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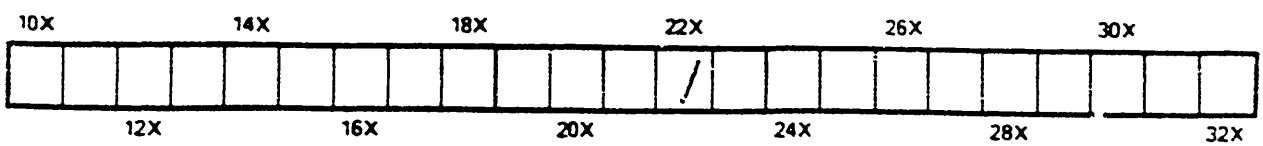

The Canadian Entomologist.

VOL. XVII. LONDON, ONT., AUGUST, 1885. No. 8

MONOGRAPH OF THE EMBIDINA.

BY DR. H. A. HAGEN, CAMBRIDGE, MASS.

1. *Oligotoma Cubana*, n. sp.

Olyntha? spec. larva. Hag. Synops. Neur. N. Amer., p. 7.

Olyntha Cubana, larva, imago, Hag. Psoc. Embid. Synops. Verh. Wien. Z. B Gesell. 1866, p. 221, 223 (no description).

Olyntha Cubana, McLachl. Linn. Soc. Jour. Zool., vol. xiii., p. 381.

Male, dry. Length of body about 8 mill.; exp. of wings about 12 mill. Head light brown, little longer than broad, narrowed behind the eyes, convex above, without any impression, rounded at the sides, cut straight near prothorax; labrum large, paler, rounded; antennæ pale brown (only 13 joints present); 1st large, cylindrical; 2nd very short, as long as broad; 3rd as long as 1st, thinner, somewhat thicker at tip; all following similar but a little shorter; antennæ and head densely clothed with very pale hairs; maxillary palpi 5-jointed, pale brown, apical joint long, conical; labial palpi small; tip of mandibles black. Prothorax light brown, narrower than head, somewhat enlarged to the mesothorax, one half longer than broad, flattened; before the apical third with a transversal sulcus; legs brown, paler on articulations; fore legs with tibia and 1st joint of tarsus enlarged. Wings narrow, faintly rugose, very pale brown, with five longitudinal white bands; radius yellowish; sector bifid; five transversals between the upper branch and the radius. Abdomen long, brown, hairy; appendages long, slender, hairy. The specimen is carded, and the parts not very discernible. If there is a difference, the basal joint of the left appendage is larger, and the apical joint of the right appendage is longer; between both above a short bent process, and on the left side of it a conical lobe, short, open at tip.

Hab. Cuba. The only specimen I received May, 1865, from Prof. Poey. It is No. 8 of his catalogue, and was named as *Olyntha* probably

after the notice in my Synopsis, p. 7, where a larva from Cuba was mentioned as perhaps belonging to *Olyntha?* I think the specimen, when caught, was young; it can not be decided if the colors are fully developed; it is carded and in a delicate condition. It is of the size of *E. Salvini* McLachl., dut directly to be recognized as a different species by the bifid sector of the wings.

Oligotoma Cubana,

Female? about 7 mill. long; dry. Head light brown, sparingly clothed with pale hairs; shape of the male; antennæ brown, densely clothed with pale hairs, 18 jointed; 1st stout, longer, 2nd very short, 3rd longer, all the following shorter, equal; the last one pointed; palpi as in the male; prothorax similar to the male, light brown; thorax and abdomen blackish brown (by exsiccation); meso and metathorax nearly equal, oblong, without any trace of wings; legs dark brown, articulation and tarsi pale; last ventral segment of abdomen not divided, lightly rounded on tip; of the appendages only the left one is present, but the tip of the apical joint is broken; the basal joint is not dilated; above, between the appendages, is a small, thin. elongated lobe.

Hab. Cuba; only one specimen carded and in bad condition, No. 136 of Gundlach's catalogue was received in 1866. If Mr. Wood-Mason's statements are to be accepted, it can be the female to the male described before. Should it be a female larva, which I scarcely believe it to be, it must belong to another and much larger species. The small larva quoted in my synopsis, p. 7, 4 mill. long, from the Museum in Berlin, was also received by Gundlach from Cuba. Probably it belongs to the same species, and is a larva.

2. *Oligotoma Hubbardi*, n. spec.

Length of the body 4 mill.; length to tip of wings 6 mill.; exp. of wings 8 mill. Male dry: Head very light brown, shining; on the sides very sparingly clothed with pale hairs; convex above, slightly narrower behind the eyes, which are black and comparatively larger than in *O. Cubana*, and less distant one from the other above; the part of the head behind the eyes a little broader than long, rounded behind, cut straight before the prothorax; antennæ (5 basal joints present) pale brown, densely clothed with pale long hairs; 1st joint short, cylindrical, scarcely longer than broad; 2nd, very small, thinner, annular; 3rd as long as the two

basals, thicker on tip; 4th and 5th similar to 3rd, but a little shorter; prothorax very small, much broader near the wings, divided by an anterior transversal sulcus; legs as in *O. Cubana;* wings very delicate (probably the specimen has been in alcohol, as the wings are crumpled) pale; venation as in *O. Cubana,* sector bifid; transversals not well visible; only indications of the white bands; abdomen pale brown; appendages broken. From what is to be seen of the tip of abdomen, the specimen is a male.

Hab. Entreprise, Florida, May 24, by H. G. Hubbard, to whom the Museum is greatly indebted for interesting specimens and other beautiful biological discoveries.

This is, as far as I know, the only specimen of an Embid collected in the U. S. It is in bad condition, and the description will have to be completed from other specimens. Though the species is obviously related to *O Cubana,* I believe the differences noted in the shape of the head and the antennæ, and the remarkably smaller size, justify the consideration of *O. Hubbardi* as a different species, till the contrary is proved. Difference in size has been noted, but never to such an extent. I possess only of one species eight specimens, which show differences in size, but only small ones.

3. *Oligotoma insularis.*

O. insularis McLachl., Ann. Mag. N. H., 1883, vol. xii., p. 227.

Length of body 8 mill.; exp. of wings, 12 mill.

Male, in alcohol: Body pitchy-fuscous, clothed with fine whitish pubescence; head a little longer than broad; sides oblique; occiput half as broad as the front part; eyes black, a little more distant one from the other than its diameter; in the middle, a little before the eyes, a small transversal impression, perhaps homologous to the obliterated ocellus in *Blatta* and *Termes.* Antennæ (only 10 joints present) fuscous, the articulations pale, whitish; 1st joint stouter than the others, a little longer than broad; 2nd very short, annular; 3rd twice as long as 2nd, a little larger on tip; 4th and 5th shorter than 3rd; 6th as long as 3rd, the following ones longer, more enlarged on tip; mouth-parts a little paler; maxillary palpi fuscous, articulations pale, apical joint ovoid, longer than the other ones, which are of equal length; labial palpi similar, apical joint ovoid, longer than the two basals. Prothorax oblong, as broad as the occiput, a little longer than broad, on each side notched after the transversal sulcus. Legs pitchy-fuscous, the articulations and tarsi pale,

except the enlarged basal joint of the fore legs, which is pitchy-fuscous. Abdomen pale dirty brown; the ventral ganglions very visible; last ventral segment dark brown, strong, ending in a bottle-shaped tube, somewhat contracted before its round opening; this tube is turned to the left side and partly surrounded by a horny hook originating between the left appendage and the tube, on which it is laying somewhat in the shape of a cornucopia. On the right side near the right appendage is a similar hook, but larger and more dorsal, as long as the tube; the basal half of it forms a spoon-shaped lobe, the apical third is analogous to the left hook, the tip bent up sharply; before tip inside a kind of blunt tooth; appendages long, the apical joint as long as the basal; the left appendage has the basal joint perhaps a little thicker at base; there is very little asymmetry if at all, in the appendages.

Wings narrow, pale fuliginous; radius dark fuscous, venation fuscescent; sector bifurcated, four transversals between its upper branch and the radius; three costals in the apical half of wing, the last one best defined; there are five longitudinal whitish bands in the wing.

Hab. One specimen from Honolulu. Mr. Hoffman, who owns a very large botanical garden there, containing many species of palms and orchids, had given orders to collect insects in his greenhouses. Among this miscellaneous lot was one *Oligotoma*. McLachlan's description is made from three carded specimens from the Hawaiian Islands; though it is difficult to compare dry and alcoholic specimens, it seems to be very probable that my specimen is *O. insularis*. The only difference of importance, the shape of the prothorax, may be the effect of exsiccation. A specimen from Antigua, in McLachlan's collection, is so similar to *O. insularis* that he hesitates to separate it therefrom. Perhaps the latter may be *O. Cubana*. Finally, a richer material will have to decide if *O. Cubana* is really different from *O. insularis*. The only specimen of the latter species before me is more delicate, the wings narrower, the colors much darker, the prothorax larger and different. It could have been imported into the Sandwich Islands with plants, just as other American insects.

4. *Oligotoma Saundersii.*

O. Saundersii, Westwood. Trans. Linn. Soc., vol. xvii., p. 373, pl. 2, f. 2.

O. Saundersii, Burm. Hde., vol. ii., p. 770.

O. Saundersii, Walker. List. Neuropt. Br. Mus., p. 531.

O. Saundersii, Wood-Mason. Contrib. Embid. Proc. Zool. Soc. Lond., 1883, p. 628-634, pl. lvi., f. 1-5.

O. Saundersii, Conry. Ascension Isl. Zool. Ann. Mag., N. H., 1881, vol. viii., p. 346.

Embia Latreillii, Ramb. Neuropt., p. 312-2.

E. Latreillii, Lucas. Ann. Soc. Ent. Fr., 1883, vol. iii. Bullet, p. cvi.

The species was described fifty years ago by Westwood: "Lutescenti-fuscescens, incisuris abdominalibus dilutioribus, alis pallide fuscescentibus, vittis 5 angustissimis albis longitudinalibus inter nervos longitudinales positis." The only known specimen from Bengal, formerly in W. Saunders' collection, belongs now to the British Museum. Burmeister, who had not seen the specimen, changed the color to "testaceofuscescens," which was copied by Walker, though the type was accessible to him. Rambur remarks that he had separated his *E. Latreillii* with 18-jointed antennæ from *O. Saundersii* with 11-jointed antennæ, only for this difference. I believe that McLachlan is perfectly correct in assuming the antennæ of the type imperfect and the identity of both species doubtless. (Journal Linn. Soc. xiii., p. 379.) He remarks, l. c., "in some examples there is a slender spiniform process between the articulate side processes (appendages); in *O. Saundersii* this spiniform process has a small tooth before the apex on the lower side. I do not see the process in all the examples, hence it may perhaps be sexual, and possibly is the intromittent organ." (McLachl.)

The 8 alcoholic specimens before me show all this process on the right side, but on the left side is a similar process, which in dry specimens is not well visible. Between both the last ventral segment is protruded asymmetrically to the left in a bottle-shaped cone, with a round aperture on tip. This is as in some Perlids and Phryganids the opening of the ductus ejaculatorius, representing the intromittent organ; the spines or similar organs have the purpose to open the female valves and to keep them in place during copulation. In *O. Saundersii* these spines viewed from beside are small bands, rounded on tip, with a small hook outside before tip; this hook is wanting on the left spine, which is also in other species more or less asymmetrical.

McLachlan has not described *O. Saundersii*, but he notes (by *O. insularis)* that the body is testaceous.

Mr. Wood-Mason found in July at Jubbulpore, E. India, a number of larvæ on a sandy spot, which were determined by McLachlan, Proc. Ent. Soc., 1879, p. 53, as possibly belonging to *O. Saundersii*. They show not the slightest traces of wings, although the asymmetry of the caudal appendages is quite apparent. Later winged specimens, being undoubtedly *O. Saundersii*, were captured; all were males of the same uniform brown color. The male sexual characters of alcoholic specimens are described. The abdominal asymmetry is carried to an extreme; not only are the caudal appendages unequal on the two sides, but the tenth dorsal and the ninth ventral segment also depart widely from symmetry, especially the former, which is incompletely divided by a deep angular notch into two unequal and greatly dissimilar parts (Wood-Mason, l. c., p. 632). The wings are described and figured in detail.

This is in fact all known about this species, except the communication by Mr. Lucas, to be recorded later. I received from S. E. Borneo eight specimens, collected in September and December. All are winged males. Their different color induced me to name them as a new species, *O. Borneensis*, especially as mine are well preserved in alcohol, and Wood-Mason's, of the same uniform brown color, were also in alcohol. Thirty years ago I twice studied the type of *O. Saundersii*, which was in good condition, and also the type of *E. Latreillii*, Ramb. As I do not find my notes, I believe it more prudent to unite the Borneo specimens with *O. Saundersii*, the more so as Rambur's description agrees.

Male imago: Length, with wings, 7-10 mill.; exp. of wings 11-16 mill. Head little longer than broad, behind the eyes rounded, about semi-circular; lightly convex above, hairy; yellowish-orange, the front part to behind the eyes dark reddish brown; clypeus pale; labrum pale, with a large brown middle-spot; max. palpi brown, articulations pale, the two apical joints a little longer than the three basals together; these are equal, as long as broad; apical joint ovoid, a little longer than the preceding one; labial palpi similar in color, apical joint ovoid, larger and a little longer than the two basals together. Antennæ much longer than the head, reaching the metathorax, densely hairy, 19-jointed (only one specimen has so many joints), brown, articulations paler; basal joint blackish, a little thicker, cylindrical; 2nd very short, 3rd longer than 1st, ob-conical; the next two or three joints equal, shorter than 3rd; all the rest as long and thick as 3rd. Prothorax much narrower than the head, longer than broad, with a transversal sulcus after the apical third, where the sides are

notched; yellowish, paler than the head; the other parts of the thorax and the abdomen more or less dark fuscous, with paler articulations. Legs fuscous, the articulations, the tarsi except of the front legs, and beneath paler. Wings fuliginous, villous, with five longitudinal narrow white bands; sector bifid; in the cell four to two transversals, and mostly two between the costa and the end of the cell. Appendages fuscous, stout, two jointed, of equal length, hairy; basal joint of left appendage much thinner at base and strongly enlarged on tip internally; basal joint of right appendage stout, cylindrical. The last dorsal segment somewhat cleft and deeply notched from the middle to the right side margin; in this place is inserted, with a largely inflated base, somewhat above the right appendage, a brown spiniform process; viewed from above the base is membranaceous paler; the process is horny, long, narrow (viewed from sides, rounded on tip), bifid at base, going outside of the membranaceous base, and sending the branch to the inner side; the inner branch and the process form a crescent, which is filled with a pale membrane, which on tip goes outside upon the process and forms a small sharp tooth; near the left appendage is a similar horny process, but without an inflated base, originating directly from the apical border of the segment; this process is shorter, a small lobe, similar to the other, ending (viewed from above) knife-shaped; between and beneath these processes is the last ventral segment produced in a cone, turned to the left side, with a round open aperture on tip.

Mr. Lucas, l. c., has given a very interesting note concerning the larvæ (?) and the habits of *E. Latreillii*. As Mr. Lucas, at the time of his publication, could not have had knowledge of Mr. Wood-Mason's article, it is still uncertain if the so-called larvæ were really larvæ or females. As Mr. Lucas has not recorded the number of joints of the antennæ, nor the asymmetry or symmetry of the appendages, we should better wait to express an opinion till these gaps are filled. The size of the larva is just the same as the male imago (8-10 mill.), therefore too small for a female, if Mr. Wood-Mason's suggestion is correct. The last dorsal segment is said to have a "petite fossette longitudinale," which would agree only with the male. The detailed description of these larvæ agrees well with *E. Latreillii*, and as the author has found among them the winged (male) imago, it will probably be that the described wingless forms were larvæ of the male. They were found by Mr. G. A. Foujade among the detritus of Cycas sent from Madagascar to the Museum of Paris. Larva and imago

live near the base of the leaves of Cycas, concealed in silken tunnels, woven by larvæ and imago. Mr. Lucas believes that this is the only instance known, that full grown imagos possess the power of spinning webs with the mouth; but the same fact is recorded long ago by P. Huber (Mem. Soc. Physiq. Genève, 1843, vol. x., p. 35-47) and other observers for *Psocus*. This faculty of spinning speaks for a relationship of Embidæ and Psocidæ.

Hab. Bengal, the type of *O. Saundersii;* Jubbulpore, between Bombay and Calcutta, end of July, 1879, and Calcutta, flying to the light in the dining-room, by Wood-Mason. *E. Latriellii* is recorded from Bombay, Mauritius Isl. and Madagascar; from Borneo, near Tumbang-Hiang, Sept., 1881, and from Telang, Dec, 1881. Both localities are in the south eastern part of Borneo. The insects were collected by Mr. Grabowsky. Both lots are in alcohol, and the specimens collected in December have exactly the same colors as those collected in September; all are winged males, and apparently identical with *E. Latreillii*. Perhaps the Calcutta specimens of *O. Saundersii* belong to the same species (McLachl. Record, 1883, Ins., p. 259), nevertheless the statement "all of the same *uniform* brown color," is rather suspicious. Mr. Corny, l. c., says that *O. Saundersii* is doing much mischief in Ascension Island; it is to be regretted that not more of the kind of mischief is recorded. The distribution of the species is a wide one; the habits of the species are only recorded by Lucas. In Jubbulpore Wood-Mason recorded them running actively by dozens (all male larvæ) on a bare and sandy spot, beneath old bricks, or openly. A violent thunder storm prevented the examination of the nest or tunnels inhabited by the insects. Mr. Westwood, l. c., p. 374, has seen a small apterous specimen of a dark brown color with a fulcous head, collected by R. Templeton on the Island of Mauritius. Probably it belongs to *E. Latreillii*.

5. *Oligotoma Michaeli.*

Embia spec.—Michael, Gardener's Chronicle, No. 157, vol. vi. (n. ser.) December 30, 1876, p. 845, fig. 156, orchid root eaten; f. 157, Embia magnified, antenna; f. 158, details of the structure of Embia; follows a notice by Mr. J. O. Westwood.

McLachlan, Gard. Chronicle, in a following number.

Oligotoma Michaeli McLachlan, Journal Linn. Soc. Lond. Zool., vol. 13, p. 373-384, pl. xxi.

Oligotoma Michaeli Wood-Mason, Proc. Zool. Soc. Lond., 1883, p. 630, pl. lvi., f. 6, female.

Mr. Michael, of Highgate, England, an extensive grower of exotic orchids, discovered in 1876 that a large mass of *Saccolobium retusum*, purchased from a London nurseryman, was apparently damaged by some insect, and examination revealed the presence of numerous Embidæ on the roots, concealed in silken tunnels. A winged example was unfortunately lost. More specimens were found in the nursery whence the plants were obtained. Mr. Michael gave an account of the discovery, illustrated by magnified figures, and accompanied by notes of Prof. Westwood, in which a doubt was implied as to the damage to the orchids being occasioned by the Embidæ. Mr. McLachlan, l. c., stated that Prof. Westwood's doubt appeared to be well founded. But the sequel proved, tolerably to his satisfaction, that the insects had eaten the roots to some extent. About the same time he received from W. A. Forbes a full grown larva without traces of rudimentary wings. Mr. Michael's figure shows a larva with only short rudimentary metathoracic wings, and McLachlan supposes that the mesothoracic pair may have been accidentally destroyed. McLachlan describes the species as *Oligotoma Michaeli*, and figures larva, nympha and imago. I should remark that all the foregoing is copied from McLachlan's excellent paper, though I have myself compared the quoted communications. Mr. Wood Mason, l. c., found in October, 1880, in the large plant house in the Botanic Gardens in Calcutta, a large wingless Embia crawling over the leaves of a plant, which he describes carefully and declares it to be the long sought for female. He does not give its name, except in the explanation of the plate, p. 634, where the figured abdomen, f. 6, is stated to be Embia *(O.) Michaeli.* He speaks, p. 631, of a black winged specimen different from his *O. Saundersii* collected in Calcutta, but he gives no description nor a name. I have received by Rev. C. C. Carleton, from Amballa, *E. India*, a female apparently identical with those described by Mr. Wood-Mason, and a small black-winged male. Both were in alcohol, together with numerous other insects, without any notes concerning their habits. I presume the male to be *O. Michaeli.*

McLachlan's descriptions are as follows:

Male, imago: Length of body 10½ mill.; exp. of wings, 18.

Deep black, somewhat shining; antennæ 24-jointed, the five apicals yellowish; legs black, knees and tarsi somewhat testaceous; append-

ages black, long, very asymmetrical; the right with the basal joint very broad, nearly quadrate; the left slender, and fully twice as long; a slender process with piceous apex from the base of the right appendage; ventrally is a large triangular projection of the last segment, concave above; wings dark smoky fuscous, with four very narrow longitudinal lines; 4–5 pale costal veinlets and three between the radius and the upper branch of the sector.

A well-grown larva is 12 mill. long; antennæ much shorter than in the imago; lurid-fuscous, the posterior portion of the head, the whole prothorax and legs more or less testaceous; underside pale; appendages with just the same asymmetry as in the imago. A starved nymph 9 mill. long; colors similar to those of the larva; legs more slender, asymmetry of caudal appendages less striking; rudimentary wings with evident neuration; fore wings reaching the base of metanotum; hind wings the apex of 2nd dorsal segment; the nymph when living was at least one-third longer. Hab. Among plants of *Saccolobium retusum* from East India in hothouses.

The three stages are described after single specimens. The color of the larva reminds strongly of the specimens from Borneo, described before as *O. Saundersii.* The figure of the nymph in the Gardener's Chronicle complicates things more. The hind wings cover only the anterior half of the metathorax, therefore the specimen was much younger than those described by McLachlan, in which the hind wings reached the apex of the second abdominal segment. Nevertheless the size marked in the Gardener's Chronicle is 16 mill., though McLachlan's when living, was only 12 mill. The figure (Gard. Chr.) shows on the hind part of the head and thorax spots and patches similar to those in Sialis and Corydalis. Mr. Wood-Mason speaks in several places of *O. Michaeli* as if he knows thls species, and finally described and figured (only the abdomen from below) *O. Michaeli.* Nevertheless his paper does not allow conclusions with certainty. The black male mentioned by him can only with doubt be united with *O. Michaeli*, as he does not mention the yellow apex of the antennæ; in fact he has not named it at all. The female, of which I possess a specimen, seems rather gigantic compared with the described male, so that I had provisionally described it as *O. valida.* But as McLachlan (Zool. Rec., 1883, p. 259) by the words in brackets, "apparently *O. Michaeli* McLachl.," accepts this determination, I have followed him not to encumber synonymy.

Female: Length of body 18 mill.; breadth 2 mill. Head nearly circular, convex above, blackish fuscous, reddish in the centre, densely covered with short reddish hairs; eyes very small, below and a little behind the antennæ, scarcely visible from above, kidney-shaped; facets less numerous, smaller and not convex, as in the males; indeed the eyes of the female are compound, flattened eyes, though those of the males are nearly aggregated eyes; clypeus short, transversal, somewhat reddish; rhinarium large pale membranaceous; labrum large, rounded, light brown, darker in middle; maxillary palpi very pale brown, the two last joints longer; labial palpi same color, last joint longer; head beneath, blackish, fuscous reddish in the middle; mentum transversal, quadrangular blackish fuscous. Antennæ (only 21 joints present) short, perhaps as long as the head, blackish fuscous, hairy, articulations pale; 1st joint thicker than the others, cylindrical, less than twice as long as broad; 2nd as long as broad, 3rd very little longer, 4th to 6th very short, annular; the seven following alike, about globular, the rest longer, ovid. Prothorax about as broad as the head, quadrangular, a transversal sulcus after the apical third, and a smaller one on the base; mesothorax about twice as long as broad, a transversal sulcus near the base; metathorax as long as broad, quadrangular; no traces of wings; the 10 dorsal segments of abdomen alike, a little shorter than broad, except the last one, which is longer, rounded on tip, obtuse, deflexed at the end. The first 6 ventral segments alike, half as long as broad; 7th shorter, the apical margin widely emarginated, the middle forming a small transverse-oval plate, behind which is to be seen the large genital aperture in the articulation of the segments; 8th segment a little longer; 9th split longitudinally in two lobes for the anus. Thorax and abdomen shining black and remarkable for its thick and firmly chitinized integument; below a little paler, brownish, and as commonly the nerves of the chorda ventralis can be recognized through the integument. Appendages symmetrical, two-jointed, cylindrical, apical joint a little longer and thinner; blackish fuscous, pale on articulations, femora and first joint of fore-tarsi strongly enlarged; middle legs less strong and smaller; the inflated 1st joint of the tarsus of fore legs with an external apical black spine, longer than the 2nd joint.

Hab. Amballa, *E. India*, by Rev. C. C. Carleton, one specimen in alcohol. There can scarcely be any doubt that it is the female of *O. Michaeli* described by Mr. Wood-Mason. The difference of the situation of the genital aperture at the base of 8th segment (he says the 9th) is only

seemingly, as he counts the "segment médiaire," of which he says, p. 630, "its sternum appears to be undeveloped." He calls the antennæ pale-tipped. Perhaps this belongs, as in the male, to the apical joints, which are wanting in my specimen.

It is doubtless true that the specimen just described is a female, as Mr. Wood-Mason has well proven by the location of the genital aperture between the 7th and 8th ventral segments; also that it is a full-grown female, as proven by the firmly chitinized integuments. How Mr. Wood-Mason arrived at the previous conclusion, that the females of Embia would be apterous, I do not know; though his supposition that the female would be probably larger in size, was justified by related families. In accepting solely on the high authority of Mr. Wood-Mason and Mr. McLachlan that this female belongs to *O. Michaeli*, it seems important to point out the differences of the male (after the description and figure by McLachlan) and the female.

1. The difference in size is very great, body of the female being at least one third longer, and half broader.

2. The female is perfectly wingless; no traces of rudimentary wings to be found at the anterior angles of the two thoracic segments. There seems to be indeed at the anterior angles a little below the dorsal plate, a very small hyaline membranous sac, but the insufficient material at hand would not justify the accepting of these sacs as traces of aborted wings.

3. The difference between the eyes of the male and the female is very striking, though not noticed by the author. The male has large eyes, prominent on the sides of the head, very visible from above, kidney shaped, and the socket of the antennæ placed in the emargination; the facets are globular. The female has the eyes much smaller, scarcely visible from above, below and behind the antennæ, from which they are wider separated; the hind part of the eye is about half broader than the front part; no inner emargination exists; the facets are smaller and flattened. The eyes of the male are more like aggregated eyes (Stylops), the eyes of the female are like the common compounded eyes of insects. The consequences of these differences are very visible in the shape of the head. The largest diameter of the head of the males is situated between the eyes; behind them the sides of the head slope down to the occiput. The head of the female is nearly orbicular, or at least very shortly ovoid. A sexual difference of the eyes does not exist, as far as known to me, among the Perlids, but very often in Psocids and Ephemerids.

4. The antennæ seem to be shorter and the joints partly more globular in the female, a character not uncommon among the Psocids.

5. The difference of the meso- and metathorax among the sexes is not much marked, owing probably to the fact that the wings of the male imago are inserted with a very narrow base, which gives a very fine membranous fold farther down along the sides. The sternum of each of the three segments of the thorax is divided in three parts. The segment médiaire is the last part of the metathorax, and the dorsum of this segment belongs to the metathorax. The abdomen has only seemingly 10 dorsal segments.

6. The apex of the first tarsal joint of the fore legs of the female has an external spine, longer than the second joint, conical, very sharp. I have not yet fouud such a spine in any male.

7. The anal appendages of the abdomen are symmetrical in the female; asymmetrical in the male, similar to Blatta. I do not know that a similar asymmetry exists among Pseudoneuroptera.

I am at a loss to understand where the larva described, p. 384, fig. 1, by McLachlan, belongs. The whole figure represents well a younger female only 12 mill. long, except that the eyes are a little larger and more visible from above. The description states, "just the same asymmetry as in the imago." This would indicate a positive difference. But there is not to be seen in the figure any asymmetry, and the segment before the last seems to be shorter. The description mentions not the ventral parts, which would be deciding. If it is not a female—and it can hardly be assumed that younger females should possess asymmetrical appendages—it can not be a male larva, being longer than the largest male imago, and not showing the slightest traces of wings. Perhaps a new examination of the type will solve the question. I can not accept the starved nymph, p. 384, fig. 2, as a nymph. The wing cases of nymphæ in Orthoptera (and Pseudoneuroptera) are always more or less connected at base, and never entirely free as in the figure. Perhaps the specimen represents a so-called short-winged form, which occurs not uncommonly among Perlids, Psocides and Termites. The figure in Gard. Chronicle (fig. 157) would represent a female (the external spine of the first tarsal joint of the fore legs is visible) if the wing sacs of the metathorax were not so well marked.

There is apparently more detailed information needed on *O. Michaeli*. As the large orchid growers here are accustomed to buy their East Indian species mostly from London nurseries, I have taken steps to ascertain if any Embids have been imported with the plants.

Male imago: Length 8½ mill.; exp. of the wings 12 mill.

There is before me one specimen from Amballa, *E. India*, by the same collector, Rev. C. C. Carleton. It did not arrive in the same lot with the female, but several years before in alcohol, together with many other insects. The very large discrepancy in size of the female, and the considerably larger size of the male described by McLachlan, though his specimen was dry, together with some differences with the description, seemed to justify my specimen as a new species, perhaps identical with the black one from Calcutta, mentioned without description by Wood-Mason. Nevertheless, some of the differences may be the result of the drying up of the specimen described, and therefore I decided to accept the specimen as a small *O. Michaeli* till the contrary is proved. It differs as follows from McLachlan's description:

There is no large, nearly circular, shallow depression on the disc of the head above; but between the eyes is a short engraved furrow, similar to an aborted ocellus. Antennæ brown with paler hairs, instead of black with black hairs; what remains, 17 joints, is considerably longer than the head and prothorax together; shape of joints as in the description; I do not know if the five apicals were yellow,; when I figured years ago the details of the specimen, and counted 21 joints, I did not note in the description that the two last joints were yellow. The pronotum is not nearly twice as long as broad; after the straight front margin and transversal sulcus, there follows a somewhat diamond-shaped elevation, and the base after it is membranous. Legs, wings and veins as in the description; the only black vein is the subcosta, which, as Wood-Mason justly remarks, is not coalescent with the radius; all other veins are brown. The wings have indeed five white longitudinal lines, only the first one behind the costa is very narrow. Appendages long, asymmetrical, brown, with long black hairs, the basal joint of the right one long, broad, straight, but by no means nearly quadrate, as in the decription; the left is a little longer, slender, thinner at base, curvated; the apical joints alike, cylindrical, straight, about as long as the basal joint. The last ventral plate is asymmetrical; somewhat more to the right originates with a larger base a cylindrical tube, straight, but turned a little to the left; shortly before its apical opening it is a little constricted; between it and the right appendages is a slender process, as long as the tube, cylindrical, its apical half thinner, tip pointed; on the left side, between tube and appendages, is a process with thicker membranous base, the apical half slender, much

twisted, sharp on tip, much shorter than the tube. I believe it probable that the difference mentioned may be explained from the fact that McLachlan had before him only a dry specimen, and I only one in alcohol. As soon as this species can be more easily got for study, we may hope to have detailed descriptions from a larger material.

DESCRIPTION OF THE LAST LARVAL STAGES AND CHRYSALIS OF MELITAEA RUBICUNDA, H. Edw.

BY W. H. EDWARDS, COALBURGH, W. VA.

On 13th Sept., 1884, I received from Mr. James Fletcher 22 larvæ in hibernation, part of a lot sent him shortly before by Rev. Geo. W. Taylor, of Victoria, V. I. The larvæ, on exposure to the light, moved about, but refused to eat Chelone glabra. I placed them in cellar, and in October forwarded to Clifton Springs, N. Y., with larvæ of other species, to go in the "cooler." On 7th March, I received them again, and found about one half to be alive. These I put in the ice house till I could get leaves of the food-plant. In last days of April they were brought to the house and given Chelone, the living larvæ now being reduced to six. On the third day, I noticed that the leaves had been eaten, and three or four days later the larvæ looked healthy and had recovered the length and diameter which they had on 13th Sept., larvæ always shrinking much during hibernation. The description then taken is as follows:

After supposed third moult: Length $\frac{7}{10}$ inch; cylindrical, rather thickest in middle, and tapering equally to either end; color black and gray-white; a mid-dorsal band of the latter color, cut longitudinally by a black line; then a broad black band reaching to middle of side, dotted with gray on the tops of the cross-ridges; below this to base about equally black and gray, sprinkled and mottled; the spines arranged as in the allied species, there being seven principal rows, one dorsal, and three on either side, besides a row of minute ones along base; these upper spines are rather long, broad at base and taper to a blunt top, and are beset thickly from base to top with long black hairs; the dorsal row spring from large orange tubercles, and for a little distance above are orange, the rest black; the other rows have black tubercles and the spines are black,

except that in the lower lateral row, from 6 to 10, there is a little orange on the outer side of each tubercle; the small spines of row along base are orange, from orange tubercles; segment 2 has a black chitinous dorsal collar on which are many small black spines, with hairs; feet black; pro-legs black, the last joint yellowish; head ob-ovoid, flattened frontally, depressed at suture, the vertices rounded; color dull black, the surface rough, thickly covered with long black hairs.

On 2nd May, one larva passed the first moult after hibernation, the supposed fourth moult. At 24 hours from the moult: length $\frac{5}{10}$ inch. By 10th May, this larva had reached maturity.

MATURE LARVA.—Length .9 inch; cylindrical, thickest in middle; color black, with a slight dorsal band of gray-white, made up of white tubercles on the cross ridges, and a heavier band of same color along lower part of side, the black area between the two being thinly dotted white; the spines long, stout at base, tapering, and thickly beset with long black hairs; those of dorsal row black at tips, the rest and the large basal tubercles, yolk-yellow; those of the other three rows black, the bases black; the small spines along base of body yolk-yellow on 6 to 10, the rest black; on 2 a chitinous collar with many small black spines with hairs; feet black, pro-legs black, the last joint yellowish; head ob-ovoid, flattened in front, depressed at top, the vertices rounded; surface rough with many long, black hairs; color dead black.

On 12th the larva suspended, and at 8 p. m., 13th, pupated. From last moult to pupation 11½ days. (In case of other Melitaeas, two moults have occurred between hibernation and pupation.)

CHRYSALIS.—Length $\frac{5}{10}$ inch; breadth across mesonotum and abdomen $\frac{4}{10}$ in.; shape of *Phaeton;* cylindrical; head case narrow, compressed transversely, excavated at the sides; mesonotum not prominent, rounded, somewhat carinated, followed by a shallow excavation; the tuberculations which correspond to the larval spines and tubercles rounded, raised but little above the surface; color of anterior parts and wing cases dark pearl-gray, marked and spotted with black; of abdomen diluted black dotted with dull white, especially along mid-dorsum, and across same, on the posterior part of each segment, where the dots form parallel rows; the mid-dorsal tubercles orange, making a round spot on the fore part of each segment, and on each spot are two small black spots in cross row; in line with the spiracles, on the anterior side of each, is a slight orange discol-

oration ; along ventral side two rows of small orange spots corresponding to the small basal tubercles of the larva ; the wing case shows a large black patch on disk, also irregularly serrated marginal black spots, and submarginal spots, rounded and sub-lanceolate ; head case largely black ; on anterior part of mesonotum a large black sub-rectangular patch, below which is an arched stripe of black, and under this, at summit, two spots ; on the posterior part two curved demi-bands meeting at the carina.

From this chrysalis came a female butterfly 23rd May. Duration of this stage 10 days.

Another larva went to pupa and imago in Philadelphia, in Mrs. Peart's care. The other larvæ from the first eat little, and some became lethargic, and some of them died. But one seemed healthy and asleep, and 23rd May I returned it to the ice box. From time to time I looked at it ; on 6th July brought it to my room and laid it on Chelone leaf. But as by 8th it had eaten nothing, though it had moved a little in the glass, I replaced it on the ice. As I write, 20th Aug., it is sweetly sleeping. It seems odd that a larva in this climate should go over the second season, as this bids fair to do.

Rubicunda belongs to the *Anicia* sub-group, flies from North California at least to Vancouver Island. I have had mature larvæ of *Anicia* and of *Baroni* (another of this sub-group), and the three species are distinctly different in this stage. They all have similar habits as far as I know them, and probably all will eat the plant of *Phaeton*, Chelone glabra, as *Chalcedon* also does.

INSECTS IN ARCTIC REGIONS.

[Extracted from "Das Insektenleben in Arktischen Landern, von Christopher Aurivillius," forming part of Nordenskiold's "Studien und Forschungen veranlasst durch meine Reisen im hohen Norden." Leipzig, 1885.]

(From the Entomologist's Monthly Magazine.)

A special interest attaches to the question of the mode of life in insects in relation to their surroundings in high Northern latitudes. Knowing, as we do, that the time available for the development of an insect in the extreme North is limited to from 4 to 6 weeks in the year, one has felt

surprised how it could be possible for certain species to run through all their transformations in so short a time.

R. McLachlan, in his paper on the insects of Grinnell Land (Journ. Linn. Soc., Zoology, vol. xiv.), refers to the difficulties which the shortness of the summer interposes to the development of insects, and intimates his suspicion that a development which would with us take place in a single summer would there require several summers.

The correctness of this suspicion has been completely established by the interesting observations on species of *Lepidoptera* in South Waranger, in latitude 69° 40′, made by G. Sandberg. He was successful in watching the development of some extreme Northern species from the egg.

Let us take as an example *Œneis Bore*, Schn., a true hyperborean butterfly, which has never been found outside the Arctic circle*, and even there only occurs in places which bear a truly Arctic stamp.

The imago flies from the middle of June onwards, and lays its eggs on various species of grass. The eggs are hatched the same summer; the larva hibernates below the surface of the earth, feeds and grows all through the following summer, but does not succeed in attaining its full size; it then hibernates a second time, and does not assume the pupa state till the spring of the following year.

The pupa, which in the allied forms in more southern localities is freely suspended in the air to a grass-stem or some similar object, here reposes in the earth, which in so inclement a climate must evidently be a great advantage.

The butterfly escapes from the pupa-skin after an interval of from 5—6 weeks, a period of unusual length for a diurnal Lepidopteron. In more southern lands the pupal repose of butterflies in summer rarely exceeds a fortnight. Hence, the entire metamorphosis is more tedious than in more temperate regions.

By these and other observations, Sandberg shows that one Arctic summer, in latitude 70°, does not suffice for the development of many *Lepidoptera*, but that two or more summers are required for the purpose.

If, therefore, more than one summer is needful for the development of *Lepidoptera*, it appears to me even more certain that Humble-bees must

* Mr. W. H. Edwards informs us that Mr. David Bruce has taken *Chionobas Taygete* Hub., which is syn. of *Oeneis Bore* Sch., in Colorado, on summits, at high elevation. Mr. Edwards' Catalogue, No. 304, says *Taygete* Hub. = *Bootes* Bd., and Staudinger's Cat. says *Bore* Sch. is the same as these, that is, it is all one species.—Ed. C. E.

require more than one summer. With us it is only the fully developed females which survive from one year to the next; in spring they form the new nest, lay eggs, and bring up the larvæ which develop into workers, and thus begin to contribute to the support of the family, whence at last towards autumn males and females are developed. It seems hardly credible that all this can happen each summer in a similar way at Grinnell Land, in latitude 82°, especially as there the supply of food must be less than with us. Hence, the development of a colony of Humble-bees must there be something quite different.

Were it not satisfactorily established that Humble-bees do occur in such high latitudes, one might, from our knowledge of their mode of life, be disposed to maintain that under such conditions they could not live.

They seem, however, to have one advantage over their more Southern brethren. In the Arctic regions they do not seem to be troubled with parasites, such as *Conops*, *Mutilla*, which help to diminish their numbers in other countries.

BOOK NOTICES.

Revised Catalogue of the Diurnal Lepidoptera of America North of Mexico, by Wm. H. Edwards, 8vo., pp. 95. From Transactions of the American Entomological Society, 1885.

This revised catalogue of American butterflies was greatly needed. Since Mr. Edwards published his first catalogue in 1877, much new material has accumulated, more than a hundred new species have been described, while a vast amount of information has been published on the preparatory stages and habits of these insects. Much of this has been communicated by the author of the catalogue himself, who has brought an amount of enthusiasm to bear on this interesting field of research exceeding that of any of his predecessors or co-laborers, while his full and accurate descriptions have been everywhere appreciated. Other excellent workers have also added to our stock of knowledge in this department, to all of which ready reference is had by the use of this catalogue. The new edition gives fuller references with dates, whereas the former catalogue gave no date. Many corrections are made in the synonymy, the result of a careful scrutiny by the author of every species in the entire list; the localities also are given with greater fullness. A large propor-

tion of the additions to the list of new species are to be found in the Hesperidæ, to which 56 have been added. Many additions have also been made to Melitaea, Thecla and Argynnis. A new and excellent feature is a copious index of genera and species, which will be much appreciated by all who have occasion to consult its pages. In this catalogue the author has given us the full benefit of his long experience and careful study, and has produced a work which will not only commend itself, but will be indispensable to all who are engaged in the study of American butterflies.

CORRESPONDENCE.

Dear Sir: In the last No. of the ENTOMOLOGIST appears a description of *E. Provancheri* by M. L'Abbe Provancher, in which the species is credited to British Columbia. This is a mistake, as the specimens contributed to him, and from which the description was made, were bred from cocoons of *A. Luna*, collected in Muskoka, a little south of Bracebridge, by Mr. R. Mosey, who handed them to me.

W. BRODIE, Toronto.

Dear Sir: On page 107 of the present volume of the CAN. ENT., Mr. Frederick Clarkson gives an account of his "Seaside Captures," and at the close of the paper says: "Among the treasures of the beach I collected several shells perforated in every part by the young of one of the lower order of Crustaceans, and rendered immaculate by the washing of the tide and the sun's rays." A little further on he continues: "The mouth parts of these Sea Worms, or Barnacles, are strong and corneous, and are capable of excavating galleries in the hardest substances."

Mr. Clarkson is in error in ascribing this tunneling of the shells to a Crustacean, for it is the work of a species of sponge (Cliona). If some of the recently cast up shells are broken open, the sponge will be readily seen, and its structure may be examined. It burrows in marble, as he describes, and particularly in the oyster, though also in other shells, such as Natica and Pyrula.

WM. T. DAVIS, Tompkinsville, Staten Island.