-worms increase.—W. Brewster, Cambridge, Mass.

Canker-worms decrease, but not *Orgyia*. The Sparrow can not eat hairy caterpillars.—Dr. H. A. Hagen, Cambridge, Mass.

Canker-worms and spiders eaten in large numbers.—J. W. Pearson, Newton, Mass.  
Eats limited numbers of insects all the year.—Elisha Slade, Somerset, Mass.

Eats hundreds of Canker-worms.—Charles H. Andros, Taunton, Mass.

Never seen to eat insects.—John C. Cahoon, Taunton, Mass.

Marked benefit by eating Currant and Cabbage-worms.—F. O. Hellier, Grass Lake, Mich.

Have yet to see a single instance in which it is beneficial.—O. C. Smith, North Adams, Mich.

No bird here eats so few insects.—Norman A. Wood, Saline, Mich.

Feeds on Grasshoppers after breeding season is over; also eats Potato-bugs, etc.—George Stolworthy, Franklin Falls, N. H.

Does not eat *Orgyia* caterpillars.—David C. Voorhees, Blawenburgh, N. J.

Does not eat Vaporor moth (*Orgyia*) to any extent, if at all.—Marcus S. Crane, Caldwell, N. J.

Seven Sparrows dissected where Elm-leaf beetles were abundant contained no insects.—Marcus S. Crane, Caldwell, N. J.

Never touches insects; sixty dissections and not a trace of an insect.—H. B. Bailey, Orange, N. J.

Moths have their wings pulled off and are then let go.—Weldon F. Fosdick, Hackensack, N. J.

Many dissections, but not an insect. Canker-worm very prevalent, but not eaten.—Lloyd McKim, Garrison, Orange, N. J.

Eats Winged ants (*Termes flavipes*?).—W. J. Kenyon, Brooklyn, N. Y.

Eats Measuring worms (*Ennomos subsignaria*); not seen to take *Orgyia* moths or larvæ.—Hon. Nicolas Pike, Brooklyn, N. Y.

Eats Bot-flies, caterpillars, White Cabbage butterfly, *Cicindela*.—Prof. Chas. Linden, Buffalo, N. Y.

Once found a Currant-worm in crop of Sparrow.—Wm. M. McLachlan, Clyde, N. Y.

Army-worms devoured in immense numbers.—J. A. Perry, New York, N. Y.

Eats Currant-worms, ants, etc., but no hairy worms.—A. Church, New York, N. Y.

Eats Army-worm.—Henry M. Burtis, Port Washington, N. Y.

“Occasionally it catches a spider, fly, or some other insect.”—Dr. Alfred Hasbrouck, Poughkeepsie, N. Y.

Does not eat hairy caterpillars; *Orgyia* has increased.—H. Roy Gilbert, Rochester, N. Y.

Hundreds seen eating grasshoppers in a dry season.—Thomas Birt, Utica, N. Y.

Plant-lice eaten sometimes.—Prof. E. W. Claypole, Akron, Ohio.

Will not touch tree insects, however abundant.—W. Hubbell Fisher, Cincinnati, Ohio.

*Ephemera* eaten; elm-tree worms disregarded.—Dr. E. Sterling, Cleveland, Ohio.

Many dissections in autumn, but no sign of insects; Web-worms not touched, although very abundant.—W. B. Alwood, Columbus, Ohio.

Have watched closely, but have never seen one eat an insect.—E. W. Turner, Newton Falls, Ohio.

Eats Grasshoppers and seventeen-year Cicadæ.—R. H. Warder, North Bend, Ohio.

The Currant-worm has appeared since the Sparrow came.—S. Gray, Norwalk, Ohio.

Close observation shows no insects in its stomach.—Thos. Shroyer, Preston, Ohio.

Scale insects are eaten largely.—W. B. Hall, Wakeman, Ohio.

*Orgyia* abounds; Sparrow eats measuring worms and diurnal lepidoptera.—Thos. Meehan, Germantown, Pa.

Destroys millions of insect eggs and larvæ.—C. A. Green, Harrisburg, Pa.

Did not eat *Galeruca*, Web-worm, *Epilachna*, or *Lecanium*, which were abundant.—Dr. S. S. Rathvon, Lancaster, Pa.

Eats moths singed by gas, but fails to touch living Currant-worms close by.—Dr. R. L. Walker, Mansfield, Pa.

Numerous stomachs examined, but very few insects found.—Dr. H. D. Moore, New Lexington, Pa.

Out of 50 dissections in March, April, May and June, no insects but one beetle.—Dr. B. H. Warren, West Chester, Pa.

Eats young grasshoppers after oats are harvested.—B. F. Maxson, Westerly, R. I.

Does not disturb the Cotton-worms.—W. J. Hinson, James Island, S. C.

Eats maggots from dead animals.—W. T. Nixon, Lawrenceburgh, Tenn.

Does not destroy the Codling-moth.—James G. Kenney, Provo City, Utah.

Eats larvæ of Bot-flies.—Dr. Hiram A. Cutting, Lunenburg, Vt.

Feeding in large flocks on Grasshoppers.—George M. Neese, New Market, Va.

Does not eat caterpillars on the elm.—Col. Randolph Harrison, Richmond, Va.

Destroys Cabbage-worms and Tent-caterpillars.—Dr. J. R. Mathers, Buckhannon W. Va.

Noticed a few alight on webs of Tent-caterpillars.—John H. Strider, Halltown, W. Va.

Very destructive to Cabbage-worms (*Pieris rapæ*).—J. H. Shank, Hickory, W. Va.

Does not eat caterpillars on grape-vines and pear trees close to nest.—G. W. Knapp, Leon, W. Va.

Eats Grasshoppers and Katydid.—Z. L. Welman, Stoughton, Wis.

This list includes quite a number of injurious species, together with a fair proportion of beneficial and innoxious ones. In the majority of the cases, however, the observations are based on seeing the bird capture the insect, and this kind of information is always less reliable than that obtained from dissections. From a long experience in collecting entomological data through circularization I have learned how unreliable the reports are, except when the reporter has some special and expert knowledge.

Among the more injurious insects captured are instances of Bag worms, Rose-bugs, Tobacco-worms, Plum Curculio, "Codling-worm," Scale-insects, Aphididæ, Chinch-bugs, and Cabbage-worms. Now these are in almost all cases isolated instances, and granting the observations to be correct, they do not alter the fact, that where any of these insects have been common within, or in the neighborhood of, a city where the Sparrows are abundant, the birds have in no instance affected the power of the insects for harm. Hence such reports, unless they take into consideration all the facts bearing upon the subject, are misleading.

Four cases are mentioned where the larvæ of *Orgyia* and one where the larvæ of *Hyphantria* have been eaten. Such cases, even if isolated, are extremely interesting; but for the present must be disposed of in the same way as those just instanced. The cases where the bird is reported as taking Locusts (*Acrididæ*), Grasshoppers (*Locustidæ*), and the Army-worm and Cut-worms (*Noctuid larvæ*) are sufficiently numerous to show that in these directions the Sparrow in the country, and under conditions of scarcity of other kinds of food, might prove of considerable benefit. The same may be said of the Canker-worms, and some other smooth Geometrid larvæ, especially *Ennomos subsignaria*, which affect trees and shrubs.

One other instance may be mentioned where the Sparrow is more or less useful, because it is in a direction scarcely looked for. This is in the feeding on bot larvæ. There is sufficient evidence that in cities the bird enjoys these larvæ, which it picks up from the droppings of horses. The beneficial bearing of this fact is somewhat neutralized, however, by the other fact that on the paved streets of our cities the *Gastrophilus* larvæ rarely, if ever, succeed in transforming; but perish from inability to enter the ground.

We are thus justified in concluding that the bird will exceptionally feed upon almost any insect; but I am strongly inclined to believe that the deduction made from my own examinations will hold very generally true, and that, in cases where injurious insects have been fed upon, it is not by virtue of any insectivorous habit or specific preference, but by mere accident. Except in the cases of Locusts and meadow grasshoppers, some field insects, the Canker-worm, and some few other smooth worms which affect trees, there is no evidence that the bird, notwithstanding its great numbers, has been instrumental in checking any of our insect pests.

Two other circumstances for which there is sufficient evidence are worthy of mention as bearing on the question under discussion, viz, (1) the bird's tendency to take insects already damaged or dead; and (2) the fact that the old birds take insects for their young rather than for themselves.

Finally, the examinations, taken as a whole, show how thoroughly graminivorous or vegetarian the Sparrow is, as a rule, and I need not in this connection add, from my own experience or from that of others, to the verdict of "destructive" which Dr. Merriam has already so well established in his last report as Ornithologist to the Department of Agriculture.

In Australia and New Zealand the farmers have been forced to poison the birds by wholesale. Their most successful method is that of placing poisoned wheat in a bag with chaff, and allowing it to leak over the tail of the cart along the road. The Sparrows are destroyed by the bushel, and one paper (*Garden and Field*, of Adelaide, Nov., 1887, vol. 13, p. 76) published the following effusion, by the "Adelaide Poet Laureate," with which I would close this report:

What means this sadly plaintive wail,  
 Ye men of spades and ploughs and harrows?  
 Why are your faces wan and pale?  
 It is the everlasting sparrows.

We may demolish other pests  
 That devastate the farm and garden;  
 But spoiled by these voracious guests,  
 Our prospects are not worth a farden.

We can't defeat a foe like this  
 With gunshot or with bows and arrows;  
 We must resort to artifice  
 To cope with enemies like sparrows

Our level best we all have tried  
 With scarecrows, nets, and cunning cages,  
 Our utmost efforts they deride,  
 And spoil our fruit in all its stages.

Lift up your heads, your hearts lift up,  
 Resume your spades, your ploughs and harrows,  
 And while you drain the genial cup,  
 I'll tell you how to lick the sparrows.

No more your wasted fruits bewail,  
 Your crops destroyed of peas and marrows,  
 A cure there is that can not fail  
 To rid you of the hateful sparrows;

The remedy is at your feet,  
 Slay them and wheel them out in barrows,  
 Poisoned by Faulding's Phœnix wheat,  
 The one great antidote to sparrows.

---

#### TABLES OF FOOD AS SHOWN BY DISSECTION.

We conclude the discussion of the insect food of the Sparrow with tables giving the entire contents, so far as it was possible to determine them, of 522 stomachs dissected at the Department of Agriculture, and of 114 stomachs dissected at West Chester, Pa.

Of the number dissected at the Department of Agriculture, 338 were from birds killed in Washington, and many of these were examined within an hour or two after death. The remaining 184 stomachs were sent to Washington in alcohol. In all cases they were carefully examined in the Ornithological Division first, by Dr. A. K. Fisher, who identified and recorded their general contents. Subsequently those which contained any traces of insect remains, or in which the presence of such material was suspected (102 in all), were referred to the Entomological Division for further examination, and 92 were found to contain insect remains in greater or less abundance. From Professor Riley's report on this subject the data have been obtained for the insect columns in the following tables, which were prepared by Dr. A. K. Fisher, assistant ornithologist.

It is only necessary to say, in explanation of these tables, that a cross in any column indicates that the kind of food specified at the head of that column was found in the specimen against which the cross stands. No attempt was made to estimate the percentages of different kinds of food in the individual stomachs, except in the case of the insect food, to which reference has been made already.

