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FURTHER NOTES ON ALBERTA LEPIDOPTERA.

BY F. H. WOLLEY DOD, MILLARVILLE, ALTA.

(Continued from page 327.)

209. *Noctua rosaria* Grt.—I consider this identical with European *rubi* Viewag. In my earlier collecting days in Alberta I seemed to recognize in what I was taught to call *rosaria*, the familiar *rubi* so common nearly everywhere in England. I noted them as probably identical after studying the British Museum material in 1909, and have now European and Calgary specimens in my collection which match exactly. The late C. G. Barrett claims that they are identical in his "Lepidoptera of the British Isles" (IV, p. 90), though in many cases his associations of European with North American species are unjustified. Sir George Hampson keeps them distinct, ascribing to *rosaria* in the table dark streaks on the veins, stated to be lacking in *rubi*. This is a variable character in *rosaria*, of which, besides a long local series, I have three from Kaslo and over thirty from Vancouver Island.

Sir George Hampson still confuses Calgary specimens of *rosaria* with *calgary* Smith. Long familiarity with both in a state of nature would doubtless obviate this. They seem quite easily separable, and the differences pointed out in my former notes hold, except that I have since occasionally found *rosaria* with black in the cell.

A much nearer ally of *rosaria* is *perumbrosa* Dyar. Though there can be no doubt of their distinctness, the differences are hard to express in words. *Perumbrosa* and its eastern ally, *rubifera*, as I understand it, have varying shades of red and brown, but entirely lack the rosaceous tint of all *rosaria* that I have seen. The colour is also much more even throughout, whereas in *rosaria* the submedian and subterminal spaces are usually slightly, though rarely contrastingly, paler than the rest of the wing. The cross lines in *perumbrosa*, though indistinct, are finer and less diffuse. Structurally the thorax and abdomen are less robust, and the fore wing has both costa and hind margin more rounded.

210. *N. calgary* Smith.—I am not in a position to make the reference at present, but it seems to me not improbable that this will prove identical with *esurialis* Grote, which certainly has no nearer ally known to me on this continent. The type of the latter is a male in the British Museum from Washington State, and is a good specimen, except that it lacks antennæ. It is well figured by Hampson, only the specimen is really a bit more even in colour, and the oblique orbicular a little more open. There are no other specimens in the collection under the name.

Esurialis has at times been associated with both *jucunda* and *rosaria*. Both these associations I seem able to explain. There are, in the British Museum, three *Anticosti* specimens which have long been associated with *jucunda*, and which are referred to by the late J. W. Tutt in "British Noctuæ and Their Varieties" (IV, p. 16 of the introduction). These specimens I should call *calgary*, as well as a male in the same series labelled "U. S. A., Grote collection." *Calgary*, too, has often been confused with *rosaria*, as witness my own confusion in former days, and Sir George Hampson's more recently. In the "Kootenai List" Dr. Dyar seems to suggest that *esurialis* is *rosaria*. What he had for comparison as true *esurialis* I do not exactly know, but it was probably a confusion of *rosaria* with *calgary* over again. I have no note of having anywhere seen *calgary* from Kaslo, though it probably will be found there. But *esurialis* is not *rosaria*. In the Washington collection I found about a dozen specimens standing under *Pachnobia carnea*, from Popoff Islands, Alaska (July 16th, 1899), which seemed to me to be *Noctua calgary*, one of which was almost exactly like Hampson's figure of the type *esurialis*.

211. *N. dislocata* Smith.—More of this species have come to hand, including females that I feel quite certain of, though only one of this sex now remains in my own collection. I feel convinced of its distinctness from *calgary*, and cannot improve upon my former diagnosis of the species. But Prof. Smith's ♀ type happens to be *calgary*, as I had supposed, the male alone holding good. *Dislocata* appears to occur in Europe, as I have a pair from Northern Finland which differs very slightly from some *Calgary* specimens in being smaller and browner, and having duller secondaries. They were received from Mr. Prout as "*festiva*, var. *conflua* Treit.," but do not agree very well with Treitshke's description as copied by Tutt (Brit. Noct., II, 122), or Barrett (Lep. Brit. Isles, IV, 76). Hampson lists *conflua* as an aberration of *festiva*, "smaller, grayer, duller,

markings less distinct," which, whilst it applies to my Finland specimens, as compared to my British series of *festiva*, mostly from Scotland, is not in accordance with Treitschke's description. Moreover, the Finland male has antennæ similar to those of both *calgary* and *dislocata*, viz., ciliate only, with the joints scarcely marked. The antennæ of my series of *festiva*, fifteen in number, are serrate-fasciculate, though not strongly so. These are nearly all lighter in colour than my series of *calgary*, but besides the antennal differences and slightly rougher vestiture of the British specimens, I see no structural differences. Hampson places *calgary* in *Agrotis*, and *festiva* in *Episilia*, but I cannot see that a generic separation is warranted. In the tables *Episilia* is diagnosed as "head and thorax clothed with hair only," and *Agrotis*, "head and thorax clothed with hair and scales and with more or less developed thoracic crests." A slightly greater development of vestiture in *festiva* I have already referred to, but the admixture of hair-like scales is sometimes present in that species also. The vestiture of the Finland specimens is like that of *dislocata* and *calgary* rather than of *festiva*. It remains to be discovered what the real name of the Finland specimens is. The differences noted, antennal and otherwise, may perhaps prove to be variable and to connect with *festiva*, but I am loth to believe that *dislocata* is otherwise than distinct from *calgary*, and observation of the two in nature supports this view, though they are undoubtedly very closely allied.

216. *N. inopinatus* Smith.—As I before suggested, I see no reason whatever for considering this form distinct from *haruspica*. It is indeed hard to find any species of Noctuid, particularly of an Agrotid, which does not manifest certain phases of variation peculiar to different regions. In a very large number of instances such local forms have been described as distinct species, or perhaps merely as races, and subsequently listed as species without further justification. In some cases, where the variation in one locality does not obviously overlap that from another, there seems no reason why a well marked form should not be designated by a distinguishing name, though it seems arbitrary to designate it as a species. But where, as in the present instance, extremes meet, and the variation in one local series includes that in another, whether specimens in the two actually match or not, it does not seem that a species name for each is justified, and it certainly causes confusion.

I happen to possess only two specimens from New York, the type locality of *haruspica*, but have no reason for considering them distinct from

Montreal and Ottawa specimens, some of which can be mated exactly with some from Manitoba and Alberta. As is usual with certain prairie forms, most from the latter places are rather smaller and less distinctly marked than those from the east, but the differences are not constant. A Kaslo series does not differ, but one from Vancouver Island shows a rather strong gray irroration in some specimens, though nothing to indicate a distinct species. Incidentally, *haruspica* seems to have been merely a change of name for what Morrison named *unimacula* the previous year, as his name was in use by Staudinger in the genus in Europe. But Staudinger and Hampson both list *unimacula* Staud. as a variety of *pecta*, and Hampson restores Morrison's name, which should now be used for *haruspica*. Grote's type of *haruspica* is in the British Museum, and is presumably also Morrison's type of *unimacula*, though I do not know that for certain.

Whether *sierræ* is a distinct species is doubtful. Hampson ascribes to *inopinatus* an entire orbicular, and an open one to *sierræ*, of which he has the type from the Sierras. This is a variable character in *inopinatus* (= *unimacula*). I have specimens from Colorado and Utah which seem of rather slighter build, and are rather darker in colour, though with secondaries paler basally. A few have an edging of faint yellowish gray scales to the transverse lines, and a fine continuous line of the same colour at the bases of fringes. But two or three of the specimens seem to stand equally well in either series.

218. *N. unicolor* Walk. was described six years previous to *clandestina* Harris, and, following the law of priority, Sir George Hampson justly gives it preference, though the pity is that the change was not made sooner, the synonymy being admitted. Walker's type is a female from Trenton Falls, N. Y. (Doubleday), and is the species universally known as *clandestina*, of which, however, I have not seen Harris's type.

219. *N. havilæ* Grt.—I have occasionally taken more specimens of this here, and have some from High River from Mr. Thomas Baird. I have it from San Francisco, and have had a lot from Stockton, Utah, in which *unicolor* (= *clandestina*) was not included. From the latter locality I have one compared with the type, a male from Nevada, in the British Museum. It was originally described as a variety of *clandestina*, but though closely resembling that, and easily confused with it, its distinctness is universally admitted. In colour it may be generally described as grayer

and more strigate, having in particular a faint grayish streak in submedian interspace, joining the median lines, which seems to be lacking in all *unicolor* at present under examination. The secondaries are even, and uniformly darker. Structurally there is a difference in the abdomen of the female, that of *unicolor* having a pair of sublateral foveas, or plates near the extremity, which are lacking in *havile*. It is by this character that Sir George Hampson separates them in the tables.

221. *Chorizagrotis auxiliaris* Grt.—The type in the British Museum is a female from Colorado, and has blue-gray collar and costa, being the form I had previously standing as *introferens*, and is much like the specimen figured by Holland as *introferens*. *Sorrer* Smith (usually written *soror*, though not as originally published) seems to me exactly the same form, though the separation seems to have been based on the form of male genitalia. *Sorrer* was described from two Montana females from the Hulst collection. There is a type at Washington, and, according to my notes, another in the Brooklyn Museum labelled "Arizona," but as this is at variance with the description, my note needs verifying.

222. *C. introferens* Grt.—The type in the British Museum is a male from Texas with yellowish collar and costa, and is the *auxiliaris* of Smith's monograph and my previous notes, with which I had associated the females of the series with the clearest and most whitish costa. The type is the actual specimen figured by Sir George Hampson as *auxiliaris*, of which he makes it the male, probably correctly. In the figure the costa should really be more even.

223. *C. agrestis* Grt.—The type, also in the British Museum, is a female from Colorado, and is the pale red-brown even-coloured form that I had standing as typical *inconcinna*. The more variegated and distinctly maculate forms formerly held by me as *agrestis* seem correctly associated with this, and I have no reason for suspecting that the Calgary, or any Canadian material that I have seen, includes two species. Nor have I yet succeeded in drawing any line between *agrestis*, *introferens* and *auxiliaris*, and suspect that they are all one. A few years ago I confined a large number of females over various herbage to try and induce them to lay, but without success.

[224. *C. inconcinna* Harvey.—This name had better be erased from the Alberta list, the series I had so referred being, as above stated, typical *agrestis*. The type of *inconcinna* in the British Museum is a male from

Texas, and is smaller, redder and less maculate than any I had previously seen. Hampson treats it as a good species, figuring a Texas specimen, but apparently not the type. He omits it from the tables, however, and records both this and *agrestis* from Texas and Mexico. Some material that I have from Texas and Arizona seems to indicate that the forms may connect, and an examination of those in other collections has not helped me in a separation. I should not feel justified, however, in making the reference at present.]

225. The species I had so listed is certainly not *terrealis*, though I have not yet found a name for it which satisfies me. It may be found to connect with *sordida* Smith, described from Kaslo, but its rarity both here and in British Columbia has prevented much study. A male type of *terrealis*, from a figure of which Hampson's figure was taken, is in the Brooklyn Museum. It has ciliate antennæ merely and is more correctly referable to *Rhisagrotis* Smith than to this group.

228. *Feltia hudsoni* Smith.—I do not appear to have met with this form here since writing my former notes, but have seen two females from Stockton, Utah, in Prof. Smith's collection, which agree with the types there. Under the circumstances, I have not had much further means of judging whether the form is really a good species, or, as I rather suspect, merely a variety of the following.

229. *F. ducens* Walk.—This is the common and widely distributed species standing wrongly in our lists as *subgothica* Haw., which is really prior to *tricosa* Lint. The correction was originally made by the late Prof. Slingerland in CAN. ENT., XXVIII, 295-299, who figured on Plate 4, at bottom, what he produced good evidence to show was Haworth's type, a male from "U. S. A." The upper figure on the same plate is of a female type of *tricosa* in Slingerland's possession. Other types of *tricosa*, both of which I have seen, are a male from Albany, N. Y., in the Strecker collection, and a female from New York in the British Museum, where is also the type of *subgothica*, obviously the same species. Sir George Hampson catalogues and figures this and *ducens* correctly, and Prof. Smith accepts the synonymy in Journ. N. Y. Ent. Soc., XV, 146 (Sept., 1907), pointing out Slingerland's error in CAN. ENT., XXVII, 301 (1895) but apparently overlooking his correction made in the following year, and referred to above. The type of *ducens* is a worn male in the British Museum labelled "W. Canada, Orilla (Bush)," which probably means Orillia, Ont.

231. *F. venerabilis* Walk.—I had this species correctly listed, and Holland's fig. 26, pl. XXII, is correct, Mr. E. J. Smith adjusting his own error in Ent. News, XVI, 277, Oct., 1905. The explanation of my having likened this species to Sir George Hampson's figure of *volubilis* rather than of *venerabilis*, is that the figure of the latter is, so my notes tell me, bad and misleading. When I wrote my notes I had never seen *volubilis*, the Chicago specimens received under that name having been all *venerabilis*. Walker's type of this is a badly worn male from Nova Scotia, and happens to be an unusual form rather *volubilis*-like in appearance. *Venerabilis* has male antennæ strongly bipectinate, and *volubilis* serrate-fasciculate only, and as a rule the two are entirely dissimilar in appearance. But specimens of one very closely resembling the other undoubtedly sometimes occur, and I have such in my series.

232. *F. vancoverensis* Grt.—I have come across no more specimens here of the form I thus listed, but have four similar specimens from Field, B. C., taken by the late Dr. James Fletcher, and one from Windermere. The latter is dated July 12th, 1907, and the Field specimens July 5th, 1902. They are smaller, paler, and less strongly marked than *vancouverensis* from the B. C. coast, but may be a small race of that species. The *volubilis-vancouverensis* group is a difficult one, comprising some forms which seem locally constant, and requires studying in longer series than I have yet been able to compare. The specimen figured by Holland as *vancouverensis* is certainly not that species. It is stated in the text to come from Labrador. I cannot name it with certainty, but it is much more like *opipara* Morrison or *munis* Grote.

233. *F. obliqua* Smith.—I have the species from Mr. Baird, of High River.

234. *Porosagrotis retusta* Walk. is the correct name for this species, Dr. Dyar's *catenula* of the Kootenai List is the same. *Catenula* Grt. is prior to *Euxoa contagionis* Smith. As a matter of fact, I believe Prof. Smith would include Calgary specimens under his name *catenuloides*, but I cannot see that this is even a well marked variation. (Cf. Journ. N. Y. Ent. Soc., XVIII, 88, and Ent. News, XXI, 396-7, June and Nov., 1910) I have it from High River.

[236. The worn specimen I had listed doubtfully as *orthogonia* is not that species, nor in the least like it. It is near, or possibly identical with, the following.]

237. *Euxoa rumatana* Smith, = *Agrotis dargo*, Strecker, the latter specific name having preference by five years. I have three male co-types of *rumatana* from Volga, S. D., one of which I have labelled as being exactly like a type of *dargo*, from Loveland, Colo., in the Strecker collection, which is a trifle paler only. I have also compared the male and female types of *rumatana* at Rutgers' College. I have Calgary and High River specimens of the same species. A male from Chicago is very similar, but darker in colour, with smaller orbicular, and less of dark border to secondaries.

238. This species is not *plagigera*, at least so far as I can at present discover, but has been described from Calgary as *Rhizagrotis perolivalis* by Smith (Journ. N. Y. Ent. Soc., XIII, 194). A male and female co-type are in my collection. Its nearest named ally appears to be *olivalis* Grt., from which it differs considerably in maculation, and structurally in having male antennæ ciliate instead of serrate-fasciculate.

239. *E. olivalis* Grt.—One of my Calgary specimens I have compared with the type, a female in the British Museum from Colorado. The *olivalis* of the Washington collection when I was there was *ridingsiana*. *Agema* Strecker, from Colorado, is in all probability a dark olivaceous specimen of *olivalis*, though I refrain from making the reference definitely at present. I am under the impression that nearly all the specimens I have seen in collections standing as *plagigera* have been *olivalis*. I do not know where Morrison's type is, nor whence it was described. *Oblongistigma* Smith, described from four females from Black Hills, Montana, is a browner, smoother form, but very much like *olivalis*, and not certainly distinct. Hampson figures Smith's species correctly from Colorado, though another Colorado specimen which I found associated with it in the collection was distinct. I have a long series from Stockton, Utah, which appear to grade through. I have seen four specimens labelled "types" of *oblongistigma*. Two females are in the Brooklyn Museum, and a male in the Henry Edwards collection in the American Museum of Natural History. Prof. Smith claims that the latter, though of the same species, cannot be of the type lot on account of its sex. A female at Washington from Nevada Co., Calif., bears the museum red "type" label, but, Prof. Smith tells me, erroneously so. That is fortunate, as it is a distinct species from those at Brooklyn, and nearer *quadridentata* G. & R. It may be what Prof. Smith has since described as *flutea* (Trans. Am. Ent. Soc., XXXVI, 255, Nov., 1910).

240. *E. maimes* Smith, = *ridingsiana* Grt.—This reference is on the strength of a comparison of a Calgary specimen with the male type of *ridingsiana* in the British Museum. Grote described his species in 1875 from the Sierra Nevada, California, though Sir George Hampson erroneously attributes it to Colorado, nor is California given in Prof. Smith's monograph or catalogue. *Maimes* was described in 1903 from five males and seven females from Calgary, Alta.; Brandon, Man.; and Colo. It is very apt to be confused with *Rhizagrotis flavicollis* Smith, which is the most closely resembling species I know. Structurally, of course, the male antennæ of *flavicollis* are ciliate only, and in *ridingsiana*, by which name *maimes* should in future be known, they are serrate-fasciculate. In maculation *flavicollis* may best be distinguished by the contrastingly pale collar and costa. In *ridingsiana* the collar is usually a little paler than the thorax, but is less contrasting, and the costal area is more streaky and less clear. It is usually common here, and apparently less so in Manitoba and Saskatchewan. Dr. Dyar has taken it at Field, B. C., and I have one in my collection from Colorado, and two from Stockton, Utah. Sir George Hampson, who has a number of Calgary specimens, bears me out in the above reference (in 1903).

241. *E. pugionis* Smith.—It seems extremely probable that this will turn out to be *quadridentata* Grote & Rob., though as I have not seen the type of the latter I dare not make the reference. The description and figures agree with *pugionis*, and Dr. Barnes thinks they are the same. I do not possess the description, and omitted to note the type locality, but believe it to be Colorado. Prof. Smith has a male type of *pugionis* from Colorado, and others, including Calgary specimens, in the series. These I noted had for the most part small, ovate, closed orbicular, and very dark secondaries. His series under *quadridentata* included a pair of "Xd types" from Stockton, Utah, and seemed to be characterized by a larger, slightly open orbicular, and slightly dark secondaries. They did not satisfy me as distinct, and I have specimens from Calgary, from Stockton, Utah, New Mexico and Colorado, which certainly seem all one species, and in which these characters are variable. As a matter of fact, *pugionis* as described, from seven males only from Colorado and Calgary, should, by description, have pure white secondaries in that sex. This is by no means always the case, even in one locality. The females differ in having collar and costal and inner margins grayish white instead of yellow, and usually darker secondaries. The *quadridentata* of the British Museum

did not seem to me distinct from *pugionis* of the same collection. Hampson separates them in the tables on the colour of secondaries. The *quadridentata* of the New York and Washington Museum collections are probably not that species. They were at any rate not *pugionis*. Holland's figure under *quadridentata* is typical *niveilinea*. *Flavidens* Smith, of which I have a female from Prescott, Ariz., compared with a female type from New Mexico at Washington, is a larger and altogether darker species, correctly figured by Holland, but apparently wrongly by Hampson, his *flavidens* seeming to me a suffused *pugionis*.

242. *E. cogitans* Smith (1890), = *choris* Harvey (1876, Hamps. Cat., IV, 265).—Sir George Hampson's reference appears to me to be correct, and I have specimens compared with both types. Prof. Smith has called the synonymy in question (Journ. N. Y. Ent. Soc., XV, p. 143, Sept., 1907), stating that he had two closely allied species in his collection under the two names. Had such appeared to me the case I should certainly have taken a note upon it when going over his material, but have no record that his *choris* seemed different. I took a female here on Aug. 10th, 1905, the only one since the male previously listed. I have a long series from Stockton, Utah. *Achor* Strecker, described in 1899 from Colorado, appears to me to be a slightly aberrant *choris*, browner and less gray than usual. The type of *choris* is from Nevada. Of *cogitans*, there are a pair of types in the Brooklyn Museum, the male from Colorado, the female from California, and a pair of types from California at Washington.

243. The specimen I have recorded from here as *Euxoa perfusca* Grt. is not that species, but bears a close resemblance to Walker's type of *perlentans* from New York, in the British Museum, with which I have compared it. I cannot be sure that it is identical, but it resembles it more closely than anything that I have yet come across. I have never taken another specimen very like it. My specimen may very likely be a form of *tessellata*, to which *perlentans* seems correctly referred, so far as I could judge.

244. The species which I quite wrongly recorded as *punctigera* appears to be undescribed, though I prefer that it should remain so at present, as it may turn out to be *sordida* Smith, which is at any rate its nearest ally known to me, but of which I have little knowledge of the variation. The female (of No. 244) is of a rather uniform dull mahogany brown, with the discoidal spots usually rather conspicuously yellowish ringed, and has the abdomen of that depressed shape which probably caused Prof. Smith to place *boretha* and *sordida* in *Chorizagrotis* (Journ.

N. Y. Ent. Soc., XVI, 86, June, 1908). All the males I have seen have been considerably redder in shade, and often closely resemble some dark red forms of *ochrogaster*. Holland figures a female of the species as *tubatis*, which it does not very closely resemble. The *punctigera* of the Kootenai List was also wrongly named, the bulk of the material being the species since described by Smith as *cocklei* (Ann. N. Y. Acad. Sci., XVIII, 96, Jan., 1908), which I make, by direct comparison with both types, = *perfusca* Grt., though at my suggestion Prof. Smith has since made a comparison himself, and is unable to support me in the reference. The type of *perfusca* is a female from Arizona in the Brooklyn Museum. It has also seemed to me that the *perfusca* of most of the other collections I have seen, including the British Museum, have been wrongly named.

245a. *E. megastigma* Smith, = *acornis* Smith. The female type of *megastigma* in the Washington Museum is a dark ochreous-gray specimen, with large, pale, oblique orbicular. The space between the discoidal spots is not nearly as dark as indicated in Sir George Hampson's figure, which is copied from a figure of this type, and not, as I erroneously stated before, from the type direct. A female co-type in Prof. Smith's collection is the same species.

246. *E. scandens* Riley.—A male from the Red Deer River, north-east of Gleichen, on July 7th, 1905, is the only other Alberta specimen I have seen besides the one previously recorded. It appears to be more common in Saskatchewan and Manitoba. There are a male and female type in the Washington Museum. *Setagrotis elata* Smith appears to me the same species. It was described from two males and a female from Colorado, and a pair of types are at Washington, and a male co-type with Prof. Smith. I made very careful comparisons, and have a specimen which I compared with the types of both names, and my notes say that I considered them "unquestionably the same." Prof. Smith, at my suggestion, has compared them since, and is unable to agree with me in the reference. Sir George Hampson places both in the genus *Lycophotia* Hübner, of which he makes *Peridroma* Hübner and *Setagrotis* Smith synonyms. *Elata*, however, was known to him only by a figure.

247. *E. vulpina* Smith.—A male at light on Sept. 23rd, 1907, is only the fourth specimen I have seen to be sure of. I have not yet identified it with any other named species. It is an ally of *incallida*, and is one of a group in which species are extremely hard to distinguish, and enormously variable.

(To be continued.)

RARE CAPTURES OF LEPIDOPTERA.

Pholus pandorus Hbn.—On the evening of July 30, 1910, I noticed a specimen of this hawk-moth on the wire of an electric light on Centre Island breakwater, Toronto. Placing my coat at the base of the pole so that the insect would not get lost amongst the rocks, I tapped the wire and it floated down. It is a beautiful female specimen, and had evidently emerged quite recently, as it secreted fluid while being captured. (Paul Hahn.)

Euptoieta claudia Cram.—While playing tennis in a gale on the lawn of the Royal Canadian Yacht Club, Centre Island, Toronto, Sept. 10, 1910, I observed a butterfly that, at first, seemed to be an *Argynnis*, but observing the peculiarity of its flight, the game was stopped and the insect captured. It proved to be a male of the above species. (P. Hahn.)

Charidryas nycteis D. & H.—A curious aberrant specimen of this butterfly was taken near the Hunt Club grounds, east of Toronto, during August, 1910, by Mr. J. R. McMurrich. The dark markings are more extensive and confluent than usual, those on the basal half of the wings forming an almost solid dark area. The broad pale submedian band is somewhat reduced, and is white instead of brownish-yellow, though the small spots in the marginal band are of the usual colour. The under side is normal. The specimen is much worn.

Mr. McMurrich also reports the capture of a specimen of *Speyeria idalia* Dru. near Forest Hill Road, Toronto, about the end of August, 1911. (E. M. W.)

Work is now being carried on to arrange and equip an entomological building at Rutgers College, New Brunswick, N. J. The building will have two stories, will provide for classrooms and laboratory work on the first floor, and will furnish offices and space for collections on the second floor, as well as accommodations for the assistants in experiment station work.—*Science*.

We have much pleasure in announcing that Mr. J. Eaton Howitt, B. S. A., M. A., Secretary-Treasurer of the Entomological Society of Ontario, has been appointed Professor of Botany in the Ontario Agricultural College, Guelph. For the last five years Mr. Howitt has been a most efficient lecturer in the Botanical Department of the College, and has well earned the promotion which has now been accorded to him.

NEW SPECIES OF EMPRIA.

II.—WESTERN SPECIES.

BY ALEX. D. MACGILLIVRAY, ITHACA, N. Y.

(Continued from page 311.)

Empria capillata, n. sp.—Female. Clypeus with a median carina, broadly, shallowly emarginate, without a median tooth, lobes broadly rounded; antennal furrows interrupted; the ocellar basin a broad, rounded, rather shallow depression, extending to the median ocellus, and between the bases of the antennæ; the median fovea a broad flaring crater at the ventral end of the ocellar basin; the ocellar and interocellar furrows distinct; the third segment of the antennæ longer than the fourth; the saw-guides convex above and below, broadly rounded at apex above and below to a rounded point just above the middle at apex; body black, with the collar and outer half of the tegulæ white; the knees and the front and middle legs below the knees infuscated. Length, 6.5 mm.

Habitat.—Peck, Idaho. Professor J. M. Aldrich, collector.

Empria carbasa, n. sp.—Female. Clypeus flat, without a median carina, deeply angularly emarginate, lobes angular and rounded at apex; antennal furrows not interrupted; ocellar basin broad and flat, extending between the antennæ, reaching the median ocellus, the median fovea pit-like, minute, above the ventral end of the ocellar basin; ocellar and interocellar furrows distinct; the third segment of the antennæ slightly longer than the fourth; saw-guides convex, above and below, obliquely, roundly truncated to a round apex below the upper margin; body black, with the clypeus, labrum, genæ, a line on the inner orbits to the occiput, the collar, tegulæ, an elongate spot on the pleuræ, coxæ, trochanters, femora at base and beneath, the front tibiæ, the middle tibiæ except a ring at apex, the hind tarsi at base and beneath, the tarsi more or less at base, and a band on the abdominal pleuræ, white. Length, 8 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

Empria confirmata, n. sp.—Female. Clypeus with a median carina, emarginate with a blunt tooth, the lobes rounded; the antennal furrows interrupted; the ocellar basin a broad, linear, flat-bottomed depression, extending from the median ocellus almost to the dorsal margin of the antennal foveæ; the median fovea a broad indistinct depression on a shelf ventrad of the ocellar basin and completely separated from the ocellar

basin ; the ocellar and interocellar furrows distinct ; the third segment of the antennæ longer than the fourth ; the saw-guides convex above and below, broadly, convexly rounded at apex ; body black, with the collar, front legs below the knees, and the knees of the middle and hind legs, white. Length, 6.5 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

Empria concitata, n. sp.—Male. Clypeus flat, without a median carina, with a minute tooth, roundly emarginate with rounded lobes ; ocellar basin with broad, flaring sides, extending to the median ocellus, the median fovea a broad, flaring pit at the ventral end of the ocellar basin, as wide as the ocellar basin ; the antennal furrows not interrupted ; the ocellar and interocellar furrows distinct ; the third and fourth segments of the antennæ subequal ; body black, with a white line on the collar, the knees and the tibiæ of the front legs white, the tibiæ of the middle legs infuscated. Length, 6 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

This specimen was originally described as the male of *Monostegia kincaidii*, from which it is very different.

Empria condensa, n. sp.—Female. Clypeus with a median carina, narrowly, shallowly emarginate, with lobes rounded outwardly and angular inwardly, the median tooth as long as the lateral lobes ; the ocellar basin and the median fovea forming a dumb-bell-shaped depression, the median fovea a rounded pit in line with the dorsal margin of the antennal foveæ, the ocellar basin extending to the median ocellus ; the interocellar furrow distinct, the ocellar furrow linear ; the third segment of the antennæ distinctly longer than the fourth ; the saw-guides straight above and below, slightly converging toward the apex, apex broadly, somewhat truncately rounded ; body black, with the clypeus, labrum, collar, tegulæ, and legs for the most part below the coxæ, white. Length, 5 mm.

Habitat.—Polk County. Professor C. F. Baker, collector. No. 6498.

Empria condita, n. sp.—Female. Clypeus with a median carina, without a median tooth, broadly, shallowly emarginate, lobes angular ; the antennal furrows interrupted ; the ocellar basin a broad depression extending from the median ocellus to the middle of the antennal foveæ, the median fovea a broad, shallow depression near the middle of the ocellar basin ; the third segment of the antennæ longer than the fourth ;

the ocellar furrow deep, the interocellar furrow deep and Y-shaped; the saw-guides convex above and below, slightly, obliquely truncate at apex, with rounded angles; body black, with the collar, tegulae, front and middle legs below the knees, and the base of the hind tibiae, white. Length, 7 mm.

Habitat.—Colorado. Professor C. F. Baker, collector.

Empria contorta, n. sp.—Female. Clypeus with a median carina and without a median tooth, shallowly emarginate, lobes broadly rounded; antennal furrows interrupted; ocellar basin broad, oval, with sloping sides on its lower three-fourths, constricted just below the median ocellus, and expanding slightly at the ocellus; the median fovea broad and deep, located near the middle of the lower portion of the ocellar basin; the third segment of the antennae longer than the fourth; the ocellar and interocellar furrows deep, the interocellar furrow somewhat Y-shaped; the saw-guides strongly concave above, slightly convex below, broadly rounded at apex, with a broadly rounded knob at apex above; body black, with the collar, tegulae and legs below the knees white. Length, 7 mm.

Habitat.—Chimney Gulch, Colorado. Mr. E. J. Oslar, collector.

Empria culpata, n. sp.—Female. Clypeus with a median carina, shallowly, roundly emarginate, without a tooth, lobes rounded; ocellar basin extending from the median ocellus to the dorsal margin of the antennal foveae, a linear depression, broadest below; the median fovea shallow, quadrangular, separated from the ocellar basin; ocellar and interocellar furrows distinct; the third segment of the antennae longer than the fourth; the saw-guides straight above, convex below, obliquely rounded at apex, densely hairy; body black, the collar white, the legs below the knees more or less rufous infuscated. Length, 6 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

Empria cumulata, n. sp.—Clypeus with a median carina, roundly emarginate without a tooth, lobes rounded; the ocellar basin a narrow linear depression extending from below the dorsal margin of the antennal foveae to the median ocellus, somewhat interrupted at middle, the median fovea deep, elongate; the ocellar and interocellar furrows indicated; the postocellar area polished; the third segment of the antennae slightly longer than the fourth; the saw-guides straight above, convex below, obliquely truncated at apex; body black, with the collar white, the front and middle legs reddish infuscated below the knees. Length, 6 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

Empria conferta, n. sp.—Female. Clypeus with a median carina, emarginate without a tooth, lobes rounded; ocellar basin a broad, deep depression extending to the median ocellus, extending between the antennæ and not limited by a transverse carina; the median fovea a rounded pit near the middle of the ocellar basin and connected by a linear furrow with the median ocellus; antennal furrows interrupted; ocellar furrow indicated at middle, the interocellar furrow distinct; the third segment of the antennæ longer than the fourth; the saw-guides convex above, and below, convexly, obliquely truncated to a point above at apex; body black with the collar, tegulæ, knees, and front and middle tibiæ white. Length, 7 mm.

Habitat.—Colorado. Professor C. F. Baker, collector.

Empria concreta, n. sp.—Female. Clypeus with a median carina, roundly emarginate with a broad, rounded tooth, lobes broadly rounded; ocellar basin broad and shallow, reaching the median ocellus, extending nearly to the ventral margin of the antennal foveæ, a deeper linear depression between the median fovea and the median ocellus, the median fovea a rounded pit situated above a line drawn through the dorsal margin of the antennal foveæ; the antennal furrows interrupted; the ocellar and interocellar furrows distinct; the third segment of the antennæ longer than the fourth; the saw-guides straight above, slightly concave below, broadly and somewhat obliquely rounded at apex; body black with the collar, tegulæ, knees, front and middle tibiæ and tarsi, tarsi somewhat infuscated, white. Length, 8 mm.

Habitat.—Colorado. Professor C. F. Baker, collector.

Empria conciliata, n. sp.—Female. Clypeus with a median carina, angularly emarginate, the median tooth small and pointed, lateral lobes angularly rounded; antennal furrows not interrupted; the ocellar basin extending from the median ocellus to the middle of the antennal foveæ, broad with sloping sides, abruptly elevated at its ventral end, with a flat, polished shelf at ventral end, a broad crater-like pit in front of the shelf, the median fovea; ocellar and interocellar furrows distinct; the third segment of the antennæ slightly longer than the fourth; the saw-guides straight above and below, squarely, truncately rounded at apex, margin fringed with hairs; body black with the labrum, collar, tegulæ, and legs below the knees white. Length, 7 mm.

Habitat.—Chimney Gulch, Colorado. Mr. E. J. Osler, collector.

Empria contexta, n. sp.—Female. Clypeus with a median carina and a broad median tooth, the lobes broadly rounded; the antennal furrows interrupted; the ocellar basin flat, not reaching the median ocellus, the median fovea a small, pin-hole puncture; the ocellar and interocellar furrows distinct; the third segment of the antennæ longer than the fourth; the saw-guides straight above, convex below, squarely, slightly obliquely, truncated at apex with the lower angles rounded; the body black with the clypeus, labrum, collar, and tegulæ white; the front and middle legs more or less yellowish infuscated. Length, 6mm.

Habitat.—Colorado. Professor C. F. Baker, collector.

Empria kincaidii MacG.—Female. Clypeus with a median carina, emarginate with a median tooth, lobes rounded; antennal furrows interrupted; ocellar basin extending to the median ocellus, ending ventrally at the dorsal margin of the antennal foveæ, broad and flat with a median carina; the median fovea wanting or very indistinct; the saw-guides convex above and below, slightly obliquely, convexly rounded at apex.

This species was originally described as *Monostegia kincaidii* from one male and seven female specimens. A re-examination of this material has shown it to be a composite of several species.

Empria curata, n. sp.—Female. Clypeus with a median carina, deeply, angularly emarginate, with a distinct tooth, the lobes angular; the ocellar basin diamond-shaped on its lower half, constricted above by a pair of rounded, mound-shaped elevations situated below the median ocellus; the median fovea a broad pit, situated above the dorsal margin of the antennal foveæ; the antennal furrows interrupted; the ocellar and interocellar furrows distinct; the antennæ with the third segment longer than the fourth; the saw-guides straight above and below, obliquely rounded at apex; body black with the collar white, the front legs below the knees more or less rufous. Length, 7 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

Empria cuneata, n. sp.—Female. Clypeus with a median carina, deeply, angularly emarginate with a median tooth, the lobes angular; the ocellar basin linear, slightly wider below, the median fovea deep; the ocellar furrow distinct, the interocellar furrow continued below the median ocellus to the middle of the ocellar basin; the third segment of the antennæ longer than the fourth; the saw-guides straight above, straight and oblique below, slightly, obliquely rounded at apex; the body black,

with the collar white, the front and middle legs below the knees rufous infuscated. Length, 6.5 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

Empria concisa, n. sp.—Female. Clypeus with a median carina, roundly emarginate without a tooth, lobes rounded; the antennal furrows not interrupted; the ocellar basin broad, with sloping sides, reaching the median ocellus, extending to the middle of the antennal foveæ, the median fovea a small pit on a level the dorsal margin of the antennal foveæ; the ocellar and interocellar furrows distinct; the third segment of the antennæ longer than the fourth; the saw guides convex above and below, obliquely rounded at apex above and below to a point slightly above the middle of the apex; body black, with the labrum, collar, tegulæ, knees, front and middle tibiæ and tarsi, all more or less infuscated, white. Length, 7 mm.

Habitat.—Pullman, Washington. Professor C. V. Piper, collector. No. 13.

Empria cupida, n. sp.—Female. Clypeus with a median carina, shallowly emarginate with a tooth, lobes acute; the ocellar basin a broad, shallow depression, broadest near the middle, extending to the median ocellus; median fovea broad and deep, situated above the dorsal margin of the antennal foveæ; ocellar and interocellar furrows distinct; the third segment of the antennæ longer than the fourth; the antennal furrows interrupted; the saw-guides straight above, convex below, obliquely, convexly rounded to a point above at apex; body black, with the collar and front and middle legs below the knees white. Length, 6 mm.

Habitat.—Olympia, Washington. Professor Trevor Kincaid, collector.

MISCELLANEOUS NOTES ON THE HYMENOPTERA CHALCIDOIDEA: THE GENUS *ARTHROLYTUS* THOMSON;
HORISMENUS MICROGASTER ASHMEAD.

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Introduction.

In describing a new species of *Arthrolytus* Thomson, I merely bring together the literature of the group.

History and Description.

The genus *Arthrolytus* was founded by C. G. Thomson in 1878 with the rank of a subgenus *Pteromalus* Swederus, 1795. The description of *Pteromalus* and the *Conspectus subgenerum*, which includes *Arthrolytus*, were given by Thomson as follows:

October, 1911

"Genus PTEROMALUS Swederus.

"Caput mandibulis 4-dentatis, sinistra rarissime 3-dentata, genis sæpe compressis, vertice interdum medio acuto; clypeo apice medio plerumque emarginato; oculis interdum hirtis, peristomio sæpe parvo. Antennæ sæpius infra medium faciei convexæ vel interdum protuberantis insertæ, scapo haud brevi, annellis plerumque bene distinctis, clava haud stylata. Thorax haud elongatus, pronoti collari sæpius discreto, sed margine antico haud acute reflexo; metathorace plerumque punctulato, plica sæpius integra, interdum abbreviata sed semper distincta instructo, spiraculis raro magnis, nucha plerumque brevi, calli fimbria sæpe magna. Alæ radio quam metacarpo interdum brevior vel æquali, stigmate haud crasso, plerumque. ♂ semper immaculatæ; abdomen sæpe ♀ rotundum, ♂ ventre rarius plica instructo, fasciis nullis determinatus ornatum, segmento 8o ♀ plerumque brevi, 2o haud dense pubescente apice late rotundato. Pedes haud graciles, coxis posticis breviter ovatis, basi postice haud pubescenti." (Thomson, 1878, p. 145.)

The *Conspectus subgenerum* follows on the next page, after a paragraph of remarks; only those portions necessary for our purpose are given in full.

"CONSPECTUS SUBGENERUM.

- A) Oculi hirti. Antennæ incrassatæ. Vertex medio acuto.
 a) *Halizous*.
 aa) *Trichoglenus*.
 B) Oculi glabri.
 b) Antennæ postannello parvo *Meraporus*.
 bb) Antennæ postannello magno.
 c) Metathorax nucha magna subglobosa. Antennæ flagello filiformi. Abdomen ♀ ovato-acutum. Alæ metacarpo quam radio longiore.
 d) *Catolaccus*.
 dd) *Pteromalus*.
 cc) Metathorax nucha sæpius minima. Alæ metacarpo quam radio interdum brevior, rarissime longior. Abdomen ♀^a plerumque rotundum. Antennæ infra medium faciei convexæ vel valde prominulæ insertæ.

- e) *Diglochis*.
 ee) Metacarpus radio brevior vel æqualis.
 f) Abdomen oblongum.
 g) Vertex medio teres. Abdomen ♀ ovatum, subtus convexum. Alæ ♀ sæpe macula magna disci fumata. Antennæ ♀ clava parva pedicello brevior..... *Arthrolytus*.
 gg) Vertex medioacuto..... *Dibrachys*.
 ff) Abdomen rotundum. Genæ compresso-acutæ. Ala vitreæ, metacarpo radio brevior..... *Cœlopisthus*."

(Thomson, 1878, pp. 146-147.)

The description of the genus is given later, on page 158, in the following words:

"Subgenus ARTHROLYTUS.

Caput vertice medio haud acuto, oculis sat magnis, ovatis, convexis glabris, clypeo apice truncto, mandibulis minus validis. Collare haud discretum. Alæ metacarpo radio vix longiore, disco ♀ sæpe macula magna fumata. Abdomen ovatum subtus convexum. Antennæ clava ♀ parva. Pedes crassi.

Detta subgenus afviker från *Diglochis* genom kortare metacarpus och anelli, mer eller mindre incrasserade antenner, äggformig abdomen hos ♀ och oftast afrindadt pronotum.^a

A) Antennæ minus validæ sec flagello incrassato, ♂ articulis longis hirtis, infra medium faciei convexæ insertæ.

1. *A. punctatus* m:.....

B^b Antennæ flagello valido longe infra medium faciei protuberantis insertæ. Abdomen segmento ultimo spiraculis ab apice longe remotis.

2. *A. albiscapus* m:.....

C^c Antennæ flagello haud valido sed incrassato. Alæ immaculatæ.

a. This subgenus differs from *Diglochis* through the shorter (*kortare*) post-marginal vein and ring-joints (*anelli*), the more or less incrassate antennæ, egg-shaped abdomen in the female and the usually (most often, *oftast*) rounded (*afrindadt*) pronotum.

b. Page 159.

c. Page 160.

3. *A. rugifrons* m :
-
-”

(Thomson, 1878, pp. 158-160.)

Eight years later, Howard (1886), in a paper entitled "A Generic Synopsis of the Hymenopterous Family Chalcididae," repeated almost entire, with the exception of two or three sentences of minor importance, the *Conspectus subgenerum* of Thomson given in foregoing, and indicated that the then subgenus was as yet unknown in the continent of North America, north of Mexico. Howard, however, raised the tribes of Thomson to the rank of subfamilies, and his subtribes to the rank of tribes. In the following year, Cresson (1887) gave Howard's synopsis of the genus *Pteromalus* verbatim, so up to that epoch *Arthrolytus* was still retained as a subgenus.

In describing the first North American species Ashmead (1893) treated the group as a genus, and thus in 1893 it first attained to that rank, already foreshadowed by its treatment as such by Möller (1882) eleven years previously and the attitude taken by Howard in regard to the larger groups of Thomson. De Dalla Torre (1898) listed the species of the genus, and gave *Pteromalus* Thomson (*sic*) as its synonym, whereas in reality *Arthrolytus* being a part of *Pteromalus* Swederus has no synonym strictly, since it was taken out of the latter group and made independent of it. Its synonymy, therefore, should have been given as *Pteromalus* Swederus (*partim*). *Pteromalus* Thomson was a subgenus of *Pteromalus* Swederus; at present, the latter, therefore, should be *Pteromalus* Swederus (Thomson); Thomson practically gave us the modern conception of the genus *Pteromalus*. Then Ashmead (1904) in his monumental work on the Chalcidoidea formally defined the genus *Arthrolytus* in a synopsis of the modern tribe Pteromalini Ashmead, 1904, which is practically the old genus *Pteromalus* Swederus raised to the rank of a tribe. Also, Ashmead there, and previously in 1893, formally designated *Arthrolytus punctatus* Thomson as type of the genus, formerly such by page precedence. Finally, Schmiedeknecht (1907, 1909) treated the genus in a manner essentially similar to Ashmead's treatment, so that it is unnecessary to quote here.

The following description of the genus is based on Thomson's descriptions of the genus and species, that of Ashmead's and Möller's

species, the new species herein described, and the synoptic table given by Ashmead (1904, pp. 318-322).

Normal position.

Male, female: Normal for the subfamily and tribe. Head wider than thorax (dorsal aspect) with the vertex not acute medially, the occipital foraminal depression immargined, rounded; the eyes moderately large, ovate in the lateral aspect, convex, hairless, or practically so; the ocelli in a curved line on the vertex; apex of the clypeus emarginate or truncate at the meson; mandibles not strong, both 4-dentate, the outer or lateral tooth forcipiform, but variable in size; the antennæ inserted slightly below (ventrad) of the middle of the face (direct cephalic aspect), but above (dorsad) of an imaginary line drawn between the ventral ends of the eyes, the face produced below, the club in the female variable, not large, frequently smaller than the first funicle joint, the latter large, longer than the pedicel; in the male, joints 1-4 of the funicle all longer than wide; flagellum filiform or moderately clavate; scape reaching to the cephalic ocellus, or nearly.

Pronotum distinct, transverse, sometimes narrowed mesially and dilated laterad; mesothorax large, the parapsidal furrows incomplete, present cephalad and extending for not much more than half their length; axillæ widely separated; metathorax variable in length and declivous or not, with a small neck, tricarinate, punctate. Abdomen conic-ovate, convex ventrad, the ovipositor not exerted. Wings hyaline, or sometimes in the female with a large fumated spot in the disk, with the postmarginal vein equal to, or very slightly longer than, the stigmal vein.

Body metallic dark greenish, with brassy tinges, or shining blackish, sculptured, usually punctate. The males differ from the females in the following details: The flagellum of the antennæ is larger and filiform, the body slenderer, the abdomen somewhat shorter, about the length of the thorax and ovate and depressed, and the eyes slightly more rounded; the funicle joints are relatively larger and more hispid, the scape longer, the pedicel and second ring-joint shorter. The abdomen more often with a pallid spot at base, dorsad, or with some yellowish there.

Readily separated from *Pteromalus* Swederus by means of the short postmarginal vein and small metathoracic neck; from *Dibrachys* Foerster by the insertion of the antennæ near the middle of the face, that is, not much below (ventrad) the point midway between the cephalic margin of the vertex and the apical margin of the clypeus, the face being produced

below, and by the broader vertex at meson; from *Metopachia* Westwood by the usually shorter postmarginal vein, the smaller metathoracic spiracles, and from the fact that in *Arthrolytus* the abdomen is not strongly keeled, or acutely, strongly produced or convexed ventrad near the base. Distinct, or not easily confused, with other genera of the Pteromalini, excepting, perhaps, *Coelopisthia* Foerster,^a from which it is easily distinguished by cephalic characters, antennal characters, and those of the abdomen.

Host Relations of the Genus.

Of Thomson's three species, which were probably captured at large, nothing concerning the host is known. *Arthrolytus puncticollis* Möller was described from specimens reared from the larva of (*Anobium*) *Sitodrepa panicea* (Linnæus), a coleopteron of the family Ptinidæ. Ashmead's species, *apatela*, is recorded from a lepidopteron, *Apatela populi* Riley, of the family Noctuidæ, but its relationships here are doubtful, *Rhogas intermedius* Cresson also being present; while *aneoviridis* Girault has doubtful relationships, having been reared from breeding-cages containing the larvæ of (*Alceris*) *Peronea minuta* (Robinson), of the lepidopterous family Tortricidæ, the adults emerging after the ichneumonoid *Clinocentrus americana* Weed, and before *Horismenus microgaster* (Ashmead). It is therefore probably a secondary parasite of the *Peronea*, its host being the *Clinocentrus*; I think it more probably a primary parasite of the lepidopteron, however. From these few records, of course, it would be hazardous to generalize in regard to the genus as a whole. It is indicated that the genus may attack the Hymenoptera, and thus play a secondary or even tertiary role of parasitism for the Lepidoptera and Coleoptera, somewhat like the role of *Dibrachys*.

Distribution of the Genus.

The genus is represented in the continents of Europe and North America. Of the European species, of which there are four, all are confined, so far as is yet known, to the Scandinavian Peninsular (de Dalla Torre, 1898), Sweden. The two North American species are recorded from Ohio (*apatela* Ashmead), and Iowa (*aneoviridis* Girault).

a. No species was mentioned in connection with the genus by Foerster, but as Thomson adopted the name and designated a type for the genus, the name holds, and Foerster is held responsible for it.

Family Pteromalidæ.

Subfamily Pteromalinæ.

Tribe Pteromalini.

Genus *Arthrolytus*

(Type *Arthrolytus punctatus* Thomson).

Pteromalus Swederus (*partim*).

Thomson, 1878, pd. 147, 158.—Subgenus *Arthrolytus*.

Howard, 1886, pp. 38, 97.—Subgenus *Arthrolytus*.

Cresson, 1887, pp. 77, 138.—Subgenus *Arthrolytus*.

Ashmead, 1893, p. 162.—Genus *Arthrolytus*.

De Dalla Torre, 1898, p. 153.—Genus *Arthrolytus*.

Ashmead, 1904, pp. 320, 322, 367.—Genus *Arthrolytus*.

Schmiedeknecht, 1907, p. 479.—Genus *Arthrolytus*.

Idem, 1909, pp. 329, 331, 358-359.—Genus *Arthrolytus*.

Descriptions of the Species.

1. *Arthrolytus punctatus* Thomson.

Thomson, 1878, pp. 158-159.

Ashmead, 1894, p. 339.

De Dalla Torre, 1898, p. 155.

Ashmead, 1904, pp. 320, 367.

Schmiedeknecht, 1909, p. 359.

"1. *A. punctatus* m: Obscure æneus, antennis basi pedibusque rufescentibus, alis ♀ macula magna disci fumata. Long., 3-4 mill.

"*Pteromalus maculipennis* Walk., l. c. III, 191, 83 (forte).

"Caput thorace fere latius, subtransversum, antrorsum vix angustatum, pone oculos magnos ovatos subangustatum, vertice minus lato, ocellis parvulis in lineam curvam dispositis; facie convexa, fortiter concinne punctata, scrobe antennali parum impressa; clypeo vix discreto, sinu laterali parvo, apice medio truncato, genis parum buccatis haud compressis; mandibulis 4-dentatis, dente apicali parum forcipato. Antennæ infra medium, faciei insertæ; articulo 10 testaceo, ocellum haud attingente, 20 longo sed postannello brevior, annellis haud parvis sed flagello arcte adpressis, 5-10 sensim brevioribus et paulo crassioribus 50 basin versus attenuato longo quam 100 transverso multo longiore, clava parva postannello brevior, apice oblique acuminata. Thorax sat crassus, supra convexus, obscure olivaceo-æneus, fortiter concinne punctatus, subglaber; pronoto haud plane verticali, collari^a haud discreto; meta-

a. Beginning p. 159.

thorace sat longo concinne punctato, nucha tantum linea apicali elevata indicato, carina media elevata, plica sat distincta vix arcuata, interdum costula transversa instructo. Alæ fere vitreæ, parum pubescentes, haud longæ nec latæ, cellula basali et speculo magno nudis, stigmatè tenui metacarpo sesqui longiore, radio sub angulo sat acuto egrediente, clava parva quam metacarpo vix breviorè, disco macula magna fumata ad radii clavam usque extensa et ad marginem inferum fere descendente. Abdomen cupreo-aureum, splendens, segmentis 20 viridi, subtus interdum pallido et 30 40 que fere glabris, 3-6 sensim brevioribus, 80 parvo sub-erecto; ventre convexo sed haud compresso. Pedes validi rufescentes, coxis anterioribus interdum concoloribus. Mesosterni epimera punctata discreta, præsterna haud parva.

"Mas differt: antennis corporis fere longitudine articulis 20 breviorè, 5-11 linearibus nigris longe hirtis, clava 2-articulata elongato-acuminata; metathorace longiore costula transversa magis distincta, abdomine oblongo macula pallida, femoribus basi et coxis totis viridiæneis.

"Sällsynt men troligen utbredd från Skane till Lappland."^a

(Thomson, 1878, pp. 158-159).

As Thomson, in the description of the species just given, makes *Pteromalus maculipennis* Walker a possible synonym, the original description of that species is appended to the foregoing, for the sake of convenience. It is impossible to decide this from the descriptions. *A. punctatus* was designated by Ashmead in 1894 as the type of the genus, and again as such, by the same author, in 1904. Further than in the places already cited, the species has not been mentioned again in the literature. The original description of *Pteromalus maculipennis* Walker follows:

"*Pteromalus maculipennis* Walker.

"Corpus mediocre; caput thorace paulo latius: antennæ clavatæ, crassæ, corporis dimidio longiores; articuli 50 ad 10 mm. longitudine decrescentes latitudine increscentes; clava articulo 100, paulo latior vix duplo longior; thorax ovatus; prothorax brevis: mesothoracis parapsidum suturæ vix conspicuæ: metathorax brevis: abdomen ovatum, subtus angulatum, apice elevatum acuminatum, non compressum, thorace paulo longius et latius: segmentum 1 mm. magnum: sequentia breviora; oviductus occultus; alæ mediocres: nervus cubitalis radiali vix brevior.

a. Rarely, but probably scattered (*utbredd*) from Servia to Lapland.

Sp. Pter. maculipennis. Fem. *Viridis*, abdomen cupreum, antennæ nigrae, pedes flavi, femora fusca, proalæ fusco maculatæ.

"Viridis, parum nitens: oculi ocellique rufi: antennæ nigrae; articulus 1^{us} flavus; 2^{us}, 3^{us} et 4^{us} fusci: abdomen cupreum; segmentum 1^{um} laete cupreo-æneum; oviductus rufus; pedes flavi: coxæ virides; femora fusca; meso- et metatarsi pallide flavi, apice fusci: alæ sublimpidæ; prealæ sub nervis ulnari et cubitali fuscomaculatæ; squamulæ fusca; nervi fulvi; stigma minutum. (Corp. long. lin. 1-1 ¼; alar lin. 1 ¼-1 ½.)

"Var. B.—Abdomen purpureo-cupreum; segmentum 1^{um} laete cupreoviride: femora flava

"Var. c. Var. b. similis: caput et thorax viridi-ænea.

"July, August: grass in fields; near London."

De Dalla Torre, 1898, p. 134.

2. *Arthrolytus albiscapus* Thomson.

Thomson, 1878, pp. 159-160.

Möller, 1882, p. 180.

De Dalla Torre, 1898, p. 155.

Schmiedeknecht, 1909, p. 359.

"2. *A. albiscapus* m: Viridis pedibus flavis, coxis posticis supra cyaneis tibiis antennisque scape albidis, abdomine aureo, alis macula magna disci fusca. ♀ Long., 3-4 mill.

"Præcedenti statura similis, sed facie infra medium valde protuberante, antennis scapo longiore, albo, flagello validiore sed haud incrassato, thorace laetius viridi subtillissime punctato, collari multo augustiore, metathorace brevior et magis declivi, costula nulla, alis limpidis, radio subangulo^a acutiore egrediente, stigmatibus crassioribus, pedibus præsertim femoribus adhuc validioribus, mandibulis externe sinuatis, apice forcipatis bene distinctus.

"Sällsynt i medlersta och södra Sverige."^b

(Thomson, 178, pp. 159-160.)

This species is mentioned by Möller (1882) in his description of *puncticollis*. With this exception, it is not again mentioned in the literature excepting in the citations given.

a. Beginning p. 160.

b. R rely, in middle and southern Sweden.

THE COLOUR OF THE LIGHT EMITTED BY LAMPYRIDÆ.

BY W. W. COBLENTZ, WASHINGTON, D. C.

The light emitted by various animals has been described as being "blue," "bluish," "green," "yellowish," "orange-coloured," "red," etc. In view of the doubts* as to whether this colour is a subjective phenomenon, resulting from the variation in colour sensibility of the eye with variation in intensity, or whether it is an objective reality, it seemed of interest to attempt to settle the question by subjecting the light to physical analysis by means of instruments which are unbiassed in the matter. One can, of course, examine the light visually by means of a spectroscope and note that in some cases it is "bluer," and on other cases it "extends further toward the red," etc., but to those familiar with the vagaries of the human eye, such a record is useless. The proper instrument to use is a bolometer, but because of the lack of sensitiveness of such an instrument and because of the intermittence of the light, the spectral analysis of the light by such means is prohibited. Spectrophotometric comparisons are also precluded. The only satisfactory means available is the photographic plate, which is integrative in its action, and hence well adapted to study weak sources of radiation. The photographic plate must be of a special kind, sensitive to all parts of the visible spectrum. The nearest approach to this condition is the Wratten and Wainwright "Panchromatic" plate, which is sensitive, in a variable degree, to all frequencies from the ultra-violet far into the red. The method is really a species of spectro-photographic photometry, in which the light of the fire-fly and that of a standard source are photographed, after which the "densities" of the negatives are compared, in a manner to be described presently.

The apparatus used consisted of a large prism spectrograph of one meter focal length, giving a long spectrum, and a small spectrograph, of triple achromatic lenses, 6 cm. diameter and 18 cm. focal length, which had a much greater light-gathering power, hence useful in photographing the weak radiations in the red. The method of procedure consisted in holding the insects in the fingers, one or two at a time, over the spectrometer slit. This required an exposure varying from one to five hours on the large spectrograph, and from one to sixty minutes on the small

*Knab.—CANADIAN ENTOMOLOGIST, 37, p. 238, 1905

Molisch.—Leuchtende Pflanzen, Jena, 1904.

October, 1911

spectrograph to obtain satisfactory negatives of the various species of fire-flies. The photographing was done in a dark room. Over 150 negatives were taken, over 56 hours being spent in holding the insects in place. The plates, being sensitive to red light, were developed and fixed in a perfectly dark room. The numerous details in the work will be published in the complete paper.

Prints from negatives of the light of *Photuris pennsylvanica* and of *Photinus pyralis* are given in fig. 23, from which it is evident that the light of the *Photinus pyralis* does not extend so far into the blue ($\lambda = .5015\mu$)

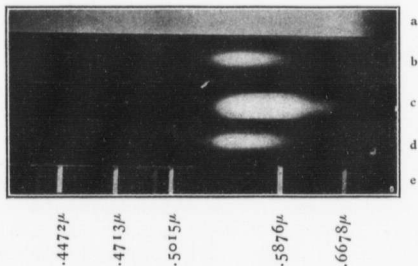


FIG. 23.—a, spectrum of "4 Watt" carbon glow lamp; b and d, spectrum of fire-fly, *Photinus pyralis*; c, spectrum of fire-fly, *Photuris pennsylvanica*; d, helium vacuum tube spectrum, used for comparison.

as, and that it extends farther toward the red ($\lambda = .6678\mu$) than does the light of the *Photuris pennsylvanica*.

In addition to the negatives of the fire-fly light, a series of photographs (see fig. 23), were obtained of the spectrum of a standard comparison lamp (carbon glow lamp operated on four watts per candle) when exposed for 2, 4, 6, 8, 12, 20, 30, 60, 120 and 240 seconds.

The "densities" or "blackening" of the photographic plates were then measured by means of a Marten's polarization photometer, mounted on a small comparator, in such a manner that strips 1.5 high and 1 mm. long were compared against the clear unexposed plate. These "densities," i.e., the amount of light absorbed, were then plotted to scale, as indicated in

fig. 24, where the horizontal scale is the wave length. In this illustration

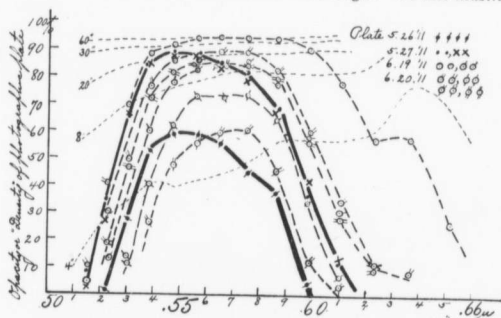


FIG. 24.—Density curves of photographic plates of *Photuris pennsylvanica* X—X—X—X

Photinus pyralis φ—φ—φ—φ

Glow Lamp — — — — —

the heavy black lines give the effect of the light of *Photuris pennsylvanica* (X—X—X—X, •—•—•—•, φ—φ—φ—φ), of *Photinus pyralis* (θ—θ—θ—θ), and of the carbon glow lamp (— — — — —).

This illustration, in itself, is an ample demonstration that the light of the *Photinus pyralis* is much richer in red and yellow rays than is the *Photuris*; for the curves intersect, and all those of the *Photinus*, whatever the density, lie to the right of those of the *Photuris* of equal density. But we can go a step farther by comparing densities of the negatives. It is assumed that the density or the effect of the light upon the photographic plate is proportional to the time of exposure. This is, of course, not true for very long exposures, and hence the highest parts of the curves are not used in this work. For convenience I have taken the four seconds glow lamp density curve as my unit. Hence the 8 seconds density curve represents 2 units, the 12 seconds density curve represents 3 units, etc. Turning now to the fire-fly curves we see that the upper, heavy, density curve of *Photuris pennsylvanica* intersects the 4 seconds density curve of the glow lamp at $.52\mu$ and at $.592\mu$; i.e., at these two points, the two

plate is very sensitive in the region of $.59\mu$, and it is difficult to eliminate this effect in the fire-fly curves. The hump in the curve of the light from the glow worm and of *Photinus consanguineus* at $.59\mu$ is, therefore, not considered of real significance. The curves of these two samples were obtained from the photographs taken with the small spectrograph.

Knowing the distribution of energy in the spectrum of the glow lamp, given in fig. 26, it is possible to determine the spectral energy distribution

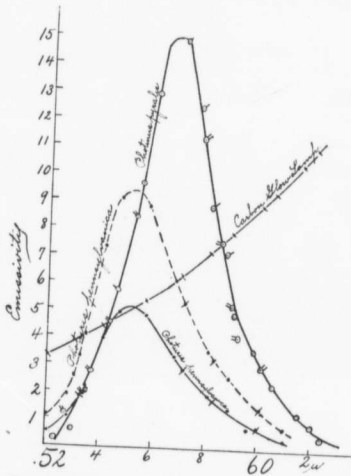


FIG. 26.—Spectral energy curves of fire-flies and glow lamp.

of the fire-fly by multiplying the energy values of the glow lamp by the ratio of densities, $\frac{\text{fire-fly light}}{\text{glow lamp light}}$ at each wave length. The resultant curves are given in figs. 26 and 27. In fig. 26 the spectral energy curve of the *Photuris pennsylvanica* and of the *Photinus pyralis* are plotted to the same scale in the blue-green. An integration of these two curves shows that for the same emissivity in the blue the energy curve of the *Photinus pyralis* is 2.83 times that of the *pennsylvanica*. To the eye it is apparent that the illuminating power of the *Photinus* is far greater than that of the *Photuris*.

The results of the study of the candle-power, radiation and temperature measurements will be described at some future time, and it will be

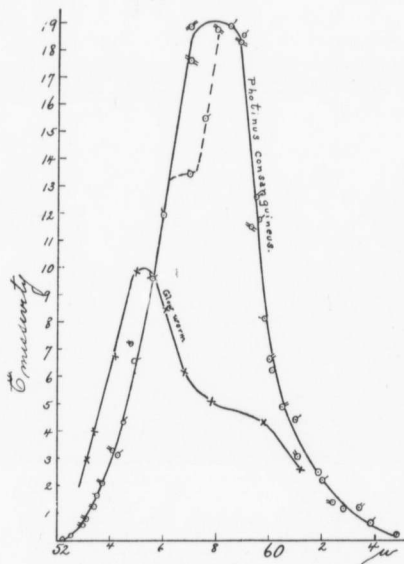


FIG. 27.—Spectral energy curves of fire-fly and glow worm.

sufficient to add that in a healthy fire-fly the abdominal segments containing the photogenic organ are at a higher temperature than the dark segments, whether or not the flashing is in progress.

In conclusion, it may be added that for the first time we have substantial evidence that the colour of the light of various fire-flies is different; the maximum emission of the

<i>Pyrophorus noctilucus</i>	being at538μ.
<i>Photuris pennsylvanica</i>	"552μ.
<i>Photinus pyralis</i>	"567μ.
<i>Photinus consanguineus</i>	"578μ.

Mailed October, 4th, 1911.