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SOME ADDITIONAL RECORDS OF CHIRONOMIDÆ FOR ILLINOIS AND NOTES ON OTHER ILLINOIS DIPTERA

BY

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ERRATA AND ADDENDA.

Page 50, second column, line 13 from bottom, for *Danais archippus* read *Anosia plexippus;* line 8 from bottom, for *mellifica* read *mellifera.*

Page 51, line 11 from bottom, for *Danais* read *Anosia.*

Page 159, at right of diagram, for *Bracon agrilli* read *Bracon agrili.*

Page 289, second column, last line but one, for *Scalops* real *Scalopus.*

Page 294, line 3, for *catcsbeana* read *catesbiana.*

Pages 327 and 330, line 12, for *orcus* read *oreas.*

Page 347, line 4, for Cecidomyidæ read Cecidomyiidæ.

Page 356, line 7, for Anthomyidæ read Anthomyiidæ.

Page 368, line 18, dele second word.

Page 373, after line 10 insert as follows: 53a, *subpruinosa* Casey, 1884, p. 38.

Page 375, after *submucida* Le Conte, 48, insert *subpruinosa* Casey, 53a.

Page 377, after line 7, insert as follows:—

1884. Casey, Thomas L.
Contributions to the Descriptive and Systematic Coleopterology of North America. Part I.

Page 379, line 11 from bottom, for *sensu lata* read *sensu lato.*

Page 382, line 12, for VII read VIII.

Page 408, line 2, for *the next article in* read *Article VIII of.*

Page 410, line 6 from bottom, for $=4$ read *'11.*

Page 412, line 7, for 31 read 30.

Page 421, line 17 from bottom, insert *it* before *grows.*

CONTENTS

ARTICLE IV.—*Some Additional Records of Chironomidæ for Illinois and Notes on other Illinois Diptera.* BY J. R. MALLOCH.

In a previous paper, Article 6 of Volume X of this Bulletin, I indicated that despite the fact that our state list of species of *Chironomidæ* is larger than any list yet published for any other state in the Union it could not be considered as a complete list of all the species occurring in Illinois. The greater portion of the material upon which the previous paper was based consisted of species collected by Mr. C. A. Hart and the writer during 1914, and containing, as it did, but a small series of collections from a number of scattered localities it could not be expected to include all of our species. Being aware of this fact and desirous of obtaining as many species as possible, the writer during the present year has devoted most of his spare time to collecting in the vicinity of White Heath, on the Sangamon River, with a view to completing the series of *Ceratopogoninæ* in the collection in so far as that particular locality is concerned. No material from this part of the Sangamon River was contained in that previously studied, though many of the species were obtained near Monticello, which is but a few miles down river from this point.

An attempt was also made to discover what species attacked man and at what particular time and in what situations. The writer endured considerable discomfort in his investigations, as mosquitoes were very numerous and bit very severely upon every occasion that he visited the river. In addition to the mosquitoes the writer had upon one occasion the experience of being bitten by the nymph of a capsid. It is not possible at present to determine the species of this insect beyond the fact that it is certainly not *Lygus pratensis*—a species which I have seen in the act of biting at Chain Bridge, Va., and which is recognized as having that proclivity.

Another source of annoyance was provided by the females of a small black bee (*Halictus* sp.), which persistently settled upon the bare arms, evidently attracted by the perspiration. On two days this species occurred in fair numbers and was very annoying, settling on the arms and being with difficulty brushed off. Judging from the actions of the insects they were sucking up the small particles of perspiration.

The worst discomfort experienced during 1915 at White Heath was that provided by "chiggers" (*Trombidium* sp.), which were in abundance—an unusual occurrence in this part of the state.

As the collection of *Chironomidæ* was but an incident in a rather overcrowded program, I found it impossible to do any work on the early stages of the aquatic forms, and the additional data obtained refer only to the habits of the imagines and to certain species which are either new to science or are not included in my previous paper.

Notes on Blood-sucking Ceratopogoninæ

In my previous paper I listed as blood-sucking species, *Culicoides varipennis, C. sanguisugus, C. hæmatopotus,* and *C. guttipennis,* the first two biting both man and cattle, the third biting man, and the last biting a horse. Before listing my records for this year it may be of interest to mention those given by Pratt in 1907 for this group*.

He lists six species as blood-sucking, viz., *Ceratopogon guttipennis, C. sanguisuga, C. stellifer, C. varipennis, C. cinctus,* and *C. unicolor.* All of these species were described by Coquillett, who placed them in the genus *Ceratopogon* (sens. lat.). All but *unicolor* belong to *Culicoides.* The generic position of *unicolor* is uncertain. It will be seen from a comparison of the two lists that four species recorded by Pratt are also in the Illinois list. This year, I have been able to find several additional biting species.

Culicoides guttipennis Coquillett†

In 1914 I did not succeed in obtaining specimens of this species attacking man, although well aware that it was considered as one of the most persistent biters in the genus. This year, however, upon different dates, I have obtained a large number of specimens in the act of biting. I found that by exposing the bare arm and settling quietly down by the side of the river I could readily obtain any number of specimens of this species. The exposed part, however, was not most subject to attack, as the insects appeared to settle much more readily upon the clothes, especially upon the legs, and almost invariably made their way up between the legs, or, when one was in a sitting posture, directed their efforts towards the under surface and particularly at the back of the knee if the leg were drawn up. It is obvious, of course, that in

*"Notes on 'Punkies'," Some Miscellaneous Results of the Work of the Bureau of Entomology—IX, Bull. 64, Part III, Bur. Ent., U. S. Dept. Agr. pp. 23–28.

†Citation to original publication is given only when species is not included in my previous paper.

attacking cattle the most vulnerable portions are best calculated to yield the best results to these small insects with their rather short mouth-parts, and that the most vulnerable parts are those near the upper extremities of the legs. I have found in the case of *Simuliidæ*, or black flies, that while they may be found upon almost any part of the body of a cow or horse they are more often found on the under surface of the body close to the leg or, in the case of the horse particularly, inside the ear—the most vulnerable spots.

The blood-sucking species of *Ceratopogoninæ* are mostly crepuscular in habit, and in most cases I found that during May and June the greatest numbers occurred after five o'clock in the afternoon, continuing active until 8 p. m. at least, this being the latest hour that it was possible for me to make observations. From experience at other times and in other localities I know, however, that the insects bite as late as 10 p. m. The earliest hour at which I found *guttipennis* biting was 1 p. m. On this occasion the sun was shining, but an hour or so later a short thunder storm occurred, the weather conditions very probably being responsible for the unusual occurrence of the species.

When in the act of biting it was not always easy to capture this species in a cyanide vial, as the insects were very readily disturbed, which is not the case with the smaller species, *biguttatus* and *sanguisugus*.

May 9, only one specimen was taken; on May 15 but two; while on May 30, thirty-five specimens were collected, all in the act of biting. On the first two dates *biguttatus* was the commonest species. On various dates in June and July *guttipennis* was found to occur commonly, but no large collection was made.

In my paper previously referred to I stated that the early stages of *guttipennis* were undescribed. Lest there should be any misunderstanding on this point it may be pertinent to indicate that meaningless figures of the larva and pupa accompanied by absolutely inadequate descriptions are given by Pratt in his paper referred to on a previous page.

Culicoides stellifer Coquillett

Two specimens of this species were taken in the act of biting the writer, August 8, 1915, on bank of Sangamon River, near White Heath.

Culicoides sanguisugus Coquillett

This species is found commonly in Urbana, large numbers of both sexes being taken on windows of stores in the city after the lights are turned on. I have also taken many specimens on the inner side of win-

dows of the Natural History Building of the University of Illinois, especially in the basement on windows close to the outer doors. Only three specimens of the species were taken in the act of biting on the dates that collections were made at White Heath, two of these being taken at the Sangamon River May 30, and the other at the railroad station in the town over a mile from the river. It appears from the rate of occurrence of this species in our collections that *sanguisugus* is more common in towns than *guttipennis* or *varipennis*.

Culicoides hæmatopotus Malloch

This species occurred along with *guttipennis* but in smaller numbers. It was taken biting on May 6, 9, and 30, and June 6. Some specimens were taken on windows of the Natural History Building also. Its biting habits are similar to those of *guttipennis*. The bite of both is less severe than that of *varipennis*.

Culicoides biguttatus Coquillett

Ceratopogon biguttatus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, p. 604.

This species is an addition to the Illinois list, the only specimens I had when I wrote my previous paper being from Virginia.

As an aid to the identification of the species it is necessary to indicate that in my key to the Illinois species* *biguttatus* will run down to No. 6. To include it, it is necessary to change the wording to read as follows:

6. Spots on wings indistinct; mesonotum without well-defined markings 6a
— Spots on wing rounded, clearly defined; mesonotum with well-defined brown markings 7
6a. Wings with only 2 clear spots, one over cross vein and the other at apex of third ..... *biguttatus*.
— Wings with several ill-defined clear marks in the posterior and anal cells along wing margin in addition to those over cross vein and at apex of third ..... *sanguisugus*.

Coquillett originally described *biguttatus* from specimens obtained in the District of Columbia. In Illinois the species occurred on the same dates as *guttipennis* and at the same place. The largest number taken biting on any one day was thirteen on May 15. This species attaches itself more firmly to the skin than does *guttipennis* and can be taken much more easily by inverting the cyanide vial over it when in

*Bull. Ill. State Lab. Nat. Hist., Vol. 10, Art. 6, p. 296.

the act of biting. In some cases the specimen succumbed to the fumes without relaxing its hold and had to be pried off. I took a single female on a window in the Natural History Building at Urbana July 25, 1915.

Pseudoculicoides griseus Coquillett

Ceratopogon griseus Coquillett, Proc. U. S. Nat. Mus., Vol. 23, 1901, p. 602.

A single specimen of this species was taken biting, on the bank of Sangamon River near White Heath on May 9.

I have a suspicion that the species which I described as *P. major** may be synonymous with *griseus*, but desire to obtain further material before definitely deciding, as I am of the opinion that there are several closely allied species in this genus, the differentiation of which will require careful study of a large amount of material.

There is no previous record of *griseus* biting man.

Ceratopogon peregrinus Johannsen

July 7, while collecting on tree trunks and limbs after a period of rain, I discovered a dead worm lodged on a branch of a cypress tree, its location and condition indicating that it had been dropped by a bird. When first seen there were several specimens of *Ceratopogon peregrinus* engaged in feeding upon it in company with a species of *Aphiochæta* and a female of *Lonchæa polita* Say. This occurred about noon, and about a dozen specimens in all were taken. One specimen that had just arrived and had only begun to feed, had the abdomen normal in size, but those that had been feeding for some time had the abdomen greatly distended. It was observed that all the specimens were females, and in one case the insect was seen inserting its proboscis in the minute drops of moisture on the leaves.

This species is very common both indoors and outdoors throughout the locality collected over, but no records of feeding habits other than the above have been obtained. An attempt was made to ascertain if the species would bite man by confining the females on the bare skin of the arm, but although this method has proven successful with some *Simuliidæ* that are not particularly prone to that habit it was unsuccessful with *peregrinus*. It may be of interest to mention that attempts to persuade several species of *Forcipomyia* to bite by allowing them to settle on the hands and arm and also by confining them on the skin by inverting a vessel over them, proved failures. I have not discovered any species of this genus attacking man or cattle.

*Loc. cit., p. 311.

Additions to List of Illinois Chironomidæ

Several of the species which were taken this year are new to science; others are new to the state list; while in some cases the males of known species are described herein for the first time, and in one instance the female is thus dealt with. In all instances care has been taken to indicate the characters by means of which the additions to our list may be separated from those already recorded by the writer. In considering the number of additions to the Illinois list it is necessary to include *Culicoides biguttatus* previously mentioned.

CERATOPOGONINÆ

Neoceratopogon, n. gen.

This genus is erected for the reception of *Ceratopogon bellus* Coquillett, a species unknown to me when my previous paper was written.

Generic characters: male.—Eyes narrowly separated above; antennæ elongate, plumose, apical 3 joints much longer than the preceding flagellar joints; legs slender; third hind tarsal joint short, slightly longer than fourth, the latter obcordate and with the third very slightly longer than fifth; claws small, slender, simple, subequal; empodium indistinguishable; wings with distinct hairs as in *Ceratopogon;* first and third veins fused, not connected by a cross vein as in *Ceratopogon;* media petiolate.

Female.—Eyes narrowly separated above; antennæ elongate, basal flagellar joints elongate, not nearly transverse as in *Ceratopogon,* apical five joints distinctly longer than preceding joints; tarsal claws unequal in size, the inner twice as long as the outer.

Type of genus, *Ceratopogon bellus* Coquillett.

Neoceratopogon bellus Coquillett

Ceratopogon bellus Coquillett, Proc. U. S. Nat. Mus., Vol. 25, 1902, p. 87. ♂

Female.—Yellowish white, opaque. Face brownish; upper part of head covered with white pruinescence; antennæ elongate and mouth parts brownish or yellowish. Disc of mesonotum covered with whitish pruinescence; a small brown spot at base of each discal hair; scutellum whitish, a black or brown streak on center; postnotum yellow. Abdomen yellowish or white above, fuscous on venter. Legs white, marked with fuscous or brown as follows: entire coxæ and trochanters, a broad median band on all femora and a very narrow one at apices; a narrow band near base on all tibiæ, a broad median band on fore pair,

a narrow one beyond middle on mid pair, a narrow one before and another beyond middle on hind pair, and the apices of all pairs, apices of tarsal joints, and whole of basal joint of hind tarsi. Wings with 8 small deep black spots as follows: on cross vein (sometimes paired), at apex of third vein, below middle of petiole of cubitus, near base of posterior branch of media and near apices of each branch of that vein and of cubitus. Halteres whitish, knob with a black spot.

Antennæ about 1.5 as long as head and thorax combined. Thoracic dorsum and scutellum with sparse rather long hairs. Legs slender; basal joint of hind tarsi slightly shorter than the remaining joints combined.

Male.—Agrees with the female in color.

Hypopygium large, projecting apical portion of lateral arm slender, curved.

Length, 1–1.5 mm.

Illinois locality, Urbana, July 5–7, 1915, several females at rest on cypress tree on university campus, one in Natural History Building, and one male on cypress tree; one female August 27, on cypress tree (J. R. Malloch).

This genus will run down to the second section of caption 3 in the key to genera of *Ceratopogoninæ* in my paper, and may be separated from *Ceratopogon*, the genus there included, by the fusion of the first and third veins of the wing, the absence of empodia, and the unequal tarsal claws in the female.

The early stages are unknown.

Forcipomyia elegantula, n. sp.

Female.—Pale yellow, marked with deep black. Head yellow, upper portion of back of head and the antennal flagellum fuscous, eyes black. Mesonotum slightly shining, with 3 glossy black vittæ, the median one bifid posteriorly and ending slightly beyond middle of disc, the lateral pair abbreviated and conspicuously broadened anteriorly, not extending to posterior margin; pleuræ with 3 shining black spots, one between fore and mid coxæ, directly above it, the upper extremity of which does not reach upper margin of pleuræ, and a third below wing base; scutellum and postnotum glossy black. Abdomen slightly shining, dorsum with anterior half of segments 2–5 and the whole of segment 6 blackened; venter yellow, blackened at apex. Legs whitish yellow, apical fourth of hind femora deep black. Wings grayish, surface hairs fuscous with the exception of a rather large patch over the apex of the third vein which is yellowish white. Hal-

teres pale yellow. Hairs on body and legs yellow, lanceolate hairs on the latter fuscous.

Eyes distinctly separated above; antennal flagellum with basal joints moniliform, sensory hairs of moderate length, thicker than the ordinary surface hairs. Mesonotum and scutellum with rather numerous long hairs. Legs with conspicuous hairs, all tibiæ with a dorsal series of lanceolate upright scales; basal joint of hind tarsi one fifth shorter than second; empodia distinct. Third vein ends at middle of wing.

Male.—Agrees in color with female.

The legs are devoid of the lanceolate hairs; the apical 4 antennal joints are elongated; the hypopygium is large and very similar to that of *specularis;* in other respects similar to female.

Length, .75 mm.

Type locality, Urbana, Ill., June 28, and August 5, 1915, taken on window in basement of Natural History Building, University of Illinois, by the writer. Allotype, August 12, 1915; same situation.

The type specimen has a large mite about two thirds as long as the abdomen, firmly attached to it near the base.

The female of this species will run down to caption 3 in my key to the Illinois species of this genus (p. 312), but may be readily separated from both species therein by the difference in coloration, and from *cilipes* by the possession of lanceolate scales on the fore tibiæ. The male can be separated from all others in my preceding paper by the yellow thorax with its conspicuous glossy black vittæ.

One female had a number of extruded eggs attached to the apex of abdomen. They are white, about three times as long as thick, slightly rounded at the extremities, and slightly curved in outline. They are closely attached to each other on their longer sides.

Euforcipomyia, n. gen.

Distinguished from *Forcipomyia* by having the basal joint of hind tarsi much longer than the second, and from *Pseudoculicoides* by the different structure of the antennæ, which is similar to that of *Forcipomyia.* In *Pseudoculicoides* the antenna of the female has the flagellar joints very appreciably constricted at apices, especially the apical 5, while in *Forcipomyia* and the present genus the joints are but slightly constricted and for a very short distance, never having a conical appearance as in *Pseudoculicoides.*

The wings are densely haired, but the hairs are slender and rather upright, more resembling those on the wings of *Pseudoculicoides* than on *Forcipomyia.* The first vein runs close to the third and is con-

nected with it by a cross vein and the media is petiolate. Empodia distinct.

Type of genus, *Euforcipomyia hirtipennis*, n. sp.

Key to Species

1. Basal joint of hind tarsus not twice as long as second (22:15) .... *hirtipennis.*
— Basal joint of hind tarsus at least twice as long as second 2
2. The short joints of antennal flagellum longer than broad, distinctly narrowed at bases, the segmentation very distinct; basal joint of hind tarsus twice as long as second (40:20) .....*longitarsis.*
— The short joints of antennal flagellum broader than long, closely fused, the segmentation indistinct; basal joint of hind tarsus about 2.5 times as long as second (37:15) .....*fusicornis.*

Euforcipomyia hirtipennis, n. sp.

Female.—Black, shining; abdomen more brownish, subopaque. Antennæ and mouth parts brownish. Legs yellow. Wings slightly grayish, covered with brown hairs. Halteres yellow. Hairs throughout on body and legs yellow.

Eyes slightly separated; antenna longer than head and thorax combined, the divisions between joints distinct throughout, basal 9 flagellar joints subequal in length, distinctly but not greatly longer than broad, hairs of moderate length, sensory organs longer than length of joints, slightly curved, apical 5 joints elongated, stout, their combined lengths less than that of basal 9, apex of last joint produced in the form of a short thorn. Thorax with long and rather sparse slender hairs, those on margin of scutellum very long. Abdomen with sparse short hairs. Legs of moderate strength; hind tibia and hind tarsus subequal in length; basal joint of hind tarsi about 1.5 as long as second (22:15); third joint slightly shorter than fourth, fourth and fifth subequal; claws small, subequal, simple; empodium as long as claws, fringed; surfaces of femora and tibiæ with numerous long hairs. Third vein ending a little beyond middle of wing, first ending one third from apex of third, connected with the latter by a cross vein at its middle; media with very short petiole, base of posterior branch indistinct; surface of wing with numerous microscopic upright hairs in addition to the long subdepressed hairs.

Length, .5 mm.

Type locality, Urbana, Ill., June 30, 1915, taken by the writer on the windows of the basement of the Natural History Building.

Nothing is known of the early stages or of the habits of the imago.

Euforcipomyia longitarsis, n. sp.

Female.—Fuscous. Mesonotum shining; pleuræ reddish brown. Legs testaceous or yellowish. Hairs on body and legs yellow; on wings brown.

Eyes contiguous; antenna about as long as head and thorax together, basal joints of flagellum longer than broad, narrowed at bases and more distinctly so at apices, apical 5 joints elongated; palpi 5-jointed. Mesonotum with pale decumbent hairs, those on lateral and posterior margins very long; scutellar hairs numerous, long and conspicuous. Abdomen with pale yellow hairs, those near the posterior lateral angles very long. Legs of moderate strength, with numerous slender hairs, those on dorsal surface of tibiæ very long; hind tibia about three fourths as long as hind tarsus; basal joint of hind tarsi twice as long as second, proportions of the first three joints, 40, 20, 15; empodium as long as claws. Wings densely haired throughout their entire surface; costa ending slightly before middle of wing; first and third veins almost fused basally, the former ending about two fifths from apex of latter; cubitus forking slightly beyond apex of third vein.

Length, .75 mm.

Type locality, Urbana, Ill., August 24, 1915, on basement window in Natural History Building, University of Illinois (J. R. Malloch).

Early stages and habits of adult unknown.

Euforcipomyia fusicornis Coquillett

Ceratopogon fusicornis Coquillett, Jour. N. Y. Ent. Soc., Vol. 23, 1905, p. 63.

Female.—Differs from *hirtipennis* in having the mesonotum with distinct brownish pruinescence, the antennæ almost black, and the legs brownish.

Eyes distinctly separated above; antenna not longer than head and thorax combined, basal joints of flagellum very distinctly shorter than broad, rather closely fused; apical five joints elongated. Mesonotum with sparse subdepressed golden hairs and a few longer upright ones intermixed. Legs of moderate strength; basal joint of hind tarsi about two and a half times as long as second (37:15), third distinctly shorter than second, fourth shorter than fifth; claws small, simple, equal; empodia as long as claws, fringed. Third vein ending distinctly beyond middle of wing, first slightly beyond middle of third, third and first almost fused; otherwise wings as in *hirtipennis*.

Length, .5 mm.

Type locality, Florida. I have seen a specimen from Beltsville, Md., July 4, 1915 (W. L. McAtee), which was taken attacking *Chauliodes* sp.

This species resembles rather closely some species of *Ceratopogon* but differs noticeably in possessing the long surface hairs in addition to the short upright ones on the wings. Several species of *Forcipomyia* have been recorded as attacking insects, and in the present paper I record a species of *Ceratopogon* feeding upon a worm.

Fusicornis has not been taken in Illinois and is added here for convenience of reference.

Johannsenomyia albibasis, n. sp.

Female.—Glossy black. Head black, face yellow, palpi pale yellow, proboscis reddish yellow. Thorax entirely glossy black, without pruinescence and with inconspicuous dark hairs which are very sparse on center of mesonotum. Abdomen shining, black apically, the basal 2 or 3 segments whitish. Legs yellowish white, blackened narrowly on fore knees and apices of fore and mid tibiæ, broadly on apices of mid and hind femora and hind tibiæ, the latter sometimes with dark suffusion to near base, apical joint of all tarsi black. Wings clear, veins of the basal half very pale, darker from middle to apex. Halteres yellowish, knob black.

Eyes distinctly separated above, antenna slightly longer than head and thorax together, second joint not much swollen, basal eight joints of flagellum distinctly longer than broad, apical five joints much more elongated than preceding joints. Legs slender, without spines or setulose hairs; fifth tarsal joint on all legs with 4 or 5 pairs of rather long ventral spines; tarsal claws long, subequal, each with short subbasal tooth. Wings of moderate width; third vein ends about one fifth from apex; first ends at two fifths from base of third, its last section distinctly shorter than the preceding one; media forks before cross vein; cubitus slightly beyond cross vein.

Male.—Differs from the female in having the antennæ yellowish, with dark plumes; the coxæ brownish, and the fore knees more noticeably blackened; the third vein ending slightly over three fourths from base of wing; the fifth tarsal joint without ventral spines; the tarsal claws much smaller and without the subbasal tooth.

Length: female, 2.5 mm.; male, 2 mm.

Type locality, White Heath, Ill., May 8–30, 1915 (J. R. Malloch).

This species will in the case of the female run down to section 13 in my key to the species of this genus in my recently published paper on the Chironomidæ of Illinois*, but is readily separated from the two species there given by the color. The male will run down to section 8 in the same key, but may also be separated from the two species with dark halteres by the color as well as several structural characters.

The species was very common at rest on the under side of leaves of trees and bushes bordering the Sangamon River. The male bears a striking resemblance to that of *Probezzia pallida* which occurred along with it.

PROBEZZIA INFUSCATA, n. sp.

Female.—Head black, face, proboscis, and palpi brownish yellow; basal half of antennæ pale yellow, apical half fuscous. Thorax glossy black, without any traces of pruinescence. Abdomen white or creamy, apical half infuscated except the 2 apical segments, which are whitish. Legs yellow, mid and hind coxæ fuscous, apical two fifths of femora, entire tibiæ, and apical two tarsal joints of all legs black. Wings, including the veins, whitish on basal half, apical half slightly infuscated, the veins blackish. Halteres brown, knobs black. Antennal hairs pale; thoracic setulæ black.

Eyes distinctly separated; second antennal joint rather small; basal flagellar joint nearly twice as long as second, all flagellar joints conspicuously longer than their diameter, entire length of antenna about one and a half times as long as head and thorax combined. Thoracic dorsum smooth, setulæ short and sparse; scutellar bristles short. Abdomen stout, without noticeable hairs. Legs slender, femora slightly swollen on apical third; tibiæ with rather noticeable setulose hairs; fourth tarsal joint of all legs obcordate; fifth joint with two series of ventral bristles; claws of moderate size, subequal, each with short subbasal tooth. Third vein ending slightly before apex of wing, first at two fifths from base of third; cubitus forking slightly proximad of cross vein.

Male.—Agrees with the female in color except that the abdomen is blackened from the base of third segment to apex with the exception of the hypopygium, which is yellowish. The wings are also less noticeably infuscated. The antennal plumes are yellowish white.

The second antennal joint is considerably larger than in the female and black in color. The fifth tarsal joint has no spines on the ventral surface; the claws are smaller and have no subbasal tooth. The third vein ends at five sixths the wing length, the first beyond middle of third, and cubitus forks under the cross vein.

*Bull. Ill. State Lab. Nat. Hist., Art. 6, Vol. 10, May, 1915.

Length: female, 4.5 mm.; male, 3–3.5 mm.

Type locality, White Heath, Ill., on bank of Sangamon River, May 9, 16, and 30, 1915 (J. R. Malloch).

The female of this species will run down to section 8 in my key to the species of *Probezzia* in the paper previously mentioned, and may be separated from *albiventris*, the only other described species with black halteres, by the infuscated abdomen, differently colored legs, and infuscated wings. The male will run down to section 14, and is readily separated from the species included therein by the dark halteres. The male of *albiventris* is not known, but must closely resemble that of *infuscata*.

The early stages and the habits of the imago are unknown.

TANYPINÆ

Tanypus carneus Fabricius

The only Illinois records I had of this species when I wrote my paper was that of a larva from the Illinois River. On June 18, 1915, I took a male imago on a window in the basement of the Natural History Building of the University of Illinois, at Urbana, which agrees with the description of the species in almost all respects, the only departure being in the color of the abdomen, which has a broad dark brown anterior band on all segments but the fourth, the latter being entirely whitish yellow. Single examples of the female were taken on July 21 and August 13. I have no doubt as to the identity of the species.

Descriptions of Males of Ceratopogoninæ previously unknown

Johannsenomyia argentata Loew

Male.—Glossy black. Head black, basal portion of flagellum of antennæ and their plumes fuscous, the latter with a whitish luster when viewed from certain angles; mouth parts brownish. Mesonotum without distinct pruinescence. Abdomen in some specimens with a faint hoary pruinescence when viewed from behind. Legs yellowish, mid and hind coxæ, apices of fore femora narrowly, of mid femora broadly, and almost the whole of hind femora, blackened, as also are the bases and apices of fore and mid tibiæ, the entire hind tibiæ, the apices of the basal four tarsal joints, and the whole of the fifth joint of all legs. Wings slightly grayish, radius and basal portion of upper fork of media blacker than other veins. Halteres black.

Eyes distinctly separated above; antennæ extending to beyond middle of abdomen. Hypopygium small, recurved, apical portion of lateral arm short and stout. Legs slender; fifth tarsal joint of hind legs with 2–3 pairs of ventral thorns, the other legs unarmed; tarsal claws short, subequal, with short basal tooth. Third vein ending at about four fifths the wing length, first slightly before middle of third.

Length, 2.5 mm.

Locality, White Heath, Ill., May 30, and July 11, 1915, on bank of Sangamon River (J. R. Malloch). I have also taken females of this species at White Heath June 26 and July 11, and Mr. Hart took it at St. Joseph June 27, 1915, neither of these localities being included in my previous paper.

The male of this species was unknown when I wrote my paper on the family, and this is the first published description of that sex. In my key to the genus it will run down to section 13; and from both the species contained therein it may be separated by the long antennæ and by its having only the hind tarsi with the fifth joint spined ventrally.

Probezzia pallida Malloch

Male.—Head brownish, eyes black, antennæ yellowish, plumes pale yellow, mouth parts almost white. Thorax varying from dark brown to deep black, shining. Abdomen white, apical half black or brown, hypopygium yellow. Legs almost white, last tarsal joint black. Wings white, veins pale yellow. Halteres yellow.

Eyes separated above; antenna longer than head and thorax combined. Mesonotum with four longitudinal rows of rather strong upright setulose hairs. Hypopygium rather large, not recurved, apical portion of lateral arm shorter than basal, strong and stout, clawlike. Legs of normal strength; fifth tarsal joint unarmed; claws small, subequal, simple. Third vein ending about four fifths from base of wing, first slightly before middle of third.

Length, 1.5 mm.

Locality, White Heath, Ill., May 9 and 16, 1915 (J. R. Malloch). A large series of this sex was taken on the under side of leaves of bushes and trees on the bank of the Sangamon River on the last-named date. The day was very windy, and the insects were resting on the sheltered side of the plants. I took two females also at White Heath on May 16, one of them from a spider's web; it was still alive when taken.

The male of *pallida* will run down to section 10 in my key to the species of this genus. It may be separated from all the species therein

by the fact that the legs are whitish and the fifth joint of all tarsi deep black. The other six species all have a greater proportion of the legs blackened.

I had a slight doubt about the identity of this sex as the male of *pallida* when I wrote the description, but since then I have examined a series of both sexes which were reared by Mr. R. A. Muttkowski from larvæ obtained in Wisconsin, and find that despite the unusual difference in color it is undoubtedly the male of *pallida*. I understand from Mr. Muttkowski that he is preparing descriptions of the early stages of this and several other species for publication.

Immature Stages of some Illinois Diptera, and Biological Notes

Not infrequently larvæ or pupæ of *Diptera* are submitted to the office of the State Entomologist for identification, and quite often it has been impossible for those in charge of this branch of the work to give names for the species involved. The immature stages of *Diptera* are comparatively little known, and very often entomologists who have succeeded in rearing species from either the larval or pupal stage neglect to make descriptions that will serve to identify the species in those stages upon any subsequent occasion; or the written description or figures are so inaccurate or vague that they serve only to give a general idea of the appearance of the species. It is the purpose of the present writer to describe in detail a number of species which have been reared by members of the office staff here or by himself, and to figure the principal features of each so that it may be possible for students to recognize the species when occasion arises.

Of the species described herein, *Psilocephala hæmorrhoidalis* Macquart is predaceous on wireworms, while the species of *Asilidæ* and *Mydaidæ* are also predaceous upon subterranean larvæ, and are of considerable economic importance. The species of *Mydaidæ* is predaceous upon larvæ which burrow in rotten tree-stumps. The species of *Bombyliidæ* dealt with are parasites, those of *Anthrax* being recorded as internal parasites upon *Lepidoptera; Exoprosopa fascipennis* is parasitic upon *Tiphia* spp., which are themselves parasitic in larvæ of *Lachnosterna* spp.; *Spogostylum anale* and *Sparnopolius fulvus* are ectoparasitic upon larvæ of *Cincindela* and *Lachnosterna* respectively. The habits of *Exoprosopa fasciata* are not known to me, while no record is available that indicates whether *fascipennis* is an internal or external parasite. The species of *Mycetophilidæ* described, *Mycetobia divergens,* has been recorded as attacking the trunks of fruit trees, but

it certainly does not do so unless there is an injury, and then it feeds, not upon the wood but upon the exuding sap and attendant fungus. The genus is of interest, however, because it is an exception to the general rule in *Mycetophilidæ* in respect to its respiratory system. A description of the larva and pupa of a species of *Sciara* is given herein which serves to show the differences between the peripneustic and amphipneustic types of larvæ.

SCIARIDÆ

Sciara sp.?

Larva.—Length, 7–8 mm. White, semitransparent; head glossy black; alimentary canal showing brownish on about two thirds of its length; ventral view of head as in Figure 1, Plate LXXX; mandibles (Fig. 8) showing but slightly above maxillary lobe; antennæ in the form of a circular clear area, not protuberant; median dorsal sclerite with 14 small round clear spots arranged as in Figure 10, Plate LXXX; hypopharynx as in same figure. First ganglion enclosed in head; two tracheal trunks emanating from each side of head, connected at prothoracic spiracle (Fig. 3), there being beyond that point only one main trunk on each side; in addition to the prothoracic spiracle 9 other spiracles are present on the succeeding segments (Fig. 2), the first and last of which appear to be closed; body without surface hairs.

Pupa (Pl. LXXX, Fig. 4).—Length, 3–5 mm. Whitish or slightly yellowish. Entire body without hairs, the usual pair on upper margin of head almost indistinguishable. Prothoracic respiratory organ rounded, not raised, stigmatiform. Abdominal segments 1–7 with distinct spiracles, apical 2 without spiracles.

A number of larvæ of this species were sent here for identification from Danville, Ill., at the end of July, 1915, with the information that they had been found traveling over a path in a ropelike mass. Unfortunately an attempt to rear the species failed, so that it is not possible to give a specific identification. It is, however, evident that it is the same species recorded by Felt as occurring at Franklin, N. Y.*

The occurrence of so-called "snakeworms" in their peculiar ropelike processions has been recorded at different times by several entomologists in America, and they have been known as occurring in Europe for many years. Various causes have been assigned as responsible for the larvæ's migrating *en masse*; but the most probable cause is that of heavy or continued rain penetrating their habitat in the earth

*Sixteenth Rep. State Ent. N. Y., 1901, p. 992.

and forcing them to get to the surface in much the same manner as earthworms. Whether we have a number of species in America that are addicted to this habit, or only one, remains to be discovered. Most of the species of the family feed upon decaying vegetable matter.

MYCETOPHILIDÆ

Mycetobia divergens Walker

Mycetobia divergens Walker, Ins. Saund., Diptera, Pt. 1, 1856, p. 418.
Mycetophila persica Riley, Prairie Farmer, June 15, 1867, Vol. 35 (n. s., 5), No. 19, p. 397.
Mycetobia sordida Packard, Guide to Study of Insects, 1869, p. 388.
Mycetobia marginalis Adams, Kans. Univ. Sci. Bull., Vol. 2, No. 2, 1903, p. 21.

Larva (Pl. LXXX, Fig. 12).—Length, 9–11 mm. White, semi-transparent. Head brownish, eye-spots black, surrounded by paler color. Thoracic segments with brown markings of variable extent and depth, pattern on dorsum generally as in figure; laterally the pale markings are generally in the form of an irregular vertical stripe on middle of segments and a pale posterior margin, those on prothoracic segment being usually connected on upper portions, whereas on the other two segments they are separated throughout their length; the pale markings of the lateral areas are continued over the ventral surface for a short distance, and there are also two wedge-shaped pale marks extending from the posterior margin of each segment which are usually short on the prothoracic segment and much longer and broader on the other two segments. Abdomen without brown marks.

Head about 1.5 as long as broad, tapering slightly anteriorly; labrum protruding, its ventral surface densely covered with fine downwardly directed hairs; mandibles as in Figure 11; labial plate as in Figure 13; maxillæ stout, of moderate length, with short papillæ; surface of head with a few short hairs. Prothoracic respiratory organs (Figs. 5 and 6) slightly raised above level of segment, their margins rugose; trachea connected by a stout transverse trunk at division of first and second thoracic segments; immediately behind the spiracular opening is a strong branch which is subdivided near its base, one of the divisions being directed forward, entering the head, the other directed backward; abdomen without spiracles, the lateral tracheal branches bifurcate, without the normal terminal connection with the outer wall of abdomen; apices of the two main parallel tracheal trunks slightly projecting beyond surface of last segment in life, retracted in dead specimens, their apical margins with a number of weak radiating hairs.

Pupa (Pl. LXXX, Fig. 7).—Length, 5–7 mm. Pale yellowish brown, opaque. Head with two short hairs on upper anterior margin. Prothoracic respiratory organs short and stout, situated well forward. Integument of entire pupa with microscopic reticulations. Thorax with numerous short hairs or spinules arranged as shown in figure. Abdomen with numerous stout spinules or small thorns as shown in figure, the dorsal arrangement of which is as shown in Figure 9, as is also the apical armature of abdomen; spiracles not distinguishable.

Larvæ of this species were abundant on tree trunks, where through injury the sap was exuding, at Urbana, in July, August, and September, 1915. Many imagines were reared from larvæ obtained from the trunk of a mulberry tree, and on the campus of the University of Illinois there were several elm trees on which the larvæ were common. In the case of all trees upon which I found the species it is noteworthy that there was a fungous growth over the surface where the exudation occurred, and in this the larvæ moved with considerable facility. They bear a striking resemblance to the larvæ of aquatic *Ceratopogoninæ* and progress by the same serpentine motion as do those larvæ. The larval skin is not generally entirely freed from the pupa at transformation, the apical half of the pupal abdomen being enclosed in it, the head of the larva lying close to the ventral surface of the abdomen. The pupa, just before the emergence of the imago, makes its appearance at the surface of the matter in which it is buried, having been previously visible only through the presence of the small respiratory organs, which generally pierce the upper layer of the covering. I found that the pupæ when removed from their normal position in the semi-liquid matter can regain that position by means of a rotary motion of the body, entering, tail first, until all but the apices of the thoracic respiratory organs are enveloped. Under natural conditions they pupate under the loose bark and possibly in this way cause very slight injury.

No damage is done to the trees by the presence of the larvæ so far as I can discover, and they are present only in those trees where an injury causes an exudation of sap. It is not impossible that they may have an irritating effect upon the wound other than that suggested above, but I doubt it. They feed upon the liquid exudation and not upon the fiber of the tree, and I reared many examples after the larvæ had been removed from the trees for over a month, their only food being that provided by the fungous matter collected along with them. I have observed that the first cold weather, not frost, proves fatal to most of the larvæ.

Of parasites I found only a small worm which moved freely about in the interior of the body of the larva. In form this resembles a

nematode, but having had so far no opportunity of submitting it to an authority on the group I can not present any definite information as to its identity.

The following observations regarding the family status of the genus may be of interest to students of the *Nemocera*.

The genus *Mycetobia* presents in the larval stage what, judging from our present very meager knowledge of the family, is a departure from the normal mycetophilid respiratory system in having no lateral abdominal spiracles. In fact the lateral tracheal branches simply fork and have no terminal extension which would seem to indicate the recent possession of abdominal spiracles. This is not, to my mind, incompatible with their position in this family, though there are some writers who may differ from me upon this point,—e. g. Osten Sacken, who considered that the genus does not belong to the *Mycetophilidæ* because of the closed spiracles. In this connection it seems necessary to mention a recent paper dealing in an arbitrary manner with the classification of this group.* In the paper referred to there is a summary of facts deduced from the writings of investigators, principally Brauer, unsupported by any other data in possession of the compiler, by means of which the latter endeavors to outline what he considers to be a natural classification of the families in the group. I have the conviction that a natural classification can only be arrived at by a careful consideration of the characters possessed by all stages taken in conjunction with their mode of life. It is impossible, to my mind, to arrive at a decision as to the importance of certain organs as a means of classification unless we know how the species live, what is the importance of the organs in the habitat, and, finally, to what extent a departure from a certain mode of life may affect one set of organs in comparison with others that seem to be of less fundamental significance. That we may, and do, find species in a family with certain organs functional which in others are vestigial or even absent, is not sufficient reason for the separation of such species into different families, and though the respiratory system is of more importance probably than any other one character, I consider that it is absurd to lay down any rule of classification based upon that one character, which is admittedly variable in most groups of insects, especially in view of the fact that we are unacquainted with probably ninety-five per cent. of the species included, in so far as their larval stages are concerned.

Another, and most reprehensible attitude is that taken by the writer previously referred to when he discounts the evidence brought for-

*The Nemocera not a Natural Group of Diptera. Ann. Ent. Soc. Amer., Vol. 8, 1915, p. 93.

ward by some investigators that *Mycetobia pallipes* has an amphipneustic larva with the statement that although he has not seen the larva he nevertheless believes "that the supposed difference rests upon an error of observation." Thus the careful work of real investigators is ignominiously thrust aside because this writer considers that the facts given, not being in conformity with his ideas and consonant with his unwarranted deductions, are necessarily erroneous. Psychological classifications are not reliable; and while they are at time interesting reading the real factors in classification must first be more fully investigated before any safe ground for deductions as to relationships of families is provided. Notwithstanding the absence of functional abdominal spiracles, we may with an easy mind retain *Mycetobia* in the *Mycetophilidæ*, and it is not improbable that further investigation will prove that it is not the only genus which presents such a departure from what is now considered the normal condition in the family. In fact, the European species *Polylepta leptogaster* Winnertz has been proven by Schmitz to be a departure in a more remarkable manner than is the present species.*

It is not necessary that I should deal with this paper here, but as it appeared three years before the note on classification which has been referred to, and as the genus *Polylepta* occurs in North America it is obvious that mention of it at least is not out of place in the present connection.

Predaceous and Parasitic Orthorrhapha

(Bombyliidæ, Mydaidæ, Asilidæ, Therevidæ, and Cyrtidæ)

It may seem a little presumptuous to formulate a method for the separation of the next seven genera dealt with upon the slender basis afforded by the species available to me, but it is not improbable that the characters which separate these may be found serviceable in the separation of others as yet unknown to me, and a key is given herewith which sets forth the structural differences observed that are considered as probably of generic value. It is essential to a better understanding of generic relations, not only of the genera here dealt with but of all genera in the so-called *Nemocera*, that a knowledge of the early stages be obtained. It is also necessary that entomologists who may be in possession of materials or data, or may later have either, should place whatever they have upon record as an aid to the elucidation of the problems connected with the classification of the group, it

*Biologisch-anatomische Untersuchungen an einer höhlenbewohnenden Mycetophilidenlarve, *Polylepta leptogaster* Winn. Natuurhistorisch Genootschap in Limburg. Jaarboeck, 1912, 4th Note.

being absolutely impossible for any one man, or even for a few men, to cover all the ground in a satisfactory manner.

The key presented herewith is based upon species in the collection of this Laboratory with one exception, and gives a synopsis of the characters which I have used in separating them. There are in the series examples of the following families: *Bombyliidæ*, *Mydaidæ*, *Asilidæ*, and *Therevidæ*. The pupæ of all these families, as far as I am aware, bear a strong resemblance to those of *Tabanidæ*, but the pupæ of the latter differ noticeably, as far as I have seen, in having no long thornlike cephalic processes, the protuberances being short and not heavily chitinized. The use of the cephalic armature by the *Asilidæ* and their allies in digging their way out of the ground necessitates that those organs be strong, as the species often must burrow through rather hard dry soil, while the *Tabanidæ*, being for the most part species which live in water or in moist situations, do not require such powerful organs to assist in their emergence from their pupal habitat. The abdomen in all the species included in the key is armed upon each segment with a median transverse series of thorns, or hairs and thorns in alternation. This feature is somewhat similar to that presented by the pupæ of the *Tabanidæ*, but the apical segment differs considerably in the two groups, while the species of *Tabanus* have usually the transverse thorns or hairs in a double row, the anterior one consisting of shorter and stronger thorns than the posterior one.

The pupæ of the only two species of *Cyrtidæ* that I have seen, one of which is described in the present paper, differ very considerably from those of the group included in the key, and also from the *Tabanidæ*, in having the head and abdomen without thorns or bristles, and the abdominal spiracles reduced in number, there being not more than five pairs.

Key to Pupæ

1. Head with but two thorns, abdominal spiracles conspicuously elevated, thornlike .....*Psilocephala hæmorrhoidalis* (p. 334).
— Head with more than 2 thorns, abdominal spiracles reniform, not conspicuously elevated 2
2. Dorsal abdominal segments with a transverse series of short flattened thorns on middle of each segment, and alternating long, slender, slightly curled hairs; sometimes the short thorns are bent upward at right angles at bases and apices*.....*(Bombyliidæ)* 3

*In all cases that I have seen these short thorns have the appearance of being attached to the abdomen, rather than of being a part of it as is the case in the other pupæ dealt with here.

— Dorsal abdominal segments without long slender curled hairs, the transverse series consisting of strongly chitinized thorns which alternate in size....8

3. The short stout thorns on abdominal segments 2 to 4 bent upward at right angles at bases and apices; armature of head consisting of a lunate series of 4 strong thorns on upper margin the bases of which are contiguous, and 2 shorter, downwardly directed thorns on middle near lower margin.....*Spogostylum anale* (p. 328).

— The short stout thorns on abdominal segments either bent up at apices only and the armature of head not as above, or if the short thorns are bent up both at bases and apices the head armature consists of 8 thorns....4

4. Upper pair of cephalic thorns slender, widely separated at base...5

— Upper pair of cephalic thorns very stout, contiguous at base..... ..... (*Anthrax*) 7

5. The short abdominal thorns bent upward at right angles at bases and apices.....*Exoprosopa fasciata?* (p. 329).

— The short abdominal thorns not bent up at base, only so at apices 6

6. Lateral pair of cephalic thorns contiguous at base, the lower one without basal protuberance or hairs..... .....*Exoprosopa fascipennis* (p. 330).

— Lateral pair of cephalic thorns rather widely separated at base, the lower one with a short wartlike protuberance at base on under side which has upon it 2 or 3 hairs.....*Sparnopolius fulvus* (p. 331).

7. Upper pair of cephalic thorns simple, without a small tooth at base on outer side; viewed laterally the middle one of the 3 caudal thorns on each side is much smaller than the lower one, sometimes indistinguishable.....*Anthrax hypomelas* (p. 334).

— Upper pair of cephalic thorns each with a small tooth on outer side at base; viewed laterally the middle one of the 3 caudal thorns on each side is about as large as the lower one..... .....*Anthrax lateralis* (p. 332).

8. Upper pair of cephalic thorns directed outward and slightly upward; apices of wing sheaths extending beyond apices of sheaths of middle legs.....*Mydas clavatus* (p. 336).

— Upper pair of cephalic thorns directed forward and slightly downward; apices of wing sheaths not extending beyond apices of sheaths of middle legs.....(*Asilidæ*) 9

9. Prothoracic spiracle merely a rugose area, without well-defined reniform portion; abdominal spiracles very large..... .....*Promachus vertebratus* (p. 337).

— Prothoracic spiracles rugose, but with a well-defined reniform area which is distinctly elevated.....10

10. Apices of sheaths of fore legs extending very distinctly caudad of apices of wing sheaths.....*Deromyia winthemi* (p. 338).

— Apices of sheaths of fore legs not extending to apices of wing sheaths 11

11. Middle of wing sheath with a small distinctly raised area; apical abdominal segment truncated, the upper pair of thorns directed upward.....*Proctacanthus milberti* (p. 339).

— Middle of wing sheath without raised area; apical abdominal segment not truncated, the upper pair of thorns directed backward and slightly curved downward.....*Asilus notatus* (p. 340).

I have not included any species in the key of which I have not examined specimens, preferring not to use descriptions which I might misinterpret. I have, however, indicated in the text characters which appear to be available for the separation of *Systœchus orcus* from *Exoprosopa fasciata* and *Aphœbantus mus* from *Sparnopolius fulvus*.

Erax lateralis Macquart has been recorded by Titus as predaceous upon *Ligyrus* spp.* Unfortunately the figures and descriptions of the larva and pupa given by him are too vague to permit my discovering their distinctive generic characters.

BOMBYLIIDÆ

Many species of this family have been reared both in North America and in Europe, and the larvæ have been found to be predaceous or parasitic in all cases put upon record. Williston gives a summary of their larval habits†. *Aphœbantus* and *Systœchus* are predaceous on egg-masses of the locust *Caloptenus spretus*. *Anthrax* is recorded as parasitic upon three genera of *Hymenoptera—Megachile, Osmia,* and *Odynerus*—and three genera of *Lepidoptera—Mamestra, Noctua,* and *Agrotis; Spogostylum* upon four genera of *Hymenoptera—Pelopœus, Megachile, Cemonus,* and *Osmia*—and two genera of *Coleoptera—Cicindela* and *Calicodoma; Bombylius* upon the hymenopterous genera *Andrena* and *Colletes; Toxophora* upon the hymenopteran *Eumenes;* and *Systropus* on the lepidopteran *Limacodes;* while *Callostoma* is predaceous on the egg-masses of the locust *Caloptenus italicœ*.

Vassiliew, in a short note on the biology of some European species of *Anthrax,* records the occurrence of *morio* Linn. and *velutina* Fall. as secondary parasites of *Masycera sylvatica* Fall., a tachinid parasite of *Dendrolimus pini* Linn.‡

*Some Miscellaneous Results of the Work of the Bureau of Entomology. Bull. 53, Bur. Ent., U. S. Dept. Agr., 1905, p. 15.

†Manual of North American Diptera, p. 213. 1908.

‡Beitrag zur Biologie der Gattung Anthrax Scop. (Fam. Bombyliidae.), Zeitschr. für Wiss. Insektenbiol., Bd. 1, Heft 4, p. 174. 1905.

Spogostylum anale Say

Anthrax anale Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 45.

Larva.—Length, 12–14 mm. White. Head small and inconspicuous (Pl. LXXXIII, Fig. 1), retracted within the first thoracic segment to the point marked X in figure; mandibles strong, slightly serrated on latero-ventral surfaces, curved downward; dorsal surface of head with 5 strong hairs arranged as in figure. Thoracic and abdominal segments with strongly defined incisions between them; prothoracic spiracle large; abdomen without noticeable spiracles (in preserved examples); apical abdominal segment conspicuously attenuated, produced in the form of a short point; no surface hairs on abdomen or thorax.

Pupa.—Length, 12 mm. Testaceous. Head with the upper armature consisting of 4 strong thorns in a crescentic series, their bases connected, and 2 smaller downwardly directed thorns near ventral surface on median line as shown in Figure 9, Plate LXXXIII; 6 long hairs on head, 4 at bases of upper thorns and 2 at bases of the median pair. Thorax with 4 long hairs, 2 above base of wing-sheath and 2 closely placed ones about midway between them and the dorso-median line in transverse line with them; prothoracic spiracle distinct. First abdominal segment with a transverse series of long closely placed slightly curled hairs anterior to middle from a little distance on each side of median line to a point more than midway to spiracle, the series broadly interrupted in the middle, and this area without the short bristles present in *Anthrax* and *Exoprosopa;* posterior to the spiracle on first segment are about 6 remarkably long hairs directed outward and slightly forward; segments 2 to 4 with the transverse armature consisting of long hairs alternating with short bristles, the apices and bases of the latter bent upward at right angles (Fig. 2); armature of segments 5 to 8 consisting of long hairs, the series except on segment 8 usually with short, straight, alternating bristles; spiracles small but distinct on segments 1 to 7; apical segment with 2 slender slightly curved thorns (Pl. LXXXIII, Figs. 8 and 10); armature of segments posterior to spiracles consisting of very long hairs, that of ventral segments of transverse series of moderately long hairs which are discontinued on middle of segments.

The larvæ and pupæ from which the foregoing descriptions are drawn, are those obtained by Dr. V. E. Shelford near Chicago, and which were used by him as a basis for his paper on the species.* Dr.

*The Life-history of a Bee-fly (*Spogostylum anale* Say) Parasite of the Larva of a Tiger Beetle (*Cicindela scutellaris* Say var. *lecontei* Hald.). Ann. Ent. Soc. Amer., Vol. 6, No. 2, 1913, p. 213.

Shelford kindly permitted me to use his material. The species is ectoparasitic.

The species is represented in the collection here by imagines from the following Illinois localities: Pekin, Quincy, Algonquin, Cedar Lake, Clay City, Grafton, Thebes, and Mt. Carmel. There is also a specimen from St. Louis, Mo. The dates of occurrence are in August with the exception of the example from Mt. Carmel, which is given as having been taken June 10 or 11—a rather unusual date if correct. Dr. Shelford gives a summary of localities for the species in his paper from data obtained from dipterologists.

Exoprosopa fasciata Macquart ?

Exoprosopa fasciata Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1838, p. 51.

Pupa.—Length, 20 mm. Testaceous yellow, thorns and wing sheaths dark brown. Head with 8 strong thorns; upper median pair widely separated at base; lateral view of head as in Figure 6, Plate LXXXIII; lateral pair of thorns slender and elongated; 2 strong hairs at base of each of the upper thorns, one above the base of each of the lower median pair and slightly laterad of them, and one close to suture between head and thorax, slightly above level of lower thorns. Thorax with the usual 4 hairs, a widely placed pair above wing base and another pair closely placed midway between wing base and dorso-median line and distinctly caudad of the posterior one of the former pair; wing sheath with a distinct, bifid, wartlike protuberance close to costal margin near base; apices of middle leg-sheaths projecting distinctly beyond apices of wing sheaths; prothoracic spiracle with well-defined rugose reniform area. Abdominal segments 2 to 6 with the bases and apices of the short thorns of the transverse series turned up at right angles (Pl. LXXXIII, Fig. 3); first segment with a transverse series of long curled hairs which does not extend over the median line and is discontinued about two thirds of the distance to spiracle; posterior to the spiracle is a series of about 8 long hairs which are distinctly shorter than those of the segment above; spiracles of moderate size, margins rugose; apical segment as in Figures 4 and 11.

The pupal exuvium from which the foregoing description was drawn was found in a garden in Urbana by Miss E. Mosher, August, 1914. There is little doubt about the identity of the species, although the imago was not directly associated with the specimen, for the large size and dark-colored wings, coupled with the fact that *fasciata* is the only common species that agrees in these respects occurring at this time here, make it very probable that the identification is correct.

The species is represented in the collection here by imagines from the following Illinois localities: Lake County, Algonquin, Waterman, Milan, Bloomington, Normal, Pekin, Forest City, Havana, Champaign, Urbana, Meredosia, Camp Point, Belleville, Dubois, Grand Tower, Alto Pass, and Metropolis, the dates of collection ranging from July 12 to August 31. The species is a very common one and probably occurs throughout the entire state. There is also in the collection one specimen from New Harmony, Ind., taken September 2, and one from Delaware Co., Pa. I have taken the species at White Heath, Ill., on two species of *Monarda* and on *Helianthus* in August.

The pupa which I have associated with this species bears a striking similarity to that figured by Riley for *Systœchus orcus*, differing however in the dark color of the wing cases and in their being comparatively shorter, not extending to the apex of the second abdominal segment, whereas in *Systœchus orcus* they extend to apex of third. There is also an evident distinction in the structure of the dorsum of the apical segment.

Exoprosopa fascipennis Say

Anthrax fascipennis Say, Keating's Narrative of an Expedition to the Source of St. Peter's River, etc., Appendix, p. 373. 1824.

Pupa (Pl. LXXXI, Fig. 4).—Length, 16 mm. Pale testaceous, slightly shining, thorns on head black-brown. Upper pair of cephalic thorns directed forward and very slightly downward, widely separated at base, parallel; below the level of these thorns on each side, on a raised base, are two stout thorns, the inner one long and directed almost straight forward, the outer much shorter, slightly curved, and directed outward; on each side of median line of lower margin of front is a stout thorn, the bases of the thorns connected (Pl. LXXXI, Fig. 5); in addition to the thorns there are 6 long slender hairs on the head capsule, as shown in the figure, visible from in front, and one on each side close to the suture between head and thorax, located near base of the sheath containing mouth parts. Thorax with a pair of closely placed hairs on disc on each side of median line, and a pair more widely placed, above base of wing; wing sheath with a sharp tubercle about one third from base, near costal margin. First abdominal segment with a transverse series of 5 or 6 short, thick thorns occupying the central portion of anterior margin, and 6 long curved hairs on each side of these in continuation of the transverse series which extends over midway from median line to spiracle; posterior to spiracle are about 7 long hairs; segments 2 to 7 with a regular transverse median series of flattened thorns, as shown in Figures 1 and 2, Plate LXXXI; on segments 2 and

3 there are no alternating slender hairs between the median 6 or 8 thorns and the hairs are rather weak when present; on segment 4 these hairs are not present between the median 4 thorns; on the other segments, 5 to 7, they are present on the whole series; segment 8 has about 6 short stout thorns in the transverse series between which, except in the case of the central pair, there are alternating long hairs; lateral aspect of pupa as shown in Figure 4; apical segment of abdomen with a parallel pair of stout upwardly and backwardly directed thorns which are broad at base and have each a small subbasal tooth.

The pupal exuvium from which the above description was drawn is that of a specimen reared from *Tiphia* sp. collected at Elliott, Ill., April 27, 1906, and which emerged July 17, 1906. There are in the collection of this Laboratory a large number of specimens of exuvia of pupæ that were obtained at Elliott and Mackinaw, Ill., the imagines emerging on various dates between July 17 and August 8. Some which produced imagines of the parasites were collected September 30. This species is a hyperparasite affecting *Tiphia* species which are parasitic upon *Lachnosterna* species.

The species is generally distributed throughout the state, occurring from the beginning of July till the end of September. Imagines are in the laboratory collection from the following Illinois localities: Algonquin, Savanna, Havana, Pekin, Urbana, Champaign, Normal, Albion, Carlinville, Clay City, Bridgewater, Williams Mountain, Herod, Grand Tower, Alto Pass, Teheran, and Metropolis. There is also a specimen from Westville, N. J.

Sparnopolius fulvus Wiedemann

Bombylius fulvus, Wiedemann, Dipt. Exot., 1821, p. 172.
Bombylius l'herminieri Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1841, p. 103.
Bombylius brevirostris Macquart, l. c.
Sparnopolius fulvus (Wiedemann) Loew, Neue Beitr., Vol. 3, 1855, p. 43.

Pupa.—Length 11–12 mm. Yellowish testaceous, slightly shining. Surface smooth. Head with upper pair of thorns widely separated at base; lateral pair separated by about as great a distance as the length of the lower thorn, the base of the latter with a slight tubercle on lower surface upon which there are two hairs (Pl. LXXXIII, Fig. 7); the pair of thorns on median line of lower portion of head of moderate size, directed downward, and rather widely separated basally; the normal 8 cephalic hairs present. Prothoracic spiracle rather small, distinctly elevated, its apex with narrow rugose rim; mesothorax with 3 hairs, 2 above the base of wing sheath and one midway between that

point and median line, slightly caudad of the posterior one of the preceding pair; in front of wing base is a slight gibbosity which has no elevated thornlike points; wing sheath without a raised area on surface; apices of sheaths of mid tarsi extending to base of last joint of hind pair and distinctly beyond apices of wing sheaths; apices of sheaths of fore tarsi extending to apices of wing sheaths. First abdominal segment with about 6 widely placed weak hairs in a transverse row near anterior margin; segments 2 to 8 each with a transverse series of short stout bristles with alternating slender and, in comparison with other species, short hairs, the bristles on all segments turned upward at apices, most distinctly so on segments 3 to 5; spiracles small but very distinct, similar to that of prothorax, present on segments 1 to 7; posterior to the spiracle on each segment there are 3 moderately long hairs; apical segment as in Figure 5, Plate LXXXIII; ventral segments each with a transverse pair of rather long slender hairs on each side near middle, the one farthest from lateral margin about midway between that point and median line, the other midway between it and the lateral margin.

The specimens from which the foregoing description was drawn are those mentioned by Dr. Forbes in his Thirteenth Report* as having been reared from larvæ of *Lachnosterna,* upon which they are ectoparasitic.

Imagines are in the collection here from the following Illinois localities: Effingham, Neoga, Urbana, and Algonquin, the dates of occurrence being in August and September.

In Riley's figure of *Aphœbantus mus* the apices of the wing sheaths do not extend beyond the apex of the second tarsal joint, the wing sheath has a small protuberance about one third from base near the costa, and there are more than 2 hairs on each side of each ventral segment.

Anthrax lateralis Say

Anthrax lateralis Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 42.

Pupa.—Length, 14 mm. Testaceous yellow, shining. General habitus similar to that of *Exoprosopa fascipennis.* Head with the pair of strong upper thorns contiguous at base, their upper surfaces with a flattened area (Pl. LXXXI, Figs 16, 17, and 21); below these thorns on each side is a slightly swollen area upon which is a single small tubercle; on the median line considerably below the level of the lateral tubercles is a pair of small sharp points, best seen when viewed

*Twenty-fourth Report of the State Entomologist on the Noxious and Beneficial Insects of the State of Illinois, 1908, p. 161.

from the side (Pl. LXXXI, Fig. 16), near the bases of which is a single long hair on each side; on each side near base of the upper pair of large thorns is a single long hair and another above base of each thorn. Thorax and wing sheaths without tubercles; the pair of hairs above wing base present, the discal hair indistinguishable. Abdomen with spiracles very small; first segment with about 6 short, stout brown thorns on median sixth slightly beyond base, and on each side of these but slightly more cephalad a closely placed series of about 20 long, slender curled hairs, reaching about two thirds of the distance from median line to spiracle; posterior to the spiracle are about 6 long hairs; segments 2 to 7 with a transverse median comblike series of stout brown thorns, interspersed with long slender hairs at about every fourth or fifth one (Pl. LXXXI, Figs. 3 and 8); eighth segment with a pair of closely placed thorns on each side of the median line, between each pair of which is a single slender hair (Fig. 19); apex of abdomen with 3 thorns on each side (Fig. 19); post-spiracular hairs 8–9 in number; each ventral segment with 6–8 hairs on each side of median line in a transverse series.

The pupal exuvium from which this description was drawn is that of a specimen that was reared from a larva parasitic in a pupa of a noctuid moth which was obtained at the Devil's Hole near Havana, Ill., June 8, 1905, the parasite emerging July 1, 1905.

Imagines in the laboratory collection are from the following Illinois localities: Algonquin, Savanna, Milo, Urbana, Champaign, Long Lake, and Kappa. There is also a specimen in the collection from Jamesburg, N. J., and one from San Bernardino, Cal. The dates of occurrence range from June 10 to August 11.

No other specimens in the collection bear any records of life history.

Anthrax alternata Say has been reared from an undetermined noctuid larva* by Gillette, and recorded by Riley and Howard. In the same paper *Anthrax hypomelas* Macquart is recorded as having been reared from a pupa of *Agrotis herilis* by Webster, and *A. molitor* Loew from a pupa of a noctuid resembling *Tæniocampa rufula*. Zetterstedt, in 1842, stated that the group to which *lateralis* belongs, deposits eggs upon lepidopterous larvæ. Glover, in the Agricultural Report for 1866, mentions that "an *Anthrax* has been bred from the chrysalis of a moth."†

*Insect Life, Vol. 2, 1890, p. 353.

†Loc cit., p. 354.

Anthrax hypomelas Macquart

Anthrax hypomelas Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1838, p. 76.

Pupa.—Length, 14 mm. Pale testaceous, slightly shining; thorns on head and on abdomen dark brown. Upper pair of cephalic thorns contiguous for two thirds of their length (Pl. LXXXI, Fig. 22), lateral thorn flattened, simple, the pair on median line near lower margin contiguous, a small fine hair on each side of the latter pair, a longer hair on each side of the upper pair of thorns and another above the base of each thorn (Fig. 20). Thorax without protuberances; a pair of small fine hairs above the base of wing cases, and another pair on each side of median line about middle of thorax. Abdomen similar to that of *A. lateralis*, differing only in having apical armature as in Figure 18, the median tooth having more the appearance of a small process on base of upper one than of a separate tooth, or occasionally almost indistinguishable.

As mentioned under the previous species, *hypomelas* has been recorded by Riley and Howard, but the figure given in the paper is not clear enough in detail to permit of its specific characters being recognized although the general habitus is unmistakable.

The specimens of *hypomelas* pupæ that I have seen include one, without label data, obtained from the Ohio Agricultural Experiment Station, Wooster, Ohio, with the statement that it had been reared at Wooster in 1907, and two in this Laboratory.

The pupal exuvia last referred to are those of specimens reared from *Feltia jaculifera* at Urbana, Ill. The larvæ of the moth were obtained June 8, 1901, and the parasites emerged September 14 of that year from the pupæ of the host.

Specimens of the imago are in the collection here from the following localities: Havana, Ill., September 5, 1905; Urbana,, Ill., September 21, 1890 (C. A. Hart); Grand Forks, N. Dak., July and August, 1890, (Miss M. J. Snyder); and Westville, N. J., September 9, 1901.

THEREVIDÆ

Psilocephala hæmorrhoidalis Macquart

Thereva hæmorrhoidalis Macquart, Dipt. Exot., Vol. 2, Pt. 1, 1841, p. 26.

Larva. (Pl. LXXXI, Fig. 10).—Length, 22 mm. White. Head brown, black on posterior margin of dorsal surface. Dorsal sclerite with a long slightly curved hair on each side one third from posterior margin; dorsal and ventral sclerites separated laterally by a rather broad membranous stripe, near the anterior extremity of which is a

very long hair directed downward and curving slightly forward, and about the middle there is a similar hair, as shown in Figure 9. Internally there are 2 strong rods connected with the mandibles, and attached to the posterior margin of the dorsal sclerite is a strong rod, dilated posteriorly, which runs to the posterior margin of the first thoracic segment internally. Thoracic segments each with a long curved hair near the middle on sides, prothoracic respiratory organ short, located close to posterior margin of segment. Abdomen with segments as in Figure 10, the pattern shown being probably caused by the spines of the pupa showing through; surface without hairs except on last segment, where there are 2 pairs, one on the dorsum and the other on the venter; apex bifid (Fig. 10, *a*).

Pupa. (Pl. LXXXI, Figs. 11 and 12).—Length, 9 mm. Yellowish white. Surface of integument of body slightly wrinkled. Head and thorax in lateral aspect as in Figure 15, thorn on wing base remarkably long and slender. Thoracic respiratory organ tubelike, the abdominal spiracles almost identical with it in form, their apices presenting to the eye the appearance of small rounded openings. Apex of abdomen with 2 long curved spines directed slightly upward (Fig. 13).

This species was found by D. K. McMillan, the field assistant of this office for northern Illinois, commonly in truck gardens infested with wireworms, upon which it feeds in the larval stage. I have seen the larvæ occasionally in wheat fields, and the adult is represented in the laboratory collection from the following localities: Algonquin, June to August (Nason); Havana, August 18, 1904 (Hart and Brown); Piper City, July 27, 1888 (Marten); Grand Tower, August 25, 1889 (Hart); Urbana, July 21, 1899 (Hart), and June 14, 1915, on flowers of wild parsnip (Hart and Malloch); Champaign, July 14, 1899 (Hart); McHenry, July 31, 1884 (Webster); Philo, June 3, 1887, from pupa found in sod corn (Hart); West Union, May 24, 1884; Waterman, July 27, 1883 (Webster); Monticello, June 28, 1914 (Hart and Malloch),—all in Illinois; Jamesburg, N. J., July 4, 1893.

The larvæ of this family are recognizable by the peculiar subdivision of the abdominal segments, as shown in the figure (10) herewith, which gives them the appearance of having 20 segments. In some other families there is a similar subdivision, for example in *Mycetophilidæ* (see *Mycetobia,* Pl. LXXX, Fig. 12), but the subdivision is of a different character, the short portion of the segments being appreciably shorter than the anterior portion is in *Psilocephala.* This species and probably allied species are no doubt of considerable eco-

nomic importance as enemies of wireworms, and it seems strange that nothing has been published in America regarding this habit.

In Europe several species have been reared, and all are credited with being predaceous enemies of insects in the larval stage. A fairly complete summary of the European investigations has been given by Lundbeck in "Diptera Danica", Part 2 (1908), p. 137. In this paper mention is made of the fact that occasionally the larvæ of *Therevidæ* may devour their own kind—a fact that comes within the knowledge of the present writer from his experience in rearing *Psilocephala*, the reason for the cannibalism being the lack of other food.

MYDAIDÆ

Mydas clavatus Drury

Musca clavatus Drury, Illustrations of Natural History, Vol. 1, p. 103, 1770.

Pupa (Pl. LXXXII, Fig. 9).—Length, 36 mm. Reddish brown, subopaque. Surface of head and thorax coarsely rugose, that of abdomen rather finely and regularly rugose. Thorns of head rugose to apices, lateral cephalic thorn as in Figure 16. Front of head as in Figure 10; lateral aspect as in Figure 15. Thorax with a bifid humeral tubercle, the one on wing-base with a single flattened thornlike process. First abdominal segment with the thorns (Fig. 21) directed forward and located close to anterior margin, succeeding segments with the thorns rather smaller, directed backward, and located caudad of the transverse median line of the segments, the portion of each segment caudad of the thorns declivitous and honeycombed, the anterior portion irregularly rugose; apical segment with 2 slightly curved processes which are a little upcurved (Fig. 8); spiracles as in Figure 23.

The specimen from which the above description was drawn, was obtained at White Heath, Ill., May 26, 1910, as a larva in a rotten tree-stump, the adult emerged July 18, 1910 (A. G. Vestal). The writer obtained a pupa under a rotten tree-stump at Kinderhook, Ill., in June, 1914. The laboratory collection contains imagines from the following Illinois localities: Urbana, July 4, 1914 (Malloch) and August 3, 1909 (Hart); Champaign, August 13, 1892 (Hucke); Albion, July 12, 1888 (Marten); Havana, July 13, 1897 (Hart and Brown); Alto Pass, August 27, 1889 (Hart); Pinkstaff, July 1, 1911 (Glenn); Monticello, July 2, 1914 (Hart and Malloch); Muncie, July 5, 1914 (Hart and Malloch); and Bloomington, July 26, 1895.

The specimens taken at Muncie were mostly captured on flowers of milkweed, several being taken with the fingers—a proceeding which generally results in the captor's discovering that the insect can pinch

rather severely with the hind femora and tibiæ. So far I have failed to find the larva, no opportunity offering to search for it, but from the fact that many imagines were found on cut-over land where the old tree-stumps remained, upon which the insects often settled, I believe that larvæ must be common in the various localities where I have seen the imagines.

The larva has been recorded as feeding upon the larvæ of insects in old tree-stumps, and the imago has also been recorded as predaceous. I am unable to confirm the last record, as all the specimens taken by both Mr. Hart and myself were upon flowers or at rest upon tree-stumps. It is not impossible that the species is predaceous, but from personal observation and an examinatian of the mouth parts, which differ essentially from those of *Proctacanthus* and allied forms, I infer that if it is predaceous it is rarely so and must be only in cases where the prey is soft-bodied. It is necessary that exact observations be made to determine the facts of the case, negative evidence such as I am in possession of being inconclusive.

ASILIDÆ

Promachus vertebratus Say

Asilus vertebratus Say, Jour. Acad. Nat. Sci. Phil., Vol. 3, 1823, p. 47.

Larva (Pl. LXXXII, Fig. 12).—Length, averaging 40 mm. (preserved specimens). White, head and spiracles brown. Head with 10 long hairs, 5 ventral and 5 dorsal, as shown in Figures 24 and 25; mandibles opposed, long and stout; maxillary palpi of moderate size; antennæ very small. Each thoracic segment with 2 hairs, one on each side on ventral surface; prothoracic respiratory organ located near posterior margin on side; anal respiratory organs (Fig. 13) located in a depression on portion anterior to last segment (8th abdominal segment?), the latter with 8 long hairs, 4 ventral and 4 dorsal (Figs. 11 and 14).

The larva here described is without doubt that of *vertebratus*, although no direct connection has been established between it and the imago. There is in the collection, however, a poorly preserved specimen that agrees in all particulars with the above, which is one of several specimens obtained by J. J. Davis, the others being reared and producing imagines of *vertebratus*. The larva is found not uncommonly in spring where ploughing is being done.

Pupa.—Length, 27 mm. Yellowish brown, head and thorax shining, abdomen subopaque. Head similar to that of *Asilus notatus* (Pl.

LXXXI, Figs. 6 and 7), lateral cephalic thorns as in Figure 4, Plate LXXXII. Thorax differs from that of *notatus* in having near the base of the wing sheath, in longitudinal line with the bifid tubercle at base of posterior leg sheath (Fig. 5), a sharp-pointed tubercle, and midway from base to apex of wing case, on its median line, 2 small wartlike protuberances on a common base. Abdominal spiracles c-shaped, very similar to those of *Mydas clavatus*, the open side directed cephalad; the abdominal armature (Fig. 20) similar to that of *Asilus notatus*, differing noticeably only on the apical two segments, the penultimate segment in *vertebratus* having strong thorns on dorsum as on other segments, while in *notatus* there are only hairs similar to those of the ventral segments; the difference in the apical segments of the two species is shown in Figure 14, Plate LXXXI, and Figure 2, Plate LXXXII.

The pupa from which the above description was drawn resulted from a larva obtained at Havana, Ill., April 24, 1905, and the imago emerged July 24, 1905.

The larva is predaceous, feeding upon the larvæ of *Lachnosterna*, and the species is distributed throughout the entire state, though not very common in most localities.

Deromyia winthemi Wiedemann

Dasypogon winthemi Wiedemann, Dipt. Exot., 1821, p. 223.
Diogmites misellus Loew, Berl. Ent. Zeitschr., 1866, p. 22.
Deromyia winthemi Van der Wulp, Tijdsch. v. Ent., Vol. 25, 1883, p. 93.

Pupa.—Length, 20–25 mm. Brownish yellow, distinctly shining; thorns dark brown. Upper pair of cephalic thorns directed forward and curved slightly downward, distance between them distinctly greater than that between them and upper one of the 3 lateral thorns; lateral thorns as in Figure 16, Plate LXXX, the lower one without basal projection. Prothoracic spiracle reniform apically, distinctly elevated; a distinct wartlike swelling on disc of thorax just above wing base; the pair of thorns in front of wing base on lateral margin of disc of thorax very long, curved backward at their middle (Fig. 14); wing cases without central protuberances, their apices in vertical line with second abdominal spiracle and much proximad of apices of sheaths of fore legs. Abdomen with transverse rugæ except on portion of first segment anterior to the transverse series of thorns, where the rugæ are longitudinal; armature of abdomen rather variable, normally as follows: first segment with a transverse series of stout thorns near anterior margin, which are broadest at middle, stand up-

right, and are slightly bent caudad near apices, several of the thorns being occasionally bifid apically; segments 2 to 7 each with a median transverse series of thorns which alternate in size, the shorter ones being generally stouter and very often bifid on middle portion of series; eighth segment with a much weaker transverse series than the others; posterior to the spiracle on first segment is a series of from 6 to 8 long hairlike bristles; spiracles conspicuous, raised, reniform; armature of ventral segments consisting of a transverse series of weak closely placed hair-like bristles at apical third of each segment except the eighth, which has a series on each side at middle extending from lateral margin halfway to median line; ventral surface without rugæ, apical segment as in Figure 15.

The foregoing description was drawn from specimens found by W. P. Flint, of the State Entomologist's office, in a garden at Springfield, Ill., August 6–8, 1915. One specimen of each sex was reared.

Imagines of this species are in the collection here from Grand Tower, Murphysboro, and St. Francisville, the dates ranging from July 25 to August 2. I took a single specimen on the south campus of the University here August 28, 1915.

Proctacanthus milberti Macquart ?

Proctacanthus milberti Macquart, Dipt. Exot., Vol. 1, Pt. 2, 1838, p. 124.

Pupa.—Length, 25 mm. Pale yellowish brown. Armature of head similar to that of *Promachus vertebratus,* differing in having the pair of anterior, forwardly directed thorns smaller and more widely separated at base and the lateral trifid process without distinct angle on base of lower thorn (Pl. LXXXII, Fig. 6). The pair of thorns at base of posterior leg sheath (Pl. LXXXII, Fig. 7) are longer and more slender than in *vertebratus;* the tubercle on base of wing sheath is absent, and a single wart is present on the swelling on middle of the sheath. First abdominal segment with a transverse series of long slender spines, about 18 in number, which are directed slightly forward, their points slightly recurved, the series occupying two thirds of the length on each side between the median line and the spiracle; between some of the long spines there is sometimes a smaller spine; posterior to the first spiracle are about 7 long hairs (Fig. 22)—3 in *Asilus notatus* and *Promachus vertebratus;* segments 2 to 7 each with a transverse median series of long slender spines alternating with shorter stout thorns which are single, bifid, or paired (Fig. 19); eighth segment with a transverse series of spines which are of irregular sizes and unevenly arranged; apical segment with a long slender upwardly

directed spine on each posterior dorso-lateral angle, and a small wartlike process about midway between the base of that and the ventral line (Figs. 1 and 3).

The specimens from which the above description was drawn are two empty pupa skins obtained by Mr. Hart at Beach, Ill., August 24, 1906. It is not certain that the pupa is that of *milberti*, as the species was not reared, but imagines were obtained at the same time and place, and as this was the only species of such large size that was found I assume that the pupa very probably belongs to it.

The species is very probably predaceous in the larval stage upon larvæ of burrowing insects.

Illinois localities represented by material in laboratory collection: Jonesboro, Beach, Havana, Forest City, Jacksonville, Alto Pass, Grafton, Grand Tower, Dubois, Oakville, Edgewood, Metropolis, Albion, Carbondale, and Litchfield. Dates of occurrence range from August 8 to September 23.

Asilus notatus Wiedemann

Asilus notatus Wiedemann, Auss. Zweifl. Ins., Vol. 1, 1828, p. 451.

Pupa (Pl. LXXXI, Fig. 7).—Length, 12 mm. Brownish yellow, slightly shining. Head distinctly shining, integument without distinct wrinkles; a pair of strong thornlike projections on anterior cephalic surface (Fig. 6) which are rather irregularly longitudinally rugose at base, smooth and highly polished at apices; on each side of the head, almost in vertical line with these thorns and located on the latero-ventral region there is a tridentate process of a similar nature to the thorns (Pl. LXXXII, Fig. 18), the posterior one having a slight scalelike process near its base. Thorax with faint indications of wrinkling on the surface and 3 wartlike projections on each side (as shown in Pl. LXXXI, Fig. 7), the lower one, at base of sheath of posterior leg, having 2 distinct sharp thorns at the apex (Pl. LXXXII, Fig. 17). Abdomen with surface of all segments wrinkled; first segment with 10 long upright brown thorns (Pl. LXXXI, Fig. 7), the apices of which are directed slightly backward, near the anterior margin on dorsum, the distance from the central one to the outer one being about equal to the distance from the latter to the spiracle; posterior to the spiracle are 3 long fine hairs, otherwise the segment is bare; second to sixth segments each with a transverse median row of stout brown thorns alternating large and small in size, extending from median line midway to spiracle on each side, being replaced at this point by a series of long fine hairs which are carried below the level of the spiracles and almost join the ventral series; seventh segment with the dorsal series located nearer to

the posterior margin than on the other segments, the bristles of almost an equal size, otherwise as preceding segments; eighth segment without dorsal thorns, only the long hairs present on lateral region; apical segment as in Figure 14, Plate LXXXI; ventral segments each with a transverse row of long rather irregular hairs near the posterior margin except in the case of the eighth, which has the series on the transverse median line.

This description is taken from a specimen obtained by the writer on the bank of the Sangamon River near White Heath, May, 1915. It was found in rather sandy soil at a depth of about 6 inches. The specimen which emerged is a male. The imagines were remarkably common in the forestry belonging to the University of Illinois, at Urbana, on June 20, 1915. The larva, which is predaceous, was not obtained. The species is common and generally distributed throughout the state, being probably our commonest species of the genus.

CYRTIDÆ

Unfortunately I have of this family but a single pupal exuvium of one species, and that is in rather poor condition. It proves, however, to be quite different structurally from exuvia in the preceding group, having neither strong hairs nor thorns on any part of head, thorax, or abdomen, thus differing markedly from those herein described and from the *Tabanidæ*, the latter having armature on the abdomen very similar to the asilid group.

It is unfortunate that in the case of the only reared specimen available here no record is given of the circumstances under which the pupa was obtained. Species of allied genera have been found to be parasitic in spiders, or to feed upon their eggs. Mr. J. L. King has obtained the larva and pupa of a species of *Pterodontia* in Ohio. The pupa differs from that of *Oncodes* in possessing only 3 pairs of raised abdominal spiracles.

Oncodes costatus Loew

Oncodes costatus Loew, Berl. Ent. Zeitschr., 1869, p. 165.

Pupa.—Length, 5 mm. White, shining. Head small, without discoverable protuberances or hairs (poorly preserved). Thorax with a wartlike protuberance on each side of disc anteriorly, indicating the location of the openings of the prothoracic respiratory organs. Abdomen with a wartlike protuberance on spiracular areas of segments 1 to 4, segment 5 without protuberance, the spiracle distinguishable, remaining segments without distinct spiracle; apex of abdomen blunt, last segment slightly protuberant but without armature of any kind,

as is the entire abdomen except for the spiracular protuberances (Pl. LXXXI, Fig. 23).

A single specimen of the pupal exuvium of this species is in the collection here. It is unfortunately in rather poor condition, being impaled upon the pin which bears the imago. The locality is Urbana, Ill., June 25, 1904 (Hart and Kegley). Additional Illinois localities (for imagines) are as follows: Carbondale, May 30, 1904, jarred from an apple tree at night (Taylor), and Odin, June 2, 1909, a large series on dead twigs of elm, and one without data, June 23, 1909, from same locality (Hart).

There is a considerable difference in the color of some of the specimens, some having the humeri and scutellum yellowish while others have those parts quite dark, almost like disc of thorax. I am not at all certain that we have as many species in North America as the listed names indicate, as color, which has been exclusively used as a specific separation, appears to be quite unreliable.

Phytophagous and other Cyclorrhapha

SYRPHIDÆ

In this paper I describe the larva and puparium of one species of *Syrphidæ* and the puparia of two others. Two of these have been previously described by other writers, but very briefly.

Metcalf has described and figured the early stages of ten species of *Syrphidæ* from Ohio, one of which is not determined specifically*. All of the named species described in his paper occur in Illinois. It is opportune to notice the occurrence in this state of a parasite of *Allograpta obliqua* Say, which did not occur in connection with Metcalf's work on that species in Ohio. This species belongs to the chalcid genus *Bothriothorax*, and is at present undescribed, according to A. A. Girault to whom the species was submitted. Four examples of each sex of the parasite were reared by the writer from a single larva. The parasites completed their metamorphoses within their host, emerging through a single exit-hole in its skin. This does not coincide with Hubbard's observation on the chalcid parasites of *Baccha babista* quoted by Metcalf†, which emerged through a number of holes in the puparium. Metcalf reared the icheumonid *Bassus lætatorius* Fabricius, from *Allograpta obliqua*. The chalcid *Bothriothorax peculiaris* Howard, has been recorded by Smith as a parasite of syrphid puparia.

*Syrphidæ of Ohio, Bull. 1, Ohio Biol. Surv., published as No. 31, Vol. 17, Ohio State Univ. Bull. 1913.

†Loc. cit., p. 51.

Tropidia quadrata Say

Xylota quadrata Say, Am. Entom., Vol. 1, Pl. VIII; Compl. Works, Vol. 1, p. 14.

Puparium (Pl. LXXXIII, Fig. 17).—Length, 9 mm. Testaceous yellow. Entire body opaque, covered with very short closely placed pale hairs. Lower part of the lidlike anterior portion with 8 small blackish thorns, 4 in a semicircle close to the lower extremity, 2 slightly higher placed, about midway between median line and lateral suture, and 2 close to suture, about midway between lower extremity and the median cross-suture; 2 strong thorns on each ventro-lateral margin close to anterior margin of pupa; anterior respiratory organ (Fig. 18) covered with small glossy knoblike swellings. Posterior extremity with 3 thorns close to ventro-lateral margin; posterior respiratory organ as shown in Figure 19, Plate LXXXIII.

The pupal exuvium from which the above description was drawn, is that of a male which bears the number 13549. The puparium was found floating in the water at Flag Lake, near Havana, Ill., August 3, 1895. Several were found on August 3 and 5, but only one imago emerged (August 14). Two specimens, evidently newly pupated, were found by Mr. Hart in a *Sagittaria* belt which had but recently become inundated.

Imagines in the collection here are from the following localities: Algonquin, Chicago, Champaign, and Urbana, the dates ranging from May 25 to July 17. There are also 2 specimens in the collection from Westville, N. J., taken August 16.

The early stages of the members of this genus have not previously been described, and the larval habits are unrecorded.

Brachypalpus frontosus Loew

Brachypalpus frontosus Loew, Berl. Ent. Zeitschr., 1872, p. 83.

Larva (Pl. LXXXIII, Fig. 12).—Length, 17 mm. White, with the prothoracic thorns and setulæ dark brown, anal respiratory organ pale brown. Surface of entire body with closely placed, stout, small, pale hairs. Front view of head and prothorax as in Figure 14; antennæ of moderate size, apices with two circular sensory organs; anterior margin of prothorax with 3–4 transverse rows of blackish thornlike processes which are recurved apically, the upper or posterior one strongest; prothorax with a strong outwardly directed, backwardly curved thorn on each side and a small respiratory organ slightly nearer to median line; each segment with 10 slight carinæ, 4 on dorsum, one on each dorso-lateral angle, one on middle of each lateral surface, and one on each ventro-lateral angle, each carina with a group of hairs at

middle of each segment, the bases of the hairs being generally fused; hairs on remainder of surface shorter than those on carinæ, and occasionally pairs are fused on lateral surfaces; ventral surface with 7 pairs of conspicuous pseudopods, all of which are armed on apices of posterior surfaces with about 4 series of short blackish recurved thorns, the apical row being strongest; apex of abdomen as in Figure 12.

Puparium (Pl. LXXXIII, Fig .13).—Length of body 11 mm., caudal process, 5 mm. Yellowish brown, slightly shining. Surface as in larva except that the hairs are less conspicuous, the carinæ are indistinguishable, and the rugæ are much more numerous, as shown in Figure 13. The head is entirely retracted and the prothoracic thorns and respiratory organs are brought almost to the antero-ventral margin (Fig. 15); the pair of pupal respiratory processes, so conspicuous in *Tropidia quadrata*, are represented by slight callosities of the surface which are barely distinguishable; ventral pseudopods much less conspicuous than in larva; apical process distinctly broader than high.

The material from which the foregoing descriptions were drawn, was obtained near Urbana, Ill., under bark on a rotten tree-stump. The specimens reared are recorded as pupating March 5 and emerging March 19 and 21.

Imagines in the laboratory collection are from the following Illinois localities: Algonquin, Carlinville, and Urbana, the last-mentioned taken on April 20; the others without dates.

The only previous American record of the larval habits that I know of is that by Keen.*

I know of no previous description of the larva; the pupa has been very briefly described by Parker.†

Ceria willistoni Kahl

Ceria willistonii Kahl, Kans. Univ. Quart., Vol. 6, 1897, p. 141.

Puparium (Pl. LXXXIII, Fig. 16).—Length of body 10 mm., apical process 4 mm. Yellowish white, mottled with brown or blackish, opaque. (Anterior portion with respiratory organs missing.) Surface covered with microscopic pale hairs. Dorsum with a median longitudinal series of paired wartlike tubercles extending nearly to apex, 6 pairs in all; apices of tubercles with a few short setulose hairs; dorso-lateral margin with a single longitudinal series of 6 wartlike tubercles, each of which is slightly caudad of the corresponding sub-

*Can. Ent., Vol. 16, 1884, p. 147.

†Proc. Ent. Soc. Wash., Vol. 17, 1915, p. 147.

median one, and is similarly armed at apex; between the submedian and dorso-lateral warts is a longitudinal series of much smaller ones in direct line with the others, and on the upper margin of lateral area is a similar series of small warts, the whole forming a diagonal series on each side of the 6 segments; medio-lateral line with a pair of small warts on middle of each segment, the anterior one of each pair white, with a conspicuous small brown spot ventrad of it, and located almost vertically midway between the warts of the series dorsad of it; on the ventro-lateral line is a single wart on each segment, located in direct vertical line between the pair in medio-lateral series; ventral segments 1 to 4 each with a small slightly raised circular area on each side of the median line, each area being crowned with numerous dark brown setulose hairs; the remaining segments somewhat flattened and slightly fused, without the well-defined circular areas of the anterior 4, though still discernible, and without the setulose hairs; apical 2 segments each with a transverse series of 4 thornlike processes, 2 on the marginal and 2 on the submarginal line; apical process about 7 times as long as thick, shining brown, transversely oval in cross-section.

The pupal exuvium from which the above description was drawn, is that of a male. The pupa was obtained in a wood at Urbana, Ill., May 12, 1888, by Mr. Hart, and the imago emerged 3 days later.

Banks records the species from Falls Church, Va., where he obtained the pupa on oak bark about the middle of March, the imago emerging March 27. He has briefly described the puparium,* and states that the larvæ of *Ceria* are said to feed in flowing sap of trees. No data on the food habits are on file in this Laboratory.

C. willistoni has been given by some authors as a synonym of *C. signifer* Loew. The puparium of *signifer* is briefly described by C. W. Johnson.† It was found by Dr. Skinner near Bala, Pa., on an oak leaf. It is not possible to decide from the description whether it is identical with that here described.

The localities from which *signifer* has been recorded include Mexico, Florida, and Texas; *willistoni* was described from Kansas.

EPHYDRIDÆ

Hydrellia scapularis Loew

Hydrellia scapularis Loew, Mon. N. Amer. Dipt., Vol. 1, 1862, p. 153.

Larva.—Not preserved, the following characters being ascertained from an examination of the puparium. Anterior and posterior mar-

*Ent. News, Vol. 4, 1893, p. 91.

†Proc. Ent. Soc. Wash., Vol. 5, 1903, p. 310.

gins of dorsal segments except the apical 3 with numerous short setulæ which are irregularly arranged; ventral segments with similar setulæ, which are arranged in distinct transverse series which extend well on to the disc of the segments; antepenultimate segment with a large transverse patch of these setulæ on disc (Pl. LXXXIII, Fig. 16).

Puparium (Pl. LXXXIV, Fig. 13).—Length, 4 mm. Yellowish brown. Anterior respiratory organs absent. Segments with similar armature to that of larva. Apical segment armed with 2 sharp processes which pierce the outer membrane of the leaf in which the puparium is enclosed, and connected with these processes, which are evidently the posterior spiracles, are 2 tracheæ which run forward and presumably connect with the pupal envelope, although the point of connection is not discernible in the specimen before me.

The above description was drawn from specimens obtained by Mr. Hart and the writer at Grand Tower in April, 1914. The larvæ were mining the leaves of a species of *Panicum* growing in a small stream, many of the mines being below the water level.

Two specimens of a hymenopterous parasite were reared, both males. One specimen was submitted to Mr. A. B. Gahan, who identified it as *Gyrocampa,* n. sp. He considered it inadvisable to describe a new species from the male only.

Scapularis is generally distributed throughout the state. There is a previous record of the larva mining leaves of *Hordeum* by Webster and Parks.* Several European species of the genus have been recorded as phytophagous, but so far this is the only North American species on record.

DROSOPHILIDÆ

The imagines of many species of *Drosophila* are numerous throughout Illinois during the greater portion of the year, and may be seen in large numbers on the inside of windows of fruit-stores and delicatessen stores, as well as in cafés and restaurants, where they are readily detected, flying over various foods, by their slow and steady flight. The principal food of the larvæ consists of decaying vegetable matter, exuding sap on trees, and fungi. A few species are found mining leaves of cruciferous plants, and several attack injured fruit.

I am unable to indicate characters for distinguishing the larvæ of the family from allied acalypterates because of the paucity of my material. The larvæ vary very considerably within the genus *Drosophila* as at present limited, and the puparia vary even more in structure; in fact there is more difference between the pupæ of certain species of

*Jour. Agr. Research, Vol. 1, 1913, p. 84.

Drosophila than there is between the pupæ of different genera in some other families.

One species that I have reared has a larva that is capable of jumping much as do the larvæ of most *Cecidomyidæ*. One specimen covered a distance of over 5 inches at a single leap. I expect to deal with this and other species of the family in a subsequent paper.

Drosophila (Scaptomyza) adusta Loew

Drosophila adusta Loew, Berl. Ent. Zeitschr., 1862, p. 231.

Puparium (Pl. LXXXIV, Fig. 1).—Length, 1.5 mm. Reddish brown. Cephalic extremity with two long tapering respiratory processes, the trachea of which may be seen traversing the area of the sunken or flattened portion of puparium. Ventral surfaces of abdominal segments with numerous very minute setulæ, arranged in rather irregular transverse series. Caudal projections whitish, rounded apically and with weak apical hairs. Dorsal surface of abdominal segments armed with setulæ similar to those of ventral surface.

The specimen from which the foregoing description was drawn, was obtained from sap exuding from a mulberry tree at Urbana, Ill., July 3, 1915. It was unrecognized in the larval stage, but the pupa was readily separated from the other species before the adult emerged.

Chittenden has recorded this species, as *Scaptomyza adusta,* mining leaves of cabbage, etc.*.

The habits of the species of this group *(Scaptomyza)* are but imperfectly known, but it seems strange that the same species should be in the larval stage both a leaf-miner and a frequenter of sap of the nature in which I found it. I have seen a very large series of *Scaptomyza,* reared by Mr. A. B. Gahan, at College Park, Md., from cruciferous plants, cabbage and turnip, which led me to conclude when I examined them that the species *flavcola* and *graminum* were synonymous, the series presenting all gradations of thoracic coloration from unicolorous ferruginous to ferruginous with a brown central vitta, and from unicolorous grayish to gray with a dark brown central vitta. It is also worthy of note that in the specimens with unicolorous thorax the setulose discal hairs were arranged rather regularly over the entire surface, whereas in those with the vittate thorax the setulæ were arranged in a single longitudinal series along the margins of the central vitta, and the area beyond these was almost or entirely devoid of setulæ. To arrive at a definite decision as to the distinctness of the forms it would be requisite to rear a series from the eggs.

*Bull. 33, n. s., Div. Ent. Dept. Agr., 1902, p. 76.

Drosophila dimidiata Loew

Drosophila dimidiata Loew, Berl. Ent. Zeitschr., 1862, p. 230.

Puparium.—Length, 2 mm. Pale reddish yellow, slightly shining. General habitus similar to that of *Drosophila adusta*. Anterior respiratory organs about three times as long as their diameter, terminating in numerous fine hairs (Pl. LXXXIV, Fig. 5). Surface of abdomen with the usual transverse bands of short setulæ; apex of abdomen with a scalelike projection as shown in Figures 6 and 7, Plate LXXXIV; above the base of the apical pair of respiratory processes is a pair of small tubercles; cephalad of the scalelike process the surface of the abdomen is broken by 2 or 3 narrow but deep depressions.

The exuvia from which the above description was drawn are those of adults reared from larvæ obtained by Mr. Hart and the writer at Havana, Ill., November 16, 1913. The larvæ were found feeding in fungus on the trunk of a fallen decaying tree on the bank of the Illinois River. The imagines emerged November 21, 1913.

This species was originally described from imagines obtained in Illinois by Le Baron. Aldrich in his "Catalogue of North American Diptera", 1905, gives only the original locality. It is one of the commonest species at Urbana, occurring on windows in the Natural History Building, and on fungi on the campus of the University during the summer. Professor Aldrich informs me that he has taken the species at Lafayette, Ind.

AGROMYZIDÆ

The larval habits of the species contained in the genus *Agromyza* are similar in that all those known are phytophagous, but they differ in the point of attack which they select, some mining in leaves, and others in the roots or in the stem. All so far reported are internal feeders, and several are of economic importance, two of the latter class recently discovered being *Agromyza pruinosa* Coquillett—mining the cambium layer of birch—and *A. pruni* Grossenbacher, mining the cambium of *Prunus*. The last-named species I describe in the present paper. It has not been taken in this state, but almost certainly occurs here. As the original description is very brief and not readily accessible to entomologists I take the opportunity of re-describing it from material kindly supplied me by Mr. Grossenbacher, who reared the species.

There are a large number of very closely allied species in the genus *Agromyza*, and much careful work upon the early stages and food habits is necessary before we shall be able to decide just how many dis-

tinct species we have in North America. In this branch of the work there is a splendid opening for original and valuable investigation.

Agromyza pruni Grossenbacher

Agromyza pruni Grossenbacher, Bull. Torrey Bot. Club, Vol. 42, 1915, p. 235.

Larva, full-grown (Pl. LXXXIV, Fig. 8).—Length, 11–13 mm. White, semitransparent, mouth hooks black. Prothoracic segment longer than succeeding one, head parts retracted within prothorax (Pl. LXXXIV, Fig. 9), prothoracic respiratory organs indistinguishable except in one larva which had evidently been near the point of pupating. First abdominal segment longer than the two preceding thoracic segments together and shorter than second abdominal; segments 2 to 5 subequal in length; 6 shorter than 5; 7 and 8 together about equal to 6; integument of thoracic segments with numerous microscopic punctiform marks which are only visible under a very high magnification; abdominal segments with microscopic setulæ at the incisions, on their anterior margins, those on segments 1 to 5 consisting of one or two series which, like those of the apical segments, do not extend entirely round the body; segment 6 with 3 or 4 series, segment 7 with 6 or 7, apical segment with 8–9; anal respiratory organs rather conspicuous, ending in 3 short branches.

Puparium (Pl. LXXXIV, Fig. 10).—Length, 5 mm. Testaceous, slightly shining. Anterior respiratory organs very small. Abdominal segmentation not deep; segments with weak transverse rugæ; anal ventral orifice marked by a black spot; anal respiratory organs small, but slightly protruded.

Imago: male and female.—Black. Head black, anterior portion of frons, the antennæ, and palpi brown. Legs black, fore tibiæ and tarsi and apices of mid and hind tarsi yellowish (alcoholic specimens).

Frons over one third the head-width; orbits differentiated, each about one fourth the width of center stripe; 5 pairs of orbital bristles present, their length decreasing anteriorly; antennæ of moderate size, third joint rounded apically, pilosity short, arista slender, almost bare, the entire length about equal to that of frons; face concave; cheek narrow, about one sixth as high as eye, marginal bristles of moderate strength, not numerous, vibrissa well differentiated; eye nearly twice as high as long; palpi of moderate size. Mesonotum with 4 pairs of dorso-central bristles, the two anterior pairs reduced in size, the foremost pair well in front of suture; the pair of bristles between the posterior pair of dorso-centrals half as long as the latter; disc with numerous short setulæ. Abdomen stout; male hypopygium small, very much

like that of *parvicornis;* female ovipositor very conspicuous, as long as preceding segment of abdomen, of almost equal diameter throughout its length; surface with short hairs (Pl. LXXXIV, Fig. 11). Legs of moderate strength; mid-tibial bristles small. Wings of moderate width; costa to slightly beyond apex of third vein; inner cross-vein below end of first vein; outer cross-vein less than its own length from inner, slightly bent, its upper extremity nearer apex of wing than its lower; last section of fourth vein about 10 times as long as preceding section; last section of fifth about 1½ times as long as preceding section.

Length, 3.5–4 mm.

The life history of this species has been dealt with by its describer in the bulletin cited under the species name in the present paper, it being an elaboration of his report upon the same species in a previous paper.*

The three species of *Agromyza* known to cause medullary spots in wood of trees are *carbonaria* Zetterstedt, a European species; *pruinosa* Coquillett, occurring in the cambium of river birch; and the present species, found in the cambium of *Prunus avium* and *domestica.* In Grossenbacher's first paper above cited he states that *Crataegus* is also attacked, while *Salix* is not. In his last paper he makes mention only of the species of *Prunus,* and gives his agromyzid a name that leads me to infer that he considers it as a Prunus-infesting species exclusively.

I have recorded *Agromyza pruinosa* from Illinois†, and it is very probable that *A. pruni* occurs in suitable localities. Up to the present I have been unable to devote time to a search for the species.

I have drawn the larva and puparium of *Agromyza parvicornis* Loew (Pl. LXXXIV, Figs. 14 and 15) to show the normal reduction in size due to the induration of the larval skin in pupation in *Agromyza.*

The imago of *pruni* will run down to section 16 in my key to the North American species of this genus‡ if the frons is considered as partly reddish, the cross veins being close together. It is readily separated from both of the species in that section by its robust build and the possession of 4 pairs of dorso-central bristles. The species has much the same appearance as *pruinosa,* but differs in venation, etc., while the food plant and larval and pupal characters are quite enough to separate them specifically. The difference in venation will separate it from *aprilina.*

*Medullary spots: a contribution to the life history of some cambium miners. Tech. Bull. 15, N. Y. Agr. Exper, Sta., pp. 47–65. 1910.

†Can. Ent., Vol. 47, 1915, p. 15.

‡Ann. Ent. Soc. Amer., Vol. 6, 1913, p. 271.

Agromyza tiliæ Couden

Agromyza tiliæ Couden, Proc. Ent. Soc. Wash., Vol. 9, 1908, p. 34.

Puparium.—Length, 2.5 mm. Yellowish white, shining. Segments poorly defined but distinguishable; surface without hairs or protuberance except the anterior and anal respiratory organs. Anterior respiratory organs of moderate length (Pl. LXXXIV, Fig. 18), located on dorsum of first segment, separated from each other by less distance than the length of one of the organs. Anal respiratory organs shorter and comparatively stouter than anterior pair (Pl. LXXXIV, Fig. 19); anal orifice distinct, a few fine irregular reticulated lines on dorsum cephalad of the orifice.

The puparium from which the above description is drawn is one of a lot collected by J. J. Davis at Chicago October 6, 1908, the imagines emerging May 24, 1909. The species makes galls on twigs of linden trees. Besides these specimens there are several in the collection here which were reared by Marten several years ago at Urbana. The galls, "at base of leaf petioles of basswood", were obtained September 27, 1891, and the imagines emerged May 2, 1892. Originally figured and described from Missouri, and recorded as making galls on linden. I subsequently recorded the species from Veitch, Va., and doubtfully from Delaware County, Pa.*

Agromyza angulata Loew

Agromyza angulata Loew, Berl. Ent. Zeitschr., 1869, p. 47.

Larva.—Length, 1.75 mm. Pale greenish or whitish. Segments laterally conspicuously swollen, the incisions between them deep, so that viewed from above the whole larva presents a somewhat moniliform appearance; viewed from the side the larva is not so thick as across the dorsum and the segments present a more even surface with little indication of swellings or constrictions. Mouth parts black and of moderate size; armature consisting of 4 hooks, one at apex, a transverse pair slightly caudad of it, followed by another one at the lower posterior angle of the anterior face. Prothoracic respiratory organs very small and inconspicuous (Pl. LXXXIV, Fig. 2). Segments throughout with microscopic wartlike processes, which are rather widely separated on the surfaces of the swollen portions; apex of abdomen as in Figure 3, Plate LXXXIV.

Puparium (Pl. LXXXIV, Fig. 12).—Length, 1.25 mm. Glossy black, with purple or violaceous reflections, especially in the depres-

*Ann. Ent. Soc. Amer., Vol. 6, 1913, p. 327

sions and on the posterior 3 segments. Surface with similar processes to those of the larva, but almost indistinguishable because of the ground-color. Prothoracic respiratory organs very small. Depressions on body very deep, those on dorsum very conspicuous, slightly crescentic in shape. Apex of abdomen similar to that of larva except that in hardening the projecting portions are contracted considerably and are less clearly distinguishable.

Reared from leaves of *Setaria glauca,* the larvæ occurring in the apical 6 inches of the leaf, usually 4 or more in each mine. In company with another species *angulata* was found to be present on vacant lots both in Urbana and Champaign in July and August, 1915, their work showing up readily because of the conspicuous whitening of the tips of the affected leaves. *Angulata* has previously been recorded as attacking timothy grass*, and it will also feed on wheat. A summary of investigations of the habits and life history of this species, with figures of the imago and puparium, are given by Webster and Parks.†

Descriptions of New Illinois Diptera

In the course of the year it frequently happens that specimens are taken in general collections, or in connection with other work, which belong to undescribed species. Often these species are of economic importance, and usually they are small forms which are readily overlooked in the field. It is considered necessary in the interests of students of the represented order to place the occurrence of such species upon record; to give adequate descriptions of them; and to indicate their relationships with already described species. Isolated descriptions of new species unless very full are often useless for the purpose of identification because of their inadequate nature or the omission of the essential characters by means of which the species of the genus are separated. Many species have been described by writers who were unacquainted with congeneric species, and because of this ignorance they either did not compare their so-called new species with those already described, or they compared it with some species to which it bore but a faint resemblance. The present writer in all cases compares the new species he describes with the forms most closely related, not because he presumes to set an example but because he considers it his duty to do so.

*Malloch.—A Revision of the species in Agromyza Fallén, and Cerodontha Rondani, Ann. Ent. Soc. Amer., Vol. 6, No. 3, 1913, p. 304.

†The Serpentine Leaf-miner, Jour. Agr. Research, Vol. 1, No. 1, Oct. 10, 1913, pp. 83–84.

PHORIDÆ

Platyphora flavofemorata, n. sp.

Male.—Black. Head black, frons highly polished; antennæ fulvous, third joint brown at apex, arista black; palpi fulvous. Thorax glossy black, upper portion of pleuræ, especially posteriorly, brownish; scutellum dull black, the surface shagreened. Abdomen black, distinctly shining throughout, surface with very faint indications of pruinescence. Legs yellow, mid and hind coxæ infuscated at bases; all tibiæ infuscated, the depth of the infuscation increasing from near base to apices; tarsi fuscous. Wings clear, thick veins fuscous. Halteres yellow, apices of stems and the knobs black.

Frons about 1.5 as wide as its length at center, the length slightly less at eye margin than at center, surface with numerous short decumbent hairs, those at vertex slightly longer than those on disc; distance between the posterior ocelli about twice that between either of these and the median one; basal antennal joint rather elongate; third joint about 1.5 as long as broad, rounded at apex; arista subapical, bare, very slender, basal joint very short, slightly swollen; cheeks with 4–5 forwardly and slightly downwardly directed bristles; palpi very small, armed with several stout apical setulæ. Mesonotum broader than long, disc with short hairs and without dorso-central macrochætæ, scutellum about twice as broad as its length at center, margin with a number of decumbent setulose hairs which lie along the edge and give it the appearance of having a rim; disc distinctly shagreened. Abdomen with second segment longer than either of the 3 following segments, 6th longer than 4+5, its lateral surfaces with short hairs; surfaces of abdominal segments minutely shagreened; hypopygium small, surface of dorsal plate shagreened. Legs stout; fore coxæ stout, over two thirds as long as fore femora, their anterior surfaces with setulose hairs which become longer and stronger towards apices of coxæ; fore tibia about two thirds as long as femur, and distinctly longer than basal joint of tarsi (17:10); fore tarsi dilated, especially the basal joint, which is distinctly wider at apex than is the tibia; second tarsal joint appreciably longer than third; mid tibiæ with 2–3 apical setulæ, hind tibiæ with short decumbent setulæ on ventral surfaces, so arranged that they appear like irregular longitudinal rugæ; apices with 2–3 short setulæ and one longer bristle; mid and hind tarsi slender, basal joint of each with a few short downwardly directed setulæ on ventral surfaces. Costa extending to middle of wing; third vein swollen, thicker than costal vein excepting apical part of latter, setulose throughout; second vein distinct, setulose; first vein swollen at apex, extending be-

yond base of second; costal setulæ about equal to diameter of costal vein; veins 4 and 5 very distinctly divergent at apices; greatest distance from vein 7 to margin of wing equal to greatest distance from vein 4 to margin.

Female.—Reddish yellow. Eyes black; frons with a slight pearlaceous iridescence, antennæ and palpi concolorous with head. Thorax similar in color to upper part of head. Abdomen dorsally darker than thorax, becoming dark brown or fuscous at apex, the iridescence very distinct, especially at base; ventral surface opaque black except at extreme base. Legs reddish yellow, the short setulose hairs on tibiæ and tarsi giving them a slight fuscous color.

Ocelli indistinguishable; width of frons less than twice its length at center, anterior outline convex; eyes very small, each about one tenth the width of frons seen from above; surface of frons with sparse microscopic hairs; antennæ smaller than in the male, shape similar; arista with very slight pale pubescence; palpi almost as large as third antennal joint, with apical setulæ as in male; cheek with 2 distinct groups of setulæ, one extending from middle to eye margin and consisting of 3 strong setulæ and several weak hairs, the other located on mouth margin and consisting of 3 strong setulæ. Mesothorax slightly over 1.5 as broad as long; disc with very weak setulæ, lateral margins more strongly setulose; posterior outline slightly emarginate; appearance of dorsum as in Figure 17, Plate LXXXIV. Abdomen with 6 distinct segments, undifferentiated from thorax except by the transverse suture, its dorsal level and lateral margins similar to those of thorax; fourth segment slightly elongated, its posterior margin broadly and slightly concave; surfaces of all segments with weak setulæ. Legs rather short and stout; fore tarsi short and distinctly dilated, basal joint as long as next two together and less than half as long as tibia; armature of legs as in male except that the mid tibiæ have a long apical spur. Wings and halteres absent.

Length: male, 1.7 mm.; female, 1 mm.

Type locality, White Heath, Ill., August 22, 1915—a pair taken *in copula* on a sandy bank along the Illinois Central Railroad between White Heath and the Sangamon River by the writer.

The male of this species bears a strong resemblance to *coloradensis* Brues*, differing noticeably however in wing venation, which in *flavofemorata* is similar to that of *eurynota*, which Brues described at the same time. In separating the males of the three North American species the following key will be found useful.

*Psyche, Vol. 21, 1914, p. 79.

1. Veins 4 and 5 almost parallel apically.....*coloradensis.*
— Veins 4 and 5 very distinctly divergent apically.....2
2. Legs and antennæ black; scutellum polished; basal joint of fore tarsi almost as long as fore tibiæ.....*eurynota.*
— Legs and antennæ yellowish, more or less infuscated apically; scutellum subopaque, shagreened, basal joint of fore tarsi not two thirds as long as fore tibiæ.....*flavofemorata.*

The genus *Platyphora* was described by Verrall in 1877 with the genotype *lubbocki* Verrall, a myrmecophilous species found in Britain*. Nothing was known of the female of the species for a number of years. In 1890 Meinert described the genus *Ænigmatias*† with the genotype *blattoides* Meinert. Mik suggested in 1898‡ that *Ænigmatias* was the female of *Platyphora*. The most definite statement concerning the relations of the genera is that published by Donisthorpe.§ In this paper it is stated definitely that the genera are synonymous, *Platyphora* being simply the winged male and *Ænigmatias* the apterous female of the same genus. This decision was arrived at from data obtained in connection with observations made on ants' nests in which the species of *Platyphora* occur. I am not aware of any copulating record having been made prior to that in the present paper, the decision as to the specific identity of the European species resting upon the fact that only males of *Platyphora* and only females of *Ænigmatias* were obtainable, and that both occurred in the immature stages in the same nests. The record now published confirms the previous one by Donisthorpe, if such confirmation were required.

Coquillett described as a male a female discovered in Arizona.|| This species, *schwarzi* Coquillett, is very similar to *flavofemorata,* and a comparison of the foregoing description with Coquillett's type will be necessary to discover specific differences, although his description seems to indicate that the two are distinct. It is pertinent to indicate here that the females of neither of the species described by Brues are known.

In the case of *flavofemorata* the species was found on a sandy bank where there were numerous ants' nests. The male was running about fairly rapidly, and it was only after I had inverted a cyanide bottle over it that I discovered the attached female. The latter was carried apparently curled forward under the abdomen of the male and was

*Jour. Linn. Soc. Lond., Zool., Vol. 13, 1877, p. 259.
†Entom. Meddel., Vol. 2, 1890, p. 213.
‡Wien Ent. Zeit., Vol. 17, 1898, p. 204.
§Ent. Rec., Vol. 26, 1914, p. 276.
||Can. Ent., Vol. 35, 1903, p. 21.

quite invisible from above on account of the rather large wings of the male, which were folded closely over the abdomen. It is quite possible that it is by this means that the females find their way from one nest to another, as they are themselves not well adapted to do so.

Coquillett's species is recorded as occurring in a situation where no ants' nests were within easy reach.

ANTHOMYIDÆ

Pogonomyia flavinervis, n. sp.

Male.—Glossy black. Frontal and facial orbits slightly brownish. covered with dense silvery pilosity. Thorax with slight, but distinct, grayish pruinescence, which when viewed from in front gives the disc the appearance of being trivittate anteriorly. Abdomen when viewed from behind distinctly gray pruinescent on sides, leaving only a rather narrow dorso-central black line which is more or less interrupted at apex of each segment. Legs black. Wings slightly tinged with yellow, all veins yellow, costa with black setulose hairs. Calyptræ whitish, margins yellowish. Halteres brown, knobs dark brown.

Eyes distinctly separated, orbits each about as wide as central stripe at narrowest part of frons; frons at narrowest part as wide as distance between outer margins of the posterior ocelli; the strong pair of vertical macrochætæ much more conspicuous than the postocular bristles; arista short-haired; head otherwise similar to that of *alpicola.* Thorax with the macrochætæ and hairs as in *alpicola* but much weaker. Abdomen rather narrow and distinctly tapering apically, the macrochætæ and hairs much less conspicuous than in *alpicola.* Legs with the armature much as in *alpicola;* mid femora with the antero-ventral surface armed with a series of 8–9 bristles, which begins before middle and extends to apex, the longest bristle being slightly beyond the middle of the series; postero-ventral surface with a series of 8–9 longer and more hairlike bristles extending from base to a point about one third from apex, the bristles increasing in length from base to apex of series; hind femora with the series of bristles on antero-ventral surfaces much less numerous than in *alpicola;* postero-ventral surface with a single long slender bristle about one third from apex (two smaller and weaker ones in *alpicola*); hind tibiæ with armature like that of *alpicola* except that the bristles are distinctly weaker. Wing venation similar to that of *alpicola.*

Female.—Agrees in color with the male except that the abdomen is almost entirely glossy black.

Eyes separated by slightly less than one third the head-width, orbits each about half as wide as central stripe at its narrowest point; decussate frontal bristles slender. Abdomen much broader than in male. Legs stouter than in male; mid femora with a stout bristle about one fourth from base on the antero-ventral surface which is appreciably shorter than the diameter of the femur (in *alpicola* this bristle is more slender and much longer than the diameter of the femur). Third and fourth wing-veins slightly convergent apically.

Length, 5.5–7 mm.

Type locality, Algonquin (Nason).

The type series consists of one male and three females, two bearing Algonquin labels (one with the date May 24, 1895), and two labeled N. Ill., one of the latter also bearing Stein's label *"Pogonomyia* n. sp.", and presumably the species referred to by him in Berliner Entomologische Zeitschrift*. Subsequently Stein referred to the species a specimen from Wisconsin, but as he had only seen females he did not describe the species.

The foregoing description should serve to separate *alpicola* Rondani, and *flavinervis*. I have not seen *aterrima* Van der Wulp, which was described from Mexico, but it must be very similar to *alpicola* if not identical with it. I have both sexes of *alpicola* from Moscow, Idaho, May 22, 1913 (J. M. Aldrich).

GEOMYZIDÆ

Aphaniosoma quadrivittatum, n. sp.

Female.—Opaque yellow. Head yellow with the exception of a small spot surrounding the ocelli and a small area round the connection between the head and thorax, which are black; eyes iridescent green in life. Mesonotum with four blackish gray vittæ, the center pair indistinctly connected with a similarly colored spot on center of anterior margin at connection of head and thorax, lateral pair discontinued at humeri, posteriorly all four vittæ being discontinued slightly beyond middle of disc, the lateral pair slightly exceeding the median pair in length; lower portion of sternopleura slightly darkened; postnotum blackened on lower half. Abdomen pale yellow, each segment with a conspicuous blackish brown cross-band on basal portion which is broad on median line and narrows towards each lateral margin. Legs yellow. Wings clear, veins yellow. Halteres yellow. Bristles on head and thorax black, surface hairs yellow.

*Vol. 42, 1897, p. 170.

Head slightly higher than long; face concave in center; upper half of back of head concave; post-vertical bristles very weak, cruciate; frons in profile slightly buccate, viewed from above nearly one half the width of head, slightly narrowed anteriorly; orbit not differentiated from center stripe; two distinct orbital bristles present on each side which are slightly reclinate and of moderate size; anterior to the lower one is a short setula; ocellar bristles forwardly directed, divergent; surface of center stripe with numerous short setulose hairs; antennæ rather small, third joint rounded, arista almost as long as frons, bare; cheeks with numerous rather distinct hairs and 2–3 stronger bristles along mouth margin anteriorly; cheek at middle half as high as eye, the latter slightly longer than high. Mesonotum with 2 pairs of widely separated dorso-central bristles, the anterior pair much weaker than the posterior and preceded by a closely placed series of short setulæ which extend along the inner margin of the lateral vittæ almost to anterior margin of disc; acrostichals two-rowed anteriorly, irregularly four-rowed posteriorly; no bristles between posterior dorso-centrals; scutellum slightly flattened on disc, 4 subequal marginal bristles present, the posterior pair located on margin very close to base. Abdomen slightly elongated, pointed at apex. Legs rather slender; tibiæ without preapical bristle. Wings narrow, auxiliary vein complete but indistinct; costa unbroken, first division one fifth as long as second; second vein distinctly arcuate, the cell between it and third vein conspicuously narrowed apically; inner cross-vein about as far beyond apex of first as it is in front of outer cross-vein; outer cross-vein short, not much longer than inner; last section of fourth vein four times as long as penultimate; last section of fifth, one and a half times as long as penultimate.

Length, 2 mm.

Type locality, Urbana, Ill., June 19 to July 9, 1915; on window in Natural History Building, University of Illinois (J. R. Malloch).

The range of variation in color in this species includes forms in which the back of the head is entirely gray, and the dorsum of thorax and abdomen almost entirely blackish gray.

The genus *Aphaniosoma* was described by Becker in 1903*, who distinguished it from *Chyromyia* by the concave occiput, the latter genus having the occiput convex. The characters of the two genera are very similar, but the shape of the head should readily separate them. The Egyptian species, *approximatum* Becker, differs from the above species in having the disc of the mesonotum opaque gray dusted and the pleuræ with gray spots. It is also considerably smaller—.5–.75 mm.

*Aegyptische Dipteren. Mitt. Zool. Mus. Berlin, II Bd., 3 Hft.

AGROMYZIDÆ

Agromyza aprilina, n. sp.

Female.—Glossy black. Frons opaque black, orbits and ocellar triangle glossy; lunula yellowish; face and cheeks opaque, slightly dusted with grayish pruinescence; antennæ, palpi, and proboscis black. Thorax highly polished without trace of pruinescence; scutellum as disc of mesonotum. Abdomen as thorax, with a slight metallic blue sheen towards apex. Legs entirely black. Squamæ and fringes whitish. Halteres yellow, knobs white.

Head in profile as in Figure 4, Plate LXXXIV, frons over one third the head-width, parallel-sided, orbits narrow, each about one fifth as wide as center stripe, five moderately strong orbital bristles present, which decrease slightly in strength towards anterior margin, orbits otherwise bare; frontal triangle distinct, rather broad and short, not extending midway to anterior margin; antennæ of average size, third joint distinctly, but not greatly, longer than broad; arista swollen at base, bare, its length exceeding that of anterior width of frons by about one fourth; face and cheeks as shown in figure of profile. Mesonotum with 4 pairs of dorso-central bristles, which decrease in size anteriorly, the foremost pair being but little stronger than the strong discal hairs of which there are about 6 irregular rows between the anterior dorso-centrals; the pair of bristles between the posterior pair of dorso-centrals distinct. Abdomen elongate, discal hairs numerous and rather strong; ovipositor stout and of moderate length. Legs normal in length and in form; mid tibiæ with the posterior pair of bristles distinct. Costa extending slightly beyond third vein; outer cross-vein slightly beyond middle of wing and a little more than its own length from inner; inner cross-vein beyond end of first vein and two fifths from apex of discal cell; last section of fourth vein four times as long as penultimate section; last section of fifth five sixths as long as penultimate; auxiliary vein complete; sixth vein extending nearly to wing margin.

Male.—Agrees with the female in color.

Differs from the female in the case of one specimen in having the outer cross-vein at one seventh of the distance from inner cross-vein to wing margin.

Length: female, 3–3.5 mm.; male, 2.5 mm.

Type locality, Cottonwood grove, Urbana, Ill., April 16–20, 1915 (J. R. Malloch).

In the key to the species of *Agromyza* in my paper in the Annals of the Entomological Society of America this species will run down

to caption 15. Including *subnigripes* (=*nigripes* Schiner *nec* Meigen) there are four species occurring in North America that fall here; they may be separated thus:

a. Squamæ gray, fringes brown.....*subnigripes* Malloch.
— Squamæ and fringes whitish.....aa
aa. Cross veins separated by about the length of outer cross-vein.....*aprilina*, n. sp.
— Cross veins separated by about twice the length of outer cross-vein.....aaa
aaa. Arista almost bare; occiput not projecting on upper half.....*abbreviata* Malloch.
— Arista distinctly pubescent; occiput projecting on upper half.....*kincaidi* Malloch.

CHLOROPIDÆ

Gaurax Loew

I recently described two new species of the genus *Gaurax* and published a synoptic key to the North American species*. Since sending that paper in for publication I have found three species which are evidently undescribed, and in presenting descriptions of these I feel that it becomes necessary to publish an enlarged synopsis of the species so that students may the more readily recognize the new forms.

I have not found any of the early stages of the species; most of the imagines occurring on tree-trunks and limbs. Several examples of *dorsalis* Loew were taken on windows of the basement in the Natural History Building of the University of Illinois.

In the case of the specimens of *montanus* Coquillett which I took here the apices of the hind femora are slightly brownish, a character possessed by the type also, though omitted in the original description.

Key to Species.

1. Wings not entirely hyaline, either with a black spot at apex of second vein, or with a distinct dark mark or infuscation on disc....2
— Wings entirely hyaline.....7
2. Wings with a small black spot at apex of second vein (Toronto, Can.).....*pseudostigma* Johnson.
— Wings with a much greater portion blackened.....3
3. Thorax and scutellum entirely yellow; a large black mark occupying the area of the wings from middle of second vein between costa and third vein and a small portion of the apex of the cell posterior to third (Ill.).....*flavidulus*, n. sp.

*Proc. Ent. Soc. Wash., Vol. 17, 1915, p. 159.

— Thorax with at least black discal marks; wings marked otherwise than as above 4
4. Thorax and scutellum black 5
— Ground color of thorax yellow, disc with black marks, scutellum yellow 6
5. Setulose hairs on frons and cheeks black; wings with very distinct infuscation, which extends to base and is most distinct in cell bounded by first vein and costa; legs entirely yellow (Ill.) ..... *pallidipes*, n. sp.
— Setulose hairs on frons and cheeks yellow; wings with rather indistinct infuscation, which does not extend to base; legs yellow, hind femora and tibiæ largely black (Ill.) ..... *fumipennis* Malloch.
6. Sides of mesonotum near anterior angles with a white spot (Ill.) ..... *splendidus* Malloch.
— Sides of mesonotum without a white spot (Mass.) ..... *obscuripennis* Johnson.
7. Thorax and scutellum glossy black; apical half of hind femora black, the remainder of legs yellow (La.) ..... *pilosulus* Beeker.
— Either disc of mesonotum or the scutellum yellow; legs not as above 8
8. Halteres yellow 9
— Halteres black 11
9. Scutellum black, disc of mesonotum yellow, with a posteriorly tridentate black mark which covers almost the entire disc (Pa., Ill., N. H.) ..... *dorsalis* Loew.
— Scutellum yellow, with brownish marks upon the disc 10
10. Disc of mesonotum with 3 confluent black vittæ, forming a large discal mark, rarely narrowly separated; scutellum with a basal black mark on each side (N. H.) ..... *ephippium* Zetterstedt.
— Disc of mesonotum with 3 black spots, the rudiments of the normal vittæ, beyond middle; scutellum with a large brownish mark on disc (Ill.) ..... *interruptus*, n. sp.
11. Legs entirely yellow or with only a faint brownish mark at apices of hind femora (N. H., Vt., Ill.) ..... *montanus* Coquillett.
— Legs with distinct, deep black marks 12
12. Thorax glossy black, lower half of pleuræ and the scutellum yellow (Ill.) ..... *apicalis* Malloch.
Thorax and scutellum yellow, disc of the former with black marks (Pa.) ..... *festivus* Loew.

Gaurax flavidulus, n. sp.

Male.—Yellow, subopaque. Head yellow, ocellar region, inner upper mouth-margin, and back of head black. Thorax yellow, a black central spot on pleuræ and a similarly colored transverse one on middle of postnotum. Abdomen yellow, infuscated on sides of first seg-

ment and entire dorsum of other segments; venter yellowish. Legs yellow, mid and hind tibiæ with a brownish black spotlike mark on dorsal surfaces near base. Wings with a large black mark covering the entire area anterior to third vein from middle of second to apex of third and extending slightly posterior to third near its apex; veins black. Halteres yellow. Setulose hairs on head and thorax black, the weak hairs pale yellow.

Frons over one third the head-width, triangle poorly defined; antennæ small, third joint rounded apically, slightly pilose; arista short-haired; cheek linear; eyes sparsely haired. Surface of mesonotum with weak hairs; apical pair of scutellar bristles distinctly stronger than basal. Abdomen rather slender; hypopygium of moderate size, recurved. Legs normal. Third costal division of wing about three fourths as long as second; veins 3 and 4 parallel, the latter ending in wing tip.

Length, 1 mm.

Type locality, Urbana, Ill., July 4, 1915, at rest on cypress limb (J. R. Malloch).

Differs from any described species of the genus in the wing markings.

GAURAX PALLIDIPES, n. sp.

Male.—Black, shining. Head yellowish brown; frons opaque black-brown, triangle glossy black; antennæ brownish; arista fuscous; palpi dusky yellow; back of head black. Thorax and abdomen shining black, the latter slightly yellowish at base. Legs entirely yellow. Wings with a very distinct infuscation on anterior basal half, which fades out before apex of third vein; veins black. Halteres yellow, knob black. Hairs and bristles on head black; bristles on thorax yellow; hairs on thorax and abdomen white.

Head short and broad; frons one half the width of head, triangle well defined and very large, filling almost the entire frons; lateral and vertical setulæ strong; antennæ large, third joint very hairy; arista slender, short-haired; marginal hairs on cheek strong; eyes very distinctly haired. Mesonotum rather densely covered with long white hairs; scutellum with similar hairs and 4 marginal bristles, the apical pair strongest. Abdomen short and broad. Legs of moderate strength. Third costal division of wing two thirds as long as second; veins 3 and 4 parallel, the latter ending in wing tip.

Length, 1.5 mm.

Type locality, Urbana, Ill., July 4, 1915, at rest on cypress limb (J. R. Malloch).

Differs from *fumipennis* Malloch in having the legs entirely yellow and the infuscation of the wings carried to the base.

Gaurax interruptus, n. sp.

Female.—Ochreous yellow, slightly shining. Head yellow, ocellar region, inner upper mouth-margin, and back of head black, arista brownish. Mesonotum with the three vittæ faintly indicated anteriorly, black on posterior third from transverse median line of disc midway to posterior margin; pleuræ with a large glossy black central spot and the upper margin narrowly black; scutellum brownish black except the margin; postnotum yellow above, black below. Abdomen black dorsally, segments paler on anterior margins, venter yellow. Legs yellow. Wings hyaline, veins grayish. Halteres yellow, knobs white. Bristles on head and thorax black, hairs yellowish.

Frons opaque, over one third the width of head, surface with numerous setulose hairs, those on vertex, lateral margins, and a pair on center of anterior margin strong; antennæ rather small, arista short-haired; eyes sparsely haired; triangle poorly defined. Mesonotum with less noticeable surface hairs than in most species of the genus; scutellum with short discal hairs and 4 marginal bristles, the apical pair strong. Abdomen and legs normal. Third costal division of wing about four fifths as long as second; veins 3 and 4 subparallel, the latter ending in wing tip.

Length, 1 mm.

Type locality, Urbana, Ill., July 5, 1915, at rest on cypress tree trunk (J. R. Malloch).

This species is separable from *ephippium* by the interrupted thoracic vittæ, and the discal spot on scutellum.

Urbana, Illinois, December 3, 1915.

Plate LXXX

Larval and Pupal Details of Sciara, Mycetobia, and Deromyia

Fig. 1. *Sciara* sp., larva, ventral view of head: *a*, antenna; *lab*, labium; *mx*, maxillæ; *lb*, labrum; *m*, mandible.
Fig. 2. The same, abdominal trachea and spiracle of larva.
Fig. 3. The same, prothoracic trachea and spiracle of larva.
Fig. 4. The same, latero-ventral view of pupa.
Fig. 5. *Mycetobia divergens*, prothoracic spiracle of larva.
Fig. 6. The same, portion of head and prothorax showing trachea and spiracle of larva.
Fig. 7. *Mycetobia divergens*, lateral view of pupa.
Fig. 8. *Sciara* sp., mandible of larva.
Fig. 9. *Mycetobia divergens*, dorsal view of apical segments of pupa.
Fig. 10. *Sciara* sp., clypeus and hypopharynx of larva.
Fig. 11. *Mycetobia divergens*, mandible of larva.
Fig. 12. The same, dorsal view of larva.
Fig. 13. The same, labial plate of larva.
Fig. 14. *Deromyia winthemi*, thorns at base of wing of pupa.
Fig. 15. The same, lateral view of eighth and ninth segments of abdomen of pupa.
Fig. 16. The same, side view of lateral cephalic thorns of pupa.

Plate LXXX

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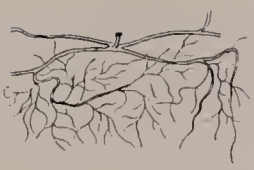

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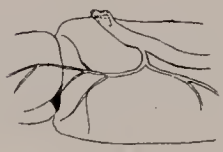

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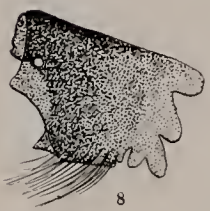

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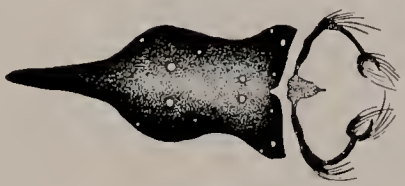

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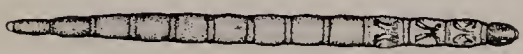

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Plate LXXXI

Larval and Pupal Details of Bombyliidæ, Asilidæ, Therevidæ, and Cyrtidæ

Fig. 1. *Exoprosopa fascipennis*, pupal abdominal dorsal bristles, dorsal view.
Fig. 2. The same, lateral view.
Fig. 3. *Anthrax lateralis*, pupal abdominal dorsal bristles, lateral view.
Fig. 4. *Exoprosopa fascipennis*, lateral view of pupa.
Fig. 5. The same, front view of head of pupa.
Fig. 6. *Asilus notatus*, lateral view of head and thorax of pupa.
Fig. 7. The same, dorsal view of pupa.
Fig. 8. *Anthrax lateralis*, pupal abdominal dorsal bristles, dorsal view.
Fig. 9. *Psilocephala hæmorrhoidalis*, larval head, lateral view: *a*, antenna; *m*, mandible; *pr*, posterior rods.
Fig. 10. The same, lateral view of larva: *sp*, prothoracic spiracle; *1–6*, abdominal segments one to six; *a*, dorsal view of apex of abdomen.
Fig. 11. *Psilocephala hæmorrhoidalis*, ventral view of pupa.
Fig. 12. The same, dorsal view.
Fig. 13. The same, lateral view of apex of abdomen of pupa.
Fig. 14. *Asilus notatus*, lateral view of apex of abdomen of pupa.
Fig. 15. *Psilocephala hæmorrhoidalis*, lateral view of head and thorax of pupa.
Fig. 16. *Anthrax lateralis*, lateral view of head of pupa.
Fig. 17. The same, front view of head of pupa.
Fig. 18. *Anthrax hypomelas*, lateral view of apical segments of abdomen of pupa.
Fig. 19. *Anthrax lateralis*, same as above.
Fig. 20. *Anthrax hypomelas*, lateral view of head of pupa.
Fig. 21. *Anthrax lateralis*, dorsal view of head of pupa.
Fig. 22. *Anthrax hypomelas*, same as above.
Fig. 23. *Oncodes costatus*, lateral view of abdomen of pupa.

Plate LXXXI

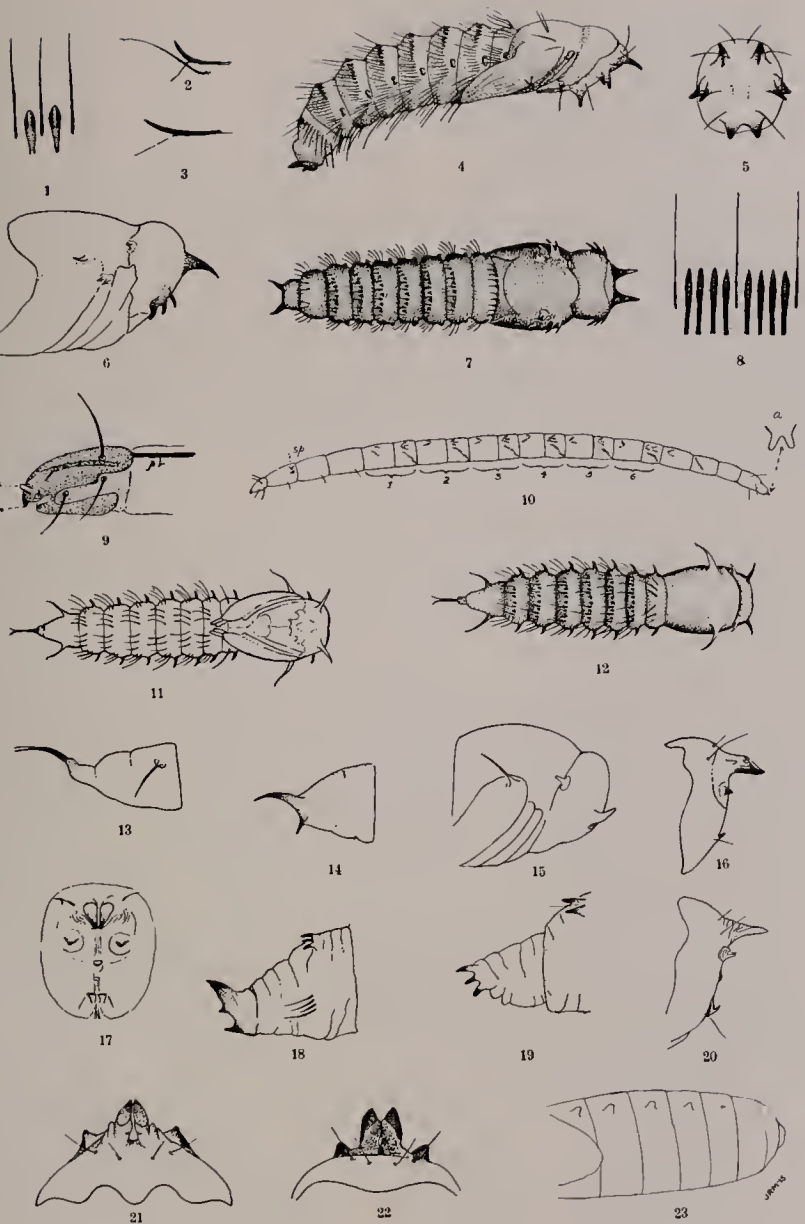


Plate LXXXII

Larval and Pupal Details of Asilidæ and Mydaidæ

Fig. 1. *Proctacanthus milberti*, ninth abdominal segment of pupa.
Fig. 2. *Promachus vertebratus*, seventh, eighth, and ninth abdominal segments of pupa.
Fig. 3. *Proctacanthus milberti*, end view of ninth segment of abdomen of pupa.
Fig. 4. *Promachus vertebratus*, side view of lateral cephalic thorn of pupa.
Fig. 5. The same, thorns at base of wing-case of pupa.
Fig. 6. *Proctacanthus milberti*, side view of lateral cephalic thorns of pupa.
Fig. 7. The same, thorns at base of wing-case of pupa.
Fig. 8. *Mydas clavatus*, dorsal view of apex of abdomen of pupa.
Fig. 9. The same, lateral view of pupa.
Fig. 10. The same, front view of head of pupa.
Fig. 11. *Promachus vertebratus*, ventral view of apex of abdomen of larva.
Fig. 12. The same, lateral view of larva.
Fig. 13. The same, posterior spiracle of larva.
Fig. 14. The same, dorsal view of apex of abdomen of larva.
Fig. 15. *Mydas clavatus*, lateral view of head of pupa.
Fig. 16. The same, side view of lateral cephalic thorn of pupa.
Fig. 17. *Asilus notatus*, thorn at base of wing-case of pupa.
Fig. 18. The same, side view of lateral cephalic thorn of pupa.
Fig. 19. *Proctacanthus milberti*, dorsal abdominal thorns of pupa.
Fig. 20. *Promachus vertebratus*, same as above.
Fig. 21. *Mydas clavatus*, same as above.
Fig. 22. *Proctacanthus milberti*, spiracular area of first abdominal segment of pupa.
Fig. 23. *Mydas clavatus*, abdominal spiracle of pupa.
Fig. 24. *Promachus vertebratus*, dorsal view of head of larva.
Fig. 25. The same, ventral view of head of larva.

Plate LXXXII

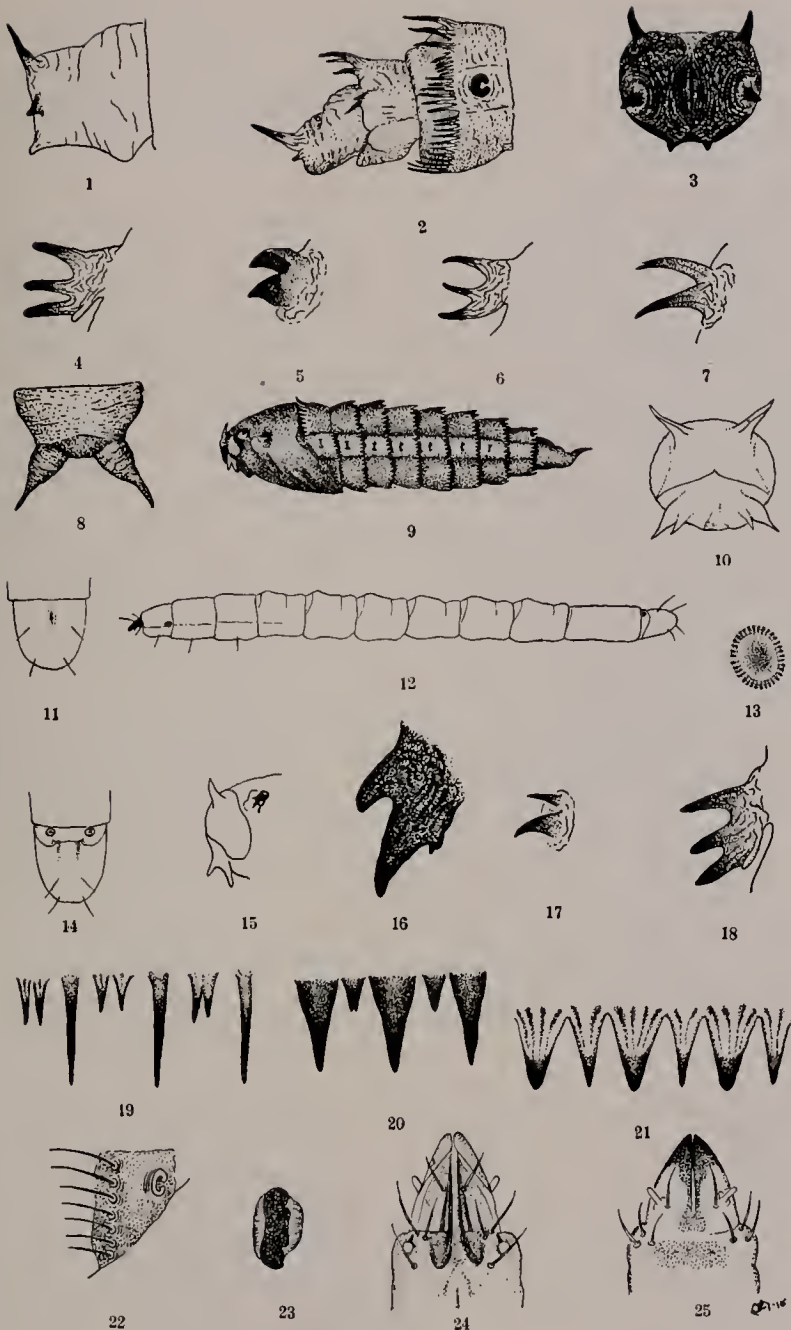
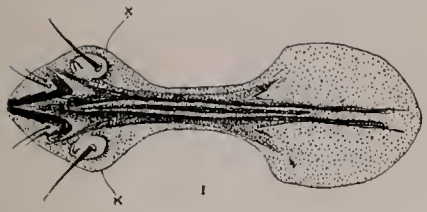


Plate LXXXIII

Larval and Pupal Details of Bombyliidæ and Syrphidæ

Fig. 1. *Spogostylum anale*, dorsal view of head of larva. Retracted within prothoracic segment to point marked X.
Fig. 2. *Spogostylum anale*, dorsal abdominal bristles of pupa.
Fig. 3. *Exoprosopa fasciata*, same as above.
Fig. 4. The same, lateral view of apex of abdomen of pupa.
Fig. 5. *Sparnopolius fulvus*, same as above.
Fig. 6. *Exoprosopa fasciata*, lateral view of head of pupa.
Fig. 7. *Sparnopolius fulvus*, same as above.
Fig. 8. *Spogostylum anale*, dorsal view of apex of abdomen of pupa.
Fig. 9. The same, lateral view of head of pupa.
Fig. 10. The same, lateral view of apex of abdomen of pupa.
Fig. 11. *Exoprosopa fasciata*, dorsal view of apex of abdomen of pupa.
Fig. 12. *Brachypalpus frontosus*, dorsal view of larva.
Fig. 13. *Brachypalpus frontosus*, lateral view of puparium.
Fig. 14. *Brachypalpus frontosus*, front view of head and prothorax of larva.
Fig. 15. *Brachypalpus frontosus*, puparium, front view of lower margin of cephalic extremity, showing the remarkable change in position of the prothoracic thorns.
Fig. 16. *Ceria willistoni*, lateral view of puparium, anterior portion missing.
Fig. 17. *Tropidia quadrata*, lateral view of puparium.
Fig. 18. The same, anterior respiratory organ of puparium.
Fig. 19. The same, dorsal view of apex of abdomen of puparium.

Plate LXXXIII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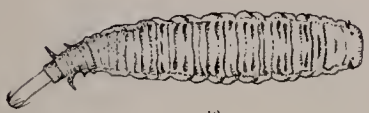
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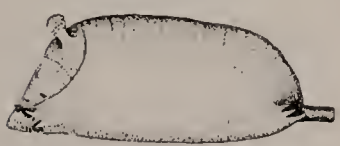
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Plate LXXXIV

Larval, Pupal, and Imaginal Details of Diptera

Fig. 1. *Drosophila adusta*, dorsal view of puparium.
Fig. 2. *Agromyza angulata*, prothoracic respiratory organ of larva.
Fig. 3. The same, dorsal view of apex of abdomen of larva.
Fig. 4. *Agromyza aprilina*, lateral view of head of imago.
Fig. 5. *Drosophila dimidiata*, dorsal view of cephalic end of puparium.
Fig. 6. The same, dorsal view of apex of abdomen of puparium.
Fig. 7. The same, lateral view of apex of abdomen of puparium.
Fig. 8. *Agromyza pruni*, lateral view of larva.
Fig. 9. The same, lateral view of head parts of larva, more enlarged.
Fig. 10. *Agromyza pruni*, puparium, lateral view with dorsal and ventral views of apex of abdomen. The larva and puparium are drawn to the same scale and show the remarkable reduction in size due to the induration of the larval skin.
Fig. 11. *Agromyza pruni*, dorsal view of apex of abdomen of female of imago.
Fig. 12. *Agromyza angulata*, lateral view of puparium.
Fig. 13. *Hydrellia scapularis*, dorsal view of puparium, showing enclosed imago.
Fig. 14. *Agromyza parvicornis*, lateral view of larva.
Fig. 15. *Agromyza parvicornis*, puparium, lateral view and enlarged view of apex of abdomen. Drawn to same scale to show comparative reduction in size in pupal stage.
Fig. 16. *Hydrellia scapularis*, antepenultimate ventral segment of larva.
Fig. 17. *Platyphora flavofemorata*, imago, dorsal view of head and thorax: *h*, head; *sp*, spiracle; *pr*, prothorax; *m*, mesothorax; *ol*, overlapping portion of mesothorax; *pn*, postnotum.
Fig. 18. *Agromyza tiliæ*, prothoracic respiratory organ of puparium.
Fig. 19. The same, ventral view of apex of abdomen of puparium.

Plate LXXXIV

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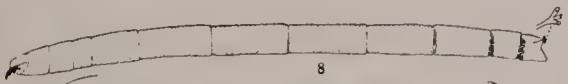

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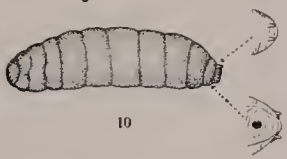

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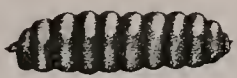

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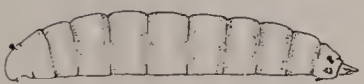

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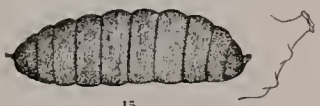

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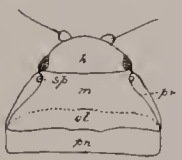

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