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# The Canadian Entomologist.

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No. 11

## ENTOMOLOGY AT BRIGANTINE BEACH, N. J., IN SEPTEMBER.

BY JOHN HAMILTON, M. D., ALLEGHENY, PA.

In the preceding volume of the ENTOMOLOGIST (vol. xvi., p. 186) an account is given of some of the Coleoptera found in September on Brigantine Beach, N. J.; and having been there this season from the 1st till the 18th of the same month, I propose to give a further account of some of the insects inhabiting that region.

*Cicindela dorsalis* Say is found in great abundance on the shore between the lines of high and low tide, keeping as close to the water as it can get. If too closely pursued it frequently takes wing, alighting in the surf and coming to the shore in the foam, from which it usually escapes before it can be taken. It is sluggish in its movements, running about a yard, then stopping, and so on alternately, and flying only when pursued, and then for but short distances. More than two-thirds of the females captured want either a part of an antenna or of a hind leg, these mutilations occurring on the right side in a large majority.

*Cicindela hirticollis* Say is likewise in as great abundance as the preceding, but does not mingle with it nor willingly pass the high tide line, inhabiting bare depressed places on the sandy beach surrounded by hillocks of white sand, on which it delights to bask in the hottest sunshine. It is a great lover of heat and light, and is sought for in vain except during a few hours of the warmest and brightest days. It is very wary and active, and by no means easily taken.

*Cicindela repanda* Dej. also occurs plentifully in bare places surrounded by grass, and on paths and roads where the ground is dark; when disturbed it rises and lights a short distance off in the short grass, where it is easily taken before it can again arise.

Though inhabiting contiguous territory, the habits of these three species keep them socially separate.

On the main land other *Cicindela*s occur in abundance. On the 14th, while there, I took in less than an hour sixteen specimens of *C. modesta*, ten of *vulgaris*, and two of *generosa*, and saw many others. I had only to stand beside one of the many bare spots that are common in the pine woods, and throw the net over the insects as they came to bask in the warm white sand. In these woods I also met with several females of a fine, large *Mutilla (occidentalis)*, black beneath, bright scarlet above, with a black abdominal band. The specimen I took measured .90 inch in length, and though the temptation to take others of so beautiful an insect was great, being unfortunately without forceps, prudence gained from painful experience forbade.

Brigantine is inhabited by many species of Carabidæ, most of which are widely distributed and not confined to maritime regions.

*Calosoma scrutator* Fab. occurs alive frequently, but is likely brought from the main land by the waves.

*Pasimachus sublaevis* Beauv. is found sparingly, there being now scarcely anything for it to live and shelter under; formerly it was abundant. The same remarks are applicable to *Scarites subterraneus*. *Platynus punctiformis* Say is plentiful, living under all kinds of debris and decaying grass. With it is found in less abundance *Pterostichus erythropus*. *Amara subaenea* Lec. and *A. musculus* Say are of common occurrence. The latter is pollenivorous as well as carnivorous, being often taken on the spikes of grasses in flower, as well as in the vicinity of decaying animal substances.

*Dermestes Frischii* Kug. was found as usual, and in considerable numbers. It seems to have immigrated to stay.

*Nitidula ziczac* Say inhabits dead birds, which are often met with. These do not become putrid nor breed Diptera, literally drying up, and in this state becoming the abode of *ziczac*.

*Sphenophorus retusus* Gyll. Of this only a few specimens were taken in former years, but this season it occurred in the greatest abundance. The larvæ evidently live in the culm, or on the roots of the beach grass, *Calamagrostis (Psamma) arenaria*. This is a very coarse grass with a culm frequently .25 inch in diameter. The loose sand drifting among it forms hillocks four or five feet in height, the grass still shooting upward as the sand accumulates, and throwing out roots beneath to retain it. There is nothing else growing there on which they could possibly live. The beetles were found in multitudes from the first to the sixth day of the

month, but after that time very sparingly. They seemingly emerge around the culms of grass, crawling slowly over the loose sand till they find mates, and always directing their course upward towards the highest point, probably on account of its being the warmest. They appear to require sunshine, warmth and dryness, not being seen when it is cloudy, cold or damp. After pairing the males soon die and lie scattered over the sand, but whether the female goes into hibernation or proceeds to oviposit forthwith could not be ascertained. In the latter case there is ample time for the ova to hatch and the larvæ to be well developed before severe frost, which would rarely affect them before the middle of November.

*Sphenophorus cariosus* Oliv. A few specimens of this beetle were found with *retusus*, and its larvae presumably live on the same grass, but, if abundant, its time of development must be earlier.

*Sphenophorus costipennis* Horn is found sparingly in hibernation under sods around the sand hills, and likewise undoubtedly lives in the larva state on the roots of the same grass, there being nothing else to feed on within a reasonable distance.

The foregoing species of *Sphenophorus* seem to prefer dry situations where there is no more moisture than naturally belongs to the soil.

*Sphenophorus placidus* Say is, on the contrary, of a more aquatic habit, being abundant on the salt marshes, where its larvae undoubtedly live on the roots of a very fine short grass that grows there densely, and is saturated almost daily with the water of the incoming tides. In September the beetle is found in great numbers in hibernation under drifted timber that has become much imbedded in the wet soil and grass, where for much of the time it must be immersed in salt water.

*Sphenophorus pertinax* Oliv. Occasionally specimens are found with *placidus*, but more commonly it occurs in hibernation under sods left in dry places by the highest tides, seemingly requiring less moisture than *placidus*.

All the foregoing species of *Sphenophorus* seem to be widely distributed except *retusus*, which, so far as known, is strictly maritime and not often taken, at least there are few with whom I exchange whose cabinets I have not supplied.

#### LEPIDOPTERA.

The species found on the island are not numerous. *Picris rapæ* Lin. is abundant, though cabbage is little cultivated. I found over a dozen of

the pupae on the beach under a small board, and on searching for the food plant, discovered the larvae had fed on the *Cakile americana*—a curious maritime plant, which though belonging to the Cruciferae, is very remote from the cabbage.

*Callidryas eubule* Lin. Specimens were observed on the wing nearly every day along the margin of the ocean, flying apparently at the height of fifteen or twenty feet and about the same distance from the shore, so that their capture could not be effected, though I took a crippled one and thus ascertained the species. All appeared to be southward bound, flying steadily but slowly.

*Colias philodice* is annually represented by a few specimens. In the absence of clover, the larvæ probably feed on an abundant native species of Phaseolus that seems in perpetual bloom, and of which the butterfly appears very fond.

*Danaï archippus* Fab. The multitude of this butterfly that assembled here the first week in September is almost past belief. Millions is but feebly expressive—miles of them is no exaggeration. On the island is a strip of ground from 150 to 400 yards wide and about two and one-half miles in length, overgrown with *Myrica cerifera*; after three o'clock these butterflies coming from all directions, began to settle on the bushes; and by evening every available twig was occupied. To see such multitudes at rest, all suspended from the lower sides of the limbs, side by side, as is their well known custom, was something well worth seeing. One evening I travelled more than half the distance of their encampment, and learned that it extended the whole length and breadth of the bushes. In the morning they gradually separated and did not appear unusually numerous during the day, but in the afternoon they came again as described. I found them on the second, the day of my arrival, as related above, and this was repeated daily till the sixth, the forenoon of which was rather calm and sultry; a storm of wind and rain came on about two o'clock p. m., continuing till midnight. The next afternoon few came to camp; the great army had disappeared—but, how? when? where to? During the next few days they appeared again in considerable numbers—about as they had been observed in former Septembers—but insignificant when compared with those that preceded. The males and females were about equal in numbers. Not a single stalk of their food plant (*Asclepias*) grows on the island. On the main land, seven miles distant, I observed several patches of *A. tuberosa* in full bloom, but saw neither larva nor

butterfly; and as I learned that this plant is plentiful in that part of New Jersey, a scarcity of food will not account for this migratory habit. Neither will a scarcity of timber in which to hibernate, for this is superabundant. For a good account of this butterfly see Riley's 3rd Missouri Report, p. 143; American Entomologist, vol. 3, p. 101; CANAD. ENT., vol. 12, p. 37, 38.

*Pyrameis huntera* Fab. is quite common, its food plant (*Gnaphalium polycephalum*) growing there abundantly.

*Deiopeia bella* Lin. This pretty little moth flies in the hottest sunshine and is excessively abundant. The food plant of the larvæ is unknown to me, but the imago frequents the flowers of a maritime species of Solidago.

*Spilosoma acraea* and *virginica*. The larvae of these two species were seen, but not in great numbers.

*Anthera polyphemus*. The larvae occur in abundance, and might be collected by the peck from the Bayberry bushes, on the leaves of which they feed. There is a marked difference between the imagos produced from the coast larvae and those raised here, the former having the colors brighter and the red on the wings deeper and more extensive.

*Hyperchiria io*. The larvae are likewise found on the Bayberry bushes, but being a general feeder, it abounds on many plants, especially such as are cultivated. It is in bad repute with the natives, one of whom informed me that its "sting" was certain death in about fifteen minutes, the only remedy being several liberal "whiskies" taken immediately.

I noticed the larvae of three or four other species of Bombycidae, and a few Noctuidae; but the place does not seem to be congenial to many species of the latter family.

The hymenopterist would find several interesting things in his line there. I observed two species of small Mutilla living in colonies in the sand hills. There are at least a dozen species of sand wasps, all seemingly solitary and in constant search for prey. There is a black species about one inch in length that I have frequently seen pounce on an unsuspecting Crustacean (sand crab) of at least twice its weight, give it a quick stab, and then haul it rapidly off to its burrow in some convenient sand hill.

I close this paper with a brief notice of a young but very enthusiastic entomologist, whose acquaintance I formed there, Master Lewis Barber, two and one half years old, a grandson of the proprietor of the hotel. This young gentleman spends all his leisure time—all that is not occupied in eating and sleeping—in collecting insects in all orders except Hymen-

optera, and is never happy unless he has some living thing in his hand. He takes particular delight in catching that ferocious Dipter, the green-headed fly, which he dexterously holds by the legs, greatly admiring its buzzing, and can not be induced to go to bed without having one of them, or something else, in his fist. His captures are never killed nor tortured, but dexterously thrust into a tin box with a sliding lid, which he carries with him; there he puts what he calls millers, grasshoppers, crickets and bugs. When he takes anything, he examines it with as much interest and gravity as his older brethren. He has no fear, handling caterpillars and worms with great composure, to the intense disgust of his mother and his lady acquaintances, who say the more hateful and horrid a thing is, and the more it wriggles, he likes it the better. His admiration was unbounded when I presented him with a larva of *Polyphemus*. He cares little for the companionship of other children unless they join him in catching insects. This entomological disposition was manifested, his mother says, before he could crawl, and all her endeavors have not in the least tended to wean him from what she calls "such horrible and disgusting playthings."

Perhaps I am now writing the first page of the biography of a renowned entomologist of the future. Who knows? This sketch will recall to such as have read "The Life of a Scotch Naturalist, by Samuel Smiles," the childhood days of Thomas Edward, associate of the Linnaean Society. Those who have not, have neglected one of the most intensely interesting biographies ever published.

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## MONOGRAPH OF THE EMBIDINA.

(Continued from page 199.)

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

17. *Embia (Olynthä) Mülleri*, n. sp.

Wingless form, female? dry. Length of body 12 mill.

Body large, stout, black, very sparingly clothed with yellow hairs; shining, the head alone semi-opaque. Head large, flat, scarcely longer than broad, a little narrowed to the occiput; hind angles rounded; a shallow impression above with a short longitudinal engraved line; eyes black, small, not prominent; antennae only 21 joints present, which are as long

as head, pro- and mesothorax; black, with yellow hairs, the 10 last joints strongly polished; 1st stouter, cylindrical; 2nd short, annular; 3rd cylindrical, as long as first; 4th and fifth very short; the rest successively longer, nearly pyriform, the last ones about ovoid. Epistom half as long as broad, sides rounded, front margin widely notched; labrum large, a little narrower at base, front margin rounded and a little yellowish, as well as the sides of the epistom; max. palpi dark brown, villous, stout, compressed, the three basal joints short, equal, 4th longer, obliquely truncated at tip, 5th a little longer and larger, ovoid; labial palpi compressed, broad, 1st very short, 2nd about as long as broad, 3rd longer, the broad apex rounded. Prothorax a little longer than broad, behind a little broader; narrower than head; side margins nearly straight; a transversal sulcus after the apical third; a fine engraved median longitudinal line; mesothorax broader and longer, flattened; near the anterior margin a transversal impression; the anterior angles rounded, a little swollen along the sides; disk with a large shallow impression; metathorax quadrangular, shorter but as broad as the mesothorax; impression near the anterior margin stronger; anterior angles more inflated, behind them a transversal small furrow, as indication of a separation; in mesothorax and metathorax the anterior margin and angles pale yellow; the "segment médiare" connected with the metathorax short, rounded before. Abdomen flat, one third less broad than the thorax, shining, very hairy; dorsal segments alike, transverse, short, the last one larger, rounded; appendages large; basal joint short, broad; apical joint much longer, ovoid; the two last ventral segments with a median longitudinal deep furrow. I can not see a genital opening, these parts being shrivelled up. Legs strong, very hairy, black shining; fore legs reaching the tip of mouth parts, femurs long, compressed, dilated; tibiae alike, shorter; tarsus with first joint shorter than tibia, bent to below, dilated with a median furrow; no spine; the two apical joints small, much shorter; middle legs similar but shorter, thinner, very little dilated; hind legs as stout as the fore legs, femur much dilated, tibiae shorter, not dilated; tarsus short, yellowish, basal joint less than half of the tarsus, cylindrical, stouter than the following ones, of which the 2nd is very short, the 3rd as long as the 1st. I see no asymmetry of the end of abdomen, but those parts are not in good condition.

Hab. One specimen from Itajahy, S. Cattarina, S. Brazil, collected

1879, by Dr. F. Müller, to whom the Museum is greatly indebted for interesting specimens and biological notices.

The specimen arrived in a letter, and is a little crushed, perhaps flattened. It is the only wingless specimen of *Olyntha* seen by me. I suppose it to be a female, because no male genitals between the appendages are to be seen, and the last ventral segment has a longitudinal furrow (or is perhaps split). There is no female of *Olyntha* known; if the females are colored like the males, this specimen belongs to a new species. The apparent indication of wings looks decidedly as when they are abortive and will never be developed. Therefore it can be assumed that the specimen is a female imago, or if winged females should exist, a wingless form similar to those of the *Termitina*.

### HISTORY OF THE FAMILY.

Latreille, *Familles nat. du règne animal*, Paris, 1825, p. 437, at the end of the *Termitines*, says: "Les genres *Termes*, *Embie* (voisin du précédent, mais à antennes différentes)." In the German translation by Dr. Berthold, 1827, p. 435, the French expression *Embie* is given as *Embium*. Latreille, in *Cuvier's Règne Animal*, new (2nd) edit., 1829, vol. v., p. 256, states in a foot note: Some insects of the southern parts of Europe and of Africa are related to *Termes*, but with the head broader than the prothorax, three-jointed tarsi, wings not longer than the abdomen or none, with compressed legs, the two anterior tibiae (sic!) much broader, without ocelli, and the thorax elongate form, the genus indicated in the *Familles Nat.* with the name *Embie* (*Embia*). It has been figured in the large work on Egypt. Indeed the celebrated Savigny, in *Descr. de l'Égypte Zool. Neuropt.*, pl. 2, f. 9 and 10, had figured one species with numerous details (*E. Savignyi* Westw.) The plate was drawn and engraved between 1805 and 1812, but not published before 1825. There are on the plate only the names of the families, even the *Termitines* wanting among them, but no names of the species. In the meantime the unfortunate Savigny had become blind, and an *Explication Sommaire* of the plates by V. Audouin was published in the last months of 1825. The note concerning *Embia* is as follows: "The two insects, figs. 9 and 10, form a new genus, named by Latreille, *Famil. Nat.* p. 437, *Embie*, which he places near *Termes*. M. Savigny has established the same relation by placing *Embia* on the same plate at the side of *Termes*." I may remark

that the two insects of which V. Audouin speaks belong to one and the same species; fig. 9 represents the insect from above, fig. 10 from below.

Mr. R. Gray, in Griffith's ed. of Cuvier, vol. xv (Insects, vol. ii., 1832) p. 346, translates Latreille's note and describes briefly a new species from Brazil as a new genus, *Olyntha Braziliensis*. It was separated from *Embia* by having the antennæ as long as the body, the thorax much longer and more separate from the head, which is rounded posteriorly, the terminal joints of the palpi rather longer. It is figured (magnified) on pl. 72, f. 2, by Westwood, and named on the plate *Embius? Braziliensis*, J. R. Gray. The type formerly in Mr. Children's collection is now in the Brit. Museum.

Prof. J. O. Westwood in Trans. Linn. Soc. Lond. 1837, vol. xvii, p. 369-374, pl. 1 (read March 4th, 1834) published: Characters of *Embia*, a genus of insects allied to the white ants (Termites), with description of the species of which it is composed. He describes three species which he places as three sub-genera of the genus *Embia*, after single specimens, one of them, *Embia Savignyi* West., only after Savigny's figures. The second, *Oligotoma Saundersii* Westw., from Bengal (the type now in the Brit. Museum); the third, *Olyntha Braziliensis* Gray, formerly described in Griffith. The sub-genera are divided in such with 5-jointed palpi, antennæ shorter than the prothorax, with less than 20 joints (*Embia* and *Oligotoma*), and with 4-jointed palpi, the antennæ about as long as the body; the 4th vein trifold (*Olyntha*). The first group was divided by the 4th vein trifold (*Embia*) or bifid (*Oligotoma*). The numerous details figured give to his work a permanent value. The genus *Embia* is said to combine *Termes* with *Eusthenia*, a Perlid; why is not stated.

Burmeister, 1839, in his Handb., vol. ii., p. 768, elevates his four species to a family of equal value with the Termitina, and brings the Embidæ to his Tribus Corrodentia. He describes four species, one new, *O. ruficapilla*. But his *O. Braziliensis* is not Gray's species, and belongs to *O. Batesi* McLachl. He corrects the number of the joints of the maxillary palpi by Westwood for *Olyntha*, which has indeed five joints, as the others. Burmeister elevates the three sub-genera of Westwood into genera.

Rambur, 1842, Neuropt. p. 310, places the Embides as a family near the Termites. His general characters are excellent; only four species are described, and very well. Three of them are believed to be new, but his *Emb. Latreillii* is *O. Saundersii*, and his *E. Klugii* probably *O. rufi-*

*capilla*. The last one, *E. Solieri*, from Marseille, is only known in the wingless state. Rambur disbelieves that *Oligotoma* and *Olyntha* are generically different from *Embia*.

Hagen, 1848, had composed a review of the literature concerning the Neuroptera (*sensu* Linn.); the part containing the Embidina was printed February, 1849, Stett. Ent. Zeit.

Mr. H. Lucas, in his splendid work, *Expl. scient. de l'Algérie*, has described and figured his new species, *Embia Mauritanica*. This publication and the later one in 1859, have in fact opened the way of a better knowledge of this interesting family. Nothing was known before on the habits and nothing on the internal anatomy and the sex of the species. As the expensive work of Mr. Lucas is not accessible to students, I prefer to translate the following important passage given in a foot note, vol. iii., p. 112:

As I liked to know to which sex belongs this (winged) form, I dissected several specimens (only 12 were collected). The ovaria are very elongate, covered by a very fine membrane, made more resistant by longitudinal fibres, giving a striated appearance. The ovaria are united internally, forming a kind of very elongated parallelogram, which covers the intestina in the whole length of the abdomen. The egg tubes are straight, parallel, very long, thick and fusiform; toward the thorax the tubes are successively thinner, prolonged in a thread, which is attached together with the fibres to the first segment of the abdomen. Toward the end of the abdomen the tubes are recurvated suddenly at their hind end to form combined a very short oviduct, nearly null, with many lateral tubiform vessels, which are very irregular, nodulose, embracing themselves and recurvated in all directions (Lucas).

Mr. Lucas states after the result of his dissections, that all twelve winged specimens at his command are females, and that all showed the same asymmetry of the last segment of the abdomen and of the appendages. The winged male is still unknown. I have to remark that the females of *E. Mauritanica* are the only known winged females and the only known with asymmetry of the tip of the abdomen. McLachlan, l. c., p. 382, has stated the three specimens of his *E. Persica* as questionable females (all ♀?), but does not say why, nor does he mention symmetry or asymmetry of the tip of the abdomen; therefore more detailed information would be desirable.

The detailed description of the ovaria by Lucas is also very important

for the systematic position of the Embidina. Indeed it disposes of ever of the claims of relation with the Perlidæ, of which the peculiar and very different form of the ovaria is well known. The ovaria of all groups of the Orthoptera are different, as far as known to me, and among the Pseudoneuroptera the Psocina differ also entirely. The only related form of ovaria we find among the Termitina, and indeed the inner organs of a virgin female of *Termes* is as similar as if the description by Mr. Lucas had been made after one of them. I think this similarity speaks indeed very strong in favor of the place of the Embidina near to the Termitina.

It should be remarked that the vol. iii. of the *Expl. scient. de l'Algérie*, though it has on the title page 1849, is published later. At least De Selys Longchamps *Revue des Odonates d'Europe*, preface February 24, 1850, was not able to give the pages and plate of the Odonata described by himself for this work (f. p. 315, 318, etc.), and the Odonata in the *Exploration* follow the *Embia*.

For the only known facts up to the present concerning the habits of *Embia*, their living in silken tunnels spun by themselves, by the wingless and by the winged form, we are indebted to Mr. Lucas in the *Explor.* and in his later paper, *Ann. Soc. Ent. Fr.*, 1859, and the corroboration of the same for *Emb. Latreillei*, *ibid.*, 1883. He believes these insects to be carnivorous.

Fr. Walker, 1853, *List of Neuropt. in the British Museum*, p. 529-533, copies mostly Burmeister. Of the eight species mentioned, one is new, *Olynta staphilinoides* from Brazil, but it belongs to Forficula.

Hagen, 1866, *Verh. Zool. Bot. Gesell. Wien.*, collected in his *Synopsis Embidinatorum* all known to him about these insects. He enumerates eleven species, two of them probably synonyms, two without description. Only seven were considered as doubtless.

Mr. R. McLachlan, 1877, *Linn. Soc. Journ.*, vol. xiii., p. 373-384, pl. 1, published a paper which gave a new and strong impulse to the study of this remarkable family—"On the Nymph-stage of Embidæ, with Notes on the Habits of the Family." He had the good chance to study living insects imported with an East Indian orchid. The carnivorous habits of Embids, accepted on the authority of Mr. Lucas, became at least doubtful, as this species makes depredations on the roots of orchids. McLachlan gives a review of all known and published on Embids, and describes four new species, *Oligotoma Michaeli*, *Embia Batesi*, *E. Salvini*, *E.*

*Persica*, so that in all eleven are known. The genera *Embia* and *Olyntha* are again united, and separated by its trifold sector from *Oligotoma* with a bifid one. I have before under *O. Michaeli* given the details of this communication, and may only repeat that the so-called nymph (when the description and the figures are correct) can not be a nymph, because the characters of the wing cases of a nymph are not present. Perhaps it is a short-winged imago. Later he has described *O. insularis*, a new species from the Sandwich Islands.

Mr. Wood-Mason, 1883, Proc. Zool. Soc. Lond., p. 628-634, pl. 1, published "A Contribution to our Knowledge of the Embidæ." His attention was drawn to this group by McLachlan before his return to India. The memoir is very interesting, but there is left enough for further observations. After the perusal of the literature he had formed the opinion that the females were still unknown, and that they would prove to be wingless and probably larger in size. Of course he has not known Lucas's work, in which by dissection the female sex of winged imago had undoubtedly been proven for *Embia Mauritanica*. He discovered larvæ of a species apparently living in society. All were males probably of *O. Saundersii*. None of them showed the slightest traces of wings, but as the size of the specimens is not recorded, the larval state is at least not yet sure. He discovered also a large wingless female of *O. Michaeli*. I have before discussed this female, which seems to be doubtless a female imago, though its belonging to *O. Michaeli* is still a conjecture. He describes the male sexual characters of *O. Saundersii*, and speaks at some length about the wings of the same species, giving enlarged figures of the venation. I have to say more about them in the chapter treating the characters of Embids. A paper promised on the differences between the Embidæ and the Perlidæ has not yet been published. He considers the Embidæ as belonging to the true Orthoptera, being in some respects the lowest term, and in others the lowest term but one, of a series formed by the families Acridioidea, Locustidæ, Gryllidæ and Phasma.

I have now described seventeen species, only two of them I have never seen (*E. Mauritanica* and *E. Persica*), and three are now not before me (*S. antiqua*, *O. Brasiliensis*, *O. ruficapilla*).

#### *Characters of the Embidina.*

HEAD.—The head is nearly free (caput liberum); the foramen occipitale is not just at the end of the head, as in *Raphidia*, but a little before and below; the membranous part of the prothorax slides gently to the

foramen. Head horizontal, small, flat, a little convex above, obovate or more or less quadrangular; the Y-shaped suture, so common in Termitina, Psocina, etc., on the upper side is entirely wanting; the eyes are always in the front corner, whereas in the other families they are placed in the middle of the sides or in the hind corner of the head. The eyes of the winged forms are large, prominent, reniform, the facets globose as in aggregate eyes; the eyes of the wingless forms are smaller, not prominent, and the facets flattened as in the composite eyes; therefore the head of wingless forms looks different, and is more ovoid; ocelli are wanting, but some species show a very small impressed line or groove, which calls to mind the obliterate middle ocellus of Blatta. The antennæ are as long as the body (Olyntha) or shorter, reaching the end of the métathorax or only the prothorax; the antennæ of the wingless forms are always shorter; they (antennæ) are inserted in a little socket in the anterior excision of the eyes; 15 to 32 articulated, but so fragile that it is difficult to find a specimen with the same number of joints on both antennæ; the basal joint is always somewhat stouter than the others, cylindrical; 2nd joint always very short, annular, 3rd joint always about as long as the 1st, and commonly followed by three shorter joints; all the following are longer, thickened toward the tip, or pear-shaped; the last one more or less ovoid. The epistoma is short, broad and united with the labrum by a membranous rhinarium; the labrum is large, nearly orbicular, cut off at the base; or it is more quadrangular, broader than long, or shorter, largely rounded in front. The mouth parts, at least the palpi, exceed a little the labrum; mandibles strong, horny, with two to three teeth on tip; maxilla narrow with two teeth on tip; outer lobe narrow; palpi longer, strong, 5-jointed (4-jointed in Termitina and Psocina), the three basal ones short, equal; the last joint much longer, ovoid; 4th joint always shorter than the 5th, but sometimes about as long as the 3rd. Labium bilobed, large, sometimes (I have not material enough to decide this positively) with two very small pointed lobes between them. They are mentioned by Burmeister, l. c. 769, and are to be seen in two of the species in Westwood's figures. On the basis of the upper side of the labium is a long middle slit (as in Psocina), the opening of the spinning glands. It is figured by Savigny, l. c. pl. ii., f. 9, u. e., but not mentioned in the description, nor anywhere else. I am not sure if the inner pointed lobes mentioned before belong to the spinning apparatus; perhaps the homologous large inner lobes of the Termitina have been here and in Psocina transformed into a spinning

apparatus. The mentum is large, oblong or quadrangular, and inserted in a sharply-cut opening of the head.

Prothorax much narrower than head, long, enlarged behind, with sharp straight side margin; after the first third a transverse deep sulcus, mostly prolonged behind along the side margin; the part before the sulcus corresponds to the similar but broader part which covers the occiput in *Termitina*; the hind part is a little convex; a sharp impressed middle line often runs along the whole prothorax. The mesothorax and the metathorax are larger, quadrangular and about equal in the winged forms; on the tergum is a large triangular elevation, to the sides of which the hind part of the wings is attached by a membranous fold. The tergum of the wingless form is without this elevation, and among those forms the mesothorax may be larger than the metathorax. Each segment of the thorax is divided into three parts.

The wings are horizontal, of the same shape and size, long, narrow, three to four times longer than broad, rounded or elliptical at the apex, as long as the abdomen, or somewhat longer in *Olyntha* (I have seen no alcoholic specimens of *Olyntha*). The wings are not deciduous as in *Termitina*, a basal squama being wanting; indeed the wings are so strongly attached that I have never seen a specimen dry or in alcohol which had lost a wing. The attachment is made by the callus axillaris anterior, just on the side of the anterior angle of the mesothorax, and by the callus axillaris posterior a little behind the former and more dorsal; the membrane of the hind margin of the wings is firmly attached by a membranous fold along the whole margin of the ob-triangular tergal elevation; the same attachment is found in *Ephemerina*, and is homologous to the membranula accessoria of the Odonata. The callus ax. anterior sends a strong vessel in the wing, forming the subcosta and the mediana; the callus ax. posterior sends from beneath in the wing the submediana and the post-costa. I was not able to find tracheæ in the wings or veins. The costa, which is a real vein, originates from the subcosta; the vein along the hind margin can be followed mostly to the middle of the wing, and originates from the post-costa. The membrane of the wings is more or less rugose, similar to the wings in the group of *Calotermes*, including *C. verrucosus*, *pusillus*, *rugosus* and related species. The rugosity is effected by numerous little pits bearing a very small hair in the centre they are more frequent and more densely placed on or near the veins, and seem then to form a kind of socket; a series of longer hairs is found on

the veins, or indicate their place when the veins themselves are obliterated. By means of these series of longer hairs there can be located between the submediana and post-costa three obliterated, or rather undeveloped, veins in *O. Westwoodi*. I can not find any sure trace of the sieve-plate, which is common at the base of the wings of the Psocina, unless it is represented by a short double series of approximated larger holes near and partly upon the base of the post-costa. The coloration of the wings is remarkable, being blackish, fuscous, fuliginous, or at least fumose, with five narrow white longitudinal bands between the veins. As these bands follow longitudinal folds or deepenings of the membrane between two veins, they perhaps represent undeveloped veins. But I was not able to discover a series of longer hairs in these white bands. Moreover the smoky dark wings of the Termitina with a number of undeveloped veins, never show similar white bands, which indeed seems to be characteristic for Embidina. The ingenious assumption of Mr. Wood-Mason, l. c. p. 633, that the white bands represent the original hyaline color of the wings, and that the dark veins are broadly bordered on both sides with brown or black-smoky, as to leave only narrow streaks of the ground color visible, is worthy of consideration. Of the veins, the sub-costa on its origin and the post-costa are usually the darkest and largest ones, but the mediana is the largest in its whole length except at base. The mediana is accompanied on both sides by a dense series of rugosities which form (*Olynta*) together with both margins of the mediana, four approximated blackish lines.

With the intention to make my descriptions easy for comparison and to avoid any confusion, I have always used the names of the veins given in the descriptions of Westwood, McLachlan and Wood-Mason. I give here the nomenclature of the veins used by me in all my neuropterological papers since 1846, because the origin and the comparative value, and the homology of the veins, become more evident. My detailed paper on the wings and veins of the Odonata, made in 1846, was to be printed at the end of the monographs on Odonata, and the nomenclature was accepted by De Selys-Longchamps and used in all subsequent papers. The monographs of the four sub-families still wanting were interrupted, and the parts ready for the general volume (wings, antennæ, legs) remain still unpublished. I had then of course not known the nomenclature used by Heer, in which Kirby's names are partly accepted, as his work was published in 1847. As Heer's nomenclature has never been used except in

some papers on fossil insects, I have used my own, and have given, Stett. Ent. Zeit., 1870, a more general paper on the rational nomenclature of the venation in the wings of insects. The plate accompanying this paper was made at my request by my old friend, Zeller, as I was then on a long voyage. The numbers and the f. at veins on the plates are all Prof. Zeller's, and very different from my views. As the plate had been published before my return, it has not been given any explanation, because the plate did not illustrate my views.

I may add that I have studied carefully Dr. Adolf's recent papers on veins of insect wings, in the hope of finding a better explanation for the aborted or undeveloped veins, but without success. The costa runs as a true and strong vein along the anterior margin to the middle of the rounded apex of the wing, where it is commonly connected with the submediana. The costa is incised at its extreme base; the very small part before this incision, which lies not exactly in the same line with the costa, is, together with the very minute part below it, homologous with the basal squama. The sub-costa is the strongest and darkest vein, straight, ending free in the basal third of the length of the wing, somewhat earlier in the hind wings. I am not able to confirm (even from wings in alcohol) Wood-Mason's statement that it would, if produced far enough, run into the costal vein. Sometimes it seems indeed more directed to the costa, but in other species (*O. Westwoodi*) it seems to run to the sinus of the mediana.

Out of the mediana (radius) originates at its base below the subcosta, and a little before it above the costa; the mediana runs as a very large and diaphan vein (the subcosta is not diaphan) parallel to the costa to the apex of the wing. Shortly before the apex the mediana is bent down and united in a curve with the submediana. Out of the middle of this curve runs a straight, short vein to the apex, which as I believe belongs to the submediana. An abnormal specimen of *O. atricapilla* and both specimens of *O. Westwoodi* do not possess this curve in all the wings; the mediana is connected by a straight transversal with the submediana, and ends shortly after this transversal obliquely in the costa. The mediana runs in the middle of a large sinus, "studded thickly on each side with microscopically minute setæ" (Wood-Mason), or between two sinuses following its whole length. I can not decide which view is better to be accepted, but I remark that a somewhat analogous sinus is to be found in a part of the wings of Psocina. I have remarked before that the four dark parallel lines described and figured for this place are formed of the

margins of the mediana and of the sinus. There are sometimes between mediana and costa in the apical part of the wing four or more not well defined transversals, and between the mediana and submediana four or less well defined transversals; as far as I am able to see, all these transversals are only connected with the sinus and not with the mediana itself.

The submediana (fourth vein, or forked fourth vein, Westw., McLachl.) enters the wing from below as a strong vein, and sends from beyond the base, before the end of the basal fourth of the wing, a much stronger vein, the post-costa, obliquely to the hind margin. The submediana runs parallel to the mediana as far off as these veins from the costa. The submediana runs straight to the tip of the wing; the part of this vein which is called by McLachlan the upper branch of the sector, is in fact the submediana itself. This is proved by *O. Westwoodi*, where the part considered as fourth sector is obliterated, and the part considered as upper branch is well developed. The abnormal specimen of *O. ruficapilla* shows the same arrangement. After all, as far as I know, when veins are partly or totally aborted, the branches are first to disappear, and are followed by the main stem. Therefore we have to call the vein which is again furcated after the middle of the wing the lower branch of the submediana. The space between the mediana and the submediana, closed by a curve before the apex of the wing, is properly called the elongated cell or discoidal cell, and is only wanting in *O. Westwoodi*. There are some, but always few (3 to 5) transversals in the cell. The lower branch may be bifurcated again (*Embia*, *Olyntha*), and in abnormal cases the branch also bifurcated, at least in one wing. In the spaces between these branches and below them are a few scattered transversals without much regularity. Near the base the submediana is connected with the mediana by a very short transversal (between  $4^1$  and  $c$  in fig. 2, Wood-Mason, l. c.) in the hind wings about opposite the origin of the post-costa, in the front wings a little later. This short transversal vein, examined with the microscope, is found to be combined of two branches, one originating from the mediana, and another from the submediana. The first one crosses the last one, and a series of hairs following it shows an undeveloped vein (the rudimentary first branch, fig. 3,  $c$ , Wood-Mason, l. c.) This connection is homologous to the arculus of the Odonat, or the cross on the base of the front wings of Palpares, etc. Such a connection is often found present, when the wing is to be stiffened for a more powerful flight, or to give to a delicate wing more stability. This connection is not always

exactly the same in Embia ; in some specimens the two little branches seem to anastomose one with the other ; sometimes the basal part of the submediana seems to be separated, or at least turned in an oblique angle ; but I think after all that no serious objection against my explanation can be made. The post-costa is a very strong vein, running obliquely to the hind margin ; from this point to the base of the wing runs a fine straight vein, the anal vein.

The whole large group of Orthoptera is very multiform. There is no help for the systematic student, if he is displeased by this multiform mass ; nature has created it in this manner, and he has to accept it just as he finds it. Erichson proved some forty years ago that the so-called Pseudo-neuroptera belong to the Orthoptera, and every later careful study has but confirmed his views. It may not be amiss to state that I had in my manuscript of the Synopsis of the N. Amer. Neuroptera (sensu Linnaei) separated in a decided manner the Pseudo-neuroptera from the Neuroptera, as this is not so evident as it should have been in the printed book. The whole group of Orthoptera consists of a number of co-ordinate families, of which no connecting living forms are known to exist ; probably they have perished in former times. This is far more conspicuous among the Pseudo-neuroptera, and indeed there is not a single living form known about which it is uncertain or doubtful if it belongs to Perlina, Ephemerina, Odonata, Psocina, Embidina or Termitina. To arrange these families, which are very different among themselves, with the small or large number of genera and species belonging to them, in an acceptable series, is still impossible.

After a detailed study of the wings of the Embidina, only the following statements can be given. Only the Termitina and Embidina have all four wings of the same size, shape and venation ; some small differences among them are not of importance. The longitudinal veins have the same simple arrangement, or even more simple because less branched in Embidina. The most striking difference is the strongly developed basal squama of the deciduous wings of the Termitina ; this squama is indeed wanting, or rather very faintly indicated in Embidina. The sub-costa ends suddenly in Embidina just as in Psocina, though it is complete in Termitina. The mediana in most of the cases is connected with the sub-mediana before the apex in Embidina ; among the Termitina only *Calotermes brevis* (Hagen, Monogr. Term. Linn., vol. xiii., pl. 3, f. 6) shows a somewhat analogous arrangement. The basal connection between the

mediana and submediana to stiffen the wings in Embidina, would be out of place in Termitina, where the strong horny basal squama served this purpose better. Nevertheless in some species such a connection seems to be faintly indicated upon the squama. Some Termitina (*Calotermes*) have also a small number of transversals below the mediana, and some have ill-defined transversals below the costa before tip. The structure of the membrane of the wings and of the veins is similar in both families, and unlike the structure of all other families. Finally, though the wings of Termitina are considerably longer than the body, and only as long as the body in Embidina (a little longer in *Olynta*), there is, considering the wings, no place more natural for the Embidina than near the Termitina.

The legs are a very striking and abnormal feature among the characters of the Embidina; they are obviously shaped for burrowing by the compressed enlargement of some parts of these limbs. I have compared them with the burrowing legs of insects of other orders, and was rather astonished to find a very great difference in the arrangement, the attachment and the development of the fossorial limbs and their joints. I have tried without success to find in the literature some general considerations or descriptions of fossorial limbs. As their shape must be the consequence of purely mathematical principles, a general study of these limbs is still an important desideratum.

The legs of the Embidina are strong, the middle legs always considerably less than the other pairs; all the legs are comparatively long, the fore legs exceeding the head, the hind legs reaching nearly the end of the abdomen, at least longer than two-thirds of it; the legs of wingless forms are always shorter. All three pairs are equidistant and attached to the end of the respective segments; but the bases of the fore and middle legs are as far distant from each other as possible, indeed the legs are attached to the sides of the thorax. The hind legs, on the contrary, are approximate one to the other, so that the coxæ are very nearly touching the opposite ones, and are longer and broader than the coxæ of the two anterior pairs, which are short, cylindrical, a little incurvate. The fore legs have the femur, the tibia and the first article of the tarsus of about equal length and strength, dilated and compressed; the first article of the tarsus rather more dilated, depressed, incurvated, with a furrow above; the two other articles short, the first of them more or less thick; the claws are short, sharp and simple; between them is no plantula. The middle

legs are shorter, thinner, the femur somewhat inflated at the base above ; the tibia and the first joint of the tarsus about cylindrical. The hind legs have the femur strongly compressed and dilated ; the tibia strongly cylindrical ; the basal joint about half as long as the tarsus, a little stronger, and with an external comb of short spines. I do not know if this comb is present in all species ; the two apical joints similar to the middle legs, perhaps a little longer. In some of the wingless forms the first joint of the tarsus of fore legs has a strong external spine.

Are the fore legs burrowing legs? Till now no observation is recorded, though their form admits the supposition. That they give help in the spinning of the silken tunnels is very probable. Are the hind legs jumping legs? No observation is recorded, but they seem fitted for jumping.

Comparing the legs of Embidina with those of Termitina, no similarity or relation is to be found. The trochanters in all pairs are very and equally approximate in Termitina. Among the Psocina we find in *Atropes divinatoria* the trochanters of the two first pair widely separated one from the other one, and those of the third pair much more approximate. For other families a comparison seems of no avail, but there exist similar distances in Odonata nymphæ, in Ephemera and Perlina. Inflated legs are not known among Pseudo-neuroptera, except in Ephemera in the earlier stages, and these are burrowing legs.

The abdomen is long, about half the length of the body, a little less broad than the thorax, flattened above, cylindrical below ; the dorsal segments about equal, transverse-oblong, more than twice as broad as they are long; last segment longer, the two before mostly shorter than the others; there are seemingly ten dorsal segments, but the first belongs to the metathorax (segment mediaire), therefore only nine belong to the abdomen ; the dorsal segments are strong, chitinous, and united on the sides by a large membrane with the ventral segments ; a longitudinal fold bearing the stigma. The ventrals are more hyaline, except the two last ones of the males, on which the internal genital organs are situated ; these two are stronger for support, usually darker colored, and polished. All the others are mostly diaphanous, so that the corda ventralis and its ganglia are visible, sometimes even partly the other organs situated in the abdomen. If the segment mediaire is not counted, there are eight ventral segments. Between the last segments of the abdomen are inserted the anal appendages. They are two-jointed, stout, very hairy, as long as the two last

segments, or shorter (*Embia*), the apical joint thinner, cylindrical. If asymmetry is present, the left appendage has the basal joint shorter, larger, sometimes almost quadrangular. Between these appendages are situated the external genital organs of the male. They consist of a middle more or less inflated conical or cylindrical membranous part, with a circular opening on tip, representing probably the intromittent organ; on each side is a horny spine, long, narrow, more or less pointed and twisted, asymmetrically in a different manner. The spine of the right side seems to present its regular more or less straight form; the left spine is twisted similar to a corkscrew in its apical half, and so nearly approximates to the intromittent organ that it is clearly to be seen only in alcoholic specimens. In all males, where these characters could be well seen (at least in *Oligotoma*), more or less asymmetry was evident, and McLachlan, l. c. p. 378, is of the same opinion. The last dorsal segment of the males is also asymmetrical, with a deep impressed fold nearer to the right side, and the apical margin is cut obliquely; the last ventral segment is also asymmetrically protruded. My description of these parts is made only from winged males, but Wood-Mason, l. c. p. 630, says that the larvæ of *O. Saundersii* collected by him in numbers at Jubbulpore, and without the slightest traces of wings, possessed all the same characteristic asymmetry quite apparent, which he considers exclusively confined to the male sex. He adds that "the asymmetry of the tergum of the terminal abdominal somite and of the cerci in *Necrosia maculicollis* (*Phasma*) appears at the corresponding early stage, and is in nymphs quite as strongly marked as in perfect insects." I am sorry that this insect is not at my disposal, nor can I compare Westwood's Oriental Cabinet. In his catalogue of Orthoptera, Westwood does not mention any asymmetry. I think that the shape of these organs is never expressed in the larvæ in a similar manner as in the imago and in the nympha. Till the contrary is proved, there must remain some doubt if these so-called larvæ do not perhaps belong to a wingless form of the imago.

I have not seen winged females, but in the wingless female, which is said to belong to *O. Michaeli*, and in *Olynta Mulleri*, no asymmetry is apparent. Not one of the few wingless forms before me considered to be larvæ, is asymmetrical, but those parts are mostly too much shrivelled up in dry specimens to enable one to be certain.

The female opening is at the base of the notched 7th segment, similar to those of the Termitina. The same arrangement of the genitals of the

males among Pseudo-neuroptera is only represented among *Perlina* and *Ephemerina*, but without any asymmetry, which appears among the true Orthoptera in *Blatina*, and after Wood-Mason, also in *Phasma*.

*The Different Forms and Stages.*

Of the seventeen species described, three are only known as wingless forms; of the fourteen winged species, not one is known as winged in both sexes. Winged females are known with certainty only in *E. Mauritanica*, and questionably in *E. Persica*. Winged males are known for the first to seventh species of *Oligotoma*, and probably for *E. Savignyi* and *Olyntha Salvini*; for the three *Olyntha*, species 13 to 15, the sex is unknown.

Of the three wingless species, one seems to be a female imago; that it belongs to *O. Michaeli*, as Mr. Wood-Mason contends, still needs proof.

The specimen which was described as a nymph, can not belong to this stage, if the description and the figure are correct, as I have stated before. Very probably it is a so-called short-winged form, similar to those known of *Termitina*, *Psocina* and *Perlina*.

The figure of *O. Michaeli* in Gardener's Chronicle, 1876, p. 845, if correct, can only be considered as a nymph; the anterior wing cases are wanting or perhaps aborted. The *O. Mülleri* looks as if it is an imago, with the anterior wing cases aborted and the posterior ones very slightly indicated. It has to be assumed that such forms exist among the *Embidina* as well as in the *Psocina*. At least I know of no other reasonable explanation. Concerning the larvæ, or the forms called larvæ, I am perfectly at a loss how to separate them from the winged imago, to which they have been assumed to belong, as about all are of the same size with the imago without any traces of wings. The head of all which I have seen has the characters of a female head. I have stated before that the so-called male larvæ of *O. Saundersii* are somewhat doubtful, and perhaps a wingless state of the male imago. Nevertheless, not having seen them, conjecture may be out of place. The larva of *E. Mauritanica* which transformed in the box, as reported by Mr. Lucas, belonged undoubtedly to that stage. As it must have gone through the nymph stage with wing cases, of which no record is given, an important gap is still to be filled. That there exist larvæ and nymphæ of *Embidina* is doubtless, but we have to confess that the knowledge of these stages is still a *tabula rasa*.

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*Habits.*

We know only of one single instance in which the winged females of *E. Mauritanica* were found gregarious. The absence of males among them is not without example; among Psocina I have observed at least in three species a very large number close together, all being females. In one flock I secured among hundreds of females, by very careful examination, only one male. I believe the same fact has been recorded of some Hemiptera.

Another isolated observation exists of larvae, and this time all males, being found gregarious on a sandy place among old bricks, by Wood-Mason. Many observers state that *E. Solieri*, discovered in many localities in southern France and Spain, and by no means rare, lives always isolated. The same is recorded of *O. nigra* by Prof. Schaum.

Mr. Lucas was first to observe that the Embidina imago and larva spin silken tunnels. It is doubtless true that the spinning is done with the mouth, as by Psocina (though this has never been observed or stated), as the spinnerets open on the labium. Probably these tunnels induced Mr. Lucas to assume that the Embidina are carnivorous, and to put insects for food in his boxes, but he has not stated that the food was used. The observation by Mr. Michael seems to prove that these insects are phytophagous. Perhaps they are both; at least I may remark that for *Gryllo-talpa* the same uncertainty still exists.

Every one asserts that all Embidina are very agile in running and flying. It will be agreed that our actual knowledge concerning their habits is no more satisfactory than that concerning their forms and stages.

*Distribution.*

There is little more known than has been given by McLachlan, l. c. p. 379. The amber species belonging to the tertiary layers is very rare among amber insects. Compared with Termitina in amber, perhaps one Embidina is found for one hundred of the former. The fossil species differs in nothing from the living ones. Whether the species in copal are fossil or not, is still an open question. There are many copal insects which seem to be or are identical with living forms. But large quantities of copal, principally near the coast of East Africa, are dug out of sand or earth, just as amber, and in localities where no copal trees are now to be found. (J. Kirk, Journal Linn. Soc., June, 1868): "At the diggings are

not found any copal trees (Wm. E. Hines, Trans. Amer. Geogr. Soc.), or even any signs of any, and to this time it is a mere conjecture in what ages these deposits of copal were made, probably many thousand years ago." I can not give the exact quotation, as I have before me only a manuscript copy of this paper, written before 1860.\* Some insects out of this copal, called in trade Zanzibar copal, but of the Zanzibar copal which was only exported to East India and not to Europe, seem to be identical with insects living in Ceylon. It can therefore not now be assumed that the *Embidina* in copal are still living forms, and that they belong to the fauna of Africa till the identity with living or African insects has been proved.

Considering that only fifteen living species are described by me, it will be seen that I have been purposely as careful as possible in making new species. I could have enumerated six species more, against which with our actual knowledge little objection could have been made. The type of *E. Klugi*, in Paris, must be examined to confirm its identity with *O. Atricapilla*. That of *O. Saundersii* should be compared again with *E. Latreillis*, with the specimens from Borneo and those collected by Wood-Mason, to make their identity certain. The type of *O. Batesii* and *O. Brasiliensis*, Burm., should also be compared concerning their identity. The larva from Athens and from Asia Minor could have been given as new species, if it were desirable to describe new species upon such material. Finally the supposition that the large wingless female belongs to *O. Michaeli* needs the support of further careful observation.

Of the fifteen living species described, *O. Saundersii* has by far the largest distribution, Bengal, Borneo, Madagascar, Mauritius and Ascension Islands. *O. Insularis*, from Sandwich Islands, is, perhaps, to be found in Antigua Island. *E. Solieri* is not rare in South France and Spain. The other twelve species are only recorded from one locality. From Bengal, *O. Michaeli*; from Persia, *E. Persica*; from Africa, *E. Savignyi*; from Egypt, *O. Nigra*; and *E. Mauritanica* from Algeria. From America is *O. Cubana*, from Cuba; *O. Hubbardi*, from Florida; *O. Salvini*, from Mexico. From South America, *O. Brasiliensis* and *O. Ruficapilla*, the locality not known; *O. Batesii* from the Amazon; *O. Muelleri*, from Santa Catarina, South Brazil.

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\*Only two incomplete sets of the transactions are in Boston and Cambridge.

There are thus known from Europe one, perhaps two, species; from Africa three, and from the islands near to it one more; from Asia three, perhaps four; from North and Central America, three: from South America, four species; from the Sandwich Islands, one; none from Australia. Probably only a small part of the living Embitina is known, and these only in very few specimens, which still form, as they did half a century ago, the gems of the collections. As far as I know, four species are represented by single specimens only, three by two specimens, one by three specimens, two by four, seven by more specimens, but none in a number sufficient to understand the whole history of the insect.

*Systematic position and relation.*

Prof. Westwood, with his usual sagacity, recognized directly that the three species known to him represented three different forms. So he accepted one large genus, with three sub-genera, which were considered to be genera by Prof. Burmeister, but united again in one large genus by Rambur. McLachlan accepted only two genera, *Embia* combined with *Olyntha* and *Oligotoma*.

The species belonging to *Oligotoma* are decidedly a very homogeneous group. The only aberrant species, *O. Westwoodi*, differs by a plainer and apparently aborted venation of the wings. Their principal characters are, the more slender form of the body, the small and longer ovoid or obcordate head; the antennæ as long as head and thorax, or mostly shorter, with fewer (14 to 20) joints; the narrow prothorax; the comparatively long legs; the narrow abdomen, with shorter appendages, and between them protruding the male genitals; the narrow wings, not longer than the abdomen, with a plain venation, and only one lower branch of the submediana. Asymmetry known only in the male sex. *Oligotoma* is known from the warm regions of the whole world, and represented in copal and amber. The species belonging to *Olyntha* form also a homogeneous group. The body is larger and broader; the head is broader, shorter, with antennæ as long as the body, with a third more (to 32) joints; thorax larger; the legs more slender; the abdomen broad, with longer appendages (male genitals not well known); the wings are longer than the abdomen, much broader, the venation more complicated by two lower branches of the submediana. The coloration of the species is very uniform. No asymmetry is known. *Olyntha* is known only from South America and from Central America.

The winged species of *Embia* are intermediate among *Oligotoma* and *Olyntha*. The body is stronger and more flattened above than in *Olyntha*; the head is shorter, about quadrangular, but the antennæ are as short as in *Oligotoma*; the prothorax is shorter and broader than in both, but near to the head more narrowed; the thorax is still larger than in *Olyntha*; the legs are as long and as strong as in *Oligotoma*; the wings as long as the body (*Oligotoma*), but broader, with the venation similar to *Olyntha*; the abdomen is broader and more flat than *Olyntha*, but with the shorter appendages of *Oligotoma*. Asymmetry is known only in the female sex. *Embia* is known only from the old world in the countries around the Mediterranean and Persia.

The knowledge of the three groups is not sufficient to assert that all are only subgenera or genera; in the last case I believe that *Olyntha* and *Embia* can not be united.

There can be no doubt that the *Embidina* belong to a peculiar and well defined family, and cannot be combined with any other family, though a number of characters are found represented in other families.

The body is slender, elongate and flat above; the abdomen representing half the length of the body; the head is free, not inserted, small, flat, quadrangular or ovoid; the eyes are exactly in the front corner of the head, and in the imago state similar to aggregate eyes; ocelli, none; no dividing sutures of the head exist; antennæ as long as the body or half as long, praeocular, moniliform or partly fiiiiform, slender and very fragile; mouth parts decidedly of Orthopterous character; maxillary palpi 5 jointed; labium bilobate, the inner lobes transformed into a spinning apparatus, as in *Psocina*, but with 3 jointed labial palpi, and without the peculiar maxilla of *Psocus*. Prothroax much narrower than the head, elongate, or as long as broad; always with a dorsal transverse furrow after the anterior third; thorax strong, oblong, the mesothorax longer; each segment of thorax with three dorsal parts, the last one of the metathorax (segment mediaire) like the abdominal segments. Abdomen flat, about equal, with nine transverse oblong dorsal segments and eight ventrals; at the tips on each side a bijointed appendage, short, or as long as the last segments; between them the male genital apparatus, just at the end of the abdomen; the female opening at the base of the seventh ventral segment; the appendages, the male genital apparatus and the last dorsal and ventral segment show, at least in certain forms, asymmetry. Wings not deciduous, narrow, rounded on tips, as long or a little longer

than the abdomen; all four of equal shape, length and venation. The legs are peculiar, the compressed and dilated shape of some parts seem to indicate burrowing legs; they are strong, long, reaching both ends of the body, the middle legs always less strong; the three pairs of legs are equidistant and attached to the ends of the respective segments; the legs of the first and of the middle pair are as distant from the legs of the opposite side as the size of the sternum will allow them to be; but the legs of the hind pair are approximate; coxæ small, stronger on hind legs; femur and tibia about the same length, compressed, inflated; tarsus about as long as tibia, but the basal joint of the first pair as long as tibia, inflated, curvate, with a superior furrow; second joint short; third joint longer, slender with two simple claws.

*Systematic Position of the Family.*

Savigny, Latreille, V. Audouin, Westwood, Burmeister, Rambur, have placed the Embidina near the Termitina. Westwood, l. c. p. 372, states: "Genus quoad affinitates, Termites cum Ensthenia Westw., inter Perlidas conjungens." I am sorry that he has not given a more detailed proof of this statement. By comparing *Olyntha Braziliensis* with *Eusthenia spectabilis* (both insects figured by himself on the same plate in Griffith pl 72), and by comparing a type specimen of *Eusthenia spectabilis*, kindly presented to me by himself, I confess to being at a loss regarding their affinity. McLachlan, l. c. p. 377, goes even further, not thinking the relationship between Termes and Embia so close as has generally been accepted, and that Westwood happily seized upon its position as between the Termitidae and Perlidae. He says that the external form is not always to be disregarded in searching for affinities, and that Embia has much of the external form of the Perlidae, especially of the genus Leuctra. But he has overlooked that certain species of Termes, for instance, *T. flavipes*, after having lost its wings is just as agile as Embia and very similar to its wingless forms. Some exotic species, as *Stolotermes*, imitate Embia, even in the winged form. Of course, each family belonging to the Pseudo-neuroptera has some characters in common with Embia, but after the knowledge of the internal female organs, which are exceptionally characteristic for the Perlina, we have to dismiss the opinion of a nearer relationship. Indeed, the slender and elongate form of the body excepted, which is found so common in many insects of

different orders, no character is left to bring the *Embia* nearer to *Perla* than to *Termes*. Burmeister, l. c., p. 768, is undoubtedly right in bringing them in a family of its own *Embidae*, near the *Termitina* (with whom they had been combined), because they differ from them by all parts of their body.

After a detailed study of the species before me (their number is much larger than the number in the hands of former students), and after due consideration, I believe there is no doubt that *Embia* is nearer to *Termes* than to any other family. Concerning the wings, I have given my opinion before in a very detailed manner, that they are not only homologous to the wings of *Termes*, the basal squama not being developed or aborted, but that the wings by their identical size, shape and venation cannot be compared with those of any other family. The abdomen, except being mostly more ovoid in *Termes*, is for the segment médiaire and the number of segments homologous; the mouth parts are alike, except the 5-jointed max. palpi; the antennae are similar; the legs are very different, the tarsus 3-jointed. The eyes are in the front corner of the head, while in *Termes* they are in the hind corner.

The relationship with the *Psocina* is indicated by the presence of a spinning organ opening on the labium, and by the similar distance of the coxae in some genera. *Embidopsorus* resembles *Embia* more than *Termes*, but is in fact a true *Psocus*, with the habitus of an *Embia* and with *Termit* wings. In another paper I may give more about this curious insect.

A comparison with the *Odonata* and *Ephemerina* seems not to be needed. Both show an important character of the *Embidae*, the situation of the eyes in the front corner of the head; the arculus of the *Odonata* is imitated in the wings of the *Embidina*.

The statement by Wood-Mason that *Embia* belongs to the true *Orthoptera* as a very degraded form—a statement which will probably be proved by him in a later paper—induced me to consider the aberrant forms of this group. The external forms of the curious genus *Cylindrodes*, have indeed some analogy with the apterous female of *O. Michaeli*. We know very little about *Cylindrodes*. *C. Campbelli*, from Melville's Island, Australia, was figured in Griffith's *Animal Kingd.*, vol. xv., pl. 131, with details of the mouth parts and legs, and described by R. Gray, *Mag. N. H.*, 1837, vol. i., p. 142, from one imperfect specimen, as belonging near *Gryllotalpa*. Burmeister makes of it a group of *Gryllotalpa*, and Serville a genus following *Gryllotalpa*. Saussure, *Mel. Orthopt.*, 1877:

vol. v., p. 205, brings it in a separate Legion, *Cylindrodites*, with the only genus, *Cylindrodes*, and describes and figures, pl. 11, a new species, *C. Kochii*, from Australia, from a rudimentary specimen. None of the authors except Gray have seen this rare insect. Probably it is a female imago; it bores in the stems of plants, committing ravages in greenhouses; it is called by the colonists, wire-worm. The tibia of the anterior legs forms a hand similar to *Gryllotalpa*. What is known about this insect is mainly the general form, which is so different from *Embidina* that it is barely possible that this degraded family may among the Orthoptera be placed not far from the *Embidina*.

To try ancestral speculations upon our present insufficient, and for the *Embidina*, *very scanty knowledge*, would certainly by Darwin himself have been considered illegitimate, if not something worse!

## TRAPPING COLEOPTERA.

BY F. B. CAULFIELD, MONTREAL, P. Q.

Wishing to procure a good series of Silphidæ for my collection, about the middle of August I put some scraps of cooked meat into an empty tomato can and hid it under a shrub. I visited it after a few days but found it untouched. I then baited a can with uncooked meat and placed it in a similar situation. I examined it on the 12th of August and took from it the following species:—

*Necrophorus orbicollis*, 10 specimens.

“ *tomentosa (velutina)*, 6 specimens.

*Silpha peltata*, 20 specimens.

“ *marginalis*, 12 specimens. (Of this and the preceding species I could have taken many more).

*Silpha inaequalis*, 4 specimens.

“ *lapponica*, 1 specimen.

“ *surinamensis*, 1 specimen.

*Staphylinus villosus* 1 “

I also took two specimens of a *Staphylinus* and a number of *Histers* not yet determined.

On examining the can containing the cooked meat, I was surprised to find in it seven specimens of *Centrophilus maculatus*, as I had not expected to trap Orthoptera.

I visited the traps again on August 15th, but as there had been a heavy thunder storm on the previous day, I met with poor success. The trap which had yielded so abundantly on the 12th, now contained nothing but water, but from the can with cooked bait I took 5 *orbicollis*, 4 *velutina*, 1 *surinamensis*, and 1 *Staphylinus villosus*.

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### NOTES ON CHRYSOMELA SCALARIS, Lec.

BY F. E. CAULFIELD, MONTREAL, P. Q.

In No. 7 of Entomologica Americana, Mr. G. W. J. Angell gives some interesting notes on this insect. Having examined a large number from various localities "showing a nearly complete gradual gradation from the finely maculate form of *philadelphica*, to the strongly marked *scalaris* type," Mr. Angell is of opinion that *philadelphica* Lin., *multipuncta* Say and its supposed varieties, are all varieties of *scalaris* Lec. I incline myself to the belief that *scalaris* and *philadelphica* are distinct species, and as my experience of these forms appears to be different to that of some other collectors, I give it in the hope that it may lead to a careful study of their life habits. I find that Dr. Harris' history and figure of *scalaris* fit it exactly as it occurs in the neighborhood of Montreal. For years past I have found it on elm and linden, and on no other plant or tree. *Philadelphica* and *Bigsbiana* I find on willow and alder; never on elm and linden. Dr. Packard in his Guide states that *scalaris* is abundant on the alder. This statement puzzled me, as I never yet have found a typical *scalaris* on that shrub. In the Report of the Entomological Society of Ontario for 1882, Mr. W. H. Harrington states that *scalaris* is "found throughout the season on various trees, as elm, the linden, and especially the willows and alders. The same writer states that *philadelphica* feeds on the leaves of the pine. It would thus seem as if these insects varied their food plants in different localities. It is now too late to do anything this season towards settling the question, but next year I trust it will be fully investigated; meanwhile I would like to hear the opinions of other collectors.

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## HYBERNATION OF FORMICA HERCULEANA, LINN.

BY G. J. BOWLES, MONTREAL, P. Q.

On the 20th October last, when in Brighton, Ont., I went to the woods in search of hibernating insects, and while examining the prostrate trunk of a small pine, found several female specimens of our large black ant, *F. herculeana* (*ligniperda* Latr.) in their winter quarters. Each ant was in an oval excavation in the wood, just under the bark, about an inch long and half an inch wide and deep. In each cell was found a single ♀ ant, together with from six to fifteen larvæ. On tearing off the bark, about half a dozen cells were exposed, on different and widely-separated parts of the trunk. In one or two instances there was a single worker ant with the large ♀. The larvæ were about an eighth of an inch long, and were all alive. They were, in every case, crowded together in a mass, each one in the same position, with the head bent over in front. This observation is, I think, interesting, as it gives a clue to the manner in which colonies of this wood-destroying ant are established. It is probable that the mother ant and the larvæ would survive the winter, and be ready in spring, as soon as the larvæ had become perfect insects, to begin operations from the cell in which they had hibernated. The cells were very neatly excavated, and each seemed to have been entirely the work of the ♀ ant which occupied it, as there was no connection with any other cell, and the surface of the trunk around each was perfectly smooth and uninjured. Nor were there any galleries extending from the cells into the wood of the tree, as I proved by close examination.

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## NOTES ON ACMAEODERA PULCHELLA, HBST.

BY C. H. T. TOWNSEND, CONSTANTINE, MICH.

The common species of *Acmaeodera*, *A. pulchella* Hbst., which is marked with shining bronze-black and bright yellow, assimilates well in color with the flowers of *Rudbeckia hirta* L., so abundant along the edges of cultivated fields, upon which this Buprestid is found. The dark parts of the beetle, which are after an etched pattern, blend well with the rich dark stigmata of the flower, as the beetle lies next to these; while the bright yellow parts easily pass unnoticed in the inside border of the yellow corolla. It is noticeable that these flower-frequenting species are found

chiefly on the flowers whose colors suit them best for protection ; in fact the insects seem to have been modified in color to suit the flowers they live on. This species is seldom found upon any other flowers than those of *Rudbeckia hirta* L. I have once taken it upon the flowers of tansy, once upon a partially yellowed leaf of *Oenothera*, once upon a high dandelion flower, twice upon the orange-red flowers of *Asclepias tuberosa* L., and once flying about some of the many flower-bunches of a clump of sumachs. These are the only exceptions that I have noticed, and are but isolated instances.

The perfect beetles are very abundant here in July ; in my notes I find reference to them only from 3rd to 13th July. It is in the heat of the day that they are to be found upon the upper side of the flowers, probably feeding upon the pollen ; toward evening, and in cloudy weather, as well as sometimes in sunny weather, they are to be found on the under side of the flowers, clinging to the sepals or petals, where they doubtless spend the night. Thus these flowers furnish the perfect beetles with food and home ; and probably their larvæ bore the very stalks which support the flowers. The beetles seem to avoid generally the large patches, frequenting isolated clumps with only a few flowers, or single flowers. On one isolated flower I have taken five or more, mostly large specimens, while the same day (8th July, 1883) I went through large patches of the flowers without taking one, or only a few scattered ones.

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### CORRESPONDENCE.

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#### ON WILLOW AS FOOD-PLANT OF *PAPILIO TURNUS*.

*Dear Sir :* As stated on page 140, willow is given in "Butterflies," p. 309. I asked Mr. Scudder for his authority, and he replies, "Gosse, in Canadian Naturalist." On page 293 of this book, London, 1840, I read : "I have taken it" (the caterpillar) "from willow, poplar," &c. So far as I know, in the 45 years since that line was printed, willow has not been noticed as one of the food-plants of *Turnus*. I asked Mr. John Akhurst, who has bred *Turnus* as often as any one living, if he had ever found the larva on willow. He says he never has, and enumerates a great number of other trees on which he has found it. I should like much to know if any of the readers of this magazine have ever found this larva on willow, or of their own knowledge can say that this is one of its food-plants.

W. H. EDWARDS, Coalburgh, W. Va.