BEETLE LARVAE OF THE SUBFAMILY GALERUCINAE

By Adam G. Böving

Senior Entomologist, Bureau of Entomology, United States Department of Agriculture

INTRODUCTION

The present paper is the result of a continued investigation of the Chrysomelid larvae in the United States National Museum, Washington, D. C. Of the subfamily Galerucinae [1] belonging to this family the larvae are preserved in the Museum of the following species:

Monocesta coryli Say.
Trirhabda canadensis Kirby.
Trirhabda brevicollis LeConte.
Trirhabda nitidicollis LeConte.
Trirhabda tomentosa Linnaeus.
Trirhabda attenuata Say.
Galerucella nymphaeae Linnaeus.
Galerucella lineola Fabricius (from Europe).
Galerucella sagittariae Gyllenhal.
Galerucella lutcola Müller.
Galerucella sp. (from Nanking, China).
Galerucella viburni Paykull (from Europe).
Galerucella decora Say.
Galerucella notata Fabricius.
Galerucella cribrata LeConte.
Monoxia puncticollis Say.
Monoxia conspata LeConte.
Lochmaea capreae Linnaeus (from Europe).
Galeruca tanaceti Linnaeus (from Europe).
Galeruca laticollis Sahlberg (from Europe).
Galeruca pomonae Scopoli.
Sermylassa halensis Linnaeus.
Agelastica alni Linnaeus.[2]

[1] The generic and specific names of the North American larvae are as listed in C. W. Leng's "Catalogue of Coleoptera of America north of Mexico, 1920," with corrections and additions as given in the "supplement" to the catalogue published by C. W. Leng and A. J. Mutchler, 1927. The European species, not introduced into North America, are named according to the "Catalogus Coleopterorum Europae, second edition, 1906," by L. v. Heyden, E. Reitter, and J. Weise.

[2] It will be noticed that in the enumeration above no species of *Diabrotica* and *Phyllobrotica* are mentioned. The larvae of these genera were considered by the present author as Halticinae larvae [Böving, Adam G. Description of larvae of the genera Diabrotica and Phyllobrotica, etc., Proc. Ent. Soc. Wash., vol. 29, 1927, pp. 193–205.]

Based on this material, a general characterization of the larvae of the Galerucinae has been worked out, and illustrated descriptions are given of the species mentioned. Preceding these descriptions is a key to the larvae (p. 8), and the paper is brought to an end (p. 40) with a discussion of the taxonomy of the subfamily.[3]

ACKNOWLEDGMENT

Several of the descriptions in the present paper, particularly of unintroduced European larvae, are based on material generously donated to the United States National Museum by the Danish entomological writers, Messrs. E. A. Rosenberg and J. P. Kryger, whose extraordinary ability in the collecting, rearing, and determining of coleopterous larvae are greatly appreciated in entomological circles, both in Europe and America. The American friends of the National Museum, the prominent entomologist, Dr. George Dimmock, and Mr. E. M. Craighead who has made a special study of chrysomelid larvae, have also donated Galerucinae larvae of great interest not formerly represented in the collections. Detailed information about these specimens will be found where the species are described.

CHARACTERIZATION OF LARVAL TYPE OF GALERUCINAE

Larva generally of medium size ranging in length between 7 and 15 mm., elongate with small head and a moderately large pygidial shield; without urogomphi (= cerci); body with subparallel sides, but somewhat attenuated both toward the head and the last segment, under side of body rather flat and not fully as long as the upper side. Segments soft skinned, mostly of the same height and width, on each side of the body with one or two small, setae bearing sclerites in all of the areas. Color varying depending upon the dimensions and shade both of the sclerites and the skin between (figs. 4, 7, 9); underside of the body generally lighter than the upper side.

Setae usually moderately long and pointed on the head capsule, the mouth parts, the prothoracic and pygidial shields and the legs; of very different lengths and shapes on the body sclerites, varying from minute to long and from pointed to capitate; inserted either irregularly or in transverse rows on the surface of the sclerites or radiating from a cone-shaped prolongation of the sclerites. (Figs. 10 to 13.)

Head capsule strongly chitinized, shining, hypognathous; frons never extending to the occipital foramen, a distinct, usually long

[3] No larvae are known from North America representing the tribes Sceloidini, with genus *Scelolyperus*, Luperini, with genus *Luperodes*, Androlyperini, Metacyclini, and Cerotomini with genus *Cerotoma*, all of which are listed as Galerucinae according to the imagines.

median epicranial (= coronal) suture always present; epicranial halves not produced posteriorly, except in the mining larva of *Monoxia consputa*. (Fig. 40.) Ocelli always present; only one on each side, distinct, with strongly convex cornea and about of the same size as one of the spiracles. Antenna short, retractile, consisting of a single joint seated in a large basal membrane; a jointlike, well developed tactile papilla and several minute, pointed sensory organs located in the membranous top of the antennal joint. (Fig. 36.)

Labrum and clypeus well developed and distinct. Clypeus whitish and soft skinned, with a chitinous plate at each hind corner carrying a series of about four small or minute setae. Labrum well chitinized, subrectangular to semicircular, with or without a median anterior emargination, exceptionally in *Monesta coryli* (fig. 35) subtriangular, with length and width about equal; medio-transversely a single row of four discal setae, two on each side; a few sensory punctures between or near the setae; along the frontmargin a series of several marginal setae, usually of very small size, the exterior two or three, however, somewhat larger than the rest, exceptionally with all marginal setae of moderate length (fig. 35).

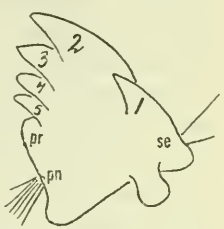


FIG. 1.—DIAGRAM OF MANDIBLE. FOR LETTERING SEE TEXT

Mandible (text fig. 1) strong, palmate, hollow toward the buccal cavity, terminally with from three to five teeth arranged in a series like fingers. First tooth (1) small, with the tip normally extending only slightly beyond the base of second tooth; third tooth, as a rule, the largest, in *Monocesta coryli* (figs. 45, 48) having a long, straight, serrated inner margin, but in all other Galerucinae larvae more claw shaped like the rest of the teeth. Inner edge of mandible behind the base of the last tooth often blade shaped and anteriorly projecting like a heel or a (sixth) tooth (*pr*). Penicillus (*pn*) present in some, absent in others, of the genera. Two setae (*se*) normally present on the dorso-exterior surface.

Maxilla (figs. 56, 59, 61, 63) provided with two well developed, usually distinct lobes of about the same size, one posterior, here interpreted as lacinia, one anterior, here interpreted as galea; both lobes strengthened at base by a narrow bandlike prolongation of the ventral chitinized side of stipes. Lacinia located in the buccal cavity and to be found only by dissection (fig. 61), generally soft skinned and armed with setae varying in number, arrangement, size, and shape according to species or genus. Galea either entirely soft-skinned or distally chitinized like a single joint with a soft-skinned tip; several setae placed irregularly at the inner margin of galea; between these a short conical papilla with a basal ring (*ga**). Max-

illary palpus short, four-jointed (three-jointed in *Galerucella nymphaeae* and *Monoxia consputa*), the basal joint crescent shaped or almost closed-ring shaped, usually carrying two long, strong setae and having two retractor muscles attached to the wall of the well-chitinized stipes and extending through the soft, whitish palpiger which is characterized by its lack of individual muscles. (Fig. 61.) Eulabium (fig. 63*b*) posteriorly limited by a chitinous postlabial band bent in a single or double arch. Labial palpus two-jointed, palpi inserted well apart, at a distance from each other somewhat longer than the length of one of the palpi, except in *Agelastica alni* where they are closer together. (Fig. 73.) Ligula short and thick, with moderately long setae.

Epipharynx (fig. 35) soft, beset with fine, short hairs.

Hypopharynx (fig. 61) soft, distally with pointed, papilliform hairs arranged in a patch inside of each lacinia; no median transverse bridge; no paragnaths; hypopharyngeal rods present, anteriorly reaching very close to or fused completely with the ends of the band-shaped chitinization at the bases of the maxillary lobes (fig. 64).

Prothorax (figs. 3, 21) dorsally with a rather large, often irregularly grooved and pitted saddle-shaped shield usually marked medianly by a light sagittal suture. Setae often long, arranged as marginal setae in one or more series around the whole shield and as discal setae in small number in the central portion of it. Entire tergum covered by the shield except for a soft-skinned, narrow region following the outline of the shield and a soft-skinned, small, subtriangular area[4] located immediately behind the head, above the ventro-lateral sulcus and in front of the oblique dorso-lateral sulcus. Epipleural area behind the dorso-lateral and above the ventro-lateral sulcus, triangular in form, with or without a setae-bearing sclerite in the middle. Hypopleural area below ventro-lateral sulcus, covered by a well-developed prehypopleural and a well-developed posthypopleural sclerite (="episternum" and "epimeron" of authors). Sternal region divided into the following areas: Eusternum, sternellum (="furcasternum" of authors), parasternum, and poststernellum (="spinisternum"). Eusternal area with a median unpaired sclerite; sternellar area with a sclerite on each side of the middle line, eusternal and sternellar sclerites usually fused into a single, compound sclerite (fig. 5); parasternal areas carrying the legs; poststernellar area without sclerite and setae.

Mesothoracic and metathoracic segments (text fig. 2) dorsally divided by a transverse median, at the ends anteriorly curved, sulcus into the prescutal area (*psc*) and the scuto-scutellar area (*sc-scl*); both areas carrying on each side an interior larger sclerite (*int*) and

[4] Possibly corresponding to the spiracular areas of the following thoracic segments.

an exterior smaller one (*ext*). The alar area (*al*) and the spiracular area (*spi*) combined into a parascutal region (*pasc*) above limited by an indistinct sulcus marked and produced by a few dorso-ventral muscles (†) to the coxal region ("the noto-coxal muscles") and below by the oblique dorso-lateral sulcus (*dl*). Parascutal region carrying two sclerites, a minor anterior (*ant*) or spiracular sclerite in the spiracular area and a large posterior (*post*) or alar sclerite in the alar area. Interior prescutal as well as the interior scuto-scutellar sclerites arranged closely together (fig. 18) or only separated in the sagittal line by a continuation of the sagittal suture of the prothoracic shield (figs. 21 to 24). In *Monocesta coryli* (fig. 1), all tergal sclerites absent except the interior prescutal and interior scuto-scutellar; in *Monoxia consputa* (fig. 9) no sclerite developed; in *Galerucella nymphaeae* (fig. 18) and *Galerucella lineola* interior and exterior prescutal sclerites fused into a single compound sclerite

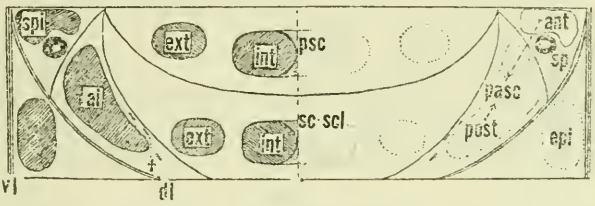


FIG. 2.—DIAGRAM OF MESOTHORACIC AND METATHORACIC SEGMENTS. FOR LETTERING SEE TEXT

just as the interior and exterior scuto-scutellar sclerites. The epipleural area (*epi*) triangular, limited above by the oblique dorso-lateral sulcus (*dl*) and below by the straight ventro-lateral sulcus (*vl*), carrying one sclerite. Hypopleural sclerites (episternum and epimeron) as in prothorax. The presternal, the eusternal, and the sternellar (combined with the coxa bearing parasternal) areas well limited by sulci but often with indistinct sclerites. Poststernellar area present in mesothorax, absent in metathorax. (Fig. 5.) Mesothoracic and metathoracic sclerites usually with a few or moderate number of short or medium long setae.

The typical abdominal segments (text fig. 3) differ from the mesothoracic and metathoracic segments mainly by having the dorso-lateral sulcus running parallel with the ventro-lateral sulcus and not obliquely toward it. The parascutal region of the thorax with the distinct alar and spiracular areas becoming smaller in the abdomen and practically fused into a single area, the parascutal area (*pasc*) of the abdomen; the epipleural area (*epi*) becoming larger and changing form from triangular in the thorax to rectangular in the abdomen. Otherwise the arrangement of the areas and the number of the sclerites in the areas are as in the mesothorax and metathorax.

First to eighth abdominal segments: In most genera (figs. 4, 10) dorsally divided by one transverse sulcus into a prescutal and a combined scuto-scutellar area, more rarely, in *Agelastica alni* (fig. 15) and *Sermylassa halensis* (fig. 14), divided by two transverse sulci into a prescutal, a distinct scutal, and a distinct scutellar area. The prescutal area and the scuto-scutellar area (in *Agelastica* and *Sermylassa*, the scutellar area) each carrying on both sides an interior (*int*) and an exterior (*ext*) sclerite. The scutal area, when distinct, carrying either a small (*Agelastica*) or a well-developed sclerite (*Sermylassa*). The interior prescutal sclerite and the interior scuto-scutellar sclerite usually fused in the sagittal line with the corresponding sclerites of the opposite side; the exterior scuto-scutellar sclerite nearer the sagittal line than the exterior prescutal sclerite. The parascutal area (*pasc*) marked above by a few longitudinally placed impressions of muscles corresponding to the noto-coxal muscles of thorax (†) and

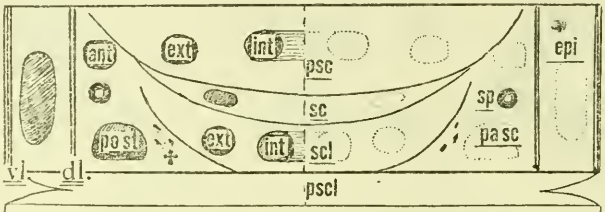


FIG. 3.—DIAGRAM OF TYPICAL ABDOMINAL SEGMENTS. FOR LETTERING SEE TEXT

below limited by the dorso-lateral sulcus (*dl*); the area never extending down to the ventro-lateral sulcus as in thorax. The parascutal area normally carrying two sclerites, one anterior to the spiracle, the anterior parascutal sclerite (*ant*), and one posterior to the spiracle, the posterior parascutal sclerite (*post*). Spiracle in most of the larvae placed directly in the soft skin, but sometimes lodged in a special sclerite, the spiracular sclerite (figs. 4, 11, 14), and sometimes located in the anterior parascutal sclerite (fig. 18). The anterior and the posterior parascutal sclerites fused in a few larvae (fig. 3), the anterior sclerite absent in many larvae (figs. 7, 24) and exceptionally (figs. 1, 9) the anterior and posterior sclerites both undeveloped. The epipleural area (*epi*) subrectangular, carrying one well-developed sclerite. The hypopleural area (fig. 7) situated directly below the ventro-lateral sulcus, carrying one well-developed sclerite. The sternal region (fig. 5) with an unpaired eusternal area and a paired area probably formed by fusion of the parasternal and sternellar areas; the presternal area absent; the poststernellar area absent in some genera (fig. 6), present in others (fig. 5), and in some of the latter genera (fig. 15, *Agelastica*) developed as an intersegmental

band. The eusternal and each of the sternellar areas usually with a thinly chitinized, lightly colored, and indistinctly limited sclerite.

Ninth abdominal segment (figs. 3, 14) either moderately large or rather small, in dorsal view subrectangular to semilunar, covered by a pygidial shield; ventral parts of the segment forming a small, narrow band often covered by a thin chitinous plate; areas not differentiated; a series of a few setae present.

Tenth abdominal segment (fig. 60) developed as a large, retractile, powerful pygopod with the sucking surface marginally lobed and anal opening placed in the middle of the surface.

Legs (fig. 62) inserted widely apart, strongly chitinized, at least on the exterior side, of moderate length, about as long as half the width of a thoracic segment, usually darkly colored, five-jointed. Coxa sessile, with a large, soft, whitish area for the reception of trochanter and femur; trochanter well developed, as long as coxa, subtriangular, in contact with almost the entire underside of femur; femur corresponding in form and size to trochanter; tibia subcylindrical, about as long as the combined femur and trochanter and also as long as coxa; claw usually strongly curved, enlarged at base and terminally pointed, rather short. Paronychial appendix (*po*) fleshy, whitish, projecting behind the claw from a soft skinned area at the end of tibia.

Spiracles (fig. 58) annuliform, all lateral and of equal, moderate size; one located in mesothorax, one rudimentary in metathorax and one in each of the first eight abdominal segments. The inside of the spiracular mouthpiece beset with numerous minute spinulæ; no definite atrium. (Fig. 57.) The closing apparatus of the one-armed type, located close to the spiracle proper.

Defensive glands (fig. 15) present only in a single larva, *Agelastica alni*, and here aggregated in the wall of sacs that can be turned inside out and that are located above the spiracles and between the almost fused anterior and posterior parascutal sclerites of the first to eighth abdominal segments.

Habits.—The larvae of the Galerucinae are herbivorous and external feeders, except the larva of *Monoxia consputa*, which mines inside the leaves of *Chenopodium album* and some related plants. The larvae are usually found on the same host plants as their imagines but make feeding marks of a different type; they never cover themselves with their excrements, and, with the exception of the larva of *Agelastica alni* mentioned above, have no defensive organs. After a larval period represented by three instars the pupation takes place either in the soil inside of a cell-shaped excavation whose walls may or may not be reenforced by spun threads (*Monocesta coryli*, the species of *Trirhabda*, *Galerucella cavicollis*, *G. kalmiae*, *G. vaccinii*,

G. spiraeae, *G. alni*, *G. decora*, *G. perplexa*, probably *G. viburni*, *Monoxia puncticollis*, *Lochmaea capraea*, all the species of *Galeruca*, *Sermylassa halensis* and *Agelastica alni*) or the pupation takes place above the soil. In some of the species whose larvae pupate above the soil the pupa is rather unprotected and found loose on the ground, in small crevices, under pieces of wood, etc. (*Galerucella luteola*) or it is attached to a leaf by the end of the abdomen (*Galerucella nymphaeae*, *G. lineola*), or the pupa is encased in a cocoon with a reticulate wall fastened to a leaf (*Galerucella notata*, *Galerucella cribrata*).

Literature.—The latest list of literature concerning Galerucinae larvae is found in a Danish book entitled "Victor Hansen: Biller (Chrysomelidae og Lariidae) 1927." The list is given on pages 390–395, at the end of a chapter, written by K. L. Henriksen, on the larvae of the Danish Chrysomelidae and Lariidae. The publication is No. 31 of a series of faunistic manuals, called Danmarks Fauna, which are edited by the Danish Society of Natural History and published by G. E. C. Gad, Copenhagen, Denmark. References to Henriksen's descriptions in this manual will in the following pages be given as "1927, Henriksen, K. L., Danmarks Fauna No. 31."

Another publication with many bibliographical notes and important descriptions to which reference often will be made is by William Colcord Woods. It constitutes Part 2 of Bulletin 319, from Maine Agricultural Experiment Station, Orono, University of Maine, 1924, and deals with the blueberry leaf beetle and some of its relatives. It will be referred to in the following as "1924, Woods, W. C., Maine Agr. Exp. Sta. Bull. 319."

KEY TO GENERA AND SPECIES[5] CONSIDERED

1. Typical abdominal segments with three transverse dorsal areas, distinct scutal area present. With or without supra-spiracular glands_____ 13.
   Typical abdominal segments with two transverse dorsal areas, distinct scutal area absent. Supra-spiracular glands never developed_____ 2.
2. Head capsule with a posterior emargination about as deep as the length of the coronal (median epicranial) suture. Abdominal segments with very thin, almost invisible sclerites. **Monoxia consputa** LeConte (p. 28, fig. 9).
   Head capsule posteriorly rounded, without or with slight emargination. Abdominal segments with at least one distinct sclerite and usually with more than one_____ 3.
3. Prescutal area of abdominal segments without any sclerite. (Scuto-scutellar area with a single, median, rather small and rounded sclerite). Third tooth of mandible comb shaped, with serrated inner margin. **Monocesta (M. coryli** Say, p. 10, fig. 1).
   Prescutal area of abdominal segments with sclerites. Third tooth of mandible subtriangular, claw shaped_____ 4.

[5] Refers to the full-grown larvae (3d instar) when not otherwise indicated.

4. Most sclerites on the upper surface of the body prolonged into senti[6]---- 11.
Sclerites not developed as senti---------- 5.
5. Abdominal spiracles lodged in a large sclerite---------- 6.
Abdominal spiracles either free or bordered by a narrow ring---------- 7.
6. Abdominal dorsal sclerites of moderate size, their setae distinct. Scuto-scutellum with interior and exterior sclerites separate. Mandible without penicillus. Maxillary palpus with four joints as normal in Galerucinae.

Trirhabda (**T. canadensis** Kirby, p. 12, fig. 3; **T. virgata** LeConte, p. 14; **T. brevicollis** LeConte, p. 15; **T. nitidicollis** LeConte, p. 15; **T. tomentosa** Linnaeus, p. 15; **T. attenuata** Say, p. 15).

Abdominal dorsal sclerites large, covering the back almost completely, setae minute or absent. Scuto-scutellum with interior and exterior sclerites fused. Mandible with penicillus. Maxillary palpus three-jointed.

Galerucella, Group A (**G. nymphaeae** Linnaeus, p. 16, fig. 18; **G. lineola** Fabricius, from Europe, p. 18; **G. sagittariae** Gyllenhal, from Europe, p. 18).

7. Parascutal area of abdominal segments with anterior sclerite developed-- 8
Parascutal area without the anterior sclerite---------- 10.
8. Several setae present on most of the dorsal sclerites of the abdomen (body with longitudinal black and yellow bands alternating)------Galerucella, Group B (**G. luteola** Müller, p.19, figs. 4, 21; **G.** species, p. 21).

Not more than two (exceptionally three) setae on any single dorsal sclerite or on each side of any compound median sclerite---------- 9.
9. Scuto-scutellum of abdomen with exterior sclerite distinct---- Galerucella, Group C. (**G. viburni** Paykull. European species, p. 21, fig. 23).

Scuto-scutellum of abdomen with exterior and interior sclerites fused into a single median compound sclerite---------- Galerucella, Group D. (**G. cavicollis** LeConte; **G. kalmiae** Fall; **G. decora** Say; **G. perplexa** Fall; **G. vaccinii** Fall; **G. spiraeae** Fall, fig. 22; **G. alni** Fall.)[7]
10. Dorsal sclerites of abdomen carrying a number of setae varying from one or two on some sclerites, to three or four on others. (Mandible with five teeth and inner margin behind the teeth blade shaped and obtusely rounded anteriorly)---------- Galerucella, Group E. (**G. notata** Fabricius, p. 23, figs. 24, 29; **G. cribrata** LeConte, p. 26); and **Monoxia puncticollis** (Say) (p. 26, figs. 7, 50.)[8]

Dorsal sclerites of abdomen on each side with one long seta on each sclerite---------- Lochmaea (**L. capreae** Linnaeus, first stage larva, from Europe, p. 29, fig. 6).

---

[6] "Sentus" has recently been defined as a more or less slender, unbranched chitinous process of the body, from which well-developed setae radiate.

[7] The species here listed as having larvae belonging to "Galerucella type D" are treated in the very valuable paper, The Blueberry Leaf Beetle and Some of Its Relatives, by H. C. Fall and W. C. Woods (Maine Agric. Exp. Sta., Orono, Bull. 319, 1924). Doctor Woods has given descriptions and diagrams of the arrangement and form of the sclerites and the distribution of the setae in the larvae of all the species mentioned of group D, *Galerucella cavicollis* excepted, but according to Mr. Fall's remarks (p. 87) that *Galerucella kalmiae* is "extremely similar to *cavicollis*, from which * * * it is scarcely distinguishable," one may expect to find the sclerites and setae of the *cavicollis* larvae arranged as shown in Doctor Wood's diagram of the *kalmiae* larva. No larva of *G. cavicollis* is preserved in the National Museum.

[8] The larva of *Monoxia puncticollis* does not represent a distinct generic type. It belongs to the *Galerucella* group E, and is separated from the two species of this type mainly by the smaller size of its setae (figs. 30 and 47) and dark colored skin with light sclerites, whereas the two *Galerucella* species normally are light colored with large, dark setal cups.

11. Abdominal segments with exterior prescutal sclerite small, about twice, or less than twice, the size of one of the spiracles, and located as far from the interior prescutal sclerite as four or five times its own diameter, or even farther. (Setae of moderate size and brownish.)
Galeruca pomonae Scopoli (p. 34, fig. 12).
Exterior prescutal sclerite three times or more the size of one of the spirales, and located as far from the interior prescutal sclerite as from two to three times its own diameter, or even nearer_____ 12
12. Senti generally slender and as long or longer than their diameter at base. Interior prescutal sclerites of the posterior abdominal segments not fused in the middle line. Setae long and creamy white.
Galeruca tanaceti Linnaeus (European species, p. 31, fig. 13*a*).
Senti generally plump and shorter than their diameter at base. Interior prescutal sclerites of the posterior abdominal segments fused in the middle line. Setae moderately long and brownish__ Galeruca laticollis Sahlberg (European species, p. 34, fig. 11*a*).
13. Abdominal segments with a transversely elongate scutal sclerite. No supra-spiracular glands___ Sermylassa halensis Linnaeus (p. 35, fig. 14).
Abdominal segments with a small round scutal sclerite. A large supra-spiracular gland lodged between the nearly contiguous anterior and posterior parascutal sclerites_____Agelastica alni Linnaeus (p. 38, fig. 15).

DESCRIPTIONS AND NOTES

MONOCESTA CORYLI (Say)

(U. S. Nat. Mus.; described from larva in vial marked "St. Thomas, Pennsylvania, July 20, 1921; E. M. Craighead, Coll.). Reared.

Mature larva (figs. 1, 2).—About 15 mm. long.

Head brown and somewhat shining, epicranial suture a black median line. Body dorsally dull brown and leathery with the chitinizations of about the same color, though slightly more yellowish and shining; underside of body yellowish brown; legs brown and shining, light colored on the inner side.[9]

Setae short to moderately long and pointed on the head, the prothoracic and pygidial shields, the laterally projecting lobes of the body and the legs; rest of body without setae or with minute setulae here and there.

Head capsule (fig. 34).—With a large, rather flat median depression in the frons behind the epistomal margin; a few deep striations radiating from the middle of the depression.

Labrum (fig. 35).—Subtriangular, about as long as wide, with lateral margins somewhat incurved anteriorly; distal end slightly emarginate. Discal setae not fully as long as labrum; marginal setae inserted in the incurved part of labrum, five present on each side, almost half as long as the discal setae.

Mandible (figs. 45, 48).—Ruffled from base to near the middle, especially on the exterior side. Four teeth present, inner margin of

[9] Larva in first stage glossy yellow; with each shedding of the skin becoming more brownish.

mandible immediately behind the teeth projecting into an obtuse low process; third tooth much larger than the rest, subrectangular and with multiserrated edge. Penicillus absent; two setae present on exterior side of mandible.

Maxilla (figs. 56, 59, 61, 63).—Lacinia soft, densely setose, and with half a dozen long, spine-shaped setae; galea smoothly chitinized, having about the same number of similarly shaped setae as lacinia and a short, pointed cone-shaped appendix between them.

Postlabial band (fig. 63*b*).—Semicircularly curved.

Prothorax (figs. 1, 2).—Shield with a finely aciculate surface and on each side a large, irregularly variolose depression; in the sagittal line a sharp furrow and at the end of this a small triangular deepening; margin thick and rounded, carrying a few short and thin setae. Epipleural area with a small, round, slightly chitinized projection carrying a few soft, short hairs. Prehypopleurum (=episternum) with a yellowish sclerite and a few soft setae. Posthypopleurum (=epimeron) with no distinct sclerite; a few soft setae present. Jugular region membranous. Eusternal plate median, large, transverse, crescent shaped, and with a single row of several setae. Each sternellar plate round, with a single seta.

Mesothorax and metathorax (figs. 1, 2).—Prescutal and scuto-scutellar areas separated by a deep transverse furrow. Prescutum of mesothorax with a small, but distinct sclerite on each side close to the sagittal line. Prescutum of metathorax without distinct sclerites. Scuto-scutellum both of mesothorax and metathorax carrying a small sclerite on each side close to the sagittal line. Alar area flat, freely projecting over epipleural area below, and carrying on an irregularly bilobate sclerite several fine setae. Spiracular area with a single seta. Epipleural area bearing a small, rounded, shining, setose projection. Prehypopleural and posthypopleural areas as in prothorax. Eusternal and sternellar sclerites weak.

First to eighth abdominal segments (figs. 1, 2).—Prescutal area separated from scuto-scutellar area by a deep transverse groove; prescutal area without any sclerite. Scuto-scutellar area with an unpaired median, rather small and scale-like sclerite. Parascutal area not sharply defined and without sclerites. Epipleural lobe projecting, cone-shaped, and provided with a chitinous top with a few short setae. Hypopleural area soft, with two moderately long setae. Eusternum soft with a single seta on each side. Sternellum (plus parasternum) soft, with two setae.

Ninth abdominal segment (figs. 1, 2).—Pygidial shield subrectangular, transverse with broadly rounded corners, leatherlike with discal part more glossy; about a dozen moderately long setae located in the hind margin in a single irregular row. Ventral part of segment with about half a dozen setae on each side.

Tenth abdominal segment (fig. 60).—With six pear-shaped lobes radiating from anus in the middle of the sucking surface. Each side with a slightly chitinized and setae bearing plate.

Leg (fig. 62).—Coxa, trochanter, femur, and tibia brown with distal end blackish, claw blackish brown. Tibia rather short, somewhat contracted and bent medianly.

Habits.—Feeding on the leaves especially of red elm, also recorded from hazel (*Corylus americanus*), skeletonizing one leaf after another; feeding when in first and second stages on the underside but in the third stage indiscriminately on either side, usually refusing to touch the epidermis of the opposite side but sometimes eating holes through the leaves. Pupates in the ground in a simple oval cavity, a few inches below the surface.

Literature.—

RILEY, C. V.
1879. "Report of Commissioner of Agriculture for the year 1878," pp. 245–277, pl. 4, figs. *a–h* (Reprint in "Author's Edition" from Annual Report of Dept. of Agr. 1878. Charles V. Riley, August 1879, pp. 40–42).

HOWARD, L. O.
1905. U. S. Dept. Agr.; Bull. 54, pp. 81–82.

TRIRHABDA CANADENSIS Kirby

(U. S. Nat. Mus.; described from larva in vial marked "North East, Pennsylvania, 1919. E. M. Craighead coll." Reared.

Mature larva (fig. 3).—About 12 mm. long.

Head (fig. 37) smooth, varying in color from brownish, in some specimens brownish with black specks, to deep bluish black; labrum shining black; anterior corners of frons light, frontal sutures whitish, sagittal line above carina of frons black. Body varying in color from dull brown to indigo-blue; prothoracic shield uniformly iridescent dark with light median suture; pygidial shield and dorsal and lateral sclerites transversely striate, with indistinct margins gradually blending into the similarly colored, dark and iridescent skin; underside of body cream colored with thin but distinctly colored ochreous sclerites. Legs usually blackish brown with ochreous inner side.[10]

Setae whitish, thin, pointed, easily broken, about half, or less, as long as the length of a body segment, present in moderate numbers.

Head capsule (fig. 37).—On each side close to the epistomal margin and near to the sagittal line with an irregular depressed area bearing two setae.

Labrum.—Subrectangular, about twice as wide as long, with front margin slightly emarginate medianly. Discal setae thin, not fully as long as labrum; marginal setae short and fine.

[10] Larva in first stage uniformly brownish, rather glossy, with setae somewhat longer than each body segment.

Mandible (fig. 49).—With five teeth; first tooth small, narrow, easily overlooked, second and third (the larger) both pointed and claw shaped, fourth and fifth small and fused at bases. Penicillus absent; two short setae externally.

Maxilla (fig 66).—Lacinia at base shining, distally membranous, covered with fine, short hairs, and carrying a few stiff setae; galea smoothly chitinized, armed with half a dozen spinelike setae and between these a small cone-shaped appendix.

Postlabial band (fig. 66).—Slightly curved forward medianly, laterally strongly rounded.

Prothorax (fig. 3).—Thoracic shield at the anterior and posterior ends of the sagittal suture with an unpaired, minor, triangular deepening, and on each side in the middle of the disk a large, rounded depression irregularly pitted at the bottom. Moderately long and rather numerous setae inserted anteriorly and posteriorly in the margin. Epipleural area with a rather large, dark-colored sclerite, in character similar to the alar sclerite of the posterior thoracic segments. Prehypopleural and posthypopleural sclerites (=episternum and epimeron) oval, similar in size and color. Eusternal and sternellar sclerites almost fused into one subquadrate plate, with four setae on each side.

Mesothorax and metathorax (fig. 3).—The compound interior prescutal sclerite with a fine white sagittal suture, on each side with two primary and a few secondary setae; exterior prescutal sclerite considerably smaller than each interior one, one primary seta and a few minute secondary ones. Interior compound scuto-scutellar sclerite similar to the interior prescutal sclerite and carrying the same number of setae; exterior scuto-scutellar sclerite large, round, with three primary setae. Alar area thick, somewhat projecting laterally, carrying a large, simple, rounded sclerite with four primary setae and several small secondary ones. Spiracular area with a small sclerite around the spiracle and one primary seta. Epipleural area with a sclerite carrying two or three setae. Pre- and posthypopleural sclerites as in prothorax. Eusternal sclerite large, oval, distinctly outlined and with about four setae on each side. Sternellar sclerite paired, small and not so distinctly outlined, with one seta.

First to seventh abdominal segments (fig. 3).—The compound, interior prescutal sclerite large, rather long and broad, with two primary setae on each side; exterior prescutal sclerite rounded and well separated from the interior sclerite, with one or two setae. Compound interior scuto-scutellar sclerite not so broad, but otherwise very similar to the prescutal, one or two primary setae present; exterior scuto-scutellar sclerite located closer to the middle line than

exterior prescutal sclerite, otherwise very similar to this, one or two setae. Anterior and posterior sclerites of the parascutal area fused to a single round, rather large compound sclerite in which the spiracle is lodged, two primary setae posteriorly and a few secondary around the spiracle. Epipleural lobe cone shaped, with a sclerite carrying three or four primary setae on the top and as many secondary ones. Hypopleural sclerite distinct, well chitinized and well colored, two setae. Compound eusternal sclerite distinctly outlined, color rather dark and sharply contrasting against the light-colored skin of the ventral side of the body, one or two primary setae on each side. Sternellar area (plus a parasternal or "coxal" lobe, particularly distinct in the present larva) with two small sclerites; the outer one circular in outline with two setae, the inner one a mere chitinous grain with one seta; both sclerites rather dark and standing out sharply against the light ventral skin.

Eighth abdominal segment.—With interior and exterior scuto-scutellar sclerites fused into a single compound plate with three setae on each side; otherwise not differing much from the preceding segments except in size.

Ninth abdominal segment.—Pygidial shield subrectangular with rounded corners, a thick margin, and a somewhat elevated corrugated discal part; several moderately long and some short setae in the margin and a few on the disk.

Tenth abdominal segment.—With six large, almost equally sized pear-shaped lobes radiating from anus.

Habits.—Eating foliage of *Solidago*; has been recorded as defoliating *Artemisia* sp in Arizona. Pupates in the ground.

Literature.—

BALDUF, W. V.
1929. Ent. News, vol. 40, p. 35. (Life History and Bibliography.)

TRIRHABDA VIRGATA LeConte

(U. S. Nat. Mus.; described from larva in vial marked: "On Solidago. Camp Hill, Pennsylvania, F. M. Trimble coll.") Not recorded as reared.

No characters have been found by which the larva of this species can be definitely separated from the larva of *T. canadensis*.

In both species the larvae appear to vary somewhat in regard to color, the length and number of the setae, and the distance between the interior and exterior sclerites of prescutum and scuto-scutellum. As, however, the imagines are closely related, occur in the same localities, and feed together with their larvae on the leaves of the same food plant, the probability is that the larval material of both species is mixed in our collections.

TRIRHABDA BREVICOLLIS LeConte

(U. S. Nat. Mus.; described from larva in vial marked: "F. H. Chittenden June 1901, Victoria, Texas, J. D. Mitchell coll.") Probably reared.

Mature larvae differs from that of *T. canadensis* in having light brownish skin and small dark-brown dorsal sclerites. Each abdominal segment with exterior sclerites of prescutum of about the same size as a spiracle and distance between exterior and interior sclerites of scuto-scutellum about three times the diameter of the exterior sclerites. Sternal sclerites of abdomen very thin and of the same pale yellow color as the skin; sternal region of abdomen therefore apparently without sclerites.

Habits.—Larva of *T. brevicollis* defoliates the bushlike tree of *Zanthoxylum* (Rutaceae) or prickly ash.

According to L. O. Howard,[11] J. D. Mitchell, Victoria, Tex., says "the larvae burrow into the ground, where it is slightly raised, making runs or galleries from which they crawl out or about day and night, but never more than a few inches from the colony home." The pupal stage is passed in the ground.

TRIRHABDA NITIDICOLLIS LeConte

(U. S. Nat. Mus.; described from larva in vial marked: "No. 4979, Los Angeles, California, D. M. Coquillet coll.") No record of rearing.

The mature larva resembles the larva of *T. canadensis* by having dorsal sclerites of about the same size and similarly striated as in that species and by having rather long setae. It differs from it by being somewhat lighter in color with greenish, bronze-colored dorsal skin and sclerites and by having pale-yellow ventral skin and very thin and pale-yellow sternal sclerites on the abdomen.

TRIRHABDA TOMENTOSA Linnaeus

(U. S. Nat. Mus.; described from larva in vial marked: "708, Haw Cr. Florida, 1896.") H. G. Hubbard collected and determined, probably by rearing.

Resembles the larva of *T. canadensis* in most characters, but has slightly larger dorsal sclerites and much thinner and shorter setae, the latter being about half as long as the sclerites in which they are inserted.

TRIRHABDA ATTENUATA Say

(U. S. Nat. Mus.; vial marked: "Hopk. U. S. 15729a. On foliage of *Artemisia* species. Yosemite Park, California, July 24, 1918. T. E. Patterson.") Reared.

The mature larva is somewhat smaller, more elongate and cylindrical than *T. canadensis*. The color is dark bronze dorsally and

[11] U. S. Dept. Agri. Bull. No. 38, new series, 1904, p. 108.

dark ochreous ventrally; dorsal and ventral sclerites well defined. Setae long, strong, and many of the dorsal ones slightly enlarged at the end, a development not noticed in the other investigated *Trirhabda* larvae, in all of which the setae are pointed.

GALERUCELLA NYMPHAEAE Linnaeus

(U. S. Nat. Mus.; described from larva in vial marked: "Craighead, Pennsylvania, July 4, 1921, E. M. Craighead Coll.") Reared.

Mature larva (fig. 18).—About 10 mm. long.

Head smooth and shining, either entirely black or with reddish-brown anterior margin; labrum cream colored with dark posterior corners; coronal (=median epicranial) and frontal sutures appearing as fine white lines. Body with membranous parts greenish-gray; prothoracic shield, dorsal sclerites and pygidial shield shining, dark chestnut brown; all three thoracic segments with a whitish sagittal suture; dorsal sclerites coarsely corrugated and covering almost the entire upper side of the body, skin between the sclerites appearing only as light lines; pygidial shield variolose, irregularly and coarsely corrugated and uniformly colored; underside of body light greenish-gray with sclerites small and light ochreous. Legs blackish brown on the exterior side, ochreous on the inner side.

Setae short, thin, and pointed (fig. 17); most sclerites with few minute spinulae.

Head capsule.—With an unpaired shallow anterior depression behind epistomal margin; a small grain-shaped elevation on each side in the posterior corner of frons.

Labrum (fig. 16).—About twice as wide as long; anterior margin forming an arch of about 120°. Discal setae rather short, straight, and pointed; marginal setae short, curved, and pointed.

Mandible (fig. 19).—With five teeth; inner margin behind the last tooth somewhat incurved; first tooth small and narrow, second, third, and fourth larger, all pointed and claw shaped; fourth and fifth completely separated; fifth short and broad, penicillus present; two short setae located externally.

Maxilla (fig. 20).—With lacinia distally pectinate, carrying a row of about 10 subcylindrical, distally obtuse, strong, and long setae, all of same length and build; galea armed with six spinelike setae of moderate length, between these a short, cone-shaped tactile appendix; maxillary palpus with only three joints, basal joint (often referred to in the literature as "palpiger") characterized by two long setae; the virtual palpiger soft, light colored, without individual muscles, and located distally to the chitinized stipes.

Postlabial band.—Medianly somewhat forward curved, laterally strongly rounded.

Prothorax (fig. 18).—Prothoracic shield with a somewhat cordiform depression anteriorly in the sagittal line and six to eight foveae on each side between the sagittal middle line and the margin of the shield; anterior and posterior margin with a few minute setae. Epipleural area with a large sclerite. Prehypopleural and posthypopleural sclerites (= episternum and epimeron) oval, about similar in size and color. Eusternal and sternellar sclerites fused into a single, rectangular, median plate; with two minute setae on each side.

Mesothorax and metathorax (fig. 18).—Interior and exterior sclerites of prescutum fused to a single compound plate with a sagittal white line and a curved, white, incomplete line indicating the limit between the exterior and interior sclerites. Interior and exterior sclerites of scuto-scutellum developed as in prescutum. Alar area carrying a large sclerite, as long as the entire segment and anteriorly separated only by a fine suture from a sclerite covering the entire spiracular area; both areas with a few minute setulae. Epipleural area with a large subtriangular sclerite with a few setulae. Prehypopleural and posthypopleural sclerites as in prothorax. Eusternal sclerite median, single, approximately crescent shaped, three times as broad as long, densely asperate, and with two setae on each side. Sternellar sclerite paired, developed as a minute asperate disk around the foot of a small seta.

First to eighth abdominal segments (fig. 18).—Compound interior sclerite of prescutum separated from exterior sclerite by a thin white suture. Compound interior sclerite of scuto-scutellum fused with exterior sclerite on each side into one single scuto-scutellar plate. Anterior and posterior sclerites of the parascutal area about equal in size, and separated by an oblique furrow; spiracle situated in the anterior sclerite. Epipleural sclerite about as long as the segment and subquadrate. Hypopleural sclerite distinct, ovate, with two small setae. Compound eusternal sclerite asperate and of the same form and size as in mesothorax and metathorax. Sternellar area with one small, round, and darkly colored asperate sclerite on each side, and in some of the segments with a dark speck close to the middle line; one or two small setae on the sclerite, one on the minute speck.[12]

Ninth abdominal segment.—Pygidial shield subrectangular with rounded corners, leathery, variolose, and with about half a dozen

[12] The sternellar sclerites may be reduced in size in some of the abdominal segments while they are distinct in the other segments of the same larva, but specimens in which sternellar sclerites are completely absent are not found in the material of larvae of *G. nymphaeae* preserved in the National Museum. K. L. Henriksen, however (see bibliography), finds that these sclerites are regularly absent in the European specimens of the same species.

moderately long setae in the margin. Ventral part of ninth segment transverse, carrying band-shaped sclerite with two setae on each side.

Tenth abdominal segment.—With four anal lobes, the lateral one on each side large and round.

Habits.—Nibbling on the upper surface of floating leaves of water lilies and many species of *Polygonum*, leaving the epidermis intact on the under side. Larva fastens itself by its tail end to the leaf before transforming into pupa; last abdominal segments of pupa covered by larval skin. According to J. P. Kryger[13] also found on *Mentha*, from which plant it was reared.

Literature.—

MacGillivray, A. D.
1903. New York State Museum, Bull. 68, pp. 325–326, pl. 27, figs. 8 and 9 [both incorrect] and pl. 31.

Chittenden, F. H.
1905. U. S. Dept. of Agri., Bur. Ent. Bull. n. s., No. 54, pp. 59–60. ("So abundant in the District of Columbia that the imagines deserted the natural aquatic food plants, as Nymphaea, Sagittaria, Brasenia, and Nuphar, and attacked near-by plants of other families, such as basket willow and beans, doing considerable damage.")

Woods, W. C.
1924. Maine Agr. Exp. Sta. Bull. 319, p. 134.

Henriksen, K. L.
1927. Danmarks Fauna No. 31, p. 348.

GALERUCELLA LINEOLA Fabricius

(U. S. Nat. Mus.; described from larva in vial marked: "On Rumex sp. Seeland, Denmark, E. A. Rosenberg collected, reared, and dedit.") Reared.

No characters have been found by which the larva of this species can be definitely separated from the larva of *G. nymphaeae*. It pupates also above the ground attached to a leaf, and with the end of the abdomen covered by the skin of the last larval instar (seen on material in the U. S. National Museum).

K. L. Henriksen records as food plants of *G. lineola* only *Salix* and *Alnus*, whose leaves it skeletonizes, but E. A. Rosenberg has added *Rumex* species. Chittenden mentions (see literature on *G. nymphaea*) that adults of the species of *G. nymphaea* occasionally feed on salix.

GALERUCELLA SAGITTARIAE Gylienhal (=G. GRISESCENS Joannis)

(U. S. Nat. Mus.; larva described from vial marked: "On the leaves of *Potomogeton* species, Donse, Denmark, 26 July 1925; imago developed 3 August 1925. E. A. Rosenberg leg. et ded.") Reared.

The larva of this species can not be distinguished from that of *G. nymphaeae*.

[13] Entom. Medd. Copenhagen, vol. 13, 1919, p. 38.

Literature.—

CHITTENDEN, F. H.
1905. U. S. Dept. of Agri., Bur. Ent. Bul. n. ser., No. 54, pp. 58.
HANSEN, VICTOR.
1927. Danmarks Fauna No. 31, p. 154 (as food plants are mentioned *Lysimachia vulgaris* and *L. thyrsiflora* and "possibly other water plants").

GALERUCELLA LUTEOLA Muller (= G. XANTHOMELAENA Schrank)

(U. S. Nat. Mus.; described from larva in vial marked: "On elm, July 21, 1907. Roselle, N. J.—B. H. Jouett, coll.") Reared.

Mature larva (figs. 4, 5).—About 12 mm. long.

Head shining black with black labrum; frontal sutures fine whitish lines; body somewhat varying in color, generally dull yellow, with a pair of longitudinal black stripes along the back meeting near the end of the abdomen; prothoracic shield yellow with a large black spot on each side; pygidial shield shining, black; underside of body yellowish with blackish sclerites; legs reddish brown to black, lighter on the inner side.[14]

Setae moderately long and moderately strong, pointed and yellowish; present in considerable number on the back and the sides of the larva.

Head capsule (fig. 38).—With a large unpaired depression in the middle of frons posterior to epistomal margin.

Labrum.—Subrectangular, about twice as wide as long, with front margin slightly emarginate medianly. Discal setae somewhat longer than labrum itself; marginal setae short and fine.

Mandible (fig. 46).—With four teeth, the second of which being the larger and more extended; inner margin of mandible immediately behind the third tooth projecting into an obtuse process, here considered as the fourth tooth. Penicillus present; no setae found on exterior face of mandible.

Maxilla (fig. 67).—With lacinia carrying a few stiff setae; galea having about seven similar setae and a rather short cone-shaped appendix between them.

Postlabial band (fig. 5.).—Semicircular.

Prothorax (figs. 4, 5, 21).—Shield with a small subtriangular deepening in front of and a similar one at the end of a whitish median suture, on each side a large, darkly colored depression. Numerous setae inserted in a double row along the whole margin and a few found inside of these. Epipleural area with a large yellow sclerite carrying six setae. Prehypopleural sclerite (= episternum) light colored with about four setae; posthypopleural sclerite (= epimeron)

[14] Newly hatched larvae nearly black; with each shedding of the skin the yellow color becomes more dominating.

also light colored with about four setae. Ventrally with a dark subtriangular eusternal sclerite wedged in between and almost fused with a pair of dark, rounded and small sternellar sclerites, the compound plate carrying two primary setae on each side.

Mesothorax and metathorax (figs. 4, 5, 21.)—Interior prescutal sclerite almost completely fused with the interior sclerite of the opposite side, the sagittal suture only indicated at each end of the compound plate, light colored, six setae; exterior prescutal sclerite distinct, dark colored, about five setae. The interior scuto-scutellar sclerite similar to interior prescutal sclerite but somewhat smaller, light colored, on each side armed with about four setae; exterior scuto-scutellar sclerite large, round, dark colored, with about eight setae. Alar sclerite large, dark, with about 12 setae. Spiracular area somewhat chitinized and armed with a single seta. Epipleural area triangular, with a moderately large, light colored sclerite carrying about four setae. Prehypopleural sclerite usually dark, with four setae; posthypopleural sclerite usually light colored, with four setae. Eusternal sclerite weak, with two to three setae on each side. Sternellar sclerite minute, with a single seta.

First to seventh abdominal segments (figs. 4, 5, 21).—Interior prescutal sclerites fused in the middle line, light colored, with about four setae on each side; exterior prescutal sclerite distinct, dark colored, with about five setae; between interior and exterior prescutal sclerites a single seta present. Interior scuto-scutellar sclerites fused, light colored, with about four setae on each side; exterior scuto-scutellar sclerite distinct, dark-colored, armed with about three setae. Parascutal area with a distinct but small anterior sclerite and a rather large posterior sclerite; both dark colored, anterior armed with two setae, posterior with about five. Epipleural sclerite rather large, light colored, about seven setae. Hypopleural sclerite rather dark, about four setae. Eusternal sclerites fused or almost fused in the sagittal line, on each side about three setae. Sternellum (plus parasternum) having one distinct, dark sclerite armed with about two setae.

Eighth abdominal segment.—Similar to the preceding abdominal segments but not so wide and high as these and with the interior and exterior scuto-scutellar sclerites all fused together into a single compound sclerite, armed with about five setae on each side.

Ninth abdominal segment (figs. 4, 5).—Pygidial shield semicircular in outline with margin thick and set off from the discal part by a groove. Setae numerous, arranged in a single anterior row and an irregular double row in the free margin; a few setae present in the discal part. Ventral part of segment with a transverse, elongate sclerite.

Tenth abdominal segment.—Anteriorly carrying a transverse, narrow unpaired sclerite; on each side a lateral, paired, small, and more rounded sclerite armed with a few setae.

Leg (fig. 5).—Coxa black; trochanter, femur, and tibia reddish brown with black distal ends; claw black.

Habits.—Feeds on the leaves of most species of elm (*Ulmus*), skeletonizing them from below, at times completely denuding the trees. Transforming to pupa at the bases of trunks or in crevices in the ground, etc.; no cocoon.

Literature.—

BRITTON, W. E.
1907. Connecticut Agr. Exp. Stat., Bull. 155.
MARLATT, C. L.
1908. U. S. Dept. of Agr., Bur. Ent., Circ. No. 8, new ed. (Species introduced into United States about 1837.)
SILVESTRI, F.
1910. Boll. Lab. Zool. R. Scuola Super. Agr. Portici, vol. 4, pp. 246–290. (Eggs, the three larval stages, pupa, imago; life-history; seasonal history; parasites, *Lebia scapularis* feeding on eggs, larvae, and pupae of the species; many figures of habitus and details.)
HERRICK, GLEN W.
1913. New York, Cornell Univ. Agri. Exp. Sta., Bull. 333, p. 491.
WOODS, W. C.
1924. Maine Agric. Exp. Sta., Bull. 319, p. 136.

GALERUCELLA species

(U. S. Nat. Mus.; described from larva in vials marked: "Galerucella sp., destroying elms, Nanking, China, June 13, 1911. Rec. by U. S. Dept. Agri., July 10, 1911, from A. W. Bowler (?) of the University of Nanking.") Not reared.

Length about 12 mm. The larva of this species is slightly different from the larva of *G. luteola*, as known in this country, the setae of the undetermined species being somewhat stronger and the color of the body being clear lemon-yellow with a single, broad, median, longitudinal, black band. The sclerites are all black and a rather large black spot in the skin surrounds the abdominal spiracles. The pygidial shield is yellow with black marks in the discal part.

GALERUCELLA VIBURNI Paykull

(U. S. Nat. Mus.; larvae described from vial marked: "Donse, Seeland, Denmark; larvae found June 7, 1896; imago developed July 4, 1896; E. A. Rosenberg leg. et ded.") Reared.

Mature larva (fig. 23).—About 8 mm. long.

Head shining dark brown, labrum black with an anterior, light-brown median spot. Body with membranous parts greenish yellow; prothoracic shield light yellowish with dark chitinous specks, me-

dianly and posteriorly with a moderately large, pale-brown region (somewhat larger than one of the compound interior prescutal sclerites of mesothorax and metathorax), sagittal line distinct and whitish; sclerites on the upper side of mesothorax, metathorax, typical abdominal segments and the pygidial shield pale brown; under side of body creamy yellow with light-brown sclerites; legs shining, dark brown.

Setae moderately long, moderately strong, light brownish and somewhat club-shaped terminally; present in limited number on the back and sides of the larva.

Head capsule.—With only slight depressions in frons.

Labrum (fig. 32).—Subrectangular, about two and one-half times as wide as long, middle of anterior margin slightly emarginate and anterior corners strongly arcuate. Discal setae moderately long and pointed. Marginal setae minute.

Mandible (fig. 27).—With five claw-shaped teeth; inner margin behind last tooth slightly incurved; fourth and fifth teeth somewhat fused at bases, fourth tooth much stronger than fifth. Penicillus present; two short setae externally.

Maxilla.—With lacinia distally pectinate, carrying a row of subcylindrical, terminally obtuse, strong setae of uniform and considerable length; galea with about six spinelike setae and a small, cone-shaped tactile appendix.

Postlabial band.—Simple, rounded, slightly curved forward in the middle.

Prothorax (fig. 23).—Prothoracic shield on each side having a large, flat depression with half a dozen round pits in the bottom; five well-developed setae in the anterior margin, one laterally and two posteriorly. Epipleural sclerite large, with two or three setae. The prehypopleural sclerite (=episternum) and the posthypopleural sclerite (=epimeron) of about the same size, the prehypopleural sclerite somewhat darker near the articulation of the leg, each sclerite with two setae. Eusternal and sternellar sclerites almost fused to one plate, two setae on each side.

Mesothorax and metathorax (fig. 23).—All the sclerites of moderate size; compound middorsal sclerites separated sagittally by a fine white suture. Prescutal area with interior compound sclerite carrying one seta on each side; exterior sclerite distinct, one seta. Scuto-scutellar area with interior compound sclerite almost identical with interior prescutal, one seta on each side; exterior scuto-scutellar sclerite almost twice as large as exterior prescutal, one seta present. Alar sclerite large, with three setae. Spiracular area chitinized, with one seta. Epipleural area with a moderately large, rounded sclerite, one seta. Prehypopleural and posthypopleural sclerites as in pro-

thorax. Compound eusternal sclerite subrectangular, two setae on each side. Sternellar sclerite minute, and with a single seta.

First to seventh abdominal segments (fig. 23).—The skin between the sclerites rather well developed and the sclerites not so predominating in size as in other species of the genus *Galerucella.* Compound interior prescutal sclerite with one seta on each side; exterior prescutal sclerite distinct, one seta. Compound interior scuto-scutellar sclerite not so wide as the interior prescutal plate, one seta on each side; exterior scuto-scutellar sclerite nearer the middle line than the exterior prescutal, one seta. Parascutal area with a distinct anterior sclerite, a distinct posterior sclerite which is twice as large, and a small chitinization around the spiracle; anterior sclerite with one seta and posterior with one. Epipleural sclerite round, large, with two setae. Hypopleural sclerite small; one seta. Eusternal compound sclerite oval, about of the same size as in mesothorax and metathorax; one seta on each side. Sternellar area with small, round sclerite, and one seta.

Eighth abdominal segment.—Similar to the preceding segments but with interior and exterior scuto-scutellar sclerites fused into a single median plate; two setae on each side.

Ninth abdominal segment.—Pygidial shield with the free margin forming an arc of about 120°. Five long, pointed, marginal setae on each side and two small discal setae on each side. Ventral part of segment with a transverse, band-shaped sclerite; two setae on each side

Tenth abdominal segment.—Carrying a lateral sclerite on each side; four anal lobes.

Habits.—Skeletonizes and eats holes through the leaves of *Viburnum opulus* and of cultivated species of *Viburnum.* No definite record as to where the larva pupates.

Literature.—

HENRIKSEN, K. L.
1927. Danmarks Fauna No. 31, p. 347.

GALERUCELLA NOTATA Fabricius

(U. S. Nat. Mus.; described from larvae in vials marked: "On *Eupatorium perfoliatum*, August 25 to September 14, 1915, and July 14, 1916. Reared and collected material. North East, Pennsylvania, R. A. Cushman." Material contains pyriform eggs in small groups on leaves; first, second, and third larval instars, cast skins of all instars; pupa, cocoon, and reared imagines.)

Mature larva (fig. 24).—About 7 mm. long.

Head shining, creamy white to light brown with labrum, clypeal chitinizations, epistoma and a round spot around ocellus olive green; fine sagittal line of frons dark, frontal sutures whitish. Body

with membranous parts creamy yellow,[15] chitinous parts, including the prothoracic and pygidial shields, light yellow, cups carrying the setae large and olive green, dorsal sagittal line of thoracic segments not distinct on account of the light color of the chitinizations; underside of body creamy white, membranous and chitinous parts having approximately same color; legs light brown with the inner sides creamy yellow and the ends of the joints and the claws darker.

Setae (fig. 30).—Moderately long, about half as long as a body segment, moderately strong, creamy yellow and capitate; present in limited numbers on the back of the larva and each inserted on top of a small, dark, tubercle-shaped cup.

Head capsule.—With only a slight, median, unpaired depression in frons.

Labrum (fig. 33).—Crescent shaped, about twice as wide as long, slightly emarginate anteriorly in the middle. Discal setae moderately long and pointed; marginal setae minute and fine, the two exterior of the row somewhat larger than the others, straight and pointed; a single small seta inserted in front of and another immediately behind the interior discal seta.

Mandible (fig. 29).—With five teeth; inner margin behind last tooth projecting into a thin blade with anterior end obtusely rounded; first tooth comparatively strong, with the tip reaching about to the base of second tooth; second and third teeth the larger, claw shaped, and slender; fourth and fifth small, of the same size, and fused except terminally. Penicillus well developed; two setae located externally, and one seta in the middle of the dorsal side.

Maxilla.—With lacinia distally carrying a single row of equally long, well developed, distally pointed setae; galea with half a dozen spinelike setae, as many minute setae, and a cone-shaped tactile appendix of about the same length as the longer setae.

Postlabial band.—Simple, rounded, not curved forward medianly.

Prothorax (fig. 24).—Prothoracic shield on each side having an irregular depression with six deep, round pits in the bottom, a transverse, shallow groove connecting the depressions of the two sides, and at each end of the sagittal line a small triangular unpaired deepening. Arrangement of setae on each side of the shield as follows: Six setae in two rows in the anterior margin, about three setae laterally and two setae in the posterior margin. Epipleural sclerite large, round, with one primary and two or three secondary setae. Prehypopleural and posthypopleural sclerites (=episternum and epimeron) about of the same size; each with one seta. Eusternal and

[15] In some specimens of this species the creamy color of the skin has changed to a swarthy color, against which the whitish chitinizations contrast sharply, giving these specimens a general appearance strikingly similar to the larvae of *Monoxia puncticollis* (Say).

sternellar sclerites almost fused into one plate, very thinly chitinized, and rather easily overlooked; two or three setae on each side.

Mesothorax and metathorax (fig. 24).—Prescutum with compound interior sclerite carrying two setae on each side; exterior sclerite distinct, with one seta. Scuto-scutellum with compound interior sclerite carrying two setae on each side; exterior sclerite large, distinct, and with three setae. Alar area with a large, distinct sclerite, carrying three setae. Spiracular area chitinized, with three setae. Epipleural sclerite carrying one seta. Prehypopleural and posthypopleural sclerites as in prothorax. Eusternal compound sclerite with two setae on each side. Sternellar sclerite minute, and with one seta.

First to seventh abdominal segments (fig. 24).—The skin between the sclerites well developed, the sclerites of moderate size. Prescutum with compound interior sclerite bearing three setae on each side; exterior sclerite distinct, and with one seta. Scuto-scutellum with compound interior sclerite bearing one seta on each side; exterior sclerite distinct, rather large, and bearing three setae. Parascutal area without anterior sclerite, without chitinization around the spiracle and with only posterior sclerite present, carrying two setae. Epipleural sclerite round, somewhat projecting, with three or four setae. Hypopleural sclerite small, with two setae. Eusternal compound sclerite with two setae on each side. Sternellar area with a small sclerite, carrying two setae.

Eighth abdominal segment.—Similar to preceding segments, but with the interior and the exterior scuto-scutellar sclerites fused into a single plate, carrying three setae on each side.

Ninth abdominal segment.—Pygidial shield small, semicircular, half as wide as eighth abdominal segment; five setae on each side in the free margin and two or three on each side of the disk. Ventral side with a transverse, band-shaped, unpaired sclerite; three setae on each side.

Tenth abdominal segment.—With one small unpaired posterior anal lobe, one small unpaired anterior anal lobe, and one large lateral anal lobe on each side.

First and second larval instars.—Mandibles and other mouth parts shaped as in mature larva; thoracic and abdominal sclerites also present in the same number, arranged in the same way, and carrying as many setae as in the mature larva; likewise possessing capitate setae.

Habits.—Feeding on leaves of *Eupatorium perfoliatum.* Transforms to pupa in an oval cocoon formed by an open network of filaments, attached to a leaf.

Literature.—

Woods, W. C.
1924. Maine Agr. Exp. Sta. Bull. 319, p. 137. (Gives only the locality and food plant of larva; no description or figures, and the writer says (p. 138) that he does not know the seasonal history of the species.)

GALERUCELLA CRIBRATA LeConte

(U. S. Nat. Mus.; larva described from vials marked: "On Solidago altissima, Springfield, Mass. Dimmock No. 1685."—Material contains: (1) Pyriform, brownish-ochreous eggs, 1 mm. long by 0.7 mm. in diameter, with surface consisting of regular hexagons with depressions in the middle; eggs deposited in large number from July 12 to 22, 1890, in groups of 1 to 12 in a place near the base of the root leaves of the food plant, sometimes on the upper surface, sometimes on the lower. In hatching the larva eats away the small, upper, free end of the egg, leaving the large portion of the shell attached to the leaf (from notes of Dimmock); (2) newly hatched larvae; (3) full-grown larvae—1685a—taken July 15, 1900; (4) pupa and cocoon.)

Mature larva.—About 7 mm. long.

Head shining, light yellow to light brown, with light-brown labrum. Body with membranous part greenish white, chitinous parts creamy yellow, with the small tubercle-shaped setal cups darker; legs creamy yellow, with brown claws.

Setae moderately long, most of them about half as long as a body segment.

The shape of the headcapsule, mandibles, and the other mouth parts, the form of the prothoracic shield and the number of its setae, the development and number of the mesothoracic and metathoracic sclerites and the number of their setae, the abdominal sclerites and their setae, the pygidial shield and tenth abdominal sclerite exactly as in *Galerucella notata;* in fact, the two species can not be separated in their larval stages by any structural characters.

Habits.—Feeding on the leaves of different species of *Solidago*, but, according to W. C. Woods, is seemingly confined to species of the subgenus Virgaurea. Pupates in an oval cocoon formed by an open network of filaments and attached to a leaf.

Literature.—

Woods, W. C.
1924. Maine Agr. Exp. Sta. Bull. 319, p. 137.

MONOXIA PUNCTICOLLIS (Say)

(U. S. Nat. Mus.; described from larva in vial marked: "Sugar beet, Rocky Ford, Colorado, June 2, 1902. U. S. Chittd.") Reared.

Mature larva (fig. 7).—About 8 mm. long.

Head moderately shining, brown to blackish, with unicolored dark labrum. Body with membranous parts dark olive green and

chitinous parts pale yellow, setal cups not particularly darker than the sclerites, legs shining, generally blackish brown to black.

Setae (fig. 47) rather short, varying from about one-eighth of the length of a normal body segment to about one-quarter of its length; some setae capitate, others pointed; some pale, others dark. Setal cups rather inconspicuous.

The shape of the head capsule, of labrum, mandible, and other mouth parts (figs. 39, 68), the development of the thoracic and pygidial shields and of the sclerites, the arrangement and form of the setae completely agreeing with the corresponding parts in the larvae of *Galerucella notata* and *Galerucella cribrata*, except in unimportant minor variations in the number of the setae on some of the sclerites.

Taxonomic comments.—The propriety of establishing the genus *Monoxia* as distinct from the genus *Galerucella* is not substantiated by the features observed in the larva of the type species *Monoxia puncticollis*, as this larva is distinguished from the larvae of *Galerucella notata* and *cribrata* by the mere specific characters of having relatively smaller setae and dark-colored skin. Moreover, in respect to the latter character it should be remembered, as mentioned on page 24, that some specimens of the larvae of *Galerucella cribrata*, preserved in the United States National Museum, possess a coloration of the skin varying from slightly more grayish than in the normal creamy yellow larva to dark olive green as in *Monoxia puncticollis*.

The larva of the species *Monoxia consputa*, however, is entirely different from this larva of *Monoxia puncticollis*, positively can not be placed in the same genus with it, and a new genus will probably have to be created for it. Further discussion on the taxonomic position of *Monoxia consputa* will be found where the species is treated on page 29.

Habits.—The larva of *Monoxia puncticollis* is injurious to sugar beets, skeletonizing or eating through the leaves and often completely devouring young plants of considerable size. Other food plants are *Chenopodium album*, *Dondia erecta*, and *Salsola pestifer*. It pupates in a simple excavated cell in the ground, in this regard differing from *Galerucella notata* and *G. cribrata*, which form a reticulate cocoon above the ground.

Literature.—

CHITTENDEN, F. H., and MARSH, H. O.

1920. U. S. Dept. of Agr. Bul. 892 (The Beet Leaf Beetle). Professional paper from Bureau of Entomology. (Eggs attached in clusters to leaves of food plants; young larva with dark brown thoracic shield, gray skin and rather dark sclerites, hairs comparatively longer than in mature larva. List of literature.)

MONOXIA CONSPUTA LeConte

(U. S. Nat. Mus.; described from larva in vial marked: "Hubbard Note No. 636, *Monoxia consputa* (?) 4th July, 1891, Syracuse Salt Vats, Great Salt Lake, Utah." Not reared. An imago of the species is placed by Hubbard in the vial together with three larvae. No other larval material of this species is preserved in the Museum, but Mr. Hubbard's well known disinclination to name a larva when it was not reared or fairly well associated with imago warrants the probable correctness of the determination. Moreover the *Monoxia consputa* larva is the only known mining galerucine larva and the specimens in question are without doubt galerucine larvae and adapted to mining in soft plant tissue.)

Mature larva (fig. 9).—About 6 mm. long.

Head moderately shining, grayish yellow with blackish colored margins and blackish epicranial midline; labrum grayish. Body light gray, membranous parts predominate; prothoracic shield light amber colored anteriorly and on the top of a posterior transverse, rounded crest; pygidial shield slightly amber; rest of the sclerites of the body very thin, gray, like the skin, and to be seen only by close examination; legs shining, light amber, with darker margins at the ends of each joint; claws amber.

Setae in general minute; viewed under considerable magnification (figs. 8, 52), short and club shaped. Pointed and either moderately long or short setae present on the head, shields, legs, and epipleural lobes.

Head capsule (fig. 40).—With hind corners of epicranium strongly produced posteriorly. Frons small, almost hexagonal, inwardly strengthened in the middle line by a dark colored, Y-shaped thickening.

Labrum (fig. 41).—Transversely oblong, about two and one-half times as wide as long, front margin straight; discal setae pointed, moderately long; marginal setae short and pointed.

Mandible (fig. 51).—Provided with five claw-shaped teeth; the second and third larger; first, fourth, and fifth all distinct and rather strong; inner edge of mandible immediately behind the last tooth produced into a small, triangular, anterior projection. Penicillus well developed; no setae found on the back of the mandible.

Maxilla (fig. 65).—With lacinia and galea carrying short, small lanceolate setae; tactile appendix of galea small. Maxillary palpus three jointed.

Postlabial band.—Broadly U-shaped, with a slight enlargement of the chitin in the middle.

Prothorax (fig. 9).—The prothoracic shield rather bulging and divided by a median transverse groove into two slightly chitinized portions; a few either short or moderately long, pointed setae present in the anterior and the posterior margins.

Mesothorax and metathorax.—Without distinct sclerites; setae minute and club shaped.

First to eighth abdominal segments (fig. 9).—Without distinct sclerites; setae dorsally few, minute, and club shaped; laterally with a single moderately long, pointed seta in epileurum.

Ninth abdominal segment (fig. 8).—With a rather small, miter shaped in outline, slightly chitinized pygidial shield carrying moderately long, pointed marginal setae.

Tenth abdominal segment.—In common with the other galerucine larvae developed as a strong pygopod.

Leg (fig. 9).—With the paronychial appendix only about half as long as the claw.

Habits.—Found mining inside of the leaves of *Chenopodium album* and a perennial *Atriplex* species, at King City, Calif. (according to unpublished notes made in 1918 by C. F. Stahl, of the Division of Truck Crop Insect Investigations, Bureau of Entomology, United States Department of Agriculture) and also in *Grindelia* (according to Essig: Insects of Western North America). No injury to sugar beets known from the larvae, though the imagines seriously injure the tops of the beets. No records as to where the larvae pupate.

Taxonomic comments.—The larva of *Monoxia consputa* is essentially different not only from the larva of *Monoxia puncticollis* but from other larvae of the subfamily Galerucinae, to which, however, it unquestionably belongs. It represents a separate generic type of the Galerucinae and is distinguished by a series of characters peculiar to many mining larvae, particularly of the subfamily Halticinae, namely, a strongly built frons, extraordinarily long posterior prolongations of epicranium, the absence from the typical body segments of distinct sclerites with well-developed setae, and unusually short paronychial appendices.

Literature.—

ESSIG, E. O.
1926. Insects of Western North America, New York, MacMillan Co., p. 473

LOCHMAEA CAPREAE Linnaeus

(U. S. Nat. Mus.; described from a single, newly hatched larva in alcohol, bought in August, 1922, from Dr. K. W. Verhoeff, determined by him and marked "South Germany; K. W. Verhoeff.")

First larval instar (fig. 6).—About 1.5 mm. long.

Head yellowish brown with dark brown margins and a dark brown median carina; labrum creamy yellow anteriorly, yellowish brown posteriorly. Body having the membranous parts greenish yellow; prothoracic shield uniformly yellowish brown with the sagittal line whitish and distinct; sclerites of mesothorax and meta-

thorax, the typical abdominal segments and the pygidial shield also yellowish brown, underside of body lighter, legs shining and yellowish brown.

Setae.—Long, whitish, either capitate or pointed, present in a rather limited number on the back and sides of the larva.

Head capsule.—With slight depression in frons.

Labrum.—About twice as wide as long, with entire front margin regularly arcuate without emargination in the middle; discal setae moderately long and pointed, marginal setae minute.

Mandible.—With second, third, and fourth teeth large and claw shaped; first and fifth very small. Penicillus and setae not found on the specimen at hand.

Maxilla.—Having lacinia armed dorsally with a single row of strong, subcylindrical, terminally rather obtuse setae, all of about same length; galea with many spinelike setae and a well-developed tactile cone.

Postlabial band.—Rounded, medianly slightly enlarged and curved forward.

Prothorax (fig. 6).—Prothoracic shield with five marginal setae anteriorly, one laterally, and two posteriorly. Epipleural sclerite large, with two setae. Prehypopleural and posthypopleural sclerites (=episternum and epimeron) well developed and of the same size. Eusternal and sternellar sclerites almost fused to one plate, with two setae on each side.

Mesothorax and metathorax.—Having all the sclerites of moderate size; compound middorsal sclerites separated sagitally by a fine, white suture. Prescutal area with interior compound sclerite carrying one seta on each side; exterior sclerite small and without seta. Scuto-scutellar area with interior compound sclerite almost identical with the interior prescutal, one seta on each side; exterior sclerite about twice as large as the exterior prescutal, one seta present. Alar sclerite large, with three setae. Spiracular area chitinized, with one seta. Epipleural area with a moderately large sclerite, one seta. Prehypopleural and posthypopleural sclerites as in prothorax. Compound eusternal sclerite subrectangular, two setae on each side. Sternella paired, sclerite not found.

First to seventh abdominal segments.—The skin between the sclerites rather well developed, and the sclerites of moderate size. Compound interior prescutal sclerite with one seta on each side; exterior prescutal sclerite distinct, one seta. Compound interior scuto-scutellar sclerite narrower than the interior prescutal sclerite, one seta on each side; exterior scuto-scutellar sclerite nearer the middle line than the exterior prescutal, one seta. Parascutal area with no anterior sclerite, a distinct posterior sclerite with one seta, and no dis-

tinct chitinization around the spiracle. Epipleural sclerite with two setae. Hypopleural sclerite rather small, with one primary and one smaller secondary setae. Eusternal sclerite with one seta on each side, sternellar sclerite indistinct.

Eighth abdominal segment.—With interior and exterior scutoscutellar sclerites fused into a single plate carrying two setae on each side.

Ninth abdominal segment.—Pygidial shield with free margin regularly arched. Five long, pointed setae on each side in or near the margin; primary discal setae not developed.

Tenth abdominal segment.—Normally developed.

Habits.—Skeletonizes and eats holes through the leaves of species of *Salix* and *Betula*. Pupates in the ground.

Taxonomic comments.—In general the larva of *Lochmaea capreae* is very similar to the larva of *Galerucella viburni*, as a comparison between the above-given descriptions will show; they differ, however, in the two following characters: The exterior prescutal sclerite of mesothorax and metathorax is without a seta in *Lochmaea capreae* but carries one seta in *Galerucella viburni*, and the anterior parascutal sclerite is absent in the abdominal segments of *capreae* but present and carrying one seta in *viburni*. There is, as far as the larva is concerned, slight reason for the creation of a separate genus for *Lochmaea capreae* as it is nearer to some of the species of the genus *Galerucella*, for instance *G. viburni* and *G. notata* than these latter are to other species of their own genus, particularly *G. luteola* and *G. nymphaeae*.

Literature.—

HENRIKSEN, K. L.

1927. Danmarks Fauna No. 31, p. 346. (The author did not have a specimen of the larva before him and therefore has only quoted the few vague and incorrect statements found in the literature; for instance, that it is similar to the larva of *Melasoma populi*, which is not the case.)

GALERUCA TANACETI Linnaeus

(U. S. Nat. Mus.; described from a larva in a vial marked: "Larvae found 26 June, 1895; pupa 4 July, 1895; imago developed 12 June, 1895. Skovröd Dam, near Copenhagen, Denmark. E. A. Rosenberg legit and dedit").

Mature larva (fig. 10).—From 12 to 14 mm. long.

Head shining, blackish brown, labrum unicolored; frontal sutures whitish with an elongate whitish spot adjacent to their anterior halves and often with a large whitish spot dorsally at each ocellus; margins of head capsule, epistoma included, shining black. Sagittal carina of frons indicated by a fine black line, each ocellus surrounded by a ringshaped blackish spot. Body on the upper side having

the skin, the thoracic and the pygidial shields, and the rest of the sclerites blackish brown, on the under side greenish gray; immediately after a molt the color of the larva is bright yellowish brown; legs shining black.[16]

Setae long, about half the length of a normal segment, creamy white, slightly capitate, present in considerable numbers, and radiating in all directions from conical elevations of most sclerites on the upper side of the body.

Head capsule (fig. 42).—With middle of frons slightly depressed transversely; setae pointed, either moderately long or long.

Labrum (fig. 42).—Having an arcuate free margin with a small but relatively deep emargination in the middle; exterior discal seta on each side pointed and as long as the width of labrum, interior discal seta about half as long, marginal setae short and fine.

Mandible (fig. 53).—Provided with five teeth; first rather short and thin; second, third, and fourth larger and provided with serrated edges; fifth, well developed, broad and pointed but not serrated, appearing as a direct anterior prolongation of the inner edge of the mandible. Penicillus absent. Two long seta on the back and a small sensory ring.

Maxilla (fig. 69).—Lacinia distally with a row of five, strong, lanceolate setae. Galea terminally chitinized, carrying about half a dozen setae similar to those of lacinia but irregularly arranged and with a cone-shaped tactile organ between them.

Postlabial band (fig. 70).—Semicircular, medianly slightly bent forward and enlarged.

Prothorax (fig. 10).—Shield with discal part transversely depressed and marginal parts thick and elevated; sagittal line present, whitish, and slightly enlarged in the middle. Numerous long setae inserted in two or more rows in the whole marginal region; inside of this only a few present. Epipleural area with a large rounded sclerite carrying about 10 moderately long setae radiating in all directions. Prehypopleural sclerite (=episternum) somewhat protuberant, with about half a dozen setae; posthypopleural sclerite (=epimeron) also somewhat protuberant, carrying about three setae. Eusternal unpaired sclerite and the two sternellar sclerites fused into a single trapezoidal, often medioposterity split, plate with three or four short setae on each side.

Mesothorax and metathorax (fig. 10).—Interior prescutal sclerite distinct, not fused with the corresponding sclerite of the opposite side of the body, arising into a well-developed conical tubercle about

[16] Newly hatched larva is very similar to the mature, but somewhat lighter brown, with proportionately longer hairs, and without distinct conical elevations, from any of the sclerites.

twice as high as wide at base and carrying six setae; exterior prescutal sclerite distinct, somewhat smaller than the interior, with a tubercle carrying three setae. Interior scuto-scutellar sclerite distinct carrying five setae on its tubercle; exterior scuto-scutellar sclerite distinct, tubercle with about six setae. Alar sclerite large, with about 10 setae. Spiracular area with a sclerite surrounding the spiracle; about four small setae present. Epipleural area triangular with an oval sclerite carrying five or six setae. Prehypopleural sclerite flat, heavily chitinized, with one or two small, pointed setae; posthypopleural sclerite somewhat protuberant, carrying about three small setae. Eusternal sclerite large, oval, convex, with about 10 setae on each side. Each sternellar sclerite distinct but small, carrying one seta.

First to seventh abdominal segments (fig. 10).—Interior prescutal sclerites distinct, not fused in the sagittal line, number of setae on each sclerite about six; exterior prescutal sclerite of moderate size and separated from the interior sclerite by a distance equal to about three times its own diameter, tubercle carrying about three setae. Interior scuto-scutellar sclerite distinct, with about five setae; exterior scuto-scutellar sclerite closer to the sagittal line than the exterior prescutal, about four setae present. Parascutal area without anterior sclerite; posterior sclerite large, carrying 8 to 10 setae; spiracle not located in a distinct sclerite. Epipleural sclerite large, protuberant, and having seven or eight setae. Hypopleural sclerite with about five setae. Eusternum with a large sclerite, carrying four or five setae on each side. Parasternal lobe (=coxal lobe, Hopkins) present, having a round sclerite with four setae. Sternellar sclerite paired, small, distinct, with one seta.

Eighth abdominal segment (fig. 13).—Interior prescutal sclerite distinct, not fused medianly with that of the opposite side, number of setae four or five; exterior prescutal sclerite with three setae. Interior and exterior scuto-scutellar sclerites fused into a single, medial sclerite, carrying six setae on each side. Posterior parascutal sclerite distinct, with about eight setae. Segment otherwise similar to the preceding segments.

Ninth abdominal segment (fig. 13).—Pygidial shield comparatively small, half as wide and somewhat shorter than the eighth abdominal segment, approximately semicircular in dorsal outline; anteriorly and along the free margin swollen and with the anterior and marginal posterior parts of the shield separated by a transverse, crescent-shaped depression. Setae numerous, arranged in a single anterior row with two setae on each side, and an irregular double row in the free margin with from 8 to 10 setae on each side; setae generally almost as long as the sagittal length of the shield. Ventral part of

segment bearing a single, transverse, elongate sclerite with five setae on each side.

Tenth abdominal segment.—On each side with a lateral sclerite carrying minute setae.

Habits.—Feeding on the leaves of *Achillea millefolia*, *Cardamine pratensis*, *Cerastium*, and other low-growing plants.

Pupates in the ground.

Literature.—

HENRIKSEN, K. L.
1927. Danmarks Fauna, No. 31, p. 345.

GALERUCA LATICOLLIS Sahlberg

(U. S. Nat. Mus.; described from a mature larva in vial marked: "On flowers of *Thalictrum flavum*, 3d July, 1914. Damhus Sö, near Copenhagen; J. P. Kryger legit et dedit." Vial contains larvae of different stages, pupae and reared imagines.)

Mature larva.—About 14 mm. long.

The general color and the structural characters the same as in *Galeruca tanaceti* with the following exceptions:

(1) Sclerites on upper side of mesothorax and metathorax and on the abdominal segments broader at base and less projecting than in *tanaceti*.

(2) Setae somewhat shorter than in *tanaceti* and more yellowish brown.

(3) Exterior prescutal sclerite of an abdominal segment comparatively large, and separated from the interior prescutal sclerites by a distance about equal to its own diameter; carrying four setae.

(4) Interior scuto-scutellar sclerite of an abdominal segment fused with the corresponding sclerite on the opposite side of the body into a single, compound medial sclerite (fig. 11). The corresponding sclerites are separate in *tanaceti*.

(5) Interior prescutal sclerites of eighth abdominal segment fused or almost fused; conical elevations low and obtuse. Same sclerites distinctly separate and produced into conspicuous tubercles in *tanaceti*.

Habits.—Feeding on the leaves of *Thalictrum flavum* and *Aconitum*.

Pupates in the ground.

Literature.—Larva not formerly described.

GALERUCA POMONAE Scopoli

(U. S. Nat. Mus.; described from a larva contained in vial marked: "Found 2d June, 1905; developed into imago 21 June, 1905. Tiis Sö, Denmark, E. A. Rosenberg legit and dedit.")

Mature larva.—About 14 mm. long. The general color and the structural details the same as in *Galeruca tanaceti* and *G. laticollis* with the following exceptions:

(1) Sclerites on upper side of mesothorax and metathorax and of the abdominal segments generally somewhat smaller at bases and projecting into tubercules as high or higher than in *tanaceti*. Sclerites much smaller and much higher than in *laticollis*.

(2) Setae yellowish brown, much shorter than in *tanaceti* and somewhat shorter than in *laticollis*.

(3) Exterior prescutal sclerite of an abdominal segment very small and separated from the interior prescutal sclerite by a distance about five times its own diameter, carrying one or two setae (fig. 12). In *tanaceti* the distance between exterior and interior prescutal sclerites is about three times the diameter of the exterior sclerite and in *laticollis* the same distance is about equal to the length of the diameter of the exterior sclerite.

(4) Interior scuto-scutellar sclerites of an abdominal segment separate as in *tanaceti;* not fused with those on the opposite side of the body as in *laticollis*.

(5) Ninth abdominal segment with a much larger fleshy region anterior to a shorter and broader shield than in both *tanaceti* and *laticollis*.

Habits.—In Europe, according to Kaltenbach,[17] feeding on leaves near the roots of *Centaurea jacea*, *Scabiosa succisa*, and *Circium palustre*. In Illinois, according to John J. Davis, feeds exclusively on *Phlox divaricata* (F. Knab mentions also *Dentaria laciniata* as a food plant for specimens collected at Urbana, Ill.). Larva digs, according to J. J. Davis, an inch or less into the ground before pupation, forming there a cocoon of a few silken threads with particles of earth interwoven.

Literature.—

DAVIS, JOHN J.
1907. Life history and habits of *Galeruca pomonae* Scopoli in Illinois (Ent. News, vol. 18, 269–275, one plate).

SERMYLASSA HALENSIS Linnaeus

(U. S. Nat. Mus.; described from a mature larva in vial marked: "No. 280, from Meinert, 1890, ex Coll. Zool. Mus. Copenhagen." Newly hatched larva kept in vial marked: "South Germany, Dr. K. W. Verhoeff Coll. Bought August, 1922.")

Mature larva (fig. 14.)—About 10 mm. long.

Head shining, yellow, region around ocellus and antenna more whitish; labrum unicolored yellow; frontal sutures whitish; margins

[17] Pflanzenfeinde, p. 315.

of head capsule, epistoma included, shining dark brown; sagittal carina of frons indicated by a thin black line. Body with the skin creamy white, the thoracic and pygidial shield and the rest of the sclerites shining yellow[18]; legs shining brownish.

Setae moderately long, cream colored to light brown, pointed, present in rather limited number on somewhat convex or flat sclerites.

Head capsule (fig. 43).—With frons reaching far back and median epicranial suture short; ratio between length of frontal carina and that of epicranial suture approximately as 4 to 1. Setae fairly long and pointed.

Labrum (fig. 43).—With free margin arcuate, medianly incurved.

Mandible (fig. 54).—With four well-developed, more or less distinctly serrated teeth; first tooth rudimentary. Penicillus present, two well-developed setae on the back.

Maxilla (fig. 71).—Lacinia and galea not appearing (on the two slides prepared) as distinctly separated; setae rather short, thin, and pointed; cone-shaped appendix present.

Postlabial band.—Narrow, forming a simple arch.

Prothorax (fig. 14).—Shield with discal part smooth and flatly convex, marginal parts thick, slightly elevated and somewhat pitted; sagittal line thin and whitish colored, but owing to the light color of the entire shield not distinct. Setae rather short, arranged in one or a few rows in the marginal region, one or two setae on each side in the discal part. Epipleural area small with a rounded sclerite carrying a single seta. Prehypopleural area (=episternum) with a well developed, somewhat convex sclerite, no seta; posthypopleural area (=epimeron) with a similar sclerite but carrying one seta. Eusternum with a narrow transverse, unpaired sclerite carrying two setae on each side. Sternellar sclerites fused together in the middle line to a small, square, narrow plate, probably including elements of the eusternal sclerite; two setae on each side, one in front of the other. Poststernellar area (=spinisternum, Crampton) triangular, distinct, and somewhat chitinized.

Mesothorax and metathorax (fig. 14).—Interior prescutal sclerite almost fused with the interior prescutal sclerite of the opposite side, two setae on each; exterior prescutal sclerite equal in size to the interior one, three setae present. Interior and exterior scuto-scutellar sclerites in form, size, and the number of their setae equal to the interior and exterior prescutal sclerites. Alar sclerite larger, with about five setae. Spiracular area of mesothorax pushed forward and located below the prothoracic shield; spiracular area of metathorax in normal position, one seta present. Epipleural sclerite with one seta. Prehypopleural sclerite (=episternum) somewhat

[18] In newly hatched larva the number of sclerites and setae is similar to that of the mature larvae, but the chitinized parts are brown and the setae proportionately longer.

larger and flatter than in prothorax, no seta; posthypopleural sclerite (=epimeron) convex and similar to that of prothorax, one seta present. Eusternal sclerite crescent-shaped, with two or three small setae. Each sternellar sclerite distinct but small, carrying one seta. Mesothorax with a well developed, chitinized poststernellar area (=spinisternum, Crampton); metathorax without this area.

First to eighth abdominal segments (fig. 14).—Dorsally divided into three distinct transverse areas, namely, the prescutum, the scutum, and the scutellum. Ventrally likewise divided into three transverse areas, namely the eusternum, the sternellum, and posternellum, the last-mentioned area forming an intersegmental band. Interior prescutal sclerite fused with the corresponding sclerite of the other side into a single, median, transverse, oval, compound sclerite with two setae on each side; exterior prescutal sclerite well developed, broadly oval to circular, carrying two setae. Scutal sclerite transverse, elongate-oval to lanceolate, in the sagittal line approaching the scutal sclerite of the opposite side but not fused with it, carrying two setae. Interior scutellar sclerite fused with the interior sclerite of the other side into a median, transverse, compound sclerite, in size and form very similar to the prescutal sclerite, two setae on each side; exterior scutellar sclerite distinct, circular, nearer the sagittal line than exterior prescutal sclerite, considerably smaller than the latter and carrying only one seta. Parascutal area with (1) a well developed anterior sclerite carrying one seta, (2) a ring-shaped sclerite surrounding the spiracle located directly behind the anterior sclerite, and (3) a posterior sclerite, twice as large as the anterior sclerite, nearer the sagittal line than this sclerite and carrying two setae. Epipleural sclerite large, convex, with three setae. Hypopleural sclerite similar to the epipleural sclerite, and with three setae. Eusternum with a large, oval, median, unpaired sclerite with three or four setae on each side, and also with an accessory sclerite at each end of the median sclerite; accessory sclerite without setae. Sternellar sclerite (or, probably, parasternal and sternellar sclerites fused) well developed, paired, with two setae. Posternellar sclerite thin and without setae.

Ninth abdominal segment.—Pygidial shield smoothly and uniformly chitinized, transverse, elliptical, small, only half as long as wide. Five setae on each side in a single row along the posterior margin, two similar setae in the central portion of the shield. Ventral part of segment with a single, transverse, narrow sclerite with three small setae on each side.

Tenth abdominal segment.—With a ring shaped chitinization at base.

Habits.—Feeds on *Galium mollugo* and *Galium verum*. Pupates in the ground.

Literature.—

HENRIKSEN, K. L.
1927. Danmarks Fauna No. 31, p. 349.

AGELASTICA ALNI Linnaeus [19]

(U. S. Nat. Mus.; described from a mature, probably just molted larva in vial marked "No. 281, from Meinert, 1890, ex Coll. Zool. Mus. Copenhagen." Probably not reared.)

Mature larva (fig. 15).—About 11 mm. long.

Head shining, dark brown, with lighter colored regions located anteriorly on frons and around the ocelli; frontal sutures yellowish; margins of head capsule and the carina of frons shining black; labrum unicolored dark. Body with dull, darkish skin; shields, sclerites, and legs shining and generally of the same color as the head capsule; anterior and lateral regions of prothoracic shield more yellowish; a sagittal line on prothorax, mesothorax, metathorax, and the first abdominal segment whitish.

Setae fine, pointed, rather short, light colored, and present in small numbers.

Head capsule (fig. 44).—Rather flat; length of frons and epicranial suture about equal; setae rather short and almost white.

Labrum (fig. 44).—With regularly arcuate free margin.

Mandible (fig. 55).—With three distinct teeth; tooth No. 1 absent, and the projecting anterior portion of the inner edge not developed as a distinct tooth. Penicillus absent; no setae found.

Maxilla (fig. 72).—Lacinia carrying about six large, lanceolate setae; galea with rather few, short, and pointed setae, conical appendix short.

Postlabial band (fig. 73).—Formed like the letter "W." Labium small; labial palpi close together.

Prothorax (fig. 15).—Shield with discal part dark colored, smooth, and flatly convex; marginal parts light, thick, slightly elevated, and having depressions and pits. Sagittal light line very distinct and complete. Setae arranged in a single row anteriorly, but without order in the rest of the marginal region; two or three small setae on each side in the discal part. Epipleural area small and with a single seta. Prehypopleural area (=episternum) rather bulging and with a single seta; posthypopleural area (=epimeron) much larger, otherwise similarly bulging and with a single seta. Eusternal sclerite narrow, transverse, and with several very fine setae. Sternellar

[19] See comments given on p. 40, where Henriksen's description and Boas's figure of this larva are discussed.

sclerites fused into a square median plate with a few setae on each side. Poststernellar area (=spinisternum) triangular, distinct, only slightly chitinized.

Mesothorax and metathorax (fig. 15).—Interior prescutal sclerite almost fused with the corresponding sclerite of the opposite side, sagittal light line very distinct, two setae on each side; exterior prescutal sclerite small, with two or three setae. Interior and exterior scuto-scutellar sclerites similar to the interior and exterior prescutal sclerites in size, form, coloration, and the number of setae. Alar sclerite large, with about five setae. Spiracular area of mesothorax pushed somewhat forward and partly located below the prothoracic shield; area normally placed in metathorax; one seta present. Epipleural sclerite with one seta. Prehypopleural sclerite (=episternum) larger, flatter, and more chitinized than in prothorax, one seta present; posthypopleural scelerite (=epimeron) as in prothorax. Eusternal sclerite oval with two or three setae on each side. Each sternellar sclerite with one seta. Mesothorax with a distinct poststernellar area (=spinisternum); metathorax without this area.

First to eighth abdominal segments (fig. 15).—Dorsally divided into three distinct areas, namely, prescutum, scutum, and scutellum; ventrally also divided into three areas, namely, eusternum, sternellum, and poststernellum; poststernellum constituting an intersegmental band. Interior prescutal sclerite fused with that of the other side into a single, median, transverse, compound sclerite, on each side with four or five light and thin setae; exterior prescutal sclerite small, carrying a single seta. Scutal sclerite located straight behind exterior prescutal sclerite and like this of small size and carrying but one seta. Interior and exterior scutellar sclerites in size, form, and arrangement similar to the interior and exterior prescutal sclerites. Parascutal area with both the anterior and the posterior sclerites well developed, closely approaching each other, forming together a frame surrounding a large supraspiracular gland, and each having two or three setae. Epipleural and hypopleural sclerites well developed, convex, carrying half a dozen setae. Eusternum with a large, oval, unpaired sclerite carrying three or four setae on each side. Sternellar sclerite distinct, paired, with two setae. Poststernellar area without sclerite.

Ninth abdominal segment.—Pygidial shield transverse, elliptical, small, about one-third as wide as long and about half as wide as the eighth abdominal segment; a dozen setae on each side in the margin, and a few setae in the central portion of the shield. Ventral part of the segment with a transverse row of three indistinct sclerites, one medianly located, and one on each side; three small setae on each side.

Tenth abdominal segment.—With a ring-shaped chitinization at base.

Habits.—Feeding on alder (*Alnus*), more rarely on hazel (*Corylus*), skeletonizing and eating holes in the leaves of young, one- to two-year-old plants. Pupates in the ground just below the surface.

Literature.—

Boas, I. E. V.

1924. Dansk Forstzoologi, 2d edition, p. 405. (The figure of a larva, said to be *Agelastica alni*, does not fit the description given by Henriksen, and is entirely different from the figure of this larva in the present paper. Boas has not described the larva, only mentioned its color, size, and life history.)

Henriksen, K. L.

1927. Danmarks Fauna, No. 31, p. 350. (Henriksen's description agrees with the figures and description of the larva in the present paper. As mentioned above, these figures are made from a specimen originating from the same old and probably not reared material in the Zoological Museum of Copenhagen which Henriksen has studied; but beside this material new, and probably reared, material is preserved in the Copenhagen Museum, collected in 1894 by William Schlick, and 1895 by E. A. Rosenberg. With this material in his hands I consider Henriksen's description and the figures and description here published by myself as correct and Boas' figure as made from a chrysomelid larva belonging to a different genus.)

TAXONOMY OF GALERUCINAE LARVAE AND THEIR RELATION TO HALTICINAE AND CHRYSOMELINAE LARVAE

In the very valuable comprehensive treatment of the chrysomelid larvae, the first of its sort in the world's literature, which K. L. Henriksen has just published in Danmarks Fauna (No. 31, pp. 290–376), the author writes, on page 314, that it is not possible to find definite characters by which the larvae of the three subfamilies, "Cyclici," "Galerucini," and "Halticini,"[20] can be grouped in the same subfamilies as the imagines, and therefore he treats the larvae of these subfamilies collectively.

In a recent paper by myself[21] I have pointed out in a taxonomic discussion (pp. 201–203) that by removing the tribes Diabroticini and Phyllobroticini from the Galerucinae and placing them in the subfamily Halticinae near the tribes Systenini, Crepidoderini, and Psylliodini it is possible to separate the rest of the larvae into the same two subfamilies as the imagines. Again, judging from our present knowledge, it is not difficult to separate the larvae of each of these two subfamilies from the larvae of Chrysomelinae, as will be shown by the following brief characterization of the three larval types of the subfamilies in question. I therefore believe that in

[20] These terms, applied by Henriksen, correspond to the terms "Chrysomelinae," "Galerucinae," and "Halticinae" used in the present paper.

[21] Proc. Ent. Soc., Washington, D. C., vol. 29, 1927.

reality it is possible to retain, with slight modification, our customary taxonomic arrangement for the larvae.

The larvae of the Chrysomelinae (=Crysomelini, Cat. Col. Eur., 1906, =Cyclica, Henriksen, with genus *Bromius* excluded) are characterized by having the antenna three-jointed, the ocelli present on each side in a number exceeding one, namely, from four to six, and the labial palpus two-jointed.[22]

The larvae of the Galerucinae (=Galerucae, Cat. No. Eur., 1906, =Galerucini, Henriksen) have the antenna one-jointed and provided with a jointlike tactile papilla, one ocellus on each side, and the coronal (=median epicranial) suture distinct.

The larvae of the Halticinae (=Halticae, Cat. Col. Eur. 1906, =Halticini, Henriksen) have the antenna one- or two-jointed, one ocellus on each side or no ocelli, and the coronal (=median epicranial) suture absent.

Among the Galerucinae larvae *Monocesta coryli* represents an isolated type particularly characterized by the unusual form of the labrum and the mandible and the unique development of the middorsal series of abdominal sclerites (figs. 1 and 2). *Agelastica alni* is the only galerucine larva having abdominal supraspiracular glands and approaches in this respect the Chrysomelinae larvae of Gastroidea, Melasoma, Phaedon, and related genera. It also possesses separate scutal and scutellar areas on the abdomen and, ventrally, well developed intersegmental bands, but these characters are likewise found in *Sermylassa halensis* and are indicated in *Galerucella luteola*. The presence of three transverse tergal areas and intersegmental bands may signify more generalized morphological conditions of the abdominal segments than the presence of only two transverse areas and no intersegmental band, so while the presence of the glands in *Agelastica* suggests some connection with the specialized chrysomeline larvae, the development of the abdominal areas is more in accordance with the development of the same features in several primititve larvae, including in particular the larvae of *Phyllobrotica* and *Diabrotica*.

The common Galerucinae type with united scutal and scutellar areas and no intersegmental bands comes in many respects near to the larva of the tribe Halticini so well interpreted by Woods and Kemner.

From this common Galerucinae type the larva of *Monoxia consputa* appears to deviate greatly but represents in reality merely a biological adaptation of the type to a mining life in soft plant tissues rather

[22] The larvae of the Eumpolpinae, to which genus *Bromius* belongs, have no ocelli and have a one-jointed labial palpus.

than an isolated phylogenetic development. The large triangular posterior prolongations of the epicranium, the strongly chitinized frontal margin and median carina of the head capsule, the soft bulging body with minute setae, and the thinly chitinized flexible pygidial shield are features often found in mining larvae, for instance among the Halticinae in *Dibolia*, *Mantura*, *Argopistes*, and *Sphaeroderma*.

Among the larvae of the common Galerucinae type the larvae of *Trirhabda* and *Galeruca* form well-defined genera, the former characterized particularly by having the abdominal spiracles lodged in large posterior parascutal sclerites and the latter characterized by the conical sclerites from which well developed setae radiate in all directions. On the contrary, the larva of *Monoxia puncticollis* is very similar to the larva of *Galerucella notata*, and the larva of *Lochmaea capreae* is decidedly closer to the *Galerucella* species *notata* and *viburni* than either of these are to such *Galerucella* species as *luteola* and *nymphaeae*.

Judged from the larvae the genus *Galerucella* includes five groups of species, all five groups characterized in the key (p. 8), namely, A, the *nymphaeae* group; B, the *luteola* group; C, the *viburni* group; D, the *decora-cavicollis* group, and E, the *notata* group. The *nymphaeae* group and the *luteola* group are very distinct, mutually entirely different, but both in different ways sharply separated from the following groups, which are closely related to each other. In the *viburni* group the tergal sclerites are all present and all free, and there are two prescutal, two scuto-scutellar, and two parascutal sclerites on each side. In contrast to this group the *decora-cavicollis* group is characterized by a fusion of the interior and exterior scuto-scutellar sclerite, and thus the species of the *notata* group possess two prescutal, only one compound scuto-scutellar, and two parascutal sclerites on each side. In the *notata* group the difference from the *viburni* group is expressed by the complete absence of the anterior parascutal sclerite, and thus the species of the *notata* group possess two prescutal, two scuto-scutellar, but only one parascutal sclerite on each side.

Monoxia puncticollis has the same arrangement of the sclerites as the *notata* group and also the other features, characteristic of this group, identically developed; it is therefore remarkable that the larva pupates in a simple earthen cell in the ground while the larvae of *notata* and *cribrata* construct an open reticulate cocoon, attached to a leaf of the food plant; this biological circumstance, and the systematic differences between the imagines, seem consequently to prove a less intimate affinity between the species than the structural details of the larvae suggest.

It has been previously mentioned that the larva of *Monoxia consputa* represents an adaptation of the common galerucine type, but it can not be considered as derived from a larva of the *Monoxia punctipennis* type. Unquestionably, it is at present misplaced in the genus *Monoxia*, as it shows no close relation to it, and a new genus should be created for it.

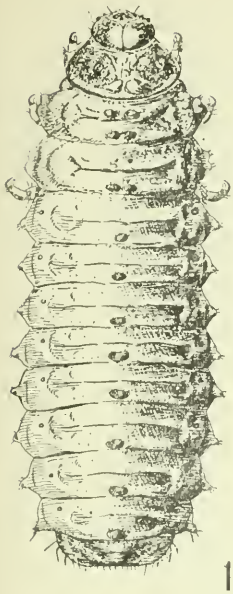
EXPLANATION OF PLATES

(All figures made by the author)

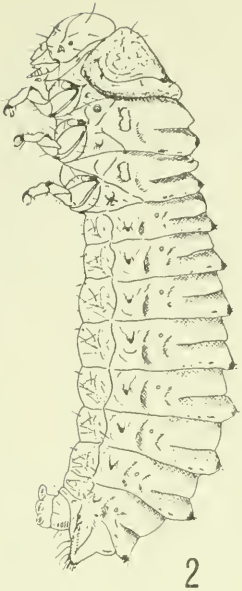
Plate 1

HABITUS OF LARVAE

Fig. 1. *Monocesta coryli* Say—Third instar. Dorsal view.
2. *Monocesta coryli* Say—Third instar. Lateral view.
3. *Trirhabda canadensis* Kirby—Third instar. Dorsal view
4. *Galerucella luteola* Müller—Third instar. Dorsal view.
5. *Galerucella luteola* Müller—Third instar. Ventral view.
6. *Lochmaea capreae* Linnaeus—First instar. Lateral view.
7. *Monoxia punticollis* Say—Third instar. Lateral view.



1

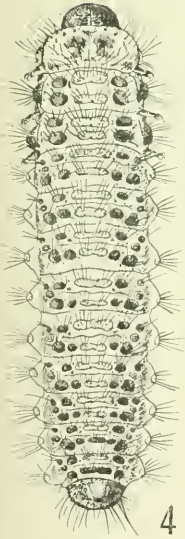


2

3

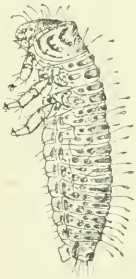
Monocesta coryli

Trirhabda canadensis

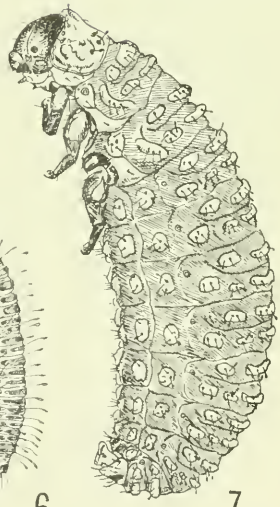


4

5



6



7

Galerucella luteola

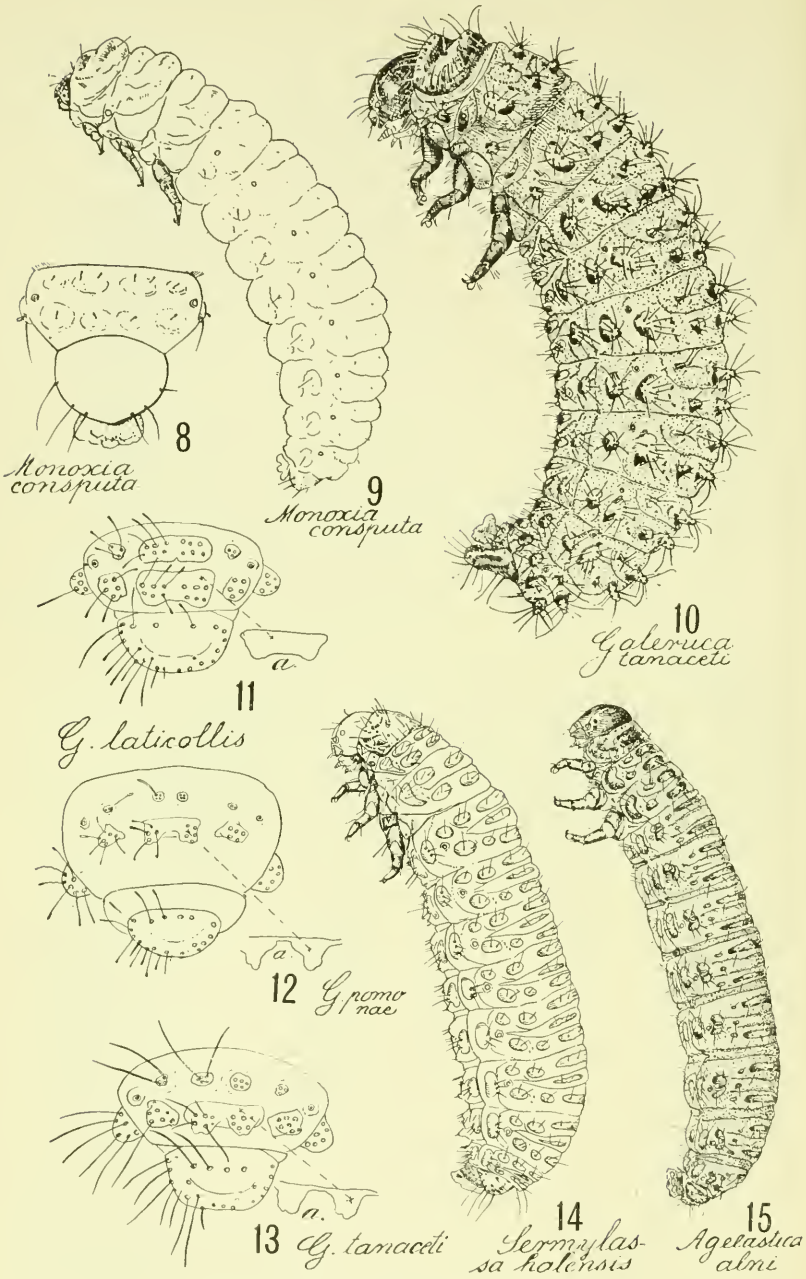
Locmaea cupreae

Monoxia punctipennis

HABITUS OF LARVAE

FOR EXPLANATION OF PLATE SEE PAGE 44

22483—29——1



HABITUS OF LARVAE—ENDS OF ABDOMEN

FOR EXPLANATION OF PLATE SEE PAGE 45

Plate 2

HABITUS OF LARVAE—ENDS OF ABDOMEN

Fig. 8. *Monoxia consputa* LeConte—The last three abdominal segments of third instar. Dorsal view.

9. *Monoxia consputa* LeConte—Third instar. Lateral view.

10. *Galeruca tanaceti* Linnaeus—Third instar. Lateral view.

11. *Galeruca laticollis* Sahlberg—Eighth and ninth abdominal segments of third instar. Dorsal view.

11*a*. *Galeruca laticollis* Sahlberg—Transverso-vertical section of scutellum.

12. *Galeruca pomonae* Scopoli—Eighth and ninth abdominal segments of third instar. Dorsal view.

12*a*. *Galeruca pomonae* Scopoli—Transverso-vertical section of scutellum.

13. *Galeruca tanaceti* Linnaeus—Eighth and ninth abdominal segments of third instar. Dorsal view.

13*a*. *Galeruca tanaceti* Linnaeus—Transverso-vertical section of scutellum

14. *Sermylassa halensis* Linnaeus—Third instar. Lateral view.

15. *Agelastica alni* Linnaeus—Third instar. Lateral view.

Plate 3

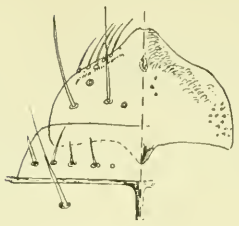
Different species of Galerucella

Fig. 16. *Galerucella nymphaeae* Linnaeus—Labrum.
17. *Galerucella nymphaeae* Linnaeus—Seta.
18. *Galerucella nymphaeae* Linnaeus—Dorsal sclerites of the thoracic and first abdominal segments. Oblique dorsal view. (Parascutal areas stippled.)
19. *Galerucella nymphaeae* Linnaeus—Left mandible. Ventral side.
20. *Galerucella nymphaeae* Linnaeus—Right maxilla. Ventral view. (Notice the three-jointed palpus.)
21. *Galerucella luteola* Müller—Dorsal sclerites of the thoracic and first abdominal segments. Oblique dorsal view. (Parascutal areas stippled.)
22. *Galerucella spiraeae* Fall—Dorsal sclerites of the thoracic and first abdominal segments. Oblique dorsal view. (Parascutal areas stippled.)
23. *Galerucella viburni* Paykull—Dorsal sclerite of the thoracic and first abdominal segments. Oblique dorsal view. (Parascutal areas stippled.)
24. *Galerucella notata* Fabricius—Dorsal sclerites of the thoracic and first abdominal segments. Oblique dorsal view. (Parascutal areas stippled.)
25. *Galerucella spiraeae* Fall—Left mandible.
26. *Galerucella spiraeae* Fall—Seta.
27. *Galerucella viburni* Paykull—Left mandible.
28. *Galerucella viburni* Paykull—Seta.
29. *Galerucella notata* Fabricius—Left mandible.
30. *Galerucella notata* Fabricius—Seta.
31. *Galerucella spiraeae* Fall—Labrum.
32. *Galerucella viburni* Paykull—Labrum.
33. *Galerucella notata* Fabricius—Labrum.

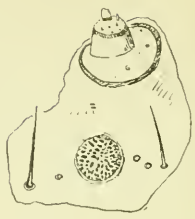
DIFFERENT SPECIES OF GALERUCELLA

FOR EXPLANATION OF PLATE SEE PAGE 46

Monocesta 34



35 Monocesta



36 Monoces.

Trirhabda 37

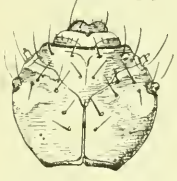
Gale- luteola

38 ricella

39 Monoxia punct.

Mon. 40 cons.

Monoxia 41 con.



42 Galeruca tanaceti

43 Sermylassa

44 Agelastica alni

45 Monoces

46 G. luteo

47 Monox. punctic.

48 Monocesta Trirh- can- 49 abd. ad. Monox.

50 punctic.

52 Monox. consput.

51 Monoxia consputa

53 Galeruca tanaceti

54 Sermylassa halensis

55 Agelastica alni

HEADS FROM ABOVE—MANDIBLES, AND OTHER PARTS

FOR EXPLANATION OF PLATE SEE PAGE 47

Plate 4

HEADS FROM ABOVE—MANDIBLES AND OTHER PARTS

Fig. 34. *Monocesta coryli* Say—Head. Dorsal view.
35. *Monocesta coryli* Say—Labrum and clypeus.
36. *Monocesta coryli* Say—Antenna and ocellus.
37. *Trirhabda canadensis* Kirby—Head.
38. *Galerucella luteola* Müller—Head. Dorsal view.
39. *Monoxia puncticollis* Say—Head. Dorsal view.
40. *Monoxia consputa* LeConte—Head. Dorsal view.
41. *Monoxia consputa* LeConte—Labrum, clypeus, epistoma, antenna, and ocellus. Dorsal view.
42. *Galeruca tanaceti* Linnaeus—Head. Dorsal view.
43. *Sermylassa halensis* Linnaeus.—Head. Dorsal view.
44. *Agelastica alni* Linnaeus—Head. Dorsal view.
45. *Monocesta coryli* Say—Tip of left mandible.
46. *Galerucella luteola* Müller—Left mandible.
47. *Monoxia puncticollis* Say—Two setae, small sclerite, and piece of dark skin.
48. *Monocesta coryli* Say—Left mandible.
49. *Trirhabda canadensis* Kirby—Left mandible.
50. *Monoxia puncticollis* Say—Left mandible.
51. *Monoxia consputa* LeConte—Left mandible.
52. *Monoxia consputa* LeConte—Seta.
53. *Galeruca tanaceti* Linnaeus—Left mandible.
54. *Sermylassa halensis* Linnaeus—Left mandible.
55. *Agelastica alni* Linnaeus—Left mandible.

Plate 5

Maxillae, labium, hypopharynx, and other parts

Fig. 56. *Monocesta coryli* Say—Buccal side of left maxilla.*—Tactile papilla of galea; *ga*—galea; *la*—lacinia.

57. *Monoxia consputa* LeConte—Spiracular trachea (*tr*) with one-armed closing apparatus; (*atr.*) atrium.

58. *Monoxia consputa* LeConte—Spiracle.

59. *Monocesta coryli* Say—Left mandible. Ventral view. 1, 2, 3, 4—Four joints of palpus; *pg*—palpiger.

60. *Monocesta coryli* Say—Tenth abdominal segment from below, showing anus in center and six anal lobes.

61. *Monocesta coryli* Say—Labium with ligula, hypopharynx, buccal side of lacinia and galea, maxillary palpus and palpiger (notice that the two muscles from the proximal end of the first joint of the maxillary palpus extend through palpiger and attach themselves to stipes, and that palpiger has no muscles extending from its proximal end); *cu*—eulabium; *ga*—galea; *hy*—hypopharynx; *la*—lacinia; *li*—ligula; *mt*—mentum; *pg*—palpiger; *ph*—pharynx; *stip*—stipes.

62. *Monocesta coryli* Say—Leg. *cl*—claw; *cox*—coxa; *fe*—femur; *po*—paronychial appendix; *ti*—tibia; *tr*—trochanter.

63*a*. *Monocesta coryli* Say—Lacinia, galea and hypopharynx facing the buccal cavity.

63*b*. *Monocesta coryli* Say—Galea, mentum, labium with ligula. Ventral view.

64. *Trirhabda nitidicollis* LeConte—Maxillae and hypopharynx; *hr*—hypopharyngeal rod.

65. *Monoxia consputa* LeConte—Maxillae and hypopharynx (notice that maxillary palpus is three-jointed, second and third joints having fused).

66. *Trirhabda canadensis* Kirby—Right maxilla. Ventral view.

67. *Galerucella lutcola* Müller—Right maxilla. Ventral view.

68. *Monoxia puncticollis* Say—Right maxilla. Ventral view.

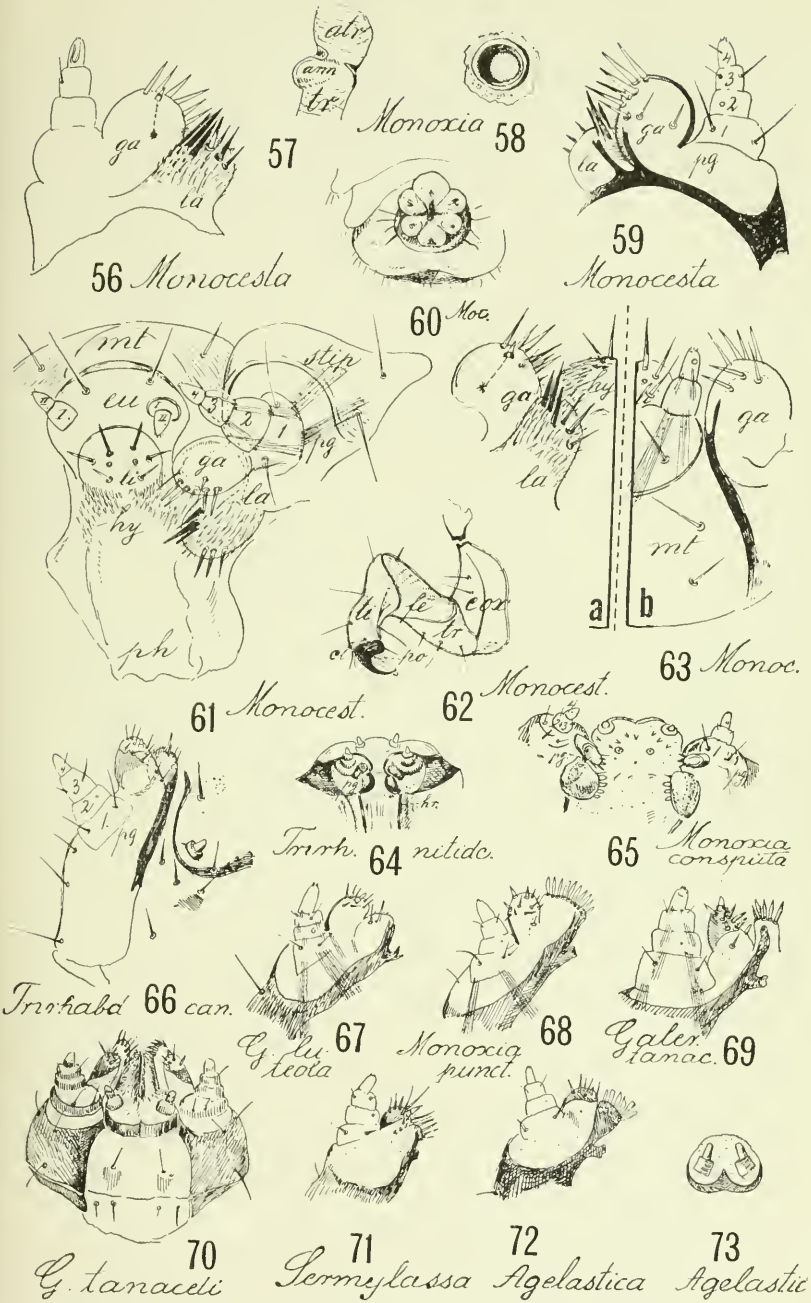
69. *Galeruca tanaceti* Linnaeus—Right maxilla. Ventral view.

70. *Galeruca tanaceti*—Ventral mouthparts and hypopharynx. Ventral view.

71. *Scrmylassa halensis* Linnaeus—Right maxilla. Ventral view.

72. *Agelastica alni* Linnaeus—Right maxilla. Ventral view.

73. *Agelastica alni* Linnaeus—Labium (notice the short distance between labial palpi).



MAXILLAE, LABIUM, HYPOPHARYNX, AND OTHER PARTS

FOR EXPLANATION OF PLATE SEE PAGE 48