

7-1-1955

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Charles D. Michener
University of Kansas

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Kansas Entomological Society

Vol. 28

July, 1955

Number 3

**SOME BIOLOGICAL OBSERVATIONS ON
HOPLITIS PILOSIFRONS and *STELIS LATERALIS*
(HYMENOPTERA, MEGACHILIDAE)¹**

By CHARLES D. MICHENER

Although the observations here described concern only fragments of the life histories of the bees concerned, they seem worth recording as part of a study of comparative behavior of bees. The observations were made southeast of Lawrence, Kansas, in 1951 except as otherwise indicated.

EXCAVATION OF NEST. Females of *Hoplitis* (*Acidamea*) *pilosifrons* (Cresson) were seen collecting pollen from flowers of *Amorpha fruticosa* on June 1, and a nest was found in a nearly upright dead broken stem of *Helianthus tuberosus*. The female *Hoplitis* was excavating pith from the stalk. She would enter her burrow at the break in the stem, remain inside from one half to two minutes, then back out, carrying bits of pith in her jaws, fly away, and drop the pith. These flights seemed random in direction, took 8 to 20 seconds, and the pith was dropped from one to three feet from the nest. This activity continued for the two hours that the nest was under observation.

PROVISIONING. On June 4 provisioning activities were observed. Pollen of yellow sweet clover (*Melilotus officinalis*) was being used. On returning from a foraging trip (durations of 4 such trips, 6 to 18 minutes), the bee flew rather directly to the nest, entered head first, presumably disgorged nectar, after 50 to 65 seconds backed out with pollen still on scopa, turned around, backed into nest and after one to five minutes came out head first and flew away. This behavior is surprisingly similar to the provisioning behavior of *Megachile brevis* Cresson (See Michener, 1953) except that the *Hoplitis* burrow is so narrow that the bee apparently cannot turn around inside and must come to the entrance to do so. The number of pollen collecting trips necessary to provision a cell was not determined.

EGG LAYING. The egg laying behavior, too, is strikingly like that of *Megachile brevis*. On returning from the last foraging trip for a cell, the bee went through the usual process of disgorging nectar and removing pollen from the scopa, as described in the preceding paragraph, but on coming to the nest entrance after removing pollen, she backed down into the burrow again and was out of sight for two minutes. The egg must have been laid during this period, for on coming out of the nest the bee immediately flew to a leaf and gathered leaf material for a partition between cells.

CONSTRUCTION OF PARTITIONS. The partitions between the cells of the nest are made largely of finely divided leaf tissue, although the thicker partitions have particles of pith in the middle between an upper and a lower layer of leaf material. The bee under observation obtained all leaf material from soft and rather young leaves of three *Oenothera* plants growing three to four feet

¹ Contribution number 886 from the Department of Entomology, University of Kansas, Lawrence.

from the nest. These *Oenothera* leaves were soft and quite pubescent, as were the strawberry leaves similarly used by the *Hoplitis producta* (Cresson) described by Graenicher (1905) and Rau (1928). A number of observations of activity during partition construction were made, but one series of observations concerning the construction of one complete partition will exemplify the process. First, seven trips to gather leaf material were made. The duration of the trips ranged from 45 seconds to 2 minutes (average 1.4 minutes); that of the periods between trips ranged from 1 to 3 minutes (average 1.8 minutes). The bee entered the nest head first carrying the leaf material and backed out afterwards.

Following the seventh leaf gathering trip there was a delay of 8 minutes, after which the bee started carrying pith from the nest. Presumably this was pith removed from the walls of the cell being constructed. Pith was brought out of the nest eleven times. Once it was merely kicked from the nest entrance but the other times it was carried off and dropped as was described under Excavation of Nest. These flights took 6 to 10 seconds; intervals between them ranged from 45 seconds to 5 minutes (average 1.6 minutes). In the midst of this activity the bee made occasional trips away from the nest, possibly for nectar. One such trip lasted 17 minutes, another 5 minutes.

After this activity with pith the bee made three flights, about a minute apart, to the vicinity of the *Oenothera* plants but did not alight on them; then it started gathering leaf material with the same tempo as described above for this process. Eight such leaf collecting trips were made before the bee backed out and flew off to return later with pollen. In all, the construction of the partition required about one hour and 40 minutes.

The preceding paragraph provides support for the conclusion reached in a study of *Megachile brevis* Cresson (Michener, 1953) to the effect that minor changes in activity between work with pith and with leaf material in cell construction are often accomplished through intermediate stages while major changes (e.g. the change from pollen collecting to cell construction or vice versa) require no intermediate steps but the change in behavior occurs almost instantaneously.

CUTTING LEAF FRAGMENTS. The bee was repeatedly observed to alight on the edge of an *Oenothera* leaf and immediately start cutting with its mandibles. She was not observed to spend any appreciable time selecting a suitable leaf. Cutting was slow compared with that of *Megachile*. As a piece was cut it was held pressed against the under side of the head by the fore legs, the bee supporting herself by the middle and hind legs. As cutting continued, she curled her body. When a piece was free, she flew to the nest. The pieces cut varied in size and shape (see fig. 2), 1 to 3 mm. in longest dimension. It could not be seen whether the leaf fragments were carried whole or chewed to a pulp, but the former seems more likely. They are chewed before being built into partitions.

NEST STRUCTURE. On June 19, 19 days after construction was first observed, the nest was found sealed with chewed leaf material. It probably was sealed a day or two before. The structure is illustrated in the drawing (fig. 1). The nine cells were 3 mm. in diameter, 8 to 10 mm. long (average 9 mm.).

The partitions range from 1.2 to 5 mm. in thickness (average 2.5 mm.). Another nest in a similar stem contained six similar cells.

The chewed leaf material in the partitions and the thick closing plug all seemed to be from the same kind of plant. The bits of leaves were irregular in shape, mostly about 1 mm. in greatest diameter. Pith fragments (sometimes intermixed with leaf fragments) in the central zone of the thicker partitions were mostly 0.75 to 1.0 mm. long, 0.5 mm. thick. The pith fragments were loose, for which reason it seems likely that the leaf fragments stick together and form firm, hard plugs because of the adhesion of their own dried juices, not because of any substance added by the bee. The upper surfaces of the partitions were smoothly concave, the lower surfaces somewhat irregular but essentially flat.

BEHAVIOR OF *Stelis*. A female of *Stelis lateralis* Cresson was repeatedly observed around the *Hoplitis* nest. The *Stelis* was not marked but it seems likely that it was the same individual present each time. It would appear and alight on leaves or stems near the nest, remain quietly for a short time, then fly to the nest entrance. Twice it was seen to come during partition construction. It merely touched the nest entrance, then flew away. On June 15 at 3:00 p.m. the *Stelis* appeared while the *Hoplitis* was away gathering pollen. The *Stelis* flew to the nest entrance, then quickly away to a stem, then returned and entered the nest head first, came out head first a minute later after presumably laying an egg, and flew away. Three minutes later the *Hoplitis* returned with pollen. The *Stelis* was enough smaller than its host that it could turn around inside the nest. This is not true of all *Stelis*, however, for Höppner (1898) mentions that *Stelis minima* Schenck backs out of its host's nest and then reenters hind end first to lay its egg.

That the *Stelis* did an effective job of parasitization is shown by the fact that a *Stelis* egg was laid in each of the nine cells, two of them in the uppermost cell.

LARVAL BEHAVIOR OF *Stelis*. Each cell was provided with one *Hoplitis* egg (white, slightly curved, 2.75 mm. long) laid horizontally on the top of the pollen mass, which is rather firm in consistency. The *Stelis* eggs (2 mm. long) were found concealed in the pollen mass near the lower end of each cell. The relative time of hatching of the two is unknown but the egg stage of the *Hoplitis* is at least four and probably five or six days in duration.

After hatching, the *Hoplitis* larva at first lies flat on the pollen mass, later feeding downward at one side of the provisions and starting to become curved, just as do young larvae of *Megachile*. In this nest they were all killed by *Stelis* larvae when from 4 to 4.5 mm. long. The structure of the head and mouthparts of the young *Hoplitis* is very similar to that illustrated for mature *H. (Aldidamea)* by Michener (1953a).

The *Stelis* larva in its first stadium is straight, robust, with a ridge on each side of the body, and without dorsal tubercles. The head and mandibles are not enlarged as they are in the first stage larvae of such other parasitic bees as *Coelioxys*, *Tripeolus*, and *Melecta*. The structure of the head and mouthparts of the young *Stelis* larva is not much different from that of the mature larva of the same species figured by Michener (1953a) except for relatively longer antennae, hairs, etc. The mandibles are acutely pointed in the *Stelis*

throughout larval life, no doubt as an adaptation to parasitic behavior, although this is not a universal feature of *Stelis* larvae. The young *Stelis* larva feeds in a generally upward direction through the pollen mass for about 4 days after hatching. At this time the *Hoplitis* has grown to about 4 mm. in length and the *Stelis* to about 2.75 mm. The *Stelis*, at what is probably its first molt, now changes to a form similar to but more slender than that characteristic of it during the remainder of the larval life, that is, slender, curved, with a series of dorsal tubercles, and without lateral ridges. A mature larva, differing principally by being more robust, is illustrated by Michener (1953a). Because of its more slender body, this stage is nearly 4 mm. long; much more slender and often a little shorter than the host. It works its way to the surface of the food mass and although its mandibles are not enlarged it attacks and kills the *Hoplitis* larva. [Verhoeff (1892) describes an encounter which he observed between the larva of *Stelis minuta* Nylander and its host, *Hoplitis leucomelaena* (Kirby). The *Stelis*, in that case much larger than the host, approached the head of the host; both worked their jaws briefly but the *Stelis* soon crushed the head of its host. After briefly feeding on the head region the *Stelis* concentrated its attention on the midsection of the host's body upon which it fed for a day or two.] Two different *Stelis lateralis* larvae were observed with the head inside a hole in the body of the host. They may eat some of the host tissue. Yet they do not consume the entire host, for in all nine cells the remains of the *Hoplitis* larva lay on the surface of the pollen mass as the *Stelis* continued its development. In some cases the *Stelis* almost certainly eats none of the host, for one *Stelis* larva was seen still occasionally biting at a *Hoplitis* after the latter had been reduced to a soft mass with a crushed head, but with the body integument apparently still intact. This *Stelis* larva later continued its pollen feeding without eating the dead host larva. In general the above observations agree well with those of Graenicher (1905) based on *S. lateralis* (misidentified as *sexmaculatus* Ashmead) as a parasite of *Hoplitis producta* (Cresson). Höppner (1904a) and Verhoeff (1892) both report that larvae of *Stelis (ornatula)* Nylander and *minuta* Nylander respectively) consume the body of the host. It was observed that after the presumed first molt, the *Stelis lateralis* larvae were considerable more active than *Hoplitis*, and would bite readily at a needle. Significant observations on the relative aggressiveness of larvae of *Hoplitis* and *Stelis* were made by Graenicher (1905).

While killing the *Hoplitis* larva or immediately thereafter the *Stelis* changes from its head up position in the pollen to a horizontal or, very soon, a head down position on top of the pollen and feeds downward on one side of the pollen mass, eventually eating most or all of it. This downward feeding stage required 13 to 17 days in the three individuals for which the data were obtained, and as this stage progressed the larvae became more and more robust. The number of molts in this portion of larva life was not determined.

The deposition of the egg near the base of the cell as well as the movements of the larva, including destruction of the host after the *Stelis* is partly grown, are characteristic not only of *Stelis lateralis* but also of *S. minuta* (see Verhoeff, 1892) and *S. ornatula* (see Höppner, 1904).

As in various other bees, fecal pellets of *S. lateralis* are voided through a considerable part of the larval life. As with *Megachile brevis* there is variation

as to the time of appearance of the first feces. In one case ten pellets were produced and left in the lower part of the cell before the larva reached the surface of the food mass and killed the *Hoplitis*. In most cases feces did not appear until the larva had assumed a head downward position. The feces (pellets about 0.5 mm. long) were then deposited on the upper parts of the walls of the cells. As has been pointed out by Verhoeff (1892) and others, many bee larvae defecate well before termination of feeding. In this respect they differ from *Apis* as well as from various wasps.

At the end of the feeding period, when the *Stelis* larvae were probably 17 to 21 days old, cocoon spinning began. This process took 3 or 4 days. First to be spun was a very light network of white fibers which excluded all fecal pellets and other loose material from the vicinity of the larva. Inside and supported by these loose threads the cocoon proper was spun. At first it was transparent enough that the regular side to side spinning movements of the larva could be seen but by the third day of spinning in each cocoon studied it was opaque and white. On the fourth day it became brown due to an amorphous material presumably deposited as a liquid on the inner wall of the cocoon. Among the individuals in the nest, cocoon spinning was completed from June 30 to July 18.

STRUCTURE OF THE *Stelis* COCOON. There is now considerable evidence that cocoon structure in the Megachilidae, although somewhat variable within a species as shown by Michener's (1953) studies of *Megachile brevis*, nonetheless will provide interesting characters. The following description is based upon a single cocoon of *Stelis lateralis*:

Length 6.5 mm. of which 0.75 mm. is a nipple at one end; width 2.5 mm. The loose, outer fine white threads first laid down by the larva connect the outer surface of the cocoon to the inner wall of cell, fecal pellets, etc., at many points. The nipple, however, is free of such connections. The outer cocoon consists of a thin meshwork of similar fine white threads, impregnated with an amorphous whitish translucent material which closes all spaces between the threads and forms a tight sheath except for a small opening (0.13 mm. in diameter) at the apex of the nipple. Here the liquid substance which hardens into the membrane of the outer cocoon evidently was not applied. A few silk threads cross this space but the spaces between them are open. The nipple is slightly brownish, not as pale as rest of the outer cocoon.

There are some loose fine white silk threads connecting the outer cocoon with the inner. Evidently they were laid down after the application of the liquid white material of the outer cocoon but somehow were not involved with the brown liquid of the inner cocoon. For this reason the outer cocoon can be easily separated from the inner cocoon. The former is relatively delicate while the latter is tough.

The inner cocoon consists of a thin meshwork of fine silk threads, doubtless originally the same as those of the outer cocoon, now imbedded in a dark brown amorphous material which must have been applied as a liquid and which gives the inner cocoon the appearance of a muscoid puparium. The nipple again lacks this sealing substance, there being an opening .17 mm. in diameter filled with a dense mass of threads but not sealed. There is no evidence of various layers in the inner cocoon.

The diameters of threads range from 0.1 to .005 mm. in both cocoons. Except for thicker individual threads, the thickness of the outer cocoon is not over .005 mm. that of the inner cocoon less than .02 mm.

Striking differences between the *Stelis* cocoon and that of *Megachile brevis* include the presence of the nipple in the former (represented in *Megachile* only by an inconspicuous ventilating (?) place), the absence of an amorphous sealing material in the outer cocoon of *Megachile*, the coarse fibers of the outer cocoon of *Megachile*, and the restriction of this outer cocoon to one end of the whole cocoon in *Megachile*. The cocoon of *Coelioxys* resembles that of *Megachile* except that its outer layer is complete (see Michener, 1953).

The adult *Stelis* emerged in the spring of 1952, destroying their cocoons and the partitions between the cells in so doing.

SUMMARY OF LIFE HISTORIES OF *Hoplitis* AND *Stelis*. The meager data presented here together with field collecting data for the *Hoplitis* indicate that both species have but one generation per year. The adults are active in May and June. *Hoplitis* females construct nests in pithy stems. Whether one female makes more than one nest is unknown. The cells are provisioned with pollen largely from small flowered legumes in this region. Larvae of both genera probably complete their feeding by midsummer and construct cocoons in which they presumably pass the winter, pupating in the spring.

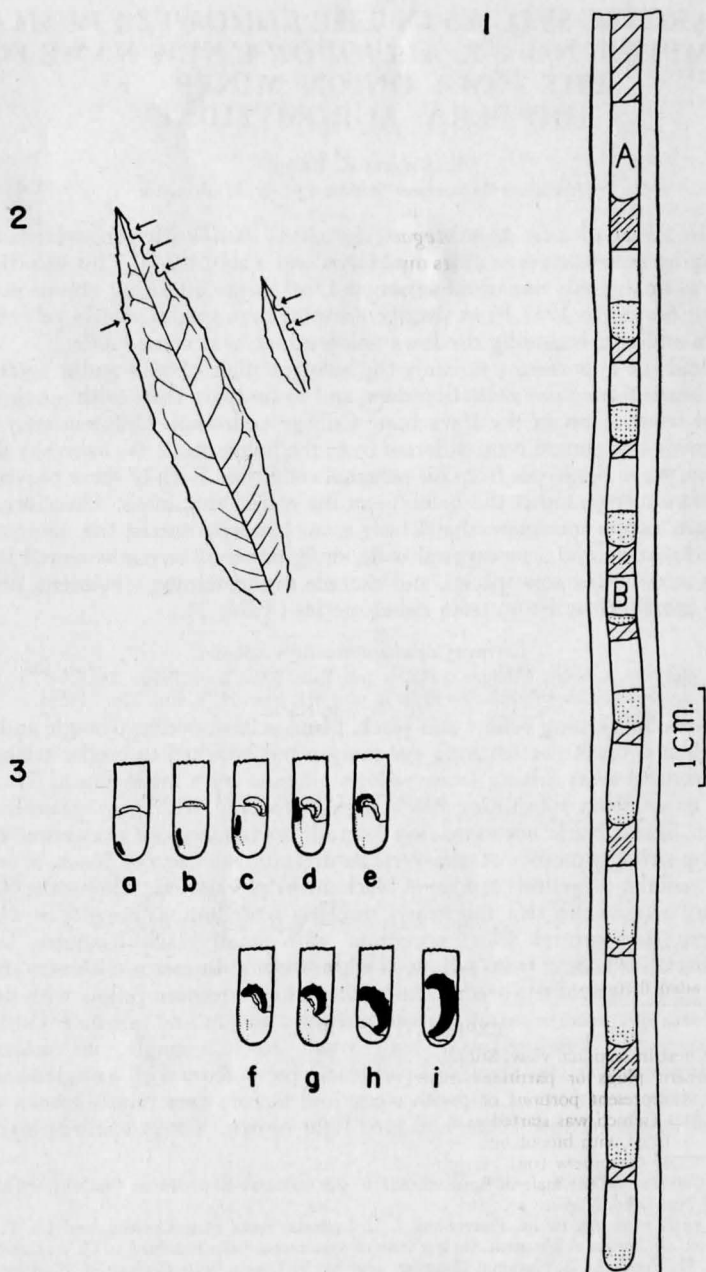
Stelis lateralis is an inquiline in the *Hoplitis* nests, laying its eggs in the pollen masses of the *Hoplitis* cells. In their second stadium the *Stelis* larvae kill those of the *Hoplitis*.

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EXPLANATION OF FIGURES

1. The nest in sectional view. Stippling represents food stores. Diagonal lines widely spaced represent plugs or partitions made of chewed leaf material; diagonal lines closely spaced represent portions of partitions made of bits of pith. A was an empty space while B (which was started as a cell to judge by the small amount of stored food) was loosely filled with bits of pith and chewed leaf material.
2. Leaves of *Oenothera* (one very young) showing pieces removed by *Hoplitis pilosifrons*. (Drawn at half the scale of figure 1)
3. Diagrams of a *Hoplitis pilosifrons* cell parasitized by *Stelis lateralis*. The egg and larva of the *Hoplitis* are white, those of the *Stelis*, black. Eggs are shown in a; in b, c, and d the *Hoplitis* feeds in typical megachilid fashion while the *Stelis* feeds as it burrows up ward, leaving a recognizable channel behind it; in e the *Stelis* attacks and kills the *Hoplitis*; in the remaining diagrams the *Stelis* feeds in typical megachilid fashion.



NEARCTIC SPECIES IN THE *LIRIOMYZA PUSILLA*
COMPLEX. NO. 3 *L. ALLIOVORA*, NEW NAME FOR
THE IOWA ONION MINER
(DIPTERA: AGROMYZIDAE)¹

KENNETH E. FRICK²

Irrigation Experiment Station, Prosser, Washington

The larvae of a fly, identified as *Agromyza pusilla* Meigen, were found damaging onion leaves in Iowa by Harris and Tate (1933). This record appears to be the only one of an agromyzid leaf miner attacking onions in the United States. In 1943 Frost described several new species closely related to *pusilla* and one, including the Iowa onion miner, was named *allia*.

I had the opportunity to study the holotype male of *allia* and a paratype male bearing the same collection data, and to compare these with specimens reared from onion in the Iowa State College collection. Unfortunately the specimens from onion were different from the holotype. C. W. Sabrosky then sent me seven paratypes from his personal collection. Each of these proved to be different from either the holotype or the reared specimens. Therefore, on the basis of the specimens that I have seen, I hereby restrict the name *allia* to the holotype and a topotypical male, designate the specimens reared from onion as *alliovora* new species, and exclude the remaining specimens, designated paratypes by Frost, from either species (Table 1).

Liriomyza alliovora new species

Agromyza pusilla (Meigen), Harris and Tate, 1933, Jour. Econ. Ent. 26:515.

Agromyza (Liriomyza) allia Frost p. p., 1943, Jour. N. Y. Ent. Soc. 51:253.

MALE. Subshining yellow and black. Head yellow, ocellar triangle and occiput black, black not reaching eye margin but attached to ocellar triangle; both vertical setae arising from yellow; antenna with arista black. Thorax with mesonotum subshining black, lightly covered with gray granules in certain lights, black not extending laterally to humerus or presutural seta, curving strongly mesally at transverse suture, supraalar seta on black, at edge, outer postalar on yellow, at edge of black, inner postalar on yellow—the black curving around this seta and nearly reaching scutellum, as broadly as width between dorsocentral setae; scutellum with small black triangles, basal scutellar setae arising from yellow, at edge of black; humerus with very small black spot, humeral seta arising from yellow; anepisternum yellow with small black triangle anteroventrally, about one-third height and one-half width of anepisternum; katepisternum with small black triangle, no posterior marking; meropleurite about one-half black; pteropleura with a single narrow black stripe anteriorly. Legs with coxae and femora very faintly brown basally, otherwise yellow; tibiae and tarsi light brown. Wings hyaline; margin

¹ Scientific Paper No. 1350, Washington Agricultural Experiment Stations, Pullman Project No. 1062.

² I wish to thank H. M. Harris and J. L. Laffoon, Iowa State College, and C. W. Sabrosky, U. S. National Museum, for the loan of specimens. I am indebted to C. W. Sabrosky and R. H. Foote, U. S. National Museum, and M. T. James, State College of Washington, for reviewing the manuscript.

and fringe of calypter dark. Abdomen with tergites broadly yellow laterally (nearly all of abdomen visible in lateral view is yellow), dorsally first two subshining black, third to sixth each with a wider posterior yellow band, sixth tergite with only a small black spot anteriorly; ninth tergite yellow dorsocentrally, otherwise dark brown, cerci yellow.

Head: In lateral view as in left figure. Gena, midway between vibrissal angle and posterior margin, nearly one-fifth eye height; eye large, nearly one and one-half times as high as long; genoventricle plate only slightly raised above eye margin, ventral lower dorsocentral seta subequal to dorsal lower dorsocentral, about five orbital setulae on either side. Antenna with third segment rounded, broader than long; setulae less than basal arisal thickness; arista about as long as eye width, slightly swollen on basal fifth.

Thorax: Four dorsocentral setae; fourth the longest, third two-thirds as long, first and second subequal, about one-half the fourth; fourth slightly farther removed from third than second is from first, second and third closest together, about three-fifths as far as fourth is from third; about six setae in the intraalar row posterior to transverse suture, intraalar present on one side, subequal to an acrostichal in length; inner postalar about one-half as long as the outer postalar; acrostichal setae about 13 in number, in four sparse irregular rows, extending posteriorly nearly to third pair of dorsocentrals; humeri each with three or four setulae plus the humeral.

Wing: About twice as long as wide. Costa terminating at wing tip, second segment nearly three times as long as third; third and fourth subequal in length; m - m cross vein about one and one-fourth its length from r - m, perpendicular to penultimate section of M_{1+2} ; ultimate section of M_{1+2} about nine times the penultimate; ultimate section of M_{3+4} nearly three times the penultimate.

Size: Wing length, 1.2 mm.

FEMALE. Larger, wing length 1.5 mm. head with gena one-fourth eye height; thorax with 15 acrostichals, five and six setulae in the intraalar rows, an intraalar present on either side, subequal to an acrostichal in length; wing with second costal segment four times length of the third; m - m cross vein at a moderate angle to penultimate section of M_{1+2} ; abdomen with all tergites except first with a broad posterior band of yellow, first very narrow, seventh segment conical, truncate, shining black.

Holotype ♂: AMES, IOWA, June 8, 1932, H. M. Harris collector, ex leaf of onion, deposited in the U. S. National Museum. *Allotype* ♀: Topotypical, July, 1931, H. M. Harris, ex leaf of onion, also deposited in the U. S. National Museum. *Paratypes*: All topotypical, 2 dated July, 1931, and 17 dated June 8, 1932 (4 bear a label reading: Pupated May 30, Emerged June 5), all reared from onion by H. M. Harris. Paratypes have been deposited in the collections of the U. S. National Museum, Iowa State College, Zoologisches Museum, Berlin, and the writer.

The known North American species in the *pusilla* complex are listed by Frick (1955). *L. alliovora* belongs to the group having both pairs of vertical setae arising from yellow. As *alliovora* has four irregular rows of acrostichal setae it can be separated quickly from *congesta* Becker, 1903, *phaseolunata* Frost, 1943, and *allia* Frost s. s., 1943, each of which has two rows. The black

of the occiput does not reach the compound eyes in *alliovora* (Fig. 1) as it does in *pusilla* Meigen s. s., 1830, *congesta*, and *phaseolunata*.

Liriomyza allia (Frost)

Agromyza (*Liriomyza*) *allia* Frost s. s., 1943, Jour. N. Y. Ent. Soc. 51:253.

MALE. Dull yellow and black. Head yellow, ocellar triangle and occiput black, black of occiput neither reaching eye margin nor attached to ocellar triangle; both vertical setae arising from yellow; antenna with arista black. Thorax with mesonotum dull black, heavily covered with gray granules (pollinose), black not extending laterally to humerus or presutural seta, curving strongly mesally at transverse suture, supraalar seta on black, in from edge, outer postalar on yellow, at edge of black, inner postalar on yellow—the black curving around this seta and reaching base of fourth dorsocentral seta and nearly reaching scutellum, narrower than width between dorsocentral setae; a light brown stripe extending from anterior of inner postalar nearly to transverse suture; scutellum with relatively small black triangles, basal scutellar setae arising from black, at edge; humerus with very small black spot, humeral seta arising from yellow; anepisternum yellow with minute oval spot midway along ventral margin, katepisternum with small black triangle, no posterior marking; meropleurite about one-half black; pteropleura with a single narrow black stripe anteriorly. Legs with coxae very faintly brown basally, otherwise yellow; tibiae and tarsi light brown. Wings hyaline; margin and fringe of calypter dark. Abdomen with tergites broadly yellow laterally (nearly all of abdomen visible in lateral view is yellow), dorsally first two dull black, third to sixth each with a wider posterior yellow band, sixth tergite with only a small black spot anteriorly; ninth tergite yellow dorsocentrally, otherwise dark brown, cerci yellow.

Head: In lateral view as in right figure. All setae short. Gena, midway between vibrissal angle and posterior margin, nearly one-fourth eye height; eye small, two-thirds as long as high, genoververtical plate moderately raised above eye margin, ventral lower dorsocentral seta minute, about one-half the length of the upper lower dorsocentral; about two or three orbital setulae on either side. Antenna with third segment rounded, broader than long, setulae minute; arista about as long as eye width, swollen on basal one-fourth.

Thorax: All setae short; four dorsocentral setae, fourth slightly the longer (first and second only five-sixths as long as fourth, third missing in this specimen); about two or three setulae in each intraalar row posterior to transverse suture, intraalar absent; inner postalar about one-third as long as the outer postalar; acrostichal setae about five or six in number, in two sparse irregular rows, extending posteriorly a little past the second pair of dorsocentrals; humerus with two or three setulae plus the humeral.

Wing: About twice as long as wide. Costa terminating at wing tip, second segment nearly three times as long as third; fourth about three-fourths as long as third; m-m cross vein about three-fourths its own length from r-m, at a moderate angle to penultimate section of M_{1+2} ; ultimate section of M_{1+2} about twelve times the penultimate; ultimate section of M_{3+4} about three times the penultimate.

Size: Wing length 1.2 mm.

TABLE 1. Disposition of Specimens Studied that are Labeled: Paratype, *Liriomyza allia* Frost

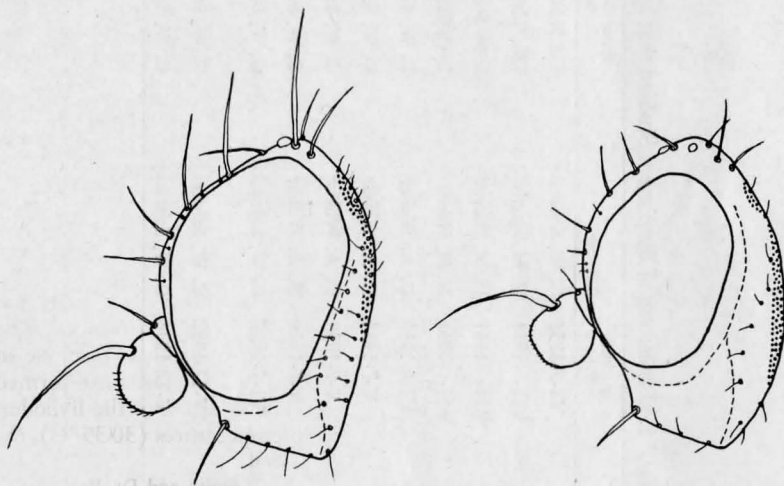
Place	Specimen Date	Collector	From Collection of:	Excluding Characters and Notes
Manhattan, Kansas	V1-9-1934	C. W. Sabrosky	U.S.N.M.	Male—same as holotype of <i>allia</i> , topotypical
Ames, Iowa	V11- -1931	H. M. Harris	U.S.N.M.	Female—allotype of <i>alliovora</i>
Ames, Iowa	V11- -1931	H. M. Harris	Iowa State College	Male—paratype of <i>alliovora</i>
Ames, Iowa	V11- -1931	H. M. Harris	Iowa State College	Abdomen missing—paratype of <i>alliovora</i>
Manhattan, Kansas	V1-6-1930	D. A. Wilbur	C. W. Sabrosky	Basal scutellar setae arising within black triangles
Manhattan, Kansas	V-7-1934	D. A. Wilbur	C. W. Sabrosky	Anepisternum about one-half black
Manhattan, Kansas	V-7-1934	D. A. Wilbur	C. W. Sabrosky	Anepisternum about one-half black
Manhattan, Kansas	V-7-1934	D. A. Wilbur	C. W. Sabrosky	Anepisternum about one-half black
East Lansing, Michigan	V1-1-1937	C. W. Sabrosky	C. W. Sabrosky	Acrostichals in two rows as in <i>allia</i> , eye proportioned as in <i>alliovora</i>
Medora, Kansas	1V-17-1932	C. W. Sabrosky	C. W. Sabrosky	Third antennal segment angulate
Kalamazoo, Michigan	V-10-1936	C. W. Sabrosky	C. W. Sabrosky	Third antennal segment angulate

Redescribed from a topotypical paratype male (Table 1) that is similar in all respects to the holotype male. *L. allia* has only two irregular rows of acrostichals. This serves to separate it easily from *alliovora*. Two other North American species belong to the group having the two acrostichal rows. These are *congesta* Becker, 1903, and *phaseolunata* Frost, 1943, and both differ from *allia* in having the black of the occiput reaching the compound eyes.

From a glance at Table 1 it is obvious that there are more species that do not have the black of the occiput reaching the compound eyes and have both vertical setae on yellow than *allia* and *alliovora*. However, I am not willing to describe additional species that belong within the *pusilla* complex until I have seen an adequate series of reared specimens of each.

LITERATURE CITED

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 Harris, H. M. and H. D. Tate. 1933. A leaf miner attacking the cultivated onion. Jour. Econ. Ent. 26:515-516.
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EXPLANATION OF FIGURES

- Left. Lateral view of head of holotype ♂ of *L. alliovora* n. sp.
 Right. Lateral view of head of paratype ♂ of *L. allia* (Frost).