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NOTES ON COLLECTING BUTTERFLIES IN WESTERN COLORADO, WITH A PARTICULAR ACCOUNT OF CERTAIN PAPILIOS.

BY WM. H. EDWARDS, COALBURGH, WEST VA.

In Vol. XXV., p. 253, I gave some account of the dimorphism of *P. Bairdii*, mainly from the observations and experiments of Mr. David Bruce. From what he had seen at Glenwood Springs, Colorado, he had satisfied himself that not only *Bairdii* and *Oregonia* were one species, but that *P. Hollandii*, Edw., formed part of the same. Though the two first named differ in facies more decidedly than do *Turnus* and *Rutulus*, and *Rutulus* and either *Eurymedon* or *Daunus*. *Hollandii* looks on the upper side like *Bairdii*, but beneath, while in general like *Bairdii*, the yellow spots are larger, making the surface much gayer. But the notable difference is in the markings of the body; *Hollandii* having the yellow, black-striped body of *Oregonia* (as well as *Zolicaon* and *Machaon*), while *Bairdii* has the solid black body of *Asterias*, with similar rows of yellow dots. *Hollandii* therefore has the body of *Oregonia*, with the wings of *Bairdii*, the latter somewhat modified.

In 1892, Mr. Bruce obtained eggs by confining a *Bairdii* ♀ over the food plant, and out of two pupæ which alone survived a catastrophe at his home (Brockport, N. Y.) came a *Bairdii* imago the next spring in his hands, and a female *Oregonia* with me. Mrs. Peart had received a few of the larvæ out of that lot of eggs, and from these came one *Bairdii* and one *Oregonia*. I related these facts in the paper spoken of, and then said that two of the pupæ which Mrs. Peart had were still alive, and would give butterflies the second year, or in 1894. It turned out that one *Bairdii* ♀ did come from one of these pupæ, April 25th, 1894, but the other pupa had died.

In 1893, at the same place, Mr. Bruce sent me two eggs obtained from an *Oregonia* ♀ in confinement, from one of which resulted a *Bairdii* ♂ the same season, the other larva dying. And about two weeks later he sent me another lot of *Oregonia* eggs, from which I got four *Bairdii*: 2 ♂, 2 ♀, the same season, no pupæ hibernating.

If there was no error in getting the eggs, such as overlooking eggs that had been laid on the plant before the female was tied to it, then there could be no question of dimorphism, for the eggs that I received were mailed the day they were laid, so that there was no opportunity for any mixing up of larvæ. As Mr. Bruce is an entomologist of many years' experience, and had, as he assured me, taken the utmost care in these experiments, knowing their importance, the facts showed dimorphism, and of a remarkable sort. There was nothing like it in the North American butterfly fauna.

Mr. Bruce's visits to Glenwood Springs began in 1888, and from the first he had noticed that *Bairdii* and *Oregonia* were always associated, and in about equal numbers. But it was a long time before he discovered the food plant. Some one brought him a green, black-striped caterpillar, taken on Artemisia dracunculoides, which looked like an *Asterias* in its last stage. From the pupa produced came a *Bairdii* imago. Then he began to get eggs by confining the females over the Artemisia. It seems a strange food for one of the *Asterias* or *Machaon* groups; all the known species, except *P. Indra* (that is to say, all the species whose larvæ are known), feeding on Umbelliferæ, fennel, carrots, and the like. Artemisia belongs to the Compositæ. It is true the larvæ of the Papilios I am treating of will eat carrot, parsnip and fennel in confinement, but not willingly, and both Mr. Bruce and myself, also Mrs. Peart, have found the mortality excessive when feeding on those plants. There were large fields of carrots about the Springs, and we inquired of several of the owners if they had ever noticed the green caterpillars, but found no one who had done so. The Artemisia grows everywhere in the valley of Grand River and its tributaries, and often covers the ground over large areas. It stands about three feet high: a loose, open-growing plant, with many long stems shooting up from the base, or branching at a small angle from the main stem, and these bear very small leaves. One can look through a large clump of it and a caterpillar of the Papilios could not easily escape observation. The yellow eggs, too, are in strong contrast with the peculiar gray-green of the leaves, and would easily be seen.

Mr. Bruce has never caught the two forms in copulation, though he seemed to miss it more than once by a very little. He had written me that on one occasion he saw an *Oregonia* ♀ pursued by two males same, and also by three males *Bairdii*, rolling through the air like a ball, and so low down that he made effort to catch them all with a throw of his net;

but they whirled away and passed out of sight. On another day he had seen a newly-emerged female *Bairdii*, and was near it, but a low intervening bush prevented him using the net. Just then down pounced a male *Oregonia*, and the pair rose vertically in the air, circling about each other—as butterflies do in courtship—and were soon lost to view. These and other similar observations had made Mr. Bruce believe firmly in the inter-copulation of the two species.

The relation of the facts then known in the CAN. ENT. excited some little interest and some surprise, together with more or less incredulity; and I determined to accompany Mr. Bruce on his 1894 trip to Glenwood Springs, if he would let me, and go through the necessary experiments with him. Though if I had been as well acquainted with Mr. Bruce as in his company for six or seven weeks I became, I might have saved myself the journey, for nothing can be more thorough than his method of working. Nothing escapes him, and he makes no mistakes. But I am glad that I had the pleasure of his personal acquaintance and company, and I can commend Mr. Bruce as a companion and chaperon through Colorado to any lepidopterist in search of pleasure and specimens for his collection.

We reached Glenwood Springs on twenty-ninth June, from Denver, by the Rio Grande R. R., via Pueblo and the Royal Gorge Canon of the Arkansas River, which river was followed many hours to Leadville—elevation, 11,000 feet; then descended the Eagle River (a tributary of the Grand) to the Springs. The Grand River is one of the two principal streams which form the Colorado River, the other being Green River;—the junction in Utah. The whole region is semi-desert, and nothing grows without irrigation except the native clothing of grasses and scrub, and such pines and other trees as will stand the dry climate. The sun shone clear nearly every day that I spent at the Springs; very hot after 8. a. m.; with occasional showers. But in August, which the people call the "rainy season," there was rain pretty nearly every afternoon; and in all there were two or three days that might properly be called rainy. The elevation of the hotel is 5,700 feet—high enough to ensure cool nights all the summer; and the mountains rise quite abruptly from the river, sometimes precipitously, to the height of 2,500 or 3,000 feet more. Everywhere the bottoms are narrow, and the road above the hotel has been cut out of the slope of the hill. Wherever there is a space fit for cultivation, from half an acre to twenty or thirty, some one is in possession, and the land is irrigated by means of the water that comes from every gulch and hollow, producing abundance of root crops and all sorts of fruit—apples, plums, peaches; (but no corn).

The morning after our arrival, Mr. Bruce showed me the river road mentioned—a narrow, single track, invariably spoken of as "the trail," now hot, dry, and covered with dust an inch or more thick. Where the hill had originally sloped to the water's edge, the trail had been cut through the rocks, and wherever there had been a little wider space, the base of the hill to the road was covered with small pieces of rock that had fallen from above. All along were clumps of Artemisia dracunculoides, and here and there were thistles in bloom. About these last Papilios were flying: a few *Bairdii*, *Zolicaon*, *Daunus*, *Rutulus*, *Eurymedon*; not one of which I had ever seen in life before. Also on same flowers, Pieris *Occidentalis*, and some Lycaenidæ and Hesperids. Satyrus *Paulus* now and then started up from the ground, or was seen flying slowly over the broken rocks. We took half-a-dozen male Neominois *Dionysius*, Scudder, a rare species described from Arizona or Utah, very little known by anybody until Mr. Bruce found it at Glenwood Springs, in 1888. This butterfly has never been seen on a flower or at water, but rises out of the dust at one's feet and alights at a little distance in dust again, or else on the adjacent rocks, springing up like a grasshopper, and, like that, turning its body around as soon as it strikes the dust or the rocks before settling quietly. The temperature was high, and the rocks were hot enough to roast eggs; yet these creatures were manifestly comfortable. The Papilios were none of them fresh—most of them worn and broken, and evidently they were the last of the early brood.

The next day, July 1st, Mr. Bruce went out alone in the opposite direction from the Hotel, and returned about noon with 3 ♀ *Dionysius*, 4 ♀ *Bairdii*, 1 ♀ Sat. *Paulus*, and 1 ♀ *Zolicaon*; all which we bagged for eggs; the Papilios on Artemisia, the Satyrids on grass. The *Zolicaon* seemed to be in just the condition to give eggs, but refused.

On the 3rd July was brought in a female *Oregonia*, and a typical ♀ *Hollandii*. Also 2 ♀ *Bairdii*, and a ♀ Coena. *Ochracea*, all which were tied up. The *Hollandii* beat herself in pieces and died without having laid an egg; and we never took another female of this form. In all we got 38 eggs of *Dionysius*, 12 of *Ochracea*, and the *Oregonia* laid 81. The Satyrid eggs were immediately mailed to Mrs. Peart, at Philadelphia, who had kindly undertaken to help me in rearing any larvæ. The

Paulus died without eggs; and we were never again able to take a female of this fine species. The butterflies are not uncommon, but live among bushes and scrub, where it was not possible to use the net. Dr. Skinner has somewhere set down *Paulus* as synonymous with *Sthenele*, which is very wide of the mark indeed.

July 2nd, a friend who was staying at the Hotel sent us with his buckboard and driver up the next mountain trail south and back of the Springs. We turned up a ravine through which ran a swift brook, and, sometimes walking, sometimes riding, reached a height of about 2,500 feet above Grand River, going in all perhaps five miles. From the start we saw butterflies; below and along the brook, Satyrus *Ariane*, *Charon*, and in the bushes, *Paulus*; for several hundred feet rise, either in the road or on the dry and naked slopes of the hill, *Dionysius*; and wherever there were scrub oaks, Thecla *Chrysalus*, var. *citima*, H. Edwards. Scores of these last could have been taken as they rested on the oak leaves. This, according to Mr. Bruce, is the only form of the species taken at Glenwood, but to the east, near Denver, it is not found at all, while typical *Chrysalus* abounds. At about 1,500 feet there was a wide curve in the road, and just there was a spring from which a little water trickled down the track for half-a-dozen rods. Where the road bent, a footpath came in from above. Here, about the wet road, and on the path, we had a good breathing spell, and took many butterflies: *P. occidentalis*, *P. Beckerii*; Colias *Alexandra*; Argynnis *Nevadensis*, *A. Behrensii* (heretofore reported only from Mendocino County, California, and exceedingly rare in collections); Melitæa *Palla*, *M. Augusta* (another rare Californian species); Phyciodes *Carlota* and *Camillus*; *Pyr. Cardui*; Grapta *Satyrus*; Satyrus *Ariane*, *Charon*, *Paulus*; Chionobas *Chryxus* (very large specimens and very yellow). This last species flew leisurely along, alighting on the wet ground, and if disturbed did not fly wildly; in fact, behaved much like Satyrus *Nephele*. Took or saw half-a-dozen *C. Ochracea*, most of which came flying down the path spoken of. Nothing can be prettier than this insect on the wing, as it flutters along, flying low, and it appears a great deal brighter yellow than is shown in dead specimens. We also took Limenitis *Weidemeyerii*; Chrysophani *Virginiensis*, *Behrii* and *Zeroe*. This last is a very pretty species; the yellow of the under surface much brighter than in dead examples. We took about a score of them, all males. *Zeroe* flies even in British Columbia, east of the Cascade Mountains. Of Lycæna, we took *Fulla*, *Clara* and *Amyntula*; of Hesperians, Eudamus *Nevada*, Nisoniades *Propertius;* Pamphila *Campestris;* Amblyscirtes *Aenus*. Higher up the mountain we met with nothing new. Although so little rain had fallen, and the ground seemed dry as a desert, yet along the entire drive were beautiful and showy flowers, great clumps of purple Penstemons, white and yellow Oenotheras, and others, the names of which I know not.

On July 6th, Mr. Bruce brought in two great-bodied females *Bairdii*, and these gave 117 and 76 eggs respectively. All the Papilios now were fresh, and of the second brood of the year. Mr. Bruce also took a Neonympha *Henshawii*, the first he had ever seen in this region; also Theclas *Edwardsii* and *Titus*, and Pholisora *Catullus*.

On the 10th, a fine and typical ♂ *Hollandii* was taken, matching completely the female before spoken of; and no other such male was taken during our stay. A ♀ *Oregonia* was bagged on the 11th, and the same day a *Bairdii*, confined two days before, was found to have laid 70 eggs.

I had now two lots of eggs of *Oregonia* and four of *Bairdii*. When the females were bagged, Mr. Bruce and I were in all cases together, and both examined the plants to see if perchance a stray egg might have been previously laid on them by some other Papilio. And I may say here that neither of us saw more than an occasional egg on any plant of Artemisia in the six weeks. The plants are by thousands and the butterflies few. All the bags were back of and close to the electric power house of the Hotel, where were conveniences for shading them from the fierce heat of the sun, and where there was no danger of trespassers—two-legged or four-legged. When the bags were opened, I attended to the eggs myself, clipped them off the stems, and put each sort in a box by itself. Thenceforth all eggs and larvæ were in my room at the Hotel, and were attended to solely by myself. So there was nowhere a chance of mixing up eggs or larvæ, or of error. The bits of stem which carried the eggs were placed in glass tumblers, labelled, and when the larvæ hatched, fresh stems were given, and these were changed daily. As the larvæ grew, they were shifted to tin cans covered with cloth, and overlaid by squares of heavy glass, to prevent escape as well as to afford light. Treated in this way there was scarcely any loss.

On 15th July Mr. Bruce left me for Denver and the high peaks about Hall Valley, in order to get eggs of Chionobas *Œno*. From

Denver he wrote me he had concluded to come back to that place after he had worked at Mt. Gibson, and go home. Thereupon I divided the six lots of Papilio larvæ, and sent him one brood of *Oregonia* and two of *Bairdii*; and, although he did return to Glenwood Springs, 28th July, I had no more to do with his half of the larvæ. Thenceforth we made no more efforts to get eggs, as it was not worth while to try and rear larvæ in New York or in West Virginia, by reason of the great mortality sure to be suffered in feeding with umbelliferous plants. Mr. Bruce made many excursions in the hope of taking typical *Hollandii* of both sexes, but in vain. On one occasion he brought in a single Neophasia *Menapia*, and several times Argynnis *Leto*, now fresh from chrysalis. On 30th July, several fresh males of Argynnis *Nevadensis*, evidently of a second brood, and thirty *Bairdii* and *Oregonia*. The next day I went with him to the place where the Papilios had been taken, along the railroad up the Roaring Fork of Grand River. There, on thistles exclusively, we took thirty-four more *Bairdii* and *Oregonia*. A field of alfalfa was in flower just over the fence, but the Papilios did not frequent that. There were, however, on the alfalfa many of the yellow form of *Eurytheme*; namely, form *Eriphyle*, Edw. This form was often seen within the grounds of the Hotel, and elsewhere as we rode about the region. But I never saw an example of the orange form or forms (for there are three of them), nor have I ever seen a live *Eurytheme*, orange. Mr. Bruce says that when he first collected in Colorado, in 1888, the orange was not uncommon, either in the Denver district or at Glenwood Springs. But year by year he has noticed the diminishing number of the orange, and the increase of the yellow form; and it is his opinion that cultivation of alfalfa is responsible for this change.

On our way up the Rocky Fork we passed a slaughter-house in a small hollow, which was at the foot of a lofty and precipitous cliff of red sandstone; and about, on the ground, fences, and roof, were perhaps three-score ravens and half as many magpies, not at all shy or difficult to approach. We were told the ravens made their nests on the adjacent cliffs. Now, in all my years before I never saw more than two or three ravens, and then flying half a mile high in W. Va.

Besides the species of butterflies enumerated, I find but one other noted down as seen at Glenwood, and that was Satyrus *Boopis*, of which two examples were taken. Our conclusion on the butterflies in general was that while individuals were plenty, the species were really few; and probably nothing else should be looked for in a semi-desert region.

On 10th August we left for Denver, taking the road up Roaring Fork to Leadville. In all my rides through Colorado I was struck by the absence of large trees, and do not remember having seen a tree two feet in diameter in the State. We rode through miles and miles of small, dead timber, probably fifty miles, killed by forest fires.

When I left the Springs my larvæ were nearly full-grown, and a few had suspended for pupation. I put the three lots into three boxes with fresh Artemisia for such larvæ as were still feeding. I also had had made a capacious tin box, and filled it with the plant. And I kept the boxes by me throughout the journey to Coalburgh. When there, after the Artemisia gave out, carrot and fennel were substituted, but many of the larvæ died in consequence.

The imagos began to come forth at eleven and more days from pupation, but many pupæ hibernated, some to give imagos in April, 1895, and an occasional one in May and June, while several will go over to 1896.

The results in fall of 1894 were :

1. From *Oregonia* eggs, 3 *Oregonia* : 1 ♂, 2 ♀.
   8 *Bairdii* : 7 ♂, 1 ♀.
2. From *Bairdii* eggs, 1st lot, 20 *Bairdii* : 18 ♂, 2 ♀.
   No *Oregonia*.
   From *Bairdii* eggs, 2nd lot, 2 *Bairdii* : 1 ♂, 1 ♀.
   No *Oregonia*.

The results in spring of 1895 were :

1. From *Oregonia* eggs, 5 *Oregonia* : 3 ♂, 2 ♀.
   4 *Bairdii* : 2 ♂, 2 ♀.
2. From *Bairdii* eggs, first lot, 11 *Bairdii* : 8 ♂, 3 ♀.
   1 *Oregonia* : 1 ♂.
   From *Bairdii* eggs, second lot, 3 *Bairdii* : 2 ♂, 1 ♀.
   1 *Oregonia* : 1 ♂.

Result in fall and spring :

1. From *Oregonia* eggs, 8 *Oregonia* : 4 ♂, 4 ♀.
   12 *Bairdii* : 9 ♂, 3 ♀.
2. From *Bairdii* eggs, both lots, 36 *Bairdii* : 29 ♂, 7 ♀.
   2 *Oregonia* : 2 ♂.

In all, 10 *Oregonia* : 6 ♂, 4 ♀.
48 *Bairdii* : 38 ♂, 10 ♀.

The proportion of *Oregonia* to *Bairdii* nearly as 1 to 5. On 8th of July, 1895, I had nineteen pupæ left, which will go over a second winter, viz., 5 *Oregonia;* 14 *Bairdii;* and most of them, by their size, I consider to be females. .Of the entire number of pupæ (77), forty per cent. gave butterflies in the fall of 1894, thirty-two per cent. in spring of 1895, and twenty-eight per cent. will probably go to 1896.

I spoke of Mr. Bruce going after eggs of Chionobas *Œno.* The weather at Denver was fair just at that time, but at Hall Valley (11,000 elev.), and on the peaks, as forbidding as could be ; day after day during his stay at his old cabin near top of Mt. Gibson, rain, snow and fog. But he found specimens of *Œno* resting under the shelter of rocks, and took some females by hand. These he brought to Hall Valley, and being confined over grass in the house there, they laid forty-five eggs, which were sent to Mrs. Peart, and in her care they hatched and the caterpillars reached pupæ the same season. Mrs. Peart was able to get the entire set of drawings of the early stages, and they will be given in Part XVII., Butt. N. A., in due time. It is enough that these stages support the conclusions I had published, that *Œno* is a distinct species from *Semidea.* My trip to Colorado was as much to get eggs of *Œno* as to rear the Papilio larvæ, and the success in one case, as in the other, is owing to Mr. Bruce's efforts.

I have in this, and the paper in Vol. XXV. referred to, spoken of the two Glenwood Papilios as *Bairdii* and *Oregonia*, but being hybrids, neither form is often true to type. Some *Bairdii* are typical ; that is, they can not be distinguished from the examples taken in Arizona, where there are no *Oregonia*, and can be no intermixture. But most depart in different degrees from the type, no two being quite alike ; are gayer, with yellow markings on the upper side, and much more so beneath, running off to *Hollandii*, which seems to be the extreme of variation.

Scarcely any of the so-called *Oregonia* taken or bred at Glenwood Springs agree fully with the type found, which flies where there are no *Bairdii*, in Washington and British Columbia. They are modified in the direction of *Bairdii* in several particulars. The typical male *Oregonia*, on the upper side, *has the basal area of the fore wings thickly dusted with yellow scales. The submarginal black band on both wings also much dusted yellow.* Beneath, *the base of cell on fore wings is always gray-yellow ; the nerves and branches of both wings are lightly edged with black ; the submarginal band is largely covered with yellow scales, and the blue on hind wings is azure. The abdomen on ventral side is* *yellow, with a thin ventral line;* another such line, subventral, on the last three or four segments; *the ventral line forks as it nears the thorax, leaving a yellow space between the forks.*

The female has the base of fore wing as thickly dusted, perhaps more so; the submarginal band more dusted. Beneath, like the male; the cell nearly solid yellow, there being two black bars, one about middle, the other half way between this and the arc. The ventral side of abdomen is either marked by two fine black lines, or these are wholly wanting; on the side a narrow stripe.

1. A male, so-called *Oregonia*, bred from eggs laid by a female *Bairdii, is very black above,* a thin dusting of yellow scales at base of fore wing scarcely detracting from the general blackness; and the submarginal band is free from yellow scales. On the under side *the cell from arc to base is black, except for a narrow transverse bar just inside the arc,* and another at two-fifths the distance from arc to base. *The nervures on both wings heavily edged with black; the blue not azure, but dark* (*as in Bairdii*). *The lines of black on abdomen are stripes rather,* and *next the thorax are diffused, making a broad black area.*

2. A male, so-called *Oregonia*, bred from egg laid by a female of same type. This is blacker than No. 1, the yellow dusting more scanty. *On under side the cell solid black,* excepting the two yellow cross-bars at and near the arc; *the nerves and branches heavily edged with black;* the *blue dark;* the *black stripes of abdomen confluent next thorax.*

In a female corresponding to No. 2, the ventral side of the abdomen is nearly solid black; in one corresponding to No. 1, the four stripes are heavy, but not quite confluent.

The above description answers for all the examples of so-called *Oregonia* which I have bred from either same type of female or from *Bairdii.* But I have a female nearer the true type *Oregonia* that Mr. Bruce bred from egg laid by *Bairdii*, 1892, and which came out of pupa in March, 1893; spoken of in CAN. ENT., XXV., 254. This has the base of fore wing and the submarginal band much dusted yellow; the base of cell beneath, gray-yellow, ending near middle of the cell in rays, and altogether as in typical *Oregonia;* the nerves and branches lightly edged black; the submarginal band on fore wings densely dusted, making it a yellow band rather; and the blue is azure. This is the nearest example to true *Oregonia* of all the bred hybrids which I have seen.

Besides the hybr.d varieties above mentioned is another that is very close to *Zolicaon.* One such example (male), out of egg of *Bairdii,* is of small size, very black above, slight dusting of yellow at base of fore wings, none on the submarginal band. Beneath the cell as in typical *Zolicaon;* that is, solid black, except the two yellow bars at and near the arc; the nervures rather heavily edged black; the blue, dark; and *much deep orange* on hind wings in all the interspaces next the black of the submarginal band, and also orange on the marginal lunules. The ventral side of abdomen solid black, by the widening of the two ventral lines so as to be confluent throughout, and the widening of the lateral stripes; next thorax the four stripes making that part of the abdomen altogether black, as in *Zolicaon.* This example has the anal black spot of *Oregonia* and *Bairdii;* that is, a pear-shaped spot, attached to the black edge of the inner margin of wing; whereas the spot in true *Zolicaon* is round, unattached. But that sort of spot appears sometimes in both true *Oregonia* and *Bairdii,* though it is rare. Except for that anal spot it would be hard to say wherein this male differs from a *Zolicaon.* Mr. Bruce has this season had a specimen come from these Glenwood pupæ that, he says, had he taken it on the wing he should have called *Zolicaon.*

From what I have said, it must be evident that the so-called *Oregonia* of Glenwood Springs is not the real article, not true *Oregonia.* It is more black, less dusted yellow (on both sides); the cell of under fore wings black (an important character); the veins beneath all more heavily edged with black; the blue, dark instead of azure; the abdomen rather black than yellow on the ventral side. That is not *Oregonia,* but a distinct type of butterfly, which, if it had been brought in from Arizona by the Wheeler Expedition, would have been pronounced a species. It may be supposed that it originated in the mating of true *Oregonia* with true *Bairdii,* at some period in the past. Whether these two species, pure type, now mingle in that region, I can not say, because I have not seen a pure *Oregonia* which was taken there. As to *Bairdii,* it varies so much, even where no *Oregonias* fly, and where there is no suggestion of intermixture, that we cannot say what the pure form is. These butterflies, as they now appear at Glenwood Springs, may have begun their career as hybrids, fifty, or one hundred and fifty, or five hundred years ago—no one can guess when; there has been evolved a distinct form, allied to *Oregonia.* It never will do for such a form to be flying without name, and I call it Papilio *BRUCEI,* and pass it in to the next generation of lepidopterists. The so-called *Bairdii* are also not true *Bairdii*, but at present it is impossible to fix upon their type, because no two of them have been found alike. I may yet figure these butterflies, but it would take half-a-dozen plates to do them justice.

The larvæ from eggs of the *Bairdii*, as well as those from eggs of the so-called *Oregonia*, were of the *Asterias* pattern; in the first three stages, black, or brown-black, with white saddle-patch on 7, 8, 9, and dots and small spots of white irregularly placed on dorsum or upper part of side, no two individuals being quite alike in this respect. After third moult, green, with a black band across the middle of each segment, in which are set rounded yellow or orange spots; the junctions of the segments also black. The green of *Oregonia* after fourth moult was bright yellow-green, the black bands narrow, the spots a rich chrome. Of *Bairdii*, a much darker green, the black bands wider, the spots pale yellow. Yet, on looking over a large number of the larvæ of each form, some of the *Bairdii* were as brilliant as the others, and in all points were like them. This might be expected of hybrid larvæ. As to the pupæ, I could see no difference in shape, and all were in general as in the *Asterias* group.

Eggs of so-called *Oregonia* laid 5th July, hatched 10th. The first moult was passed 14th and 15th; the second, 19th and 20th; the first to pass third was on 23rd; to pass fourth, 30th July; the first pupa, 9th of August; the first imago, 22nd August.

Length of the egg stage, 5 days.
Length of first larval stage, 4 days.
Length of second larval stage, 5 days.
Length of third larval stage, 4 days.
Length of fourth larval stage, 7 days.
Length of pupa stage, 13 days.
From laying of egg to imago, 38 days.

Eggs of *Bairdii* laid 8th July, hatched 12th. The first moult was passed 17th; the second, 23rd; the third, 27th; the fourth, August 2nd; pupation, 12th August. The first imago, 31st August.

Length of egg stage, 4 days.
Length of first larval stage, 5 days.
Length of second larval stage, 6 days.
Length of third larval stage, 4 days.
Length of fourth larval stage, 6 days.
Length of pupa stage, 19 days.
From laying of egg to imago, 44 days.

It becomes of importance to know the distribution of *P. Bairdii* and *Oregonia*, as well as the hybrid, *P. Brucei*. I have never seen an *Oregonia* from Arizona, but have received many *Bairdii* from that territory: some from the Wheeler expeditions, some from Mr. Morrison's catch. On the other hand, *Oregonia* flies in British Columbia, east of the Cascade Range, and perhaps in other districts. Dr. Hagen and Mr. Stretch took it in Washington in 1882; and the Doctor wrote a long paper which appeared in Papilio II., p. 149, in which he took the ground that *Zolicaon* and *Oregonia* were forms of *Machaon*, "not to be separated." He says nothing of having seen *Bairdii*, but, on page 160, says: "It is probable that *Brevicauda*, *Bairdii*, *Indra*, *Pergamus*, and probably *Americus*, all belong to *P. Asterias*." The Doctor's views of what constituted a species were somewhat hazy about that time. But we may conclude that he did not see *Bairdii* in Washington, or he would have expressly said so in his paper.

The only locality that I have been able, by correspondence, to discover, where *Bairdii* and *Oregonia* have both been found, is in Squaw Canon, Sioux Co., Nebraska. Prof. H. G. Barber, of the Univ. of Nebraska, at Lincoln, writes me that an *Oregonia* was taken in Squaw Canon in 1893, and an example of *Bairdii* in July, 1892; in different years, it will be noticed. Another specimen of *Oregonia*, Mr. Barber says, was taken on Lodge Pole Creek, in S.-E. Wyoming, in 1893; but no *Bairdii*. Prof. C. V. Piper, of the Washington Agr. College, at Pullman, Wash., sent me several typical *Oregonia* taken there and in the near-by district in Idaho; but he had seen no *Bairdii*.

(Nothing surprised me more than seeing our Eastern robin, *T. migratorius*, hopping about the lawn at Glenwood Springs, and I learned from Mr. Bruce that it is common throughout Colorado: on the high peaks even, above timber; where it nests in the crevices of the rocks. But if anywhere on those heights a miner's cabin is built, the robins come, and always keep about it.)

SUPPLEMENTARY.

After the foregoing paper went to printer, I received from Mr. Bruce a statement of the results obtained thus far from the pupæ of so-called *Oregonia* and *Bairdii* in his charge, and before spoken of. Thus:

1. *Oregonia* pupæ gave—

1. In fall of 1894, 5 *Bairdii*: 4 ♂, 1 ♀.
   2 *Oregonia*: 1 ♂, 1 ♀.

2. In spring of 1895, 9 *Bairdii:* 6 ♂, 3 ♀.
7 *Oregonia:* 4 ♂, 3 ♀.

2. *Bairdii*, first brood—

1. In fall of 1894, 7 *Bairdii:* 5 ♂, 2 ♀.
2 *Oregonia:* 2 ♀.

2. In spring of 1895, 8 *Bairdii:* 6 ♂, 2 ♀.
4 *Oregonia:* 4 ♀.

3. *Bairdii*, second brood—

1. In fall of 1894, 3 *Bairdii:* 3 ♀.
1 *Oregonia:* 1 ♂.

1. In spring of 1895, 5 *Bairdii:* 3 ♂, 2 ♀.
4 *Oregonia:* 2 ♂, 2 ♀.

From *Oregonia*, fall and spring: 9 *Oregonia*, 14 *Bairdii*.
" *Bairdii*, " " 11 " 23 "

Total: *Oregonia*, 20; *Bairdii*, 37. *Oregonia* being to *Bairdii* as 1 to 1.85. More *Oregonia* in proportion than came from the three broods I had.

It appears that each of the six broods described, 2 of *Oregonia*, 4 of *Bairdii*, gave examples of imago of its own form, and also of the other form.

Neither Mr. Bruce nor myself have obtained a *Hollandii*, and the true position of that form remains to be determined hereafter.

NOTES ON SOME SOUTHERN LEPIDOPTERA.

BY HARRISON G. DYAR, A. M.

Suborder FRENATÆ, Superfamily Microlepidoptera.

Family PSYCHIDÆ.

Oiketicus Townsendi, Cockerell.

1893—Dyar, Ent. News, IV., 321 note. (No name.)

1894—Dyar, Ann. N. Y. Acad. Sci., VIII., 205 (fig. of larval setæ).

1895—Cockerell, Bull. 15, New Mex. Agr. Ex. Sta., pl. fig. 7, 7a.

1895—Cockerell, Ann. Mag. Nat. Hist., (6) XV., 208.

Venation.—Primaries—Vein 1 (IX.) twice angled, branch to margin (XI.), branch to 1c (VIII.), which is faint toward base; median (cubitus) 4-branched, 4–5 (V_2, V_3) stalked; 6 (V_1) from cross-vein, the false discal (media) joining 7 (III_5) just below apex; 8–9 (III_3, III_4) stalked, 10 (III_1) from cell,* 11 (II.) from base.

*The fore wing has 11 veins, vein III_2 being absent. *T. ephemeræformis* has also 11 veins, but it is V_2 which is absent; *O. Abbotii* has all 12 veins present.

Secondaries.—Three internal veins. Median (cubitus) 4-branched; 4–5 (v_2, v_3) stalked; 6 (v_1) above angle of cell; 7 (III.) from cross-vein joining end of cell with 8 (II.); false discal (media) furcate; frenulum large. Wing shape nearer Thyridopteryx than Oiketicus, but colour of the latter. Primaries less drawn out at apex; secondaries less pointed than in *O. Abbotii*. Larval case built on the type of *Thyridopteryx*.

Colour umber-brown (Ridgway III. 14), paler than *Abbotii*; secondaries scarcely tinged with smoky outwardly; body a little darker than the wings. Primaries brown, palest in the area below the cell, the terminal portion between end of cell and margin a shade darker. A vitreous bar at the end of the cell covering the cross-vein as in *O. Abbotii*. A blackish-brown shade fills the cell and obtains slightly in the interspace between veins 6–8 just beyond the vitreous bar and in an oblique shade from lower corner of cell, directed towards anal angle. A black shade below vein 1 at base, extending as far as the branch to the margin. Subcostal and median veins less closely approximated than in *O. Abbotii*, so that the blackish space is more pointedly triangular and extends narrowly to base. Below all brown, the vitreous space only showing. Expanse, 36.5 mm; length, 20 mm.

O. Townsendi is nearer the genus Thyridopteryx than Oiketicus, though not structurally identical with either.

Family MEGALOPYGIDÆ.

Specimens of the species figured by Stoll as Amanda were received from Colombia under the generic term Artace. In Kirby's catalogue it stands as *Dryocampa* (?) *amanda*, following Walker. Even a casual examination is sufficient to show that it does not belong to either of these genera, and, indeed, to neither the Lasiocampidæ nor the Citheroniidæ. A glance at the accompanying figure of the venation will show that the moth belongs to the group of the more specialized Microlepidoptera, and I am in doubt whether to refer it to the Eucleidæ (Limacodidæ) or to the Megalopygidæ. The Megalopygidæ are essentially Eucleids with hairy larvæ, or, rather, the Eucleidæ are the more specialized type which have lost the larval hairs. In the absence of any knowledge of the larva of *amanda*, I am in doubt as to its position. I have separated these families by the characters of their antennæ; this applies to the North American species only, and fails when we consider the Eucleidæ of the world. Therefore I have at present no positive diagnostic character to separate the imagines of these families.

I venture to propose a new generic term for this species, to be provisionally referred to the Megalopygidæ.

Brachycodion, n. gen.

Male antennæ broadly pectinate for less than basal half, the rest short serrate; of female, simple. Head sunken, eyes large, palpi short, porrect, not reaching the front; legs subequal, the tibiæ slightly shorter than the femora, the tarsi very slightly longer than the femora, smooth; no epiphysis; anterior tibiæ unarmed, the middle and posterior with a pair of very short apical spurs. Venation as in the figures. [Venation of *Brachycodion amanda*, Stoll. Rt. = retinaculum of the frenulum in ♂. Figs. 21 and 22.]

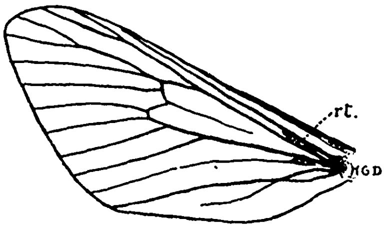

FIG. 21.

Retinaculum of the frenulum in male a long fold from vein 12 and a shorter reversed one from vein 1c; in female, only the latter fold; frenulum well-developed. Body robust, the thorax in width almost equalling one-third of the length of the costa, as long as wide; clothed with dense, short, suberect scaly hairs. Abdomen exceeding secondaries in male, scarcely so in female. The wing scales are spatulate with evenly-rounded ends or rounded triangular, conspicuously striate, on the secondaries produced into long hairs.

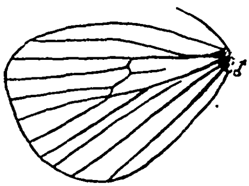

FIG. 22.

The following synopsis of genera has been revised and enlarged from that which I have previously given:—

Vein 7 arising nearer base than vein 9.

  Vein 10 on a stalk with 11; male antennæ pectinate at base .... *Brachycodion.*

  Vein 10 on a stalk with 7–9; male antennæ pectinate to tip. *Eupoeya.*

Vein 7 arising beyond 9.

  Veins 3–4 of secondaries stalked or from same point...... *Carama.*

  Veins 3–4 of secondaries not stalked, separate.

    Veins 4–5 of primaries short stalked................ *Mesocia.*

    These veins not stalked.

      Vein 8 of secondaries united to 7 to outer third of cell or less.

        Large species; primaries produced......... *Podalia.*

Small species; primaries rounded........ *Ochrosoma.*

Vein 8 united to 7 nearly to tip of cell.

Female vein 10 of primaries on stalk with 7–9; frenulum distinct......... .... *Sciathos.*

Female vein 10 from cell; male short stalked; frenulum rudimentary..... .... *Megalopyge.*

As indicated above, I find that *Megalopyge orsilochus* is not congeneric with the other species, and Walker's name may be restored for it. The moth is less modified than Megalopyge; the male frenulum is distinct, and on primaries the costal loop is very well-developed. In Megalopyge proper it has disappeared. While Megalopyge has one or two branches from vein 1 on primaries, Podalia has three such, having developed supplementary veins for the strengthening of the internal margin.

Prof. Comstock has interpreted the single branch of vein 1, found in our species of Megalopyge, to be the remains of the first internal vein;* but in *M. lanata*, male, this vein is forked, and it seems scarcely clear whether the whole structure may not be a neomorph. It is rather characteristic of the Megalopygidæ to have this structure, though in the female of Sciathos it is a mere rudiment and it is absent in Eupoeya.†

Family EUCLEIDÆ.

The genus Euryda H.-S. contains in Kirby's catalogue three species. One of these, *leucostigma*, Sepp, is referred, in the appendix, to the Arctiidæ, where it evidently belongs; another, *lohor*, Moore, belongs to the genus Belippa, according to Hampson; and we have left only the type *hipparchia*, Cramer. I have both sexes of this species before me. It belongs to the genus Phobetron. Stoll figures the larva, and it is not to be distinguished from our *P. pithecium.*

I think it will be preferable to refer *Limacodes Beutenmuelleri*, Hy. Edw., also to this genus. In placing it in Semyra I followed Kirby, and I have not seen the type of Semyra in nature. Walker's description of the type (*S. coarctata*) implies a species allied to Euclea and Sibine, and can scarcely be near Phobetron, from which *Beutenmuelleri* does not differ essentially.

*Evolution and Taxonomy, Wilder Quarter Century Book, p. 81.

†Until the larva of Eupoeya is known, we can not be sure that it does not belong to the Eucleidæ.

Genus PHOBETRON, Hubn. (= Ecnomidia, Westw., = Euryda, H.-S.).

1 *P. pithecium*, A. & S. (= *abbotana*, Hubn., = *nigricans*, Pack., = *hyalinum*, Walsh, = *tetradactylus*, Walsh).

2 *P. hipparchia*, Cram. (= *violaris*, H.-S).

3 *P. Beutenmuelleri*, Hy. Edw.

Synopsis of differences.

Primaries of female without a distinct ocherous patch at apex; t. p. line regularly dentate; wings of male largely hyaline... *pithecium*.

Primaries of female with an ocherous patch at apex; t. p. line obscure.

Expanse of female, 30 mm. or more; secondaries with reddish tinge; ocherous patches on primaries distinct; male darker, with a hyaline patch on wings................. *hipparchia*.

Expanse of female, 25 mm.; more fragile; secondaries without reddish tint; the ocherous spots on primaries smaller and less distinct.............................. *Beutenmuelleri*.

SUPERFAMILY NOCTUINA.

Family LASIOCAMPIDÆ.

Tolype brevicrista, n. sp.

This species seems not to be referred to in the Biologia Centrali Americana, nor in the subsequent writings of Mr. Druce or Mr. Schaus, so far as I am aware.

Types: A male in my collection probably from Mexico; one from Mr. T. D. A. Cockerell, Las Cruces, New Mexico (R. R. Larkin). Also a specimen in the Edwards collection labelled Arizona.

Male.—White; eyes bordered with blackish; abdomen faintly banded with pale gray. On thorax, posteriorly, a small median tuft of metallic blue-black flattened spatulate hairs, not curled, and not extending forward to middle of thorax. Wings white, the primaries crossed by seven gray, or blackish-gray, bands, in the pattern of *Tolype velleda*. The three basal, narrow, rather faint; fourth beyond end of cell touching third at inner margin, and approximate to it on costa but remote centrally, angulated outward on veins 4 and 8; beyond this three more bands, the last terminal, broad, separated by narrow white spaces; the fifth and sixth almost united in the dark N. M. specimen, well separated in mine; outer edge of sixth band a little irregular on the veins. Fringe and veins white. Below, the markings are faintly repeated, but washed with white. Pectinations of antennæ brown.

In my specimen the third band is partly obsolete, and all are fainter and paler than in the N. M. example; the white spaces are wider, so that the third and fourth bands are not approximate at either costa or margin.

Expanse, 32.5 mm.

THE COLEOPTERA OF CANADA.

BY H. F. WICKHAM, IOWA CITY, IOWA.

XIII. THE CLERIDÆ OF ONTARIO AND QUEBEC.

The Cleridæ are a rather small family of beetles, but make up for their comparative scarcity by the beauty of form and colour shown by many of them. As a rule, they may be easily recognized by their resemblance to a few common types such as are found in all cabinets, and agree in possessing the following family characteristics: The antennæ are usually serrate, with the outer joints enlarged, forming an open or more rarely a compact club; the tarsi are five-jointed, the first or fourth joint often very small and indistinct, all but the fifth furnished with membranous appendages. The ventral segments are free, the first not elongate, and the hind coxæ are flat. In habits they are diverse, but most of them may be found in the perfect state, during the summer months, on flowers, leaves or freshly-cut timber, while *Necrobia* lives about dry carrion, and may even at times do a certain amount of damage in museums by preying upon dry specimens of various sorts, since the species are easily carried from place to place, like *Anthrenus*. In this way they were introduced from Florida into the museum of the University of Iowa, and have continued to breed there in small numbers. The larvæ of *Trichodes*, *Clerus*, and allied genera are said to feed on the young of other insects, and to be found in the nests of bees or under bark of trees infested by wood-boring larvæ of various sorts.

A great many species of *Cymatodera* and allied forms do not extend into high northern latitudes, and we find in consequence that the Canadian fauna does not show a very good representation in the family, only a little over thirty having been reported from the region under consideration. These are included in thirteen genera which may be separated by the following table. Care must be taken in the study of the tarsi, though after a little practice a specimen can usually be placed in its proper position without much trouble :—

A. Tarsi with fourth joint about equal to third, flanks of thorax continuous with disk. Middle coxæ moderately distant (except in *Hydnocera*).

b. Tarsi distinctly 5-jointed, first joint not shorter than second; antennæ 11-jointed, serrate; eyes coarsely granulate. *Cymatodera.*

bb. Tarsi apparently 4-jointed, the first joint small, usually visible only from below.

c. Eyes moderate in size and emarginate in front.

d. Antennæ serrate, eyes strongly granulated...... *Priocera.*

dd. Antennæ usually distinctly clavate, eyes finely granulated.

e. Last joint of maxillary palpi broader than the preceding; thorax and legs blue, shining; elytra blue or violet with red bands or the reverse........... *Trichodes.*

ee. Last joint of maxillary palpi slender.

Posterior tarsi rather broadly dilated........ *Clerus.*

Posterior tarsi longer and slender...... *Thanasimus.*

cc. Eyes not emarginate, often very large and prominent.

Antennæ stout, club 3-jointed, not abrupt... *Thaneroclerus.*

Antennæ slender, club sub-globose........... *Hydnocera.*

AA. Tarsi with the fourth joint very small, forming merely an enlargement at the base of the fifth; flanks of prothorax separated from the disk (except in *Ichnea*) by a more or less distinctly elevated margin. Middle coxæ contiguous or slightly separate.

f. Antennæ with outer joints flattened, and triangular or inwardly prolonged.

g. Eyes with an internal emargination.

Club of antennæ 3-jointed, not longer than the other portion.............................. *Phyllobænus.*

Club 3-jointed, each joint as long as basal portion... *Ichnea.*

gg. Eyes with a frontal emargination.

First joint of tarsus equal to second, anterior tibiæ serrate externally.............................. *Chariessa.*

First joint of tarsus small, inferior; eyes coarsely granulate .... *Orthopleura.*

ff. Antennæ with a small compact club.

Smaller; above reddish to blackish........... *Laricobius.*

Larger; above bright blue, with or without reddish markings.................. .... *Necrobia.*

CYMATODERA, Gray.

The two Canadian species are of elongate form and readily distinguished thus:—

Black, thorax yellow, basal and apical margins black; femora at basal half and two basal joints of antennæ yellow. .30 –.36 in.. *bicolor*, Say.

Brownish or piceous, antennæ ferruginous, legs brownish, the coxæ and tarsi paler. .30–.36 in.............................. *inornata*, Say.

PRIOCERA, Lec.

The only species is *P. castanea*, Newm., known by the generic characters. In colour it is rufous, shining, with long, sparse pubescence. Each elytron with two yellow spots near the middle, and a broad black band. Occasionally there is an additional small yellow spot at base. The feet are piceous. .25–.40 in.

TRICHODES, Hbst.

These are very pretty blue or black insects, banded with red or yellow, found on flowers, especially Umbelliferæ, during the summer. The two Canadian species separate easily thus:—


Fig. 17.

Elytra rather finely punctate, bluish, with basal, median and subapical red or yellow bands. .40 in. (fig. 17)................................. *Nuttalli*, Kirby.

Elytra coarsely deeply punctured, red with two transverse bands and tip black. .46–.60 in........ *apivorus*, Germ.

The figure of *T. Nuttalli* is made from a specimen showing rather less red than usual, the extent of this colour being quite variable. In the Western Provinces it is replaced by *T. ornatus*, Say, a still more variable species, in which the middle band is always more oblique than in Nuttalli; anterior to this band is usually found a very distinct red or yellow subsutural spot on each elytron.

CLERUS, Geoffr.

Several species of this genus vary so much in colour as to make their recognition from description rather difficult. The abdomen, for example, may be (in *quadriguttatus*) either rufous or black, and in some others the elytral ornamentation varies greatly. They may be found about flowers or on freshly-cut timber, resorting to the latter probably for the purpose of egg-laying, since the larvæ prey on those of wood-boring insects. The Canadian forms separate thus, though intermediate patterns of coloration, which I have not seen, may perhaps occur:—

A. Elytra broadly rufous at base, head and thorax rufous, varying rarely to blackish. Elytra with transverse black and cinereous bands. .20–.28 in.. .... *quadriguttatus*, Oliv.

AA. Elytra at base black or only narrowly rufous.

Thorax and head rufous; elytra with basal or subbasal, postmedian and apical band black, subapical band cinereous. .42 in. (fig. 18).................. *ichneumoneus*, Fabr.

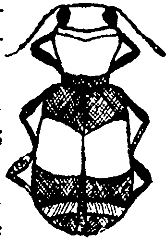

Fig. 18.

Thorax rufous, with a large baso-median black spot; head and elytra black. .20–.27 in......................... *thoracicus*, Oliv.

Thorax, head and elytra black; the last with three cinereous bands, of which the posterior is widest, and apical or subapical in position. .27–.35 in. *nigriventris*, Lec.

Near the Pacific Coast we find also *C. sphegeus*, Fabr., which is about the colour above of *C. nigriventris*, but larger (.34 in.), and the abdomen is red, while the elytra have a very wide median and small apical cinereous band.

THANASIMUS, Latr.

The character given for the separation of this genus from *Clerus* is not very evident, and most reliance must be placed on the specific descriptions, which have been made moderately full. There is the same tendency to colour-variation as in most other genera in this family. The characters of the Canadian forms are as follows:—

Elytra rufous, with broad median band and tip black, intermediate band cinereous. Feet black. .39–.51 in............. *trifasciatus*, Say.

Elytra rufous at base, dark posteriorly with two cinereous or whitish fasciæ; beneath rufous. .34 in.................... *dubius*, Fabr.

Elytra black, very narrowly rufous at base, with two cinereous bands, of which the anterior is shaped like a w and narrower than the posterior, which is not undulated; thorax reddish, anterior margin piceous, post-pectus black at middle. .20–.30 in........... *undatulus*, Say.

Elytra black with two undulate cinereous fasciæ, the posterior broader; thorax black, abdomen and feet rufous. .30–.38 in.. *nubilus*, Klug.

Elytra black, the suture anteriorly cinereous, and two bands of the same colour; the posterior broader, outer row of punctures extending beyond the middle; abdomen sanguineous, thorax and legs black. .30 in............................ *rubriventris*, Lec.

Of the above, *rubriventris* is considered a variety of *dubius*, and *nubilus*, in a like manner, of *undatulus*. Some allowance must be made for colour variation, but, as a rule, specimens may be easily assigned to their proper places by the table.

THANEROCLERUS, Spin.

T. sanguineus, Say, is easily recognized among the Canadian species of this family by its colour, the head and thorax being obscure brownish, while the elytra are sanguineous. Length about .20 in.

HYDNOCERA, Newm.

Smaller and more slender insects than most of the other Cleridæ, found commonly on foliage, and easily obtained by beating or sweeping. The eyes are very large and prominent, as in *Cicindela* and *Stenus*, to which latter genus a few of them bear, at first sight, considerable resemblance. Some species have the elytra much shorter than the abdomen. Ordinarily well-marked specimens may be identified by the following table:—

A. Thorax not or only slightly longer than broad.

b. Punctuation of elytra confused.

Thorax with subacute lateral dilatation; elytra blackish with a narrow yellowish median fascia. .17 in.. .*unifasciata*, Say.

Thorax hardly acutely dilated at sides; elytra with the humerus usually broadly rufous, varying to entirely black; legs black or rufous. .17–.20 in.................. *humeralis*, Say.

Thorax with rounded lateral dilatation and profound anterior impression; anterior legs testaceous. .20 in............................... var. *cyanescens*, Lec.

bb. Punctuation of elytra distinct, the individual punctures evident.

Blackish-blue, polished, elytra without testaceous markings, legs black, tibiæ and tarsi sometimes more or less testaceous. .10 in.............. .... var. *difficilis*, Lec.

Black, antennæ and feet pale, elytra pale with the margin, apex, suture and median fascia black (these markings variously reduced). .17 in. (fig. 19).......... *pallipennis*, Say.


Fig. 19

AA. Thorax distinctly longer than broad, elytra shorter than the abdomen, legs much elongate. Blackish species, base of elytra sometimes testaceous.

Thorax twice as long as broad, elytra slightly shorter than the abdomen. .19–.25 in........................ *tabida*, Lec.

Thorax one-half longer than broad, elytra much shorter than the abdomen. .11 in.................. ...*longicollis*, Ziegl.

Of the above, both *cyanescens* and *difficilis* are considered varieties of *humeralis*, though, owing to the difference in sculpture, one of them is placed in a different division of the table from the others. The genus needs careful revision in the light of more material than is at my command.

PHYLLOBÆNUS, Spin.

Contains a rather small species, *P. dislocatus*, Say (.11–.17 in.), of a black colour and elongate form, the last three joints of the antennæ compressed, sub-triangular. The elytra are very coarsely punctured in rows, and ordinarily ornamented with a curved sub-basal and undulate median band of yellow, and an apical spot of the same colour. Either the first or last may be absent or the median one alone remain.

ICHNEA, Lap.

Represented in Canada by *I. laticornis*, Say, about .24 in. long, black, linear, the head vittate with yellow, thorax margined with the same colour, elytra with striæ of large punctures, the apical ones confused.

CHARIESSA, Perty.

C. pilosa, Forst, is a beautiful velvety-black insect about .50 in. long, the thorax roseate with two broad black discal lines, usually confluent behind. The variety *onusta*, Say, (fig. 20) has these lines reduced or wanting, and the elytra margined with yellow.

Fig. 20

ORTHOPLEURA, Spin.

O. damicornis, Fabr., is black, thickly punctured, pilose, the thorax reddish. It varies in length from .25 to .38 in. The antennæ have the usual broadly dilated, compressed club of this group.

LARICOBIUS, Rosenh.

Of this genus, *L. Erichsoni*, found also in Europe, is the only Canadian species. It is a small brown insect about .10 in. long, with short black hairs, while the elytra are marked with rows of large quadrate punctures.

NECROBIA, Latr.

As the name indicates, the species are found about carrion, especially that which is in a dried state, and they form one of the most efficient scavengers on the Western plains. In colour they are blue, more or less polished, and sometimes marked with red. They easily separate thus :—

Thorax and base of elytra red (.21 in.)............*ruficollis*, Fabr.
Thorax and elytra blue.
Legs reddish (.21–.25 in.)...... ....*rufipes*, Fabr.
Legs blue or blackish (.17–.21 in.)........... ..*violacea*, Linn.

Most of the papers treating of the North American Cleridæ are sadly out of date, and, in addition, very difficult or expensive to obtain. The list of titles following gives the chief of those that will aid the student :—

1841. Klug, J. C. F., Versuch einer systematischen Bestimmung und Auseinandersetzung der Gattungen und Arten der Clerii. Abh. d. Konigl. Akad. der Wissensch. zu Berlin, pp. 259–397, 2 pl.
1844. Spinola, M. Essai monographique sur les Clérites. Gênes, 2 vols., pp. 386 and 226, 47 pl.
1849. Leconte, J. L. Synopsis of the Coleopterous Insects of the group Cleridæ which inhabit the United States. Ann. N. Y. Lyc., V., pp. 9–35.
1876. Horn, Geo. H. Synopsis of the species of Cymatodera and Trichodes of the United States. Trans. Am. Ent. Soc., V., pp. 220–232.

MISCELLANEOUS NOTES ON COCCIDÆ.

BY T. D. A. COCKERELL, LAS CRUCES, NEW MEXICO.

(i.) *Lecanium*, sect. *Eulecanium*.

(1) *Lecanium caryæ*, Fitch, var. *canadense*, v. nov.

♀ scale smooth, shiny, red-brown, convex, malleate, but not or hardly plicate. Length 4, breadth 3, height 2 mm., varying to length 5, breadth 4, height 3 mm. (Some Maine specimens 6 mm. long.) Removed from the twigs, the scales leave an oval white mark. (Nappan scales are paler and more yellowish, also somewhat smaller. Posterior incision perhaps a little longer; scales also rather more tending to be plicate.)

♂ scale ordinary, rugulose.

♀ with 6-jointed antennæ, formula 326154; 3 considerably longer than the remaining joints put together; 1 with 2 hairs; 2 with 2 hairs at its end, one especially long; 3 with 2 hairs near its end; last joint with several hairs, one especially long. (Nappan antennæ practically the same, but 1 larger; 4 and 5 each show a hair; 6 hardly so long, formula 3 (126) 54. Maine antennæ show one long hair at end of 3, 2 with one very long hair; 2 a little longer than 4; 4 a very little longer than 5; 6 a little longer than 2; formula 36245.) Derm obscurely tessellated, with large gland-pits. (In Maine specimens gland-pits frequently in pairs.)

Femur not much longer than tibia. Tarsus hardly ⅓ shorter than tibia; distinctly swollen at base. Claw rather stout, curved at its tip like a falcon's beak. Digitules of tarsus apparently wanting (deciduous?). Digitules of claw large and distinct, extending well beyond tip of claw, stem moderately stout, knob large and oval. A bristle on end of coxa, one on end of femur, and one on end of tibia. (Nappan scales show legs much the same, but femur proportionately longer, tarsus only a little swollen at base; tarsal digitules well-developed, long, ordinary; digitules of claw short, not extending to end of claw; claw stout, nearly straight, not hooked. Maine examples show coxa stout, broader at base than its length, with a hair at its tip; trochanter with a long hair; femur longer than tibia, tarsus about ⅓ shorter than tibia; digitules all filiform.)

Eggs (Maine specimens) very pale pinkish.

Hab.: The types are from Stittsville, about 20 miles from Ottawa, on *Ulmus racemosa*, sent by Mr. Fletcher. Other specimens are from Nappan, Nova Scotia, on elm (Fletcher), and Orono, Maine, on elm (Harvey). Prof. F. L. Harvey states that it is very abundant at Orono; he has known it for eight years, and it is increasing. The branches are often almost covered with them.

The Stittsville examples are affected by a Coccinellid, and by an Encyrtid parasite, perhaps a *Chiloneurus.*

The species is quite different from the European *Lecanium ulmi*, and is doubtless a native of this country. It illustrates well the extreme difficulty of dealing with the American species of *Eulecanium*, which have, perhaps, not succeeded in reaching a condition of specific equilibrium since the new developments which doubtless followed the termination of the glacial epoch. It will be seen from the above that the characters given are quite variable, unless we are dealing with three species instead of one—a view which I cannot for a moment entertain. While thus convinced that all these elm forms are strictly one thing, I have a very lively conviction that *L. ribis*, Fitch, is different—a conviction which I feel sure would be shared by any one who had seen quantities of both—yet it is difficult to point out the precise nature of the difference, apart from the smaller size of *ribis*. Two species of Fitch, *L. cynosbati* and *L. caryæ*, have been redescribed by Signoret, who shows that they have 6-jointed antennæ like *ribis* and *canadense*. I have not seen authentic examples of either, but the description of *L. caryæ* agrees so nearly with our elm species that I place the latter under it as a variety.

(2) *Lecanium ribis*, Fitch.

This species may be known by its comparatively small size, and 6-jointed antennæ, with the third joint very long. There are two long hairs almost at the end of the third joint. The derm shows large gland-pits, often in pairs. The insect reminds one of *L. hemisphæricum*, but it is a true *Eulecanium*. It is not confined to *Ribes* by any means. Dr. Lintner sent me specimens found by Hon. G. W. Clinton, on *Ostrya* and *Carpinus*, in Albany Rural Cemetery, June, 1885. These were 3 mm. long, 2 broad, 2¼ high. Just lately, Prof. Webster has sent it plentifully, infesting mulberry in Southern Ohio. The specimens are a little larger than usual, but clearly *ribis*. This attack on mulberry—a tree hitherto very free from insects in this country—is apparently a serious matter, and will doubtless be fully investigated by Prof. Webster. The *L. mori*, Sign., found on mulberry in the Savoy (Europe), is quite different.

(3) *Lecanium Fitchii*, Signoret.

On wild blackberry, Medina County, Northern Ohio, sent by Prof. F. M. Webster. The specimens have 8-jointed antennæ. I think this is the most western locality in which the species has yet been found.

Lecanium quercitronis, Fitch.

Mr. V. H. Lowe sends this on ironwood, but omits to state when it was found. Hitherto it has only been known on oak. The antennæ are 7-jointed. The newly-hatched larva is very pale yellowish, with a pale gray dorsal band.*

Certain forms of *Lecanium* found on oak and rose at Manitou, Colorado (Gillette), and on rose at Santa Fé, N. M., have given me a lot of trouble, and even now I do not know what to call them. It was at first questioned whether the rose species might not be the European *L. rosarum*, introduced, but it now seems tolerably certain that such is not the case.† It was hoped that they could be classified by the antennæ, but the more specimens examined, the greater grew the confusion, owing to the variability observed. Mr. Joseph Bennett, when a student at the N. M. College, examined these forms and found the antennæ thus :—

*Compare the young of *L. Fitchii*. The lately-hatched young of species of *Lecanium* differ more or less in appearance. Thus, the living young of *L. armeniacum*, Craw, sent by Mr. Ehrhorn from Sta. Clara Co., California, are pale gray mottled with white, with a conspicuous white or yellowish-white dorsal longitudinal band. Miss Tyrell considers *armeniacum* a variety of *pruinosum*, which probably is correct.

†It is also quite distinct from *L. pruinosum*, Coq., which Mr. Ehrhorn sends me on rose from Mountain View, California.

(a) On oak, Manitou.. Antennæ 8-jointed, formula 3 (24) 18 (567).
(b) On rose, Santa Fé.. " 8-jointed, " 38 (12) 45 (67).
(c) On rose, Manitou.. " 7-jointed, " 3 (24) (17) (56).

Later, I myself obtained the following results :—

(b) On rose, Santa Fé.. Antennæ 8-jointed, formula 4 (31) (28) (567). Joint 4 was a very little longer than 3.
(a) On oak, Manitou.. Antennæ 7-jointed, formula (34) (21) 7 (56).

I asked Prof. Gillette for more abundant material of the Manitou forms, and he sent them in quantity, but even then I could reach no certain conclusions. It appears, at all events, that the antennæ, *never* 6-jointed as in *ribis* and *canadense*, may have either 7 or 8 joints in the same form. Further, that while the third joint is usually the longest (as in *quercitronis*), 4 may be equal to it or even a little longer. In every instance, 5, 6, 7 are the three shortest, but when there are only 7 joints, 7 will be longer than 5 or 6. The differences seen in the formula given are not so important as might appear, for the slightest change in the length of a joint may alter the formula where several joints are so nearly of one length.

In general appearance, these scales are much alike, and do not differ in any marked degree from *L. quercitronis*. In fact, unsatisfactory as I feel the conclusion to be, I see nothing for it but to call them all *L. quercitronis*, var., at least until further studies of the living insects in all stages can be made. The differences between these *quercitronis* forms and *Fitchii* will also have to be clearly made out. Here again, the antennæ will not assist us. I think *Fitchii* and *quercitronis* must surely be distinct; but to *think* so is not to prove it—and the variability already observed in these forms throws doubt on formerly-accepted marks of distinction. The statements of Mr. Douglas regarding willow and rose species in England are suggestive in this respect.

It is much to be hoped that some of the Eastern and Canadian entomologists will study the biology of these perplexing forms. It is only by such means that we can arrive at sound conclusions. When dried specimens are sent to me, I can point out how they differ, but am left often in doubt as to how far the differences are specific, and how far due to ordinary variability, or even to the direct influence of the environment.

At Las Cruces, one day, I found a small *Eulecanium* on an umbellifer—one specimen only. It looked different from anything I had seen, and the finding of a *Eulecanium* on an herbaceous plant was contrary to all preconceived ideas! What was I to do?—call it a new species? Close by was a peach tree, on which were a few ordinary *L. persicæ*, and here of course was the explanation. But had I sent the umbellifer scale away to some entomologist, with no information about the adjacent *persicæ*, I really don't see how he could have guessed what it was—the thing was so starved and altered by its unwonted food!

All these remarks will naturally tend to produce the impression—doubtless correct—that we have too many nominal species of *Eulecanium* in the books. But if we must distinguish species with caution, so also must we lump them with caution. It is a stupid way out of the difficulty to throw all those together that we cannot quite easily separate.

(5) *Lecanium robiniarum*, Douglas. In May, 1894, I bred a parasite from scales of this species found on locust in Las Cruces, N. M. Mr. Howard identifies it as *Blastothrix longipennis*, Howard, and states that it has previously been reared from several Lecaniines.

On osage-orange in Las Cruces, I find a scale just like *L. robiniarum*, but perhaps a little more shiny and more decidedly pruinose. But the eggs of the osage-orange form are always pure snow-white, while those of *L. robiniarum* are salmon-pink!

(ii.) *Lecanium*, other sections.

(6) *Lecanium perforatum*, Newstead. A flat species with 8-jointed antennæ, found on palms. Mr. Ehrhorn sent me specimens from a greenhouse in San Francisco. Miss Mary W. Tyrrell, of Oakland, sends me a very pretty enlarged photograph of this insect, which she regards as *L. tessellatum*, Signoret. While I cannot very well doubt that it is Newstead's *L. perforatum*, I must confess that I am not well-satisfied about its distinctness from *tessellatum*. It does not seem, however, to be the same as the Jamaican species on lignum-vitæ, which I had regarded as *tessellatum*, though the two things are very much alike. For the present, no more can be said, though it seems likely that the Jamaican insect will need a new name.

(7) *Lecanium oleæ* (Bern.). Prof. Toumey sends this on orange from Arizona; and Mr. Lataste found specimens in Chile, on *Yucca* in a garden. In both these cases it has of course been introduced.*

*In both cases the names of the exact localities were sent, but I regret that I am totally unable to decipher them. Will correspondents please write names of localities plainly?

(8) *Lecanium hemisphæricum*, Targ. On a house-fern belonging to Mrs. Fred. Lohman, in Las Cruces, N. M., I found this species and *Dactylopius longispinus*, Targ. These Coccids will not live out-of-doors in the climate of Las Cruces, so far as we know.

(9) *Lecanium insignicola*, Craw, emend. Mr. Ehrhorn sends me this, on *Pinus insignis*, from Golden Gate Park, San Francisco. The specimens belong to *Physokermes*, and we must write the species *Physokermes insignicola* (Craw).

(iii.) *Pulvinaria*, section of *P. camellicola*.

(10) *Pulvinaria camellicola*, Sign., *P. urbicola*, Ckll., *P. simulans*, Ckll. These species need some further elucidation. The second is only known on *Capsicum* in Jamaica; the third only in Trinidad. We are supposed to have *P. camellicola* in this country, but I have never seen any with 6-jointed antennæ, as described by Signoret. Here is a short description of our insect:—

♀ remains brownish after boiling in potash. Tarsal digitules distinct and well-formed. Digitules of claw extremely large and stout, very broad at ends. A very long hair on end of trochanter. Marginal spines numerous and long. Lateral (stigmatal) incisions each with three spines, brownish and stout, one large, the other two small. Antennæ 8-jointed: 3 longest; 2, 4 and 8 subequal and next longest; 5 shorter than 4; 6 and 7 equal and shortest; 2 with a very long hair at the end; 3 with a moderately long hair at end; 5 with two very long hairs at end; 7 with a long hair; 8 with many long hairs.

Hab.: Macon, Ga., Apr. 15, 1892, on *Euonymus*. (Div. Ent., No. 5029; received through Dr. Riley.)

Just lately, Prof. Townsend has found the same species in abundance at Brownsville, Texas. The antennæ are 8-jointed, as in the Macon ones, formula 32 (41) (58) 67. The name of the food plant is not known, but it is not camellia, nor capsicum.

Notwithstanding the external similarity (which counts for little in *Pulvinaria*), I do not see how we can reconcile the above with Signoret's account of *camellicola*, assuming the latter to be correct. In 1886 Douglas treated of *camellicola*, and perhaps threw new light on the matter, but I have not now access to his paper.

If we thus assume that our insect is not *camellicola*, is it *urbicola* or *simulans?* Unfortunately, we know these latter only from one locality each, and are not well-informed about their possible range of variation.

In the large digitules of the claw it resembles *simulans;* in the 8-jointed antennæ, *urbicola*. In the ovisac it rather resembles *simulans* than *urbicola;* in fact, its external appearance is practically the same. In *simulans* the fourth joint of the antenna is very short; in our insect it is much longer than 6 or 7, and somewhat longer than 5. This comes nearer to the condition of *urbicola*. All things considered, perhaps it would be best, for the present, to call our insect *P. simulans*, variety. *P. bigeloviæ*, Ckll., is another species of the same group.

(iv.) *Asterolecanium*.

(11) *Asterolecanium pustulans* (Ckll.). On oleander from Honolulu; sent by Mr Ehrhorn. Mr. Maskell has placed this as a synonym of *A. fimbriatum* = *Planchonia fimbriata*; but I have true (French) specimens of the latter, kindly sent by Mr. Howard, and it is a totally different thing. It is hardly necessary for me to say that I cannot in the least agree with Mr. Maskell's proposed synonymy of the species of *Planchonia* or *Asterolecanium*. As several of the rejected species are my own, I do not care to discuss the matter now, but will leave it to the judgment of other coccidologists who may have occasion to examine the several forms. In fact, Mr. Maskell himself (as I hear from him) is giving closer attention to the matter, and will, I doubt not, eventually revise his present classification.

(v.) *Dactylopius*, section without lateral tufts.

(12) *Dactylopius virgatus*, Ckll. This is a destructive species, hitherto only known from Jamaica. Prof. Townsend has just discovered it in numbers on a cactus and other plants at Brownsville, Texas. Fortunately, it is there preyed upon by a *Scymnus* larva and a Chalcidid, which Mr. Howard tells me will form a new genus of Bothriothoracini. In Trinidad, Mr. Urich has found a *Dactylopius* on *Croton*, which I cannot distinguish from *D. virgatus*, var. *farinosus*; although, curiously, it also seems identical with Mr. Newstead's *D. ceriferus*, found on *Croton* in India. If this is so, *ceriferus* falls as a synonym of *virgatus*. No more need be said now, as I believe the subject will hereafter be fully discussed by Messrs. Townsend and Urich.

(vi.) Various *Diaspinæ*.

(13) *Mytilaspis pomorum* (Bouché). In the mountains, at Mountain View, California, on *Cornus californicus*. Sent by Mr. Ehrhorn. The specimens show fewer glands in the groups than some from apple,

viz., caudolaterals, 9; cephalolaterals, 14; median, 8. Mr. Schaufuss sent me *M. pomorum* on *Cornus* from Saxony long ago.

(14) *Diaspis amygdali*, Tryon. (=*lanatus*). This evidently reached California from Japan. Mr. Ehrhorn sends me some on dwarf peach from Japan, in Japanese nursery at San José, California. Also a grayish form of the same on persimmon from Japan, found by Mr. Craw in his quarantine work. The latter form looks different from ordinary *amygdali*, but is clearly that species; it shows caudolateral groups of glands with 36 orifices, cephalolaterals, 43; median, 15. The grayish appearance is partly due to dirt. Mr. Ehrhorn says it also infests dwarf cherry.

(15) *Aulacaspis bromeliæ* (Kerner). On pineapple in conservatory at San José, California (Edw. M. Ehrhorn). The exuviæ are nearly marginal.

(16) *Chionaspis assimilis*, Maskell. Sent by Mr. Ehrhorn. It was found by Mr. Craw on a tree from Australia, in the course of his quarantine work.

(17) *Chionaspis quercus*, Comst. On oaks at Dripping Spring, Organ Mts., N. M., 5,600 ft. (Ckll.). New to New Mexico.

(18) *Ischnaspis filiformis*, Dougl. Trinidad, West Indies. In extraordinary numbers on *Cycas revoluta*. (J. H. Hart.)

(vii.) *Aspidiotus*.

(19) *Aspidiotus juglans-regiæ*, Comst., Southern California, on prune. (Edw. M. Ehrhorn.) This species is quite generally distributed in Las Cruces and Mesilla, N.M., but here always white (var. *albus*). Two days ago I found it in Mesilla on apple, pear and apricot. Nowhere does it increase like *perniciosus*, and it is a comparatively harmless species, though anything but desirable in an orchard.

(20) *Aspidiotus piricola*, Del Guercio. This species, lately described as new from Italy, has turned up on plum at San José, California, specimens having been sent by Mr. Ehrhorn. A mounted specimen is dated March 18, 1892, others 1894; so it has been in California for some time unrecognized. The following description, from Californian examples, is worth giving:—

♀ scale 1½ mm. diam., flattened, circular, pale gray; with the exuviæ covered normally by a thin film of secretion, and then hardly noticeable, but the film very easily rubbed off, when the shiny, orange-brown exuviæ are conspicuously seen.

♀. Median lobes orange-brown, the others colourless. Median lobes large, prominent, well-developed, rounded at ends. The other lobes all very small and rudimentary; 2nd, 3rd, 4th and 5th pairs can be distinguished, becoming successively smaller; 2nd and 3rd very distinctly bifid. Small saccular incisions between the lobes. Five groups of ventral glands; all the groups rounded or oval, compact; median of 8, cephalolaterals, 13, caudolaterals, 8. Anal orifice circular, a little posterior to line of caudolateral groups, and a considerable distance from hind end.

A. ancylus differs by its dark scale, and the position of the anal orifice, &c. It is also clearly distinct from *Howardi*, *ostreæformis* and *juglans-regiæ*.

A. Howardi is still only known from Canon City; the Illinois specimens on cherry (W. G. Johnson), reported as such, prove on examination to be a slight variety of *A. ancylus*.

(21) *Aspidiotus ficus*, Ashm. On *Cocos nucifera* and *Oreodoxa regia*, Iacmel, Hayti, sent by Mr. F. Wolff. New to Hayti.

(22) *Aspidiotus destructor*, Sign. On cocoanut, San Juan, Porto Rico. Sent by Mr. J. D. Hall. New to Porto Rico, and the first Coccid-record for that island! It shows the grouped glands well: caudolaterals, 6; cephalolaterals, 10; median, 1 only.

THE BOREAL AMERICAN SPECIES OF PAMPHILA.

BY DR. HENRY SKINNER, PHILADELPHIA, PA.

There seems to be some misapprehension in regard to the validity of our species of *Pamphila*, and inasmuch as I have been studying our Hesperidæ for some years past, I thought some remarks on the subject would not be inappropriate. We now have in this genus ninety-six species as they would appear in a list according to the generally accepted specific values. With the exception of about two groups, I consider the species remarkably well defined and constant, and if you once become thoroughly familiar with them, there is not the slightest difficulty in separating any of them at sight. The great difficulty has been to determine them from descriptions, as the word pictures are often inadequate, and almost impossible to comprehend, as the descriptions seem to fit a number of species that may not be even very closely related. Many of the figures have also been failures to a great extent; this is particularly true of the difficult Comma group, which is in most collections in a condition akin to certain of our species of Argynnis, Melitæa and Colias.

The first group of species of uncertain value is the so-called *comma* group; this is named *comma* group because the species, so-called, resemble or are variations of an European species, *Pamphila comma.* I think it unwise to separate these forms of *comma* and consider them species, as the variation is almost endless, every locality seeming to produce a new one. I have received individuals of this group from Southern Texas to Assiniboia, and how much farther north or south they are found I do not know. Their western limit is the Pacific Ocean, and the eastern limit is perhaps not well-defined, being somewhere in Canada, and as far east as Colorado in the United States. I would limit the *comma* group proper to *Ruricola*, *Oregonia*, *Columbia*, *Colorado*, *Nevada*, *Manitoba*, *Juba*, *Assiniboia*, and any others that people care to name after the special localities where found. The fewer specimens one has of these variations the better off he is in regard to being able to determine them—if he has large series from various localities he is "at sea." I have recently received a form from the mountains of Utah, which some ambitious lepidopterist might like to call *Utahensis.* There is one other group that presents some difficulty, and in which some species do not seem to me to be clearly defined—they are *sylvanoides*, *agricola*, *pratincola*, *milo*, *verus*, *mystes*, *siris*. I do not mean to say that all of these are not valid species, but that some of them seem variable and to run into each other, and some are hard to separate. The remaining species, as a rule, are remarkably distinct and have excellent characters. There is much work to be done in the genus in the way of correcting synonymy, and in a few cases there are actual synonyms, but in comparison to the great number of species the synonyms are few. As an example of the mixed synonymy, the following may be cited :—

Vitellius, Fabricius = *Vitellius*, Hubner = *Delaware*, Edwards.
Arogos, Bdl.-Lec. = *Vitellius*, Abb.-Sm., = *Iowa*, Scudder.

All who have heretofore written on the subject have put *arogos* as a synonym of *cernes*, but Boisduval and Leconte knew *cernes*, which they figure, and also give a recognizable figure of *arogos*, a southern and western species. I hope to monograph the genus some day, and desire all the material I can get. I have all the species, with but few exceptions, and am very anxious to get these, either by purchase or exchange. I have been studying photography and the "half-tone" process, with a view of illustrating these interesting little fellows, but their non-actinic colours of black, yellow, orange, and red make them the most difficult things imaginable to reproduce in this way. I think, however, there is a great future for the illustration of natural history objects by photography.

NOTES UPON THE NORTH AMERICAN SATURNINA, WITH LIST OF THE SPECIES.

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Of the three families of *Saturnina* found in North America, only the *Saturnidæ* occurs in the European fauna. Conversely no analogue of the European *Aglia tau* * has been found in America. In a very interesting paper, Ann. Mag. N. Hist., Vol. XI., 1893, Dr. Packard says of this species: "*Aglia* appears to be a Ceratocampid in its earlier larval stages, the caterpillar in its final stage, however, and the moth being closely related to the Saturnians." This being so, it is clear that *Aglia* cannot be classed as a subfamily of *Citheronidæ*, from which the habit and structure of the moth and the mode of pupation seem to exclude it. *Aglia* seems, in fact, a comprehensive type, showing characters of the other three families of *Saturnina*. The head and antennæ are compared by Dr. Packard to those of *Automeris io*. *Aglia* resembles *Telea* somewhat in maculation and colour, and the wings in repose are held as in this genus and *Callosamia*. In fact. the ♂ moth reminds one in many respects of *C. promethea*: the slender body, the ovate outline of the antennæ and especially their position, together with the ready diurnal flight. All these characters are opposed to the *Citheronidæ*. The ♀ *Aglia tau* has remained in a more generalized condition. The group may be considered as higher than the *Hemileucidæ*, with which it is allied in venation, and probably as entitled to family rank, as suggested by Dyar. We have shown, in 1866, that there is a general difference in antennal structure between the three families, *Saturnidæ*, *Hemileucidæ* and *Citheronidæ*, and this notice has probably served as the basis for subsequent attempts to classify the *Saturnina* upon antennal structure. In the same paper, Ann. N. Y. Lyc. N. Hist., VIII., p. 378, we draw attention to the difference in pupation. The *Saturnidæ* weave large and dense cocoons attached to objects free from and elevated above the surface of the earth; the *Hemileucidæ* spin cocoons of slighter texture on or near the ground and granules of earthy matter are mixed with the web (*Automeris*), or in a surface cell among debris with no or little silk (*Hemileuca*); the *Citheronidæ* enter the ground to form a cell beneath the surface, in which the naked pupa reposes, showing an analogy of

*This moth is very common in beech woods in this neighbourhood, Hildesheim, and almost everywhere in Central Europe. I should not wonder if it were in time imported by dealers, and then reported as indigenous to America, as I believe has been done with *Xyloicus pinastri*.

habit with the *Sphingina*. Consult also, for perhaps the earliest recognition of the relationship implied by the habit of pupation between the *Citheronidæ* and *Sphingina*, my "Notes on the Sphingidæ of Cuba," pp. 4–5, Phil., 1865. The larvæ of *Citheronia* and *Eacles* have the same peculiarity with the Hawk moths, that they change colour and wander restlessly about in searching for a place of entrance. The habit in pupation of *C. regalis* is described with interesting original details by Dr. Hamilton, CAN. ENT., XXI., 101. I believe the *Citheronidæ* to be exclusively American. For a note on the geographical distribution of the family, see CAN. ENT., XX., 76, 1888. Since, then, the two latter families are absent in Europe, we can only compare the *Saturnidæ* in the two faunæ. There are no identical, but probably one "representative" species, the Californian *Saturnia mendocino*, Behrens. When my good friend, Mr. James Behrens, sent me his MS. and type of the species (CAN. ENT., VIII., 149), I saw we had to do with a genuine *Saturnia*. Consult Behrens, CAN. ENT., VIII., 175, where the author says: "After examining my type of *Saturina mendocino*, Prof. Grote considers it a true *Saturnia* and points out that in its yellow hind wings it resembles *S. Carpini* ♂." I may say that had my determination been wrong, and Behrens's beautiful species belonged to an allied genus, say *Calosaturnia*, Sm., my theory that the California fauna contained some residuary palæarctic types, prevented by the mountains from spreading east, would have been damaged. But my determination holds good. I cannot now compare *mendocino* with the two smaller European forms, the types of *Heæra*, Hubn., 1806, but it may well be that it "represents" *Saturnia pavonia minor*, L. I do not know *S. galbina*, Clem., which Neumoegen and Dyar make the type of *Agapema*, reversing Prof. J. B. Smith's determination of these two forms.

The nearest ally of *Saturnia* in our Eastern fauna is *Samia cecropia*, L., and I placed this genus next to *Saturnia* in my classification in Proc. Am. Phil. Soc., 1874, as well as in my Check List of 1882. Mr. Dyar had asked me to examine the larvæ of the European *Saturnia* unknown to him in nature, so as to see whether they agreed with his definition of the family. I did so, and found the tubercles prominent, no single tubercle on ninth segment. I was impressed by the resemblance between the full-grown larva of *Saturnia pavonia major* with that of our *Samia cecropia*. I sent Mr. Dyar then the prepared larvæ of the two European species in three stages, as his testimony in the matter would relieve my own doubt that I was correct in my observation. Mr. Dyar kindly writes me upon the specimens as follows: "They are evidently true Saturnians, as you wrote them to be, but differ from any which I have seen before, in lacking the unpaired dorsal tubercle on eighth abdominal segment. The tubercle is absent also in *Anisota* (*Citheroniidæ*), but in no other genus which I have yet seen. I thought at first that the unpaired tubercle was simply absent in *Anisota*, and wrote my first article on larvæ under that impression. But when I had the opportunity of studying the larvæ in stage I., I found that really the original tubercle i. remained unconsolidated, and ii. disappeared, just as on the more anterior segments. But in these Saturnians (*pavonia major* and *minor*) we cannot say whether i. is consolidated into an unpaired tubercle with its fellow and the structure lost, or whether i. is separate and ii. is gone. The first stage would probably not help us here, as the primitive first stage is lacking in all the Saturnians which I have seen. But, by analogy with *Anisota*, I conclude that i. is unconsolidated. *S. pavonia minor* is the more generalized form, when we come to consider the mature larva. *S. pavonia major* has suffered a modification in the evolution, and is more specialized. The secondary hairs are greatly reduced, but those that are left, together with the central setæ on the tubercles, are elongated and have acquired flattened and enlarged tips; the tubercles themselves stand up prominently and are coloured blue, strongly suggesting a simple form of our *Samia* type. I seem to see even a trace of the predominance of the subdorsal tubercles on meso- and metathoracic segments, which is so marked in the American forms. As to colour, the primitive black, seen in generalized larvæ like our Hemileucids, *Pseudohazis*, etc., is replaced gradually during ontogeny by green, as is done in *Samia*, etc., and in *Citheronia*. A beautiful adaptation to the environment."

Thus it appears from Mr. Dyar's study, that our *Samia cecropia* and allies are descendants of the same stock with the European *Saturnia*, while the position I have assigned to *Samia* as next to *Saturnia* is justified. There remains for me to point out some facts with regard to the formation of the cocoon in our American genera which induces my arrangement of the family. In *Attacus*, *Philosamia* and *Callosamia*, the larva attaches the deciduous leaf, which forms the basis and natural attachment for its web, firmly to the branchlet by a pedicel of silk. Evidently this is an acquired habit. It has been found more useful to the species that the cocoon be prevented from falling to the ground with the fall of the leaf. *Telea* and *Actias* have not this habit. The cocoon falls in the autumn with the leaf which was used in the spinning. The Attacid group, with falcate fore wings and ovate secondaries, have generally this habit of attaching the cocoon. This proves at once the validity of *Callosamia*, which has the habit strongly developed, as compared with *Samia*, which has it not at all, but spins a thick double cocoon attached to the branches themselves, often near the ground and much after the fashion of the European *Saturnia*. I therefore place the genera with the pedicel habit at the commencement of the family, *Saturnia* and *Samia* following and closing with *Actias* and *Telea*, in which the thinner cocoon falls with the leaf to the ground. This study of the genera of our *Saturnidæ* leads virtually to the same arrangement as proposed by me in 1874; it places merely *Actias* and *Telea* together at the last, instead of commencing with them; the main point lies in the association of the genera which are naturally nearest, *Attacus*, *Philosamia*, *Callosamia*, and again *Samia* and *Saturnia*. Asking his opinion, Mr. Dyar kindly answers me that he would arrange the *Saturnina* "just like your list of 1882, except that *Thauma* and *Quadrina* should change places." I do not know *Thauma*; of *Quadrina* I had only the ♀ type, and I never possessed an example of *Gloveria*, with which Neumoegen and Dyar unite it, from a photograph of the venation furnished by Prof. Comstock, considering it the same as the European *Dendrolimus*, with the types of which I am also unacquainted. Those using the Philadelphia Check List should therefore alter the incorrect classification there adopted, for that in the New York Check List, as here amended in detail. I would also suggest, that the specimens in the National Museum in Washington be labelled to agree with the list given here, as their present labels must be, in large part, erroneous.

The first separation of the *Hemileucidæ* was by Grote and Robinson in 1866, under the name *Hemileucini*; while the genera of the *Dryocampini* grouped together in the same paper correspond to the family *Citheronidæ* of Dyar. I have elsewhere shown that Kirby is incorrect in giving *Laocoon* as the type of *Eacles*, Hubn. Verz. The type of *Eacles* is fixed by Dr. Packard in 1864; the two genera are distinct in all stages. The revision of the species of *Citheronia*, given by Grote and Robinson in 1866, has perhaps not been read by Mr. Kirby. I would follow Mr. Dyar in excluding the *Lacosomidæ* from the present series. I am indebted to Neumoegen and Dyar for details of synonymy and locality.

Family SATURNIDÆ.

Family type: *S. pavonia major*, L.

Gen. ATTACUS, Linn., 1767.

Type: A. atlas.

1. erycina, *Shaw.* South America to Mexico; Texas?
   splendidus, Beauv.
2. jorulla, *Westw.*
   cinctus, Tepp. Mexico to Arizona.

Gen. PHILOSAMIA, Grt., 1874.

Proc. Am. Phil. Soc., XIV., 258.

Type: P. cynthia.

3. cynthia, *Drury.* Atlantic Coast, introduced from Asia.
   aurotus, Fabr.
   insularis, Voll.

Gen. CALLOSAMIA, Pack., 1864.

Type: C. promethea.

4. calleta, *Westw.* Mexico to Arizona.
   polyommata ·epp.
5. promethea. ·ury. Canada, south and westward.
6. angulifera, ·alk. Atlantic States; Buffalo, probably Lower Canada.

Obs.—These three genera form the first group in the family; the second consists of *Samia*, *Saturnia* and *Agapema*; the third, of *Actias* and *Telea*.

Gen. SAMIA, Hubn., 1818 (1822?).

Type: S. cecropia. (Packard restr., 1864.)

= *Platysamia*, Grt., 1865.

7. cecropia, *Linn.* Canada, southward.
8. columbia, *S. I. Smith.* Canada to Michigan; Eastern States.
9. Gloveri, *Streck.* Arizona to Rocky Mountain region.
   var. reducta, *Neum.* Mts. of Colorado, 11,000 ft.
10. rubra, *Behr.* (1855.) California to Pacific Northwest.
    californica, Grt. (1865.)
    ceanothi, Behr. (1868.)
    euryalus, Streck. (1875.)

Gen. SATURNIA, Schrank, 1802.

Type: S. pavonia major (*pyri*).

= *Heræa*, Hubn., 1806.

Type: S. carpini.

= ‖ *Pavonia*, Hubn., 1818 (1822?).

= *Calosaturnia*, J. B. Smith, 1886.

Type: S. mendocino.

11. mendocino, *Behrens*. Northern coast region, California.

Gen. AGAPEMA, Neum. and Dyar, 1894.

Type: A. galbina.

12. galbina, *Clem*. Texas.

Gen. ACTIAS, Leach, 1819.

Type: A. selene.

= Tropæa, Hubn, 1818 (1822?).

Type: A. luna.

13. luna, *Linn*. Canada to Texas; Mexico.
var. dictynna, *Walk*.
var. Rossi, *Ross*.

Gen. TELEA, Hubn.

14. polyphemus, *Cram*. North America throughout.
paphia, Linn.
fenestra, Perry.
var. oculea, *Neum*.

Obs.—The late Mr. Hy. Edwards applied Mr. Walker's name in 1880 to a variety of *luna*, in which, as I remember, the outer margins of the wing showed a reddish band. I have not seen Mr. Walker's type. It is, I believe, that form of *luna*, found also in the north, which led Prof. Agassiz in 1860 to suspect a distinct species. The reference of *luna* to *Tropæa* is founded on the belief that the Asiatic species may belong to a distinct genus. I have not been able to compare them.

Family HEMILEUCIDÆ.

Pack., Ann. Mag. N. Hist., 173, 1893.

= *Hemileucini*, G. & R., 1866; Grote, 1874.

Family type He mileuca maia.

Gen. AUTOMERIS, Hubn., 1818 (1822?).

Type: A. janus. (Grote restr., 1874.)

= *Hyperchiria*, Hubn. Verz.

Type: A. io. (Pack. restr., 1864.)

= || *Io*, Boisd., 1875.

1. Zelleri, *G. & R.* Texas.
2. pamina, *Neum.* Arizona.
    var. aurosea, *Neum.*
3. zephyria, *Grt.* New Mexico.
4. io, *Fabr.* Canada, southward.
    varia, Walk.
    Fabricii, Boisd.
    var. argus, *N. & D.*
    ♀ *var.* lilith, *Streck.* (Atlanta, Ga.)

Gen. THAUMA, Hy. Ed., 1875.

Type: T. ribis.

5. socialis, *Feisth.* West Coast, Vancouver to Chile.
    angulifera, Walk.
    ribis, Hy. Ed.

Gen. COLORADIA, Blake, 1863.

Type: C. pandora.

6. pandora, *Blake.* Rocky Mountain region.

Gen. ARGYRAUGES, Grt., 1883.

Type: A. Neumoegeni.

7. sororius, *Hy. Ed.* Lower California.
8. hualapai, *Neum.* Arizona.
9. Neumoegeni, *Hy. Ed.* Arizona.

Gen. HEMILEUCA, Walk., 1855.

Type: H. maia. (G. & R. restr., 1866.)

= *Euchromia*, Pack., 1864.

= *Euleucophæus*, Pack., 1872. (Grote ref., 1883.)

Type: H. tricolor.

10. electra, *Wright.* So. California.
11. maia, *Drury.* North America, throughout.
    proserpina, Fabr.
    var. nevadensis, Stretch.
    lucina, Hy. Ed.
    var. californica, *Wright.*
    artemis, Pack.

12. juno, *Pack.* Mexico to Arizona.
yavapai, Neum.
13. Grotei, *G. & R.* Texas to Colorado.
diana, Pack.
14. tricolor, *Pack.* New Mexico; Utah.

Gen. PSEUDOHAZIS, G. & R., 1866.

Type: P. eglanterina.

15. eglanterina, *Boisd.* Rocky Mts.; Arizona.
var. Nuttalli, *Streck.*
16. shastaensis, *Behrens.* Coast region of California; Mt. Shasta.
var. denudata, *Neum.*
17. hera, *Harris.* Rocky Mts; Eastern Oregon.
pica, Walk.
var. marcata, *Neum.*

Family CITHERONIDÆ.

Neum. & Dyar, 1894,
=*Dryocampini*, G. & R., 1866.
= ‖ *Ceratocampidæ*, Auct.
Family type: Citheronia regalis.

Gen. EACLES, Hubn., 1818 (1822?).

Type: E. imperialis. (Pack. restr., 1864.)
=*Basilona*, Boisd., 1868.

1. imperialis, *Drury.* Lower Canada to Texas; Mexico.
imperatoria, Abb. & Sm.
didyma, Beauv.
var. punctatissima, *Neum.*
var. nobilis, *Neum.*

Gen. CITHERONIA, Hubn., 1818 (1822?).

Type: C. regalis.

= ‖ *Ceratocampa*, Harris, 1834.

2. regalis, *Fabr.* Lower Canada to Southern States.
regia, Abb. & Sm.
var. infernalis, *Streck.*
var. saengeri, *Neum.*
3. mexicana, *G. & R.* Mexico.
4. sepulcralis, *G. & R.* Mass. to Florida.

Gen. SPHINGICAMPA, Walsh, 1864.

Type: S. distigma.

Grt., Proc. Am. Phil. Soc., 1874.

5. albolineata, *G. & R.* Mexico; Texas?
6. Heiligbrodti, *Harvey.* Arizona.
7. bicolor, *Harris.* Western States; Mississippi Valley.
   distigma, Walsh.
   var. suprema, *Neum.*
   var. immaculata, *Jewett.*
8. quadrilineata, *G. & R.* Mexico; Texas.
9. bisecta, *Lintn.* Western States to Texas.
   var. nebulosa, *Neum.*

Gen. ANISOTA, Hubn., 1818 (1822?).

Type: A. stigma. (Grt. restr., 1874.)
= *Dryocampa*, Harris, 1841.

10. stigma, *Fabr.* Atlantic States, westward.
11. senatoria, *Abb. & Sm.* Atlantic States, westward.
12. virginiensis, *Drury.* Canada, southwardly.
    pellucida, Abb. & Sm.
13. rubicunda, *Fabr.* Canada, southwardly.
    var. alba, *Grt.*
    pallida, Bowles.

Obs.—This arrangement is that adopted by me in 1874. It is possible, when the larvæ of all the forms are known, it may be slightly altered. The relationship between the types of *Adelocephala*, Boisd., and the species included by me in the extension of *Sphingicampa*, is not known. I had been inclined to look upon *Sphingicampa* as a specialized form with more affinity to *Eacles* than to *Anisota.* I have not been able to compare the larvæ properly. I had endeavoured to rescue Harris's term *Dryocampa* for *Anisota rubicunda;* but the moth does not seem to offer distinct structural characters; hence, the collective term *Dryocampini*, G. & R., 1866, must also fall. Mr. Dyar writes me positively that he thinks *rubicunda* strictly congeneric with *Anisota*, both as larva and moth. The tubercles of *Anisota* are peculiar, and Mr. Dyar finds no difference between the species. I think this settles the matter, and that the present nomenclature of the *Saturnina* can be accepted without much reservation.

THE MARX COLLECTION OF ARACHNIDA.

The eminent arachnologist, Dr. George Marx, of Washington, D. C., died January 3rd, 1895. His important collection of Arachnida has been placed by his widow in charge of the undersigned committee of the Entomological Society of Washington, to be disposed of by sale. The collection is one of the most important in existence. It contains more than one thousand species of Aranaeina alone.

Of this one thousand species, about five hundred are described species from North America. These are distribued among 175 genera. The families Theridiidæ, Epeiridæ and Theraphosidæ are particularly well-represented, and have been identified largely by some well-known authority. The Theridiidæ were in the hands of the late Count Keyserling, and about thirty of his species have their types in this collection. The Theraphosidæ have been recently in the hands of Simon, of Paris, while Dr. McCook has examined the Epeiridæ. In addition to these 500 described American species, there are about 200 species of European spiders properly identified and labelled, and nearly 300 American species which bear Dr. Marx's manuscript names. There is, further, a great mass of material which has never been worked up.

The species are many of them represented by many specimens. The collection is contained in vials in Muller's fluid, and the vials are arranged in the standard trays of Dr. Marx's own invention, as figured and described in Riley's "Directions for Collecting and Preserving Insects" (Smithsonian Institution, Part F, Bulletin 39. U. S. National Museum). The collection is of special interest, aside from the number of species, on account of the excellent representation of the boreal fauna. There are many specimens from Alaska on the west and Labrador on the east. In addition, all parts of America north of Mexico are represented. Besides the Aranaeina there are many specimens of Scorpionida, Solpugida and Pseudoscorpionida, and Pedipalpi.

After due consideration, we have decided to offer, for the present, this collection for sale for the sum of fifteen hundred dollars ($1,500).

Correspondence relative to the collection, or its possible purchase, may be addressed to any member of the committeee :

C. V. Riley, U. S. National Museum.

L. O. Howard, U. S. Department of Agriculture.

E. A. Schwarz, U. S. Department of Agriculture.

Theodore Gill, Smithsonian Institution.

Washington, D. C., August 1st, 1895.

P. S.—With the collection will be delivered to the purchaser, Dr. Marx's large and valuable library on Arachnida, comprising all the important works on the group, well-bound, together with several hundred pamphlets.

Mailed September 7th, 1895.