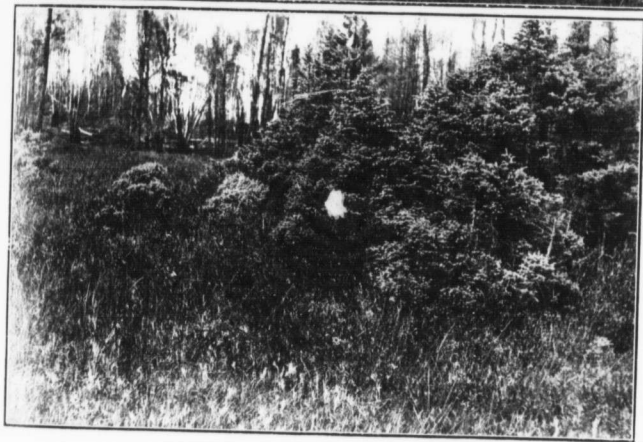




FIG. 1.—HABITAT OF *CHRYSOPHANUS DORCAS* KIRBY, AT WAUCEDAH, MICH.



FIGS. 2 AND 3.—HABITAT OF *CHRYSOPHANUS EPIXANTHE*  
BD. & LEC., AT TOMAHAWK LAKE, MICH.

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## CHRYSOPHANUS DORCAS KIRBY, AND RELATED SPECIES IN THE UPPER PENINSULA OF MICHIGAN.

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The principal object of this paper is to present some observations upon three species of *Chrysophanus*, *dorcas*, *epixanthe* and *helooides*, which were found in Dickinson County during the summer of 1909, while the author was collecting insects for the Michigan Geological and Natural History Survey. Through the courtesy of Dr. Alexander G. Ruthven, Chief Field Naturalist of the Survey, I am enabled to give these notes in advance of the full report.

Up to the time these observations were made, I could obtain no authentic records of any of these butterflies from Michigan, except of *dorcas* from the Lower Peninsula. But on this expedition definite data were secured of the occurrence of all three in Dickinson County, in the Upper Peninsula. From the time of arrival of the party in the field diligent search was made for both *dorcas* and *epixanthe* and their food-plants, as it was particularly desired to add to the knowledge of the distribution of these species in Michigan.

The food-plant of *dorcas*, the shrubby cinquefoil (*Dasiphora fruticosa*), which I discovered in the summer of 1908, while making investigations upon this insect in the southern part of the State, was not found by us in Dickinson County until the second of August. On this date a member of the party brought in a spray of the plant from Waucedah, a small town some sixteen miles south of Brown Lake. On the fourth of August I was able to visit the locality, and found, just east of the railroad station at Waucedah, many acres of the shrubby cinquefoil (locally called "nine-bark"), (pl. IV, fig. 1). It was very thrifty, the bushes being fine large ones, and few having the dwarfed appearance of those often seen in Oakland County, in the southern part of the State. In fact, in spots it fairly crowded out all other vegetation. Notwithstanding the late date, the imagoes of *dorcas* were abundant; some of the males were worn and some in good shape, while all of the females observed, with one exception,

were in fine condition. No pairs in copulation were seen, and no eggs were found upon examination of a large bunch of the cinquefoil. The bright condition of the butterflies, absence of eggs, etc., indicated one of two things—either *dorcas* appears much later in the northern part of the State than in the southern, or the season of 1909 was unusually late. The latter was undoubtedly the case, for the species was taken in good condition in both sexes in Oakland County the same summer on July 25th, a date at least two, perhaps three, weeks later. Further observations, however, are needed on the exact time of appearance in a normal year, since the past two summers (1908 and 1909) in which this species has been studied, have been unusually backward in Southern Michigan. While the difference in latitude might account for a slight difference in the dates of appearance, it should be noted that the conditions which the bogs present to the butterflies, at least in the vegetation and low temperature, are probably little different north or south in the State, for the bogs in Southern Michigan preserve their boreal character, although set in more southern surroundings.

Until we found them at Waucedah, our search for the *fruticosa* and *dorcas* had been confined to the country about Brown Lake, practically entirely away from the inroads of civilization. Apparently very favourable localities existed for the plant about the margins of the bogs and lakes in that region, but it could not be found. I mention this, as it would seem that *Dasiphora fruticosa* and its tenant *dorcas* can enter such regions only after the latter have been altered by man, or that considerable open areas (natural or artificial) about the borders of bogs, etc., are necessary for the successful establishment of this shrub.

I was able to make only one other short trip to the Waucedah habitat on the ninth of August. The condition of the females, still bright and fresh and more numerous than five days before, two pairs in copulation and only slight evidence of oviposition (only two eggs having been found on a large lot of *fruticosa*), emphasized the late flight of the species.

Sixty females were collected, and I find that the most noticeable difference between this series of females and those taken in Southern Michigan lies in the predominant amount of yellow in the northern ones (form *florus*). There is not a specimen in the lot that does not show an indication of yellow, while in about one-fourth of them it is conspicuous in a nearly complete band adjacent to the outer side of the transverse row of black spots. In the others there are various gradations in the amount of yellow down to an almost entire absence of that colour. This is in

contrast to the conditions in Southern Michigan, where the form of the female without any yellow is the usual one, the intergrades with varying amounts of yellow coming next and those with the nearly complete band occurring comparatively rarely. The bright effect in those specimens of *florus* with the yellow predominating is heightened by an extension of the line of orange crescents from anal angle along the outer border; three, and sometimes four, well-marked crescents in such cases may be counted. In typical *dorcas* from Southern Michigan these crescents are practically obliterated, and in *florus* reduced to one or two, rarely three.

A form of the female which had not previously been met with was found in the Waucedah habitat. There were seven examples collected, two of which are particularly noteworthy. In these, the ground colour is of a uniformly lighter shade of brown than in the ordinary form, the entire surface of both wings is more or less stippled with a darker brown, the black dots are less conspicuous because of the stippling, the orange crescent at the anal angle is nearly obsolete, and the yellow on the fore wings is merely indicated. The other five present these differences less prominently and grade into the normal form, but four of them exhibit more or less of the yellow of *florus*. None of the males show any noteworthy variations, but I might add that I have one male from Oakland County in which there is a slight stippling in the darker, outer portion of the hind wings.

The distribution of *epixanthe* in Michigan is virtually unknown, except as it may be partially inferred from the presence of cranberry bogs, in the vicinity of which it occurs. Personally, I believe it will be found at many points in the State, both north and south. A number of years ago this species was reported from Grand Rapids,\* but evidently in error for *dorcas*. It has also been stated as occurring on Isle Royale, but this again appears to be a doubtful record. The late Dr. Fletcher, quoted in the 1909 Isle Royale Report, says of *epixanthe* †

"This is the only species I have some doubts about. There is no doubt that some of the records of *epixanthe* should be of the rare and little-understood species *dorcas*, which occurs in the Lake Superior region and into Manitoba. It is easily distinguished from *epixanthe* by its slightly larger size and the brilliant orange wash on the under surface. *Epixanthe*

\*Robt. H. Wolcott: Butterflies of Grand Rapids, Mich., CAN. ENT., Vol. XXV, p. 103.

†An Ecological Survey of Isle Royale, Lake Superior, Chas. C. Adams, 1909. Published as part of the Report of the Board of Geological Survey of Michigan for 1908, p. 274.

I have only actually taken myself in Ontario. *Dorcas* I have from Nipigon on Lake Superior, the Bruce Peninsula and from Manitoba, west of that the form, for it is hardly a variety, *florus*, which is really only a dimorphic form of *helloides*, occurs, and has, I think, sometimes been recorded as *epixanthe*. The reference of *florus* to *dorcas* instead of *helloides* as a variety, which was done by Dr. Dyar, has, in my opinion, no reason in it at all."

This is a mistake. *Florus* does not belong to *helloides*; it is simply a form of *dorcas*, and occurs only in the female sex. Why Dr. Fletcher should have been in doubt as to the identification of *epixanthe* is not clear, unless he failed to see all the specimens, for four were reported as captured, and it would seem as though some one of them would have been recognizable.

*Epixanthe* was located in Dickinson County in at least two places, and possibly in a third. It was first found at Tomahawk Lake (Pl. V, figs. 2 and 3), a small lake of about ten acres extent, just west of Brown Lake. Surrounding the lake was a typical black spruce and tamarack bog, from which the higher vegetation was largely removed by the fierce forest fires of the preceding season, which had left only a few trees and a margin of unburnt vegetation a few feet to forty or fifty feet wide at the water's edge. Within this area grew a variety of bog plants and a goodly amount of cranberry.

*Epixanthe* was first detected in this bog on July 9th. It was in its prime from about the 11th to the 17th, on each of which dates and on the 15th a fair number were observed flying. Males were always more numerous than females, in the proportion of four or five to one. The last seen at Tomahawk Lake were on the 30th, when three or four worn males and one female were observed. On August 18th a belated female was met with near Tamarack Lake, about two miles south of Brown Lake. A brief search resulted in the finding of some cranberry nearby. The third instance in which the species was probably detected was on July 24th, when a small butterfly, which I took to be *epixanthe*, was flushed out, but not captured, in a cedar tamarack swamp not far from Brown Lake; cranberry was also growing there.

The butterflies of *epixanthe* were very uniform, and differed from specimens from other localities only in a slight difference in the colour of the under surface. This was a purer, chalky-white, especially on the hind wings, than in specimens from Ottawa, Canada, and Lakewood, New Jersey, examples from the last named place being decidedly yellowish.

*Helloides*, as was to be expected, was found at several points, although nowhere commonly, the greatest number seen on any one day being six or seven at Foster City. It was also observed at Norway, Waucedah, Brown Lake, Tomahawk Lake, Jackson Lake, etc. There were two generations, the first one being met with during the latter part of June and the first part of July, the second one in fresh specimens on August 9th and 14th. Michigan is the most eastern State in which the species has yet been found, although Dickinson County is in about the same longitude (87°-88° west) as Lake County, in the north-western part of Indiana, where *helloides* is also known. This is a western butterfly, and its occurrence in the Upper Peninsula is an addition to the western element in the fauna of that region.

Two other species of the genus, *hypophleas* and *thoe*, were also met with in the County, but not at any time in numbers.

#### WISCONSIN BEES—NEW AND LITTLE-KNOWN SPECIES.

BY S. GRÄNICHER, PUBLIC MUSEUM, MILWAUKEE.

(Continued from page 104.)

*Anthidium*, Fabr.

*Anthidium* (*Protanthidium*) *Chippewaense*, n. sp.

♂.—Length about 15 mm. Black, with bright yellow markings. Body closely punctured all over, especially so on head and thorax, clothed with fulvous pubescence on vertex, mesonotum and pleurae, and whitish pubescence on face and thorax underneath. Scutellum slightly bilobed. Clypeus and sides of face whitish-yellow. Apical margin of clypeus with a row of five small black teeth. Mandibles whitish-yellow with black tips. A yellow line behind the eye above, and markings of the same colour on the following parts of the body: A line on posterior margin of tubercle, a spot at base and two spots near the apex (one in each corner) of each tibia on its outer surface; outer surfaces of all the metatarsi; dorsal bands on abdominal segments 1 to 6, interrupted on 1. These bands border on the narrow depressed black apical margins of the segments. They are very narrow in the middle of segments 1 to 4, broaden out laterally, and show a distinct emargination anteriorly on each side of band 1 to 4. On segment 5 the band is broad, on 6 still broader, taking up the greater part of the segment, deeply emarginated anteriorly in the middle. Dorsum of segment 7 entirely black, truncate at apex, with rounded corners, a median carina, and ending in a median distinct tooth.

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♀.—Somewhat smaller than the male, but of the same general appearance. Clypeus and sides of face of the same bright yellow colour as the markings of other parts of the body. Face-marks narrowing above, and extending up along the anterior orbits to a greater distance than in the male. Mandibles entirely black. A line behind the eye above, a spot on each side of the thorax just above the anterior half of the tegulae, and two spots on the scutellum yellow. Scutellum not bilobed. Tibiae with a yellow spot on the outer surface near the base. Inner surfaces of metatarsi with fulvous pubescence. Yellow continuous bands on abdominal segments 1 to 5, not reaching the sides of the segments, narrow in the middle, broadened laterally, slightly emarginate on the outer borders of bands 3 to 5. Band on segment 1 interrupted in one of the specimens. Ventral scopa light fulvous.

Types: August 3, 1909, Indian village at the juncture of the Lower Tamarack and St. Croix Rivers, Pine Co., Minnesota. On the flowers of *Rudbeckia laciniata*. (Nos. 31757 and 31758.)

Paratypes: Three ♀'s taken between July 28 and August 2 on the Wisconsin side of the St. Croix River, near the mouth of the Yellow River in Burnett Co. These specimens were collected from the flowers of *Rudbeckia hirta*. This species is very similar to *Protanthidium Cockerelli* Titus, occurring in Colorado.

*Halictus* Latr.

*Halictus Vierecki* Crawford.

*H. Vierecki* Crawford, Ent. News, XV, 79, ♀.

♂.—Length about 4 mm. Head and mesonotum dull metallic-green, pleurae of the same brassy colour as head and thorax in the female. Abdomen more reddish than in the female, with blackish clouds, especially on the last four segments. Pubescence whitish throughout, notably on the face (golden-yellow in the female). Antennae long and slender, scape and first joint of flagellum dark brown, the remaining joints testaceous on their lower surfaces, brown above. Legs darker than in the female.

One ♂ (No. 29435), mouth of Yellow River, Burnett Co., Wis., taken between July 28 and 31, 1909, on the flowers of *Ceanothus Americanus*. Nineteen ♀'s were obtained in the same locality during the same period, as also at Randall, Burnett Co., Wis., from Aug. 5 to 7, 1909, from the flowers of *Ceanothus Americanus* and *Solidago graminifolia*. They were collected by the Milw. Publ. Mus. coll. exped., and are all in the collection of the Museum.



This species, which was described from female specimens found in New Jersey and the District of Columbia, has a wide range of distribution. It is not uncommon in north-western Wisconsin at the points mentioned, and a few years ago I received, through the kindness of Mr. Hartmann, of Austin, Tex., four female specimens from that locality.

*Sphcodes* Latr.

*Sphcodes Davisii* Rob.

*S. Davisii* Robertson, Trans. St. Louis Ac. Sc., VII, 319, ♂.

♂.—Nine specimens from 7 to 10 mm. in length. In some of these the black on the basal portion of the first abdominal segment takes up nearly the entire segment, leaving only a narrow apical strip of red. Second segment entirely red, third either entirely red or with a black apical margin.

♀.—Head dull, closely punctured. A prominent median ridge from the front ocellus down to the base of the antennæ. Mandible with a very distinct tooth. Antennæ rather short and thickened towards the tip, black, with a slight trace of reddish underneath. Mesonotum dull, strongly and closely punctured, on the disk, however, as also on the scutellum, where the punctures are farther apart, the surface is somewhat shining. A distinct rim bordering the semicircular enclosure of the metathorax. Enclosure, truncation and sides of the metathorax all coarsely sculptured. Wings not as clear as in the male, and nervures darker. Abdomen red, sometimes with a blackish hue around the tip. First segment shining and impunctate. Remaining segments finely and closely punctured, except on the depressed apical borders of segments 2 to 4. Length, 8 to 10 mm.

Fourteen ♀ specimens from Milwaukee, Racine and Washington Cos. in Wisconsin, and one ♀ from Ludington, Mason Co., Michigan.

In size, sculpture and opaque appearance of head and thorax the female of this species, which is a *Sphcodes sens. strict.*, as defined by Robertson, resembles two other species of the Milwaukee region, viz: *S. (Proteraner) ranunculi* Rob., and *S. (Drepanium) fulcifer* Patton.

*Andrena* Fabr.

*Andrena Peckhami* Ckll.

*A. Peckhami* Cockerell, Ann. and Mag. Nat. Hist., 7, IX, 105, ♀.

♀.—The type is about  $8\frac{1}{2}$  mm. long, but the length may reach 10 mm.

♂.—Length, 7–8 mm. Head very large, clothed with long white hairs. Face broad, shining, anterior border of clypeus slightly emarginate. Mandibles long and curved, dentate, rufous at apex. Antennæ black,

joint 3 about equal to 4 + 5. Cheeks broad and subquadrate, shining, slightly convex, with an upturned rim along the hind margin, and a rounded lower angle situated below the middle of the eye. Thorax shining, covered with long and soft white pubescence, intermixed with short and black pubescence on the mesonotum. Abdomen shining, with distinct apical bands of white hair on segments 2 to 4, widely interrupted on 2.

Eleven ♂ specimens from Milwaukee, the type locality. Besides, I have taken both sexes at Cedar Lake, Washington Co., Wis., and at various points along the St. Croix River in north-western Wisconsin, from the Nemakagon River in Burnett Co., on down to Farmington Township in Polk Co. (Milw. Publ. Mus. coll. exped.)

As Prof. Cockerell has remarked (loc. cit., p. 105), this species is very close to *A. parnassie* Ckll., but the latter makes its appearance later, around the last week in August, and visits exclusively the flowers of *Parnassia caroliniana*. *A. Peckhami*, on the other hand, flies from the second week in July on to near the middle of August, and visits especially the flowers of the Compositæ. In the type specimens, as stated by Prof. Cockerell, the first recurrent nervure joins the second submarginal cell at its middle in *parnassie*, and considerably beyond the middle in *Peckhami*, but a series of specimens shows these characters as being variable, and therefore not reliable in separating the two. The presence of distinct abdominal hair-bands in the male of *Peckhami* distinguishes it from the male of *parnassie*, and the two differ besides in the shape of the cheeks, which are subquadrate in *Peckhami*, subtriangular, with a distinct angle above the middle of the eye in *parnassie*.

*Andrena clypeonitens* Ckll.

*A. clypeonitens* Cockerell, CAN. ENT., XXXIV, 47, ♀.

♂.—Length about 9 mm. Black, with ochreous pubescence as in the female; head, abdomen and legs shining, thorax dull. Antennæ black, joint 3 slightly longer than 5, the latter equalling 4. Mandibles long and curved, black, notched near the apex. Cheeks broad, shining, subtriangular, with a reflexed hind margin and a distinct angle slightly above the middle of the eye. Legs black, posterior tarsi somewhat ferruginous. Abdomen with bands of short ochreous hair on the posterior margins of segments 2 to 4 in one of the specimens (No. 31727, Milwaukee, August 18, 1908); in the second (No. 29014, Nemakagon River, Burnett Co., Wis., July 25, 1909), these bands are not developed. Both males in the collection of the Milw. Publ. Museum.

This bee has been found also at Cedar Lake, Washington Co., Wis.

## NOTES ON A FEW SCOLYTIDÆ.

BY J. M. SWAINE, MACDONALD COLLEGE, QUEBEC.

The three American species of *Xyleborus*, *pyri* Zimm., *tachygraphus* Zimm., and *obesus* Lec., form a well-defined group among the described American species of the genus. They are distinguished by the short, stout form, and by the peculiar minute and humpbacked males. These species have been separated as the genus *Anisandrus* F., and by others as the subgenus *Anisandrus*. In view of intermediate forms the separation of these species as a distinct genus would hardly seem warranted. The genus *Xyleborus*, as at present constituted, however, contains about 240 species, and subgenera would be convenient. I consider the forms named above, together with the species described in this paper, as belonging to the subgenus *Anisandrus*. Dr. LeConte has described the antennal funicle of these species as "4-jointed." This is certainly an error. The funicle is distinctly 5-segmented, with the first segment large and subglobular. In N. Y. State Museum Bulletin, 134, plate 13, fig. 42, the description should read: "Part of antennal funicle and antennal club."

*Pyri* Zimm., has long been considered a synonym of the European form, *dispar* Fabr. From a careful comparison of American and European specimens I feel satisfied that all belong to one species, but I find in my specimens slight but constant differences. In the American specimens the minute reticulations of the chitin are so developed that the body is quite opaque, but little shining; in the European specimens these reticulations are less developed, and the body is decidedly shining. The American males have the first three interspaces of the elytral disk rough, with transverse ridges; the European males have these interspaces nearly smooth. From my specimens it would appear that *pyri* Zimm., is a variety of *dispar* Fabr. If these differences are found to be constant, they have perhaps been developed since fruit trees were first brought to America.

Of the other two described American species, *tachygraphus* appears to be quite distinct. The original description of Zimmerman is here quoted:

"*X. tachygraphus* Zimm.—Long, 1½ lin.; brown; antennæ and feet ferruginous-yellow; prothorax not longer than wide, roughly tuberculate, more coarsely in front than behind, thinly pubescent; elytra short cylindrical, behind obtusely rounded, punctate-striate, the intervals also punctured, with fine rows of hairs, and behind also with small elevated

teeth. North Carolina. (This species is also found in Pennsylvania.—Lec.)”

The females are readily distinguished from those of the allied species by the granulations of the caudal half of the pronotum and the teeth of the declivital interspaces. The pronotum appears almost square from above, and the entire disk is rough, with large flattened spines in front, reduced to small flattened granules behind. The elytra are  $1\frac{1}{2}$  times as long as the pronotum; sides straight to beyond the bend of the declivity; sutural striæ more strongly impressed, particularly on the declivity; second and third interspaces wider on the declivity and each bearing three or four acute denticles, those of the second larger; the outer interspaces each with a few acute granules. I have not seen males of this species.

I have never seen a specimen which I could reconcile with Dr. LeConte's description of *obesus*, quoted below. Apparently it has the general characters of *dispar*, about the same length, 3 mm., but a much stouter form and more widely-spaced elytral punctures. It cannot be the form here described as *serratus*—the teeth of the declivital ridge in *serratus* (♀) are very distinct. It may be a large variety of the form here described as *minor*; that can only be determined by an examination of the type. It cannot, of course, be the male of *dispar*, for the length given for *obesus* is entirely too great.

Original description of *X. obesus* Lec. (LeConte, Trans. Am. Ent. Soc., 1868, page 159): “*X. obesus*.—Short and stout, cylindrical, blackish-brown, thinly clothed with long, soft, erect pale hairs, antennæ reddish-brown; head convex, coarsely but not densely punctured; prothorax rather broader than long, strongly roughened with subacute tubercles in front, nearly smooth behind; elytra with rows of large punctures, not very closely set, intervals flat, marked with small distant punctures, from which proceed the long hairs; tip obliquely declivous, not tuberculate, but with the striæ somewhat impressed, and the side and tip acutely margined, as in the two preceding species. Long, 3 mm.

Virginia, Massachusetts and Canada. Differs from the two preceding by its much stouter form and by the absence of the small acute tubercles of the declivous tip of the elytra.”

*Xyleborus serratus*, n. sp.—Female: Length,  $3\frac{1}{4}$ – $3\frac{1}{2}$  mm.; width,  $1\frac{1}{3}$ – $1\frac{1}{2}$  mm. Black, and sparsely clothed with long, slender grayish hairs, which are shorter on the disk of the pronotum. It is closely allied to *dispar* (♀), but differs in the following characters: It is larger and

stouter; the front is more shining, with the epistomal carina often more strongly developed. The disk of the pronotum is more shining behind. The elytra bear regular rows of punctures, which are smaller than those of *dispar*, and not so closely placed. In *serratus* the diameter of the punctures is almost always distinctly less than the distance between the punctures in the rows. (In *dispar* the diameter of the punctures is usually equal to or greater than the distance between the punctures in the rows; this is more noticeable near the suture.) These punctures bear very minute hairs. The interspaces bear in front minute punctures, which are replaced behind by small granules. From these punctures and granules arise the long hairs with which the elytra are clothed. The seventh interspace is raised behind into an acute, serrate ridge, which forms the ventral margin of the declivity on the sides. This ridge bears three or four acute, curved, separated spines and several smaller acute granules. This ridge is present also in *dispar*, but is not so strongly raised, not so acute, and though usually slightly crenulate, and sometimes with one or two minute granules, is never at all serrate. In *serratus* the fifth abdominal sternite has the punctures of the median area much smaller and sparser than those on the sides, and the anterior margin of the fourth sternite is usually nearly smooth. In *dispar* the abdominal sternites are usually equally punctured. In *serratus* the anterior tibiae are wider than in *dispar*, and with the teeth longer and more closely placed. Aside from these differences, the sculpture of *serratus* (♀) agrees closely with that of *dispar*.

Male: Length,  $1\frac{3}{4}$ – $1\frac{3}{4}$  mm. Front moderately convex, sometimes with a slight median impression, shining, with punctures sparse and small across median area, but close on epistomal margin; hairs long and slender, with dense fringe of shorter yellow hairs along epistomal margin. The pronotum is rather sparsely clothed with long slender hairs. The outline from above is subcircular, very slightly narrowed in front and broadly rounded in front and behind. The cephalic asperations are very minute. The caudal half is finely punctured, with a smooth median space of variable extent. The elytra are sparsely hairy, with long hairs from the interspaces, and with rows of widely-separated punctures (much as in the ♀) bearing short hairs; interspaces with small punctures, and minute granules behind. The interspaces are not much roughened. The ridge of the seventh interspace on the declivity is, as in the allied males, not much developed, with a few small granules, but no teeth. The tibiae are more slender than in the female and with fewer teeth. The venter is sparsely and coarsely punctured. In *Betula lutea*, diseased trees, Ste. Anne de Bellevue, Que.; St. Hilaire, Que.

There is a smaller form belonging to this subgenus which may be *obesus* Lec., but which is constantly much smaller than the length, 3 mm., given by Dr. LeConte. Among many specimens of this smaller form collected in Quebec and New York State I find no considerable variation in size,  $2\frac{1}{4}$ - $2\frac{1}{2}$  mm. long. I present here a description of these small specimens as *X. obesus*, variety *minor*.

*Xyleborus obesus*, variety *minor*.—Female: Length,  $2\frac{1}{4}$ - $2\frac{1}{2}$  mm.; width : length :: 60 : 137 (average of pinned specimens.) Front convex, punctured and sparsely hairy, with epistomal fringe, median carina very faint. Pronotum, outlined from above, slightly wider than long (60 : 50-55), truncate behind, very slightly rounded on the sides and very broadly rounded in front; asperate in front and sparsely punctured behind, with the faintest trace of a median carina; sparsely hairy. Elytra : width : length :: 60 : 80 (average); hairy, slender hairs from the interspaces; rows of punctures very slightly impressed, noticeably so on the declivity; punctures of the rows more widely spaced than in *dispar*, the distance between the punctures in the rows usually greater than the diameter of the punctures; the interspaces wide, with irregular, very fine punctures replaced by minute granules behind; the seventh interspace ridged behind and forming the ventral margin of the declivity, as in *dispar*, but with a few acute granules.

Male: The front is sparsely punctured and with long hairs. The carina is slightly developed. The epistomal fringe is longer and thinner than in *serratus* ( $\delta$ ). The asperations of the pronotum are sparse but well developed; the caudal half is punctured as usual, but the smooth median space is absent in my specimens; the outline from above is broadly rounded in front and behind, more strongly narrowed in front than in *serratus* ( $\delta$ ), but not so strongly as in *dispar* ( $\delta$ ); sparsely hairy, as in *serratus*. Elytra much as in *serratus* ( $\delta$ ), hairy, and with rows of widely-spaced punctures. In *Betula lutea*, *B. populifolia*, *Acer*, diseased trees. Montreal Island, St. Hilaire, Que.; Ithaca, N. Y.

*Xyleborus dispar* F.—Male: Length, 2 mm. Front nearly opaque, punctured and hairy, much as in *serratus* ( $\delta$ ), but with the median carina of the  $\varphi$  distinct. The pronotum is coarsely asperate in front, but slightly less so than in the  $\varphi$ , punctured behind, and with a distinct smooth median space. The long hairs are developed only on the sides, the hairs of the disk being very short. The outline of the pronotum from above is strongly narrowed in front and narrowly rounded. The elytra also have the disk nearly naked, the long hairs forming a fringe around

the sides and behind. The rows of punctures are slightly impressed, so that the elytra is faintly striate. The punctures are large, deeply impressed, and as closely placed as in the female. The interstitial punctures and granules are much as in the female.

KEY TO THE AMERICAN SPECIES OF THE SUBGENUS ANISANDRUS FERR.

- A. Body stout, cylindric; hind wings well developed. . . . . Females.
- B. Pronotum rough throughout, asperations in front, granules behind; elytral declivity with teeth on 2nd and 3rd interspaces. . . . . *tachygraphus* Zimm.
- BB. Pronotum nearly smooth behind, 2nd and 3rd interspaces of the elytra without teeth.
- C. The ridge formed on the declivity by 7th interspace strongly and sparsely toothed. . . . . *serratus*, n. sp.
- CC. The above ridge not toothed.
- D. Length, 3 mm. to  $3\frac{1}{4}$  mm.; pronotum as long as wide; punctures of elytral striæ closely placed, the distance between the punctures equal to or less than the diameter of the punctures. . . . . *dispar* F.
- DD. Length,  $2\frac{1}{4}$ - $2\frac{1}{2}$  mm.; pronotum wider than long, width: length :: 6:5; outline of pronotum from above very broadly rounded in front and truncate behind; punctures of elytral striæ more closely placed, distance between punctures usually greater than diameter of punctures. . . . . *minor*.\*
- AA. Body much smaller, *flattened*, hump-backed and oval in outline from above; wings very small, functionless. . . . . Males.
- B. Pronotum and elytra with central portion with only very short hairs, elytra striate, punctures closely placed, regular, interspaces with large granules behind. . . . . *dispar* F.
- BB. Body entirely clothed with long hairs above; elytra with rows of punctures, punctures more widely spaced, variably irregular behind, interspaces with the granules very small.
- C. Pronotum with very minute asperations; larger,  $1\frac{1}{2}$ - $1\frac{3}{4}$  mm. . . . . *serratus*, n. sp.
- CC. Pronotum with sparse, well-developed asperations in front; smaller,  $1$ - $1\frac{1}{4}$  mm. . . . . *minor*.\*

\*A variety of *obesus* Lec. (?)

## TWO NEW SPECIES OF PENTATOMIDÆ FROM NEBRASKA.

BY J. T. ZIMMER, UNIVERSITY OF NEBRASKA.

While working over the material contained in the collection of the University of Nebraska, two undescribed species of Pentatomidæ have thus far come to my notice.

Family PENTATOMIDÆ.

Subfamily Cydninæ.

*Anectus pallidus*, n. sp. (Fig. 10, a, b, c).

General appearance of *A. pusillus* Uhler. Colour flavo-testaceous. Head rounded; tylus very slightly exceeding jugs, and with four terminal comb-teeth; jugs, each with five comb-teeth; head coarsely punctured. Margins of pronotum convex anteriorly, concave posteriorly, distinctly

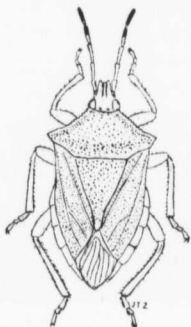


FIG. 11.—*Euschistus latimarginatus*, n. sp. (x 2.5).

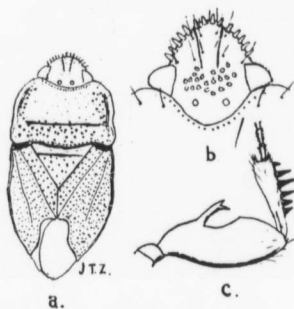


FIG. 10.—*Anectus pallidus*, n. sp.—a. Entire insect (x 16); b. Head (greatly enlarged); c. Anterior leg (greatly enlarged).

impressed, transverse line posteriorly; back of this line and on lateral submargin distinctly, coarsely punctured; punctures on rest of pronotum finer, less distinct, with the exception of a submarginal row of small but distinct punctures on anterior edge, as in *A. subferrugineus* Hope, and another such row along posterior margin. Scutellum with large, distinct punctures; basal impunctate margin separated from punctate portion by distinct, transverse, impressed line. Corium rather heavily punctate, exceeding abdomen in length; posterior margin trisinate. Abdomen



with prostrate pubescence. Legs flavo-testaceous; tibiæ armed with spines, those on anterior tibiæ stouter, piceous. Anterior femora (at least in ♀) with large arcuate, bifid teeth as in *A. spinifrons* (Say). Antennæ flavo-testaceous; second joint small, third joint longest, fourth and fifth joints equal. Length (♀), 2.75 mm.; humeral breadth (♀), 1.25 mm.

Type, 1 ♀, South-east Nebraska (L. Bruner), in University of Nebraska collection.

This small form is easily recognized by the bifid tooth on the anterior femora, by the size, and by the number of comb-teeth on the juga.

Subfamily Pentatominae.

*Euschistus latimarginatus*, n. sp. (Fig. 11.)

General appearance of *E. fissilis* Uhler, but form much broader posteriorly. Colour pale yellow, distinctly punctured with fuscous or black, the punctures tending more or less to coalesce and group themselves irregularly, especially along the latero-anterior pronotal submargins, the margins being calloused, impunctate, pale. Juga longer than the tylus, leaving the apex of the head distinctly incised as in *E. fissilis* Uhler. Antennæ pale at base, fifth and distal half of fourth joint blackish; second, third, fourth and fifth joints subequal, longer than the first joint; first joint reaching at least as far as distal end of tylus. Latero-anterior margins of pronotum concave; humeral angles prominent, subacute. Tip of scutellum paler, impunctate. Membrane immaculate. Hemelytra much narrower than the abdomen, leaving connexivum exposed. Connexivum broad, calloused, pale, forming a conspicuous lateral margin to abdomen when viewed dorsally. Legs dotted with fuscous. Venter more or less distinctly punctured; punctures on pectus larger and more distinct than those on abdomen. Angles of ventral abdominal segments darker, but without conspicuous black points. Length (♀), 14.5-15 mm.; humeral breadth (♀), 8-9.5 mm.; breadth of abdomen (♀), 8 mm.

Type, 1 ♀, Dewey Lake Township, Cherry Co., Nebraska, June (R. H. Wolcott). Paratypes, two ♀'s, Brady Island, Nebraska, May, 1896 (L. Bruner); 1 ♀, Dismal River, Nebraska, July, 1889 (L. Bruner); 1 ♀, Halsey, Nebraska, June, 1900, (L. Bruner, J. C. Crawford). Type and paratypes in University of Nebraska collection.

This form is very readily recognized by the head with the apex incised, by the broad, pale, exposed connexivum, and by the immaculate membrane. It is a sand-hills form, Dewey Lake Township, Brady Island, Dismal River and Halsey being situated in typical sand-hill country. So far, all specimens taken have been females.

## A NEW GELECHIA INQUILINOUS IN CECIDOMYIID GALLS.

BY AUGUST BUSCK, WASHINGTON. D. C.

*Gelechia inquilinella*, new species.

Labial palpi normal for the genus, with moderate furrowed brush, longest at base, gradually shorter towards the tip of second joint; second joint white, strongly sprinkled with blackish fuscous scales; terminal joint nearly as long as second, blackish fuscous, slightly sprinkled with white. Antennæ slightly serrated, bluish-black, each joint spotted with white on the under side. Face light steel-gray; head darker gray, tipped with black. Thorax blackish fuscous. Fore wings with whitish ground colour, but so heavily overlaid with bluish-black and dark fuscous scales as to appear blackish-fuscous to the naked eye. On the middle of the cell is a small, obscure, ill-defined black spot; on the fold below and at the end of the cell are similar equally obscure black spots, both slightly edged by a few dark ochreous scales. Cilia light gray. Hind wings broader than the fore wings, light shining fuscous; cilia still lighter, with an ochreous tint. Abdomen dark fuscous. Legs blackish fuscous, with the tuft on the posterior tibial light straw-coloured. Venation typical; hind wings with 3 and 4 connate, 6 and 7 short-stalked.

Alar expanse, 14-15 mm.

Habitat: Karner, New York. Issued March 24, 1910.

Type, U. S. Nat. Mus. No. 13119.

"Bred from brassicoides gall of Cecidomyiid on willow" (Felt).

Received from Dr. E. P. Felt, who has asked me to publish this description for his use in connection with his work on *Cecidomyiida*. The species is an obscure looking, typical *Gelechia*, nearest in coloration and oral parts to *Gelechia pravinominella* Chambers.

## OBITUARY.

The Rev. Jeremiah Lott Zabriskie, well known for his work in Entomology and Microscopy, died at his home in Brooklyn, N. Y., on April 2, at the age of seventy-five years. He was an active and much-esteemed member of the New York Entomological Society.

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## SOME NEW AMERICAN BEES.

BY T. D. A. COCKERELL, BOULDER, COLORADO.

*Dioxys pomona*, n. sp.

♂.—Length hardly 7 mm.; black, the thick flagellum dull reddish beneath, eyes sage-green, tegulae entirely piceous, wings strongly dusky; subapical lateral spines of the abdomen sharp and conspicuous. By its small size and general appearance this suggests *D. Rohweri* Ckll., compared with which it is more robust, with the head and thorax broader and less hairy, the tegulae without red (largely red in *Rohweri*), the wings considerably darker, the abdomen much more coarsely punctured, and with acute subapical spines. Compared with *D. Martii* Ckll., it is smaller, with narrower abdominal bands and dark tegulae. The tarsi are somewhat reddish, but not so red as in *Martii*; the spurs in both are red. The first r. n. joins the second s. m. some distance from its base. In spite of the greater superficial resemblance to *D. Rohweri*, the insect is most nearly related to *D. Martii*.

*Hab.*—Claremont, California. (C. F. Baker, 7221.)

## HOPLITELLA, gen. nov.

A genus of small bees related to *Osmia*, *Hoplitis*, etc.; colours red and black, not metallic; wings dusky; stigma rather small, its part on marginal cell less than first s. m. on marginal; marginal rather obtusely pointed, away from costa; b. n. meeting t. m.; first r. n. joining second s. m. very close to base, and second r. n. about twice as far from apex; basal middle of first abdominal segment smooth and shining, not separated by a keel or ridge; maxillary palpi 5 jointed, the joints measuring in  $\mu$ : (1) 70, (2) 102, (3) 120, (4) 85, (5) 50; the third is more slender than the second; labial palpi with the joints measuring: (1) 680, (2) 1260, (3) 70, (4) 153; the second is about 153 broad at apex; the third very short and stout, almost heart-shaped; the last slender basally, broadening apically; tongue reaching about to level of last joint of labial palpus; blade of maxilla very long and slender. Male with head and thorax finely punctured; labrum of the usual form, but only moderately long, its apical margin gently convex, the corners rather rounded; mandibles strongly bidentate; antennae simple, flagellum slender; cheeks moderate, occipital region of head not enlarged; sixth abdominal segment with a strong red tooth at each side, and its reddish hind margin slightly reflexed and shallowly emarginate in the middle; seventh segment broadly truncate, the truncation deeply notched in the middle; no ventral teeth.

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*Hoplitella pentamera*, n. sp.

♂.—Length about  $7\frac{1}{2}$  mm.; head, thorax and legs black; abdomen with the first three segments bright ferruginous-red, the second and third with a blackish stain in the middle; sides of fourth red, the others black; ventral segments with more or less evident white hind margins; face densely covered with long silky-white hair, stained with yellowish about the middle; eyes sage-green; flagellum slender, entirely black; mandibles black; ocelli large; thorax with rather long dullish white hair; area of metathorax smooth and shining; tegulae bright apricot colour; abdomen finely punctured, with poorly-developed white hair-bands; spurs creamy-white.

*Hab.*—Claremont, California. (C. F. Baker, 7224.)

*Hoplitella* shows many points of resemblance to *Proteriades* Titus (*P. semirubra* Ckll.), but is at once distinguished by the 5-jointed maxillary palpi, and the form of the labial palpi, and more superficially by the dusky wings.

Compared with *Chelostoma (Cephalapis) jacintanum* Ckll., it is easily known by the ordinary-sized head, bidentate mandibles, more slender marginal cell, merely emarginate seventh segment, etc.

Compared with *Osmia andrenoides* Spinola, from Algeciras (*Morice*), it is superficially very similar, though smaller; but *andrenoides* has a much longer tongue, the venation is different in several ways (thus, the first r. n. enters second s. m. a long way from base), the sixth abdominal segment has no lateral teeth, and the seventh is bidentate with a pair of triangular teeth.

*Osmia semirubra* Friese, from Jericho (*Morice*), also differs greatly in venation from *Hoplitella*. The b. n. in *semirubra* goes basad of the t. m., and the first r. n. enters the second s. m. far from its base.

*Osmia remotula*, n. sp.

♀.—Length about  $6\frac{1}{2}$  mm.; broad, robust; head, thorax and legs black, with much white hair, becoming grayish dorsally, and pale yellow on inner side of tarsi; head broad, eyes sage-green; antennae short, entirely black; mandibles black; head and thorax minutely punctured; area of metathorax shining, dull and rugose at base; tegulae shining piceous; wings dusky, nervures black; venation as in *O. andrenoides*; spurs creamy-white; abdomen with the first three segments bright ferruginous-red, without bands, exactly as in *O. andrenoides*, except that they are more feebly sculptured; other segments black, with grayish-white

hair, which covers the apical one; ventral scopa white, short. The female *O. andreoides* compared is from Corfu (*Morice*).

*Hab.*—Claremont, California. (*C. F. Baker*, 7226). A representative of the group of *O. andreoides* (subgenus *Erythrosmia* Schmied.), not before known in America.

*Osmia (Gnathosmia) Louisianae*, n. sp.

♀.—Length nearly 9 mm; agrees with Cresson's description of *O. Georgica*, and Robertson's additional diagnosis, except that instead of being "black, tinged with blue," it has the head, thorax and abdomen shining blue-green. The colour and general superficial appearance are as in *O. physariae* Ckll., but the wings are very brown, whereas in *physariae* they are clear. The mandibular processes are very large, forming, as Cresson says of *Georgica*, an arch interrupted in the middle. Legs black, the hind femora faintly submetallic in front; tegulae rufo-piceous; ventral scopa long, light orange-yellow. The anterior coxae are sharply keeled on the outer edge.

*Hab.*—Mound, Louisiana, May 4, 1905. (*C. R. Jones*, 234) *O. Georgica* Cresson, was based on a single female from Georgia. Since then Robertson has taken it in Illinois, and Professor Titus informs me that it occurs in North Carolina. It is possible that the present insect is only a variety or geographical race, but it seems more likely that the difference of colour indicates a distinct species.

### A NEW ALEYRODES ON BEARBERRY

BY T. D. A. COCKERELL, BOULDER, COLORADO.

Although the common bearberry (*Arctostaphylos uva-ursi*) is circumpolar in its distribution, the insects which affect it in America do not seem to occur in Europe. Examples occur among the Coccidæ (*Targionia Dearnessi* Ckll.) and Aphididæ (*Phyllaphis Coweni* Ckll.), and now I have to add a species of Aleyrodidæ, of which I found pupæ and an adult near the top of Flagstaff Mountain, Boulder, Colorado, March 20, 1910.

*Aleyrodes ursorum*, n. sp.

Pupa oval, pure black,  $680\ \mu$  long,  $518$  broad; a little white secretion around the base, but no distinct fringe, and no dorsal secretion; the usual sutural cross lines present; dorsal area bounded by a well-defined double margin, which, when the pupa is seen from above is  $35$  to  $50\ \mu$  from the lateral outline; margin strongly crenulate, the projections shaped as in *A. mori* (Proc. U. S. Nat. Mus., XXVII, pl. XXXII, fig. 39), but longer,

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about four in  $25\ \mu$  of the margin; vasiform orifice about  $25\ \mu$  broad, short and rounded, with the broad entire margined operculum practically filling the orifices. In the table by Mrs. Bemis (Proc. U. S. Nat. Mus., XXVII, p. 485), this runs to *A. nigrans*, but differs in the regularly oval shape; the adult also is quite different.

Adult about  $1140\ \mu$  long; body above blackish, covered with white meal, the base and sides of abdomen white, the extreme base of wings yellow; beneath, the abdomen is light yellow, with the last two segments gray; eyes black, completely divided; wings white, each with a small dusky spot in the apical field, and also two very faint slightly iridescent clouds above the principal vein, one from the dusky spot toward the apex, the other apparently marking the place of the lost upper branch.

Nearest, I think, to *A. Dorseyi* Kirkaldy, but the dorsal area of the pupa is much more obtuse posteriorly than in that species, which occurs on *Rhamnus* in California. The adult of *A. Dorseyi* is unknown.

#### NOTES ON TENTHREDINOIDEA, WITH DESCRIPTIONS OF NEW SPECIES.

BY S. A. ROHWER, WASHINGTON, D. C.

##### PAPER X. — NEW SPECIES OF EMPRIA.

Lepeletier in 1828 (Encycl. Method, X (2), p. 571), described his genus *Empria*, and included three species, the first of which, *Dolerus* (*Empria*) *pallimacula* Lepeletier, was named as the type by Brullé (Hist. Nat. Ins. Hym. IV, pp. 666, 1846).

In 1835 Dahlbom, in his Conspect. Tenthred. Scandin., p. 13, No. VIII, founded the genus *Pacilostoma* for *Tenthredo guttatum* Fallén. Thomson, in 1871 (Scand. Hym. I, p. 227), changed the spelling of Dahlbom's genus, *Pacilostoma*, to *Pacilosoma*.

Dr. Ashmead, in his tables in the CANADIAN ENTOMOLOGIST for 1898 (p. 256), made *Haripiphorus maculatus* Norton, the type of a new genus, *Pacilostomidea* and *Monostegia ignota* Norton, the type of *Tetratneura* Ashmead.

*Dolerus* (*Empria*) *pallimaculata* Lepeletier, is the same as *Tenthredo guttatum* Fallén, and *Haripiphorus maculatus* Norton and *Monostegia ignota* Norton, are congeneric with *Tenthredo guttatum*, so the synonymy of the genus *Empria* is:

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EMPRIA Lepeletier, 1828.

*Pæcilstoma* Dahlbom, 1835.

*Pæcilosoma* Thomson, 1871.

*Tetratneura* Ashmead, 1898.

*Pæcilstomidea* Ashmead, 1898.

Rev. F. W. Konow (Zeit. Hym. Dipt., p. 36, 1908) published a similar synonymy for *Empria*.

Up to the present time a number of species of this group have been lumped under the name *maculata* Norton, but on studying these forms carefully and examining the saws there seems to be a number of allied but distinct species. At the present time a revision of this genus seems inadvisable, but at some future date such a paper may be published. It would greatly simplify matters if the various economic entomologists would refer their material to a specialist.

*Empria distincta*, n. sp.—♀. Length about 7 mm. Clypeus subtruncate, carina present but not strong; antennæ rather robust, the third joint a little longer than fourth; antennal furrows interrupted below ocelli; middle fovea circular and not connected with the ocellar basin; sheath obliquely truncate, angles rounded; saw with rather small teeth. Black; anterior margin of clypeus, pronotum, tegulæ, legs below coxæ, except the brown hind femora and tarsi, reddish-yellow; the usual abdominal spots. Wings hyaline, iridescent; venation dark brown.

Type locality: Virginia.

Type, No. 12833, U. S. N. M.

*Empria affinis*, n. sp.—♀. Length, 6 mm. Clypeus tridentate, shallowly emarginate, lobes small, sharp, carina strong; antennæ of the slender type, third joint longer than fourth; antennal furrows complete; middle fovea small, circular, deep, nearly connected with the ocellar furrow; saw with small teeth, the upper part not reaching apex; sheath with the lower margin strongly rounded. Black; extreme apical margin of clypeus, line on pronotum and tegulæ, knees and usual abdominal spots white. Wings hyaline, iridescent, venation dark brown.

Type locality: "Colo. 1041." Collection of C. F. Baker.

Type, No. 12834, U. S. N. M.

There are also some other Colorado numbers.

*Empria Caudelli*, n. sp.—♀. Length about 7.5 mm. Clypeus distinctly emarginate, lobes broadly triangular, carina wanting; antennæ

of the very robust type, third joint much longer than fourth; antennal furrows subinterrupted below ocelli; middle fovea circular, not separated from broad ocellar furrow; sheath rounded at apex; teeth of saw small, upper part ribbed and reaching to the tip. Black; line on pronotum and tegulae, and legs below knees, white; the usual abdominal spots. Wings brown, venation brown.

Type locality: Cheney Gulch, Colorado, May 13, 1901. (Dyar and Caudell.)

Type, No. 12835, U. S. N. M.

Also some Colorado numbered specimens from the C. F. Baker collection.

*Empria submaculata*, n. sp.—♀. Length, 5 mm. Clypeus gently emarginate, lobes broad, triangular, carina wanting; antennae of the normal slender type; antennal furrows complete; middle fovea small, circular, deep; ocellar furrow almost wanting; sheath slender and rather sharply pointed; saw sharp, teeth large in comparison to size of saw, upper part reaching tip, its margin somewhat irregular. Black; clypeus, line on pronotum, tegulae white; legs below coxae pale brown to white; usual abdominal spots. Wings hyaline, iridescent; venation dark brown.

Type locality: "Cana 2051." Collection of C. F. Baker.

Type, No. 12836, U. S. N. M.

*Empria Arizonensis*, n. sp.—♀. Length, 8 mm. Clypeus narrowing apically, middle tooth distinct, lobes broad, rounded at apex, carina strong; antennae more robust than the slender type, but not very robust; antennal furrows complete; ocellar furrow and middle fovea making a diamond-shaped area on the front; head and thorax more shining than usual, sheath strongly rounded on the lower margin; saw with broad, rather large teeth, upper margin ribbed and reaching tip. Black; line on pronotum, tegulae, knees and indistinct abdominal spots white. Wings and venation black.

Type locality: Arizona.

Type, No. 12837, U. S. N. M.

*Empria salicis*, n. sp.—♀. Length, 6 mm. Clypeus deeply emarginate, lobes sharply triangular, inner tooth faint, as is the carina; antennal furrows complete; ocellar furrow and middle fovea complete, making a broad furrow; antennae of the slender type; sheath truncate, the upper angle sharp; saw with small teeth, the upper part extending to near the



apex. Black; clypeus, line on pronotum, tegulae and abdominal spots white; legs reddish-yellow, hind tibiae white at base, the apical part black. Wings hyaline, iridescent; venation dark brown.

Type locality: Florissant, Colorado. Specimens swept from *Salix brachycarpa* in June and July by S. A. Rohwer. There are also some Colorado numbered specimens in the C. F. Baker collection.

Type, No. 12838, U. S. N. M.

The male is very like the female, but has the usual sexual differences.

*Empria melanostoma*, n. sp.—*Pacilostomidea maculata* Kincaid, Wash. Ac. Sc., Vol. II, Nov. 24, 1900, p. 346.

♀. Length, 6 mm. Clypeus as in *salicis* Roh., but the carina is stronger; antennae of the short, sublender type; antennal furrows complete; middle fovea and ocellar furrow forming a deep, shining frontal furrow; sheath obliquely truncate, the angles rounded; saw with large teeth, the upper part reaching nearly to tip, the margin strong. Black; line on pronotum, abdominal spots and knees white; tibiae brownish. Wings hyaline, iridescent; venation dark brown.

♂. Length about 5 mm. Very like the female, except for the sexual differences.

Type locality: Sitka, Alaska, June, 1899. (T. Kincaid.)

Other localities: Yakutat, Alaska, June 21, 1899. (T. Kincaid.) Oregon (Koebele), "W. T."

Type, No. 12839, U. S. N. M.

Var. A.—♀. Edge of clypeus white; third antennal joint longer than fourth; emargination of clypeus broader and the lobes sharper.

♀, Ute Creek, Colorado, July 4, 1907, 9,000 ft. (R. W. Darson.)

*Empria mellipes*, n. sp.—♀. Length, 7 mm. Clypeus broad, subtruncate, carina nearly wanting; antennae short, subrobust; antennal furrows slightly interrupted below ocelli; middle fovea small, circular, indistinctly connected with the narrow ocellar furrow; sheath of the normal type, rounded beneath; saw with rather large hooked teeth, the upper part faintly ribbed and reaching apex. Black; pronotum, tegulae, indistinct spot on pleurae, legs below the coxae and the abdominal spots, which are large, reddish-yellow. Wings pale brownish; venation pale brown.

Type locality: Missouri. Specimen labelled "Straw. Apr. 14, 71 C. Mo."

Type, No. 12840, U. S. N. M.

## LIFE-HISTORIES OF NORTH AMERICAN WATER-BUGS.—III.

BY J. R. DE LA TORRE BUENO, NEW YORK.

*Microvelia Americana* Uhler.

## I.

In 1834 Westwood<sup>1</sup> placed *Velia pygmaea* L., Duf.,<sup>2</sup> in a section or subgenus, which he called *Microvelia*. In the following year (1835) Burmeister<sup>3</sup> erected a new genus to contain this species, and with the calm that characterized him, ignored Westwood's previous work and named the genus *Hydroïssa*. Entomologists of the German school to this day persist in the latter generic name, although Westwood's is universally recognized to have priority.

No North American species of the genus had been recognized till 1883, when Uhler<sup>4</sup> described his *Hebrus americanus*, which a careful reading of the generic characterization shows not to be a *Hebrus* at all, but a true *Microvelia*. His description, however, leaves no doubt as to the insect he had before him. Nevertheless, he appears not to have considered this a sufficient description, or else recognized his initial error in placing the species in *Hebrus*, since he redescribed it as new in 1895,<sup>5</sup> and this is the date commonly quoted.

Briefly, the synonymy is thus :

*Microvelia* Westwood, 1834.

*Hydroïssa* Burmeister, 1835.

*Hebrus* Uhler (not Curtis), 1883.

*Veliomorpha* Carlini, 1895.

Species : *americana* Uhler, 1883 (as *Hebrus*).

The species is widely distributed, and it has been recorded by various writers from Ontario, in Canada ; and from Maine, New York, New Jersey, Pennsylvania, Maryland, North Carolina, Kansas and Colorado, in the United States. It is probably spread throughout all the Atlantic and middle Western States, but possibly it does not range as far to the south as Florida and the Gulf States, where we should expect to find other species. California is also said to be within its range, but this at best is doubtful.

1. Ann. Soc. Ent. Fr., III : 647, Pl. VI, fig. 5.

2. Op. c., II : 115, Pl. V, fig. 6.

3. Handbuch Ent., II : 213.

4. Standard Nat. Hist., II : 273.

5. Bull. 31. Col. Agr. Exp. Sta., Hem. of Col., p. 61.  
May, 1910

Many an entomologist when drinking from a field or roadside spring has noticed the tiny black, silver-spangled insects that detach themselves from the stones forming the basin and run across the surface, or glide out from the side and swiftly curve in to their former resting places. This is *Microvelia americana* Uhler. It is to be found on the banks of any body of water, moving or still. Where the walls of the spring or the bank of the stream or pond are more or less vertical, they perch a little above the water. But on shelving or sloping banks they wander about over the mud or pebbles seeking their prey, leaving the shore only when alarmed or disturbed. They also conceal themselves under overhanging banks of streamlets, as observed by Uhler in Maryland and the writer in New Jersey. I have found them perched on logs jutting out from the shore, and among the heaps of brush and twigs that gather in the slack waters and eddies of streams. In such places they pass the time from earliest spring till the bleak days of late autumn. I have secured adults just emerged from their hibernacula as early as March, and as late as the end of September have seen adults and nymphs, and in mid-October adults only. From then on, according to Uhler, "they hibernate in colonies beneath the overhanging banks of little streams (in the Middle States)"<sup>6</sup> until the first warm days of spring entice them from their shelter. They must begin to breed at once, because, again quoting Uhler, "by the latter part of June they have become fully winged." I have myself noted the young in May, and taken nymphs arriving at the adult toward the end of July, which perhaps is as early as is normal in the latitude of New York. Of course, their precise time of appearance in the spring, and of seeking hibernacula on the approach of winter is largely governed by the temperature, and naturally varies with the latitude and the variations of the thermometer.

All the water-striders, large and small, are carnivorous, and *Microvelia* is no exception to the invariable rule. In nature they doubtless feed on such small insects as are tiny enough to be overpowered, such as Spring-tails, larvæ of flies, and other soft-bodied and feeble forms, or on those larger ones which are drowned in their haunts. In the aquaria they have been fed on house-flies, and where there have been water-fleas in the water, they have feasted on the unlucky ones imprisoned in the surface film. Like all the predaceous Heteroptera, they are always in a condition of semi-starvation, and when a living fly is fed them, of course they attack

6. Standard Nat. Hist., II, p. 275.

it in force. When it struggles, they beat a hasty retreat; but if it quiets but for an instant they are on it again, piercing it at the joints of the legs or in the sutures between the segments, until the victim of their voracity perishes, exhausted by its struggles and unable to overcome the actively poisonous saliva *Microvelia* injects. Then all feast at their ease, some perched upon the carcase, others sucking at the joints, until they are filled to satiation. But at a pinch, when there are no living victims, they do not disdain long-dead and gamey food, and I have often seen them feeding on decaying flies, as much as two and three days old, and which smelt to the four winds.

In regard to their manner of progression, Uhler (l. c.) says it "runs with astonishing rapidity, but not with the rowing impulses of *Limnotrechus*," and Kirkaldy<sup>7</sup> describes the gait of *Microvelia pygmæa* of Europe in these words: "Their gait may be described best as a 'scuttle,' a series of very quick short steps, the femora being almost horizontal. They move very rapidly, but rarely sustain the effort long—the opposite legs are moved alternately." He goes on to say that they apparently have very feeble adhesive powers, and are unable to mount a perpendicular glass surface, but this is only natural when it is considered that the claws are subapical, and that there do not appear to be any pulvilli. In the main, these two accounts cover *M. americana*, but in addition I have observed it to move with the rowing impulses of the other Gerrids. This, however, happens only when it is far from shore, or closely pursued and making desperate efforts to escape, and its ordinary gait is of no avail. This I have seen, but not very often, both in nature and in my aquaria.

The *Microvelie* are cleanly beasts, and indeed, the nature of their velvety covering and the many tactile and other hairs which abound on their bodies, make it imperative that they should keep themselves in good condition, and accordingly, a good part of their time is spent in cleaning themselves. Kirkaldy (l. c.) observed the toilette of *M. pygmæa*, and describes in detail how the legs are employed in the dry wash, and the careful manner in which the antennæ are cleaned. In the macropterous adults, the wings are lifted and the legs passed under them. I have been so fortunate as to be able to observe *M. americana* in this tidying process more than once, and on one of these occasions careful notes were made while one of the little fellows in my aquarium was thus engaged, and this

7: 1899, ENTOMOLOGIST, Vol. XXXII, "A Guide to the Study of British Water Bugs (Aquatic Rhynchota)," p. 113.

is what he did: First, he rubbed the first pair of legs together, that is, the tarsi and tibiæ, and then each leg rubbed the other all the way down to the tarsi, much as a man washes his hands and arms. Then the middle leg of one side was vigorously rubbed against the hind leg, and then against the front. Then, with the front legs, the antennæ were rubbed quite vigorously, but always from the base to the tip, so as not to disturb the tactile hairs which all point in that direction. The middle legs were bent under, and the sternum and abdomen rubbed with the tibiæ. The minuteness and quick motions of the bug caused many points to be missed, but this is the process in its essentials. The reason for the use of the tibiæ is that all are furnished with a comb at the distal end, running crosswise of the leg.

In common with all the other Gerrids, *Microvelia americana* displays the phenomenon of apterousness, but in a very marked degree. Ordinarily, all the examples of *Microvelia americana* taken, or to be seen in collections, are wingless, but at times it is possible to get a few winged individuals in sheltered spots, under the overhanging banks of streamlets principally, or in exceptional seasons or situations. Thus, in the summer of 1907, there was a great abundance of winged individuals of normally apterous species to be found in the streams about White Plains, N. Y. Then I secured some dozen or so, seven in one limited area of perhaps 20 or 30 feet on one August day. The next summer, also in August, no less than 15 winged were taken in a roadside drinking trough, which was fed by a cold stream flowing from a hillside in a pasture. They were gathered in large numbers at the inlet end of the trough, where the water ran coldest. In the tropics the winged individuals are more abundant, as Westwood notes in his introduction, where he says Hope possessed a large number of *Microvelia pulchella* from St. Vincent, almost all winged.

Distant, in Hemiptera of British India, notes that Green has taken in Ceylon *Microvelia singalensis* in an acetylene moth trap. I have never got any of our species at light, but doubtless the fact will be recorded by some fortunate investigator in due time.

This little bug does not appear to be as amorous as its larger relatives of the *Gerrine*. According to the classification, of Gadeau de Kerville, of the ways of mating in Hemiptera,<sup>8</sup> it comes under "accouplement par superposition," as in the *Gerrine*, and, in fact, in all the water-bugs I have observed. I was able to observe the act in some bred

8. 1902, Bull. Soc. Ent. Fr., No. 4, p. 68

aquarium specimens, which were only two days old, and the following notes were taken as they were watched through a magnifying glass. When the male in its wanderings ran across the female, he stood still behind her for an instant, taking aim as it were, and then started suddenly, running swiftly onto her back. When up, he held on by the front and hind legs, the tibiae of the first pair bent under and holding on to the shoulders of his mate. The hind pair were held with the femora at right angles to the body, the tibiae bent under, the extremities being under the edge of the female's abdomen, with the tarsi seemingly hanging limply down. The middle legs were held out from the body, the tarsi held up from the surface of the water, the object of this apparently being to aid in balancing the male on his precarious perch. While in this position the male positively quivered, the antennae and the middle legs actually vibrating with the intensity of his passion. The genitalia (but obscurely seen from above) were bent toward those of the female, where they could be seen vibrating. The female, of course, remained passive during the act. Three days later, that is to say, five days after reaching maturity, this bred female was quite swollen with ova.

In nature, the eggs are probably deposited on stones or sticks, just above the surface of the water, but not on vegetation, to judge from the preferences shown by the little bugs in the aquaria, which deposited their eggs on the sides, but not on the abundant duck-weed furnished them. In the course of some two or three weeks more or less, depending on the temperature, the nymphs emerge, and after five moults reach the adult in about five weeks. The females display no maternal solicitude, and the young nymphs fend for themselves from their tenderest infancy. No adult parasitism by mites nor egg parasitism by Hymenoptera has thus far been observed.

My first attempt to breed *Microvelia americana* was made in the summer of 1904, and two individuals were brought to maturity after five moults. No systematic notes were kept, other than a careful note of the number of ecdyses. In 1905, and again in 1908, more minute observations were made and a more careful record kept, my results being set forth in the following pages.

It is not a difficult task to breed *Microvelia americana*. My equipment consists of one or two large aquaria and an assortment of club-cheese pots, Stender dishes of various sizes, and screw-top, opaque, white glass pomatum pots, about an inch or an inch and a half across the top. The first and last named are preferable, because they offer a white

background, against which the little bugs are more clearly revealed, and therefore more easily observed. The adults were kept in numbers in the large aquaria, where they mated and oviposited, and the young, as soon as emerged, were transferred singly to one of the small dishes, where they could be observed and a more accurate record be kept of their transformations. Every morning before going to the office where I earn my living, the aquaria were examined, the cast skins removed, the moults noted, and any other pertinent observations recorded in the books I keep for the purpose. On my return from business a similar routine was gone through. It is necessary to keep the aquaria, large and small, covered to prevent evaporation, and also to keep the bugs from escaping, especially the smaller ones. With a water surface to run upon, and food in sufficient quantity, they require nothing more. A few water plants help to keep the water sweet and add sightliness to the large aquaria, but they cannot be successfully employed in the smaller.

All the descriptions and figures are from balsam mounts, and this perhaps may have caused some slight distortion in the form of the insect, making it possibly a little broader and longer than it really is. The bugs in the earlier series of slides were killed in alcohol (about 90%), washed in Cologne spirits (98% alcohol), and cleared in turpentine. In the latter, they were put living into carbol-turpentine, made by putting crystallized carbolic acid into an equal part of fine spirits of turpentine, which gives excellent results, producing very clear mounts.

One fact should be borne in mind in these life-histories, which is that the conditions are largely artificial, and in all likelihood more favourable than in nature, and this may contribute to an acceleration of the life cycle as compared with that in natural surroundings. In the first place, the food supply is regular and abundant, which is not likely to be the case in *Microvelia's* normal haunts, for it is scarcely likely that in a secluded spring they can get a single insect each a day. And in the second place, the temperature is bound to be both higher and more constant in the confinement of a closed aquarium, and the air is more heavily moisture-laden as well. A regular and abundant food supply, high temperature and a moist atmosphere are all conducive to rapidity of development in the Heteroptera, as may be readily verified by observing how much more quickly bugs reach their moults in the hot, humid days of July and August than they do in the cooler May, June, September and October.

## II.

Between August 20th and 27th, in 1905, the *Microvelia americana* in my aquaria mated and began ovipositing. A portion of the eggs were attached to the upper surface of some duck-weed floating on the water, while a few were dropped on the surface of the water itself. The majority, however, were embedded in a colourless waterproof jelly, and fastened in masses to the sides of the aquarium, slightly above the water. Subsequent observations confirm this mode of ovipositing, and in the absence of direct observations in nature, I should say the eggs are deposited on rocks and stones, just above the surface of the water, or else on floating sticks.

Ovum.—Ellipsoid in shape; colour, translucent white, more or less glairy. Under the microscope the chorion is seen to be sculptured in irregular hexagons. Dimensions by camera-lucida and scale: .6 x .25 mm.; .63 x .24 mm.; .63 x .22 mm.; .68 x .29 mm.; .725 x .27 mm. (Fig. 12.)

As development progresses, the eggs grow darker, and at one end the red eyes, the legs, the rostrum, etc., of the nymph are visible through the shell. At the end of about 17 days the eggs hatch, and the young nymph emerges by a longitudinal slit about two-thirds of the length of the egg, along one side and the end.

Nymph.—1st Instar: Head, long.: lat.: 15: 22; eyes: vertex: 6: 10: 6; antennal joints, 1, 2, 3, 4: 5: 6: 5: 15.

Antennæ 4-jointed, 1st curved and stout; 2nd straight, a little stouter than the 1st; 3rd slenderest; 4th fusiform, slightly slenderer than the 2nd, but as stout or a little stouter than the 1st, all thickly covered with long hairs, one long stout hair near the distal end of the 1st joint set in a sense pit and pointing outward; inserted under the head. Eyes exteriorly rounded, set obliquely in the head, occupying a little over one-half the head. Head thickly pilose. Rostrum 4-jointed, rising under the head. Proportions of joints: j1: j2: j3: j4: 26: 7: 60: 40. The second joint is annuliform, and the 4th darker and apparently more heavily chitinized than the others. The tylus is slightly prominent. In moulting, the lancets are cast with the skin.

Prothorax clearly indicated, ring-like; long.: lat.: 5: 25, in shape something like a curving collar of even width, sides rounded and sloping

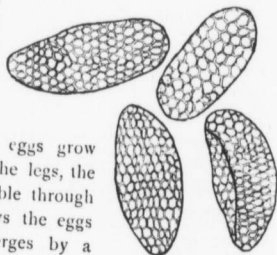


FIG. 12.—Ova of *Microvelia americana* (x 27).



forward, thickly pilose. Prothorax and mesothorax fused into one, but an effaced suture visible between them; thickly pilose.

Legs: First pair shortest, 3rd longest. All tarsi single-jointed, claws long, simple, slender, subapical, extending as far again from the tip of the tarsus as the tarsus projects beyond the insertion of the claw. Coxæ and trochanters much elongated in the third pair. First tibiæ with two combs, second with one, apically situated; third tibia with a long stout subapical spine. First pair of legs, femur longest, then the tibia, then the tarsus, which is stouter than the other two; second pair as the first; third pair, tibia longest, femur next and stoutest, then tarsus, which is more slender than either; all covered with long hairs.

Abdomen oval, segments well marked, genital segments prominent; all the segments dark, except at the connexivum, which is wholly light; eight apparent segments. The spiracles are seemingly not to be found in this instar, not being visible in either the entire nymph or in the cast skins mounted in balsam, even at a magnification of 530. This, of course, is not a proof that they do not exist, but rather shows how well they are concealed.

Dimensions: Length, .75 mm.; width, .42 mm., measured from living bug.

After five days the tiny bug moulted the first time.

Nymph.—2nd Instar: Proportions of head: long.: lat.: 7: 10: eyes: vertex :: 14: 32: 14; antennal joints, 1: 8: 9: 20; rostral joints, 9: 3: 13: 10.

The rostrum extends to the base of the prosternum, or to the insertion of the first pair of legs.

Prothorax, lat.: long. :: 38: 6.

First pair of legs stouter than the other two; the tarsal combs of the first and second pair as before; the third tibiæ armed with a stout double-pointed spine, apically and exteriorly, and some stout scattered spines interiorly, beginning half-way up the tibia. The end of the tarsus extends beyond the middle of the claws.

The abdomen and other details omitted are as in the first instar.

Dimensions: Length, .9 mm.; width, .55 mm., taken from balsam mount of nymph.

In four, five and six days respectively, the nymphs moulted the second time.

Nymph.—3rd Instar: Proportions of head: long.: lat.: 23: 35: eyes: vertex :: 7: 21: 7; antennal joints, 12: 10: 11: 21; rostral

joints, 6 : 6 : 19 : 9 (measured from cast nymphal skin) ; prothorax, lat. : long. : 6 : 42. The antennæ and legs grow comparatively slenderer, but the number of joints does not change. The cleft spine on the outer side, subapically, of the posterior tibiæ still persists. The other details omitted are as in the previous instars.

Dimensions of nymph, taken from balsam mounts : Length, 1.32, 1.20 mm.; width, .8 to .72 mm.

Four, five and six days later, respectively, they moulted the third time.

Nymph.—4th Instar : Antennal joints, 12 : 9 : 10 : 24 ; rostrum, rostral joints, 7 : 6 : 17 : 9.

Owing to having nothing but moulted skins, a number of details must be omitted in this and the next stage of the nymph. The general form, aspect and coloration are as before, the main changes noticeable being in the increasing slenderness of the legs and antennæ. In this and the preceding instars, the spiracles can be seen in the cast skins, as little round openings in the connexivum. In the entire bug I have not been able to locate them. The basal joint of the antennæ is stout and curved, as before, and there is no change in the relative thickness among them. The other details are practically unchanged. The first pair of legs is the stoutest, especially as to the tarsi, and these are single-jointed in all the legs.

The fourth moult took place two and four days after the third.

Nymph.—5th Instar : Antennal joints, 20 : 13 : 13 : 35 ; rostral joints, 6 : 4 : 21 : 10. With slight differences, the other details are as before. The tarsi continue single jointed, with long, simple claws, the posterior tibiæ are spined toward the end, the spines increasing in number from the femoral to the tarsal extremity, and stout in proportions. The cleft spine mentioned before is still present, but is not so noticeable. In this instar, though still greenish in colour, with darker spots, lines and markings, the silvery patches, so characteristic of the adult, first make their appearance. The female can in this instar be already distinguished from the male on account of its larger size, and less prominent genital segments. The males are so much smaller in this instar than the females, that they may be mistaken for nymphs in the fourth instar only. The dimensions of the nymph, taken from the cast skins, mounted in balsam, are not quite accurate, as the skins are much distorted. Length, 2.14 mm.; width, 1.25 mm. The fifth, and last moult, took place seven, eight and ten days later, respectively.

In moulting, the skin of the head splits along the eyes, and rises like a lid at the front. In the body, it splits longitudinally along the middle line of the thorax, and down the dorsum to the third or fourth abdominal segment. As mentioned before, the rostral lancets are moulted entire, including their insertion in the interior of the head, as well as the tracheæ. In this connection, it may be mentioned that the cast skins are excellent for the study of the hairs and other external characters, the number of antennal and rostral joints, etc.

Adult.—The following proportions and dimensions are apparently not mentioned by the describer of the species. Antennæ four- or five-jointed, the latter if the minute jointlet between the second and third joints is to be taken into account. Proportion of joints, approximate, 24 : 17 : 2 + 22 : 27, from balsam mount, somewhat distorted; these proportions are only approximate, as different specimens differ slightly from each other, and even the right and left antennæ are not alike. A dry specimen, mounted for the cabinet on a paper point, gave these proportions: 23 : 16 : 2 + 23 : 30. The first joint is stout, curved; second not so stout; third slenderest; fourth fusiform, stouter than first. The stout tactile hair in the sense pit near the apex of the first joint still persists in this adult. The rostrum is four-jointed, as in the nymphal instars; the proportions are : 8 : 4 : 27 : 13; head, length : width :: 30 : 45; eyes : vertex :: 11 : 22 : 11. The ommatidia are round, as they are not as close together as in the compound eyes of other Heteroptera, and this is also the case in all the nymphal instars.

In the wingless form, the pro-, meso- and metathorax are clearly indicated as rings. Including the genital, there are nine apparent segments in the male, as seen from above. The spiracles are hidden on account of the extreme hairiness of the bug. The legs have a tibial comb on the first and second pairs, as in the nymphs. The peculiar cleft spine of the posterior tibiæ, so noticeable in the nymphs, appears to be single in the adult, and there is now interiorly a comb-like arrangement of close-set spines, thick hairs, or bristles.

When the adult is just emerged from the nymphal skin, it is a creamy white, with dark eyes, claws, etc. This is the case also with the nymphs.

In the nymphs, the third antennal joint appears to be sunk in a deep, cup-shaped depression in the second joint, and there is a minute jointlet entirely concealed in this depression. This structure does not appear till the second instar, the joint appearing pedicellate in the first. In the adult, however, the jointlet does not appear to be sunk in this manner.

In my descriptions above, I have included this jointlet as a part of the third, because, in fact, I have taken no account of it, the dimensions of this joint being taken as that part of it from the tip of the second joint to the insertion of the fourth.

A male and a female *Microvelia americana*, which came to maturity on October 2nd, mated on the 4th, and the female was noticeably swollen with ova by the 5th. On December 31st of that year, the female died, being under artificial conditions, and without food, but not before depositing several batches of eggs, which hatched out in due course, yielding nymphs which in some cases attained the first and second instars. The males lived on into January, when they too perished, after being fed no flies for over two months.

Summarizing, the bred insects had seven instars, one embryonic, five nymphal, and one adult, which took between 36 and 46 days for accomplishment. This would make possible several broods in the course of the year. Assuming that the ova are deposited about the middle of April, which would not be any too early in a normal spring, there would be adults from these by June 30th, which in turn breeding, would give a generation maturing about the first half of July; this brood would in turn reproduce itself, and adults would be forthcoming, since the season would be at its most favourable time for quick development, say by about the same time in August. The August progeny, in due course of nature, would see another generation under the favourable weather conditions of that period of summer, including the dog-days, by about the same time in September, and these, reproducing themselves, would by the end of October know that the generation to carry the species to the next year had attained its growth. We thus see that there may be as many as five generations in the course of a single summer. This, however, seems to me the least that they would do. As a matter of fact, it is scarcely possible to compute what would actually occur in nature, because, since oviposition is practically continuous, and one female may live say for a month while ovipositing, there is any number of overlapping broods to contend with, but it seems to be reasonable to estimate them as an average of five a summer, or possibly six.

In conclusion, I wish to point out that this species, *Microvelia americana* Uhler, may turn out to be the type of a new subgenus, characterized by having the anterior tarsi single-jointed, and the two others two-jointed, as opposed to *Microvelia* proper, which is said to have the tarsi two-, three-, three-jointed. For this I propose the name KIRKALDYA, in memory of my friend.

## BOOK NOTICE.

GENERAL BIOLOGY: A Book of Outlines and Practical Studies for the General Student. By James G. Needham, Ph. D. Comstock Publishing Co., Ithaca, N. Y.

Although not customary in an entomological journal to notice biological works of a general character, it seems justifiable in the present case, in view of the many illustrations of biological phenomena, taken from the insect world, which the author has introduced into this attractive work.

The book is wholly unlike the ordinary text-books of zoology and botany, in that it is not dominated by any special phase of the subject, but touches upon the entire field; its aim being to guide the general student in following the course of practical studies which it offers rather than to supply him directly with all the knowledge he is expected to acquire.

Each of the seven chapters forms an introduction to some branch of general biology, which is illustrated by references to familiar examples, and the practical exercises which they contain are not studies of animal types but of the biological phenomena in question. These practical studies contain directions for obtaining and preparing the necessary material, as well as for the intelligent study thereof. They are full of valuable suggestions, not only for the student, but for the instructor, and will be found most useful for teachers of biology, entomology and kindred subjects, in both high schools and universities.

The arrangement of the subject matter is somewhat novel, as indicated by the following list of headings of the seven chapters:

- I. The Interdependence of Organisms.
- II. The Simpler Organisms.
- III. Organic Evolution.
- IV. Inheritance.
- V. The Life Cycle.
- VI. The Adjustment of Organisms to Environment.
- VII. The Responsive Life of Organisms.

All the chapters except the second contain many references to insect biology. The first discusses the relations between flowers and insects,

and those between ants and aphids, and the interrelations of gall insects. In the third homology and phylogeny are illustrated by studies of the wing-veins of three series of closely allied insects. In Chapters V and VI, as the headings suggest, entomology takes a prominent part. A special feature of Chapter VI is a number of practical studies of aquatic animals, mainly insects, which are particularly well suited to the study of secondary adaptations to environment. As examples of these studies may be mentioned the following :

“The principal types of gills found in aquatic insects.”

“The comparative development of respiratory apparatus in aquatic insect larvæ.”

“A comparison of the structure of ground beetle and diving beetle.”

“A comparative study of the size and activities of diving beetles.”

“Field observations on diving beetles.”

“The adaptive structures of diving beetles.”

Animal coloration is also chiefly illustrated from insects, and forms the subject of one of the practical field studies. It is treated under four headings : Resemblance, Flash Colours, Warning Coloration and Mimicry, each of which is illustrated by examples easily obtainable by the general student.

In the last chapter, which deals mainly with psychological phenomena, the nature of instinct is analyzed by experiments on the reactions of caterpillars in different bodily states to various stimuli, and on the case-building habits of caddis-flies.

In the appendix, in which directions are given for handling the microscope, dissecting, etc., a key to the genera of North American Dytiscidæ is included as an aid in the studies of diving beetles mentioned above.

The book is eminently readable, the style being lucid and vigorous, and is fairly free from typographical errors. The numerous illustrations are largely original, and include a number of good photogravures.