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THE
BUTTERFLIES
OF
NORTH AMERICA
WITH
COLORED DRAWINGS AND DESCRIPTIONS

BY
W. H. EDWARDS

THIRD SERIES.

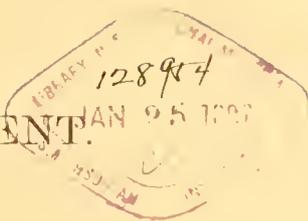


PART I.

BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY
The Riverside Press, Cambridge
LONDON: TRÜBNER & CO.
1887

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I HAVE concluded to begin a third Volume of the "Butterflies of North America," and have made such arrangements that at least ten Plates may be expected to appear in each year. It may be found advisable to give sixty Plates instead of fifty, as in preceding Volumes, and probably three or four will contain figures of eggs exclusively, for I desire to make it clear at a glance that a natural genus is indicated quite as decidedly in the shape and ornamentation of the egg as in the imago. The drawings on stone will be made under the supervision of Mrs. Mary Peart, and the preparatory stages of the species treated will be illustrated more fully, if anything, than in Vol. II.

Some surprise has been expressed that Vol. II. should have been so great an advance on Vol. I. in the matter of these early stages; but the explanation is simple. When Vol. I. was undertaken, in 1868, nothing was known by myself or any one else, of eggs, larvæ, or chrysalids, except of the more common butterflies. As an egg or larva could but rarely be traced back to a particular female, it was impossible that much knowledge could be gained of the life histories. Scarcely any advance in this respect had been made, in fact, since the time of Abbot, about 1800, and I said as much in the Advertisement which appeared with Part I. Abbot represented nothing but the mature larva and pupa. His larvæ, as I have been told by Mr. Titian Peale, who knew him at Savannah, were brought in by boys, white and black, and generally what they were was made known when the butterflies came from chrysalis.

But in 1870 I discovered an infallible way to obtain eggs from the female of any species of butterfly, namely, by confining her with the growing food-plant. If the eggs are mature they will be laid. The first experiment was made with *Papilio Ajax*, and seasonal tri-morphism established. Three described species of *Papilio* then and there resolved into one tri-formed species. The same summer, the seasonal di-morphism of *Grapta Interrogationis* was determined; and soon after, of *Grapta Comma*. And from that day to the present I have so obtained eggs at will, besides receiving others, of many species, from correspondents, got

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in the same manner, and have reared larvæ without end. In this way, many cases of polymorphism have been established, and the position of many doubtful forms settled. A light has also been thrown on the limits of variation in species. In every case, I have preserved descriptions of the several stages, and many of them have been published. Of a large proportion, also, Mrs. Peart has executed colored drawings, magnified when necessary, and my albums contain nearly one thousand figures.

In 1868, Coalburgh was inaccessible from the East, except by stage-road across the Virginian Alleghanies, and the journey to Philadelphia was a matter of four days; therefore it was next to impossible to get larvæ to the artist. Had that state of things continued, very few larval drawings could have been given in Vol. II. But the opening of the Chesapeake & Ohio Railroad, in 1870, changed all that. Now, every part of North America which can be reached by railway — Florida, Arizona, Southern California, and even Vancouver's Island and British Columbia — is tributary to these Volumes.

And so, in this Christmas time of 1886, I commend Vol. III. to the good will of the friends who have made my small audience for so many years.

WM. H. EDWARDS.

COALBURGH, W. VA., *December 25, 1886.*

COLIAS I.

COLIAS EURYDICE, 1-4.

Colias Eurydice (Eu-ryd'-i-ce), Boisduval, Ann. Soc. Ent. France, 1852. Edwards, But. N. A., Vol. I., pl. 16, p. 53. Form. ΑΜΟΡΦΛΕ, H. Edwards, Proc. Cal. Acad. Nat. Sci., 1876.

WHAT I supposed was the typical form of *Eurydice* was figured in Volume I. Boisduval says: "The yellow (of *Cæsonia*) is replaced by a vivid orange, and the fore wings have a violet reflection." It is impossible to represent in colors the peculiar reflection. It is also variable, some examples having scarcely any violet, others an excess, and my figure was made from one of the last. Mr. Henry Edwards called attention, in the paper above referred to, to the difference between the spring and autumn generations of this species, and regarded the former as the type. "The butterflies of spring make their appearance in April and May; the secondaries of the male are wholly bright orange, without any spots or marks on the margin, except some brown dots to note the termination of the nervules, while the female is immaculate. The autumn brood, however, appearing in July and August, have the secondaries of the male with a black marginal border, and the females have the margins distinctly marked with brownish patches, and rarely with a black sub-median band, composed of clouded patches, crossing the wing." (Fig. 4.) To the autumnal form Mr. Edwards gave the name ΑΜΟΡΦΛΕ. In same paper, mention is made of an example of *Eurydice* from Mendocino County, in which the "dog's head" is suffused with the richest purple.

From Mr. W. G. Wright, at San Bernardino, I have received many examples of the butterfly, and they are characterized by small size, and absence of any decided violet reflection. Often there is no reflection at all, and the color of the dog's head varies from a pale to a deep or indian yellow. From the same lot of eggs I have bred the larvæ to imago, and obtained these varieties. It is this small form, with yellow primaries, that I call var. BERNARDINO. The females have a large, deep brown or brown-black, discal spot on primaries, and often there are

COLIAS I.

traces of sub-marginal spots on same wings; on the under side the sub-marginal clusters of scales on both wings are usually conspicuous. (Figs. 1-3.) The preparatory stages of *Eurydice* are thus described:—

EGG.—Fusiform, thick in middle, tapering to a small rounded summit; the base flat; ribbed longitudinally, the number of ribs about eighteen, four or five of which end at nearly three quarters the distance from base to summit; they are low, narrow, of even height and width throughout, the spaces between flat and crossed by many fine horizontal ridges; the micropyle (Fig. a^2) in centre of a rosette of five hexagons, outside of which is a ring of cells of same shape but irregular; color yellow-green. (Fig. a .) Duration of this stage about five days.

YOUNG LARVA.—Length .1 inch; cylindrical, thickest on 2 and 3, tapering slightly to 12; each segment several times creased, and on the ridges so made are many black points, each giving a short black hair; scattered among these points are black tubercles, some with long black hairs, but most with white clubbed appendages (Figs. b^3 , b^4); on front of 2 is a cross row of the hairs, five on either side, running from dorsum to base; on 3 and 4 are four each, also in front, but from 5 to 12 there are three of the white appendages on the side of each segment, a subdorsal one on the front ridge, an upper lateral on fourth ridge, a lower lateral on second ridge, or between second and third; these form three longitudinal rows, and the subdorsal extends over 4; 13 has three hairs in triangle on either side, and from 4 to 12, below spiracles, are two hairs each, the front one always a little below the other; color dull yellow-green; feet and legs same; head rounded, a little depressed at top; on either side of face are seven rounded tubercles, and two in the triangle, in all sixteen, each with long depressed black hair; color of head pale yellow-brown. (Figs. b , b^2 .) Duration of this stage about four days.

After first moult: length .14 inch; rather more tapering, the ridges thickly set with black points, each with black hair; among these are small tubercles of same color, mostly on middle of each ridge and nearly equidistant, with longer hairs (Fig. c^3); color yellow-green; head nearly as before, somewhat broader in proportion across lower half; the tubercles and hairs much more numerous than before; color pale yellow-green. (Figs. c , c^2 .) As this stage proceeds a yellowish basal stripe begins to show itself. To next moult four to five days.

After second moult: length .22 inch: color deep green; the points and tubercles as in previous stage; the basal white band distinct; just over it, on 3 and 4, on middle of the segment, a black, vitreous, round process, almost a hemisphere; head yellow-green, more thickly beset with tubercles than before, mostly small, but twelve, scattered among the others, are of larger size. (Figs. d , d^2 , d^3 .) To next moult three days.

COLIAS I.

After third moult: length .4; same color; in addition to the black processes on 3 and 4 is often a similar but much smaller one on each of the succeeding segments, but they are variable in number; the band has now an ochreous yellow discoloration at its lower edge, which deepens as the stage proceeds, becoming yolk-of-egg color; head as before. (Figs. *e*, *e*².) To next moult three days.

After fourth moult: length .6 inch; orange now appears in the band. To maturity about three days.

MATURE LARVA. — Length 1.1 inch; cylindrical, of nearly even thickness from 3 to 11; thickly covered with small black tubercles, each of which gives a very short, fine black hair; along base from 2 to 13 a narrow white band, through the lower part of which runs an orange stripe, often macular; on 3 and 4 each, over the band, on middle of the segment, is a vitreous, hemispherical process, black, with purple reflection; from the centre springs a very small hair, and around base is a cluster of minute black points (Fig. *g*²); these processes on 3 and 4 are constant; often smaller processes of same character are found on part or all the succeeding segments to 9 or 10, the posterior sometimes greatly reduced; a ring of points similar to those about the glassy processes surrounds each hair on the mature larva (as the artist has endeavored to show in the enlarged segment, Fig. *e*²); color dull green; under side blue-green; feet and legs same; head round, slightly depressed at top, much covered with fine black points, each with its short black hair. (Figs. *f*, *f*², *f*³.) From fourth moult to pupation about six days.

There is some variation in the markings at last two stages; one larva had a narrow black band on middle of each segment, including 2 and 13 (as shown in Fig. *h*). Another had black beads sprinkled about as follows: on 2, one subdorsal; on 3, three high on side; on 4, two high on side; on 5 and 6, one subdorsal; on 8 and 10 each a short bar; in this last example, as occasionally happened with others, there were black lunate spots beneath the band, such as is commonly seen in *Eurytheme* and *Philodice*.

Another larva had spots from 3 to 11, most with an oblique black dash on lower side. (Fig. *g*.)

The larval measurements were taken at or near twelve hours from the egg and several moults.

CHRYsalis. — Length .8 inch; breadth across mesonotum .19; across abdomen, .2 inch; greatest depth .28 inch; compressed laterally; the thorax on ventral side prominent and forming a narrow ridge; abdomen tapering, conical; mesonotum less prominent than in *Eurytheme* or *Philodice*, low, rounded, with a slight carina, followed by a small excavation; head case produced to a point, a little curved upward, with a regular slope on both dorsal and ventral sides, angular laterally; color apple-green; a white stripe often marks the side of abdomen. (Fig. *i*.) Duration of this stage nine or ten days.

COLIAS I.

The food plant of *Eurydice* is *Amorpha Californica*. (Fig *k*.) I have several of these from Mr. Wright, and they are growing in my garden. I also have received eggs and larvæ through the mails. The first sent reached me 2d April, 1883. The larvæ began to pass first moult 4th April; the second, 9th; third, 12th; fourth, 15th; to pupate, 23d; and the first imago appeared ten days later. Whole period from laying of egg to imago about 33 days.

On 4th May, 1884, I received larvæ of all ages, about seventy. The black spots over the band varied greatly. All the mature larvæ had one each on 3 and 4. Of 37 examples, 23 had no other spots. One had spots from 3 to 9; another 3 to 10; but in both cases none on 5; four had spots from 3 to 10, five from 3 to 11, two from 3 to 12. These larvæ were attacked by a fatal disease, and I lost nearly all. A black speck would appear on middle segments and soon extend over the body. So pupæ that were at first apparently healthy died in same manner. Mr. Edwards, in the paper referred to, speaks of losing many chrysalids from a similar disease. I tried in vain, in 1883, to make the larvæ eat white clover (which several species of *Colias* will eat, though they may refuse red clover), but, in 1884, I succeeded, and on this plant the larvæ went to pupation. The habits, at all stages, are similar to those of *Eurytheme* and *Philodice*. When first hatched, they eat furrows in the surface of the leaf; after first moult, they eat the leaf; and they lie extended on the upper side along the mid-rib.

When the plate in Volume I. was published, 1870, little was known of the distribution of *Eurydice*. I quoted from Mr. Edwards, that the insect was rare and local; that its chief home was in Marion County, about thirty miles from San Francisco. It is now known to inhabit several counties of California from north to south. Mr. Henry Edwards writes: "I do not know how far south the species may fly, but certainly not as far as San Diego, the many collections I have seen from the neighborhood of that city containing not a single specimen. It is however quite probable that it may reach nearly as far. To the north, it is taken in Mendocino County, but not in Oregon, Nevada, or British Columbia. The food plant, *Amorpha Californica*, grows throughout Oregon, and, I think, even as far as Vancouver's Island, and it is somewhat odd that the range of the species should stop short, as it apparently does, about half way between San Francisco and the Oregon line. It is most common in the counties of Napa, Sonoma, and Mendocino, and never more than fifty or sixty miles from the coast. It frequents the lower ranges rather than the mountains, and I have never seen it in any part of the Sierra Nevada. I should say that its home is limited to about 400 miles at the utmost from north to south, and about sixty miles inland from the seaboard. It must therefore be regarded as an extremely local species." The mature larva and chrysalis described by Mr. H. Edwards, in Proc. Cal.

COLIAS I.

Acad. Nat. Sci., June 5, 1876, were much larger than any San Bernardino examples, the larva measuring 1.45 inch, the chrysalis .95 inch.

The several stages from egg to pupa are closely like other Coliades described in these Volumes. There is no generic difference whatever observable in any of these stages between *Eurydice* and *Philodice*. So far as I am acquainted with the butterflies, there is no case where a natural genus does not show its distinctive characters in the preparatory stages, either in all of them, or part. Hence I have declined to accept the genus *Megonostoma*, created by Reakirt, in 1863, to accommodate *Casonia* and *Eurydice*. There is no more natural genus than *Colias*, and it seems to me quite enough that the differences in the imagos, which are trifling at best, should be indicated by Groups, as I have treated them in my Catalogues.

ARGYNNIS.
I.



NITOCRIS 1 2 ♂ 3 4 ♀

ARGYNNIS I.

ARGYNNIS NITOCRIS, 1-4.

Argynnis Nitocris (Ni-to'-cris) Edwards, ♂, Trans. Am. Ent. Soc., V., p. 15, 1874; Mead, Rep. Wheeler Expedition, V., 751, 1875. ♀, Edwards, Can. Ent., XI., p. 82, 1883; ♀ aberr. *Nokomis*, Strecker, Rep. Ruffner Expedition, p. 1853, 1878.

MALE. — Expands 3 inches.

Allied to *Nokomis*. Upper side bright fulvous, much obscured from base to middle of disk, except upon a portion of the cell of primaries; both wings bordered by two parallel black lines, which, on secondaries, enclose a rather broad clear fulvous space, on primaries a narrow space cut by the black nervules; anterior to these lines, on primaries, a series of black lanceolate spots, the anterior ones connected and touching the inner line; on secondaries the spots are lunular, separated, and do not touch the line; the extra-discal spots on primaries are irregular in size and shape, rather sub-quadrate and lanceolate, on secondaries minute; the markings to base as in *Nokomis*, heavy on primaries, light on secondaries, the discal band on the latter being broken into small, separate, sub-lunular spots; fringes fulvous, on primaries black at tips of the nervules.

Under side of primaries red from base to hind margin, and over whole wing except a small area near apex, where it is bright ochre-yellow; a brown patch on middle of this area; the black markings repeated; the upper five sub-marginal spots enclose silver, and there are three silver spots on the patch.

Secondaries deep ferruginous-brown from base to the outer edge of the second row of spots, between this and outer row a clear ochre-yellow space; the hind margin same color as the disk, with an obscure appearance of fulvous between the nervules; all the spots well silvered; the seven sub-marginal are narrow segments of circles, and are edged broadly on anterior side by ferruginous-brown; those of the second row are rather small, mostly rounded, the one next inner margin sub-lunate; the third row consists of three large spots, the outer ones sub-lunate, the other rounded, and edged on posterior side by black; all the spots of the two rows edged heavily on basal side by black; in cell a round spot, and below

ARGYNNIS I.

cell, an oval, both ringed with black; a silver patch at base of cell, and another at base of sub-costal interspace; shoulder and inner margin lightly silvered.

Body above fulvous, beneath same with many black and gray hairs; legs fulvous; palpi same, buff at the sides; antennæ fuscous above, fulvous below; club black, the tip fulvous or ferruginous. (Figs. 1, 2.)

FEMALE. — Expands 3 to 3.25 inches.

Upper side blackish-brown, darker than female *Nokomis*, the black markings from base to middle of disk nearly lost in the dark ground; the light spots as in *Nokomis*, and of a pale yellow color, except the small sub-marginal, which are whitish; the light spots of secondaries narrower than in most examples of *Nokomis*, owing to the broad edging of brown upon each nervule; they are also much dusted brown, particularly on the basal portion.

Under side of primaries deeper red than in the male, the sub-apical area clearer yellow. Secondaries of a darker brown, dusted ferruginous next base, the belt of a brighter yellow, divided into spots by the broad edging of the nervules; the silver spots generally as in the male. (Figs. 5, 6.)

I have not seen a male other than the one in my collection. This was taken in the White Mountains, northeast Arizona, in 1873, by Lieut. Henshaw, of the exploring expedition under Lieut. Wheeler.

Several females have been taken in Arizona, Colorado, and Nevada. Probably the species will be found in abundance in some of the valleys of southwest Colorado, and south Utah.

ARGYNNIS.
II.



LAIS 1 2 ♂ 3 4 ♀

ARGYNNIS II.

ARGYNNIS LAIS, 1-4.

Argynnis Lais (La'-is) Edwards, Can. Ent., XV., p. 209, 1883.

MALE. — Expands 2 inches.

Upper side bright red-fulvous, somewhat obscured at base ; both wings bordered by two parallel lines, the spaces between cut by the black nervules ; the markings as in the allied species, but all slight ; the common discal band broken into spots, which, on secondaries, are very small ; fringes yellow-white, black at ends of nervules.

Under side of primaries cinnamon-red, paler next inner angle, the apical area buff ; the upper sub-marginal spots enclose silver and there are two or three silver spots on the sub-apical patch.

Secondaries from base to outer side of the second row of spots dark brown mottling a yellowish ground ; the belt beyond these spots pale yellow ; all the spots small and well silvered, the outer row sub-crescent, the second row mostly oval.

Body above fulvous, beneath pale fulvous with many gray hairs ; legs fulvous ; palpi same, with black hairs at sides ; antennæ black above, fulvous below, club black, ferruginous at tip. (Figs. 1, 2.)

FEMALE. — Expands 2.2 inches.

Upper side less bright, the base more obscured ; the markings all heavier ; the marginal lines more or less confluent on primaries ; the discal band, in many examples, connected on primaries, but on secondaries as in the male.

Under side as in the male. (Figs. 3, 4.)

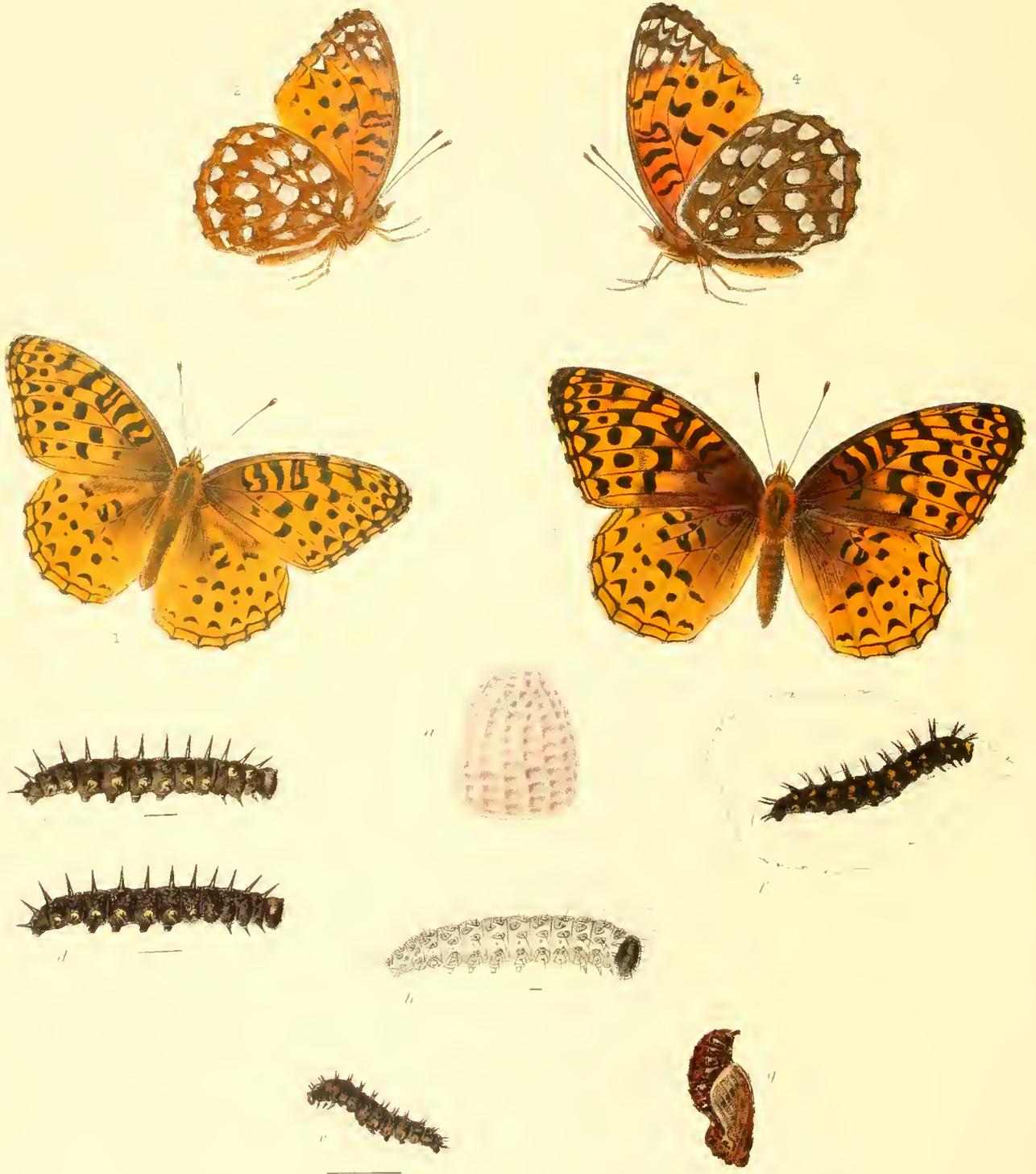
This pretty species is found in N. W. Terr., and was discovered by Captain Gamble Geddes, in 1883, at Edmonton, early in July. It was common and associated with *Cybele*. In 1884, Captain Geddes took it at Calgary, in the foot-hills, flying with *Atlantis*. Also at Morley, in Kicking-horse Pass, in July and beginning of August, and at Laggan, at the summit of same Pass.

ARGYNNIS II.

Mr. Thomas E. Bean, writing from Laggan, 13th September, 1886, says: "As to *Lais*, I can only speak of this region and McLean, 600 miles east of this. Here *Lais* appears not to fly at all. At McLean, it is the single common species of the larger *Argynnis*. It appeared quite freely along the railroad and about the station buildings. But its native haunts I found to be among the openings of the little groves of poplar and willow. I have the idea from the localities Captain Geddes gives that he took his specimens chiefly on the Red Deer River, and that is far to the west and north of McLean. Also he called it rare, from which I should consider that he was collecting away from its metropolis. I think that may be in the region about McLean."

ARGYNNIS.

VI.



ALCESTIS 1 2 ♂. 3 4 ♀,

a Egg magnified e larva 4th mlt nat size
 b larva young " f " 5th " mature
 d " 2nd and 3rd moults " g Chrysalis

ARGYNNIS VI.

ARGYNNIS ALCESTIS, 1-4.

Argynnis Alcestis, Edw., Tr. Am. Ent. Soc., V., p. 289. 1876. Id., Can. Ent., Vol. XII., p. 69. 1879. Worthington, Can. Ent., Vol. X., p. 37. 1878. French, Butt. East. U. S., p. 158. 1886. Scudder, Butt. N. E., Vol. III., p. 1802. 1889.

MALE. — Expands about 2.8 inches.

Upper side bright fulvous, but slightly obscured at base; hind margins bordered by two parallel lines, the spots on inner side of which, on primaries, are lunate next apex, elsewhere serrate, on secondaries lunate, small; other markings as in *Aphrodite*; the mesial band, on both wings, broken into separated spots, which on secondaries are very small; fringes of primaries alternately fuscous and yellowish, in equal parts, of secondaries yellowish, with fuscous at the tips of the nervules.

Under side of primaries bright cinnamon-red from base to margin, the apical area of same hue as the hind wing, varying as that varies; the black markings repeated; the upper five, and often the sixth, submarginal spots silvered, and two or three silver spots subapical.

Secondaries of one color from base to margin, either dark chocolate-brown, as in *Idalia*, or deep ferruginous-brown, with no mottling on the disk, and therefore in contrast with the allied species *Aphrodite* and *Cipris*; occasionally, in the middle of the space between the two outer rows of silver spots is a narrow strip or a streak which shows a pale subcolor, but washed by the prevailing color of the wing; the spots well silvered; the seven of the outer row sub-triangular, edged on basal side with darker ferruginous; the second row has the first three and fifth and sixth nearly equal, sub-ovate, the fourth small, sub-triangular, the seventh and eighth sub-lunate, the eighth sometimes wanting, or obsolescent; in the third row are five spots, the first sub-rotund, the second and fifth small, long oval, the third sub-pyriform, large, divided, with a black edging on the basal side of the outer segment, the fourth rather small, lunate; all these, as well as the spots of the second row, heavily edged with black on basal side; in the cell are either one or two round spots, and below cell an oval, all ringed black; a spot without black at base of cell, and another at base of subcostal interspace; also at the origin of costal interspace is an elongated silver spot edged with black, and frequently the costal margin next base has very little or no silver; inner margin lightly silvered.

Body above red-fulvous, brown tinted; beneath, the thorax buff with fulvous

ARGYNNIS VI.

hairs; legs reddish buff; palpi buff, fulvous in front and at tip; antennæ black, fulvous beneath; club black tipped with ferruginous. (Figs. 1, 2.)

FEMALE. — Expands about 3 inches.

Upper side darker, more red, much more obscured at base; the marginal lines heavy and on primaries more or less confluent; on same wings the submarginal spots are heavy and rest on the lines; all the markings and inscriptions heavy, the mesial band connected; on secondaries this band is either made of separated spots, or the posterior half is connected, the rest separated.

Under side of primaries fiery red, the apical area as on the hind wing, the silver spots large; the sixth spot more or less silvered, and sometimes the seventh partly; often there is a dash of silver on the basal side of the rounded spots in the lower three interspaces, and narrow, lanceolate spots of silver are in the lower subcostal and both discoidal interspaces between the marginal and discal rows (this excess of silver is very unusual in the genus); secondaries, as described for the male, of either olive or dark red-brown, solid color; the silver spots as in male in number and shape, enlarged; the costal and inner margins more extensively silvered. (Figs. 3, 4.)

EGG. — Conoidal, truncated, and depressed at top; in general like *Aphrodite*, but taller than broad, and taller in proportion to the width at base, the sides less convex (comparing some of the allied species, in *Alcectis* the breadth is to the height as 80 to 96, in *Aphrodite* as 80 to 90, in *Cybele* as 80 to 80); marked by eighteen prominent, vertical, slightly wavy ribs, about half of which extend from base to summit, and form around the latter a serrated rim; the remainder end irregularly at three fourths and upwards distance from base to summit, sometimes squarely at one of the cross ridges, but usually curve towards and unite with the long ribs; the rounded interspaces separated by nearly equidistant fine cross ridges; color when first laid greenish yellow (Fig. *a*). Duration of this stage twenty-five to thirty days.

YOUNG LARVA. — Length at twelve hours from the egg .08 inch; cylindrical, stoutest anteriorly, tapering backward, the dorsum sloping considerably; color brownish green, semitranslucent; marked by eight longitudinal rows of dark, sub-triangular, flat, tuberculous spots, three of which are above the spiracles on either side, and one below; these bear small tubercles; in the upper, or dorsal, row two, in the next two rows one, in the lowest row four, each giving out a long, tapering, clubbed hair; on front of 2 is a large blackish dorsal spot bearing three tubercles on either side of the mid-dorsal line, and below it, in line with the third row, is a small spot with two short hairs; and near the front, against the spiracle are two points, each with very short hair; on 3 and 4 the spots of

ARGYNNIS VI.

the three upper rows are in vertical line, but from 5 to 13 they are in triangle, those of the dorsal row near the fronts of the segments, the next row to the rear, the third a little in front of the middle; at the end of 13 is a large spot, or double spot, with several hairs; the spots of the infra-stigmatal row are placed on the middle of the segments, and still lower, in a line along the base of the legs, are single points, with a fine hair each, but two on 2; under side, feet and legs less brown, more green; head a little broader than 2, rounded, slightly bilobed, with many hairs; color dark brown (Fig. *b*). Most of the larvæ became lethargic direct from the egg, but about ten per cent proceeded to first moult and farther. The first moult was reached at eighteen days from hatching.

After first moult: length .15 inch; shape of *Aphrodite*; color yellow-green, the dorsum mottled with brown, especially about the bases of the spines; spines as in the genus, long, tapering, black, beset with short and fine black bristles, those of the second row rise from either pale yellow or greenish tubercles, all others from black ones; head sub-cordate, the vertices rounded; at top of each, to the front, a little conical process; color black, the hairs black. To next moult, in the Fall, five to seven days, in the Spring, fourteen to twenty-three.

After second moult: length .22 inch; shape as before, color black-brown, the sides paler than dorsum; the spines black; the bases of the dorsal rows pale buff on outer side, but black on the dorsal side, those of second row black, of third buff; the intermediate ones on 3 and 4 yellow; head shaped as before, black (Fig. *c*). To next moult, in the Fall, six days, in the Spring, seven to twelve.

After third moult; length .3 inch; color velvety black, with a tint of brown; the outer side of bases of dorsal spines now dull yellow; those of second row have very little yellow, and of third have yellow at base and a little way up the stem; color of front head shining black, but the back is yellow (Fig. *d*). To next moult, in the Spring, eleven to fourteen days.

After fourth moult: length .5 inch; color as at last previous stage; spines black, both dorsals and those of the second row very slightly reddish yellow at base; those of the third row and the intermediate spines of 3 and 4 are all orange at base and nearly halfway up; head as before, black in front, orange at back. At ten days after the moult: length .9 inch; not changed in color, the spines now deep red (Fig. *e*). (The length mark on the plate represents the length at the moult, not at ten days after, when the drawing was made, and should not have been present). To next and the last moult fourteen and fifteen days.

ARGYNNIS VI.

After fifth moult: length 1 inch; at from fourteen to twenty days from the moult was fully grown.

MATURE LARVA. — Length 1.4 inch at rest; greatest breadth across middle segment, .3 inch; cylindrical, of even thickness from 5 to 11, each segment rounded; color velvety black; the spines disposed as in the genus, long, slender, tapering; the dorsals on 2 directed forward, but are not longer than the others; all are beset with many short black bristles; those of dorsal rows are greenish brown at base, except on 3 and 4, where they are dull yellow; those of second and third, as well as the intermediate row, are dull yellow at base and halfway up, the tops black; under side and prolegs brown, the feet black; head sub-cordate, flattened frontally, the back rounded, the vertices conical, each at top bearing a little process or sharp tuberculation which is turned forward; on the face, many fine, short, black hairs; color black, the back either reddish yellow or dull yellow, individuals varying (Fig. *f*). From fifth moult to pupation from twenty-two to thirty-three days. The length of the several stages depends somewhat on the state of the weather.

CHRYSLIS. — Length 1 inch, breadth across mesonotum .33 inch, across abdomen .3; greatest depth .36 inch; cylindrical, somewhat compressed laterally; general shape of *Aphrodite*, but more slender; head case nearly flat at top, rounded, the curve being almost equal on dorsal and ventral side, a minute sharp tuberculation at each corner, the sides incurved; mesonotum prominent (as in the sub-group), carinated, the sides convex, followed by a deep rounded excavation; the wing cases flaring at base, compressed in middle dorsally, elevated ventrally, curving to the abdomen; this is conical, and shows two rows of tubercles which correspond to the dorsal tubercles of the larva, and extend to mesonotum and head case; a row of small ones on side, and another, more or less complete, below the spiracles; the whole surface finely corrugated; color red-brown, irregularly mottled black, the wing cases black along the nervules, and with a black patch on disk (Fig. *g*). Duration of this stage about twenty days.

ALCESTIS flies in southern Michigan, northern Indiana, and Illinois, in Iowa and Nebraska. It seems to be limited to a narrow belt of latitude, and is therefore vastly more restricted in its range than the allied species *Cybele* and *Aphrodite*, with which it associates. Mr. Worthington, in the paper above cited, says it is abundant on the prairie west and north of Chicago, in July and August, but seems to be local. "as examples taken a few miles north, in a timbered region, are almost uniformly *Aphrodite*." He adds, "I have been greatly surprised at

ARGYNNIS VI.

the readiness with which a strong *Aphrodite* upon the prairie can be distinguished, while on the wing, from the surrounding *Alcestis*, owing mainly to a slight difference in its manner of flight, which resembles that of *Cybele*." It may be distinguished also from the western *Aphrodite* by its intense red color, and by the hue of its under surface. This is often olivaceous like *Idalia*, and unlike any other North American Argynnis, of whatever sub-group, and the color is solid on secondaries from base to margin, with no submarginal band or any mottling of yellow on the disk, such as seen in *Aphrodite* and *Cipris*; at times the ground color is blackish ferruginous, also solid. In all the earlier stages, from egg to chrysalis, there are distinct differences from *Aphrodite*.

I have twice bred the larvæ of *Alcestis* to imago, the eggs having been obtained by confining the females over violet. The first eggs were received 26th September, 1876, from Mr. Thomas E. Bean, then at Galena, Illinois. The larvæ hatched 14th October, and at once went into lethargy. I carried them through the winter, at Coalburgh, but with much loss, not yet having discovered the advantage of a snowbank for hibernating larvæ. During January, 1877, they began to feed, and by 1st February, some had passed their first moult; on 15th, the second; on 27th, the third; on 10th March, the fourth; 25th March, the fifth; and pupation took place 16th April, the imago appearing 7th May.

In 1877, I received another lot of eggs from Mr. Worthington, at Chicago, which began to hatch 23d September. A second lot received later hatched 1st October. All the larvæ at once went into lethargy, and were kept in as cool a room as I could give them. Several were alive during January, and some were feeding in February, but one after the other died, and none reached the first moult.

In 1878, Mr. Worthington sent more eggs, and these were hatching 6th September. Several of the larvæ fed at once, and some were passing their first moult on 25th September. I never saw that happen with any larvæ of the larger Argynnis in my possession except in this one instance. But as I have related under *Cybele*, in this Volume, Mr. Siewers had known a larva of that species to feed and pass its second moult, and had found one wild that was deemed to have passed its third. On 1st October, some were passing the second moult, on the 7th of same month, the third moult. I was absent from home two weeks just after this, and on returning, 5th November, I found but one of these large larvæ living, and it seemed in lethargy. But ten days later it had died.

Of the larvæ that hibernated from the egg, two were found to be alive on 5th February, 1879, and one passed first moult on 11th February, the other 18th. The oldest passed second moult 4th March; the third, 11th March; the fourth, on 25th; the fifth, 9th April, and pupated 12th May. The other larva I had sent to Mrs. Peart, and had no record of its changes.

ARGYNNIS VIII.

ARGYNNIS ADIANTE, 1-3.

Argynnis Adiante, Boisduval, Lep. de la Cal., p. 61. 1869.

MALE. — Expands from 2.3 to 2.4 inches.

Upper side red-fulvous, lightly dusted with brown at base; marked and spotted with black after the usual manner of the group; hind margins bordered by two parallel lines, resting on which, on primaries, are small serrated spots; on secondaries the corresponding spots are lunate, and most or all fail to reach the lines; the rounded spots very small on both wings; the other markings as in the group, but slight, and on secondaries extremely so, the mesial band being reduced to little more than a line, often macular; fringes yellowish, fuscous at the ends of the nervules on both wings.

Under side of primaries pale fulvous over basal area, and along inner margin, taking in the basal half of the cell, and half the remainder along and next the median nervure: on this part of the wing the black markings are repeated, reduced; the rest of cell, and a space beyond cell on the subcostal and upper median interspaces yellow-buff, the apical area pale brown-buff; the markings obliterated.

Secondaries have the basal area to the inner side of the second row of spots pale brown-buff, limited without by a faint brown stripe, corresponding to the mesial stripe of upper side, the hind margin bordered by same color; the rest of the wing — the extra-discal area — pale yellow-buff; the spots, which in most species are silvered, are here entirely without silver, yellow-buff in color, faintly edged with brown on the basal side.

Body above and below concolored with the basal part of the wings; legs reddish; palpi yellow, with red hairs in front; antennæ fuscous above, ferruginous below; club black, tip ferruginous (Figs. 1, 2).

FEMALE. — Expands 2.3 to 2.6 inches.

Both sides as in the male, and the markings similar; in some examples the

ARGYNNIS VIII.

basal area of primaries beneath is fiery red, in others it is paler, and as in the male (Fig. 3).

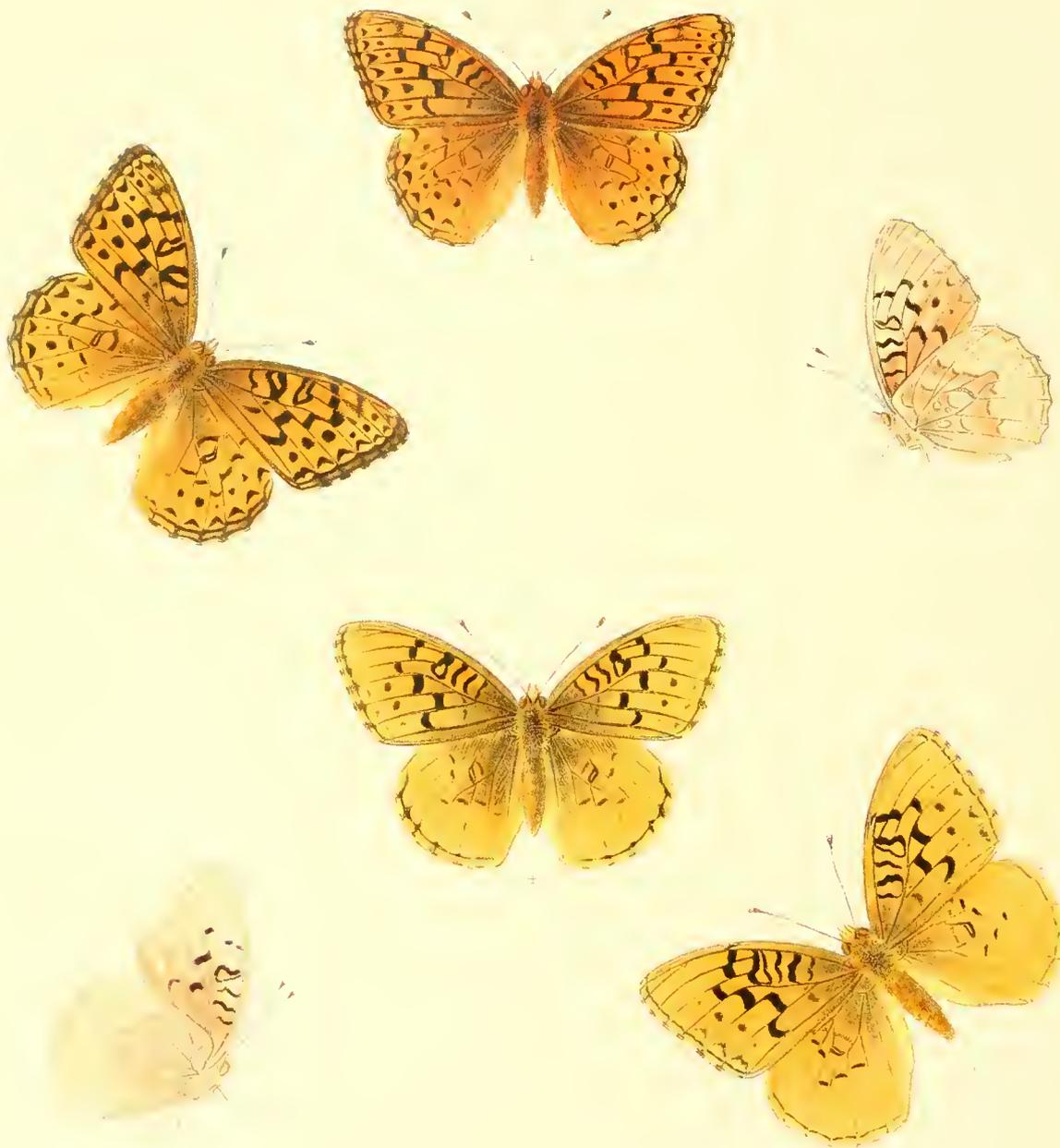
The male figured on our Plate is the original type of Dr. Boisduval, sent me by himself, and bearing his label as "type" ADIANTE. In his description of this male he says: "The four wings on upper side are of a vivid fulvous with the black spots disposed nearly as in the neighboring species. . . . The female resembles the male. This beautiful Argynnis was taken in some numbers by M. Lorquin, on the edges of woods, in the eastern part of California."

Of late years *Adiante* has not been a very common species in collections, owing to its local habits, apparently. Professor J. J. Rivers writes me that "it is found above Los Gatos in the Santa Cruz Mountains. It also occurs at several localities in the same range, and in Santa Clara and San Mateo counties; but it does not appear to be found farther south than about nine miles north of Santa Cruz city." Apparently Dr. Boisduval was mistaken in the locality.

Dr. Behr writes, March 15, 1890: "*Adiante* is found in the Santa Cruz Mountains, near Searsville, extending to Los Gatos Creek and farther south. I do not know its southern limit. If you strike the right time, it is common near the sawmill on the upper Los Gatos Creek, and in an hour you may catch several dozens. It is very constant, and unlike many of the California Argynnides, develops neither variations, nor aberrations, nor races."

ARGYNNIS.

VIII.



ADIANTE 1268.

ATOSSA 4566.

ARGYNNIS VIII.

ARGYNNIS ATOSSA, 4-6.

Argynnis Atossa, new species.

MALE. — Expands 2.5 inches.

Upper side bright yellow-fulvous, the base very lightly dusted brown; hind margins of both wings bordered by a single line, and that is the inner one of the two usually seen in the group, there being no trace of the outer line; no black submarginal spots on either wing, except on primaries, in the lower three interspaces, in each of which is a small spot representing the apex of the usual serration; nor are there the usual rounded black extra-discal spots, except on the lower four interspaces of primaries, and of these, the middle pair only are decided black; the black subapical patch is also wanting; the discal and cellular markings on primaries are light, and very much as in *Adiante*; on secondaries the mesial band is reduced to a series of abbreviated narrow bars, widely separated; the S-shaped spot at end of cell is slight; fringes pale yellow throughout.

Under side of primaries very pale fulvous at base to middle of cell, and in the P-shaped spot, and the basal part of the median interspaces; on this area the black markings are repeated, reduced; all the rest of the wing, in the cell and to apex and hind margin, pale yellow-buff, the markings obliterated.

Secondaries wholly pale yellow-buff, the basal area to the inner side of the second row of spots scarcely darker than the rest; all the spots faint, and with no trace of silver, their inner edges slightly dusky.

Body above concolored with the basal part of the wings; beneath, the thorax yellow-buff, the abdomen reddish-buff; legs reddish on the fronts, yellow behind; palpi yellow, the long hairs in front red; antennæ fuscous above, ferruginous beneath; club black, ferruginous at tip (Figs. 4, 5).

FEMALE. — Expands 2.6 inches.

Upper side of same hue as the male, a little paler next apex of primaries, with

ARGYNNIS VIII.

a gray edge to the costa and around the apex; the hind margins bordered by a single line, as in the male, with no diffusion at the nervures; the markings of both wings as in the male.

Under side of primaries deeper fulvous about base; otherwise as in the male (Fig. 6).

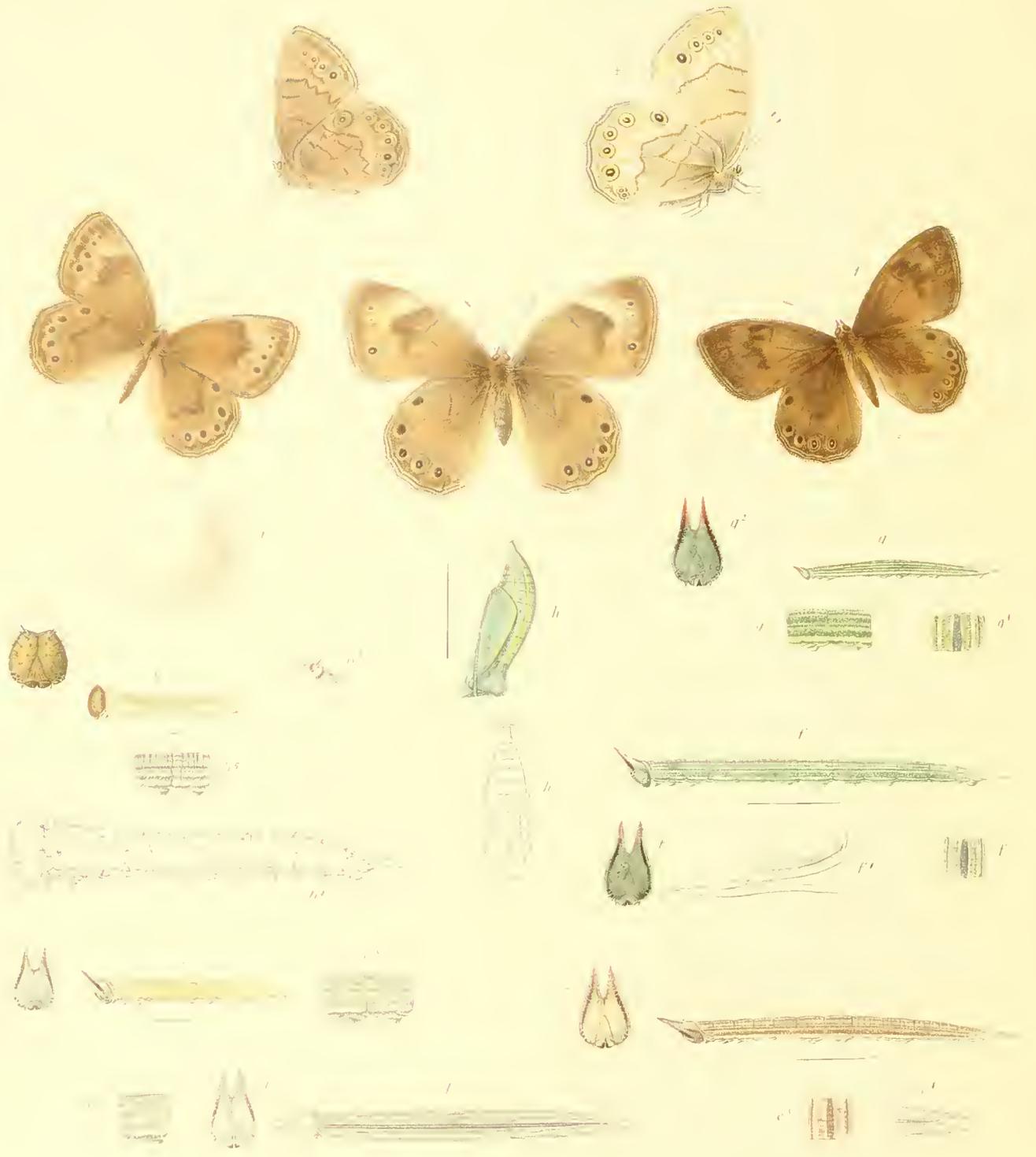
Something more than twenty years ago I came into possession of a strange *Argynnis*, which I was told was North American, but beyond that could get no information whatever. No one knew where it came from, but it was said to be surely American. I had never seen anything like it, and believed it must be a foreign species, but kept it in my collection, hoping one day to learn more about it. This was the male figured on the Plate. In January last (1890), Mr. H. K. Burrison, of Boston, Mass., sent me a few *Argynnides* for name, taken by him, in 1889, in south California and Arizona, and among them was a female exactly corresponding to the male spoken of. On asking where it came from, Mr. Burrison replied as follows: "It was taken at Tehachipe, south California. I stopped there only a few days, from July 4th to 8th, and this and another female were found in a little valley about four miles from town, by a small stream. I saw others, but caught only the two. If I remember rightly, the elevation was about 4,800 feet. I was in haste to reach Arizona to meet by appointment the friend with whom I traveled there, and did not have time to examine the tops of the mountains about Tehachipe, so can say nothing as to the height at which the species may be found."

I myself have seen but the pair figured, but Mr. Burrison reported to me the points of the second female, which agree with those of the one sent me, and now figured. All three examples are characterized by the peculiar yellow color on upper side, by the absence of the outer marginal line, and of the usual marginal and discal black spots.

That so striking a species could have been unnoticed in a region supposed to be thoroughly explored by lepidopterists, gives reason for the belief that many species of *Argynnis* yet undiscovered exist within the United States and Canada.

ACTROIDES

I.



CANTHUS 1 2 ♂, 3 4 ♀, 5 ♂ VAR.

a Egg magnified g Larva, 5th moult mature nat size
 b Larva young to 1st moult g 2-4 head and seg^{ts} magnified
 h Chrysalis.

SATYRODES I.

SATYRODES CANTHUS, 1-5.

Satyrodes Canthus. Boisduval and Leconte (not Linn.), Lep. de l'Amer., pl. 60. 1833. Westwood-Hewitson, Gen. Di. Lep., II., p. 375. 1851. Edwards, Can. Ent., XV., p. 64. 1883. Id., XVII., p. 112. 1885. Fernald, Butt. Maine, p. 70. 1884. French, Butt. East. U. S., p. 232. 1886.

Boisduvallii, Harris, Ins., p. 305, fig. 128. 1862.

Eurydice, Scudder (not Linn.), Butt. N. E., I., p. 193, pl. 1, fig. 10, pl. 11, fig. 5. 1889.

MALE. — Expands from 1.6 to 2.2 inches.

Upper side gray-brown, the outer third of both wings light, but varying much in individuals; the darker portion of primaries limited without by a fuscous diffuse stripe from subcostal to second or third median nervule, bending outward on the upper median nervule at nearly a right angle; on secondaries there are traces, more or less distinct, of a similar stripe, but narrowed; primaries have an extra-discal, nearly straight, transverse row of small, round, fuscous spots, usually four in number, standing on the two discoidal and the median interspaces; sometimes a fifth spot is present on the lower subcostal interspace, out of line with the rest, turned towards the base; these spots vary in size, usually the lower two being largest and equal, the upper two a little smaller and equal; the fifth spot minute; all surrounded by a narrow ring, paler than the ground color; but often there is nothing of this; sometimes the lower spot has a white central dot; secondaries have a corresponding row of six spots, sometimes all large, at others small as the spots of primaries, either without rings, or with decided rings of brown-yellow, the uppermost spot, which is usually the largest of the series, always without ring, and the spot next angle always minute; fringes gray-brown.

Under side yellow-brown, the outer third of each wing paler; the two areas separated by a dark brown stripe, which in some examples is sharply serrate throughout most of its course, sometimes sinuous; each wing has a similar stripe covering the are of cell, and there is a common stripe crossing both cells and the interspaces; the spots repeated, enlarged, each in a brown-yellow ring, which

SATYRODES I.

itself is surrounded by a dark ring and a pale halo, and each has a white pupil; the anal spot duplex, with double pupil.

Body above color of wings, beneath, the thorax and abdomen yellow-white, or in the darkest winged examples, brown-yellow; legs yellow-brown above, whitish below; palpi yellow-white with brown hairs in front; antennæ fuscous above, narrowly ringed yellow or whitish, beneath red-brown; club fuscous, the top red-brown. (Figs. 1, 2, var. 5.)

FEMALE. — Expands from 1.7 to 2.4 inches.

In general like the male, but of paler hue; the spots larger; on the under side the inner rings are more yellow, and each series of spots is inclosed by a pale elongated ring; but the uppermost spot on secondaries is separated from the rest and has its own set of rings. (Figs. 3, 4.) Examples from Colorado are larger than any from New England, and somewhat larger than from Michigan or Illinois. There is everywhere great variation in the color and markings of this species, but I have never seen an example, nor is there one recorded, that is without the rounded spots on upper side.

EGG. — Subglobular, much flattened at base, as broad there as high; surface slightly rough, but without definite markings even under a pretty high power; but increasing this, there are to be seen small shallow cells, and a resemblance to eggs of the *Neonymphæ*; color greenish-white. (Fig. *a*). Duration of this stage about seven days.

YOUNG LARVA. — Length .09 inch; cylindrical; segment 2 rounded and somewhat prominent; from 3 to 11 tapering very gradually, 12 and 13 abruptly, and ending in two short pointed tails; color at first yellow-white, in a few hours changing to pale green; the upper surface shows six longitudinal rows of low, conical, black tubercles, each of which gives a short, thick, black bristle, thickened at the end; on 3 and 4 these are in cross line, on middle of the segment; on 2, the tubercles of the upper rows are advanced to front, and behind and between is an additional tubercle; that of the lateral row is above the line and in middle of the segment, and is without bristle, and below, in front of the spiracle, is a smaller tubercle and hair, and under it a hair without tubercle; on 4 to 12 the tubercles are in triangle, as in *Neonymphæ*; on 13 is a triangle at the front, two at base of tail corresponding to the upper rows, and longer than elsewhere; at the end of the tail a still longer bristle; along the base of the body is a row of short hairs, two on 2 and from 4 to 12, one on 3, 4, springing from tubercles and longer and tapering, one on 13; still another row of very short, tapering hairs

SATYRODES I.

over feet and legs, three on 2, one on 3 to 6; two on 7 to 10, one on 11, 12, one on front of 13, and three over the anal legs; feet and pro-legs green; head considerably broader than 2, obovoid, truncated, the top depressed, the vertices low, conical, excavated at summit, and in the cavity a small tubercle and tapering hair (Fig. b^3); other tubercles arranged in cross rows, the upper row of two and largest, the next of six, the next of four, and the lower row of two, those of the second and third rows next suture without hairs; other short hairs over mandibles; the surface shallowly indented; color light brown; ocelli reddish-brown. (Figs. b, b^2 .)

At three days from the egg, length .18 inch; color pale green, showing three whitish longitudinal lines, one near middle of dorsum, one on the verge of dorsum, one on middle of side. As the first moult approaches, the body becomes broad as the head, vitreous-green, the white lines distinct. (Fig. b^5 .) Duration of this stage about eight days.

After first moult: length .26 inch; slender, slightly thickest in middle segments; the tails longer in proportion than at first stage, slender, sub-conical, pink-tinted, rough with white pointed tubercles and short bristles; on the transverse ridges of all segments are fine, sharp, white tubercles, each with its short white hair, or process; color at first greenish-yellow (Fig. c), later changing to pale green (Fig. c^3); on middle of dorsum a dark green stripe free from tubercles, on either edge of this a line of white tubercles; another line of tubercles, sub-dorsal, a third along base; between the last two are two other fine white lines, and one such between the dorsal and sub-dorsal; feet and legs green; head a little broader than 2, obovoid, the sides more sloping, less rounded, than in the first stage; on each vertex a long, tapering process or horn, tuberculated, brown-tipped, and marked in front by a reddish stripe which is extended down the side of the face to the ocelli; surface finely tuberculated; color of face and head yellow-green. (Fig. c^2 .) To next moult six to nine days.

After second moult: length from .34 to .4 inch; same shape; color yellow-green; the same tuberculated lines; head as before, but narrower and higher, the horns longer and nearer together, striped as before, but the upper part pink; color of face pale green. (Figs. d to d^3 .) To next moult fourteen to eighteen days.

After third moult: length .55 inch; shape and color, at first, as at preceding stage; but a few hours after the moult, in nearly all the examples, the color changed to brown and buff; at twenty-four hours from the moult, length

SATYRODES I.

.57 inch ; on middle of dorsum a broad brown stripe, on either side of which is a band of reddish-buff, passing into greenish-buff on the outer side ; on the side another buff band, through the middle of which runs a brown line ; the basal ridge buff ; head and horns as at preceding stage (Figs. *e* to *e*⁴). A few days later the buff larvæ became lethargic.

But one of the green larvæ proceeded to fourth moult without change of color. From third to fourth moult, in the Fall, twenty-six days.

After fourth moult, in Fall : length .6 inch ; color green ; but twenty-four hours after the moult had changed ; color now yellow-buff and red-brown ; the mid-dorsal stripe pale brown, the bands on either side of it greenish-yellow ; the side brown, with a dull green line running through it ; head shaped as before, the face green, stripes reddish-brown. This larva became lethargic a few days later, but died during the winter.

After hibernation, in Spring : the color gradually changed from buff to green ; wholly dull green, with a darker mid-dorsal stripe ; a yellow sub-dorsal line from horn to tip of tail ; two obscure yellow side lines ; along base yellow ; tails green to tips ; head pale yellow, the stripes brown. Twenty-two days after the end of hibernation passed fourth moult.

After fourth moult in Spring : length .62 inch ; color pale green, the mid-dorsal stripe dark green ; the dorsal bands yellow-white ; the two lines on side and the basal stripe same hue ; head emerald-green, the horns reddish, the stripe dark brown. (Figs. *f* to *f*³ ; *f*⁴ is the natural size a few days after the moult.) Duration of this stage thirty days.

After fifth moult : length one inch ; color green, striped with whitish ; in about twelve days was fully grown.

MATURE LARVA. — Length 1.2 inch ; long, slender, segments 2 and 12 of equal diameter, the dorsum arched on middle segments, sloping evenly both ways, ending in two long tapering tails, which are roughly tuberculated ; each segment creased transversely so as to make six ridges, the front one, from 3 back, twice as broad as any other and flattened, the rest a little rounded ; whole surface covered with fine sharp tubercles, each of which gives a fine short hair ; color of body green ; a darker mid-dorsal stripe, and on each side of this a pale green dorsal band, on the outer edge a yellow-green stripe ; the side covered by a pale green band through which runs a yellow line ; along base a yellow stripe ; feet

SATYRODES I.

and legs pale green; head obovoid, high, the top narrow, on each vertex a long, tapering, conical process or horn, the two meeting at base; whole surface rough with fine tubercles, each with fine, short hair; color yellow-green, the horns red; down the front of each horn from near the top, a brown stripe, which passes along side of face to the ocelli, tapering to a line. (Figs. *g* natural size, *g*² to *g*⁴ magnified.) The length of the period from last moult to pupation I am unable to give, but it is probably about ten days.

CHRYSalIS. — Length .62 inch; breadth across mesonotum .16, across abdomen .17 inch; cylindrical, slender; the edges of wing cases prominent; head case a little produced, beveled transversely to a sharp edge, excavated very little at the sides, the top incurved, the corners sharp; mesonotum prominent, the anterior side forming almost a right angle with the dorsal side, carinated, the sides flat and sloping; color green; the top of head case and dorsal edges of wing cases buff, a buff mid-dorsal stripe, and on either side of this another; also a faint lateral stripe on abdomen of same color. (Figs. *h*, *h*², magnified.)

CANTHUS flies in the northern States from Maine to Wisconsin, at least, and from New Jersey and northern Pennsylvania to Iowa, Nebraska, and Colorado. In the latter State it has been observed only in the northeastern part. Mr. David Bruce writes: "It occurs near Estes Park. This region is of about 5,000 feet elevation, and is well watered by the Big Thompson and Cache la Poudre rivers, and is full of small lakes and reedy flats where many of the small waterfowl breed in numbers. In this locality *Canthus* flies in abundance. The Colorado examples are of large size, exceeding any eastern ones, the males reaching 2.2 inches in expanse of wing, the females 2.4 inches, but they do not differ in other respects from their congeners.

Until recently, this species has not been reported in the southern States, or south of the Ohio River. But, in *Psyche*, Vol. V., p. 348, May, 1890, Mr. Ellison A. Smythe, Jr., of Columbia, South Carolina, relates as follows: "While collecting *Catocalas*, in September, 1889, in a thick swamp, in Clarendon Co., S. C., near the Santee River, I came to a spot where a ray of sunlight penetrated the thick foliage far overhead, and there, in the glow, were a great number of *Debis Portlandia*, having a game of 'hide and seek' with one another. I stood watching their gambols for some time, until I thought that one of their number seemed smaller and otherwise different from the rest; in a moment he lit close to me, and I saw to my surprise that it was something entirely different, and at the moment I could not place it. That was enough, however, and I started to capture

SATYRODES I.

it. But the game was not in my own hands. At the first movement, off he went, jerking in and out among the cypress knees and live oak buttresses, for some distance, becoming invisible when he lit. Capture on the wing seemed the only possible means of securing him, and so off I dashed, into tree trunks, splashing through water, occasionally falling flat in the mud over a concealed root; but the last time I fell, my net was over my prize, which proved to be *Canthus*. After considerable beating about, I started another, whose final capture was effected after a repetition of my first chase. These were the only two seen, though I hunted the same swamp for the next day. This capture seemed strange, for that especial swamp has been a favorite of mine for over eight years, and has been searched thoroughly by me. It is the only instance, to my knowledge, of the occurrence of the species anywhere in the southeastern States."

On reading this, I wrote Mr. C. Troxler, Senr., of Louisville, Kentucky, a collector of experience, but the reply came that he had never known *Canthus* to have been taken in Kentucky. Nevertheless, from the secluded habits of the species, it may perhaps haunt many a spot in the South.

In British America, the species ranges from Nova Scotia to Hudson's Bay, and westward nearly to longitude 85°, perhaps farther. Mr. Scudder speaks of a colony far to the north, at Great Slave Lake. It is said to be not uncommon in the Adirondacks of New York, but I have never seen it in the Catskills, in the same State. Mr. Scudder tells us that, in New England, it lives in elevated, moist meadows, and "is so restricted to them that one may sometimes find it in a spot but a few acres in extent, and search in vain beyond." Dr. Holland writes: "I found it very abundant at Saratoga, New York, in the grassy meadows near the lake. It seemed to hide among the tall drooping tufts of marsh grass, and by beating these, I succeeded in startling forth a large number of fresh specimens, male and female."

Mr. Bruce, at Brockport, western New York, says: "*Canthus* is common near here, in a genuine bog by the side of the Erie Canal. Another station in this State is near Syracuse. I never met with it on open, dry places."

Mr. James Fletcher, Ottawa, Canada, says "It is a common species here, found in many places. I have never taken it before 28th June, nor after August 2d, that I remember. It flies with a slow, drooping flight, very much like that of *Satyrus Nephela*. Notwithstanding this, however, it is very difficult to catch, being quicksighted and wary. It has, when settled, the same habit as *Debis Portlandia*, of facing round and watching as you approach. It always flies in wet meadows, or swamps, and nearly always over water. I got the larvæ by beating beds of *Scirpus eriophorum* in the beginning of June. They will feed on any of the coarse *Cyperaceæ*. I have also found the larvæ on *Carex bromoides*.

SATYRODES I.

It seems to be an early feeder ; I have never found larvæ feeding in a state of nature after five o'clock in the morning."

Superintendent I. N. Mitchell, of Fond du Lac, Wisconsin, writes: "*Canthus* occurs here, but my knowledge of its habits is entirely from meeting it in southern Michigan. I have taken many specimens there in two neighboring spots, in Cass County. One of these is a large meadow on the border of a lake, the meadow being covered with high grass. In some parts also thickly covered with trees and shrubs, but in others only partially with clumps of willow and shrubs, leaving open spaces of grass. It is in this last part that *Canthus* is most common, though it flies in all parts, and among the trees. It usually starts out of the grass near a clump of willow, flies among the bushes, in and out, dodges around them, where *Eurytris* flies through them. *Canthus* is much more easily taken than the other species. The second spot referred to is a small marsh, bordered by an abrupt hill which is wooded with beech and maple. In the marsh are grasses three or four feet high, willows, tamarack, sumac, and shrubs scattered about. I often started *Canthus* from the leaves of the beeches on the edges of the marsh, but never very far from the marsh. They usually made toward it when disturbed, and often settled near the upper ends of the grass stems, but low enough below the tops to be well hidden. They often alight on the trunks, limbs, or leaves of trees or bushes growing in the marsh, and I have started them out by throwing clods. Occasionally I took them on the stump of a recently felled maple, attracted by the sweet sap, and then in company with *Graptas* and *Vanessans*."

Professor Edward T. Owen, at Madison, Wisconsin, says: "I take *Canthus* in large numbers in and about our swamps. It is quite rare even a quarter of a mile from them. The tall swamp grass is its favorite haunt."

Mr. Edward A. Dodge, of Louisiana, western Missouri, writes: "*Canthus* was a not uncommon insect in both Illinois and Nebraska. So far as I know from eighteen years' experience, it was to be found only in grassy and weedy sloughs, flying weakly, close to the ground, and alighting on the grass stems."

Mr. Worthington writes from Chicago: "*Canthus* is equally abundant in open dry woods, dense ridges, or swamps. About the Calumet Lakes, on the wooded ridges, in swamp land, it is abundant. It also flies in the open oak woods on the high sand hills further north and east. North of the city, in the wooded lands, thirty to fifty feet above the lake, it is quite common. I remember the species distinctly as taken near and north of Milwaukee, Wisconsin, where all the land is high and rolling. From its habit of visiting the prairie morning and evening, I judge it may breed there; but a flight in the open in broad day is certain death, as they are an easy prey to the dragon-flies."

SATYRODES I.

Mr. Fletcher says he received an example of *Canthus* from Rev. W. A. Burman, at Griswold, Manitoba, taken "in a shady ravine."

Professor French writes: "My observations are that this species flies in dry grass lands, and in the edge of low brushy places. I did not find it in swamps at all. But I never saw it flying except in one locality, in northern Indiana, where I was staying a few days."

I see no reason why the species should not frequent upland and dry places, or dry, open woods, as well as wet meadows, though from the testimony it is most often found near water. But in confinement, the larvæ eat lawn grass, and, of course, could eat any grass in a state of nature, though they seem to have a preference for coarser sorts, and such as grow in wet places.

Mr. Worthington sent me the first eggs I obtained, laid 11th to 13th July, 1879, by females tied in a bag over grass. When they reached me, on 20th, some were still unhatched. The first moult was passed 27th July, the second, 2d August, the third, 16th August; but at each stage some larvæ lagged, so that the third moult came on at various dates up to 2d September. The color of all the larvæ was green till after the third moult, when the first which had passed that moult, in course of twenty-four hours after same, changed to buff and brown, and on 31st August, these were evidently beginning their hibernation. But two, which passed third moult latest, went to fourth, one of them having changed to buff and brown, and passed that moult on 19th September, the other retaining its original color. This last passed fourth moult, 17th September, and during the day after, had also changed color. I lost all the larvæ of this brood.

On 25th July, 1881, I again received eggs, this time from Mr. W. C. Gallagher, then at Whitings, Lake County, Indiana, and another lot on 1st August. From one cause or other, the most efficient being minute spiders in the sod, I had but three larvæ left on 30th August, all past the third moult. All changed from green to buff and brown shortly after that moult. One was sent to Mrs. Peart, in Philadelphia. By 10th September, the other two were in lethargy, but it was observed that they had moved several times up to 4th December. One died during the winter, the other I brought into a warm room, 13th February, and placed in the sun. In about fifteen minutes it moved, and soon after, was feeding. When brought in, it was much smaller than when it went into lethargy; then measuring .6 inch, now less than .4 inch. By 25th February, it had reached .5 inch, and by 2d March, its former length, .6 inch. Early in March it began to change color, and by 6th inst., had become green again. It reached .66 before the fourth moult occurred, 24th March. I sent it to Mrs. Peart, for drawing, and there it passed 5th moult, 25th April; and continued to feed, by 7th May becoming full grown. After this, it seemed to be at rest all

SATYRODES I.

the time, and finally died, 2d July, before pupating. So that the egg which had been laid in middle of July produced a larva which had not pupated 2d of July the year after.

The larva which was sent Mrs. Peart in the Fall behaved differently, going on to fourth moult, which it passed 17th October. This lived in lethargy through the winter, but escaped before its fifth moult.

The chrysalis figured I received from Mr. Fletcher, 22d August, 1884. Mr. Fletcher writes, 4th February, 1890: "I generally feed and get the pupæ of a dozen or so *Canthus* every spring. All my larvæ have been green, not drab. When the larva is at rest, it lies extended along the leaf, generally beneath the blade, and also alongside the midrib, the horns of the head and tails in a line with the body, and it is very hard to detect it when at rest." My observations are to the same effect, that when at rest, these larvæ have their heads turned down and under, so that the horns are nearly in same plane with the body, after the manner of larvæ of *Apatura*, also of *Neonympha*. But when feeding, the tails are elevated. Mrs. Peart has well shown this in figure *f*⁴. When in this position, one extremity in profile is almost the same as the other, and the dorsum, being elevated in middle segments and sloping equally either way, makes the beholder uncertain at first view which is the head and which is the other extremity.

The species *Canthus*, *Portlandia*, *Gemma*, and *Areolatus*, placed in three genera, have some points, in the early stages, in common, and in others a curious interrelationship. The shape of the egg is the same in all; in *Portlandia*, the surface is smooth, even under a high power; in *Canthus*, it is smooth, but a high power brings out reticulations similar to those of the remaining two species, which are nearly alike. The heads of the young larvæ of *Portlandia* and *Canthus* are ovoidal, truncated, of *Areolatus*, ovoidal, but approaching a circle in outline, in *Gemma* more decidedly circular; *Canthus* has on each vertex a depression, out of the middle of which rises a low cone; *Portlandia* has the cone without the depression; *Areolatus* has an ovoid knob; while *Gemma* begins with a pair of high, divergent, conical horns. At first moult, *Portlandia* shows a pair of widely separated, high, conical processes or horns on head; *Canthus* a pair much resembling, but coming near together at base; *Gemma* long, tapering, divergent horns; *Areolatus* has a low cone on each vertex; and in each species the peculiar style of process runs through all the larval stages. As to the appendages on the bodies of the young larvæ, *Canthus*, *Gemma*, and *Areolatus* are very nearly alike, in *Portlandia* they are everywhere longer. In maturity, *Portlandia* and *Areolatus* are rather stout, *Gemma* and *Canthus* quite slender; and all four have long, slender, tapering tails. As to the chrysalids, *Portlandia* and *Areolatus* are very much the same shape, while *Gemma* and *Canthus* differ from them consider-

SATYRODES I.

ably, but less between themselves. In the imagos, *Canthus* is midway between *Portlandia* and the other two. It has the habit of alighting on trees, like *Portlandia*, and according to Mr. Fletcher, of facing about, and watching an approaching entomologist, also like that other species, but in the others there is nothing of this. Both *Portlandia* and *Canthus* are attracted by sweet fluids, but I have never observed this in the other two. *Canthus* has drifted about from one genus to another in the Catalogues, being of late years classed with *Neonympha*. Mr. Scudder has done well to separate it, and give it a distinct genus, which I have adopted, as it is largely based on the preparatory stages.

NOTE. — EURYDICE is not a North American butterfly, as I will show. A species of that name was published by Linnæus, 1764, and its name was changed by him, in 1767, to *Canthus*, *Syst. Nat.*, 13th edition, p. 768, No. 129. “*Alis integerrimus fuscis: subtus primoribus ocellis quatuor, posticis senis. Papilio Eurydice, Hab. in Amer. Sept.*”

Fabricius, *Syst. Ent.*, p. 486, No. 191, says: “*Canthus; alis integris, supra fuscis, immaculatæ. P. Eurydice, Linn., Hab. in Amer. Boreali. Alæ omnes supra fusæ, immaculatæ,*” etc. In *Ent. Syst.*, III., p. 157, he again describes *Canthus*, “*omnes immaculatæ,*” etc., in same words as before, but gives as synonym, *Arganthe*, Cramer, pl. 204, fig. C. D., besides *Eurydice*, Linn. *Arganthe* is a South American species, without spots on upper side. The mistake in the habitat was a common occurrence in the earlier days. The insect perhaps was received from New York or Philadelphia and credited accordingly.

Godart follows Linnæus and Fabricius, translating their descriptions. The distinguishing character of *Canthus*, Linn. and Fab., is that the upper side bears no spots; it is immaculate.

We first come on our *Canthus* in Boisduval's *Lep. Amer.*, where it is well figured. My copy has no text to this and half a dozen other plates, and how this happened I never knew. But it is to be supposed that the text had been duly printed when the plate appeared. Dr. Harris first called attention to the fact that *Canthus*, Linn., was not our species. He says: “This butterfly is figured in Dr. Boisduval's *Hist. des. Lep. de l'Amer.*, under the name of *Canthus*, Linn. and Fab., but as it does not agree with the description of *Canthus*, of Linn. or Fab., I have thought it entitled to a new name,” and he accordingly calls it *Boisduvallii*. I myself prefer to call it *Canthus*, Bois., the more, as since Boisduval's publication, 1833, the species has usually been known, and most often treated of, by that name. However, if *Eurydice*, Linn., had been the same species, I would not at this late day substitute that name for *Canthus*. A name in use should never be changed for an obsolete name, and the neglect to observe this common-sense rule has worked a great deal of mischief.

EXPLANATION OF THE PLATE.

CANTHUS, 1, 2, ♂, 3, 4 ♀, 5 var. ♂.

a EGG.

b YOUNG LARVA; *b*² head; *b*³ process on vertex; *b*⁵ section of side, segments 7 and 8; all magnified.

*b*⁴ showing the tubercles and processes.

c Larva at 1st moult; *c*² head; *c*³ side of 7 and 8; all magnified.

d Larva at 2d moult; *d*² head; *d*³ side of 7.

e Larva at 3d moult; *e*² head; *e* dorsal view of 7; *e*⁴ last segment; all magnified.

f Larva at 4th moult; *f*² head; *f*³ dorsal view of 7; all magnified; *f*⁴ larva natural size, near the end of the stage.

g MATURE LARVA, natural size; *g*² head; *g*³ side of 7 and 8; *g*⁴ dorsal view of 7; the last three figures magnified.

*h, h*² CHRYSALIS, somewhat enlarged.

THE
BUTTERFLIES
OF
NORTH AMERICA

WITH
COLORED DRAWINGS AND DESCRIPTIONS

BY
W. H. EDWARDS



THIRD SERIES.—PART II.

BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY
The Riverside Press, Cambridge
LONDON: TRÜBNER & CO.
1887

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COLIAS. III.



T. Sinclair & Son lith. Phila.

HARFORDII 1. 2 ♂, 3 4 ♀
 VAR. BARBARA 5 6 ♂ 7 8 ♀ 9 ♀

<i>a</i> Egg	<i>magnified</i>	<i>d</i> 3 rd moult	<i>magnified</i>
<i>b</i> 1 st moult		<i>e</i> 4 th " 1. mature	<i>b</i> " "
<i>c</i> 2 nd "		<i>g</i> Chrysalis	"

COLIAS II.

COLIAS HARFORDII, 1-9.

Colias Harfordii, Henry Edwards, ♂, Proc. Cal. Acad. Nat. Sci., February 5th, 1877. (Vol. VIII.)
C. Barbara, id., ♀, l. c. VII., 1877. W. H. Edwards, Papilio, IV. 2, 1884.

Primaries produced apically, the hind margins slightly concave or slightly convex.

1. FORM HARFORDII.

MALE. — Expands 1.5 to 1.9 inches.

Upper side lemon-yellow, often lemon-chrome, the bases of wings not at all, or very little, blackened; the marginal borders of primaries of medium width, or narrow, black, dusted with yellow atoms, cut by the yellow nervules nearly to outer edge, of even width, extending but little way on either costal or inner margin, the inner edge more or less erose; discal spot pale yellow in a sub-oval black ring.

Secondaries have the borders varying in width like the primaries, and ending at lower median nervule; discal spot orange, pale to deep; fringes rose-pink, yellow at inner angles of primaries and outer angles of secondaries.

Under side pale to deep yellow; the discal spot of primaries as above; of secondaries, small, pearl-white, in a narrow red-brown ring; at base a few pink scales; no patch at outer angle; traces of sub-marginal spots, mere points, and not in complete series, often altogether wanting; the surface not dusted with dark scales, but immaculate; but some examples show a slight dusting, and some have a few scales at outer angle, suggestive of a patch.

Body above black, with long gray hairs, beneath yellow, the hairs on thorax tipped with roseate; collar same; legs same; palpi yellow, roseate at tip; antennæ and club brown-red above, more red below, the club tipped with ferruginous. (Figs. 1, 2.)

FEMALE. — Same size.

COLIAS II.

Color delicate lemon-chrome; the border usually narrow, and of slight texture, scarcely wider at apex than elsewhere; but sometimes it is wider and heavier, with loose scales and points on the inner side, and advanced on costal margin about as in the male; in all cases it crosses the wing from margin to margin.

Secondaries either have no border, or there are a few black scales along outer angle, or small clusters on the anterior nervules; discal spot either wanting, or orange, pale to deep. Under side as in the male, slightly dusted. (Figs. 3, 4.)

2. FORM BARBARA.

MALE. — Color of form *Harfordii*, varying like that, a little black at base; the under side much dusted; the sub-marginal markings varying from mere points to conspicuous spots, a small patch at outer angle; the discal spot often large, usually in a broad ring, or double ring, and sometimes duplex. (Figs. 5, 6.)

FEMALE. — Color clear, pale, yellow (originally described as canary-yellow), the border slight, very narrow, and extending across the wing, but little wider at apex than elsewhere. Under side thickly dusted, the sub-marginal spots variable; the patch and discal spot as in male. (Figs. 7, 8, 9.)

These types run through both sexes; that is, the *Harfordii* male, as originally described, is matched with a female as immaculate as itself, and the *Barbara* female, as described, is matched with a male as much dusted and spotted as itself; and between the two extremes are intergrades. (Figs. 1 and 5 show the extremes of color in the males.)

EGG. — Fusiform, thick in middle, tapering to a small rounded summit; the base flat; ribbed longitudinally, the number of ribs being about twenty, four or five of which end at three quarters and more the distance from base to summit; they are low, narrow, and the spaces between are flat, and crossed by many fine horizontal striæ; the micropyle (Fig. a^2) is in centre of a rosette of five cells, hexagons, outside of which is a ring of cells, of same shape but irregular; all these roundly excavated; color yellow-green, in a short time changing to crimson, as do all *Colias* eggs. (Fig. a .) Duration of this stage about four days.

YOUNG LARVA. — Length .12 inch; cylindrical, a little thickest on 2 and 3; each segment several times creased, and on the cross-ridges so formed are many black points, each giving a short, black hair; scattered among these are long,

COLIAS II.

white, clubbed appendages; color brown-green; feet and legs green; head rounded, a little depressed at top, thinly furnished with black tubercles, each with black hair, longer than the hairs on body; color yellow-green. Duration of this stage about four days.

After first moult: length .16 inch; the ridges thickly set with black points, each with its short, black hair; there are also many white processes, which form five or six longitudinal rows on either side, those on dorsum and down to about mid-side, broad and thin at top, paddle-shaped, on remainder of side, and on front ridge of 2, long, tapering, club-shaped; on 2, longest and more numerous, and directed forward; head rounded, somewhat depressed at top, with black tubercles and many of the white clubbed processes. (Figs. *b b*².) To next moult about four days.

After second moult: length .28 inch; color dark green, very much as at previous stage; along base a yellow-white stripe; the white processes more numerous than before, less broad, rather club than paddle-shaped. (Figs. *c c*², *c*³.) To next moult about three days.

After third moult: length .4 inch; color darker green; the basal stripe wider, with a yellow stain on middle of each segment; later a red streak appears on part or all the segments within this stripe; the white processes now replaced by short black hairs from conical tubercles, and around base of each is a ring cluster of black specks. Head as before, lighter than body. (Figs. *d d*².) To next moult about three days.

After fourth moult: length .55 inch; color dark green; the band white, with a macular red stripe. (Fig. *e*, natural size, *e*², *e*³ magnified.) In three days from the moult the larva reaches maturity.

MATURE LARVA. Length 1.1 inch: cylindrical, thickest from 4 to 8; on the flattened ridges of each segment are many small, black, conical tubercles, each giving a short fine hair (as *d*²; the same form of tubercle prevails through the last two stages, but they are more numerous in the final stage); on dorsum these hairs are gray, on sides and beneath, white; color light green; feet and legs pale green; along base, from 2 to 13, a white band through middle of which runs a red stripe, almost filling it, the ground below the stripe stained yellow; in one example, on segments 4 to 10 inclusive, was a small black patch to each under the band, but in all others there was no trace of this; head sub-globular, a little depressed at top; color green, somewhat lighter than the body, covered with black tubercles, the same size as on body, with black hairs. (Fig. *f*, magnified.) From fourth moult to pupation about five days.

COLIAS II.

CHRYSLIS. — Length .75 inch; greatest breadth .18 inch, depth .2 inch; compressed laterally, the thorax prominent; the head case pointed, beak-like, rounded on the ventral side, less so on dorsal; mesonotum rounded, rising to a low carina; color yellow-green, the abdomen more yellow, and granulated with paler, and along its side a bright yellow band, through which runs a red or an orange stripe; on ventral side, also, a row of small ferruginous spots; head case on ventral side at extremity and for a little way down the lateral ridges bright yellow; on middle of wing case a blackish dot, and a series of sub-marginal ones, one on each interspace. One example, instead of the ventral spots, had a reddish band across three segments. (Fig. *g.*) Duration of this stage nine to eleven days; of the larval stages about eighteen days; from laying of egg to the imago about thirty-one days.

C. Harfordii was described by Mr. Henry Edwards, 1877, from seven males, no female being mentioned; and in same paper *C. Barbara* was described from two females, the male said to be unknown. A year later, Mr. Edwards says that he is inclined to think *Barbara* is the female of *Harfordii*. In 1882 and 1883, Mr. W. G. Wright, at San Bernardino, several times took *Harfordii* males in copulation with *Barbara* females, as well as with females of their own type, and became satisfied that the two represented but one species.

In July, 1883, Mr. Wright obtained eggs by confining the females over *Astragalus crotalaria*. As these females were afterwards sent me, I was able to identify them all as *Barbara*. The first lot of eggs, ten in number, were six days in the mail, and, the heat not having been extreme, all but two had hatched on arrival, 13th. Next day came thirty-one young larvæ. I fed these on white clover, red clover being refused, but many died at every stage to pupation, either from change of food or climate, so that I got but two butterflies, a female on 6th August, a male on 8th. The female is the one figured Nos. 3, 4, *Harfordii* type. The male was of same type. From the result of this breeding, and Mr. Wright's observations in the field, it seems to me possible that the species may be seasonally dimorphic, *Barbara* representing the earliest brood of the butterflies from hibernating larvæ, *Harfordii* the later, or midsummer, but not so definitely as is the case with many species of butterflies. I have in vain endeavored to learn more about this matter by breeding, the distance and the heat in July making it almost impossible to transmit any eggs which will hatch on middle of the journey. The larvæ are pretty sure to die. Lots of eggs sent in '84, '85, failed to give me one larva. Mr. Wright got twenty larvæ of all sizes on the food plant, as late as 24th December, 1883, but of course it would have been of no use to transmit larvæ in winter, as I could not feed them.

COLIAS II.

As to the distribution of this species, it is common in the region about San Bernardino. Mr. Henry Edwards gives Santa Barbara and Santa Clara counties as localities; also Kern County.

Writing recently, Mr. Edwards says: "*C. Harfordii* was taken by me first near San Francisco, in Contra Costa County, which is as far to the north as I have ever heard of it. Its home seems to be in the southern part of the State, or rather from Santa Clara to San Bernardino."

Mr. Edwards also says: "The descriptions of these forms were read before the Academy, February 5th, 1877, but were only published in my extra advance sheets. The Academy stopped its publications with the 7th volume, and are only now about to renew them. My paper on Colias cannot therefore be referred to as being in the Proc. of Cal. Acad., though it will appear within a few months in Vol. 8."

The males of extreme *Harfordii* type come near the males of *C. Interior*, as will be seen by the Plate next following. This is a smaller species, — that is, no *Interior* are as large as the largest *Harfordii*, — with a much rounded apex to fore wing and a rounded hind margin. The border is wider, and extends farther along costal margin and it is deeply incurved. So that, while there is some resemblance in this sex there is more divergence. But in the females, the differences are emphatic. In *Interior*, the border is apical, as in the *Pelidne* sub-group, broad at apex, gradually narrowing on the margin, ending at some distance above the inner angle. It is a triangular border, in fact, as distinguished from a marginal border, such as *Harfordii* presents, and which is characteristic of other sub-groups in the genus. One species cannot be mistaken for the other.

So far as relates to the ornamentation of the under side, *Barbara* is nearest to the *Eurytheme* sub-group. So that the species in certain points resembles species belonging to two distinct sub-groups, a fact suggestive of the descent of all from a more or less remote common ancestor.

ARGYNNIS.

IV.



T. Sinclair & Son lith Phila

CORONIS 1.2 ♂ 3.4 ♀

ARGYNNIS IV.

ARGYNNIS CORONIS, 1-4.

Argynnis Coronis (Co-ro'-nis), Behr, "No. 2," Proc. Cal. Acad. Nat. Sci., II., 173, 1862; Edwards, Proc. Ent. Soc., Phil., III., 435, 1864. *Juba*, Bois-duval, Lep. de la Cal., 60, 1869; ♀ *Necadensis*, Edw., But. N. A., I., pl. 33, figs. 3, 4, 1871.

Primaries long, narrow, moderately arched, slightly concave on hind margin.

MALE. — Expands 2.15 to 2.3 inches.

Upper side yellow-fulvous, but varying, many examples reddish; hind margins bordered by two parallel lines, which enclose narrow fulvous spaces between the black nervules; the sub-marginal lunules narrow, serrate or lunular; the extra-discal rounded spots small; the mesial band rather heavy on primaries, light on secondaries; the other markings as in the allied species; fringes luteous, black at the ends of the nervules.

Under side of primaries pale buff with a red or yellow tint, varying, the base and the median nervules red-brown, often much diluted; the sub-apical patch brown, with three silver spots, the upper four or five spots within the marginal lunules silvered.

Secondaries yellow brown from base to outer edge of second row of spots, mottled in shades, the band beyond clear and of the lighter shade; the spots large, well silvered; the outer row sub-serrate, edged above with red; the second row mostly sub-ovate, slightly edged above with black; the third row so edged; a round spot in cell, sometimes duplex, ringed black; three spots at base in the several interspaces; shoulder and inner margin well silvered.

Body above dark fulvous, beneath, the thorax gray-fulvous, the abdomen yellowish; legs red, yellowish on inner side; palpi yellow, ferruginous at tip and in front; antennæ black above, ferruginous below; club black, ferruginous at tip.

FEMALE. — Expands 2.7 to 3 inches.

Same color; the markings heavier; the marginal lines confluent on primaries; the sub-marginal lunules on same wings enclose paler, often nearly white spots.

ARGYNNIS IV.

Under side red-brown at base, the upper outer part of cell and extra-discal area to margin yellowish; silver as in male.

Secondaries buff, mottled with ferruginous-brown, the band narrow, buff, the spots large, well silvered.

This is the type of *Coronis*, Behr, but there is a great variation in the species in the coloration of under side. Examples from Gilroy, California, where *Coronis* seems to be abundant, are of the type form. From Mt. Shasta, the males are lighter, rather cinnamon color, the females a pale brown, or often fawn color over secondaries and apical area of primaries. Examples from Washington Territory, taken by Mr. Morrison, are nearly like those from Shasta; several from Mt. Judith, Montana, are almost same; so a male from the Northwest Territory, taken by Captain Gamble Geddes. A male from Nevada, taken by Morrison, has the under side decidedly yellow, the mottling pale gray, while a male from Utah, sent me by Mr. B. Neumoegen, has almost no mottling, but is nearly clear yellow over secondaries and all of primaries, except just at base, where the red is greatly diluted.

The species has a very extended distribution, ranging from Kern County, California, to Washington Territory; from Utah to Montana and the Northwest Territory (Belly River and Crow's Nest). I have not seen it from southern California, below Kern County, nor from Colorado.

Dr. Behr described *Coronis* in the paper before referred to as "No. 2," in a series of descriptions of the Californian Argynnides, not being then (1862) able to say whether or no the species had been described elsewhere. He says it is very similar to *Callippe* Boisduval, "but differs by the upper side being colored in the usual way of the genus, and not showing the pale lunulae and spots of the disk like *Callippe*, which resembles in this respect more an *Euptoietia* than a true *Argynnis*;" and in his Latin description, he says of the under side of secondaries, "posticae subtus fuscæ usque ad fasciam macularem intermediam partim dilutiores." Dr. Behr, about that date, sent me a sheet of colored figures of eight of the species described by him, and by this I am able to fix the type. In the paper in Proc. Ent. Soc., Phil., 1864, referred to, I gave an abstract of Dr. Behr's paper, and by his consent the name *Coronis* was applied to the "No. 2."

Dr. Boisduval described *Juba* in 1869; and added, "This species has so close a connection with *Callippe* that it may be but a local variety. The fore wings above are of a vivid fulvous in both sexes, while in the male *Callippe* they are of a pale blackish-fulvous. The under side does not offer notable differences. Mr. Lorquin, who has taken a number of examples of *Juba*, considers it a distinct species." In Boisduval's Latin description of *Juba*, he says, "posticae subtus

ARGYNNIS IV.

flavescentes." Now in his description of *Callippe*, he says, "posticæ subtus cinereo-fuscæ." This does not agree with the color of *Juba* as given, nor with what Dr. Behr says of *Coronis* ("fusca"). But I have the type male of *Juba*, sent me by Dr. Boisduval, and named and marked "type" in his own hand, and this is not "flavescens," but the color of Behr's type. However, as I have said above, the species varies from red-brown to yellow on under side. *Callippe* is figured in Vol. I., But. N. A., and the differences between these species are really great, though they belong to the same sub-group, which also includes *Liliana* and *Semiramis*, both figured in the present Volume.

The female figured in Vol. I., Plate 33, as *A. Nevadensis* is *Coronis* of a pale-colored under-side variety. When that Plate was published, 1871, I followed the instructions of Mr. Henry Edwards, who had taken what he supposed to be the females of *Nevadensis*, at Virginia City. Later, 1878, Messrs. Mead and Morrison collected in Nevada, and brought back numbers of both *Nevadensis* and *Coronis*. The female of the former is always green. I concluded from the evidence laid before me at that time that *A. Meadii*, figured in Vol. II., Plate 24, must be an extreme variation of *Nevadensis*, in which the green is dark and lustrous.

ARGYNNIS CALLIPPE.

Argynnis Callippe, Boisduval ; Edwards, But. N. A., Vol. I., p. 77, pl. 25.

Mr. W. G. Wright, at San Bernardino, says of this species: "Its range, in this region, is from near the sea level to the altitude of 2500 feet. It is found in the low valleys, where the hills shut off the winds, and the hot sunshine makes a torrid temperature. Its season is short, only about five weeks, and I have had no evidence of a second brood. When the males first appear, about 20th May, the bottom of the valley and adjoining hillsides are green with grass, and gay with flowers of various plants. These males are restless, alighting on the flowers but for a moment, and seem incessantly occupied in searching for their mates. Almost always I have had to take them on the wing. The females appear about 1st June, and should be searched for among the dead twigs and branches of the small bushes which dot the hillsides, such being the spots to which they resort to lay their eggs. Under these bushes, a few violets have grown in early spring, and by June, their dead leaves may be seen. The violets never grow at the bottom of the valley, and the female never approaches green violets, some bunches of which are to be found, in June, at a higher elevation. Her instinct leads her to the dead plants. Among the twigs about these, and upon the rubbish at the ground, she flutters and crawls, and having found a satisfactory place, pushes her abdomen down into the rubbish as far as possible and drops an egg. Perhaps puts another near the first, and then flies to another place. The young larvæ come from the eggs in about twelve days, and must be in lethargic state till the beginning of the next season. I have never been able to find the larvæ in spring, though I have searched diligently."

In the region about San Bernardino, there are but three species of *Argynnis*, namely, *Liliana*, *Callippe*, and *Semiramis*, and the last two have the same habits in disposing of their eggs. According to Dr. Behr, as stated in Volume I., *Callippe* is distributed throughout the State, and is the most common species about San Francisco, but it is everywhere one-brooded.

In the text concerning *Callippe*, in Vol. I., some doubt was expressed as to what form Dr. Boisduval applied that name, his description not being definite. But I afterwards received from him the type male (the *Callippe* of my Plate).

NEONYMPHA I.

NEONYMPHA GEMMA, 1-4.

Neonympha Gemma, Hübner, Zutr. Exot. Schmett., I, figs. 7, 8, 1818; Boisduval and Leconte, Lepid. de l'Amer., pl. 62, 1833; Edwards, Can. Ent., XI, 31, 1879; French, But. of East. U. S., p. 235, 1886.

MALE. — Expands 1.25 inch.

Upper side uniform gray-brown; secondaries have four small black spots on middle of hind margin, in pairs on the interspaces, often more or less obsolete; fringes concolored with the wings.

Under side lighter, with a yellowish tint, through which the dark ground shows in fine streaks, particularly over basal areas; primaries crossed by three brown crenated lines, two of which limit the discal band, the other midway between this and margin, running towards apex; these discal lines are continued on secondaries, but are more widely separated, heavier, more irregular, the outer one projecting a sharp spur on second sub-costal nervule, reddish-brown; there is also a trace of a sub-marginal line next anal angle, the margin there reddish-brown; on middle of hind margin a large sub-oval patch of red-brown thickly dusted with yellowish scales, so as almost to conceal the ground, and within this, next margin, four velvet-black spots in pairs, each bearing an inverted T-shaped silver mark; the interspaces to outer angle each with two dashes of silver, and the second median interspace with an interrupted silver serration, the sub-median with a dash.

Body above color of wings, beneath, the thorax gray and brown, abdomen yellowish; legs gray-brown; palpi same with many black hairs; antennæ fuscous above, brown below, ringed with yellowish; club ferruginous, black on upper side.

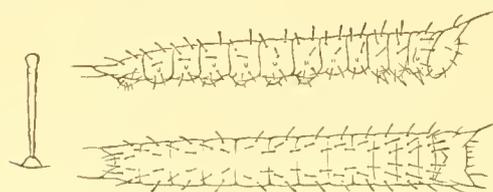
FEMALE. — Expands 1.3 inch. Scarcely differing in any respect from the male.

EGG. — Sub-globular, as high as broad, the base flattened; surface under a low power smooth, but under a high one seen to be reticulated throughout in

NEONYMPHA I.

irregular hexagons, the sides of which have broad flanks that occupy nearly all the interior, leaving but a light point in centre of each; color yellow-green. (Fig. *a.*) Duration of this stage from three to six days, according to the temperature.

YOUNG LARVA. — Length .12 inch; cylindrical, a little thickest in middle, tapering very gradually to 13, which ends in two conical tails, from the end of each of which proceeds a long bristle, the space between the tails concave; color yellowish-white; the upper surface presents six rows of low, conical tubercles, each giving out a short process; those on upper part club-shaped, slightly thickened at extremity; low on either side is another row, of same thickness through-



out; on 2, 3, 4, the upper processes are nearly in cross line; on 4 to 12 they are differently arranged, each three being in triangle, the dorsal one lying on front of the segment, the sub-dorsal at the rear, the other a little before the middle; on

13 there are eight, in two rows of four, the front consisting of the pair of dorsals and pair of laterals, the hinder row of the dorsals and sub-dorsals, besides a pair of sub-dorsal long bristles in the rear, and a pair of short ones in the concavity between the tails; in the lower row, on each segment from 2 to 13, are two shorter processes, nearly in horizontal line, the hinder one always a little below the other; on 7 to 10 each, and on 13, over the pro-legs, is a pair of very short hairs, in horizontal line; head one half broader than 2, broad as high, flattened frontally, a slight angular depression at top; on each vertex, a conical, divergent horn, somewhat curved forward, in three sections, each smaller at the junction than the top of the next below; at the end a bristle, and another on the middle, on the inner side; a few shorter ones scattered over face; color of head and horns black-brown. In about two days from the egg the color gradually changes to pale green, and stripes appear, a white sub-dorsal, and two on mid-side. (Fig. *b, b*².) Duration of this stage, six days in April, August, and October.

After first moult: length .18 inch; nearly the same shape, somewhat thicker in middle, the dorsum more arched; the tails longer, more slender, and brown-tipped; each segment five times creased, and on the ridges so caused a row of white tubercles, irregular, conical, each with a short white hair; color dark green, marked longitudinally by white; on mid-dorsum a clear green stripe, and the ground on either side of it is whitish, owing to the numerous tubercles there; on the verge of dorsal area a white stripe, another along base of body, and between these, on side, are two contiguous white lines; under side bluish-green,

NEONYMPHA I.

feet and legs green; head sub-pyriform, truncated, higher and narrower in proportion than before, the horns longer, more tapering, less divergent, slightly curved forward, about as long as the face; the space between them not angular, but concave; color of head and horns brown, pale on front face, and green-tinted; from base of each horn a dark stripe passes down the side of face, and there is a second such stripe in front. (Figs. *c*, *c*².) Duration of this stage, in August five days, in October ten, in May seven.

After second moult: length .34 inch; nearly the same shape, the tails longer; color pale green, the stripes as before; head nearly as at second stage, the horns more divergent; color of front face deep green, the back of head dull green, the stripes and horns reddish-brown. (Figs. *d*, *d*².) Duration of this stage, in August five days, in May eight.

After third moult, in autumn: length .55 inch; same shape; color soiled white, greenish on dorsum next head; the dorsal stripe dark, the sub-dorsal and basal brown.

At four days from the moult: length .72 inch; color now drab on dorsum, the median and sub-dorsal stripes darker; sides red-brown, the two lines buff; basal stripe yellow-buff; under this, a broad black-brown stripe the length of body; tails drab, reddened at tips.

MATURE LARVA. — Length .96 inch; slender, the dorsum slightly arched; ending in two long, conical, sharp-pointed tails, which meet at base; the whole surface finely and sharply tuberculated, most of the tubercles giving out a short white hair; color buff and reddish-gray in bands and stripes; a narrow gray mid-dorsal stripe, then a broad buff band to verge of dorsal area, and edged by a reddish line; next a broad gray lateral band, with a narrow buff stripe below; the basal stripe yellow-buff; beneath this a partly obsolete blackish band; tails drab, red at tips; feet and legs brown; head sub-pyriform, truncated, on each vertex a long, conical, pointed horn, but little divergent, the space between the two at base concave; color drab, both back and face; horns drab behind, black-brown in front and between; a broad black-brown stripe down the front face, and a narrow one on side from base of horn. (Figs. *g*, natural size, *f*, *f*², *f*³, magnified.) In August, ten days from third moult to chrysalis.

MATURE LARVA, in May, from eggs laid in April: color light yellow-green, the dorsal stripe darker, the sub-dorsal and lateral lines and basal stripe yellow; tails pink-tipped; head sordid greenish-white front and back, the stripes brown, horns red-brown. From third moult to pupation five and six days. All the larvæ, ten in number, of this April and May brood were green. (Fig. *e*, magnified.)

NEONYMPHA I.

CHRYSalIS. — Length .46 to .52 inch: greatest breadth, at abdomen, .14 inch; cylindrical, abdomen conical; head case scarcely produced beyond mesonotum, narrow, excavated at sides, ending in two sharp, divergent projections, the depression between angular; mesonotum prominent, carinated, angular, the summit rounded; followed by a shallow depression; wing cases flaring on dorsal side; color of abdomen and dorsum from buff larva sordid yellow-buff, the wing and antennæ cases and the projections all more yellow; the surface finely streaked brown, irregularly and mostly longitudinally; from posterior base of mesonotum to 13 a brown band; the wing case shows an irregular, wavy, brown stripe on disk, and a stripe on costal margin; each nervule ending in a blackish dot. (Figs. *h*, *h*, natural size, *h*², magnified.)

From green larvæ green chrysalids; blue-tinted, the dorsum and abdomen streaked with whitish; wing cases without stripe; the dorsal edges of wing cases carmine, and top of head case cream-color. Duration of this stage, in May, eight days.

The attitude of this larva in suspension is peculiar. From 13 to 5, the body hangs almost straight, the dorsum incurved; the anterior segments bent at right angle, the head turned down on 2. When at rest, in all the later stages, the larva holds the head bent under, so that the horns are nearly in the dorsal plane. (Fig. *d*.)

Gemma is quite a common species in certain localities near Coalburgh, W. Va., but altogether wanting in others which would seem equally favorable for it. It is abundant in the grassy streets of a small village, and there are stretches of road through the woods, or near the creeks, where one is sure to find it during its season. I have never seen it on the hillsides. It has a slow, tremulous flight, near the ground, rests frequently, and returns to its haunts.

There are here three annual broods: the butterflies appearing in April and May, in June and July, about 20th August and through September. The late larvæ hibernate. They feed on grasses, and eggs are easily obtained by confining the females over grass set in flower-pot. Eggs laid 21st April gave butterflies from 2d June. Eggs laid 7th August hatched 11th. The larvæ were mature 3d September, and pupated 5th. On 23d August, I got sixteen eggs. Several of the larvæ were placed in alcohol, but the remainder were mature, though in a lethargic condition, 20th November. I failed to carry these through the winter. Another female, 30th September, gave two eggs. From these, I raised one larva, which was lethargic and mature 24th November. This was kept in the house, and at intervals moved a little and fed; finally pupated 4th February. As described above, the larvæ of the spring brood have all been green, those of the later broods brown.

NEONYMPHA I.

Gemma flies in southern West Virginia, and in the same latitude to Illinois; is common in the mountains of North Carolina and eastern Tennessee, and in the northern parts of Georgia, and Alabama. It does not seem to fly far from the streams. Rev. W. J. Holland writes that it was found in great numbers at the foot of Bald Mountains, Madison County, N. C., near the French Broad River. "The whole country here stands on end, and is a mass of piled up rocks and tilted strata. Here in the gullies and clefts *Gemma* abounded, in company with *N. Sosybius*. I never saw it in the lowlands of the State."

Mr. E. M. Aaron writes: "*N. Gemma* I took in swampy woods around Maryville, east Tennessee, and at several points in western North Carolina. In fact, through all the river and creek bottoms of east Tennessee and western North Carolina it is moderately common. I have received it from the northern parts of South Carolina, Georgia, and Alabama. My brother took quantities of it along the river bottoms of the Gulf coast of Texas, and one specimen at Monterey, Mexico. When taken on the mountains of Tennessee, it was never at any altitude, and when far from running water was always badly worn."

NEONYMPHA I.

NEONYMPHA HENSHAWI, 5-8.

Neonympha Henshawi, Edwards, Trans. Am. Ent. Soc., V., 205, 1876.

MALE. — Expands 1.5 inch.

Upper side dark brown, often with a russet tint over the extra-discal areas of both wings; some examples have an ill-defined patch of russet on the median interspaces of primaries, and there is usually a russet edging to hind margin of secondaries next anal angle; on middle of same margin two small black spots, not always present; fringes dark gray.

Under side either brown or russet, thickly dusted with yellow-white scales, more yellow beyond the discal band of secondaries; the whole surface finely streaked and dotted with red-brown; primaries crossed by three wavy red-brown lines, two of which enclose the discal band, the other lying nearly midway between the band and margin, often macular; some examples have a demi-line crossing cell to median; the discal lines are continued across secondaries, the outer one often projecting roundly on second sub-costal nervule; a short sinuous line at anal angle; on middle of hind margin a large sub-oval patch, the ground of which is dark brown, sprinkled with whitish scales; within this, in upper median and discoidal interspaces, a pair of velvet-black spots, each with an inverted T-shaped patch of silver; in the interspaces towards outer angle a pair of silver dashes each, and in lower median a silver serration, and a bar in sub-median.

Body above dark brown, beneath gray-brown; legs same; palpi gray with many black hairs; antennæ blackish, annulated with light; club black above, ferruginous at tip and beneath. (Figs. 5, 6.)

FEMALE. — Expands 1.7 inch; russet, brown about the margins; spots on secondaries as in male. Under side of primaries russet, of secondaries yellow-brown; marked like the male. (Figs. 7, 8.)

NEONYMPHA I.

EGG. — Sub-globular, broader than high, about as 7 to 6, the base flattened; wholly covered, when seen under a high power, with a flat network of irregular hexagons; a fine rosette about the micropyle. (Figs. *i*, *i*².)

This species seems to be common in parts of New Mexico, Arizona, and Colorado. It was first taken by Mr. H. W. Henshaw, of the Wheeler Exploring Expedition, 1874. Mr. Morrison afterwards brought examples from Arizona, and Mr. B. Neumoegen from Oak Creek Cañon, Colorado. In 1881, Mr. Doll sent me eggs from Arizona, by which I was enabled to get the drawing, but none of them hatched. The resemblance of *Henshawi* to *Gemma* is close so far as regards the markings.

THE
BUTTERFLIES
OF
NORTH AMERICA

WITH
COLORED DRAWINGS AND DESCRIPTIONS

BY
W. H. EDWARDS

THIRD SERIES.—PART III.



BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY

The Riverside Press, Cambridge

LONDON: TRÜBNER & CO.

1887

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MELITÆA I.

MELITÆA BARONI, 1-5.

Melitæa Baroni, Henry Edwards, Papilio, I, p. 52, 1882; W. H. Edwards, Can. Ent., XI., p. 129, 1879.

MALE. — Expands from 1.5 to 1.8 inch.

Upper side black, spotted with red and pale ochrey-yellow, mostly in common transverse rows; the spots of the marginal row red, well separated; of the second row yellow, often quite small on primaries, or mere lines; of the third row, yellow on primaries, red on secondaries; the fourth is bifid on median nervure of primaries, the two branches running to costa, the outer one partly red, partly yellow, the inner one yellow; from median to inner margin either yellow, or yellow and red, the outer half each spot being red; on secondaries the spots of this row are yellow and large; from outside arc of cell of primaries to base four bars, red and yellow alternately; a yellow patch below the origin of the lower median nervure; the basal area and costal margin much dusted yellow, the shoulder red; secondaries have a fifth, but demi-row, from costa to median, red, sometimes wholly wanting, and four yellow spots on basal area, two in cell, one below cell, one on costal margin; fringes of both wings yellow, black at the ends of the nervules.

Under side red, primaries dull, secondaries bright; both wings have broad marginal borders; the yellow spots of second and third rows of primaries repeated, the former much enlarged; a large yellow sub-triangular patch on the sub-costal interspaces; the yellow spots in and below cell repeated; secondaries have the yellow spots of second and fourth rows repeated, enlarged, forming two confluent bands, the outer one lightly edged black above and below, the other or discal always edged with black on the basal side, but not always on the marginal side; the third row is of red spots, each wholly but lightly edged with yellow, except on the marginal side; between the third and discal row is an intermediate narrow stripe of red from lower branch of sub-median to upper branch of sub-costal, and this is often confluent with the yellow discal band; but sometimes a black

MELITÆA I.

line partly separates them ; in some examples this red stripe is suppressed, or absorbed by the spots of the third row, and in this case there is a black edge on marginal side of the discal band ; the basal area red, the four yellow spots repeated, all edged with black ; a fifth spot on costal margin ; shoulder and inner margin yellow.

Body black with long gray hairs on thorax, the collar red ; beneath, thorax buff, abdomen buff, red laterally ; legs red ; palpi red, yellow at base ; antennæ either annulated red and buff, alternately and equally, or red only ; the under side black ; club black, tip ferruginous. (Figs. 1, 2.)

FEMALE. — Expands 1.6 to 1.9 inch.

Upper side black, and nearly as in the male ; or there is an excess of red, all the red spots being much enlarged. Beneath as in male. (Figs. 3, 4, 5.) Many females have scarcely any black edging to the spots of the second and third rows on secondaries, and contrast strikingly in this respect with *Rubicunda* and the other species of the group. (Fig. 5.)

EGG. — Conoidal, rounded at base and there marked by many shallow indentations ; the sides ribbed vertically, the ribs about twenty in number, straight, low, the spaces between a little excavated ; the top truncated, a little depressed ; color yellow-green. (Fig. a.)

YOUNG LARVA. — Length .08 inch ; cylindrical, of nearly even thickness from 2 to 10 ; the segments rounded ; on each segment low conical tubercles, each of which gives a long tapering hair ; under a high power these hairs are seen to be thickly set with barbs ; (Fig. *b*⁴;) the tubercles form six longitudinal rows, on either side one dorsal, one sub-dorsal, one lateral ; on 2 the three are in straight line on the front, and on rear of same segment is another row of four, two on either side, and lying between those of front row ; on 3 the row is straight, on the front ; on 4 the two dorsal tubercles are on front, the others a little behind, so as to form a curved row ; from 5 to 12 inclusive the two dorsals are in front, the 1st and 6th a little back, the 2d and 5th either on middle of the segment or more to the rear ; on 13 are six in front, the 2d and 5th a little back, and behind these six in two longitudinal rows to extremity ; in general the hairs of anterior segments are turned a little forward, those on posterior half back ; below spiracles is a row of smaller tubercles, with shorter hairs, one each on 2, 3, 4, on the rest two, on 13 three, the hairs all bent down, the hindmost one of each pair placed a little higher than the other ; color of body greenish-brown ; head rounded, a little broader than high, a little depressed at suture, the vertices

MELITÆA I.

rounded; color black; on the front are small tubercles and hairs, seven on either lobe. (Figs. *b*, *b*², *b*³.)

After first moult: length .15 inch; color greenish and pale brown, mottled; body now furnished with seven rows of spines, which are present at each stage to maturity (as in all species of this genus), one row being dorsal, three lateral (two above, one below spiracles); these spines are long, tapering to a point, and thinly beset with long tapering black hairs, the one at extremity recurved somewhat; the dorsals run from 5 to 12, and are yellow; the first laterals from 3 to 13, black; the second laterals from 3 to 13, black; (there are four spines on 13, two on front, two on rear, and the front ones may be considered to belong to the first laterals, the other to second;) the lower row from 3 to 11, black; there are also low rounded yellow tubercles, two on 2, one just above the other, below the line of the spiracles, with two short hairs; on 3 and 4 one, in line with spiracles, with four hairs; and along base a row, one on 2, 3, 4, 5, 11, 12, 13, with four hairs; from 6 to 10 inclusive two with two hairs; on dorsum of 2 are three small tubercles on either side in front, and one behind, four in all, each with one long hair turned forward; head as at first stage, the tubercles and hairs disposed in same way, with an additional one on either lobe making eighteen. (Figs. *c*, *c*², *c*³.)

After second moult: length .22 inch; color black; all spines black, except of dorsal row, which are yellow, as before; in shape as at second stage, but the hairs are more numerous and the one from apex is straight. (Fig. *d*.)

After third moult: length, in hibernation and therefore contracted, .3 inch; color as before; the spines more thickly beset with hairs, which are more divergent, and make a dense covering.

MATURE LARVA, probably after fifth moult.—Length 1 inch; cylindrical; color velvet-black, dotted on the rear of each segment with white tubercles; spines long, tapering, thickly beset with long, tapering, divergent hairs, a straight one from summit; the dorsal row and the row along base yellow, all others black; under side smoky-brown; feet black, pro-legs brown; head subcordate, the vertices rounded, thickly covered with low tubercles, each of which gives a short black curved hair; color black-brown. (Figs. *e*, *e*², *e*³.)

CHRYSLIS. — Length .65 inch; cylindrical; head case short, narrow, excavated at sides; mesonotum moderately prominent, rounded, followed by a shal-

MELITÆA I.

low depression; abdomen stout, furnished with several rows of sharp, conical, short tubercles (corresponding to the larval spines); the wing cases a little flaring at base, depressed in middle; color blue-gray, the whole surface much marked with black; wing cases buff, more or less tinted red; with a black patch from base almost to hind margin, the nervules within it being orange, a marginal row of serrated spots, and another submarginal; head case and mesonotum largely black; the tubercles more or less enclosed with black; behind the dorsals are four small spots each, forming with the tubercle a triangle; similar spots on sides. But there is much variation in extent of the black markings. (Fig. *f*.)

In 1876, Mr. Oscar T. Baron, then at Mendocino, California, sent me several mature (or nearly) larvæ of the present species by mail. They were twelve days out and but one was alive on arrival. From this the drawing given on the Plate, Fig. *e*, was made. Several larvæ had pupated, but were more or less eaten, and I suppose the single larva had kept itself alive in that way.

On 16th December, 1878, I received from Mr. Baron, then at Navarro, about twenty of the same larvæ, in hibernation. Mr. Baron wrote that the eggs were laid June 29th, in clusters, one large and several small, the former containing sixty or more eggs, the latter from five to twenty. The larvæ hatched 20th July, or after 21 days. Their first care was to spin a common web, and this was occupied (of course, with additions, as needed) until the time for hibernation approached. Then some larvæ left the common web and spun for themselves among the wilted leaves of the food plant. Mr. Baron thought this plant was a species of *Castelleia*, but it was not identified. These larvæ did not survive the winter. I was able to get a description of the stage after third moult, and had to depend on alcoholic specimens for the earlier stages and the egg.

On 18th May, 1879, I received from Mr. Baron several chrysalides which had come from the same lot of larvæ, and from them obtained six butterflies, between 22d and 31st May. One of these was the red variety, female, shown by Figs. 5, 6.

Not much is known of the early stages of the American species of the group of *Melitæa* to which *Baroni* belongs. It is a difficult group to separate, and this makes it the more important that the preparatory stages of the several species should be studied.

ARGYNNIS.

III.



LILIANA 12.♂.3.4 ♀

ARGYNNIS III.

ARGYNNIS LILIANA, 1-4.

Argynnis Liliana, Henry Edwards, Proc. Cal. Acad. Nat. Sci., VI., 1876.
Aber. BARONI, W. H. Edwards, Trans. Am. Ent. Soc., IX., 3, 1881.

MALE. — Expands 2.2 inches.

Upper side either deep red-fulvous, or pale, varying; the black markings as in the allied species, but slight, the spots small; the mesial band on secondaries continuous; the fulvous spots on same wings, both marginal and discal, often paler than the ground color; fringes on both wings yellowish, black at the ends of the nervules.

Under side of primaries yellow-buff; the basal area, and to hind margin below median, brown, with buff in the median interspaces; some examples, however, are red-brown at base, and the nervules are edged red; the outer half of cell yellow-buff, the P-shaped spot as the base; the two or three spots on the subcostal brown patch and the five uppermost marginal spots well silvered, the sixth spot partially so.

Secondaries brown, very little mottled with buff; the band narrow, brown-ochre; the spots large and well silvered; the sub-marginal triangular, those of second row, except the small ones, fourth and seventh, oval or sub-oval, narrowly edged black on basal side; of third row, the three spots are oval, pyriform, and crescent, with intermediate dashes of silver in some examples, and a streak on inner margin, also edged black; a round spot in cell and three at base; shoulder and inner margin well silvered.

Body above covered with red-brown hairs; below, the thorax with hairs which are gray at base, yellow to reddish without; abdomen buff; legs red and buff; palpi yellow at base, red without and at tip; antennæ pale black above, red-brown below; club black, tip ferruginous. (Figs. 1, 2.)

ARGYNNIS III.

FEMALE. — Expands 2.35 inches.

Upper side pale fulvous; the marginal spots of both wings lighter. Under side as in the male, the basal area and nervules of primaries red. (Figs. 3, 4.)

ABERR. BARONI. The two marginal lines very heavy, and in place of the sub-marginal lunules a broad band crossing the wing; the row of round black spots is represented by a band from costa to upper median nervule, with two round spots in the median interspaces, the two spots usually found in the next interspaces wanting; on the under side, the marginal silver spots of primaries are changed to a solid bar, and the corresponding lunules on secondaries are changed in same manner; so the three spots of second row next costa are confluent, making one great spot. This fine aberration is in the collection of B. Neumoegen, Esq.

EGG. — Conoidal, truncated, depressed at summit, marked vertically by twenty-two or twenty-three ribs, which are as in the other species of the genus; the outline of this egg is much as in *Eurynome*, Vol. II, pl. 23, the base being broad, the top narrow, and the height not much more than the breadth; color yellow. (See Plate V of *Argynnis*, Fig. *a*.)

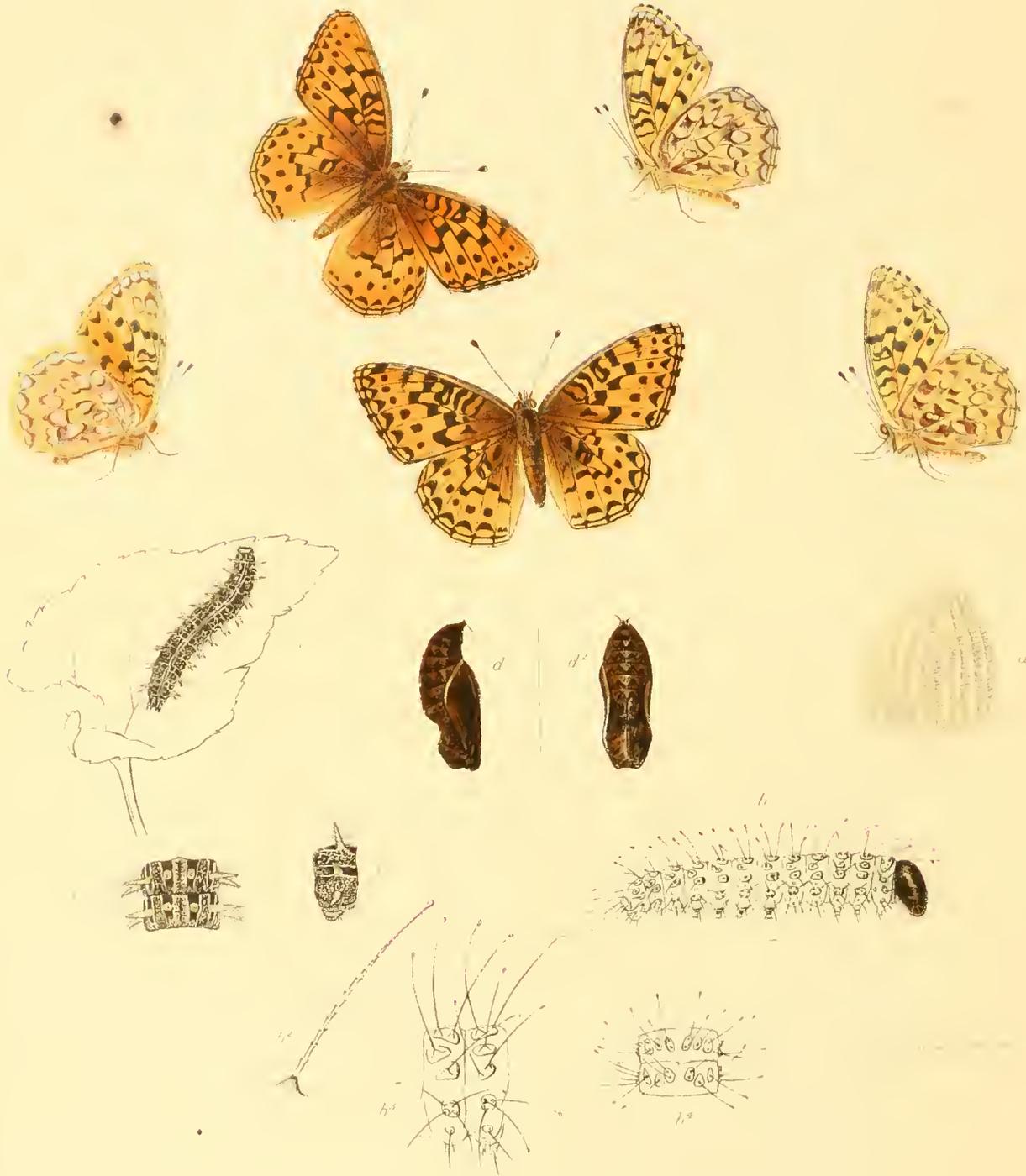
YOUNG LARVA. — Length .08 inch; cylindrical, marked as in the genus by tuberculous patches, with hairs the same in number, but somewhat different from some other species in the sub-dorsal rows; there are here two hairs from each tubercle, but instead of being nearly equal in length, the anterior one is much the shorter, and inclines toward the head, while the other stands up straight, or leans a little towards the tail; color of body light brown; head as broad as 2, sub-globose, somewhat pilose; color black-brown. (Plate V, Fig. *b*.)

Liliana flies in northern California and Utah. The examples taken by Mr. Henry Edwards, from which the description was made, were from Napa County. Mr. O. T. Baron supplied collectors during the years 1878 to 1880 from Lake County and elsewhere, and on 12th July mailed me eggs just then laid by a female confined over violet. The eggs hatched 24th July, or at about 13 days from the laying, and the larvæ at once went into lethargy. Later in the season, I sent them to Maine for safe-keeping through the winter, but none survived. (By an oversight the egg and young larva were not figured on the present Plate, but will be given on Plate V of this series of *Argynnis*.)



ARETINIS.

IX.



EGLEIS 12 ♂ 34 ♀ 5 VAR. ♂.

partes *antennarum* *et* *pedum* *larvae* *et* *stadii*
et *partes* *antennarum* *et* *pedum* *larvae* *et* *stadii*
et *partes* *antennarum* *et* *pedum* *larvae* *et* *stadii*

ARGYNNIS IX.

ARGYNNIS EGLEIS, 1-5.

Argynnis Egleis (Eg-le'-is), Boisduval, Lep. de la Californie, p. 59, 1869.

"No. 5," Behr, Proc. Cal. Acad. Nat. Sci., II., p. 174, 1862.

Montivaga, Edw., Syn., 1872 (not Behr).

♀ *Mormonia*, Bois., l. c., p. 58.

MALE. — Expands 1.8 to 2 inches.

Upper side bright fulvous, a little obscured at base; marked and spotted as in the allied species; double lines along hind margins, the mesial band on secondaries continuous and all the markings of both wings light; fringes of primaries alternately fulvous and black, or nearly all black, with a little fulvous in middle of each interspace, of secondaries, either wholly fulvous, or with black just at ends of nervules.

Under side of primaries yellow-buff apically, pale red at base and to hind margin below median, or just at base, and along the median nervules, in which last case the interspaces are buff; the black markings repeated; the sub-marginal spots either buff altogether, or the upper four and the two on the brown sub-costal patch are imperfectly silvered.

Secondaries yellow-buff, the belt between the two outer rows of spots clear colored and immaculate; the remainder of wing to base washed with diluted brown, through which the yellow ground appears more or less clearly; the sub-marginal spots narrow, and sometimes well silvered; the other spots as in the allied species, but small, never, so far as observed, perfectly silvered, but varying much in this point; the spots of second and third rows rather heavily edged with black on the basal side.

But many examples are reddish-buff on under side, and the brown on secondaries is darker than in the type.

Body brown above, with long fulvous hairs. buff below; legs fulvous and buff; palpi fulvous; antennæ black above, fulvous beneath; club black, tip ferruginous. (Figs. 1, 2.)

ARGYNNIS IX.

FEMALE. — Expands from 1.8 to 2.1 inches.

Upper side less bright than in the male; the markings no heavier; but examples occur which are darker fulvous, and others which are much obscured over basal areas, and the fulvous is everywhere washed with brown; on the under side the base of primaries is more red than in the male; in the darker examples the disk and base of secondaries are more covered with brown or brown-ferruginous; and the spots of both wings are silvered, but not so perfectly as in many species. (Figs. 3, 4.)

There is much variation, and one of the common varieties is represented by Fig. 5. In this there is no trace of silver, and the spots are clear yellow-buff, color of the ground of the wing. I have seen no female of this type.

EGG. — Conoidal, truncated and depressed at top, rounded at bottom; the breadth to the height nearly as 8 to 9; marked by 18 thin, elevated, vertical ribs, slightly sinuous or bent, one half of them running from base to summit, the others but about two thirds the distance, then uniting with the first; the ends forming a serrated rim; between the ribs the rounded depressions are crossed by many very low horizontal ridges; color yellow. (Fig. *a*.)

YOUNG LARVA. — Length .06 inch, at 12 hours from egg; cylindrical, of even size from 2 to 10, each segment a little rounded; color greenish-white (changing in a few days to greenish-brown); marked by eight longitudinal rows of dark tuberculous spots, three being above the spiracles on either side, and one below; these spots are flat, oval or sub-triangular, and bear one or two small conical tubercles, from each of which springs a long tapering hair; under a high power these hairs are seen to be barbed, and knobbed at the ends; on dorsum of 2 is a bar, corresponding to the four dorsal and sub-dorsal spots of other segments, and on its front are six hairs, on the rear four shorter ones; the spots of the dorsal rows are sub-oval, each with two hairs; of the sub-dorsal rows triangular and smaller, each with but one hair; of the third or mid-lateral row sub-oval, on 2, 3, 4 with two hairs, on following segments but one; the spots of the fourth, or infra-stigmatal, row are rounded, and except on 2 and 13, each of which has two, have four divergent hairs; along base, on 3 to 6, and on 11 to 13, is a line of tubercles, one to each segment, with short hair, but on 2 in same line is a spot like those of upper rows, small, with two hairs; the hairs of the dorsal rows on the three anterior segments are bent forward, on the middle segments are nearly upright, on the last four are turned back; it is almost the same with the sub-dorsal row, but in the mid-lateral the two hairs on 2, 3, 4 are turned in opposite ways, and after 4 are bent down; in the fourth row, the upper two on each spot

ARGYNNIS IX.

from 3 to 9 or 10 are quite divergent and are turned up, and the lower pair, just as divergent, are bent down; after 10 all are turned down; feet and legs color of body; head obovoid, bi-lobed, dark brown, shining, much covered with short hairs. (Figs. *b* to *b*⁴.)

After first moult: length .1 inch; color grayish, mottled and specked with black; body furnished with six rows of spines (as is the rule in this genus, from first moult to last); these spring from shining black tubercles and are black, stout at base, tapering to top, and beset by many short black hairs; head obovoid, black, with black hairs. The duration of this stage was seventeen days and upwards, in February and March.

After second moult: length .16 inch; the tubercles of the lower row dull orange; color of body dark gray, mottled with black; on either side the medio-dorsal line a gray stripe, and along base a gray band; head as before. Duration of this stage 11 days and upwards.

After third moult: length .22 inch; scarcely different; the spines of lower row now yellow nearly to tips. To next moult nine days.

After fourth moult: length .4 inch; the lower spines yellow as before, and the dorsals of 2 also yellow; color of body black-brown mottled with gray-white; the gray dorsal lines as before. To next moult 9 days.

After fifth moult: length .6 inch; in about twelve days reached maturity.

MATURE LARVA. — Length 1.2 inch; cylindrical, thickest in middle segments, tapering pretty evenly either way; color gray-brown, mottled and specked; running with the dorsal and sub-dorsal spines is a black stripe, edged on either side by a sordid white line; between the dorsals a yellowish band cut in middle by a black line, and specked with brown; the spines small at base, and rather short for the size of the body, the bristles very short; the dorsals dull white, the other rows dull yellow, and all with black tips; the dorsals on 2 turned forward, but not longer than others of the same rows; feet and legs pale brown; head subcordate, the vertices being rounded, the front flattened; color black on front, dull yellow behind, much covered with black hairs of irregular length. (Figs. *c*, *c*², *c*³.)

CHRYSLIS. — Length .8 inch; shaped as in other members of the genus; head case square, transversely rounded, a little depressed at top; mesonotum

ARGYNNIS IX.

prominent, carinated, followed by a deep excavation ; the tubercles on abdomen very small, scarcely visible ; color dark brown, mottled in shades, and with more or less yellow-brown, particularly on the abdomen, on dorsal side of which the darker shade makes a serrated border to the front of each segment ; the wing cases dark and glossy. The only chrysalis died before pupation. (Figs. *d*, *d*².)

This species was first described by Dr. H. Behr, without a name, but designated as "No. 5" in his paper on the Californian Argynnides, 1862 ; and it is compared and contrasted with his "No. 4," which later he called *Montivaga*. Dr. Behr says that No. 5 is much more common than the other, and "is easily recognized by the black bordering of the spots of the intermediate fasciæ (the second and third rows). their oval, not quadrangular, shape, and the rounded (lunular) form of the marginal spots." In 1869, Dr. Boisduval described the species as *Egleis*, Dr. Behr not having meanwhile applied a name to it, but included in it, I apprehend, the *Montivaga*, Behr, and certainly the distinct species *Irene*. He calls attention to this last as a variety which he had taken to be a species, but says that after having compared more than a hundred examples he finds that one runs into another in such a way that they cannot be separated. After eliminating *Montivaga* and *Irene*, there still remains a wide amount of variation between the forms which yet pass under the name *Egleis*. One of these is figured on the Plate (5). Examples from Mt. Bradley, California, are often very dark, not fulvous but brown, the females well silvered. *Mormonia* is not distinguishable in the original description from *Egleis*, and in the Latin synopsis of characters at the head of each description the same words are used for both, except that for *Egleis* the spots of the under side are said to be silvered or pale, whereas in *Mormonia* they are said to be silvered only. Dr. Boisduval sent me the male of *Egleis* and female of *Mormonia*, and there is no more difference between the two than would belong to different sexes.

The species is widespread, occupying northern California, and especially Nevada. It flies also in Utah, near Salt Lake, and in northern Colorado, though it seems nowhere to be common in this last-named State. Mr. Mead took large numbers in 1878, at Summit, Nevada, and the same year Mr. Morrison also collected in Nevada. I had the opportunity of examining all the variations in both collections. Besides the Nevada examples, I have at different times received many from Mts. Bradley and Shasta, from Mr. Behrens.

Mr. Mead (1878) sent me from Summit several eggs of *Egleis*, laid on violet by a female in confinement, and they hatched on or about the 18th August. The larvæ at once went into lethargy, as is the case with all the larger Argynnid larvæ of the later generation, or all larvæ where there is but one annual genera-

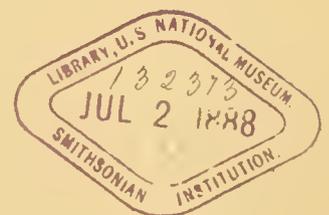
ARGYNNIS IX.

tion. I kept them in a cool room till last of January, 1879, when the survivors, three in number, were brought to a warm room and placed on violet. By 5th February they were seen to be feeding. On 18th February, one passed first moult, the second moult 5th March, the third 16th, and was that day accidentally killed. The second larva passed third moult 15th April, the third larva the same moult 17th April. This last died before another moult, but the second passed fourth moult 26th April, the fifth 7th May; suspended 20th and pupated 21st May; but died before imago. The general history is therefore similar to that of *Cybele*, *Atlantis*, and the other larger species, but unlike that of *Myrina* and the species of Group II.

THE
BUTTERFLIES
OF
NORTH AMERICA
WITH
COLORED DRAWINGS AND DESCRIPTIONS

BY
W. H. EDWARDS

THIRD SERIES.—PART IV.



BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY
The Riverside Press, Cambridge
LONDON: TRÜBNER & CO.
1887

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CÆNONYMPHA I.

CÆNONYMPHA GALACTINUS, 1-9.

Cænonympha Galactinus, Boisduval, Annales de la Soc. Ent. de France, 2d Series, X., 309, 1852; W. H. Edwards, Can. Ent., XVIII., 291, 1886.

FORM CALIFORNIA, Westwood-Hewitson, Gen. Diurnal Lep., 398, pl. 67, 1851. *Californius*, Boisd., l. c., X., 309, 1852.

VAR. ERYNGII, Henry Edwards, Pacific Coast Lepidoptera No. 24, Feb'y, 1877.

FORM GALACTINUS.

MALE. — Expands 1.2 to 1.4 inch.

Upper side sordid yellow-white, with a dusky shade over secondaries caused by the dark under surface; immaculate; the base more or less obscured by black scales, but some examples have nothing of this; fringes long, color of wings.

Under side gray-brown, darkest over basal half of secondaries, the hind margins of both wings lighter, a yellowish-gray; the inner margin of primaries either whitish or tinted brown; a pale ray crosses the disk beyond cell to lower median nervule, and on the basal side of this the dark scales are dense and make a sinuous or crenated edge; secondaries have a similar ray, angular, interrupted on upper median interspace, broadest between this and costa; primaries have near apex a small black ocellus, in pale ring, with white centre, but often there is merely a black dot, and sometimes this is wanting; secondaries have from one to four sub-marginal ocelli in the median and disco-cellular interspaces, differing in individuals as to distinctness.

Body above, color of wings, beneath, the thorax is covered with long dark gray hairs; legs and palpi dark gray; antennæ same above, yellowish below; club gray, tip ferruginous. (Figs. 1, 2.)

FEMALE. — Expands 1.45 inch.

As in the male, the under surface rather darker; the ocelli more pronounced, sometimes a second one in the second median interspace of primaries. (Figs. 3, 4.)

FORM CALIFORNIA.

COENONYMPHA I.

Both sexes are lighter colored than *Galactinus*, nearly white, there being no dark shade over upper surface, and no black at base; beneath, the general color is yellowish, the extra-discal areas being nearly or quite free from black scales; the basal half of secondaries pale brown, slightly dusted black; the ocelli same. (Figs. 5-8.)

VAR. ERYNGII.

This variety differs from *California* simply in being of a more yellowish hue on both surfaces, the basal areas on under side scarcely darker than the rest; and in the absence of ocelli, which is usually total; some examples, however, have traces of ocelli, as seen in Figure 9.

EGG. — Conical, truncated, the flat top covered with a low network of irregular meshes, very fine about the micropyle; the lower part well rounded, with a netted and indented surface; the sides ribbed vertically, the ribs low, narrow, in number about forty, of which several end at from one third to four fifths the distance from base; color yellow-green, with ferruginous specks here and there. (Fig. *a*, micropyle *a*².) Duration of this stage about thirteen days.

YOUNG LARVA. — Length .1 inch; from 2 both dorsum and sides slope regularly to 13, which ends in two short, conical tails, at the end of each of which is a process like those on dorsum; color pale yellow-green, the under side less green, more yellow; on mid-dorsum a brown line, and on either side three such, one sub-dorsal, one on middle, less distinct, and a third running with the spiracles; on each segment are six white processes, each process from the summit of a conical brown tubercle, forming six longitudinal rows, three on either side; those of the dorsal rows are club-shaped, much thickened at end, of the sub-dorsal rows are more slender, of lower row, which is just above the spiracles, of equal thickness throughout; on 2, 3, 4, the processes are nearly in cross line, but on 4 to 12, they form a triangle on each segment, the dorsal one being on the front, the sub-dorsal on the rear, the other on second ridge; on 2 the processes of the two upper rows are on front, and between them on the rear is a third; in front of the spiracle are two, the upper one short, and like the others of the lower row, but the second one is long and tapers like a hair; on 13 are fourteen processes, six being dorsal, three to each row, and four lateral, two to either side; two at the ends of the tails, and two in the hollow between the tails; (in Fig *b* one process on 13 is by oversight omitted; its place is near front of the segment in the lateral row;) along the base is a row of very short processes, two on 2, one on 3 and

CÆNONYMPHA I.

4, two each from 5 to 12, one on 13; also over the pro-legs, 7 to 10, are two hairs each, but on 13 there are three, besides two clubs; the processes of the upper rows are recurved, except on 2, where they turn forward, those of the basal row bend down and back; feet and pro-legs yellow-green; head broader than 2, rounded, narrowing toward the top, a little depressed; color carnation; over the face a few short clubbed processes, thick like the dorsals. (Figs. *b* to *b*⁶.) Duration of this stage twelve to eighteen days.

After first moult: length .19 inch; stouter; the dorsum less sloping, curving rapidly from 11 to end; color yellow-green; the mid-dorsal stripe dark green, the three side lines paler, and not very distinct, the upper one edged on its lower side by whitish-green: the basal ridge yellowish; tails red at end; surface covered thickly with low rounded tubercles, each with its short, bent, slightly clubbed white process; feet and legs green; head sub-globose, broader than 2; color dark green; the face much covered with fine white tubercles with short processes. (Figs. *c-c*³.) Duration of this stage about seven days.

After second moult: length .32 inch; scarcely differing from last previous stage; the tubercles finer, much more numerous, rounded, the processes short, straight, and of uniform thickness. (Figs. *d-d*³.) To next moult ten days.

After third (and last) moult: length .56 inch; shape as before; color yellow-green. But soon after the moult some of the larvæ began to change color, and within four days had become red and buff.

MATURE LARVA. — Length .84 inch; slender, scarcely arched dorsally, of even height and width from 3 to 7 or 8, then tapering gradually to 13; ending in two short conical tails, which meet at base and are rough with tuberculations; color yellow-green, striped longitudinally with yellow, there being two narrow stripes near together on mid-side, and a heavier and deeper colored basal stripe; on mid-dorsum a dark green stripe, edged by pale green; the tails red at tip; under side, feet and legs bluish-green; whole upper surface thickly covered with fine sub-conical white tubercles, each of which gives a fine short white process; these are either tapering, or slightly clubbed, or cylindrical, the effect being to give a downy coat; head broader than 2, sub-globose, narrowing toward top, depressed at suture; much covered with fine tubercles and short processes. (Figs. *e-e*³.)

Or the body was reddish with a buff tint, the stripes yellow; the under side

COENONYMPHA I.

red-brown; head greenish-yellow, with a tint of brown over face. (Fig. *f*.) From third moult to pupation about twelve days. (The larval measurements were taken at from 12 to 24 hours from the egg or moult.)

CHRYSalIS. — Length .36 inch; breadth at mesonotum .14, at abdomen .16 inch; very much as in *Satyrus Alope*, the ventral side straighter, the abdomen more swollen, less tapering; cylindrical, stout, the upper end truncated, the abdomen conical; head-case narrow, ending in a sharp cross ridge which is a little arched at top, the sides roundly excavated; mesonotum prominent, arched, the carina rounded transversely, the sides slightly convex, followed by a shallow depression; color — from green larva — yellow-green, over dorsum and abdomen finely specked with white; marked by nine black stripes of irregular length; of these, there is one on dorsal edge of each wing-case from base to inner angle; a curved stripe on middle of same reaching the hind margin; a short one on hind margin on ventral side, two parallel short ones on the antennæ cases, and a larger one on ventral side between the wings; there is also an imperfectly colored black stripe on either side of 13 (in the figures this is too black and distinct); top of head case whitish with a dash of black below on dorsal side.

From buff larva; color pinkish brown, no decided marks, but the curved wing stripes appear in a deeper shade of brown. One chrysalis from a buff larva was green, but the wing cases were buff; and it was fully striped black. Another, also from buff larva, was pinkish at first, with three darker stripes on dorsum in addition to the nine before described, which last were faint brown; the three were, one on mid-dorsum below the excavation, and one on either side this; in a day or two the chrysalis had changed to full green, with the nine distinct stripes as usual, but the three additional ones had disappeared. Another was wholly green, with no stripes or traces of them. (Fig. 9.) Duration of this stage eleven and twelve days.

The two forms *Galactinus* and *California*, or *Californius*, are of one species, as has been proven by breeding from the egg, *Galactinus* being the winter, the other the summer form. And although *California*, Westwood-Hewitson, has the precedence of one year, yet I call the species GALACTINUS, because the winter form of a dimorphic species is regarded as the primary form, the only form when the species was single-brooded, and the summer form as secondary and derived from the other.

On 1st May, 1885, I received thirteen eggs laid by *Galactinus* in confinement, from Professor J. J. Rivers, at Berkeley, California, and which had been mailed 23d April. They began to hatch 5th May. On 7th May, I received a second

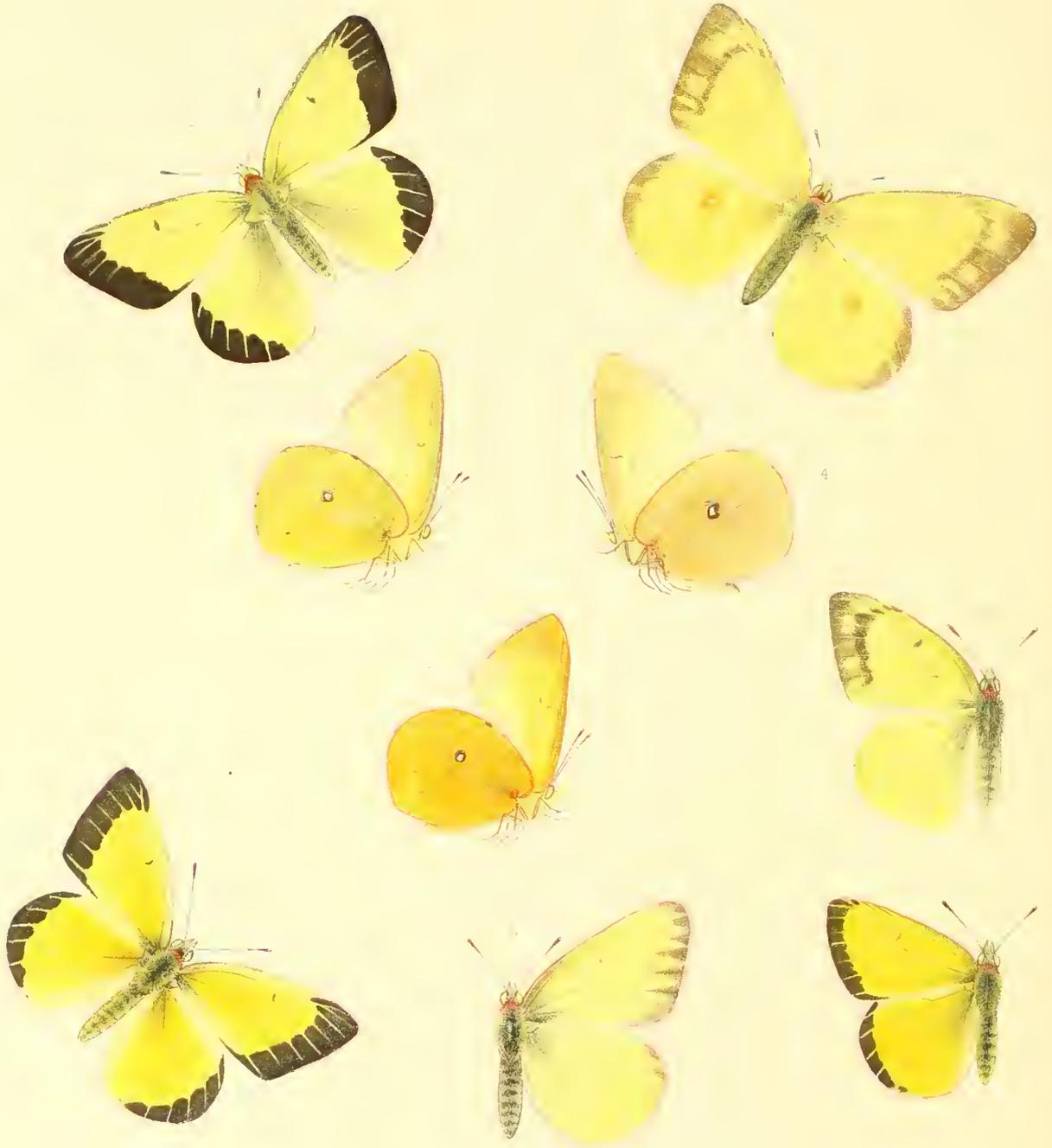
CEENONYMPIA I.

lot of eggs from Professor Rivers. By 11th inst., all had hatched. On 17th May, the first moult was passed by some of the larvæ, the second on 24th May, the third on 3d June. The first pupation took place 15th June, and the first butterfly came out 26th June. From laying of eggs to imago, 65 days, the egg stage having been 13, the larval 41, the chrysalis 11. The butterflies were all of the form *California*. The larvæ fed on any species of lawn grass. The egg much resembles that of the genus *Satyrus* in shape, but there are twice as many ribs as in *S. Alope*, and the network on summit is much finer. The egg differs in all respects from any species of the genus *Neonympha* with which I am acquainted. The larva and chrysalis are very like *Alope*, but the processes at the first larval stage are widely different from *Alope*, or other true *Satyrus*. The arrangement of the tubercles and processes on the young larva are almost exactly as in *Neonympha Gemma*, except that in the latter the processes are more of the nature of hairs. As in *Gemma* also, there were but three moults, which is exceptional with butterflies.

Mr. Henry Edwards writes of *Galactinus*: "It is almost the earliest butterfly of the year in California, making its appearance on warm days even in March, and becomes abundant in April, continuing so throughout May. It is always found upon grassy plains and meadows, and in the open; has a slow and rather irregular flight, alights very often, and is fond of settling upon flowers. If a storm comes on, or the sky becomes much obscured by clouds, it at once clings to the stems of grasses or other plants, and folds its wings to rest. It is remarkably common about the Bay of San Francisco, and I have taken it in the mountains up to 5000 and 6000 feet. It is certainly found in Nevada, though I never saw it in that State. I took it in Oregon and Washington Territory, but not on Vancouver's Island. It seemed there to be replaced by *C. Ampelos*." Professor Rivers says: "*Galactinus* affects open places in the vicinity of woods or in the cañons, or on the slopes of the foothills of the Coast Range. It is common at Berkeley at from two to four hundred feet above the sea-level; also in Napa and Sonoma Counties, and is found both in the valleys and on elevated hillsides where there are open places associated with trees and bushes. Its mode of flight is a short and low up and down movement, sometimes drifting with the wind, but always making short stoppages on the lowest herbage. It remains with us here till the latter part of October." The habits as described are similar to those of the *Neonymphæ*.

Kirby catalogues some two dozen species of this genus, and they are found throughout the north temperate zone in Europe, Asia, and even in Northern Africa. In North America there are seven or eight species. The mature larvæ and chrysalids of two species are figured in Buckler's "Larvæ of British Butterflies," (London, 1886,) and in both cases these stages are closely like those of *Galactinus*.

COLIAS.
IX.



TRINCLAIR & SON, LITH. PARIS

CHRYSOMELAS 1 2 ♂, 3 4 ♀. VARS ♂ 5 6 7 ♀ 8 9

COLIAS IV.

COLIAS CHRYSOMELAS, 1-9.

Colias Chrysomelas (Chry-som'-e-las), Henry Edwards, Pacific Coast Lepidoptera, Feb., 1877.

MALE. — Expands 2 to 2.4 inches.

Upper side greenish-yellow, not much obscured at base; the marginal border of primaries very broad, black, more or less dusted with yellow scales, cut nearly to the outer edge by the yellow nervules, usually even-edged within, or slightly erose, but sometimes roughly dentated, curving roundly at the apex, but little advanced on costal margin, and on inner margin projecting a rather long spur; discal spot small, sub-ovate, black.

Secondaries also have a broad border, cut to the outer edge by the two median nervules; not dusted yellow; the discal spot usually wanting, but sometimes orange, or indicated by a slight orange tint; fringes of both wings pink, yellow at inner angle of primaries.

Under side of primaries lemon-yellow, deeper colored along costal margin, and orange-tinted over apical area, often deeply; except on inner margin and to middle of cell, thickly dusted with fine brown scales; the discal spot repeated, a slight oval ring with yellow or sometimes pink-tinted interior; costal edge pink; submarginal patches are sometimes present in the median interspaces, a small cluster of black scales to each, but oftener there is no trace of these.

Secondaries entirely orange-yellow, thickly dusted; the discal spot pearl-white, or perhaps roseate throughout or about the edge, in a red-brown, broad ring; at base a small patch of pink; at outer angle a cluster of brown scales, never large, often a mere trace; some examples have submarginal patches in the median interspaces only. Body covered with greenish-yellow hairs, the collar dull pink; under side yellow; legs pink; palpi yellow, pink at tip; antennæ and club brown above, elsewhere pink, except that the end of the club is ferruginous. (Figs. 1, 2.) Very rarely examples are of a deep yellow, as Fig. 5, and the marginal borders narrow and as in Fig. 7.

COLIAS IV.

FEMALE. — Expands 2.2 to 2.5 inches.

Either bright yellow, or of the tint of the male, or paler, a whitish yellow; the marginal border of primaries broad, of nearly even width except at apex, pale dusky black, completely inclosing a series of yellow patches that cross the wing; discal spot as in the male, occasionally orange.

Secondaries have the border much narrower and limited to upper half the wing; often represented by a few scales or patches; the discal spot either pale orange, solid, or an orange ring with pale centre. (Figs. 3, 4, 8.) Fig. 9 represents a curious variety, in which the border of primaries takes the form of a series of long triangles, one on each nervule.

So far as at present known, *Chrysomelas* is limited to Northern California. Nevada has been thoroughly searched for butterflies, and this species has not been taken there. The original examples from which Mr. Edwards made his descriptions were from Napa County. Mr. James Behrens has for several seasons taken many at Shasta, Shasta County, and at Soda Springs, Siskiyou County.

There is no doubt that *Chrysomelas* is nearly allied to *C. Occidentalis*, Scudder, figured in Vol. I. pl. 18, described on page 57, a species found over N. W. Br. America, from Vancouver's Island to Lake Saskatchewan, but not in the Rocky Mountains or at high elevations. The two form a distinct sub-group, differing from any other in the character of the border of the fore wing in the female. I have thought *Chrysomelas* might be a southern form of *Occidentalis*, and so put it in my Catalogue, 1884. On the other hand, Mr. Henry Edwards has been familiar with both these forms in the field, and is positive that they are distinct species. At the end of his description he says: "I have no doubt whatever of the distinctness of this species. It is most nearly allied to *C. Occidentalis*, Scud., the original types of which are now before me. It differs in the extreme width of the marginal band, equally broad on primaries and secondaries, and always distinctly cut by the nervules on both wings; by its much larger size, and by the paler ground color of the female, with more pronounced marginal border. The usual absence of the discal spot of primaries is also a strongly marked character." This was in 1877. Ten years later, June, 1887, Mr. Edwards writes me: "I am fully of the opinion that *Chrysomelas* is quite distinct from *Occidentalis*. There is a difference between the two that cannot be expressed in words, but any one who has taken the two forms on the wing, as I have, must be of my opinion. *Chrysomelas* is from the Coast Range, a different region from the home of *Occidentalis*. My first specimens of the former were from the foothills of Napa County. I afterwards got it from Mendocino County, and Mr. Behrens takes it at Shasta. These localities are part of the same range of mountains, the Coast

COLIAS IV.

Range. Now *Occidentalis* is found on Vancouver's near the sea-level, and thence across the continent at low elevations to western Canada."

I have thought it best, therefore, to give *Chrysomelas* as a species, for the judgment of an experienced lepidopterist, familiar with both these butterflies in life, is of weight. Whether there are two species or two forms of one species must hereafter be determined by breeding from the egg.

Mr. Scudder described the female of *Occidentalis*, Proc. Bost. Soc. Nat. Hist., IX., 109, 1862, as white, with a greenish tint, with margins like those of *C. Eurytheme*, Boisd. It is said that three females were under view. This description does not cover the yellow female, an example of which is figured on the Plate in Vol. I., but applies to the albino Fig. 5, which I now believe to be *Eurytheme*, and quite out of place on that Plate. Dr. Hagen called attention to this some years ago, and on examination I allow that he was right. Striking out this albino, the true type of the female is represented by Figure 3. I have never seen an albino female *Occidentalis* or of *Chrysomelas*.

ARGYNNIS.
X.



T. SIMON & SON LITH. PARIS

NAUSICAA 12 ♂, 34 ♀.

ARGYNNIS X.

ARGYNNIS NAUSICAA, 1-4.

Argynnis Nausicaa (Nau-sic'-a-a), Edwards, Trans. Am. Ent. Soc., V., 104, 1874; id., Papilio, II., 6, 1882; Mead, Report, Wheeler Exped'n, V., 752, 1875.

MALE. — Expands 2.5 inches.

Upper side deep red-fulvous, the bases much obscured; hind margins edged by two lines almost confluent; the submarginal spots lunular, separated, the other markings as in the allied species, light; the mesial band of secondaries broken, not continuous; fringes yellowish in the interspaces, black at the ends of the nervules.

Under side of primaries almost wholly bright red-brown, less red next apex; a little buff in the middle of the sub-costal interspaces; the submarginal spots lanceolate, the lower ones black, those next apex brown, the upper six imperfectly silvered; one or two sub-apical silver patches.

Secondaries dark brown, often ferruginous, mottled with buff; the band between the two outer rows of spots narrow, much encroached on by the ground color, sometimes clear buff, sometimes more or less dusted with brown scales; all the spots small and well silvered; those of the submarginal row narrow, broader next outer angle, all edged above with brown or ferruginous; those of the second row narrow, heavily edged above with black; the third row consists of three sublunate spots, also edged black; in the cell one or two often minute spots in black rings, and three patches at base; the shoulder and inner margin silvered. Body dark fulvous, beneath, gray-brown on thorax, the abdomen buff; legs buff; palpi buff at sides, brown in front and at tip; antennæ fuscous above, brown below; club back, the tip ferruginous. (Figs. 1, 2.)

FEMALE. — Same size.

On the upper side the marginal lines are confluent on primaries, and the lunules are joined to them, these latter inclosing pale fulvous spots inclining to white next apex; the spots of the mesial band small, mostly lunular. Under side of primaries deeper red, the buff spaces more extended, and covering the upper

ARGYNNIS X.

outer corner of the cell; secondaries darker, more mottled, the band more restricted; the silver spots a little larger. (Figs. 3, 4.)

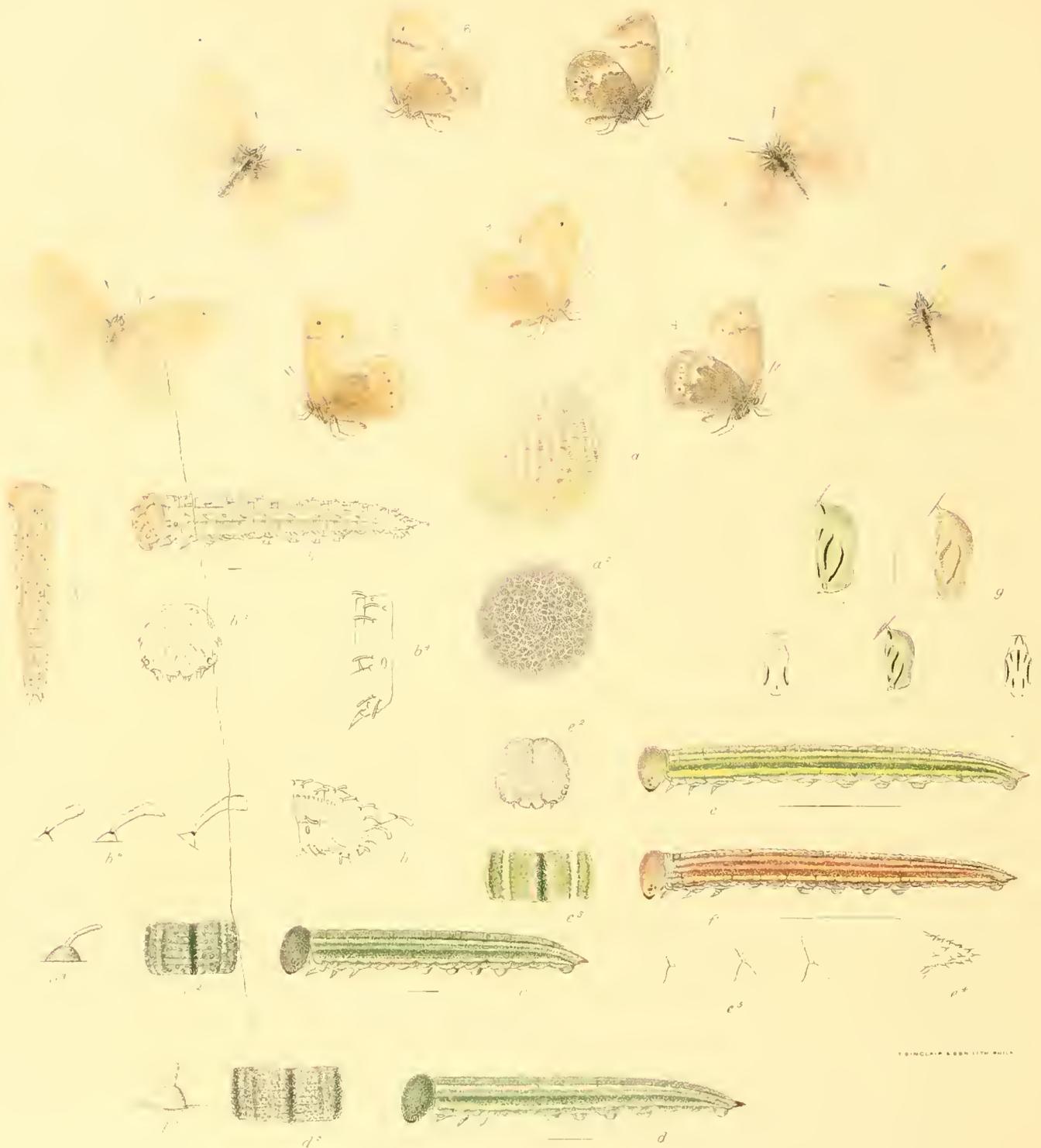
This species was described from 1 ♂ 2 ♀ taken by Mr. Henshaw, member of Lieut. Wheeler's Expedition, 1874, at Rocky Cañon, Arizona. The late Mr. Morrison brought a few examples, all males I believe, from Arizona in 1882, but I know not the exact locality. Up to the present year, 1887, these were the only ones to be found in collections. It was reserved for Rev. George D. Hulst, of Brooklyn, New York, to make us better acquainted with the species, and I have to thank him for the examples figured on the Plate, and for the interesting account I am able to give of locality and habits. Mr. Hulst writes: "About the middle of last June (1887), I started on a summer vacation to California and Arizona, going first to California. On the way home I stopped at Prescott, Ariz., and thence went twelve miles south to Maple Gulch, in the mountains, at the head-waters of the Hassayampa River. I reached this place July 1st, and had eleven days' collecting. It was in the rainy season, and, with one exception, it rained every day, more or less, while I was there. I took specimens of *Argynnis Nausicaa* each day of my stay, mostly males, the first females appearing only the day before I left.

"The country there is extremely broken and mountainous, with the little brooks at the head of the river running through rocky cañons, up the steep sides of which the mountains rise from 1,000 to 2,000 feet. Along the beds of these brooks, where the dampness is constant, are found white-stemmed violets, the same or very nearly related to the eastern *Viola Canadensis*. Where these were found, and never at any great distance from them, this butterfly was found; so that, probably, the violet is its food-plant. The species was very local, only found in the bottoms of the cañons, at 6,000 to 7,000 feet altitude, and within an area of not more than one by three miles. And with a single exception all that I saw were on the north side of the divide. That one was on the south, but the conditions were the same, though I did not see the violets. The butterflies were very quick on the wing, and rarely alighted. The few taken on flowers were on *Aselepias tuberosa*. Some were taken on the ground, sipping moisture where the bright sunlight reached the beds of the streams. Except when alighted they were very difficult to catch, as there are neither roads nor paths in that wild country; heavily thorned shrubs were plentiful, and not a square rod of level surface was to be found."

Mr. Hulst thinks it probable that this species is to be found in central and southern Arizona, in the mountains where violets grow, but it must be local and much restricted. It is the most southern species of its genus, and its affinities are with the *Aphrodite* sub-group.

CLEONYMPIA.

II.



GALACTINUS 12 ♂, 34 ♀, FORM CALIFORNIUS 56 ♂, 78 ♀,
 VAR. ERYNGII 9 ♀.

a, a' Egg magnified
 b, b', b'' Larval stages
 c, c', c'' Chrysalis

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THE
BUTTERFLIES
OF
NORTH AMERICA
WITH
COLORED DRAWINGS AND DESCRIPTIONS

BY
W. H. EDWARDS

THIRD SERIES.—PART V.



BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY
The Riverside Press, Cambridge
LONDON: TRÜBNER & CO.
1888

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MELITAEA.

II.



T. BINCLAIR & SON LITH. PHILA.

RUBICUNDA 12 ♂, 34 ♀, 5 VAR. ♂

MELITÆA II.

MELITÆA RUBICUNDA, 1-5.

Melitæa Rubicunda, Henry Edwards, Papilio, I., p. 52. 1882.

MALE. — Expands 1.7 to 2 inches.

Upper side black, spotted with deep red and ochrey - yellow, pale or deep, mostly in common transverse bands ; the spots of the marginal rows small, well-separated, red ; of the second row, either red or yellow, or the red is partly replaced by yellow, always small, often altogether wanting, in which case there is a broad, black, common band, as shown in Fig. 5 ; of the third row, yellow on primaries, red on secondaries, the latter large ; the fourth row, on primaries, is bifid from median nervule to costa, the outer branch and main row usually wholly red, but sometimes the spots are more or less edged yellow on basal side, the inner branch yellow ; in cell four transverse bars, red and yellow alternately from arc to base ; also a yellow bar below cell ; secondaries have a red stripe from costa to median across end of cell, red, sometimes macular or wanting, though usually a small spot is left at outer end of cell ; four yellow spots near base, three in straight row from costa to sub-median, the fourth outside in cell ; fringes of primaries mostly black, white or pale yellow in the median interspaces, of secondaries, a little black at the ends of the nervules, the rest light.

Under side red, of nearly the same shade as above ; the yellow spots repeated on primaries, enlarged and distinct ; on secondaries all spots are repeated, enlarged ; the red ones of third row each lightly edged yellow, except on marginal side ; above this is a bit of the black ground, and next a narrow red stripe from costa to sub-median, separated by a black line from the fourth or discal band of yellow ; (in many of the allied species this stripe is yellow and is in part confluent with the discal band ;) on the basal area a fifth spot on costa ; shoulder and inner margin yellow.

Body black, brown above, the collar red ; beneath, the thorax covered with long yellow hairs, which within are gray, the abdomen red ventrally, on the sides red ; legs red ; palpi red, yellow at base ; antennæ red on upper side, with fine rings of black, black below ; club black, tip ferruginous. (Figs. 1, 2. 5.)

MELITÆA II.

FEMALE. — Expands 2 inches.

Upper side as in the male; often there is an excess of red, the yellow spots being mostly replaced by red. On the under side the red spots of third row are more decidedly edged yellow. (Figs. 3, 4.) Of the preparatory stages of *Rubicunda* nothing is yet known. What I described as the larva and chrysalis of *Rubicunda*, Can. Ent., xv. 119, 1885, were of another species, *M. Taylora*, of Vancouver's Island.

RUBICUNDA was originally described by Mr. Henry Edwards as possibly but a variety or form of *M. Quino*, Behr. Curiously enough, no one, not even Dr. Behr himself, to-day, knows what *M. Quino* is or was intended to be. The types were lost, and the published description fits no known species or variety. It certainly was not what Mr. Edwards understood it to be when he compared both *Baroni* and *Rubicunda* with it. He says of the latter, that "red is the prevailing tint, and the sub-marginal bands of secondaries are simply bands of red," etc. Since this was written, *Rubicunda* has been taken in great numbers by Mr. James Behrens, at Mendocino, California, and I have received from him many more than a hundred examples. There is much variation among these; one type, and that the most common, having nearly all the upper side spots small, so that a large part of the black surface is exposed. (Fig. 1.) Another, having the second common row obsolescent, or wanting altogether, so as to present a conspicuous black band there. (Fig. 5.) In another, the red spots of third row are very large; and in another still, red prevails over the marginal half of each wing, and it was this which Mr. Edwards had in view in making his description.

Respecting this species, Mr. Behrens says: "My catch of 1884 and 1887 was in the Comptche District of Mendocino (Comptche, name of old Indian chief). This district is the highest ridge of the County, all deepest redwood forest, *Sequoia sempervirens*, 1600 to 2000 feet above ocean-level, and twenty-five miles inland from the coast. I caught all the males in the timber flying with *Chionobas Iduna*, and they have the same habits as that species, flying high and settling on the sandy road in the sunshine. It also alights on the leaves of a tan-bark oak, a small species, growing not much over twenty feet high. There are no visible flowers in these dense forests, and I am totally at a loss to mention the food-plant of the larvæ. I was all the time on the lookout for it. It must have surprised you that during six weeks so few females were taken by me, in all less than a dozen, while I took hundreds of the males. But I did capture three of the females in an open uncultivated field a few miles away. If you could form an idea of this mountainous and rough region you would hold me excused for not

MELITÆA II.

diving down the precipices on one side the county road, or climbing the heights on the other, with all the impediments of bramble and underbrush, and that at a temperature never under 80° Far., all June 100°, and now again in August, 100° every day. Both *Iduna* and *Rubicunda* females seem to avoid the flight up from the deep gulch." Mr. Behrens notices that the males adhere tenaciously to the net, by reason of the strength of the claws or feet, more so than other Melitæas he was accustomed to take.

No doubt the food-plants of *Rubicunda* are same as those of the allied species, *Scrophularia*, *Penstemon*, *Castelleia*, etc., which grow either in the gulches or the open fields, and there is where the females would congregate.

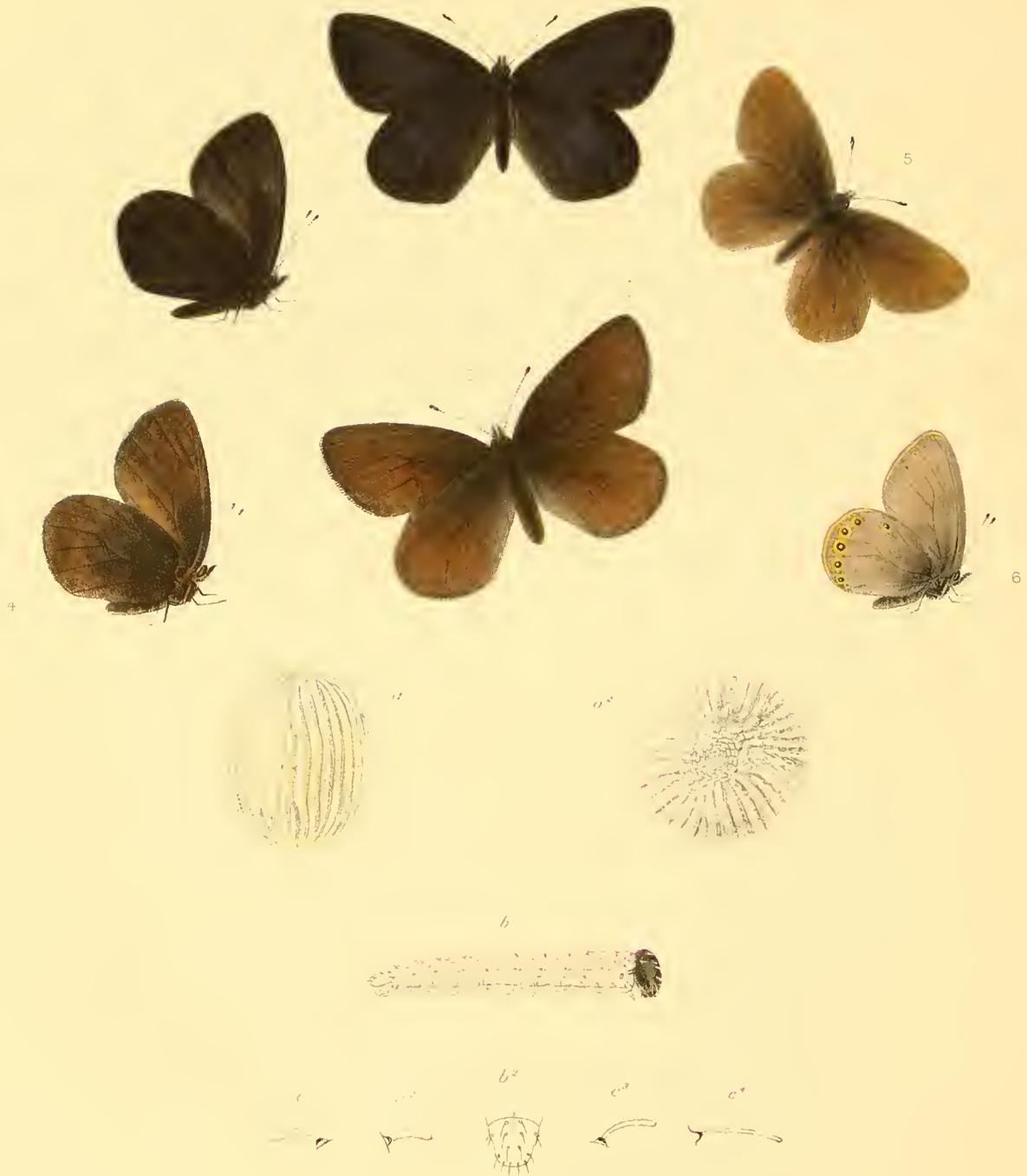
Mr. Henry Edwards writes: "The home of *Rubicunda* is Mendocino County. This is in the coast range of mountains, about one hundred miles from San Francisco, north. It is mostly pine forest, and it would appear that it is not a rich butterfly country, as this species and *Chionobas Iduna* are the only things of importance found there."

On looking over old letters of Mr. O. T. Baron, I find several mentions of *Rubicunda*. On 11th May, 1880, he writes from Mendocino: "For the first time I have the caterpillars of *Rubicunda* and *Baroni* side by side for comparison. They resemble each other much, but still if they were mixed up I would pick either kind out without a single mistake." On November 20th: "*Rubicunda* I caught in Eden Valley, Mendocino County; also fifteen miles north of Ukiah, the county-seat, and on the head waters of the Big River, eighteen miles west of Ukiah. Eden Valley is about 3000 feet above the level of the sea; the other places mentioned have about 1500 feet elevation. I have also raised two or three specimens of the same insect from caterpillars found on two different plants, the one, I think, a species of *Castelleia*, the other I do not know. The caterpillar is certainly distinct from that of *Baroni* and feeds on different plants. I shall be able to give you the whole history in the coming spring, and also send the larva, pupa, and probably eggs." Unfortunately, I never received any of these stages, Mr. Baron soon after having left that region.

Mr. Morrison took *Rubicunda* on Mt. Hood, Oregon.

EREBIA.

II.



SCIENCE & ART LITH. PHILA.

MAGDALENA 1 2 ♂, 3 4 ♀.

a *Eggs a micropyle* magnified
 b *Larva (young)*
 c *processes*

HAYDENII. 5 6 ♂.

EREBIA I.

EREBIA MAGDALENA, 1-4.

Erebia Magdalena (Mag-da-le'na), Strecker, Bulletin of the Brooklyn Ent. Soc., III, p. 35. 1880.

MALE. — Expands about two inches.

Upper side blackish-brown, glossy, with a tint of purple. Under side nearly as dark, paler along inner margin of primaries.

Body, color of wings; legs brown; palpi black-brown; antennæ black above, annulated with gray-white, under side gray-white; club ferruginous above, black beneath. (Figs. 1, 2.)

FEMALE. — Same size.

Paler colored. (Figs. 3, 4.)

EGG. — Ovoidal, the base and top almost equally rounded; marked by about forty somewhat sinuous ridges from end to end; these are highest in the middle, and decrease gradually either way; a cross section at the middle would show the elevations and depressions to be about equal, the tops a little rounded, the sides sloping, and at the bottom a very narrow flat space; the micropyle in a depression, in centre of a rosette of half a dozen concentric rings of small indented cells; color yellow-brown. (Figs. *a*, *a*².) Duration of this stage, about twelve days.

YOUNG LARVA. — Length .1 inch, shape of *E. Epipsodea*; thickest anteriorly, tapering on back and sides to 13, which ends roundly; marked by three longitudinal rows of dark sub-conical tubercles, each of which gives out a white process; these rows are dorsal, sub-dorsal, and lateral; on 2 there is an additional tubercle back of and between the dorsal and sub-dorsal, and another a little below and behind the latter; and there are two in front and a little above spiracle; on 3 and 4 the three are nearly in vertical line, but after 4 to 12 inclusive they are in triangle, the dorsal on front, the sub-dorsal at rear, and the lateral a little

EREBIA I.

before the middle of the segment ; on 13 are six in two rows made up of the dorsal and sub-dorsal, which fall nearly into line, a lateral on either side in front, and six around the end, these last smaller and with shorter processes ; the processes on 2 are decidedly club-shaped (Fig. *c*) ; on the other segments to 12 scarcely clubbed (Fig. *c*³) ; on the sides of all moderately clubbed, and short (Fig. *c*²) ; on 13 the four uppermost are cylindrical and long (Fig. *c*⁴) ; along base a row of minute tubercles with short hairs, two to each on 2, 7 to 13, one on each of the rest ; color at first pink-white, with a brown mid-dorsal stripe, and three brown lines on the side ; a few days later the dorsum had a green tint ; later the anterior half became greenish, the rest pink-white ; under side, feet, and legs paler ; head a little broader than 2, ob-ovoid, the top a little depressed ; color black-brown, surface granulated ; marked by a few low tubercles, each giving a white process. (Figs. *b*-*b*².) This larva died before a moult.

Very few examples of this *Erebia* are to be found in collections, and all, so far as I know, have been taken by that indefatigable lepidopterist, Mr. David Bruce, of Brockport, New York. Mr. Bruce wrote me, July 15, 1887 : " I have just got in from the mountains after a hard struggle. The rainy season has commenced a month earlier than usual, and consequently there is no depending on anything. I have been on Bullion Mountain, 14,000 feet, for nearly two weeks, have taken five *Magdalena*, a good series of *C. Bore*, also of *Semidea*. I send you two eggs of *Magdalena*." These were laid 10th July, and one hatched on 22d. The other was put in alcohol, that its likeness might be drawn. The larva at first seemed lethargic, and I thought it would sleep as the larvæ of the genus *Satyrus* do, and so pass the winter. But on 26th I noticed that it had eaten of the grass on which it rested, and had changed color, as small larvæ usually do after feeding. On 28th I sent it to Mrs. Peart, at Philadelphia, and learned that it died there a few days later, and before a moult, attacked by mould.

Later, Mr. Bruce kindly wrote out his observations on this species, thus : " *E. Magdalena* is found in the most uninviting-looking spots it is possible for a naturalist to explore. Black, barren, detached rocks, that look as if an immense peak had fallen and split into fragments ; hardly a blade of grass or a patch of lichen to relieve the utter desolation. Yet even here, animal life is found in plenty, and fitted for such a dwelling-place. All day long can be heard the singular ' keek ' of the ' Little Chief ' Hare, *Lagomys princeps*, and until the animal is seen, the stranger is puzzled to know if it is the voice of a bird or an insect, on the earth or in the air ; yet the little ventriloquist is sitting on a rock probably within a yard of his feet. A loud shrill whistle announces the

EREBIA I.

presence of the large Mountain Marmot, who may be seen on the topmost rock, keeping a good lookout. A few pairs of the Mountain Linnet or Gray-crowned Finch are sure to fly from the rocks, where they are breeding, to the nearest snowbank, and are soon busily engaged searching for seeds that have blown from below or washed from above. The sun gleams out, and, awakened into activity by its beams, comes *Erebia Magdalena*, flitting leisurely, like the rest of its family, then suddenly taking an upward flight, it soars around, more like a *Limenitis* than an *Erebia*. Another of same species springs up from the rocks, the usual skirmishing chase ensues for a few minutes, the sun is again obscured, and the insects disappear as if by magic, and will not be seen until it is bright again. I have never found this species but among such broken rocks, varying from 12,000 to nearly 14,000 feet elevation. The females fly to the nearest grasses to deposit their eggs. They alight on the ground, and crawl into the tuft of grass quite to the root, and it is difficult to find them, while no amount of beating or brushing will make them fly out. I saw one drop into a tuft which I could cover with my hat, and searched for her for ten minutes in vain. It was only by pulling the tuft entirely in pieces that at last I found her. It was this female that laid the two eggs in confinement which I sent you. I have never seen the males fly beyond the rocks at all. *Magdalena* when fresh has a beautiful satiny gloss, which in the males has a purple tint, but they soon become worn and brown and lose this tint. As far as my experience goes, this is the most difficult to capture of all our native butterflies, not because of its rapid flight, but from the nature of its habitat. The collector cannot follow it, and when it is at rest on the black rocks it is almost invisible. Owing to its habits the species will always be rare in collections. I have met with it from June 28th to July 18th, on the front range of the Rocky Mountains, Park County, Colorado."

Magdalena on upper side is exactly like the Arctic-American species, *E. Fasciata*, Butler, the same size, shape, and color even to the club of antenna. But *Fasciata* is conspicuously banded beneath across both wings. Our Coloradan must have descended from the same stock with *Fasciata*, if it be not an offshoot of that species. Usually *Erebia Epipsodea* is distinctly banded beneath, but individuals are found in Colorado with no more of a band than *Magdalena* shows. So far as known by Mr. Bruce this absence of a band in the present species is constant.

It may be a very long time before more is known of the early stages of *Magdalena* than what I have related. I find it almost impossible to rear larvæ of these high alpine species, and in cases where larvæ have reached maturity they fail to pupate.

I asked Mr. Bruce, if, considering the great elevation at which this species

EREBIA I.

lives, and the frosty nights even during the short period of its alpine summer, it would require three seasons for the larva from egg to reach imago, the first winter being spent by the larva in its first stage, the second either when mature or in pupa. He replies: "As to the three year theory, I do not think it is so at all. You have no idea of the forcing and invigorating influence of the air, and the effect on everything that has life, both animal and vegetable. You may leave the barren-looking cold hills for a week and return to find them carpeted with flowers, in many cases actually pushing through the snow. Where the sun catches, in early spring, the snow soon melts, and the hibernating larvæ feed and grow rapidly. I can only form my ideas from hibernating Arctic (Heterocera) larvæ; these hibernate when very small indeed, come out very early, will freeze and thaw as the cold or heat predominates, yet keep growing all the time. I have no reason to think the diurnals do very differently. I think there is plenty of time for Erebias to feed up and be out on the wing by the middle of June. The mountain larvæ are all very partial to basking on the stones in the sunshine, feeding little till the afternoon and evening, but then they feed voraciously. The temperature gets down to 30° Fahr., or lower, every night during the summer months; a thin ice frequently forms on the small lakes in July even. Yet I believe the grass feeders *do not get into a torpid state* after vegetation once starts, for the soil and stones retain heat where the sun has struck for any length of time. Yet the air is so cold that moths do not fly by night at all, the Noctuids and Bombyces, at these elevations, being day-fliers."

EREBIA I.

EREBIA HAYDENII, 5-6.

Erebia Haydenii, Edwards, ♂, Hayden's Report, Survey of Montana, 1872, p. 467; id., Trans. Amer. Ent. Soc., V. p. 19. 1874.

MALE. — Expands 1.6 inch.

Upper side blackish-brown, immaculate; under side paler, dusted with gray scales; secondaries have a complete series of black-brown ocelli along hind margin, each ringed with rust-red, and having a small white pupil; on primaries two or three black points, the margins edged by a narrow rust-red stripe.

Body, color of wings; legs yellow-brown; palpi black-brown; antennæ yellow-brown, annulated white; club ferruginous. (Figs. 5, 6.)

FEMALE, at present unknown.

This species was described fifteen years ago from two much worn and badly damaged males, brought in from Yellowstone Lake by Dr. Hayden's Expedition, and until recently I had not known of another example in any collection. Nothing whatever was known of the species except what the dried insects discovered. To call attention to the species I concluded to figure the male only. After the Plate was done, I accidentally learned that Prof. S. A. Peabody, of the University of Illinois, had taken *Haydenii* in 1887, and he kindly sent me two pretty fresh males, and gave the following account of their capture: "I send you two males *Haydenii*, I have no females. These were taken in the immediate vicinity of the Falls of the Yellowstone, on the grassy slopes west of the cañon, and at an altitude of about 8,000 feet, or, say, between 7,700 and 8,000. I see that in the Trans. Ent. Soc., V. 19, this species is reported at Yellowstone Lake, which is about 15 miles from the Falls. I did not go there. The altitude of the lake is not materially different from that of the upper fall. I did not see any females. I was at the Falls, Aug. 3d and 4th. On 5th, I passed over Washburn Mountain

EREBIA I.

to Yancey's, on horseback. I went to the mountain with a company and a guide, and could not stop to take insects. From the summit I was alone, and on a pretty good trail, but as I had yet twenty miles to go before nightfall, you may understand that I did not delay very much. The next day's travel was over an arid and parched country, and mostly under cold and rainy sky, where nothing flew. These Erebias were on sunny slopes, covered with the wild flowers of the country, few of which were known to me. Every other butterfly seemed to be *Argynnis*."

DEBIS I.

DEBIS PORTLANDIA, 1-4.

Debis Portlandia, Fabricius, Spec. Ins., II, p. 82, 1781; Boisduval and Leconte, Lepid. de l'Amer., p. 226, pl. 58, 1833; Morris, Lepid. N. Am., p. 79, 1862; Edwards, Can. Ent., XIV, p. 84, 1882; Fernald, But. of Maine, p. 70, 1884; French, But. of East. U. S., p. 29, 1886.
Andromacha, Hübner, Samml. Ex. Schmett., I, 1806-1816; Say, Amer. Ent. II, pl. 36, 1825; Morris, l. c., p. 78, 1862.

MALE.—Expands from 1.9 to 2.2 inches.

Upper side yellow-brown, or wood-brown, individuals varying in depth of color; the extra-discal area paler, more yellow, variable; on this a row of four oval or rounded blind ocelli, sometimes unequal throughout, sometimes the posterior pair very large, equal; often the spot on lower discoidal interspace wanting, or reduced to a point; these ocelli are of a soft brown hue, and each lies within a pale yellowish ring which fades into the ground; on primaries, owing to the transparency of the wing, the outer edge of the basal area is dark, particularly next costa, and projects in an angle, often double-toothed, on upper median nervule; a similar dark edging is sometimes to be seen on secondaries, but usually there is nothing of this; secondaries have also a series of five ocelli, unequal, the middle one often very small, sometimes altogether wanting; sometimes the upper pair are very large, equal; both wings bordered by two fine parallel dark lines; fringes brown at the ends of the nervules, gray or whitish in the interspaces.

Under side paler brown, with a slight violet reflection; the basal areas edged without by a common dark stripe, sinuous, projecting considerably against both cells and on inner margin of primaries; halfway between this and base a similar stripe, nearly straight, bending upwards on lower median interspace of secondaries and joining the outer stripe on sub-median nervule; on the arc of each cell a dark stripe; the extra-discal area of primaries lighter, of secondaries same as the basal, with a dull yellow or whitish diffuse band passing entirely round each series of ocelli; these have now small white pupils, and each is within a definite

DEBIS I.

yellow ring, pale or bright; on secondaries there is a duplex sixth ocellus next inner angle, each part very small, elongated.

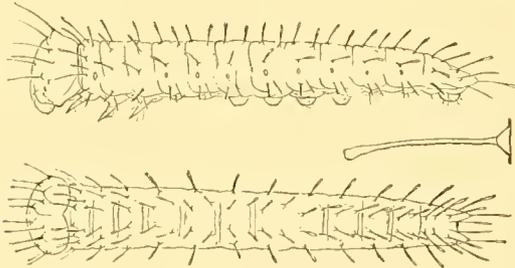
Body above yellow-brown, beneath yellow-white, the abdomen lightest; legs brown-yellow, the tibiae whitish; palpi white within, with long black hairs in front; eyes brown-black; antennae blackish above, ringed with white, red-brown below; club black, the tip red-brown. (Figs. 1, 2.)

FEMALE. — Expands from 2 to 2.25 inches.

Very much as the male; the ocelli varying in same manner, perhaps, however, never so small as in some males. (Figs. 3, 4.)

EGG. — Semi-ovoid, a little higher than broad, the base slightly rounded and arched at the middle; surface smooth; color greenish-white. (Fig. *a*.) Duration of this stage from four to six days.

YOUNG LARVA. — Length .13 inch, cylindrical; tapering slightly on both dorsum and sides from 2 to 13; ending in two short conical tails; color at first yellow, somewhat tinted brown, after two days changing to yellow-green, more green on dorsum; on each segment from 3 to 12, above spiracles are six conical tubercles forming as many longitudinal rows, three on either side, a dorsal, sub-



dorsal, and lateral; on 3 and 4 they are nearly in cross line, but from 5 to 12 are in triangle, the dorsal one standing on the front ridge, the sub-dorsal on the rear, the lateral on the second ridge or a little before the middle of the segment; from each of these a long, slender, tapering hair, the end thickened (Fig. *b*⁶); on 2 are three tubercles and hairs corresponding to the three rows, though not all in line with them, and behind and between the upper two an additional one; against spiracle, to the front, is a fine hair, and just over it a shorter, coarser one; (see cut; on the Plate, figs. *b* and *b*⁴ fail to show the sub-dorsal tubercle on 2;) on 13 are twelve tubercles, three on each side in the upper two rows, two in the lateral row, two at the ends of the tails, and two short hairs in the concavity between the tails; below the line of spiracles is a row of short, coarse hairs, not thickened at ends, two to each segment, except on 3, 4, 13, which have but one; head at first nearly twice as broad as 2, at two days from the egg one-fourth broader only; ob-ovoid, truncated, slightly depressed at the suture; on each vertex is a small sub-conical protuberance, from the top of

DEBIS I.

which comes a long, tapering hair; a few hairs over the front. (Figs. *b* to *b*⁶.) Duration of this stage, six to eight days.

After first moult: length .26 inch; the dorsum arched, on 3 and 4 depressed; 13 ending in two long, tapering tails; color bright green; densely covered with low, sharp, whitish tubercles, which are disposed in longitudinal rows, one of which edges either side the dark green mid-dorsal stripe, and another lies between this and the sub-dorsal narrow yellowish stripe, which itself is crowded with tubercles; below this stripe there are four somewhat irregular rows, and then the yellowish basal stripe; each tubercle gives a very short white hair; under side, feet, and pro-legs paler green, head higher than before, the sides less curved, depressed somewhat more; on each vertex a high, conical process, which, as well as the whole face and back, is thickly covered with whitish sub-conical tubercles, each with its short white hair; color green, the ends of the processes red. (Figs. *c* to *c*³.) Duration of this stage, seven to eight days.

After second moult: length .44 inch; shape as at second stage; tuberculated in same way; the sub-dorsal and basal stripes as before; head same, the processes more red. (Fig. *d*.) To next moult about nine days, but, like all stages, the duration depends on the weather.

After third moult: length .52 inch, scarcely different. (Fig. *e*.) To next moult, in a single instance, six days; all other larvæ hibernated at this stage.

After fourth moult, in spring: length .6 inch; shape nearly as before, the abdominal segments arched, the others level; tails long; color yellow-green; a darker mid-dorsal band, a green line next above the yellow sub-dorsal stripe, and another on mid-side; the basal stripe yellow; head narrower at top, the bases of the processes meeting at the suture; color green, the ends red. (Figs. *f* to *f*⁴.) To last moult eleven days; in one instance sixteen, in another twenty days, owing to cold weather.

After fifth moult: length 1 inch; in about ten days the larva was full-grown.

MATURE LARVA. — Length. ♂, 1.2 inch, greatest breadth, on middle segments, .16 inch; ♀, 1.4 inch, breadth .17 inch; cylindrical, slender, the dorsum arched, and sloping about equally either way from the middle; 13 ending in two long, slender, tapering tails; color yellow-green; on mid-dorsum a dark green band, on the edge of dorsal area a narrow yellow stripe to the tail, and on upper side of it a dark green line, another such line on mid-side, and a yellow stripe along

DEBIS I.

base; all the cross-ridges thickly set with fine whitish tubercles, each giving a very short fine hair; tails red-tipped; under side, feet, and legs pale green; head ob-ovoid, broad on lower front, narrowing rapidly upwards, well rounded on front and sides; on each vertex a long, tapering process, their bases meeting at the suture; these processes, as well as the rest of the head, are rough, with large rounded equal tuberculations, each with its short, stiff white hair; color yellow-green, the processes red, all tubercles white; the ocelli brown, the largest green with brown rim. (Figs. $g-g^2$.) From fifth moult to pupation about fifteen days. The position when suspended is shown by Fig. h .

CHRYsalis. — Length .6 inch, greatest breadth across both mesonotum and abdomen .22 inch; cylindrical, the abdomen conical; head case short, bevelled on both sides equally to a rather broad, sharp ridge, with sharp, triangular corners, at top a little excavated, the sides roundly excavated; mesonotum prominent, angular, the apex rounded, followed by a shallow depression; wing cases flaring at base, very little constricted in middle; color delicate green, sometimes with a bluish tint; the ventral side of abdomen paler; the top of head and dorsal edges of wing cases cream-white; surface smooth, glossy. (Figs. i to i^3 .) Duration of this stage in May, thirteen to fourteen days.

PORTLANDIA flies throughout the Atlantic States and Mississippi Valley. It is abundant in the South and West, but how far to the West it flies I am unable to say. I have received it, however, from Fort Niobrara, Nebraska. It is believed to be nowhere a common species in New York or New England, and is occasionally taken as far east as Halifax, Nova Scotia. Prof. C. H. Fernald informs me that at Orono, Maine, the late Mr. Anson Allen used to find it in some numbers through the summer on a road through a growth of spruce trees. I learn from Mr. H. H. Lyman, of Montreal, that Mr. E. C. Trenholme, of that city, has found this species tolerably common on the Western and Little Mountains, above Montreal, on one occasion having "come upon a flock of a dozen, flitting about near the ground." Mr. Lyman writes that he has received two specimens taken at East Selkirk, Manitoba, lat. $50^{\circ} 10'$, the most northern locality probably so far noted.

In Say's time, about 1825, *Portlandia* was known only as southern, and that author states that it had never been taken so far north as Pennsylvania. Very likely the species has spread to the north and east during the last sixty years, as many species of birds are known to have done. Mr. Philip H. Gosse, in his "Canadian Naturalist," London, 1840, p. 246, speaks of seeing a single

example in Canada. The same author, in "Letters from Alabama," London, 1859, page 122, gives an interesting account of the habits of the species, under the name of *Hipparchia Andromacha*, which I copy here. "It is interesting from its social and gamesome habits. A particular individual will frequent the foot of a particular tree for many successive days, contrary to the roaming habit of butterflies in general. Hence he will sally out on any other passing butterfly, either of his own or of another species, and after performing sundry circumvolutions, retire to his chosen post of observation again. Occasionally I have seen another butterfly of the same species, after having had his amicable tussle, take likewise a stand on a neighboring spot, and after a few minutes' rest, both would simultaneously rush to the conflict, like knights at a tournament, and wheel and roll about in the air as before. Then each would return to his own place with the utmost precision, and presently renew the 'passage of arms,' with the same result, for very many times in succession." I have myself never had an opportunity of observing the habits so well described, nor can I hear of others having done so. But a butterfly restricted to forests in which was no undergrowth, like the pine forests of the South, would of necessity have the habit of resting on trees. The late Mr. James Ridings collected butterflies in Georgia, a few years ago, and informed me on his return that *Satyrus Pegala* alighted on the bark of trees in the pine forests, and returned persistently to the same spot, and as he compared the habit with that of *Portlandia*, probably he had noticed the latter species in the same district. I know of no other of the North American Satyrinæ which do this, unless it be the *Chionobas* of the *Gigas* group.

The species is not a common one in the region in which I live, but every year I see a few individuals flying near the ground about the edge of the wood, or among the trees and shrubs near my house. They are also to be seen in the depth of the forest. On one occasion, in June, I visited an unopened coal seam at least a mile from any clearing, and at five hundred feet elevation above the creek, where the coal was exposed to view, owing to its being between two ledges of rock, a little sulphur-tinctured water trickled upon the base rock, and here were several *Portlandia* and that rare butterfly, *Eudamus Cellus*, in a cluster, eagerly sucking. On the way down the creek, the wheel of the wagon struck a small, decayed, moss-covered stump at the foot of the hill, and quite a flock of *Portlandia*, which had been resting on the stump, were flushed. I caught eight, four of them with one sweep of the net, all males fresh from chrysalis. Near the same place, several summers ago, Mr. Ridings took a number of specimens. He told me that this butterfly was infallibly attracted by any excrementitious matter, and he had only to wait near a spot where such was to be found to get all the individuals he wanted.

DEBIS I.

Mr. Lewis Ullrich, of Tiffin, Ohio, wrote in August, 1881, that shortly before, he had taken some hundred and fifty good examples of *Portlandia*, and rejected many more as imperfect, in a certain piece of woods near by, and remarked that the species seemed to be confined to this particular spot, and, so far as he knew, was not to be found elsewhere in the County. Two or three years later I applied to Mr. Ullrich for specimens, and learned that the old hunting-ground had been cleared of undergrowth and cattle turned in, to the utter destruction of these butterflies.

The larvæ, like all the family, eat grasses. I first obtained one egg of *Portlandia* by confining a female on grass under a net, August 22, 1873, but it failed to hatch. Several other experiments were unsuccessful, until August 15, 1877, when I got seven eggs. These hatched on 21st, and on 27th, the larvæ began to pass the first moult; on 3d September, the second moult, on 12th, the third, and soon after, all became lethargic, and were left in a cool room for the winter. On February 17, 1878, they were brought into a warm room, and the same day were seen to be moving. On 26th February, one passed the fourth moult, and died soon after from injuries received on the way to Philadelphia, for its portrait. Meanwhile all the rest had died. That is a sample of the bad fortune which often happens in rearing butterfly larvæ, and it has not unfrequently taken me several years to get at a complete life-history of a species.

On September 5, 1881, I received twelve eggs from Mr. Ullrich. These began to hatch on 8th; on 15th the larvæ were passing first moult, on 23d, the second. On 8th October, one passed the third. The moults were irregular, several days intervening between the passage by the first and last larva of same stage. On 24th October, one passed the fourth, but died soon after; the others were in lethargy by 1st November. Early in February, 1882, these larvæ were brought into the house, and on 24th, were observed to be in motion; by 1st March all were feeding. The fourth moult was passed from 16th to 23d March; on 31st, one passed the fifth, and the last passed same on 4th April. The first chrysalis formed 13th April, and this gave imago 29th. Two that passed fifth, 5th April, pupated 20th, and the butterflies came out 4th May.

The hibernating larvæ, therefore, pass three moults in the fall, and two in spring; but it is probable that the number of moults of a summer brood is but four, as with some of the allied species.

While the larva is at rest the head is bent under so that the horns are turned forward, and the back part is in line with dorsum, as seen in Fig. *g*. When a moult takes place, as the old face is cast off, the new horns are seen folded down over the face and flattened, and it is several minutes before they begin to rise and fill out, and fully ten before they are erect. These organs are not solid, but

DEBIS I.

hollow shells merely. I noticed one larva as it was passing the second moult, and another at the fourth, and the behavior was the same in both cases. As the tails were disengaged from the old skin, they stood apart at a right angle for some time, and in about ten minutes began slowly to approach each other and get in line with the body. The first movement of the larva was to turn around so as to get at and devour the cast skin. In suspension the figure is very different from *N. Gemma*, but is like *N. Sosybius*, and nearly same as in *Satyrus Alope*. (Fig. *h*.)

I have taken *Portlandia* at Coalburgh, W. Va., as early as 18th May, and fresh examples in June, July, and August. There must here be at least two annual generations, possibly three. If three, the first in May, the second middle of July, the third late in August.

This is the only species of its genus accredited to the Americas, but under the supposed synonymical name of *Lethe*, Marshall and De Nicéville, in "The Butterflies of India," describe thirty-four species, which they divide into four groups, principally inhabiting the Eastern Himalayas and Assam. Nothing is said of the early stages of these species, and it remains to be seen from comparison of egg, larva, and pupa, whether either of the groups or any one of the species is really congeneric with *Debis Portlandia* or not. It is highly probable that they are not, and that *Portlandia* properly forms a genus by itself.

Say describes the caterpillar briefly as "downy and mucronate behind," — mucronate, in his glossary, meaning "terminating in a sharp point." Of the chrysalis he says, "It is angulated, bi-mucronate on the front;" which is not a correct description, as the head case is without points or processes. Boisduval and Leconte give a fair representation of the chrysalis after Abbot, but the caterpillar is bad as can well be. The description in the text is drawn from the figure and not from nature, and it is said that the two points which surmount the head spring up in the form of ears (*s'élevent en form d'oreilles*), as indeed they do in the figure. The same authors copy from Abbot's unpublished figures what perhaps is the Georgia type of the butterfly, large, with very large and nearly equal ocelli over both wings.

NOTE. — Since this paper was printed I have received a letter from Mr. L. Ulrich, before mentioned, and to whom I had written to ask if he had observed the gamesome habit described by Mr. Gosse. Mr. Ulrich is an experienced collector of lepidoptera; he is also Clerk of Seneca County, Ohio, and was so engrossed by his official duties that he could find no time for an earlier reply. Hence this note. The letter says: "I do not recollect of ever seeing *Portlandia* flying antagonistically at other species, but to see them sitting on the side of a tree or stump head downward, the wings closed over the back, was a common occurrence. The many butterflies I found in 1881 — and I took hundreds of them — were all from an area of about one acre in extent, within a small piece of woods. Here was an open patch on which grew a certain kind of grass, the food of the caterpillars, and joining it was a half acre of open second-growth of hazel, maple, and other trees, from fifteen to twenty feet high. When the sun shone clear it was usual to find a score or more of *Portlandia*

DEBIS I.

about one tree, sitting on the trunk, flying up and away a few feet, and returning to same tree, apparently playing with each other. At the same time the great body of the butterflies seemed content with resting in the full sunlight on the tops of the leaves.

"Some trees seemed to have more attraction than others. I remember a certain hickory where I could always find some of the butterflies sitting on the trunk.

"Plenty as *Portlandia* was there, not one did I ever find outside this acre, not even in the piece of wood in which it was enclosed, or in any other part of Seneca County."

I also have had a few lines from Mr. Behrens, in which he asserts that the larger *Chionobas* of the Pacific coast have no such habit of settling on the trunks of trees, as I had conjectured might be the case from an expression in one of his old letters.

DEBIS I.

EXPLANATION OF THE PLATE.

PORTLANDIA, Figs. 1, 2 ♂, 3, 4 ♀.

- a* EGG, magnified.
- b* YOUNG LARVA, side view; *b*² back, magnified.
- b*³ head; *b*⁴ segment 2; *b*⁵ last segment; *b*⁶ hairs, magnified.
- c* Larva after 1st moult; *c*² head; *c*³ dorsal view of one of the middle segments, magnified.
- d* Larva after 2d moult.
- e* Larva after 3d moult.
- f* Larva after 4th moult; *f*² head; *f*³ middle segment; *f*⁴ end of 13, magnified.
- g* MATURE LARVA after 5th moult, nat. size.
- g*² head of same, magnified.
- h* Larva suspended for pupation.
- i* *i*² *i*³ CHRYSALIS.

Number IV was published in part by a grant from the Elizabeth
Thompson Science Fund.

W. H. EDWARDS.

COALBURGH, W. VA., *May* 15, 1888.

THE
BUTTERFLIES
OF
NORTH AMERICA
WITH
COLORED DRAWINGS AND DESCRIPTIONS

BY
W. H. EDWARDS

THIRD SERIES.—PART VI.



BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY

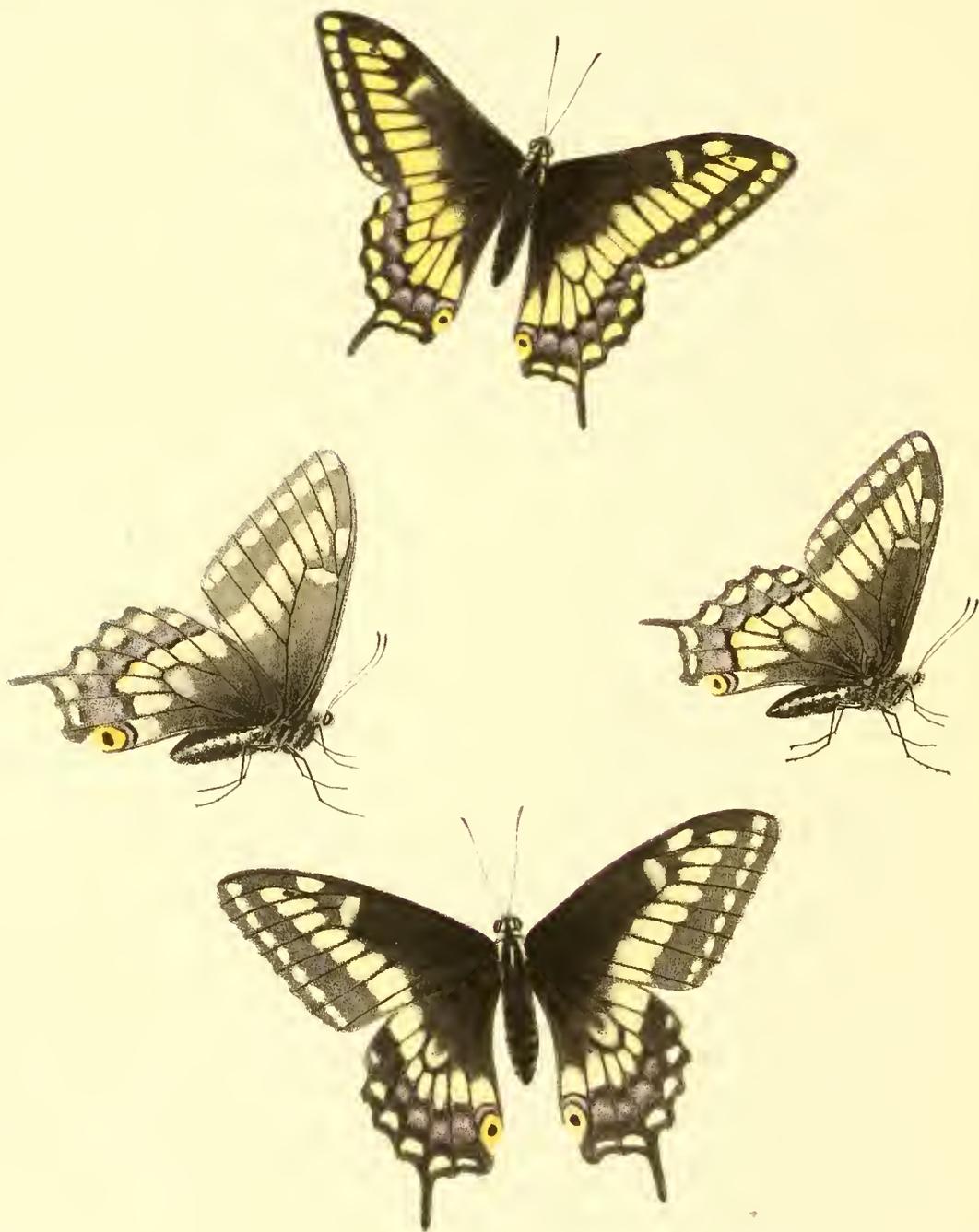
The Riverside Press, Cambridge

LONDON: TRÜBNER & CO.

1889

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PAPILIO.
1.



F. LINCOLN & SON, 117 N. 3RD ST. PHILA.

NITRA 12 ♂. 34 ♀

PAPILIO I.

PAPILIO NITRA, 1-4.

Papilio Nitra (Ni'-tra), Edwards, *Papilio*, III., p. 162. 1883.

The sexes alike in color and markings.

MALE. — Expands 3 inches.

Upper side black, spotted and banded with yellow after the manner of the *Asterias* group; the sub-marginal spots of primaries rounded next apex, the rest ovate, of secondaries semicircular, the one next inner margin sub-erescens; the common discal band composed of long separated spots, the anterior ones on primaries lanceolate, the others truncated and not definite on the basal side; an oval spot in the subcostal interspace and a crescent bar inside the arc of cell; on secondaries the band covers about one fourth the cell; the spot at anal angle yellow, on which is an orange ring about a round black spot; on the extra-discal black area loose clusters of black scales entirely across the wing.

Under side pale black, the markings repeated, pale; the extra-discal area on secondaries dusted lightly with yellow scales, and above these blue scales about a rather dense nucleus of same, particularly in the median interspaces; the anal ring deep orange-fulvous.

Body black, the wing-covers yellow, the abdomen showing a slight lateral stripe from base of wing to last segment; legs and palpi black; the frontal hairs black, yellow at the sides; antennæ and club black. (Figs. 1, 2.)

FEMALE. — Expands 3.3 inches.

Spotted and banded as in the male, the upper spots of discal band sub-ovate; the yellow paler; under side without orange in the interspaces except the median. (Figs. 3, 4.)

NITRA was described from a single pair taken by Wm. M. Curtis, M. E., in Judith Mountains, Montana, July, 1883. Mr. Curtis wrote me that he saw

PAPILIO I.

several other examples, but took only the two, not supposing the species to be new or rare. I ventured the conjecture that *Nitra* would be found in British America, and this has happened. At different times three examples have been sent me for examination by Mr. James Fletcher, two of them taken in the Rocky Mountains, at Canmore. 26th June, 1885, on the summit, in company with *P. Zolicaon*; and the third, at Regina, N. W. Terr., by Mr. N. H. Cowdry. And Mr. Fletcher states that a fourth is in the Geddes collection, at the National Museum, Ottawa.

ANTHOCHARIS I.

ANTHOCHARIS GENUTIA, 5.

Anthocharis Genutia, Fabricius; Edwards, *But. N. A.*, II., p. 83, pl. 17. 1878.

EGG. — Long, narrow, thickest in middle, curving moderately towards the base, which is broad and flattened, towards summit more rapidly, so that the upper half is cone-shaped; the top depressed, the micropyle surrounded by minute irregularly hexagonal cells; ribbed vertically, the number of ribs about sixteen, half of which reach the summit and curve to the depression, the others ending not much short of summit, the spaces between crossed by numerous fine ridges; color yellow-green. (Figs. *a* to *a*³.) Duration of this stage about four days.

YOUNG LARVA. — Length .05 inch; cylindrical, tapering very gradually from 2 to 12, curving roundly on dorsum of 13, ending squarely; color greenish-yellow; running longitudinally are three rows of rounded tubercles on either side, from each of which proceeds a short straight hair, which tapers from the base, and is thickened at the end, the end usually covered by a globule of fluid (Fig. *b*¹); the tubercles are concolored with body, the hairs light; on 3 and 4 stand in cross row, sometimes with a little irregularity; after 4 to 12 in triangle, the dorsal tubercle being on the front of the segment, the sub-dorsal on the rear, and the lateral a little before the middle; on 2 the upper two are near together on the front, and corresponding with the lateral row below is a very small one, and a hair without tubercle close to and under it; there is also a third one behind and between the upper two equal to either in size; on the front of 13, the three tubercles are in triangle as with the preceding segments, and at the rear is a cross row of four, the two middle ones being dorsals, the others smaller and apparently of the lateral rows; at the extreme end, on either side a small tubercle; along base a row of short hairs, two on 2, and from 5 to 12; one on 13, and on 3 and 4 one each, from a tubercle; head a little broader than 2, sub-globose, depressed at top; on each lobe three tubercles like those on body

ANTHOCHARIS I.

in triangle, so placed that the bases make a cross row of four on forehead; a few smaller ones scattered about; color pale brown. (Figs. *b* to *b*³.) Duration of this stage two to three days.

After first moult: length .14 inch; same shape; color light-green, or green-yellow, glossy; no dorsal or basal stripe; the tubercles present, but conical with broader bases, and disposed as before, the hairs similar but shorter; the surface is now thickly covered with little round very pale brown spots, from the centre of each a minute and very short black hair; head much as before but broader in proportion to the height, light brown, a little greenish, tuberculated as before, but more thickly, one on the front of each lobe much larger than any other; color green with a tint of brown. (Figs. *c* to *c*³.) Duration of this stage two days.

After second moult: length .27 inch; color yellow-green, glossy; a yellowish mid-dorsal band begins to appear indistinctly, and a more distinct band of white along base; the tubercles present, with same arrangement, each broader at base and flattened there, a little more brown than before, the hairs similar but still shorter; the rounded spots much as at second stage, not so pale brown; head as last described, but much more tuberculated, two on each lobe being now conspicuous; color pale green with two brownish discolorations on front. (Figs. *d* to *d*³.) To next moult two days.

After third moult: length .38 inch; color dull yellow-green, glossy; a yellow dorsal band not always clear, except on anterior segments, and a whitish, or yellowish-white basal band; the tubercles about as at next preceding stage, but darker, as are the spots; head still more tuberculated, all being small except the two mentioned before, and a third one over the ocelli; color of face pale green, the sides whitish, a cloudy brown patch on each lobe. (Figs. *e* to *e*⁴.) To next moult two days.

After fourth moult: length .6 inch; in three days was full-grown.

MATURE LARVA. — Length .92 to .95 inch; cylindrical, slender, the head broad as 2; color dark yellow-green, glossy; under side, feet and legs lighter; a yellow mid-dorsal band from 2 to 13, a broader white band along base; upper surface furnished with six longitudinal rows of shining black tubercles, low, conical, the bases broad and flattened, each giving a short black hair or process, which tapers slightly and is thickened at end; on 3 and 4 these tubercles are arranged in straight cross row, on 2 in cross row, but the middle one on each side is a little

ANTHOCHARIS I.

in advance, and an additional one behind makes a triangle with the upper pair; from 5 to front of 13 in triangle, the dorsal tubercle being on front of the segment, the sub-dorsal on rear, the lateral a little before the middle; the shield on 13 is black and on it is a large dorsal tubercle on either edge of the band, with a lesser one behind, besides two minute ones across the band at the end, in all twelve black tubercles on this segment; below shield are several white tubercles with white processes; from 3 to 13, on the lower edge of the white band, is a small black tubercle to each segment; all the cross ridges are thickly set with very fine, short black hairs, some of which, especially on the anterior segments, come from minute black tubercles, but most rise from a pale black rounded spot, without tubercle; the under side whitish, outside feet and legs yellow-green, above to the band less yellow, more green; head sub-globose, broad as high, narrowing at top, and a little depressed at suture, broad at base; color white and pale green, with a pale black patch on the forehead on either lobe, and one below, crossing the triangle; on each upper patch is a triangle of large black tubercles and on lower one two on either side the suture; many small white tubercles cover the face. (Figs. *f* to *f*⁴.) From fourth moult to pupation about five days; from laying of egg to pupation about nineteen days.

CHRYsalIS. — Length .72 to .78 inch; slender, the abdomen long, round, tapering to a point, the head case surmounted by a long tapering process, so that altogether the shape of the two ends is much the same; in some examples the dorsal outline is regularly arcuated as in Fig. *h*; in others the mesonotum is slightly prominent, and the outline is less regular, as at *h*²; on ventral side the thoracic segments form a prominent sub-triangular projection, compressed laterally, and covered by the wing cases; color generally of a pale yellow-brown, with a reddish tint, mottled with white and darker brown about mesonotum, the process at head brown; the wing cases more or less dotted and streaked black; on abdomen a dorsal row of black dots, two to four on a segment, varying; and a sub-dorsal row of dots or points. (Figs. *h*², *h*³, much enlarged, *h* showing the natural size in outline.) The chrysalis passes the winter, and the butterfly comes forth the following spring.

In Volume II. 1878, I gave all the particulars I had been able to learn of this species. No one was known to have bred it, and nothing was reported of its preparatory stages, except that Mr. Boll, in Texas, had seen the female laying eggs on Cardamine. Of late years, however, some of the Washington lepidopterists had become acquainted with the full history, and Mr. Henry F. Schönborn, of that city, kindly undertook, in 1886, to supply Mrs. Peart with eggs, larvæ, and food

ANTHOCHARIS I.

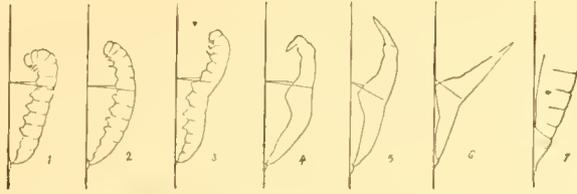
plants, and did so, until the full set of drawings was made, sending day after day one stage or other of the plants. I myself saw none of those larvæ, but received three pupæ from Mrs. Peart which had formed about 22d May. From one of them came a male butterfly 7th March, 1887. The periods of the earlier stages of one example were thus: larva hatched 27th April; 1st moult 30th April; 2d, 4th May; 3d, 9th; 4th, 12th; pupated 22d; at Philadelphia. The plant was *Sisymbrium Thaliana*, described in Wood as growing among rocks and in sandy fields from Vermont to Georgia, and westward to Kentucky, with a stem 4'-12' high.

The present year, 1888, Mr. Schönborn supplied me with eggs and plants, and I immediately found the same plant abundant close by my house. I believe, at one time or other, I had confined females *Genutia* upon every cruciferous plant in the neighborhood but the right one, and had never obtained an egg. This butterfly is rare here, however. The eggs are laid on the flower-stalks, and Mr. Schönborn writes that he has never found more than one egg on a plant, nor more than one larva. He says: "I never found a larva in open fields, although the plant grows there in abundance in large patches. I always found them on isolated plants growing in places sparingly covered by large oaks, hickories, cedars, and other trees." The young larva feeds on the flowers and buds, and as these pass away, on the seed pods, usually beginning at the end of the long, slender pod and eating towards the stem. (See Fig. *g*.) After the plant has gone to seed, Mr. Schönborn says it utterly disappears, and the larvæ never pupate on the plants, but go to the trunks of the nearest trees and there change in the cracks of the bark, or other protected places. The color of the pupa is such that on an oak it would be almost undistinguishable.

I kept my larvæ on growing plants set in a flower-pot and covered by a muslin bag kept upright by sticks, and one morning chanced on a larva in the act of pupating, almost done, while another was just about to begin. Both were attached by buttons of white silk and by girdles to the same stick. The second one at this time was curved from end to end, the head almost touching the stick. (See cut, 2.) Presently it straightened itself and a creeping movement passed from tail to head in a way to loosen the skin from the body, the larva convulsively throwing itself against the girdle, then to the support (3). These throes soon burst the skin at top, exposing the head over which the process was bent down, flattened and small (4). When the cast reached the last segment it was thrown to the ground by a rapid twisting movement of the pupa, and afterwards the same continued for nearly a minute, accompanied by a vigorous pushing downward. This double motion fixed the hooks securely in the button, which was forced into a cup shape, so that it quite sheathed the end of the segment

ANTIIOCHARIS I.

and afforded a firm support (7 magnified). I have not noticed this peculiarity in the shape of the button in any other species. It would be useful, considering that nearly a year must pass before the butterfly will issue. Immediately after



the skin dropped the thorax was a little prominent (4) — no indication of this had been given by the larva — and it enlarged almost imperceptibly, while the dorsum remained arched. This was the attitude up to fifteen minutes. At twenty the depth of thorax was .14 inch; the process .1 inch long, .03 wide at base, partly raised, semi-translucent (being hollow, a thin shell), not yet rounded (5); the abdomen and all the dorsum still retained the larval colors, even to the yellow band, every tubercle and spot having its corresponding pale black spot or point; the wing cases and under side of head and the process dark brown. As the depth of the thorax increased the girdle was tightened, and the dorsum bent in; and when at thirty minutes the projection touched the stick the dorsum was bent in at an angle which fell a segment below the girdle. The pupa had thus assumed its final shape (6), the process meanwhile having straightened, and rounded, becoming .18 inch long and .06 broad at base. The depth of thorax was now .17 inch. At about twenty-four hours the pupa had assumed its final colors, losing the resemblance to the larva. Fig. 1 represents the attitude of the larva for a time before pupation began.

ANTHOCHARIS I.

ANTHOCHARIS LANCEOLATA, 1-4.

Anthocharis Lanceolata, Boisduval, Annales de la Soc. Ent. de France, 2me Ser., X. p. 284, 1852; Mead, Psyche, II. p. 183, 1878. *Edwardsii*, Behr, Trans. Am. Ent. Soc., II. p. 304, 1869.

MALE. — Expands 1.4 to 1.8 inch.

Upper side white, the apical and upper marginal nervules of primaries edged with brown scales; on the arc of cell a sub-oval or crescent black spot; the bases of wings dusted black; fringes white, on primaries brown at ends of nervules.

Under side white, the apical area finely streaked across the interspaces with brown; the discal spot crescent. Secondaries streaked over whole surface with gray-brown, green-tinted, most densely on costal area, lightly over the outer third of wing; near outer angle an oblique pure white band from costal edge to cell.

Body covered with gray hairs beneath, the thorax white, abdomen yellowish; palpi white, the front hairs brown at end; antennæ whitish, club gray-black, yellow at tip. (Figs. 1, 2.)

FEMALE. — Expands 1.7 to 1.9 inch.

Similar to the male; the nervules more widely edged brown, forming long serrations from the margin; across the sub-costal interspaces a loose band of same color. (Figs. 3, 4.)

MATURE LARVA. — “Length 1.25 inch; body rather elongated, tapering somewhat posteriorly from the sixth segment; upper side apple-green, shading off laterally into pale blue, which is bounded by a distinct bright yellow line just above the spiracles; next this line is a slightly broader one of pure white; under side and legs apple-green, the former bluish along middle; each segment is covered with fine black points arranged in transverse rows” (that is, on the cross ridges of the segments); “on each also are six minute black tubercles, each with fine black bristle, arranged in triangle; head rounded, pale green,

ANTHOCHARIS I.

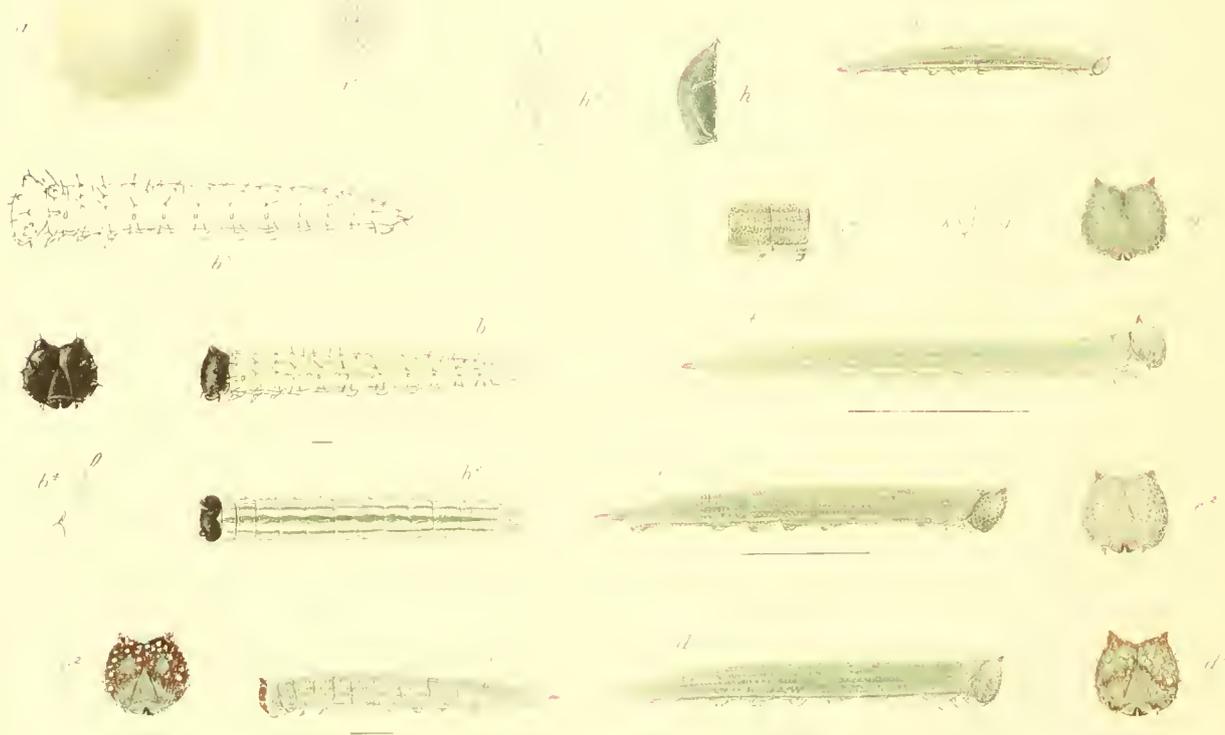
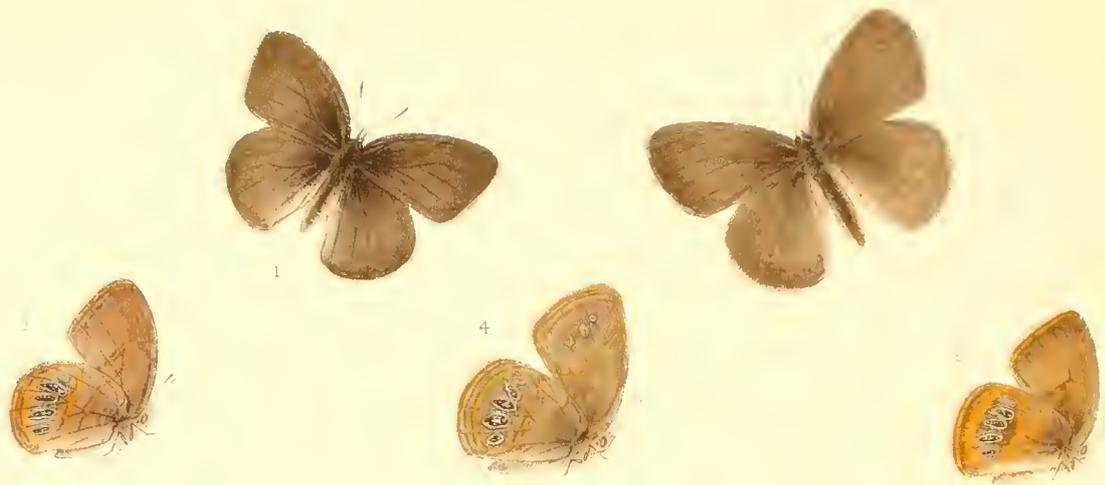
thickly dotted with black." (Mead, Psyche, II. 183, 1878.) The tubercles without doubt are disposed in same way as in *Genulia*, in straight cross rows on 2-4, in triangle after. Mr. Mead was of the opinion, when the above was written, that this larva was *Lanceolata*. He says: "At different times during June, I found, in the Yo Semite Valley, a few caterpillars which I feel certain are those of *A. Lanceolata*." He describes their chrysalids as having "the long palpi case bent around backward into a sickle shape," and this identifies the species. No other Californian Anthocharis has that shape of the chrysalis, and I believe the chrysalids of all except one very rare species are now known. Those bred by Mr. Mead died during the winter, he informs me.

CHRYSALIS.—Length about one inch; slender, the abdomen tapering to a point, the head case surmounted by a long tapering process, which in all examples observed is much recurved; on ventral side the thoracic segments form a prominent rounded projection, compressed laterally and covered by the wing cases; color brownish-yellow, immaculate. (Fig. *x*.)

LANCEOLATA flies in the hills of Marin, Sonoma, and other Counties in northern California. Mr. O. T. Baron found it most abundant in Shasta County. He also took examples near Summit, July 6, 1888, the elevation being 8000 feet. At Bear Valley, altitude 4000 feet, he took a female while ovipositing on *Arabis perfoliata*. Mr. Baron tells me that ten years ago he took this species in Mendocino County early in April, and in Shasta County, at elevation of only 3000 feet, at the end of June, and he believes it to be double-brooded. That is the more probable, as several other of the Pacific species of this genus are known to be double-brooded, as *Hyantis*, *Ausonides*, and *Reakirtii*, *Sava* being the second brood of the latter. The late Mr. H. K. Morrison brought examples of *Lanceolata* from Nevada, and it has appeared in collections from Arizona, but I am unable to give the localities in either region.

NEONYMPHA.

II.



AREOLATUS 12 34 5 VAR 6

12 34 5 VAR 6
 12 34 5 VAR 6
 12 34 5 VAR 6

W. H. & S. N. 178 PHILA.

NEONYMPHA II.

NEONYMPHA AREOLATUS, 1-5.

Neonympha Areolatus, Abbot and Smith, Insects of Georgia, 1. pl. 13, 1797; Boisduval and Leconte, Lepid. de l'Amer., pl. 63, 1833; Edwards, Can. Ent., XIV. p. 163, 1882.

MALE. — Upper side brown, immaculate; fringes concolored. Under side paler, with a gray tint; hind margins edged by a common ferruginous stripe, a little before which is a second, narrower on primaries, often broader on secondaries; on the basal areas two such stripes, not always reaching costa of primaries, nearly parallel, the outer one somewhat sinuous; this outer stripe on secondaries unites at the angles with the second marginal one, and forms an irregular oval ring, within which, in each interspace from the upper discoidal to submedian inclusive, is a sub-oval, mostly long and narrow, dark brown spot in yellow ring, and dotted with metallic bluish points or minute clusters of scales; there is much variation in these spots; the upper one is small and sometimes wanting, and the lower one, or fifth, is much smaller than either of the other three. Occasionally there is a sub-oval ring on primaries also, enclosing one or two small ocelli in the middle interspaces.

Body above, color of wings; beneath, the thorax gray-yellow, abdomen gray-brown; legs brown; palpi buff, with dark brown hairs in front and at tips; antennæ dark above, buff below, club ferruginous. (Figs. 1, 2.) Fig. 5 represents a variety of the male on which the bands of secondaries are diffused.

FEMALE. — Expands 1.7 inch.

Both sides colored and in general banded and spotted as the male, but often the oval ring on primaries and the small spots are present. (Figs. 3, 4.)

EGG. — Sub-globular, as high as broad, the base flattened; surface under a low power smooth, but under a high one seen to be reticulated in irregular shallowly excavated hexagons; the micropyle in centre of a rosette of minute cells, five-sided; color pale yellow-green. (Figs. *a*, *a*².) Duration of this stage about six days.

NEONYMPHA II.

YOUNG LARVA. — Length .12 inch; cylindrical, the thoracic segments equal, then tapering on dorsum and sides to 13, which ends in two short conical tails, from the end of each of which proceeds a long bristle, the space between the tails angular; color delicate green; the upper surface presents six rows of low, conical black tubercles (Fig. *b*¹), each giving out a short black bristle or process, thickened at the end; on 2, 3, 4, these are nearly in cross line, on 4 to 12 in triangle, the dorsal one on front of the segment, the sub-dorsal at the rear, the lateral a little before the middle; on 13 there are eight, in two rows of four on front and rear, besides the pair at ends of tails; on 2 the cross line is to the front, and behind and between the upper pair is an additional one; also in front of spiracle is a small tubercle, and just below it a fine hair; along base of body is a row of fine short hairs, two on each segment from 2 to 13; feet and pro-legs green; head about twice as broad as 2, sub-globose, flattened frontally, a slight angular depression at top; on each vertex a low semi-ovoid process, at the top giving two divergent black hairs; just below vertex is a similar smaller process, and two others in vertical line at side face, each of these with a single hair; color black. (Figs. *b* to *b*⁵.) Towards the end of the stage the color changes to decided green and several longitudinal stripes appear; on either side of the green mid-dorsal one is a whitish stripe, and others on middle of side, and along base. (Figs. *b*, *b*².) Duration of this stage about eight days, but depending on the weather.

After first moult: length .22 inch; slender, the dorsum slightly arched, the tails longer, tapering; color of body green, the tails tinted red; surface thickly covered with fine yellow tubercular points, partly arranged in longitudinal rows, ten in all, one on either side being next the mid-dorsal green stripe, one sub-dorsal, two on side, one along base, each point giving a fine short whitish hair; under side, feet and legs green; head rather ovoidal, truncated, and depressed at top; on each vertex a low compound process, made of a central cone, and others about its base, each with its bristle; surface of face rough with sharp tubercles of varying size, each with short bristle; color of back of head and the front triangle deep green; the rest of the front and the processes on vertices red-brown, with two green patches one on either side the suture; ocelli emerald-green. (Figs. *c*, *c*².) But some larvæ have the head wholly green, the vertex processes reddish; one had a brown band across forehead, the rest green; another had the front face except the triangle brown, the cheeks green. To next moult about nine days.

After second moult: length .3 inch; shape as before; color yellow-green; stripes as before; head as at last previous stage, sometimes wholly green, some-

NEONYMPHA II.

times partly brown; one example had one cheek brown, the other green. (Figs. *d*, *d*².) To next moult about seven days.

After third moult: length .7 inch; color yellow-green. (Figs. *e*, *e*².) In all examples bred by myself this was the closing stage. But Mrs. Peart carried one larva to fourth moult, the length then .96 inch. (Fig. *f*.)

MATURE LARVA (whether after third or fourth moult). — Length 1.1 to 1.3 inch; slender, the dorsum well arched, the slope either way from middle equal; tails slender, conical, divergent; color yellow-green; the surface covered with fine sharp tubercles, most dense in certain longitudinal rows, one of which is on either side of the mid-dorsal dark green stripe, one sub-dorsal running from head to end of tail, two on the side, and a broad one along base; tails reddish; under side, feet and legs green; head obovoidal, truncated, the top depressed angularly; on each vertex a small conical process about the slope of which are several minute tubercles, each giving a short bristle; surface rough with fine green tubercles among which are scattered a few white; ocelli emerald-green. (Figs. *g* to *g*⁴.) The attitude in suspension is that of figure 6, quite unlike that of *N. Gemma*, before described.

CHRYsalis. — Length ♂ .48 inch, breadth at both mesonotum and abdomen .18 inch; ♀ (probably) .54 inch, breadth .2 inch; cylindrical, abdomen conical; the wing cases a little raised on dorsal side; head case very short, scarcely projecting beyond mesonotum, bevelled transversely to a sharp edge, roundly excavated at the sides, the top very little incurved; mesonotum rounded, carinated, the sides flat or a little excavated; color green, the edges of carina, wing cases and top of head cream color; surface much covered with dots and small patches of whitish, not distinct enough to affect the general green hue. Duration of this stage about ten days, in summer. The late larvæ doubtless hibernate when half grown.

AREOLATUS, so far as at present known, is restricted to the Gulf States, and part of Tennessee, and to the southern Atlantic States. A few examples have been taken as far north as Atlantic City, New Jersey. Mr. E. M. Aaron has found the species among the mountains of east Tennessee, and probably it would fly in west North Carolina also. It is difficult to get information about the localities of butterflies from the southern States, so few persons are interested in such matters. Its habits are similar to those of its near ally, *Gemma*. I have never seen it on the wing.

I have had greater difficulty in bringing larvæ of *Areolatus* to pupation than almost any species of the genus I have experimented with. For several years I

NEONYMPHA II.

fed them on lawn grass, which nearly every Satyrid larva in my hands has eaten readily. The eggs of this species in nature are laid on coarse grasses, and at last I found that by selecting one such — *Dactyloctenium Ægyptiacum* — I did better. The first eggs received came 17th August, 1877, from south Georgia, some twenty, and were hatching on arrival. Part of the larvæ got through two moults, but by 30th September all had died.

In 1881, I received three young larvæ from Dr. Wittfeld, Indian River, Florida, but all died before first moult.

In 1882, 30 to 40 eggs came, 12th May, from Mr. J. Elwyn Bates, Florida. On 29th May, two passed first moult; on 30th, of four which endeavored to pass second but one got through, the others dying during the process. By 4th June, there remained eight larvæ in second stage. On 15th, the sole survivor passed second moult, and I sent it to Mrs. Peart, at Philadelphia. This larva passed third moult July 3d, the fourth July 15th, and pupated 28th. This chrysalis died, but was probably female, measuring .54 inch in length against .48, one which produced a male.

The same year I received from Dr. Wittfeld a dozen larvæ in first stage. These I fed on the coarse grass as before said. The first moult was passed 20th July, the second 29th, the third 5th August, and two larvæ pupated 17th August, another 20th. The last of these gave a male butterfly 30th August. Dr. Wittfeld has written me that this species moulted but three times.

Kirby's Catalogue, 1871, calls *Areolatus* a variety of *Phocion*, Fabricius. In the same way *N. Gemma* is there put as a synonym of *Cornelius*, Fabr. The descriptions in both cases are insufficient of themselves to determine what species were meant, and may be applicable to a dozen as well as to those under view, and there are no figures to serve as guide. As regards *Gemma*, I believe it is generally agreed among lepidopterists to begin the history with Hübner's figures and name. As to *Phocion*, as described, it is quite another thing from *Areolatus*. In Sp. Ins. II. p. 138, 1781, the text translated from the Latin reads: "Wings above fuscous, immaculate; hind wings beneath with yellow (*flavis*) stripes and three oblong ocelli. Habitat _____" (that is, unknown); "fore wings beneath fuscous, immaculate; hind wings with four yellow (*flavis*) stripes, whereof the second and third unite at either end, and between them are three much elongated black spots in yellow (*flava*) rings, and with many silver (*argenteis*) points."

The bands of *Phocion* are yellow, and the same word is used as for the yellow rings of the spots; the spots or ocelli are three in number; the points on the spots

NEONYMPHA II.

are silver; and the under side of fore wings is immaculate. Whereas in *Areolatus* the bands are ferruginous, while the rings are yellow, the ocelli are five, the points are metallic blue, and the fore wings are not immaculate, but crossed by the pair of common ferruginous bands, and ocelli are often present. In the female there is an increase in the number of bands on fore wing, and ocelli are present. And whether *Phocion* came from Asia, Africa, or America, was unknown. Abbot figured *Areolatus* ninety-one years ago (1797), and Boisduval and Leconte again in 1833. As *Areolatus* the species has been known to this day. In any case, very much less than ninety years of possession, especially when the title begins with an undoubted description or reliable figure, is sufficient against all claimants. To surrender in favor of a doubtful or forgotten name, accompanied by an inapplicable description, and with no locality, is not to be thought of. I reject *Phocion*, therefore, and have no idea that *Areolatus* is a variety of what Fabricius had in view, or that one name is a synonym of the other.

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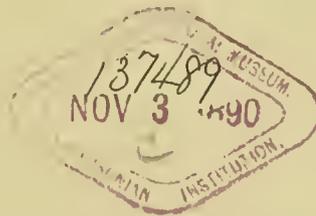
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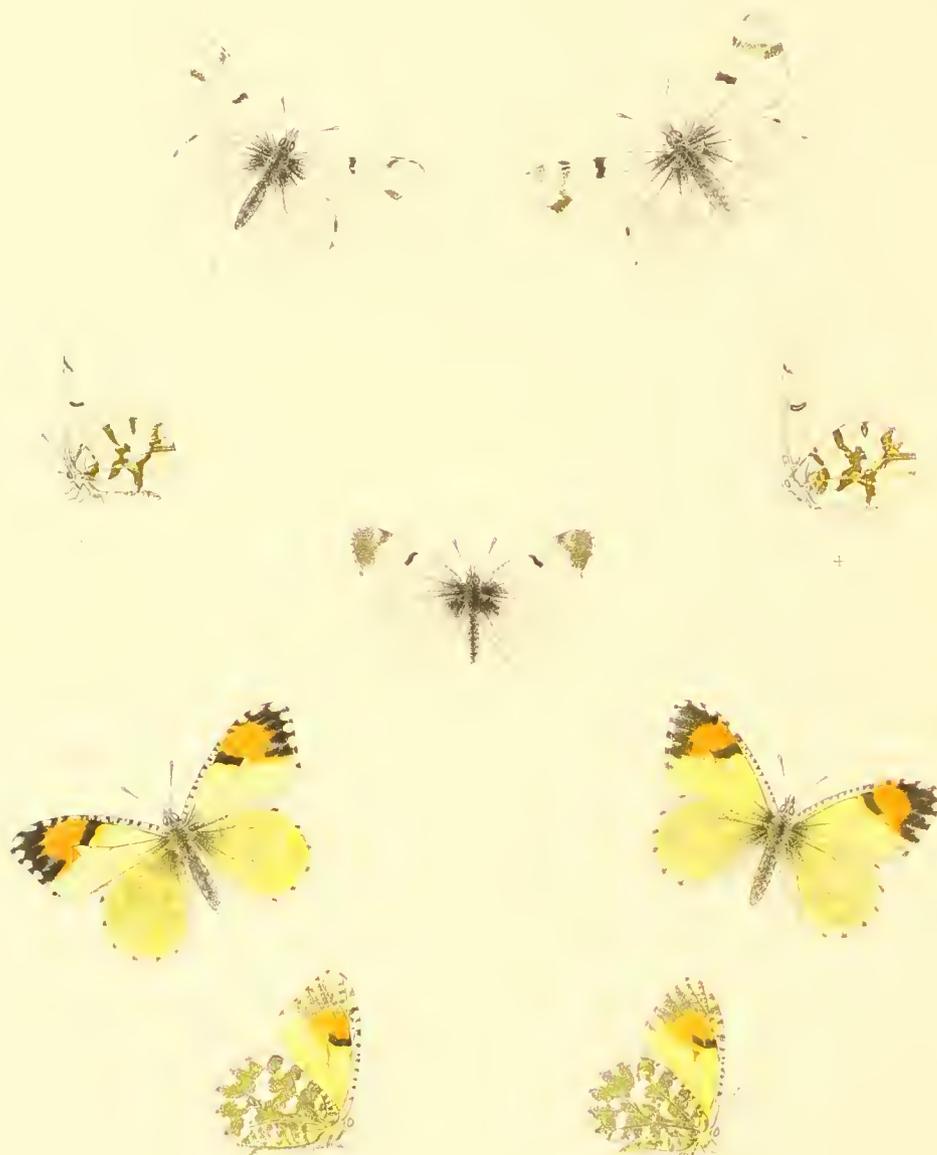
THIRD SERIES.—PART VII.



BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY
The Riverside Press, Cambridge
LONDON: TRÜBNER & CO.
1889

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ANTHOCARIS.
II.



W. McCLELLAN & SON LITH. PHILA.

ROSA 12 ♂ 34 ♀, OLYMPIA 5 ♂
PIMA 67 ♂, 89 ♀.

ANTHOCHARIS II.

ANTHOCHARIS ROSA, 1-4.

Anthocharis Rosa, Edwards, Papilio, II, p. 45. 1882.

MALE. — Expands 1.2 inch.

Upper side of both wings pure white, the bases pale black; costal margin of primaries sometimes immaculate, sometimes much streaked with black; near apex a short straight black bar, turned back obliquely, another bar at the end of upper median nervule; the apical area between these almost immaculate, a few scattered black scales only lying near costa; on the arc a narrow black bar, bent or a little sinuous.

Secondaries of thinner texture, discovering the markings of under side; fringes black at the ends of the two sub-costal nervules, otherwise white, as also on primaries.

Under side white, with a pink tint over costa of primaries and all of secondaries anterior to the sub-costal nervure, deepest next base; the bar on costa repeated, much reduced, the black scales largely replaced by yellow; the bar on hind margin suppressed, but indicated by a patch of yellow; the upper sub-costal nervules yellow, and at the end of each a black streak running with the edge of costa; the discal bar much reduced, paler, and cut by the yellow arc.

Secondaries have three cross bands of luteous-yellow, densely covered with black scales, with some open spaces or patches showing clearly the yellow ground; the anterior band narrow, making a circle about base not always complete; the second, or discal, sends a short stout branch along median to the third, and is attenuated on inner margin; the third has a triple fork on hind margin, is very narrow in middle, and broad on inner margin; at outer angle a wedge-shaped bar; the nervures and branches on middle of the wing yellow.

Body covered with long light-gray hairs, the abdomen gray-white, beneath, the thorax with white hairs, at the sides yellow, abdomen white, faintly tinted yellow; legs pinkish, the femora clothed with long white hairs; palpi white, with

ANTHOCHARIS II.

pale gray hairs at top and sides; antennæ white above, yellowish below; club white above, yellow below and at tip. (Figs. 1, 2.)

FEMALE. — Expands 1.4 inches.

Color of male on both surfaces, and similarly marked; between the ends of the apical bars are black scales in considerable number, suggesting a cross band, and next apex are more such scales than in male. (Figs. 3, 4.)

Rosa was described from 3 ♂ 3 ♀, sent me by the late Jacob Boll, and taken by him on one of his expeditions to the extreme west of Texas, in 1878. He informed me, in answer to inquiry, that he took several more, and all were of the same type, particularly having reference to the markings about the apices of fore wings. The species is very near to *Olympia*, figured in Vol. II of this work. In *Rosa* the apical area is immaculate in the male, except for a few loose scales next costal margin, a little distance from the apex. In the female there are somewhat more of these scales, and a nebulous connection of the two marginal bars. (In the Plate, Fig. 3, this last feature is a little too pronounced, the flecking in the insect being no heavier in this than next the apex.)

The first known examples of *Olympia*, 1 ♂ 1 ♀, were taken at Coalburgh, W. Va., April, 1871. The description soon after published in Transactions of the American Entomological Society, III, p. 266, mentions "a large gray patch at apex, partly replaced by white." — that is, a gray patch with one or more interior spots or patches of white. Nothing is said of a definite bar on either margin. In the insects, which are now before me, the inner edges of the gray patch are somewhat blacker than the rest, especially next the margins, but there is nothing of a definite bar. The description in Volume II was rewritten, and gives the apex as covered by a gray sub-triangular patch, "terminating on either margin in a small spot of darker color;" and the figure of the male accompanying shows a pale patch filling the apical area limited on the margins by spots or clusters of scales of darker color.

Since 1871, *Olympia* has been taken in all the States lying west of West Virginia, to Nebraska, and in Colorado. The species seems particularly abundant at Whiting's, Lake County, Indiana, and I have seen many from that locality. One of these is represented in Fig. 5, and all the Indiana examples which I have seen have been near to this, showing a patch of solid pale black with a small white interior patch next costa in the direction of the base.

In both the descriptions of *Olympia* spoken of, I mentioned a single male as being in the Museum of Comparative Anatomy, at Cambridge, Mass., also from Texas, and by Mr. Boll. This was taken at Dallas, and I considered it to be the

ANTHOCHARIS II.

same as *Olympia*. I have recently asked Mr. S. H. Scudder to look at this insect and compare with the figure of *Rosa*. He replies: "It is almost precisely like your Fig. 1, with the sole exception of the position of the dusky flecks at the extreme tip of the wing, those in Figs. 1 and 3 showing a little bar parallel to the one within, while these were at the very apex itself." From which the Dallas example would seem to be *Rosa*.

It may be that these are properly but forms of one species, *Olympia* the northern, *Rosa* the southern form. As yet not much is known about either, and of *Rosa* nothing but what I have given above. Doubtless they are common in many localities, but flying at the same time with the white Pierids, they are unobserved.

ANTHOCHARIS II.

ANTHOCHARIS PIMA, 6-9.

Anthocharis Pima (pee'ma), Edwards, Canadian Entomologist, XX, p. 158. 1888.

MALE. — Expands 1.75 inch.

Upper side of both wings yellow, the bases pale black; primaries have the basal half of costa white, crossed by irregular black streaks; the apex edged white on both margins, and within this is a series of five large, elongated black spots, almost confluent, filling the interspaces to second median nervule, each projecting a spur to the margin; on the arc a broad, rectangular bar, the area between this and the spots and costal edge intense orange.

Secondaries of thinner texture, discovering the markings of under surface; fringes whitish, a few black hairs at the end of each nervule on secondaries, and many on primaries.

Under side of primaries yellow, the costal margin as above, the apex white, green-tinted, the lower three black spots of upper side indicated by yellow-green, and finely dusted black, the bar repeated, the orange also, but paler and diffused over cell and second median interspace.

Secondaries yellow-white, largely covered by broad patches of yellow-green, which form four irregular, connected, transverse bands between hind margin and base above median nervure; below median to inner margin crossed by stripes of similar color, unequal, mostly wedge-shaped.

Body covered with long gray hairs, which are yellowish at extremity, the abdomen yellow-gray; beneath, the thorax white, abdomen yellow-white; the femora white, other joints buff; palpi white, black at tip, and with black hairs at sides; antennæ imperfectly annulated white and black above, white below; club black above, orange beneath and at tip. (Figs. 6, 7.)

FEMALE. — Expands 1.7 inch.

Same yellow as male; the apical spots larger and completely confluent, the

ANTHOCHARIS II.

orange narrower, paler, the bar less rectangular, broadest on sub-costal; under side as in the male. (Figs. 8, 9.)

Four examples of this species, 2 ♂, 2 ♀, were taken early in April, 1888, by Oscar T. Baron, in Arizona, Pima County, on the barren plains between Pontano and Tucson. It is the only known American Anthocharis in which both sexes are yellow.

EREBIA II.

EREBIA FASCIATA, 1-3.

Erebia Fasciata, Butler, Catalogue of Satyridæ in British Museum, p. 92, pl. 2, Fig. 8. 1868. Edwards, in Report on the Diurn. Lep^a. collected in Alaska, by E. W. Nelson. Washington, 1887.

MALE. — Expands 2.2 inches.

Upper side black, immaculate; fringes concolored. Under side of primaries brown, with a tint of ferruginous over cell; on the extra-discal area a broad ferruginous transverse band from costa to middle of sub-median interspace, both edges crenated; on the costal margin the color of this band is less distinct, rather passing into brown; the discal area, lying between the band and the pale base, takes the shape of a band common with that of secondaries, but very pale; apical area dusted gray.

Secondaries have at base from costa to middle of cell an obscure gray space, the rest of basal area blackish-brown and confluent with a broad discal band of same color which crosses the entire wing, its outer edge irregularly crenated; beyond this a dark gray narrower band, gray scales on brown ground, the outer edge also irregularly crenated; the margin bordered by brown, slightly dusted gray.

Body black-brown throughout; legs brown; palpi black-brown; antennæ black above, gray below; club black above and (apparently so) on under side. (Figs. 1, 2.)

FEMALE. — Expands from 1.9 to 2.2 inches.

Upper side paler brown, the discal area of primaries dull ferruginous over the median and half of sub-median interspaces and lower outer part of cell, nearly as in *Discoidalis*. Under side of primaries very pale ferruginous, the discal band distinct, the apical and costal area to cell hoary. Secondaries have the whole basal area dark cinereous, the discal band blackish, the band beyond whitish-

EREBIA II.

cinereous, the border brown, the exterior part hoary. Antennæ whitish above, ferruginous below, club black above, ferruginous below. (Fig. 3.)

Another female, from Kotzebue Sound, shows a narrow dull ferruginous band above, corresponding to the extra-discal band beneath; on the under side the red is nearly lost, a mere tint; on secondaries the similar band is much narrower than in the male, and the marginal border is proportionately broader, dark gray except a black stripe along its anterior edge; antennæ as in the other female.

Mr. Butler described this species from nine examples, giving "Arctic America" as the locality. He speaks of the antennæ as varying, "black, rarely ferruginous." As I have said above, the antennæ of the single male examined are black, of the two females gray and ferruginous. Mr. Butler sent me two of the Museum examples, by authority of the Trustees, many years ago, and from those the figures on the Plate have been drawn.

The second female is smaller, and shows some variation from the type. Was taken by Mr. E. W. Nelson, at Kotzebue Sound, 14 July, 1881, caught, as he says, in his hat. As Mr. Nelson reports butterflies to have been numerous in that region, *Fasciata* is probably a common species there. I have never seen it in other collections. The resemblance of the upper side of the male *Fasciata* to *Magdalena* is evident.

EREBIA.

II.



TEINCLAIR & SON 117th PHILA

FASCIATA 12 ♂ 3 ♀
DISCOIDALIS 45 ♂ 6 ♀.

EREBIA II.

EREBIA DISCOIDALIS, 4-6.

Erebia Discoidalis, Kirby, ♂, Fauna Boreali-Americana, IV, p. 298, pl. 3, figs. 2, 3. 1837.

MALE. — Expands 1.8 inch.

Upper side dark brown; primaries have a large castaneous patch, which covers half the sub-median and all the median interspaces, as well as lower outer part of cell; costa next base freckled gray and brown, towards apex two or three small gray patches; secondaries immaculate; fringes gray, on primaries brown at ends of nervules.

Under side of primaries brown, the castaneous patch repeated; some examples have this patch diffused so that nearly the whole wing is red; over the hind margin a gray bloom, which becomes strong next apex; the whole costa mottled brown and gray-white; secondaries brown over basal half, mottled and streaked in light and dark, beyond to margin gray, with many transverse brown streaks interiorly; at outer angle a gray-white patch, a smaller one a little nearer base, another on the inner edge of the gray area in discoidal interspace.

Body brown, the abdomen underneath gray; the fore legs brown, the femora of the middle and hinder pair brown, other joints yellow-brown; palpi brown; antennæ imperfectly annulated red and gray, gray beneath; club brown, ferruginous below. (Figs. 4, 5.)

FEMALE. — Expands 2 inches.

Similar to the male. (Fig. 6.)

DISCOIDALIS was described by Kirby from Cumberland House, lat. 54°, several specimens having been taken. In 1863, I received perhaps twenty examples from Mrs. Christina Ross, wife of Bernard C. Ross, Hudson Bay Company agent at Fort Simpson, Mackenzies River, and I do not remember having seen the species since, though many collections on both the west and east coast of America have been submitted to me. Mr. James Fletcher tells me that but a single example has been brought in by the late Canadian Government Expeditions, and that was from Fort Simpson.

GEIROCHEILUS.

II.



EDINBURGH: W. & A. G. BROWN, 1874.

TRITONIA. 12 ♂, 34 ♀.

GEIROCHEILUS I.

GEIROCHEILUS TRITONIA, 1-4.

Geirocheilus Tritonia, Edwards, ♂, Trans. Am. Ent. Soc., V, p. 18. 1874.

MALE. — Expands 2 to 2.3 inches.

Upper side velvety blackish-brown, changing to brown on hind margin of primaries, with an olivaceous tint at apex; costal edge of primaries near apex yellow-white; beyond disk a transverse row of four small white spots set in the middle of the discoidal and median interspaces, the lower one smallest and sometimes wanting; secondaries have a broad dull ferruginous marginal band, running from outer to inner angle, sometimes ending abruptly at lower sub-costal nervule; this band encloses next the margin a series of broad crenations of darker color, the interior of each paler than the edges; on the basal side of the band, and a little within, some examples show two or three white points in the middle interspaces, one to each; fringes of primaries black at the tips of the nervules, yellow-white in the interspaces, of secondaries nearly all black, or brown-black, there being but a few light hairs in each interspace.

Under side smoky-brown; the white spots repeated, enlarged, each forming the pupil of a large rounded black ocellus; secondaries have the band repeated, but the red is brighter and variegated with lilac in nebulous clusters in and next the nervules mostly, and over the posterior half are scattered yellow scales; in the sub-costal interspaces the red is mostly suppressed, and ground is nearly brown; on the basal edge of the band, upon clear red spaces, is a row of yellow points and spots, commencing with a point on the lower sub-costal interspace, and ending at sub-median nervure, just before which are two points. The three spots in the median interspaces are crescent or V-shaped, varying in individuals; the crenations repeated, edged on the basal side by brown, ferruginous elsewhere, and more or less dusted yellow.

Body black-brown, beneath same, abdomen gray-brown; legs brown on upper side, all the joints whitish beneath, the last joint of the front pair entirely white,

GEIROCHEILUS I.

a little dusky on upper side ; palpi whitish, the long hairs in front and at tip brown ; antennæ brown, grayish towards end, gray below, club yellow. (Figs. 1, 2.)

FEMALE. — Expands from 2 to 2.3 inch.

Similar in color and markings to the male. (Figs. 3, 4.)

TRITONIA was first made known by Mr. H. W. Henshaw, of the Wheeler Expedition, 1873, a few examples having been taken among the White Mountains of Arizona. Later, I received others from near Prescott, Arizona. Neither Mr. Morrison nor Mr. Doll, in their collecting trips to that region, fell in with this species, nor was it seen by Mr. Wright or Mr. Baron. It probably is confined to special localities. Of its habits I know nothing, but Mr. Baron writes me of the allied species, *G. Patrobas*, which he took in Mexico, that it flies at an elevation of 6,000 feet, among pine and oak timber, and a thick growth of coarse grass. Its habits may be similar to those of *Satyrus Pegala*, in south Georgia.

These two species constitute the genus. I have a pair of *Patrobas*, sent by Mr. Baron. It is a considerably larger insect than the other, in general similarly marked. The white spots are smaller, the crenated marginal band much wider, occupying fully one half the whole ferruginous area, the ocelli below and their pupils are larger ; on the fore wings there is a lilaceous sub-apical nebula, not found in the other ; on hind wings the variegated area is narrower, more red, less lilac, and becomes obsolescent on the upper half or third to costa ; and the spots of the yellow series are smaller and more regular.

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By SAMUEL H. SCUDDER.

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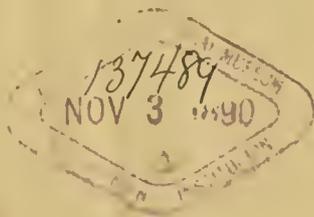
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THE
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NORTH AMERICA

WITH
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BY
W. H. EDWARDS

THIRD SERIES.—PART VIII.



BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY

The Riverside Press, Cambridge

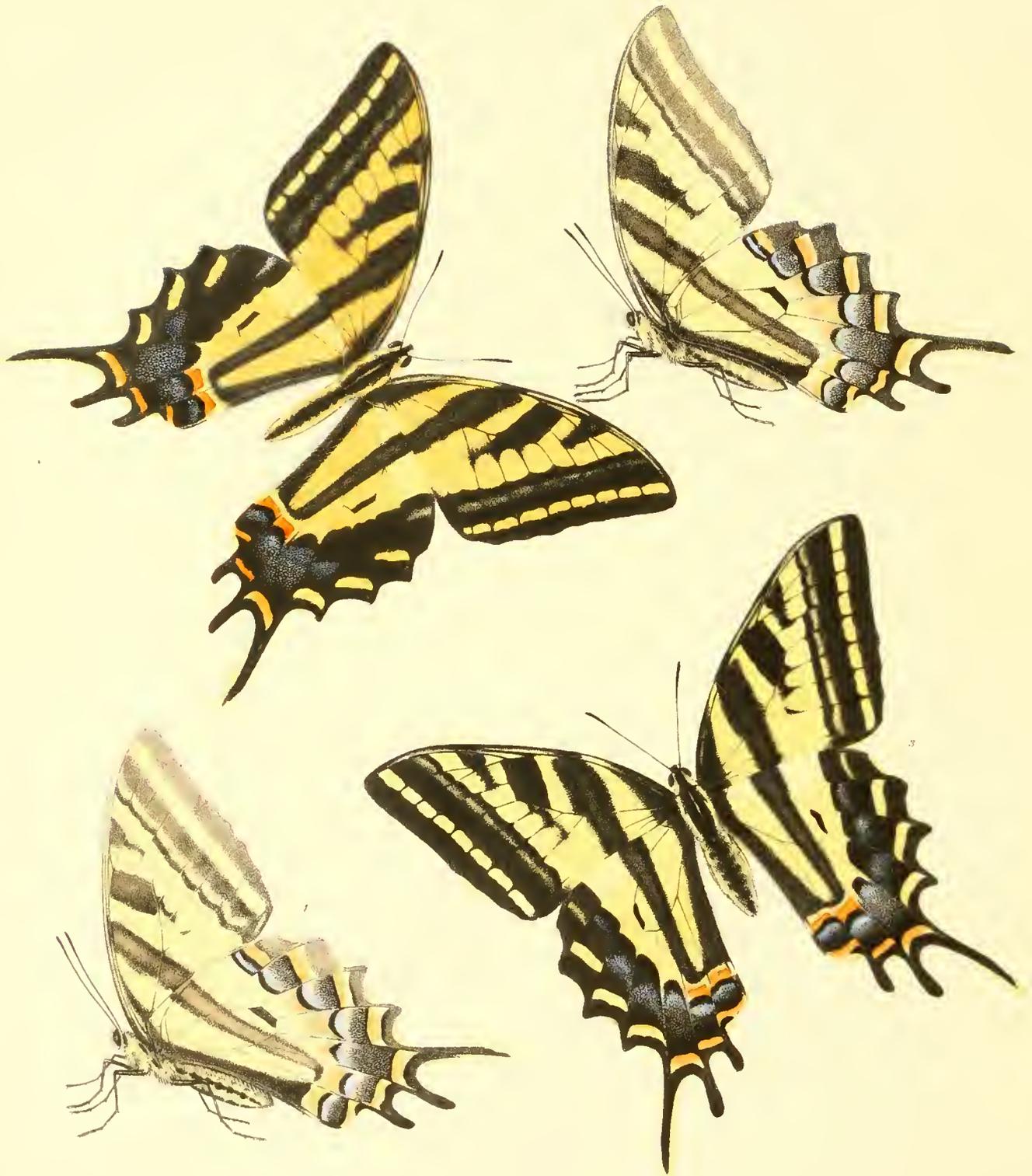
LONDON: TRÜBNER & CO.

1889

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The Riverside Press, Cambridge, Massachusetts, U. S. A.
Printed by H. O. Houghton and Company.



PAPILIO II.

PAPILIO PILUMNUS, 1-4.

Papilio Pilumnus, Boisduval, Spec. Gen., I, p. 340. 1836; Ménétriés, Cat. Mus. Petr., II, p. 110, pl. 7, fig. 2. 1857; Mead, Report on Diur. Lep. of Wheeler Expedns., p. 741. 1875; Strecker, Lep., p. 13, pl. 2, figs. 3, 4, ♂. 1873.

Size and general form of *Damnus*; secondaries with three tails.

MALE. — Expands from 3.8 to 4.25 inches.

Upper side either bright yellow or dark yellow, banded with black much after the pattern of *Damnus*, but there is one band less on primaries; the bands, except the marginal, are also much heavier; costa of primaries black, the space between the nerves mostly yellow; a narrow band covers the bases of wings and the inner margin of secondaries, widening gradually from the median nervure, and ending squarely a little above the marginal band; a second proceeds from costa against the middle of the cell, is broad at first, tapers very gradually on primaries, rapidly on secondaries, and ends evenly with the inner band, the two being connected by a narrow stripe; the third lies on arc of cell, and has a more or less macular extension to the lower median nervule; the fourth is short, and lies across the subcostal nervules to the discoidal; hind margins bordered by a broad band as in *Damnus*, within which, on primaries, is a narrow stripe of yellow, divided into spots by the nervules, and near the inner edge a macular line of yellow scales; on secondaries are five lunate submarginal yellow spots, the two posterior ones washed with red-brown; above the angle the margin is excised and edged with red-brown; above this, and also in the next interspace, is a cluster of metallic blue scales, under which, in the outer interspace, are separated scales both blue and yellow; in the second median interspace is a large loose cluster of yellow, with a few blue at top, and some individuals have small clusters of blue to the costal margin; some also have a yellow streak or small spot in the uppermost interspace in this same line; the exterior tail is long and narrow, the tip pointed, somewhat convex on the outer side, edged yellow on that side near tip and on all the inner side, the yellow more or less washed red-

PAPILIO II.

brown; the other tails are entirely black, rounded at end; the lengths of the three are about as 63; 30; 22; fringes of primaries yellow, of secondaries same in the emarginations, the rest black.

Under side yellow, the black markings repeated, paler; the submarginal yellow stripe broader, and now a continuous band; the line of scales more definite; the interior of the second band yellowish-black through its length; the spots on secondaries much enlarged, all washed red-brown; above each the ground is dusted yellow, with increasing density towards the top, and the series ends in an elongated narrow metallic blue spot, above which the clear black ground shows in a small lunation; the yellow on disk next the marginal band in the median and submedian interspaces washed red-brown.

Body above black, a yellow stripe passing along thorax from head to insertion of wings; beneath, thorax yellow; abdomen yellow, with a ventral black band and lateral line; legs black; palpi yellow; antennæ and club black. (Figs. 1, 2.)

FEMALE. — Expands 4 to 4.5 inches.

Like the male, the red-brown on upper side darker. (Figs. 3, 4.)

Nothing is known of the early stages of this species, nor of the food plant, but probably the larvæ feed on plum, cherry, and, in general, the same plants as *Damnus*.

One or two examples of *PILUMNUS* were brought from New Mexico by the Wheeler Expedition of 1871, as Mr. Mead relates. But what the locality was is forgotten. And the late Mr. H. K. Morrison took one male in Arizona, in 1882, on Graham Mountain, as is believed. I know of no other instance in which the species has been taken within the United States. Its home is in Mexico and Central America. Hearing that Professor Edward T. Owen of Madison, Wisconsin, had seen *Pilumnus* in Mexico and captured many examples, I wrote him for what information he could give me, and his reply was as follows: "My experience with *PAPILIO PILUMNUS* is limited to the region about Jalapa, in the state of Vera Cruz. Some years ago, I took several, mainly at the summit of a sharp hill of two or three hundred feet elevation above the surrounding country. This summit, during the months of February and March, was a trysting place for quite a number of species of butterflies. They seemed possessed with an instinct for mounting, and on reaching this hill would rise along its slope to the summit. Once there, they circled about till the end of the entomological day. Most species showed

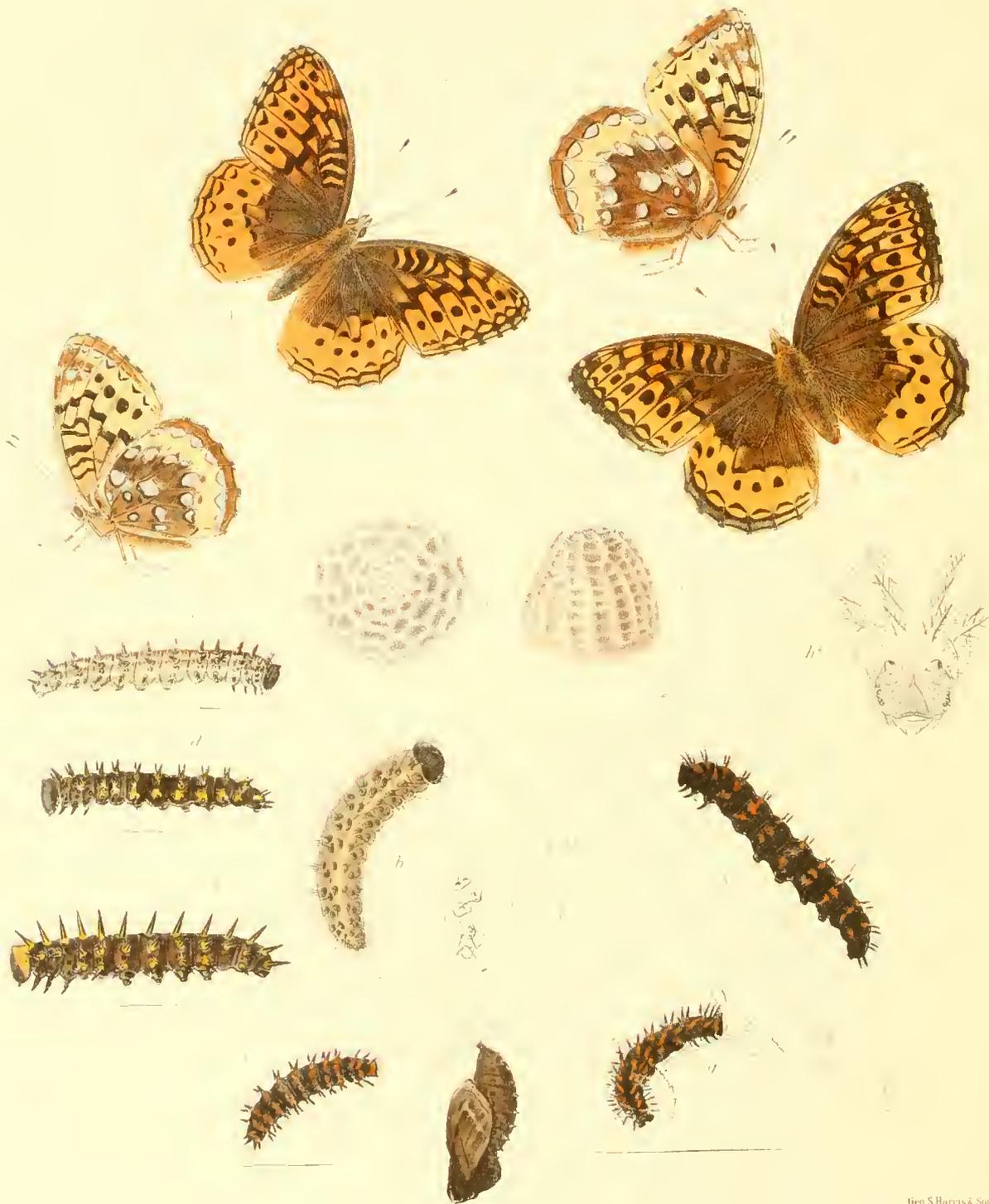
PAPILIO II.

such fondness for the place that they might be relied on to return even if frightened off by an unsuccessful stroke of the net; *Pilumnus*, however, showed more discretion, and once missed by the net, took permanent leave. While watching a beautiful male, as he flitted round the regular course which each species under such circumstances quickly adopts, it occurred to me to utilize the habit of salutation which prevails throughout the butterfly tribe. Accordingly, I took from my box a battered specimen recently caught, and pinned it through the thorax to a switch about five feet long, trimmed to the greatest possible inconspicuousness. With this wand I danced my butterfly up and down, so as to imitate, though feebly, natural flight, and to prevent too easy discovery of its condition. With left hand thus occupied, the right grasping the handle of the net, jealously kept behind me, I watched for a moment when the new-comer's back was turned, and took position on his beat. As he swung down upon me, the thump of my pulse apparently furnished enough appearance of vitality to my decoy; for he started rapidly toward it, settling on it before I was ready with the net. The few seconds, however, necessary to demonstrate the sex of the decoy, enabled me to bag my prize with ease, and without injury to his perfect tails. In this way I caught seven males that day. After this, I kept a damaged specimen on hand, during the rest of my trip, and I rarely missed a butterfly of that species.

“Later, at Queretaro, I tried the same plan successfully with *P. Daunus*; and later still, in Colorado, I caught *Daunus* with a *Turnus* decoy. I intend in future to carry pasteboard and water colors, with a view to imitating, even if clumsily, any rare species which I may find especially difficult to catch. Only males were taken in this way. The females of all these species are more easy of capture on account of their heavier flight and mental preoccupations.” I spoke of this mode of taking Papilios to Mr. David Bruce, and he told me he had used paper decoys with success.

In Papilio IV. p. 100, is a description of what purports to be the mature larva and chrysalis of *Pilumnus*, but there is some mistake in the matter, the stages as described belonging to the *Palamedes* group, and probably to *Palamedes* itself. I have seen the identical pupa which was so described, in the collection of Mr. Henry Edwards, and it is of the form and peculiar character of *Troilus*. Certainly the pupa of *Pilumnus* would be of same character as that of *Daunus*, *Rululus*, and *Turnus*.

ARGYNNIS.
 XI.



Geo. S. Harris & Sons Lith. Phila.

CYBELE VAR CARPENTERII. 12 ♂. 34 ♀.

Cybele *carpenterii* *var. carpenterii* *var. carpenterii*
Larva *carpenterii* *var. carpenterii* *var. carpenterii*

1874

ARGYNNIS XI.

ARGYNNIS CYBELE, 1-4.

Argynnis Cybele, Fabricius; Edw., *But. N. Am.*, I, p. 67, pl. 21. 1868; id., *Can. Ent.*, VI, p. 121. 1874; xii, p. 141. 1880; Scudder, *But. N. E.*, p. 589, pl. 4. 1889. CARPENTERII, Edw., *Tr. Am. Ent. Soc.*, V, p. 204. 1876.

Var. CARPENTERII.

In Volume I, I gave what information was at that date attainable respecting the distribution and habits of CYBELE. Examples of the species have since come from Montana, locality unknown, but supposed to be Helena, and from Fort Niobrara, Nebraska. These are the extreme western limits recorded. Mr. Scudder states that it has been taken, at the north, in Alberta; at the east, at Cape Breton. His map, Plate 21, showing distribution, draws the western line through middle of Dakota, Nebraska, and Kansas; and the southern line with the south line of Virginia and Kentucky. But I have seen examples from the collection of Mr. E. M. Aaron, which were taken at Maryville, east Tennessee. Mr. Aaron reports *Cybele* also from Highlands, Macon County, North Carolina, the extreme southwest of the State; also that he has taken it in considerable numbers at Elizabeth City, at the lower end of the Dismal Swamp. The species is so far unknown in the Gulf States and Texas.

Mr. Scudder says, p. 559, that in New England *Cybele* is scarcely larger than *Aphrodite*. Examples from Maine which I have seen are often very small, dark above, and the under side of hind wings is usually quite dark brown, the females especially so. Those taken in West Virginia, on the contrary, are large, with heavy black lines on upper side, and the hind wings beneath are red-brown. In Nebraska and Montana, the size is about same as at the east, but the fulvous color is brighter, more red, and the under side is very light, near to cinnamon-red, — so far as the examples seen by me show.

I described *Carpenterii* as a distinct species, near to *Cybele*, and was influenced in the determination by the fact that *Cybele* was not known to fly within hum-

ARGYNNIS XI.

dreds of miles of New Mexico. The examples, two males, one female, were taken by Lieut. (now Captain) W. L. Carpenter, U. S. A., in New Mexico, above timber line. I wrote, in 1887, for further information, and Captain Carpenter replied: "The *Argynnis Carpenterii* were collected on Taos Peak, about 12,000 to 13,000 feet elevation. I saw several others at same time. I had collected the preceding year, in Colorado, above timber line, without seeing it." On reading this, I wrote Prof. F. H. Snow, who has collected butterflies extensively and during several seasons in New Mexico, Colorado, and Arizona, to ask if he had ever seen this butterfly, or *Cybele*, in those regions. To which he replied that he had not, but had never been on Taos Peak. I have also inquired of every person I knew of as having collected among the high peaks of Colorado, Messrs. Bruce, Snow, Mead, Nash, particularly, but no one had seen the species in that State. Just so as to Arizona. The case therefore is peculiar. A colony of a strictly northern butterfly is evidently imprisoned on the summit of a lofty mountain far to the southwest. In New England and New York, as well as in Virginia, *Cybele* does not fly at even moderate elevations, but in the lowlands; on the higher ground it is replaced by *Aphrodite*. If this colony on Taos Peak could descend, we may be sure they would do so. That they do not shows that either the climate forbids or their food plant is wanting. Violets are common plants among the mountains of Colorado and Arizona, and both States are remarkably rich in species and individuals of *Argynnis*. The conditions are plainly unfavorable to the spread of *Cybele* to the south and southwest, and that it has not done so is the more singular, inasmuch as the largest and handsomest examples are those found near the southern limit. Probably it cannot live or perpetuate its kind on the hot sandy soil of the extreme south, or the burning plains of Texas. We may infer that this colony in New Mexico was cut off from the main body when the climate was changing, and the species was retreating to the north, after the manner so graphically described by Messrs. Grote and Scudder in the case of *Chionobas Semidea*, a species which was left stranded on the summit of the White Mountains of New Hampshire.

These specimens of *Carpenterii* in coloration as well as size most nearly resemble their congeners from the extreme east of New England, and differ widely from western examples.

DESCRIPTION OF THE PREPARATORY STAGES OF CYBELE.

EGG. — Conoidal, truncated, and depressed at top, broad at base, the breadth equal to the height; marked by about eighteen prominent, vertical, slightly wavy ribs, half of which extend from base to summit, and form around the latter a serrated rim; the others end irregularly at two thirds to three quarters the

ARGYNNIS XI.

distance from base; the broad, rounded spaces between crossed by nearly equidistant low ridges; micropyle in the middle of three rows of small rounded cells, outside of which are rings of cells of irregular sizes, mostly five-sided; color yellow. (Figs. *a*, *a*².)

YOUNG LARVA. — Length at 12 hours from egg .07 inch; cylindrical, stoutest in middle, the last segments tapering rapidly; color dull green, translucent; marked by eight longitudinal rows of dark subtriangular tuberculous spots, three being above the spiracles on either side, and one below; these spots are flat and bear small conical tubercles, those of the upper, or dorsal, row two of the next two rows, one, of the infrastigmatal row four, and each tubercle gives out a long tapering clubbed hair; on 2, on either side, is a large spot, corresponding to the spots of the upper two rows of other segments, and bearing three tubercles and hairs; the dorsal spots are near the front of the segment, the subdorsal beyond the middle to the rear, the lateral a little in front of the middle, and the lowest row on the middle; under side, feet and legs green; head a little broader than 2, rounded, slightly bi-lobed, with a few hairs from fine tubercles; color black-brown. (Figs. *b* to *b*³.)

After 1st moult: Length .13 inch; stoutest in middle; color dull green mottled with brown, the latter taking the form of macular longitudinal stripes; spines disposed as in the genus, tapering, black, rising from black tubercles, except those of the lateral row, which have yellow tubercles; each spine ending in a short black spinule and beset by several others about the sides; feet black, pro-legs greenish-brown; head sub-cordate, the vertices rounded, at top of each, on the front side, a little conical black process, the front flattened, and showing many black hairs; color shining black-brown. (Fig. *c*.) To next moult eight to twelve days.

After 2d moult: Length .24 inch; color chocolate-brown, the lateral spines pale yellow at base and for one third up; the upper rows have the bases more indistinctly yellow and then mostly on the outer sides, the inner being nearly or quite black; spines otherwise shining black, the bristles black; head as before; color shining black. (Fig. *d*.) The next moult four to nine days, according to the state of the weather.

After 3d moult: Length .4 inch; color dark velvety brown; the spines black; all of the laterals yellow at base and for about one third up; the subdorsals distinctly yellow at base on the anterior segments, the yellow gradually fading to

ARGYNNIS XI.

the last segments; the dorsals also distinctly yellow on anterior segments, the last wholly black; the dorsal spines on 2 are directed forward, but are no longer than others; head as at next previous stage, black in front, but yellow behind; all yellow is reddish, or honey-colored.

At this stage there was some variation in individuals in the color of the spines. One had all yellow at base except the dorsals on 2 and 12, which were black. (Fig. *e*.) To next moult five to eight days.

After 4th moult: Length .6 inch; color velvet-black; laterals wholly bright yolk-yellow; subdorsals same on anterior half, the remainder duller yellow; dorsals bright yellow on anterior half, but after 6 less so, and on 9 to 12 black; in line with the dorsal spines on segments from 3 to 11 two gray dots; head as before.

Another larva had all three rows of spines largely reddish-yellow fully half-way up from base; the last two pairs of dorsals shading into brown. (Fig. *f*.) To next moult four to eight days.

After 5th moult: Length 1.1 and 1.2 inch. (Fig. *g*.) Reached maturity in six to eight days.

MATURE LARVA. — Length 1.8 inch at rest, 2 inches in motion; greatest breadth at rest .35 inch; color velvety black, under side chocolate-brown; between each pair of dorsal spines from 3 to 11 two gray dots transverse; the spines throughout slender, beset with short black bristles; the bases of all spines reddish-yellow, and for about two thirds up, the rest shining black; the spines of 2 wholly black, a little recurved, directed forward, but no longer than other dorsals; the longest dorsals .14 inch; feet and pro-legs black; head small, .14 inch wide, and equally high, subcordate, the front flattened, finely tuberculated, the back much rounded, the vertices sub-conic, and each on its anterior side giving a small black conic process; the face much covered with black hairs of irregular length; color of front dull dark brown, of back reddish-yellow. Several larvæ were as described, others showed much less yellow on the spines; the laterals always largely yellow, the subdorsals much less so, the dorsals a little yellow at base from 3 to 6, after that less and less, changing gradually to brown, and on 11 to 13 black. In from two to three days after maturity the larvæ suspended, and in about twenty-four hours pupated. (Fig. *h*.)

CHRYsalis. — Length 1.1 inch; breadth at wing-cases .4, of abdomen .36 inch; cylindrical, a little compressed laterally; head case prominent, nearly square at top, the vertices being but very slightly elevated, transversely rounded

ARGYNNIS XI.

to the ridge at summit, the sides bevelled; mesonotum moderately prominent, rounded, carinated; followed by a deep rounded depression; the wing cases with prominent conical processes at base, much elevated above surface of body, the outer edges flaring, the middle part depressed; on the abdomen two rows of small tubercles corresponding to the dorsal spines of the larva, and which extend to the head case; one row of minute tubercles on each side; the whole surface finely corrugated; color variable, being sometimes glossy dark brown, with a fine mottling of reddish-orange, not distinct, over wing cases and anterior parts; or dark brown mottled with drab, this last prevailing on the wing cases; or dark brown mottled with lighter brown, most distinctly light at margins of wing cases, where they pass down to surface; or almost wholly dead-leaf brown, a little obscure on wing cases; the anterior abdominal tubercles usually black in front, yellow behind, the posterior tubercles wholly black. (Fig. *i*.) Duration of this stage sixteen to twenty days.

In the text to *Argynnis Diana*, page 147, Volume II, 1876, I gave a general account of raising larvæ of *Cybele* from egg. In the *Canadian Entomologist*, XII, p. 143, 1880, I gave farther observations, and related that up to the preceding winter I had always lost most of the larvæ of this species, as well as *Diana* and *Aphrodite*. They died off during the winter, or during the stages in spring, or in chrysalis, and I had been unable to contrive any successful mode of carrying the larvæ through. But, in fall of 1879, it occurred to me that freezing them solid might be the proper thing, and I sent several larvæ of *Cybele* to Professor Fernald, then at Orono, Maine, to be placed in his ice-house. They were in small paper pill-boxes, the unglazed sides of which afforded foothold. These were put in a flat tin box and deposited in frozen sawdust under the ice, as Professor Fernald informed me. Five months later, on 5th March, 1880, I received the boxes by mail. The larvæ were nearly all alive, and when first seen, several showed some movement, though only three days from the ice. Others were lethargic some hours longer, but next day all had left the boxes and betaken themselves to the plants of violet among which I had laid them. They crawled to the stems and down to the bases in the hollows, and there rested when not feeding. On 10th March, one was found to have passed the first moult, several days in advance of any other, and this one continued in advance to maturity, passing second moult 18th, third 27th, fourth 4th April, fifth 12th, suspended 23d, pupated 24th April, and gave a female imago 14th May. The whole period from ice to imago was seventy-three days. The other larvæ passed first moult 19th March, second 29th March to 2d April, third from 4th to 6th

ARGYNNIS XI.

April, fourth 11th to 12th. fifth from 16th to 19th April, and the butterflies came out from 12th to 27th May. After the first moult I lost no larvæ. Before that there had been some loss, mostly, I thought, from their having been brought to a warm room too soon after I received them. These imagos were all of large size, equalling any ever seen here in the field. Comparing the stages of these frozen larvæ with others which in previous year I had carried through winter in a cool room: —

ICED LARVÆ.	BROUGHT FROM COOL ROOM.
Time from removal to 1st moult, 8 to 18 days	44 days and upwards.
“ “ 1st moult to 2d, 8 to 12 days	17 “ “ “
“ “ 2d “ to 3d, 4 to 9 days	11 “ “ “
“ “ 3d “ to 4th, 5 to 8 days	12 “ “ “
“ “ 4th “ to 5th, 4 to 8 days	14 “ “ “
“ “ 5th “ to chrysalis, 9 to 12 days	12 “ “ “
“ “ chrysalis to imago, 16 to 20 days	24 “ “ “
Total period, 73 to 86 days	134 “ “ “

Evidently the freezing served as a tonic, and the larvæ subjected to it were in a healthy condition. Since 1880, I have been in the habit of freezing hibernating larvæ of all species, and have been very successful in rearing them to imago.

The early brood of *Cybele* appears here about the first of June. In some seasons they are quite abundant, but in others rare. For twenty years I have recorded the first appearance. The earliest date for the male has been 19th May, the latest, 17th June; the females always a few days later than the male. Soon after 1st July they are all gone. About 15th August, fresh males appear again, and then the females, and both are exceedingly plenty in September, the males disappearing about middle of the month, the females, some of them, living till frosts come in October. Eggs can always be got during September, by confining the females over violet. In one instance, 219 eggs were laid by a single female. When several are confined together, the bag and plant and earth are sprinkled with eggs. It would seem as if there must be two broods of the imago, one in June, the other in August, but two months do not give sufficient time for eggs to be laid and larvæ to mature and for the pupa stage. The shortest period for the egg has been twelve days, for the larval stages and pupa seventy to eighty. Of course, the hot weather between June and September might accelerate all stages, if eggs were laid in June. I never saw a mature egg in any female dissected in June, nor could eggs be obtained in confinement. In June, 1887, the species was plenty, and I shut up nine females on 29th; but failed to get an egg.

ARGYNNIS XI.

and dissection showed no formed eggs, nothing but fatty masses. In 1874, I endeavored to find out how long after the females of the fall brood appeared, mature eggs were formed. The first one was seen 16th August. On 20th, I dissected three, and in all, the eggs were soft and unformed; on 26th, they were soft, but had form; on 3d September, were firmer; on 17th, were fully mature, and a day or two after, many were laid. So that nearly a month seemed to be required for eggs to mature. At Coalburgh, all the larvæ have gone into lethargy at once on leaving the egg. But the late Mr. C. G. Siewers, of Newport, Kentucky, a first-rate observer, with whom I corresponded about the peculiarities of *Cybele*, wrote me, 30th October, 1877, that two eggs gave two larvæ, one of which fed up to and past second moult, and had gone to the base of the plant to hibernate. In 1881, 28th October, he wrote that he found a larva, ten days before, under rotten wood; that it was one half inch long (which would make it past third moult). To see if it would feed, he trimmed a violet stock and laid it by the larva. On 26th, he went again to the woods and found the larva, which had eaten holes in two leaves and then hidden itself in a crevice so that only its spines protruded. It may be, therefore, that some larvæ in West Virginia, from eggs first laid, pass three or four stages in the fall, and so begin the next year a month in advance of the main body of the species. This will account for the early butterflies. But why June females have not laid eggs is not easy to conjecture. Mr. Siewers wrote in 1876, that, on 24th June, he took a pair in copulation; they separated in the net; he kept the female five days, and till she died, got no eggs, and found none in the abdomen. On 25th June he caught another pair, which separated after three hours, and the result was the same.

As I have said, females are often to be seen flying late in the fall, and until frosts destroy them. This is long after all males have disappeared. I believe these females to be barren, or who have not had an opportunity to mate, and so live much longer than the rest of their sex, for the females of all species of butterfly die very soon after their eggs are exhausted.

I have rarely seen a larva of *Cybele* in natural state, but on two occasions found one hibernating at the top of the root of a violet plant which I had dug up to set in pot for my larvæ. Once, in March, I found one on under side a grass leaf in a bit of sod I had taken up, and it must have spent the winter there. On 16th May, 1888, a mature larva was found on the under side of a lath which was lying on the ground. This larva died, but had it pupated, the imago would have come out about 10th June.

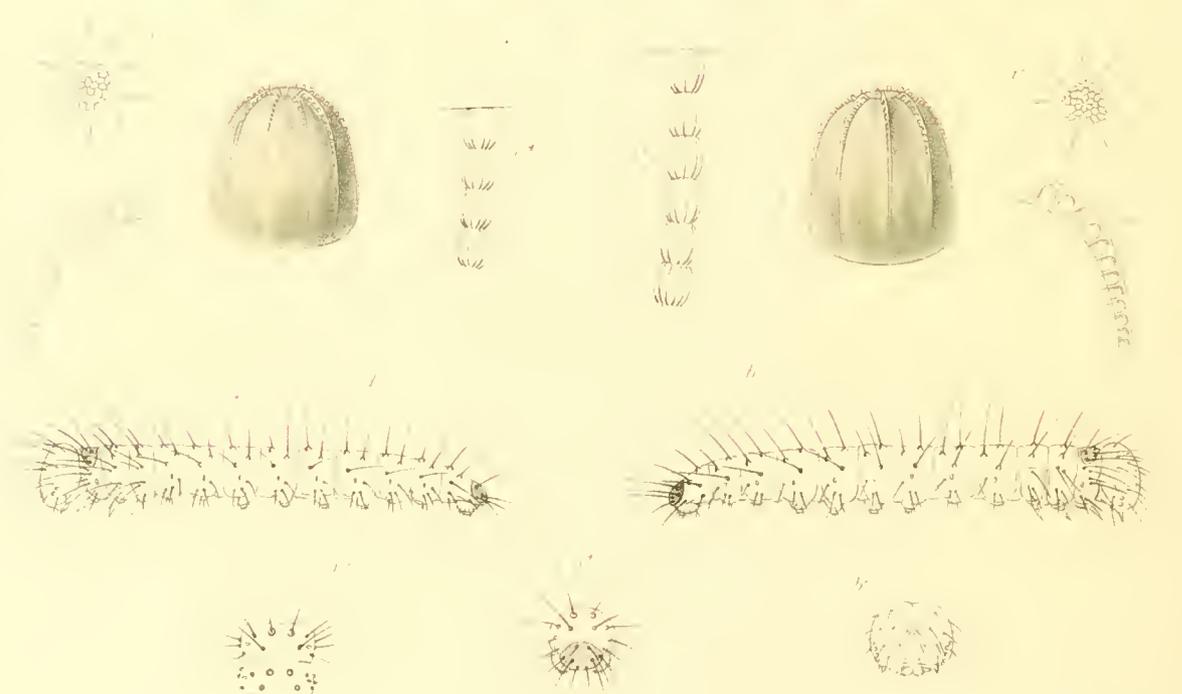
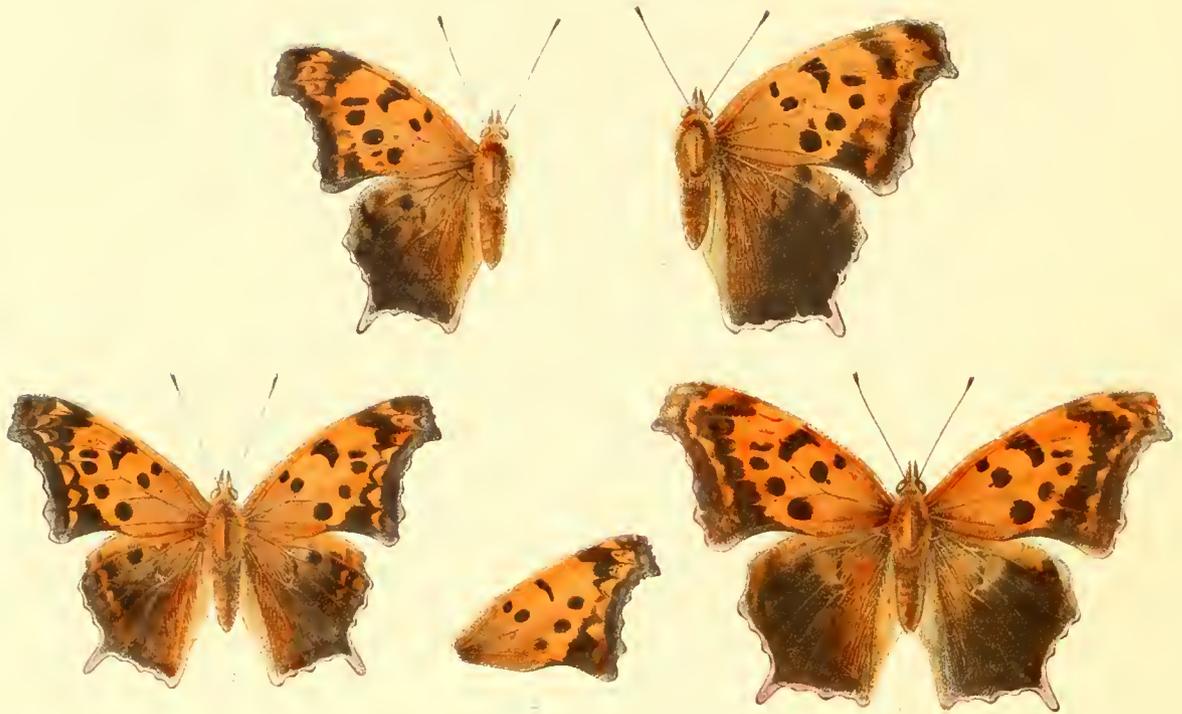
The caterpillars feed on every kind of wild or cultivated violet or pansy, and the flowers are eaten with avidity. In moulting, the skin bursts below the head, along 2 to 4, and the three pairs of legs are extricated first, the head being bent

ARGYNNIS XI.

back by the tension of the skin on dorsum, so that the legs are lifted up in the air, with much struggling to free the head and to burst the skin along dorsum. The spines lie flat and back and rise slowly as the skin slips off them, and the bristles, which are in pencil, separate slowly as they dry. At first every spine is yellow to base and the head also dull yellow, but all become dark in a few hours. The June butterflies are particularly fond of *asclepias* flowers, and may often be picked off by the finger, seeming besotted with the liquid they feed on, in the same way as *Turnus* and other *Papilios*.

Mr. Scudder says, *But. N. E.* p. 561, that *Cybele* is single-brooded in New England, appearing the last of June ; that the eggs are laid about middle of August, and the insects are on the wing till middle of September, or occasionally later.

GRAPTA.
I.



Geo S Harris & Sons Lith Phila

INTERROGATIONIS 1 ♂, 2 ♀.

- a Egg
- b Larva (young)
- c Egg Comma
- d Larva (young)

CHANGED BY COLD 3 4 ♂. 5 ♀.

magnified

GRAPTA I.

GRAPTA INTERROGATIONIS, 1-5.

Grapta Interrogationis, Fabricius.

Form FABRICII, Edw., *But. N. A.*, I, pl. 39, p. 115. 1872; Scudder, *But. N. E.*, I, p. 319. 1889.

Form UMBROSA, Lintner; Edw. l. c., I, pl. 38, p. 111. 1872; Scudder, l. c. 1889.

THE preparatory stages of this species were but imperfectly described in Vol. I, and therefore I now give them fully.

EGG. — Conoidal, the base flattened and rounded; marked by from eight to eleven thin vertical ribs, which near the base are low, but from about the middle begin to rise, increasing gradually, and terminate around the rim of the summit with an incurved slope; these ribs have their sides scooped in grooves perpendicular to the surface, the grooves enlarging as the rib deepens; micropyle in centre of a rosette of six minute pentagonal cells, outside of which are two and partly three rings of larger cells, irregularly five-sided; color pale green. Duration of this stage three to four days in summer, in April and May about ten days, depending on the weather. (Figs. *a* to *a*⁴.) (The egg of *Umbrosa*. Fig. *b*. pl. 38, Vol. I, is not good, nor even of proper shape, though drawn by so excellent an artist as Mr. Konopicky.)

YOUNG LARVA. — Length, at 24 hours from egg, .1 inch; cylindrical, even from 2 to middle, then tapering slightly to end, the dorsum falling rapidly on the last segments; on 2 is an oval chitinous patch on which are eight tubercles, four on either side the mid-dorsal line, three in front, and one behind and between the upper pair, each with long, tapering black hair, turned forward over the head; on each segment from 3 to 13 are six conical tubercles, forming as many longitudinal rows, three on either side, a dorsal, sub-dorsal, and lateral; on 3 and 4 they are nearly in cross line, the lower one on each and the corresponding one on 2 replaced by a pair of minute ones close together, on 2 a little above the line; but from 5 to 13 in triangle, the dorsal one standing on the front ridge, the sub-dorsal on the rear, the lateral a little before the middle

GRAPTA I.

of the segment, all these except the laterals on 2 to 4 with long tapering hairs, those on front segments turned a little forward, on the middle upright, after 6 more or less recurved; the hairs on 2 to 4 are short, turned down and forward; on 2 to 13 is a row of minute tubercles running with and behind the spiracles except on 2, two to the segment on 2 to 4 and on 13; on 2 the pair stand before and a little above the spiracle, oblique to the line, and the hairs of these are unequal, the upper one being one third as long as the other, turned down and forward; the other hairs of this row are turned down and back; along base from 2 to 12 is a row, also minute, two to the segment, the middle ones nearly in horizontal line, on other segments the hinder one a little elevated, the hairs short, depressed; at base of each pro-leg a fine depressed hair, on 13 four such in line; on 3 and 4 similar hairs, but from minute tubercles; on 13 a chitinous sub-oval shield on which are eight tubercles and hairs, two dorsals in front, two on rear, two at each side, corresponding with the sub-dorsal and lateral rows; color of body at first whitish-yellow, semi-translucent; feet and legs same; some examples have the dorsum crossed by brownish patches alternating with the yellow of the intermediate segments; as the stage proceeds the color changes to red-brown with white on dorsum of 4, 6, 8, and 10, individuals varying, however; head rounded, very little broader than high, the top depressed slightly; color shining black; furnished with several small black tubercles, in four pretty regular cross rows; one row near top of four, of which the largest is in front on the middle of the lobe, the other round the side; one across middle of eight, one below this of six, all these minute; and one over mandibles of four, still small; each tubercle with its short black depressed hair. Duration of this stage three days in May, two in summer. (Figs. *b-b*¹.)

After 1st moult: Length .14 inch soon after the moult, in 24 hours .20 inch; slender, even; color red-brown, with indistinct whitish lines; of these, a wavy line runs with second laterals; from base of each first lateral is an oblique line outward to the front of the segment, and from each dorsal are two such lines, one on either side; armed with seven rows of spines, one dorsal and three on either side, as in the genus; these are short, stout, black, beset near top with short branches, with some spinules on the sides; on dorsum of 2 is a transverse row of four short, simple spines; as the larva approaches second moult, the bases of the dorsal and first lateral spines become white or yellow, or reddish-yellow, while the color becomes more red, and the lines become more distinct; legs and feet dark brown; head rounded, depressed at top, the vertices a little produced, each bearing a stout, thick, black process, with conical spine at top, and shorter ones around the base of this; color black, with many black hairs. Duration of this stage from two to three days.

GRAPTA I.

After 2d moult: Length .24 inch; color black, the lines as before, with the addition of one running with lower laterals, more distinct, often macular; spines as before, but variable in color; in some examples, all are black except the dorsals and first laterals on 4, 6, 8, 10, where they are reddish-yellow; some have the spines on these rows light, except on 9, 11, and 12; usually the second laterals are black and the lower row is pale yellow; in all cases the tips are black; as the stage proceeds the color of body changes to olive-brown, and the lines become more conspicuous; head as before, much covered with white simple spines. Duration of this stage from two to three days.

After 3d moult: Length .5 inch; color black, with cream-white lines, quite macular; spines very variable; some examples have every spine of the upper five rows reddish to reddish-yellow, the lower laterals pale yellow; some have the dorsals and first laterals from 3 to 11 red, the rest and all of second laterals black; some have the body color vinous instead of black, with no black spines, the upper rows very red anteriorly, the lower laterals yellow; the lines yellow; head either deep brown red, or decided red in the vinous larvæ, the processes red, with spines both red and black; the spines on face yellow or white. Duration of this stage two to three days.

After 4th moult: Length .9 inch. In two to three days is fully grown.

MATURE LARVA. — Length 1.3 to 1.5 inch; cylindrical, stout; the color very variable; some are dull black with white, yellow, and red tubercles on the cross ridges, and longitudinal lines and bands of red and yellow; there being a band along the basal ridge, a stripe running with second laterals, an oblique line from base of each first lateral outwards to the front of the segment, and one from either side of each dorsal also to the front of the segment; some are very black, the tubercles yellow, no lines or stripes above the basal ridge; some are russet, the lines and stripes obliterated, the tubercles yellow and red; and there are intermediate variations; under side black-brown; spines long, slender, tapering, with several spinules at top, one being a continuation of the spine, the others arranged somewhat irregularly; these are of about equal length in the several rows; others, which are shorter, are found on the sides of the spines, and are particularly numerous on the upper rows of the anterior segments; the dorsals have five main spinules, the first laterals six, the second and lower laterals four and five; in most examples the dorsals and first laterals are red, except on 3, where they are red with black bases, and on 11 and 12, where they are usually black, the red being deepest on anterior segments; the second laterals are sometimes all red, and the lower row is always yellow (but in the varieties of this

GRAPTA I.

larva there is great variation in the color of the spines from deep red to yellow); over the feet from 2 to 10 is a simple red spine; on 2 is a dorsal row of six simple black spines; spiracles conspicuous, black in white rings; head obovoid, rather flattened, deeply cleft, the vertices high, and each bearing a stout and black process, ending in a long spur, with five others about its base, each hair-tipped; the face covered with simple spines and tubercles, some minute; on each side below vertex are four long spines, black, the rest are mostly white, each with hair; color either deep red-brown or red, about the ocelli a large black patch. From 4th moult to pupation, five to six days.

CHRYSA LIS. — Length 1 inch, greatest breadth .3 to .32 inch; cylindrical; head case prolonged, compressed transversely, at each vertex a long conical process; mesonotum elevated, the carina prominent, thin, nose-like, more rounded on the anterior side than in *Comma*, followed by a deep depression; wing cases raised, flaring at base, compressed in middle, with a prominent point on the margin on dorsal side; on the abdomen three rows of tubercles, those corresponding to the dorsal row of the larva minute, to the first laterals large and conical, the pair in the middle of the series particularly prominent; those in the excavation gilded; color variable, in shades of brown from light yellow to dark, often clouded with olivaceous or lilac; sometimes a dark green stripe on the side of abdomen beyond wings. Duration of this stage from seven to eleven days, according to the weather.

INTERROGATIONIS is both sexually and seasonally dimorphic. Mr. Scudder, *But. N. E.*, I, 329, has thus spoken of this peculiarity: "The two forms differ so greatly and constantly from each other, not only in coloring but in the form of the wings, and even in the abdominal appendages, that they have been considered distinct species; in each form, too, the sexes differ considerably in the coloration of the under surface of the wings, so that the species includes four sets of individuals, which may be distinguished quite as readily as a great many acknowledged species of the best studied faunas." Also, page 317: "Here is an insect where there are two very distinct forms in each sex, and in each of which the sexes are readily distinguished by the coloration of the wings; they differ in the brightness and variegation of the lower surface of both wings, and the obscurity of the upper surface of the hind pair, . . . not only differ in the markings of the wings, but also in their form, and in the structure of the genitalia."

Part 9, Volume I, which contained the two Plates of this species, appeared early in 1872. I had established the fact of seasonal dimorphism the preceding summer by raising larvæ of the June and July broods from eggs laid by the form *UMBROSA*, in both cases finding the two forms among the resulting imagos. In the

GRAPTA I.

Canadian Entomologist, X, p. 69, 1878, I gave a statement of farther observations to date, and said that, at Coalburgh, W. Va., there were three broods of the imago annually in descent from the hibernators, and an effort, more or less successful, towards a fourth, depending on the temperature in the fall months and the consequent length of the mild season. That some individuals hibernated, and the females surviving laid their eggs in the last days of April or early in May. From these eggs came butterflies the last of May or first of June. That the second laying occurred in June and the butterflies therefrom appeared early in July; that the third laying took place the last of July and the butterflies appeared in September, some as early as the first, others late in the month. That females of this brood, which is the third of the year, laid eggs about the middle of September, and the butterflies from them came out in October. But that the larvæ were now liable to be caught by cold weather and destroyed, or the food plant was cut off, and so they starved, the result being that few could reach chrysalis and imago. And that I was inclined to think that the butterflies of the third brood did not hibernate, and the continuance of the species here depended on the few individuals which survived from the earlier imagos of the fourth brood. In no other way could I account for the scarcity of this species in spring as compared with *G. Comma*. There then followed a statement of the several lots of eggs I had bred from up to end of 1877.

Four years later, in same magazine, XIV, p. 201, 1882, I brought the history to date, and stated that the hibernating form was *Fabricii*, but that I had seen one *Umbrosa* flying so early in the year that it also must have hibernated. That on the only occasion on which I had been able to get a hibernated female of *Fabricii* to lay eggs in confinement, the result was wholly the other form, *Umbrosa*. That eggs laid by the females of *Umbrosa* of the first brood in descent from the hibernators had produced either a mixed brood or all *Umbrosa*. That eggs laid by the females of *Umbrosa* of the second brood in descent from the hibernators had also produced a mixed brood, with a greater proportion of *Fabricii* than in the preceding brood; and that eggs laid by *Umbrosa* of the third brood, or larvæ found late in the year, had in all cases produced *Fabricii* only. Also that all the butterflies so far seen late in the year had been of the form *Fabricii*.

I now bring the observations spoken of together, and supplement them with others to end of 1888. As will be seen, the eggs, save in one instance, have been laid by *Umbrosa* females. That is because in all these years (since 1870) I have found no *Fabricii* females to breed from, while from July to September, in every year, *Umbrosa* is in abundance. Nearly all the *Fabricii* I have seen have been late in the fall, though the result of breeding in summer shows that there must be many *Fabricii* flying.

GRAPTA I.

FIRST BROOD: Eggs laid by FABRICII.

1877, 28th April, obtained eggs from ♀ *Fabricii* in confinement. Result, about 4th June, 21 *Umbrosa*. This was the only ♀ *Fabricii* I have ever been able to take and breed from. (Where the word "about" is used, a few days before and after the given date is meant.)

SECOND BROOD.

1871, 4th June, eggs laid by ♀ *Umbrosa* in confinement. Result, about 1st July, 11 *Umbrosa*, 6 *Fabricii*.

1869, 5th June, found larvæ. Result, about 25th June, 26 *Umbrosa*.

1873, June, found larvæ. Result, last of same month, 19 *Umbrosa*.

1870, 4th July, found eggs. Result, 10th August, 1 *Umbrosa*, 2 *Fabricii*.

1878, 27th May, obtained eggs from ♀ *Umbrosa* in confinement. Result, about 22d June, 54 chrysalids, from which came 38 *Umbrosa*, 11 ♂ 27 ♀, and 16 *Fabricii*, 14 ♂ 2 ♀.

1879, 3d June, eggs from ♀ *Umbrosa* in confinement. Result, about 21st June, 16 pupæ, which were placed on ice. From these came but 3 ♂ 4 ♀, all *Umbrosa*.

1879, 20th to 28th July, found eggs and larvæ. Result, 65 *Umbrosa*, 28 ♂ 37 ♀, 4 *Fabricii*, 3 ♂ 1 ♀.

1879, 20th July, eggs from ♀ *Umbrosa* in confinement. Result, 21 *Umbrosa*, 7 ♂ 14 ♀.

1881, 7th July, found larvæ. Result, 8 *Umbrosa*, 2 ♂ 6 ♀.

1887, 23d June, eggs from ♀ *Umbrosa* in confinement. Result, about 13th July, 41 pupæ, from which 22 *Umbrosa*, 12 ♂ 1 ♀, 9 *Fabricii*, 8 ♂ 1 ♀.

1888, 24th July, eggs of ♀ *Umbrosa* in confinement. Result, about 9th August, 10 *Umbrosa*, 9 ♂ 1 ♀.

That is, 11 UMBROSA to 6 FABRICII.

26	"		
19	"		
1	"	"	2
38	"	"	16
7	"		
65	"	"	4
21	"		
8	"		
22	"	"	9
10	"		

Total, 228 UMBROSA to 37 FABRICII;

GRAPTA I.

or of the former 86 per cent., of *Fabricii* 14 per cent. Of the eleven broods six produced *Umbrosa* only, five both forms.

THIRD BROOD.

1870, 1st August, found larvæ. Result, about 13th September, 6 *Umbrosa*, 16 *Fabricii*.

1871, 29th July to 5th August, confined several ♀ ♀ *Umbrosa*. Result, about 1st September, 63 *Umbrosa*, 34 *Fabricii*.

1877, 15th August, found larvæ. Result, about 22d September, 2 *Umbrosa*, 9 *Fabricii*.

1878, 16th August, eggs from ♀ *Umbrosa* in confinement. Result, about 19th September, 1 ♀ *Umbrosa*, 20 *Fabricii*, 7 ♂ 13 ♀.

1881, 2d and 3d August, found eggs and larvæ. Result, about 1st September, 46 *Umbrosa*, 17 ♂ 28 ♀, 6 *Fabricii*, 5 ♂ 1 ♀.

1887, 10th to 15th August, found larvæ. Result, from 15th to 22d September, 6 *Umbrosa*, 9 *Fabricii*.

That is, 6 UMBROSA to 16 FABRICII.

63	“	“	34	“
2	“	“	9	“
1	“	“	20	“
46	“	“	6	“
6	“	“	9	“

Total, 124 UMBROSA to 94 FABRICII ;

or *Umbrosa* 57 per cent., *Fabricii* 33 per cent. Every lot produced both forms.

FOURTH BROOD.

1872, 10th October, found larvæ past third moult. Result, 8th to 18th December, 4 *Fabricii*.

1879, 1st September, eggs from ♀ *Umbrosa* in confinement. Result, to 8th October, 25 *Fabricii*, 10 ♂ 15 ♀.

1879, on 19th and 26th September, 2 ♂ *Fabricii*.

1887, 8th October, from three found larvæ, 3 *Fabricii*, 2 ♂ 1 ♀.

1878, 8th September, found larvæ. *Result, about 3d October, 10 *Fabricii*, 6 ♂ 4 ♀.

That is, 4 FABRICII.

25	“
2	“
3	“
10	“

Total, 44 FABRICII, no UMBROSA.

GRAPTA I.

This goes to show, therefore, that in the first brood from the hibernators the form *Umbrosa* was produced to the total exclusion of *Fabricii*. Although this brood was raised but in one instance, we may conclude with much probability that the result in several instances would be the same, inasmuch as where the species is but two-brooded, the first in descent from the hibernator is *Umbrosa*, with very rarely an exception. In the second brood *Umbrosa* preponderated largely, as 86 to 14, and six lots produced that form only, five lots both forms. In the third brood there were fewer *Umbrosa*, the proportion being as 57 to 43, and every lot, whether raised from eggs or from found larvæ, was made up of both forms. In the fourth brood all were *Fabricii*.

I think it probable that some few of the later individuals of the third brood hibernate. This would account for an occasional *Umbrosa* seen late in the year or early in the spring, and which therefore would be a hibernator. Also it would preserve the species when the fall is cold and unpropitious for the production of a fourth brood, as it apparently sometimes is. The season of 1888, at Coalburgh, during all September, was cold and wet, and the leaves of Elm and Hackberry fell early in October, so that no larva of a fourth brood could have reached pupa on those plants — and in the fall there are no other food plants. If the species is not extinct the coming spring (1889), it would seem to be because some imagos of the third brood were able to hibernate.

In Florida there must be at least four full broods of *Interrogationis*, as the season is much longer at each end than in West Virginia. On 28th September, 1880, I received twenty-five half-grown larvæ from Indian River, sent by Dr. Wm. Wittfeld. These were passing the fourth moult on 8th October, and between the 12th and 17th November, 16 *Fabricii* came out, and no *Umbrosa*. (By an oversight, in *Can. Ent.*, XIV, p. 206, this is stated as 25 instead of 16.)

Individuals sometimes occur which are intermediate between the two forms of this species. One such I have seen from the collection of Miss Morton, and another I am told is in the collection of Mr. Neumoegen. The shape is of *Fabricii*, and the color of under surface as well, but the hind wings on upper surface have the black of *Umbrosa*.

It is interesting to compare the history of a species like the present in several localities, especially with the more northern. In the lowlands of New York, *Interrogationis* seems to be three-brooded. Miss Morton says there are three broods at Newburgh. On June 11, 1886, 15 to 20 larvæ, one third grown, were found. All the butterflies from these, coming out from July 7th to 20th, were *Umbrosa*. This was the first brood. All butterflies seen on the wing the last half of August were *Umbrosa*, and Miss Morton considered them to be the second brood. All seen the last part of September and in October were *Fabricii*, the third brood.

GRAPTA I.

Professor Lintner, in *Trans. Am. Ent. Soc.*, II, p. 315, 1869, says of the species: "During the first week of July, 1861, there were brought to me, at Schoharie, N. Y., 14 larvæ and chrysalids. The larvæ were mature and in a day or two pupated. The imagines proved to be every one of the 'black variety' (*Umbrosa*), 3 ♂ 11 ♀." This of course was the first brood. "About the middle of July several other seemingly identical larvæ were taken by me, which, emerging the last of the month, gave the ordinary *Interrogationis* (*Fabricii*)." This would be the second brood. "I collected, on August 10th, two chrysalids and twenty larvæ from one half inch to nearly full size. During the ensuing two weeks many additional larvæ were taken by me," etc. As the result, about 110 *Interrogationis* (*Fabricii*) were obtained and not a single *Umbrosa*. These would be the third brood. In the same paper, Mr. Lintner speaks of the rarity of *Umbrosa*, and says "it seldom falls into the hands of a collector." This was at Schoharie, in the heart of the Hop region, and was written before the seasonal dimorphism of the species was known, and when the two forms were recognized as distinct species.

Mr. Scudder, *But. N. E.*, I, p. 330, says there are but two broods in New England. "The eggs laid by the hibernating females produce nearly but not all *Umbrosa*, and the eggs of the last brood almost invariably only *Fabricii*." And he gives the experience of Professor Carl Braun, of Bangor, Maine, as decisive. But the experience of Mr. F. H. Sprague, in eastern Massachusetts, also given, seems to show that in that State there are three broods. "Mr. Sprague's experience tells the same story, excepting in 1887, when, he writes me, 'the August brood was mixed, about evenly divided between the two forms.' He adds that the later ones, which he looks on as a third brood, were *Fabricii*, though an *Umbrosa* was reared the last week of August; so, too, I bred, about the middle of October, a single male of the form *Umbrosa*." Mr. Sprague's observations go to show that the first brood is *Umbrosa*, the second mixed, the third *Fabricii*. Mr. Lintner's second brood came out all *Fabricii*, and Miss Morton's all *Umbrosa*. It is much to be wished that a series of careful observations of this species, with breeding from the egg, could be made in the region of three broods, as in New York, for satisfactory comparison with those to the north and the south, the two and four-brooded regions.

I wrote Professor Braun for the particulars of the broods raised by him at Bangor. On the 12th June, 1886, he shut up a female *Fabricii*, and by 19th (keeping the insect alive by feeding it molasses) there were 110 eggs. These hatched from 27th to 30th June, and the larval stages required 17 days, the pupal 5. This brings the emergence of the imagos to middle of July. The result was *Umbrosa*, except 2 ♂ *Fabricii*. This was the first brood in descent.

GRAPTA I.

Professor Braun writes that the same year, by 10th August, he had 24 eggs laid by *Umbrosa*, and the butterflies from them came out between the 20th and 25th September, and were all *Fabricii*. He adds: "There are only two broods of this insect in Maine."

As stated, Mr. Scudder had an *Umbrosa* from pupa in October. Miss Morton saw a fresh *Umbrosa* in northeastern New Jersey, 14th October, 1888. I myself have seen an *Umbrosa*, at Coalburgh, which had hibernated. But these are exceptions to the rule that the last brood of the year from Maine to Florida, in regions where there are two, three, and four broods, is *Fabricii*.

According to Mr. Scudder, *Interrogationis* is very rare north of the boundary line of the United States, and then only in Ontario and Quebec, in the latitude of New England. So that nowhere in its territory is the species represented by a single form.

Where a species is already two-brooded and the length and warmth of the season permits a third brood, the original hibernating form would seem to be the one to lay eggs from which would come the hibernating imagos. In the present case, *Fabricii* being the hibernator where there are but two broods, the first in descent will be *Umbrosa*, the second *Fabricii*, this last hibernating. If there are to be three broods, the *Fabricii* would seem to be the form to lay eggs, and these might be expected to produce *Umbrosa* as the hibernators. If a fourth brood was reached, *Fabricii* would be the hibernator as it was at first, when the species was two-brooded. That is, we should expect the odd broods to be *Umbrosa*, the even *Fabricii*. But it is found that in all latitudes, in New England, in Virginia, in Florida, the original winter form remains the winter form, and the middle one of three broods, or the second and third of four broods, are made up of both forms. These interior broods seem to be interpolated between the original summer and winter broods. Apparently, the heat of summer disposes to *Umbrosa*, while the tendency to alternate produces *Fabricii*, and the result is a mixed brood. But late in the season, one tendency overcomes the other, and the last brood everywhere is *Fabricii*.

In Vol. I, I gave the food plants as Hop, Elm, Nettle, and *Boehmeria*. To these I add Hackberry, *Celtis*, of any species, but the preference is for the two first-named, Hop early in the season, Elm in August and September. I have near my house a preserve of Elm sprouts which are cut down in July, to be soon replaced by a fresh growth. It is on the tender terminal leaves of these that the female prefers to lay her eggs, usually on the under side of the leaf, either singly or in strings of two to eight. I had supposed the number of ribs

GRAPTA I.

in all eggs laid by one female was the same, but Mrs. Peart found that in a string I sent her the topmost egg had eleven ribs, while all the rest had but nine, as shown on the Plate, Fig. *a*⁴. The young larvæ do not consume their egg shells, as many species do. They eat holes in the leaf, each for itself, and during the first two stages feed about the margins of these. During all stages they are unprotected, except as they lie beneath the leaf. They are not gregarious as a rule, though doubtless where the species is abundant, and the food plant local, their numbers may suggest gregariousness. But so many as are hatched on the leaf keep together for two or three stages, then scatter about the plant.

GRAPTA INTERROGATIONIS.

ON THE EFFECT OF COLD APPLIED TO THE CHRYSALIDS OF GRAPTA INTERROGATIONIS.

INTERROGATIONIS has proved susceptible to the influence of cold. In *Psyche*, Vol. III, p. 15, 1880, I related this at length. The same account was given in the Appendix to Weismann's "Studies in the Theory of Descent," Part I, p. 149, 1880, London. I have thought it well to publish Plates of the species affected, showing the changes brought about, and the present is the first of the series. Figs. 1, 2, show the upper sides of the normal male and female. Figs. 3, 4 ♂ 5 ♀, changed examples. Eggs of form *Umbrosa* were obtained from females in confinement, June, 1879. As the chrysalids formed, at intervals of from six to twenty hours after pupation, they were placed in the ice-box. At fourteen days, all but five were removed, these being left six days longer. Several were found to be dead at the end of the fourteen days. The temperature most of the time was about 35° Fahr. (1.7° C.), but a little higher each day, as the ice melted, reaching then 40° to 45° Fahr. (4° to 7° C.). From the first lot were obtained seven perfect butterflies, 3 ♂ 4 ♀, from the twenty-day lot five, 4 ♂ 1 ♀. All were form *Umbrosa*, and nearly all had been changed in one striking particular. In the normal *Umbrosa* of both sexes, the fore wings on upper side have, on the costal margin next inside the broad border of the hind margin, and separated from it by a considerable space of fulvous, a dark patch which ends a little below the discoidal nervule; inside the same border, at inner angle, is a similar patch, lying on the submedian interspace. Between these two patches, across all the median interspaces, the ground is fulvous, but very slightly clouded with black, often so slightly that it would not be noticed. Now, in all four of the females exposed to cold for fourteen days, there is present a broad black band which crosses the entire wing, continuous, of uniform shade, covering the two patches as well as the intervening clear space, and almost confluent with the marginal border from end to end, only a streak of obscure fulvous anywhere

GRAPTA INTERROGATIONIS.

separating band and border (Fig. 5). The other spots on same wing are not at all changed.

In the fifth female, the one from chrysalis exposed twenty days, the band is present, but while it is broad and crosses the space between the patches, it is not continuous, but includes on its outer side a series of obscure fulvous lunules. While it may have been changed, there is no certainty of it, because individuals are sometimes bred or taken having the same peculiarity. One such is figured in Vol. I (Fig. 3, Pl. 39).

In all the males, the patches are diffused, those at the apices almost coalescing with the borders. In the three from fourteen days' exposure the patches are connected by a narrow band (Fig. 3). In the four from twenty days this band is macular but decided (Fig. 4). As in the females, all the change is limited to the extra-discal area of fore wing. In the females no change was noticed on under sides. In the males, perhaps none also in the markings, but it was stated in the first account that the colors of all were intense, with more red than in a series of natural examples. But the delicate shades are evanescent, and to-day I do not see the peculiarities I noticed two years ago. For this reason no figure of the under side is given.

It appeared, therefore, that fourteen days was as effective in producing changes as a longer period. In fact, the most decided change was found to have taken place in the females which were exposed the shorter period. Also that cold, in case of this *Grapta*, changed certain markings only, and that the females were most susceptible to the influence.

In 1878, I had put chrysalids of *Grapta Comma* on ice at from ten minutes to six hours after pupation, some therefore being quite soft and none fully hardened, and lost every one of them. This led me to expose the *Interrogationis* in 1879, at from six to twenty hours from pupation, after hardening had taken place.

One object I had in view in these experiments was to learn whether exposing the summer chrysalids would result in producing the winter form of the butterfly (*Fabricii*). But all were *Umbrosa*.

I should have continued these experiments in subsequent years, but at Coalburgh we rarely have ice.

GRAPTA I.

GRAPTA COMMA.

Grapta Comma, Harris.

Form HARRISII, Edw., *Can. Ent.*, V, p. 184. 1873; *Comma*, Edw., *But. N. A.*, I, pl. 36. 1871; id., *Can. Ent.*, XIV, p. 189. 1882; Fernald, *But. Maine*, p. 52. 1884; French, *But. Eastern U. S.*, p. 185. 1886; Scudder, *But. N. E.*, I, p. 332. 1889.
Form DRYAS, Edw., *Trans. Am. Ent. Soc.*, III, p. 17. 1870; id., *But. N. A.*, I, p. 109, pl. 37. 1871; Scudder, l. c. 1889.

THE stages of this species also were imperfectly described in volume I.

EGG. — Conoidal, the base flattened and rounded; marked by from eight to eleven thin vertical ribs, which near the base are low, but from about the middle begin to rise, increasing gradually, and terminate about the rim of the summit with an incurved slope; these have their sides grooved as in *Interrogationis*; the micropyle in centre of a rosette of minute five-sided cells, about which are two or three rings of larger cells; color pale green. (Fig. c.) Duration of this stage, at Coalburgh, W. Va., five days in April, four in July.

YOUNG LARVA. — Length, 12 hours from egg, .08 inch; in shape and clothing in all respects like *Interrogationis*, as before described; color whitish-green; feet and legs green; head rounded, the top depressed slightly; color dark brown. (Fig. d.) Duration of this stage, four days in April, two days in July.

After 1st moult: Length .13 inch; color either brown-black, or black with whitish lines at the junction of the segments; the spines short, stout, black, and set with short divergent bristles; in the individuals which have white lines, on segments 4, 6, 8, 10, the spines spring from whitish tubercles, on the other segments from black; in the black examples all tubercles are black; on 2 are four small spines in cross row on the chitinous band; a row of small spines over legs and feet; feet black, pro-legs olivaceous; head round, depressed at top, the vertices a little produced, each bearing a short, thick process with short spines at top; color of head and processes dark brown; many black hairs over face

GRAPTA I.

springing from black tubercles. Duration of this stage, three days in April, two in August.

After 2d moult: Length .3 to .33 inch; same shape; color dark olive-brown or black-brown or reddish-brown, individuals varying; the spines longer, and at one third from the top give off branches; the posterior end of each segment after 2 crossed by two or three fine white lines; in front of the medio-dorsal row of spines are two oblique divergent whitish bars, and one such bar from base of each spine in first lateral row on outer side; the spines vary largely in color, some larvæ having all the spines black, some have the dorsal and first lateral rows on 5th, 7th, 9th segments white, the rest black; some have white from 4 to 11; some have white on 9 only; on 2 a collar of black simple spines; head broader than high, the top rather square, not much depressed, the processes larger, but similar to preceding stage, crowned with six points, one in middle, the rest about it; surface glossy black, with many simple spines, of different sizes, usually all black, but some examples show a few white among the black; each with long hair. To next moult, in May three days, in August two days or somewhat less.

After 3d moult: Length .38 to .4 inch; color black, crossed on the posterior end of each segment with two or three lines or stripes of white, sometimes more or less macular and varying much in width; the oblique marks on dorsum as before, more conspicuous; a yellow band runs along base in line with lower lateral spines, and the posterior part of each segment above this band shows an oblique bar, and some white spots and points; the spines as before; the medio-dorsal row always white; those of first lateral row usually white, but sometimes on 3 are black, or partly black; some examples have the second lateral row wholly black, others white, or some of the last spines are parti-colored; head as before, the white spines predominating largely. To next moult, in May three days, in August two days or somewhat less.

After 4th moult: Length .8 inch; in three days reaches maturity.

MATURE LARVA. — Length 1 inch; cylindrical, stout; the color varies much, some examples being cream-white, some greenish-white, with almost no markings, or the markings are obsolescent; others are velvet-black, the dorsum crossed by white stripes on the posterior edges of the segments, with two white divergent bars meeting at a small angle in front of each dorsal spine and running to the anterior edge of the segment, and with a similar oblique bar from each spine of the first lateral row on the lower side of it; along base is a raised

GRAPTA I.

yellow ridge, and from this up to second laterals the ground is crossed by abbreviated white stripes or patches, particularly on the last half of the segments; above this the side is black; but individuals vary in the extent of this black area, and sometimes the same area is vinous-red; the spiracles black in broad white rings; at the bases of the second laterals, from 9 to 11 or 7 to 11, is usually a fulvous or orange patch, varying in extent; the spines long, tapering, each with from three to five spinules a little below the summit and one which is the prolongation of the spine itself; those of the dorsal and upper lateral row are largest and longest, each with five spinules, besides one or two lower down, and some very small ones nearer base; those of second lateral row are of medium length, with four branches; and those of the lower row are shortest and have three and four branches; in the green and white varieties all the spines and branches are whitish or yellow, in the black, the spines are yellow, mostly black-tipped, but those of first lateral row are sometimes black to their bases, those of second row sometimes wholly, sometimes but partly black; 2 has a collar of six simple spines, and two others are on each side; under side either greenish or brown-yellow; head rather square, higher than broad, with high vertices; in the light examples the color of head is dull pink, in the dark ones black, shining, sometimes with a forked whitish stripe down front; on each vertex a short, stout process, cylindrical, compressed in the middle, broad at the top, crowned by five equal, blunt-tipped spines around a sixth in the middle; each with hair; these processes are black in the black larvæ, and in the light ones either red or red with black tops; face and whole head thickly covered with simple white spines of variable length, all white, except that sometimes there are one or two of the longer ones on side face below the vertex which are black, or black and white; along back of head and down the sides is a row of these spines close set. From fourth moult to pupation five days.

CHRYSA LIS. — Length .8 to .9 inch; greatest breadth .24 to .26 inch; cylindrical; head case high, compressed transversely; at each vertex a long, conical process; the mesonotum elevated, the carina very prominent, thin, nose-like, followed by a deep excavation; wing cases raised, flaring at base, compressed in middle, with a point on the margin; on the abdomen three rows of tubercles, those corresponding to the dorsal row of the larva small, to the first laterals large and conical, the pair in the middle of the series particularly prominent, and those in the excavation silvered, gilded, or bronzed, varying; color variable, many examples being dark brown, with lighter or with yellow-brown, and much reticulated with dark lines; others are dead-leaf brown; others are light, up to dead-white, shaded slightly with yellow-brown, with a bronze lustre over the wing cases and anterior dorsal parts. Duration of this stage about seven days.

GRAPTA I.

The two forms of this species were figured and described in Volume I as distinct. In Canadian Entomologist, V, p. 184, 1873, I gave the result of breeding larvæ from eggs laid by a female *Dryas*, at Coalburgh, the same year. Among the imagos both *Comma* and *Dryas* appeared, and seasonal dimorphism was established. In Vol. VI, p. 157, 1874, I showed that eggs laid by *Comma*, later called form HARRISII, produced *Dryas*. So that either form produced both forms. In Vol. X, p. 69, 1878, I gave a statement of all observations to date, and said that at Coalburgh there were three broods of the butterfly annually, and the individuals of the third hibernated. That the hibernating females deposited their eggs last of April or early in May, and the first brood of the butterflies came from chrysalis about 1st June; but should the weather be cold during May, then from middle to last of June. That the second laying of eggs took place in July, between 15th and 30th, and the butterflies from these appeared last of August or early in September. That the third laying of eggs occurred in September, and the butterflies from them came out in October. That, so far as appeared from breeding, or from observations in the field running through many years, the last laying of eggs produced *Harrisii* only, and that the series began in the spring with eggs laid by females of that form exclusively. That the result of the eggs laid by these hibernating *Harrisii* had in all cases been *Dryas*, with a single exception, when a male *Harrisii* appeared. That the next brood of the season, the eggs having been laid by *Dryas*, had sometimes consisted wholly of *Dryas*, but in others of both forms, *Harrisii* considerably outnumbering *Dryas*. That the third brood, eggs laid by *Dryas*, had given *Harrisii* only and closed the season.

In same magazine, XIV, p. 189, 1882, I brought the history down to date. It appeared that in different years there was variation of at least a month in the laying of eggs by the hibernating females, depending largely on the state of the weather, and consequently nearly or quite a month's difference in the appearance of the first brood of the butterflies of the year.

I now bring together all these observations, with others to end of 1887.

FIRST BROOD: Eggs laid by HARRISII.

1869, 18th June, from chrysalis came 1 ♂ *Harrisii*.

1871. Between 10th and 18th May, found larvæ. Result, from 20th May to 2d June, 7 *Dryas*.

1873, 20th May, found larvæ. Result, about 20th June, 4 *Dryas*.

1874, 10th May, obtained eggs from female in confinement. Result, about 27th June, 34 *Dryas*.

GRAPTA I.

1875, 14th May, obtained eggs as last described. Result, about 18th June, 19 *Dryas*.

1882, 17th April, obtained eggs, etc. Result, about 22d May, 12 *Dryas*.

1886, 16th May, found larvæ. Result, 1st June, 2 *Dryas*.

That is, 78 DRYAS to 1 HARRISII.

SECOND BROOD: Eggs laid by DRYAS.

1870, July, found larvæ. Result, 2 *Dryas*.

1873, 30th July, obtained eggs from female in confinement. Result, about 1st September, 6 *Dryas*, about 50 *Harrisii*.

1876, 29th July, obtained eggs, etc. Result, about 14th August, 5 *Dryas*.

1886, 25th July, came from chrysalis, from found larvæ, 2 *Harrisii*, 1 *Dryas*.

That is, 14 DRYAS, 52 HARRISII.

THIRD BROOD: Eggs may have been laid by either form.

1870, last of September, found 70 larvæ. Result, in October, all *Harrisii*.

The butterflies of the first brood then have come from chrysalis from 20th May to 18th June, in different years. Of the second brood, from 25th July to 2d September; of the third, about middle of October.

The caterpillars vary much, as shown on the Plates in Volume I, some being very black at maturity, others greenish-white. But the color does not indicate the form of the imago. From one lot of larvæ in June came 19 *Dryas*, though eleven of the larvæ were black, eight white.

Comparing the behavior of the species with what is in New England; according to Mr. Scudder, the first brood comes from chrysalis at the end of June and to middle of July, the second from about 25th August to last of September. This may be regarded as the history in northern New England. In the Catskills of New York, at Hunter, elevation about 2000 feet, I have found two broods, from about 20th August, all the individuals seen being *Harrisii*, in midsummer *Dryas*. In the lowlands of New York, I think there are three broods, but no one seems to have carefully observed about this. Mr. Lintner, at Scholarie, took both forms 24th July, when, if there were but two annual broods, only *Dryas* should have been flying.

The winter form *Harrisii* is found as far to the north as Fort Simpson, Mackenzie River, whence I formerly received several examples (as stated in Vol. I), in a large collection of butterflies made during one or two seasons by Mrs. Ross. As no *Dryas* appeared, it is to be presumed that this form did not fly there, and that the species was one-brooded only. And, according to Mr. James Fletcher, the recent collections made under the auspices of the Canadian Government

GRAPTA I.

give evidence in the same direction.¹ It appears also that in Maine, at least in the interior and beyond, only *Harrisii* is found. Professor Braun tells me that neither he nor any collector known to him in the vicinity of Bangor has ever taken or seen *Dryas*, though *Harrisii* is not uncommon. And he did not recognize examples of *Dryas* which I sent him. Professor Fernald, in his Butterflies of Maine, speaks of the species as two-brooded, but he writes that he is not now certain of that, and has himself never known a *Dryas* to have been taken in Maine.

In Vol. I, I gave the food plants as Hop, Nettle, and false Nettle (*Boehmeria*). To this I add Elm and cultivated Gooseberry, on which last plant I saw a female lay an egg, 14th April, 1886. According to Mr. Scudder, Professor Packard also gives Currant and Basswood (*Tilia*). But at Coalburgh the eggs are almost always laid on Hop and *Boehmeria*, and either singly or in small clusters, more or less of them in strings of from two to half a dozen or more (on one occasion, a female confined in a bag over Hop laid forty-eight eggs, nearly all in strings, one of nine, two of eight, one of seven, and others of less number), standing at right angles to the surface of the leaf. The under side of the terminal, tender leaves is selected, but on Hop, the stem also. The newly hatched larva eats a hole in the substance of the leaf, and during the first stage feeds about this. For the first two stages it is exposed just as the larva of *Interrogationis* is, but at the second moult behaves differently from that species, which makes no shelter for itself at any time. In August, 1882, I watched three larvæ of *Comma* to learn at exactly what stage they began to protect themselves, placing them as soon as hatched on a plant of *Boehmeria* set in flower-pot and in my room. Very shortly after the second moult they had got to the bases of the third pair of leaves from the top, two on one leaf, one on the other, and were engaged in drawing the edges of the leaves, next base, down with silk spun. To effect this, they had bitten off the principal rib on either side the mid-rib, very near the edge of the leaf, and had also cut across to the edge. This leaf naturally curves the other way, so that the caterpillars were working at a disadvantage on the convex side. But notwithstanding this, they had, in course of an hour, bent down the edges and bound them together for one half inch from base. Next morning all

¹ Mr. Scudder, *Bt. N. E.* p. 338, makes this remark respecting the occurrence of *Comma* on Mackenzie River: "In the north, Edwards records it from Fort Simpson, Mackenzie River, which is too far in advance of its ordinary range to be probable; as he had butterflies from the fort of the same name on Albany River, and Jenner Weir reports it from Moose Factory near there, the more southern fort is the probable locality meant." To this I would say that I once

received a few butterflies from Rupert House, three or four *Machaon-Alaska*, and one *Chionobas Calais*, carried overland by Mr. Drexler in his note-book, and from no other quarter in northern British America. The *Comma* came from Mackenzie River. Mr. Bernard C. Ross afterwards told me, when in New York, that the summer at Fort Simpson was hot, even if short, and that melons had ripened within the walls of the fort.

GRAPTA I.

were resting under their completed awnings, two under one, as at first, and had fed off the tip end of the leaf. I had to transfer them to a larger plant, and the next day found two under one leaf, which had been brought together during the night. The third larva was on the upper side of its leaf and had closed that next base. Later, this larva had drawn down the top of the plant and was concealed very much after the manner of the larva of *P. Atalanta*, which uses this same plant. Here it passed the fourth moult. By which it appears that these larvæ can adapt themselves to circumstances. I noticed that at the older stages the ribs were not bitten, nor were the edges of the leaf cut, the larva being able to draw down the edges and sides without that aid. When lying under the shelter they are at the inmost part, and are curled up much like figure 6. I have occasionally found two larvæ under one tent on Hop. So far as I know, pupation does not take place under the tent, but the larva seeks a suitable and protected place at a distance.

The nearest ally of *Comma* is *G. Satyrus*, figured with its larva in Vol. I, pl. 40, a species common in the Pacific States to the Rocky Mountains, and which has occasionally been taken as far to the east as Montreal, Canada. An example has also been taken in the Adirondacks of New York, by Mr. W. W. Hill. I received a large number of chrysalids of *Satyrus*, perhaps fifty, from Mr. H. K. Morrison, sent from Olympia, W. T., and not one gave imago. Each was filled with multitudes of dipterous larvæ. If this pest is found elsewhere as at Olympia, it would seem that the Grapta has a severe struggle for existence. *Satyrus*, like *Comma*, is seasonally as well as sexually dimorphic, the second form being *MARSYAS*, figured in Vol. II, pl. 34. The larvæ much resemble those of *Comma* and protect themselves in precisely the same manner. These are the only American species of the genus known to have this peculiar habit.

I placed twenty-six chrysalids of *Comma*, at from ten minutes to six hours from pupation, on ice, and kept them at a low temperature for eighteen and twenty days. All were killed, and since then, for want of ice, I have been unable to repeat the experiment. Perhaps better results would have been obtained had the pupæ been from twelve to twenty-four hours old.

THE BUTTERFLIES
OF THE
EASTERN UNITED STATES AND CANADA.

With Special Reference to New England.

By SAMUEL H. SCUDDER.

NOW ISSUING IN MONTHLY PARTS, BEGINNING NOVEMBER, 1888.

To be completed in Twelve Parts, each containing eight plates (plain and colored) and about 144 pages of text.

Subscription price, Five Dollars per Part, payable on issue.

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CAMBRIDGE, MASS.

Part VIII. is published in part by a grant from the Elizabeth Thompson Science Fund.

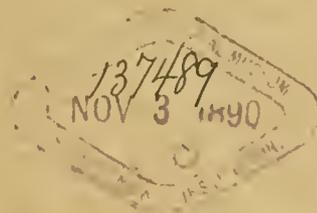
W. H. EDWARDS.

COALBURGH, W. VA., 1 June, 1889.

THE
BUTTERFLIES
OF
NORTH AMERICA
WITH
COLORED DRAWINGS AND DESCRIPTIONS

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W. H. EDWARDS

THIRD SERIES. — PART IX.



BOSTON AND NEW YORK
HOUGHTON, MIFFLIN AND COMPANY

The Riverside Press, Cambridge

LONDON: TRÜBNER & CO.

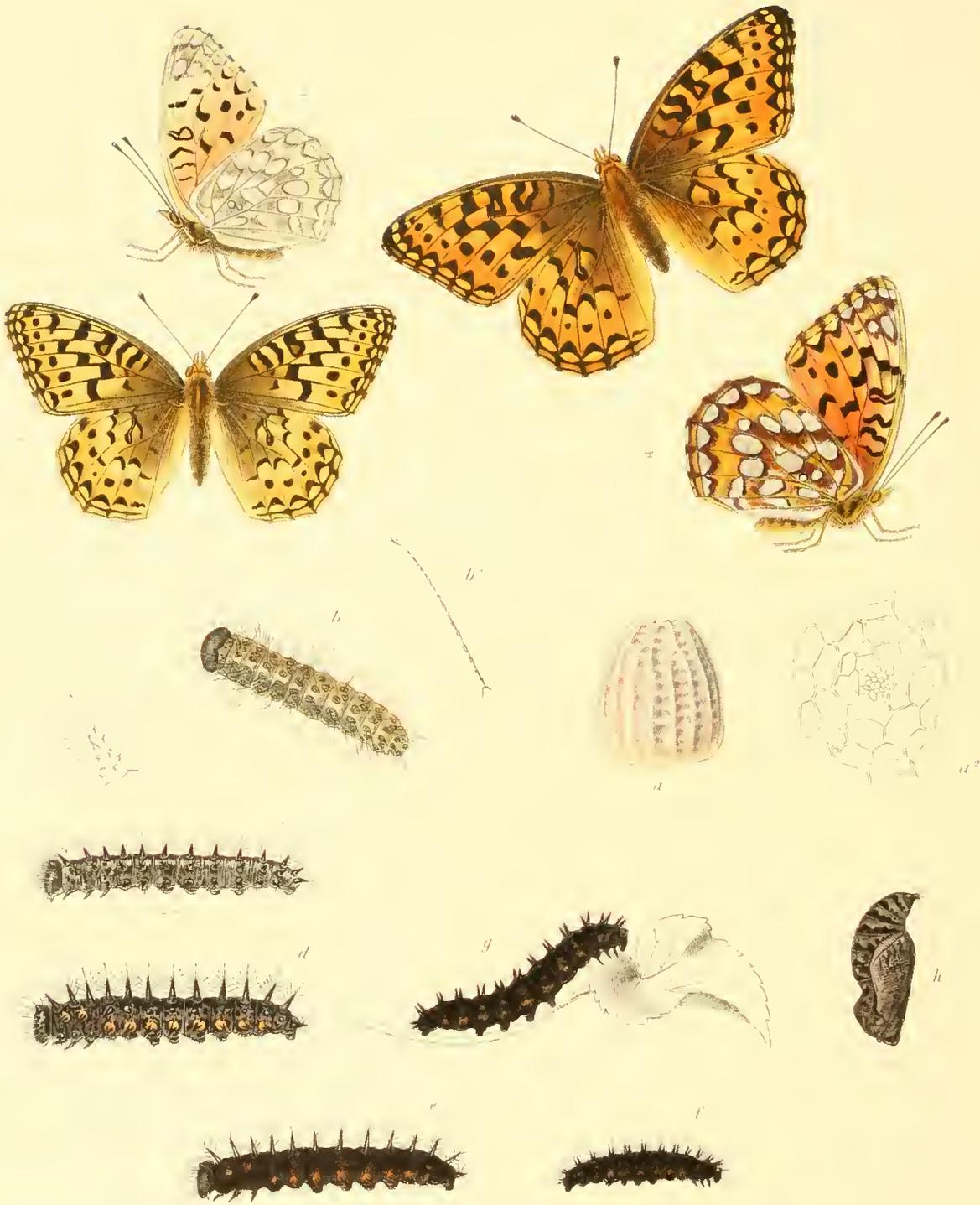
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The Riverside Press, Cambridge, Massachusetts, U. S. A.
Printed by H. O. Houghton and Company.

ARGYNNIS.

7.



NEVADENSIS 1 2 ♀, HALCYONE 3 4 ♀.

APHRODITE.

a a' Egg magnified
 b g Larva, the only stage "
 h Chrysalis

ARGYNNIS V.



ARGYNNIS NEVADENSIS, 1, 2.

Argynnis Nevadensis, Edwards, ♂ (not ♀), *But. N. A.*, Vol. I, p. 93, pl. 33. 1871; Geddes, *Can. Ent.*, Vol. XIX, p. 232. 1887.

FEMALE. — Expands from 2.2 to about 2.6 inches.

Upper side pale yellow-fulvous, often very light; the submarginal spots paler than the ground, as are often the spots on secondaries which correspond to the second silvered row beneath.

Under side of primaries as in the male, but often quite red at base and along inner margin; the apical area and hind margin, and all of secondaries, mottled with pale olive-green on yellow ground; the silver spots large. (Figs. 1, 2.)

At the time the Plate in Volume I was published, 1871, scarcely anything was known of this species, beyond the fact that Mr. Henry Edwards had taken a few examples in Nevada, about Virginia City and Lake Washoe. The female figured was sent by him as belonging to the male, but was afterwards found to be of *A. Coronis*, which is illustrated in both sexes in the present Volume.

NEVADENSIS proves to be a widespread species. Mr. H. K. Morrison brought great numbers of it from Nevada, Wyoming, and Montana; I received examples from the boundary line, Montana, by Dr. Cones; also from Douglass County, Washington, and from Utah; and Captain Gamble Geddes also reports it at Calgary, N. W. Territory.

ARGYNNIS V.

ARGYNNIS HALCYONE, 3, 4.

Argynnis Halcyone, Edwards, *J. But. N. A.*, Vol. I, p. 83, pl. 28. 1869.

FEMALE. — Expands from 3 to 3.25 inches.

Closely like the male in color and markings, as described; but some examples are of a deep brown-red. The silver spots are large. Those of the second row round or broad oval mostly. (Figs. 3, 4.)

HALCYONE was described twenty years ago from two examples of the male sent me by the late B. D. Walsh, which had been taken somewhere in Colorado by Dr. Velie. It was many years before I saw another, on Mr. Morrison's return from a collecting trip in southern Colorado. From him I had a few specimens, mostly females. Some years ago, Mr. E. A. Dodge sent me a male taken in the same State, but with no note of locality. And in 1886, Mr. David Bruce sent a male from Golden. The species is still a very rare one in collections, but I think somewhere in the south or southwest of Colorado and the adjacent parts of Utah and Arizona it will some day be found in abundance.

ARGYNNIS V.

ARGYNNIS APHRODITE, a-h.

Argynnis Aphrodite, Fabricius ; Edwards, But. N. A., Vol. I, p. 71, pl. 22. 1868 ; id., Can. Ent., Vol. VI, p. 121. 1874 ; Fernald, But. Maine, p. 39. 1884 ; French, But. East. U. S., p. 157. 1886 ; Scudder, But. N. E., p. 563, pl. 4, figs. 1, 2. 1889.

BOTH SEXES of APHRODITE are figured in Volume I. The preparatory stages have never been described or figured, with the exception of the egg, young larva and chrysalis, in But. N. E. I now give the complete history.

EGG. — Conoidal, truncated and depressed at top ; in general like *Cybele*, but narrower at base, or higher in proportion to the width ; marked by about eighteen prominent, vertical, slightly wavy ribs, part of which extend from base to summit and form about the latter a serrated rim, the others ending irregularly at three fourths or more the distance from base ; the rounded spaces between the ribs crossed by nearly equi-distant fine ridges ; micropyle in the centre of seven minute five-sided cells, about which are two or three rows of larger cells, irregular, but mostly five-sided. (Figs. *a*, *a*².) Duration of this stage 15 to 22 days.

YOUNG LARVA. — Length, at twelve hours from the egg, .06 inch ; cylindrical, somewhat stoutest in middle ; color dull green, semi-translucent ; marked by eight longitudinal rows of dark, sub-triangular, flat, tuberculous spots, three of which are above the spiracles on either side and one below ; these bear small tubercles, in the upper or dorsal row two, in the next two rows one, in the lowest row four, each giving out a long, tapering, clubbed hair ; on front of 2 is a large dorsal spot, sometimes divided into two, bearing three tubercles on either side the mid-dorsal line ; on the two following segments the three spots are nearly in vertical row ; on 5 to 13 those of upper row are near the fronts of the segments, of the next row to the rear, of the third row a little in front of the middle ; color yellow-green ; under side, feet and legs, more green ; head a little broader than 2, rounded, flattened frontally, a little bilobed, with many long

ARGYNNIS V.

hairs; color black-brown. (Figs. *b*, *b*².) The larva hibernates at this stage, direct from the egg.

After first moult: length, at twelve hours, .14 inch; shape of *Cybele*; color gray-green, mottled with olive-green and brown; spines as in the genus, black from greenish bases, each ending in a short black spinule, and with several others about the sides; under side more green; feet black, pro-legs brown-green; head sub-cordate, the vertices rounded; at top of each, to the front, a little conical process; furnished with many black hairs; color shining black-brown. (Fig. *c*.) To next moult seven to ten days.

After second moult: length, at twelve hours, .2 inch, color dark greenish-brown, mottled in shades; the spines black, and also the bases, except that the upper row have a little yellow on the outer side, the lower row, and those of middle row on 3 and 4, a little yellow all round; under side brown-green; head shaped as before, shining black. (Fig. *d*.) Duration of this stage five to eight days.

After third moult: length, .36 inch; color dark brown, the spines black; those of lower row and the anterior two of middle row, dull reddish-yellow at base, the rest of both rows very slightly tinted same; head as at previous stage, black, with many long hairs. (Fig. *e*.) To next moult six or seven days.

After fourth moult: length, .55 inch; color dull black; all spines black, the lower row dull yellow at base; head as before, but dull black over front, reddish-yellow behind. (Fig. *f*.) To next moult about six days.

After fifth moult: length one inch. Reached maturity in about seven days.

MATURE LARVA. — Length, at rest, 1.6 inch, in motion, 1.9 inch; cylindrical, slenderer than *Cybele*, somewhat thickest in middle segments, each segment well rounded; color blackish-brown, with a velvet black patch about base of each spine, making six longitudinal macular velvety bands; the spines of dorsal rows on 2 no longer than others, a little turned forward; all spines slender, beset with black bristles; the bases of lower row dull reddish-yellow, the others black, but those on anterior segments greenish; under side dark brown; feet black, pro-legs brown; head small, as broad as high; sub-cordate, the front flattened, the back much rounded, the vertices sub-conic, each on its anterior side bearing a small conical process; the face much covered with black hairs of irregular lengths;

ARGYNNIS V.

color of front dull black, of back reddish-yellow. (Fig. *g.*) In five or six days from maturity the larva suspends, and in from thirty-six to sixty hours pupates. Time from fifth moult to pupation twelve to fourteen days.

CHRYsalis. — Length one inch, breadth at wing cases .35, at abdomen .32 inch; greatest depth .4 inch; cylindrical, a little compressed laterally; shape of *Cybele*, rather more slender, the head case a little narrower; head case, and antennæ and tongue cases, shining brown-black, the first of these a little mottled with brown-yellow; the wing cases light yellow-brown, crossed by very many fine dark brown streaks, and with a patch of same color near shoulder, another on disk, and a large, broad patch near to and along hind margin; abdomen gray and brown in transverse bands; on dorsum the gray area is serrated, the points reaching the front of each segment; on sides and beneath the brown and gray areas are about equal, the gray in rear. (Fig. *h.*) Duration of this stage seventeen to twenty days.

Another chrysalis was olive-brown, the anterior parts much covered with dark brown dashes; the wing cases pink-tinted, and dark next hind margin, the whole finely reticulated with dark brown streaks; the anterior part of each abdominal segment black, in a cross band, the posterior edges irregular, rather crose than serrated.

In the text to *Argynnis Diana*, Vol. II, p. 147, 1876, I gave a general account of raising larvæ of APHRODITE. I have since then several times bred the species from eggs obtained at Coalburgh, W. Va., carrying the larvæ through the winter in a refrigerating house. In all cases they went into lethargy direct from the egg.

In 1888, I obtained eggs from a female confined over violet, on 23d September. These hatched 15th October, and the larvæ were sent to Clifton Springs, New York, whence I received two survivors, 16th April, 1889. These were placed at once on a plant, set in flower-pot, and covered by a muslin bag. One was seen no more, but the other fed and passed its first moult 24th April; the second, 1st May; the third on 6th, the fourth on 12th, the fifth on 18th; suspended 30th, and pupated 2d June. The imago came forth 19th June, a female, after seventeen days in pupa. The only peculiarity I noticed in this larva was, that when about to pupate, it made for itself a tent of the leaves of the plant by weaving them loosely together, so low down that when in suspension it would nearly touch the ground. Not knowing what was going on, I pulled one leaf off and the larva fell. The same afternoon it had fixed itself under another leaf.

ARGYNNIS V.

five inches above ground, and with no attempt to bring other leaves about it. There it pupated. It may be that the making of a tent for pupation is the usual habit of the species in natural state, and it may also be a habit of the genus. But in confinement I have not before observed it in any species. Usually my *Argynnis* larvæ have suspended from the sides or top of the bag.

Since the Plate of this species was given in Vol. I, 1868, much has been learned of its distribution. It is not common in the Kanawha Valley, West Virginia, where *Cybele* is abundant. I never have seen it in June, when many *Cybele* are flying, but every year I see a few examples in September. To the eastward of my home, some fifty miles, among the mountains, elevation 2000 feet and more, I have reason to think it is common enough, and perhaps replaces *Cybele*; for some years ago, Professor Julius E. Meyer brought several *Aphrodite* and no *Cybele* from a day's collecting in Fayette County. Probably it is found in the mountains all the way to southern North Carolina. Mr. E. M. Aaron has taken it at Asheville, and has received it from Macon County, in same State. He has taken it, he tells me, in various parts of middle and eastern Tennessee, and knows of its having been taken in northern Alabama. How far to the westward it flies is uncertain, because it has been confounded by myself, Mr. T. L. Mead, and others, with *Arg. Cipris*, Edw., a nearly allied species that abounds in the Rocky Mountains from New Mexico and Arizona, through Colorado and Montana into British America; and with another, *A. Alcestis*, Edw., which inhabits Illinois and beyond, to Nebraska. It therefore happens, from the confusing three species together, that the western limits of *Aphrodite* are as yet undetermined. In *Papilio*, Vol. III, p. 161, 1883, I gave Judith Mountains, Montana, as a locality, but I had *Cipris* in view. So I think it possible that *Cipris* was the species taken by Captain Geddes, at Edmonton, Alberta, and by Professor Dawson, at Woody Mount, Assiniboia. *Aphrodite* is stated by Mr. Scudder to be common in parts of Ontario, and in Quebec, along the lower St. Lawrence; also in Nova Scotia; but is wholly absent from the White Mountain region of New Hampshire, being replaced there by *Argynnis Atlantis*.

SATYRUS.

I.



PEGALA 1 2 ♂, 3 4 ♀, 5 ♀ VAR.:

ALOPE VAR 6 7 ♂, 8 ♀.

SATYRUS I.

SATYRUS PEGALA, 1-5: 8.

Satyrus Pegala (pe-ga'la), Fabricius, Syst. Ent., p. 494. 1775. Edwards, Proc. Ent. Soc., Phil., Vol. VI, p. 195. 1866; id., Can. Ent., Vol. XII, p. 5. 1880.

Alope? var., Boisduval and Leconte, Lep. de l'Amer., pl. 228, p. 59. 1833.

FORM PEGALE, J. B. Smith, Bull. Brooklyn Ent. Soc., Vol. VI, p. 128. 1884.

MALE. — Expands from 2.4 to nearly 3 inches.

Upper side dark brown; hind margins bordered by two fine darker parallel lines, a little within which is a stripe of same color; primaries have an extra-discal deep ochre-yellow transverse band, broadest anteriorly, incised on basal side at the upper median nervule; on this is a single black ocellus, lying across the discoidal interspaces, with a small central cluster of blue scales, a few of which are often replaced by white; occasionally there is a black dot, or even a small blind spot, suggesting a second ocellus, in middle of second median interspace.

Secondaries have a black ocellus on second median interspace, in yellow ring, with small white, or blue and white, pupil; fringes of both wings concolored.

Under side yellow-brown, with a gray tint, most decided on apical area of primaries and beyond disk of secondaries; the band repeated, paler; the ocellus repeated, a little enlarged, the cluster of scales enlarged, often elongated into a blue nebulous streak, having, in the end toward base, a solid nucleus of white; the marginal lines and stripe conspicuous; the brown area covered densely with abbreviated dark streaks, which over bases and disks form somewhat concentric broken rings, limited without by a common dark stripe; this on primaries edges the band, on secondaries is irregularly sinuous, throwing out a rounded projection against cell, followed by a rounded sinus on second median interspace; the ocelli are six, in two groups of three, each on a patch of clear dark brown, one across the lower subcostal and discoidal interspaces, the other across the median; these are either round or oval, individuals varying, the middle one of each group

SATYRUS I.

largest; each in yellow ring, and with blue or blue and white pupils, the clusters varying sometimes as described on primaries.

Body concolored with wings; legs and palpi dark brown; antennæ brown, finely annulated with white; club ferruginous. (Figs. 1, 2.)

FEMALE. — Expands about three inches.

Upper side color of male; the band broader; the ocellus sometimes large, with large central cluster; some examples have an additional spot, like some males, and occasionally there is a second ocellus quite as large as the first, and as conspicuously pupilled. Under side more gray, sometimes very light on secondaries; there is also a trace of a brown stripe on same wings near base, particularly across cell. (Figs. 3, 4, vars. 5, 8.¹)

This species varies in respect to the ocelli of both surfaces. In my paper referred to, in the *Canadian Entomologist*, I stated that I had before me twenty-nine examples, being all I had in my own collection, or could borrow from correspondents. Of these, twenty-one were males, eight females. Of the males, fourteen had one ocellus on fore wing, two had an ocellus and a small black spot, six had the ocellus and a mere point. Beneath, seventeen had six ocelli on hind wing, three had five, and one had five on one wing and six on the other. All had the ocellus on upper side of hind wing.

Of the females, five had one ocellus only; one had one and a small spot, while two, one of which is figured on the Plate (5), had two large, equal, and conspicuously pupilled ocelli. On under side, six had six ocelli, one had five, and one had five on one wing and six on the other. "The uniformity of these characters — the ocellus at inner angle always present, and the number of small ocelli, which are scarcely ever less than six and never less than five — in so many examples brought from various quarters, contrasts strikingly with the great variability of *Alope* and *Nephele* in the same points" (p. 54).

One of the two-eyed examples seems to have been figured by Boisduval and Leconte, after Abbot, for *Alope*. Dr. Boisduval says in the text that he regards *Pegala* as a one-eyed variety of *Alope*. In my copy of the work, the larva is represented as having the dorsum green, the side white, divided longitudinally by a narrow gray band. This white may have originally been colored yellow, as Mr. Smith says his copy of the book shows yellow, with green over the gray band. But all this is quite unlike *Alope*, and its co-form *Nephele*, as may be

¹ Fig. 8, on the Plate, represents a fore wing of *Pegala*, variety, from Florida, and the reading at bottom is incorrect.

SATYRUS I.

seen on referring to Volume II, Plate 41, Fig. *h*. The whole surface here is green, except a narrow stripe of yellow along base, and a subdorsal faint yellow line. The larva of *Alope*, form *Olympus*, Plate 42, Fig. *a*, is green, but has the subdorsal line developed into a stripe as conspicuous as the basal. The chrysalis of Boisduval's plate has two ocellar prominences, much as in *Neonympha Gemma*, while the head case of *Alope* is truncated and rounded, with no projections.

I have tried in vain for years to obtain eggs of *Pegala*, in order to become acquainted with all the preparatory stages. Until we know to the contrary, I suppose the coloring of the larva and the shape of the chrysalis, as given by Abbot, must be regarded as correct. Though I only know of these by Boisduval's figures spoken of.

I was informed by that veteran lepidopterist, the late Mr. James Ridings of Philadelphia, who collected one season in Georgia, after I became acquainted with him, that, in its habits, *Pegala* differed considerably from *Alope*, flying in the pine forests and alighting on the bark of trees. When disturbed, it would fly about for a while, and eventually return to the same spot. It seemed to him to resemble *Debis Portlandia* in habits rather than *Alope*.

Mr. William H. Ashmead, when a resident of Jacksonville, Florida, wrote me: "*Pegala* is quite common in hummocks, along fences, and in the outskirts of forest, from about the middle of July to October. When chased they fly high and alight on the side of a tree, and are seldom seen in open fields." (*Alope* and *Nephele* fly slowly and low, and I have never heard of their alighting on trees.) Dr. A. W. Chapman wrote from Appalachicola: "*Pegala* is or was common in the open pine woods back of this city. It seemed to like a hot, sandy exposure, but I never saw one in my garden or in the fields. They always alight on the naked bodies of the pines, with head up, down, or sideways."

This species seems to be very nearly restricted to the southern part of the Gulf States. It has been taken in a single instance by Mr. T. L. Mead, in middle Florida, at Oviedo, Orange County. He sent me a male caught in his peach orchard, the present year (1889); and writes as follows: "The only examples seen were the one sent you and one other. I saw them in the orchard on the fallen fruit. When disturbed, and at other times, they hid in the dense foliage of the orange trees. In company with them were some *Limenitis Eros* and an *Apatura*." So far as I know, *Pegala* has not before been taken much to the south of Jacksonville. How far to the northward, along the coast, it flies, I am not advised. I formerly received examples from St. Simon's Island, Georgia.

What I spoke of as "a diminutive *Pegala* (as if from a starved caterpillar)" in *Can. Ent.* XII, 52, sent me by Professor Lewis R. Gibbes, of Charleston, S.

SATYRUS I.

Carolina, I now believe to have been a variety of *Alope*. Rev. Dr. John G. Morris told me, in 1880, that he had never known *Pegala* to have been taken along the coast of Virginia or Maryland. At the same time, Professor C. V. Riley made inquiries of lepidopterists in Washington, and all agreed that the species was unknown there. A similar inquiry made the present season received a similar reply. I could not hear that it was found in middle and northern Georgia or in north Mississippi, on corresponding with collectors. And the late Messrs. Boll and Belfrage, long resident in Texas, and professional collectors, could give me no information about *Pegala*, though Mr. Belfrage said that *Alope* was common where he lived, in Bosque County. Mr. Heiligbrodt, at Bastrop, said that, at times, *Alope* had been common, but he did not know *Pegala*. But, on the other hand, Mr. Otto Meske, of Albany, N. Y., wrote that, in 1876, he received a single *Pegala* from Bastrop, the only one he ever saw from Texas. This may have been a one-eyed *Alope*, for occasionally an *Alope* with but one ocellus is taken in the Northern States.

But, on the other hand, Mr. William H. Ashmead writes me that he saw two examples of *Pegala*, the present season, at Alum Springs, Rockbridge County, Virginia, "one of which alighted on the side of an oak tree not four feet from me, and I had a most excellent opportunity for seeing it. It astonished me to see this species so far north, and I pointed it out to my little daughter, who was walking with me at the time, and said: 'See, there is a beautiful butterfly, like what we have in Florida.'" The locality is about 150 miles southwest of Washington, among the mountains. It is almost impossible to get information about butterflies, at the present day, in any of the Southern States, except Florida and Texas. Fifteen and even ten years ago, there were several persons, in different States, to whom I could apply for information. Now I do not know of one. The late H. K. Morrison lived among the mountains of North Carolina, and year after year made collections of butterflies for sale, but I have never heard that he took *Pegala* anywhere, certainly, in his own State. I have no idea that this species is found from Alum Springs southward, or that its presence in the locality mentioned is other than accidental.

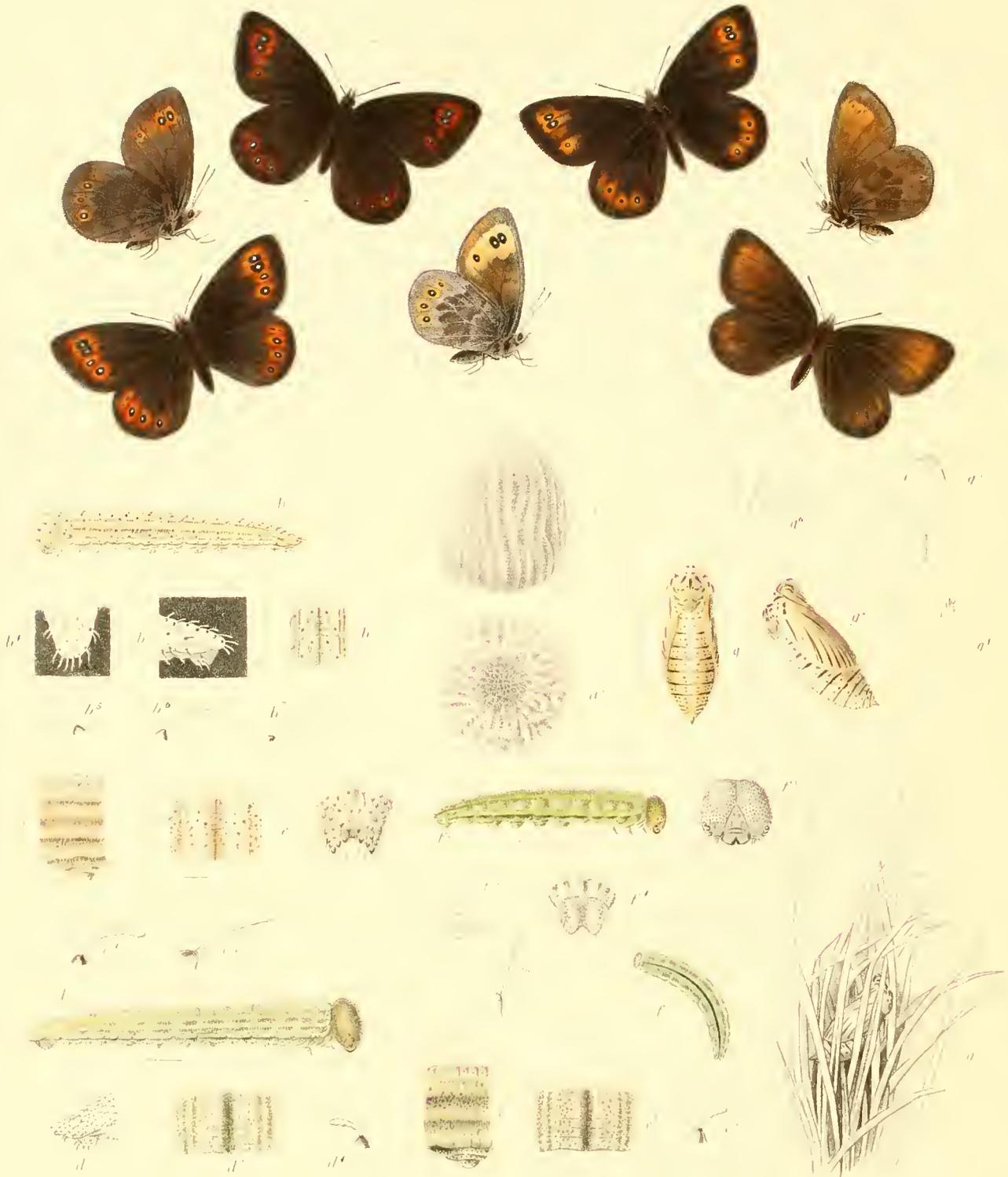
What, then, is the form which has been taken somewhat abundantly in certain parts of New Jersey; by Mr. E. M. Aaron, at Mt. Holly, in 1882, by Mr. J. B. Smith, "in the pine barrens," 1883, and by Dr. Henry Skinner, at Cape May, 1889? It is small (Figs. 6, 7), the size of *Alope-Maritima*, and looks like that form. But many examples have but one ocellus; others have one and a point in place of the second. Dr. Skinner writes that there are all sorts of intergrades up to undoubted *Alope*, and they fly together. He has sent me a male, on which the band is yellow, not ochraceous. On fore wing there is a single ocellus, and on

SATYRUS I.

under side of hind wing there is also but a single ocellus. The absence of more or less of these ocelli on hind wing is a peculiarity of *Alope*, but not of *Pegala*. In the former, a large percentage of individuals have but one, two, and three ocelli, and many indeed none at all. I regard these New Jersey examples as strictly variations of *Alope*. If the whole group, in North America, has sprung from *Pegala*, as I consider probable, these cases of single ocellus appearing at the east, in the territory of *Alope*, or, at the west, in that of *Ariane*, are owing to reversion. But I have spoken of this matter at length in Volume II, and need say no more here.

EPISODEA.

III.



EPISODEA 1 2 ♂ 3 4 ♀ 5 ♂ 6 7 ♂ VAR BRUCEI.

1 2 3 4
Larva

unspined

5 6 7
Larva mature
Chrysalis

EREBIA III.

EREBIA EPIPSODEA, 1-7.

Erebia Epipsodea, Butler, Catalogue of Satyridæ of British Museum, p. 80, pl. 2, fig. 9. 1868; Mead, Report Wheeler Expedition, Vol. V, p. 776. 1871.

Rhodia, Edwards, Trans. Am. Ent. Soc., Vol. III, p. 273. 1871.

Var. BRUCEI, Elwes, Trans. Ent. Soc., London, 1889, Part II, p. 326.

MALE. — Expands 1.6 to 1.9 inch.

Upper side dark velvety-brown; primaries have a submarginal patch of bright red-fulvous, broad on the lower subcostal and discoidal, narrow on the median, interspaces, containing from two to four black ocelli, one being in each of the discoidal interspaces, one in the second median, and if there be a fourth, it is in the upper median; the third and fourth, one or both, are usually mere dots; sometimes the larger of these ocelli are pupilled with white, but often all are blind.

Secondaries have a submarginal row of fulvous patches, four or less, sometimes immaculate, at others with a central black dot in one or more of them; but sometimes with pupilled ocelli as large as the lower one on primaries. Fringes concolored.

Under side of primaries dark brown, often with a faint tint of fulvous over the disk; the patch repeated, the spots also, the upper pair, one or both, usually enlarged.

Secondaries brown, with broad discal band of darker hue, the inner edge of same irregularly sinuous, the outer sinuous, partly crenate; the basal and marginal areas paler, with a sprinkling of gray-white scales, as shown in the figure of the female, 4; in many examples the entire wing is nearly of one shade, and the markings are obsolescent as in Fig. 2; the spots of upper side repeated, each within a slight ring of fulvous.

Body brown-black; palpi same; fore legs same, the others gray-buff; antennæ brown above, gray-white below; club brown above and below, the sides and tip fulvous. (Figs. 1, 2, 5.)

EREBIA III.

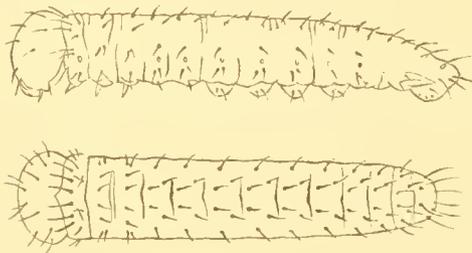
FEMALE. — Expands 1.8 to 2 inches.

Similar to the male in color and markings, except that the ocelli are enlarged, and are often very conspicuous (Fig. 5); the tint of fulvous of under side is often a decided color; occasional examples show five ocelli on primaries, the fifth being in submedian interspace; in one under view, the upper pair and the fourth spot are large, the third is small, and the fifth is of half the diameter of the third, and all five have white pupils. (Figs. 3, 4.)

Var. BRUCEL. This differs from the type in having no ocelli on either wing; and the under side of secondaries of nearly uniform shade, with little or no trace of a band. But in some examples which show no ocelli on upper side of primaries, there are black points on one or both surfaces, in the discoidal interspaces. (Figs. 6, 7.)

EGG. — Sub-ovoidal, a little flattened at base, the top depressed and a little convex; broadest just above base, narrowing towards summit; about one fifth higher than broad; marked by about thirty-five vertical, somewhat sinuous, ridges, most of which extend from base to the rim of summit, but a few from base one third to one half up, or from summit as far down, and join the main ridges; these are high, narrow at top and flattened or rounded, the sides sloping, a little incurved, the bottom of the depression rounded; the micropyle is in the centre of a rosette of several concentric rings of minute cells; color chalk-white. (Figs. *a*, *a*².) Duration of this stage about twelve days. The egg resembles that of *Magdalena* in sculpture, but is less regularly ovoidal, and the base is flattened.

YOUNG LARVA. — Length, at twenty-four hours from the egg, .11 inch; thickest anteriorly, tapering very gradually on back and sides to 7 or 8, then more rapidly, the dorsum arching to 13, which ends bluntly, without tails; furnished



with three rows of blackish, sub-conical tubercles, each of which gives a white process; these rows are dorsal, sub-dorsal, and lateral; on 2 there is an additional tubercle back of and between those of two upper rows, and another a little below and behind the lateral; and there are two in front, in vertical line, a little above the spiracle; on 3 and 4

the three tubercles are nearly in vertical line, but from 5 to 12 they are in triangle, the dorsal one in front, the sub-dorsal at rear, the lateral a little before

EREBIA III.

the middle of the segment; on 13 are two rows with six tubercles, made from the dorsal and sub-dorsal, which here come nearly into line, a lateral on either side, in front, and six around the end, projecting horizontally (Figs. b^3 , b^4); the interior four small, with somewhat shorter processes; the processes on 2 are thickly clubbed (Fig. b^5), on the following segments to 12 are longer and scarcely clubbed (Fig. b^6), on 13 cylindrical, and still longer (Fig. b^7); along base a row of minute tubercles with short hairs, two to each segment on 2 and 5 to 13, one on each of the rest; color greenish-white, with a mid-dorsal brown line, and three similar equidistant lateral lines, the space between the second and third specked with black or dark brown; under side, feet and legs paler; head a little broader than 2, subglobular; covered with shallow pits, marked by a few low subconical tubercles, blackish, each with light hair. (Fig. b ; cross section, middle segments, b^2 .) Duration of this stage six to seven days.

After first moult: length, at twelve hours, .2 inch; nearly same shape, thickest at 2, tapering gradually to 11, then rapidly, curving roundly to extremity, 13 ending in two short conical tails (Fig. c^3); the tubercles similar to those at first stage, but much more numerous, bent, arranged irregularly in both horizontal and cross lines, those on 2 decidedly, on segments to 12 slightly, club-shaped (Fig. c^4), on 13 nearly cylindrical, gradually thickening towards end (c^5); color greenish-yellow, as are also the under side, feet and legs; a mid-dorsal blackish-brown stripe, on the side three narrow, equidistant, brown stripes; the basal ridge yellowish, and under it a brown line; head as before, subglobular, pitted, with many fine tubercles, and short processes and hairs; color green-yellow. (Figs. c , c^2 , section of side and dorsum, segment 7.) To next moult about ten days.

After second moult: length, at twenty-four hours, .28 inch; shape as before, tails as before; the tubercles and processes much more numerous; color greenish-yellow; a mid-dorsal heavy brown stripe, three light ones on side, equidistant; the basal ridge more yellow, and beneath it another brown stripe; under side, feet and legs pale green; head as before, yellow-green. (Fig. d ; d^2 , cross section.)

After third moult: length, at twenty-four hours, .38 inch; scarcely differs from the last preceding stage, the tubercles still more numerous, bent close to the body. (Fig. e , section of side of segment 7; e^2 , across dorsum of same.)

Some weeks after the moult, one of the larvæ having reached the length of .6 and two of about .5 inch, they became lethargic, and were taken to Clifton Springs, New York, and placed in the refrigerating house there, the temperature

EREBIA III.

of which is supposed to be about 40° Far., the year round. I received them again 5th April following, two alive and healthy. During the night of 14th-15th April, one passed a moult.

At fourth moult: length, twelve hours after, .65 inch; color over dorsal area brownish-green, the sides pale brown-yellow; the mid-dorsal band intense black; a pale black, almost faded out, sub-dorsal line, a stripe of pale black on middle of side; the basal ridge more yellow, and under it a macular black line; gradually, as the stage progressed, the brown passed away, and by the sixth day from the moult, the body was decidedly green, as shown in Fig. *f*². At about twelve days from fourth moult, the larva was fully grown.

MATURE LARVA.—Length one inch; body stout, thickest in middle, arched dorsally, the last segments curving rapidly; 13 ends in two short bluntly rounded sub-conical tails (Fig. *f*¹), the space between nearly a right angle; whole surface densely covered with fine, sharp, conical tubercles, each giving a short tapering process (Fig. *f*⁶) or hair; color a delicate yellow-green, the under side more green, as are also the pro-legs; the legs brown-yellow; the mid-dorsal band narrow, widest on middle segments; high on the side, a rather indistinct yellowish stripe; the basal ridge greenish; head sub-globose, covered with shallow brown pits (the lithographic artist has represented the face in *f*³ as if covered with raised tubercles, and the mistake was not noticed in time to correct it); color pale yellow-brown, the ocelli black. (Fig. *f*, side view as in *f*²). From fourth moult to pupation about seventeen days.

CHRYSLIS.—Length .48 inch; breadth across mesonotum .16, across abdomen, .18 inch; cylindrical, abdomen stout, conical, the ventral outline nearly as much curved as the dorsal, ending in a short spur, which is furnished at and near the bluntly rounded tip with a few very short, straight bristles (Figs. *g*⁴, *g*⁵, *g*⁶); head case short, projecting little beyond base of mesonotum, but produced on ventral side considerably, so that the ventral outline from summit to middle of wing cases is much excavated (the entire ventral outline, from summit to cremaster forms a double curve); the top narrow, a little convex, the sides notched; mesonotum low, scarcely at all carinated, rounded both ways, followed by a shallow excavation; color whitey-brown, much specked with brown-yellow, especially on dorsal side; the head case and mesonotum marked by abbreviated brown streaks, the most conspicuous of which are three converging on the carina and sides of mesonotum; the antennæ and tongue cases also indicated by black lines; the wing cases have eleven or twelve black longitudinal streaks,

EREBIA III.

reaching the hind margins; the abdomen crossed by brown lines at the junctions of the segments, and dotted longitudinally with black in dorsal and lateral lines, two dots to the segment. (Figs. *g*, *g*², *g*³, enlarged.) Duration of this stage ten days.

EPIPSODEA was first known to me by examples taken by Mr. T. L. Mead, in Colorado, 1871. He says, in Report of the Wheeler Expedition: "This species inhabits the mountains of Colorado below timber line. Specimens were brought from Fairplay by the Expedition. It begins to appear about the first week in June, is common by the middle of that month, and remains until the last of July."

Several examples were received in 1883, by Mr. William M. Curtis, from Judith Mountains, Montana, at about 4,000 feet elevation, in July. From Mr. Ernest Stevenson, at Walla-Walla, southeast Washington, came some unusually large specimens, late in June, 1885; others from Spokane Falls, in east Washington, by Dr. W. J. Holland. I have also received this species from St. Michaels and Nushagak, Alaska; and have received eggs from Mr. Thomas E. Bean, at Laggan, Alberta. On the other hand, I have not seen *Epipsodea* from south Colorado, or New Mexico, or Arizona, or Utah, nor from the Sierra Nevada range anywhere. So far as appears, it is confined to the Rocky Mountains from middle Colorado northward to the Arctic sea, but flies over the lowlands in its northernmost range, and may there have a wide distribution. Many examples from Colorado are small, the wings expanding less than any seen from Alaska; and the largest have come from Washington. Throughout its territory the two principal varieties seem to be found, the banded and not banded.

Mr. Butler described the species from two individuals "from Rocky Mountains," but the locality was not stated.

Mr. Bruce writes: "I first met with *Epipsodea* in Platte Cañon, Colorado, at about 9,000 feet elevation. It frequents damp and boggy places where the grass grows rank and coarse. In such situations, up to nearly 12,500 feet, I found it rather common. In one place, at the highest altitude named, a small stream of muddy water from a mine had been conveyed in wooden troughs which emptied into a basin-like depression; in this place, being always moist, the grass and flowers grew luxuriantly, and many species of butterflies were in profusion. *Epipsodea* was plenty, and in almost all the examples I captured here, the ocelli on upper wings were absent. Many had none on lower wings, others showed black points more or less minute.

"This variety, which Mr. Elwes has called *E. BRUCEI*, I see, is probably peculiar to these high stations, where I have found it during three seasons, for, in the

EREBIA III.

valley below, there was a narrow, boggy tract, more than a mile long, where *Epipsodea* was plentiful; but I found none of the variety spoken of. The only variation there was marked by the absence of the band on under side hind wings, and this was confined to few individuals.

“*Epipsodea* has a rather quick, jerky flight. It is not very readily captured, for, although it never appears to be in a great hurry, it flies close to the ground, and is always just ahead, dodging under every bush, and around every grassy hummock, as if in earnest search of something. It takes long flights without going far away, and seldom alights on flowers. Directly the sun is obscured, it dives in the grass, like almost all the mountain diurnals. All the *Erebias*, as well as the alpine species of *Chionobas*, ‘play possum,’ and pretend to be lifeless when captured, and will lie in or under the net, or on one’s hand, some moments in that condition. I have found *Epipsodea* from June 9th to the end of August, in the front Range, in Colorado; at the latter date it was badly worn.”

Mr. Elwes says, Tr. Ent. Soc., Lond., 1889, Part II, p. 334: “I have a single specimen, and Mr. Godman has a similar one, collected by Bruce in Cashier Valley, Summit County, Colorado, at 12,000 feet, which are considered by Bruce and W. H. Edwards to be a variety of *Epipsodea*, though it is so different from it that, had I more specimens, I should be inclined to consider it a different species, more especially as *Epipsodea* does not appear to extend to such great elevations, or to vary much; though its range of altitude is very great. I have taken it in Idaho at about 2,000 feet elevation, and in the Yellowstone Park at 5,000 to 6,000 feet, and have it from Colorado, taken by Bruce, as high as 9,500 feet. The specimens above mentioned are somewhat smaller, and with rounder wings, than the average of *Epipsodea*, but are best marked by the entire absence of ocelli on either wing or on either surface, and the partial disappearance of the red band.” In the Synopsis of same paper, page 326, Mr. Elwes puts this under the species name as “? Var. BRUCEI.”

Mr. Bean writes: “At Laggan, *Epipsodea* is moderately common in June and early July, frequenting open, grassy flats of the Bow River valley, at an altitude of about 5,000 feet. It is, in my experience, rarely found on the mountains, but I took a single male, the past season, on a mountain ridge, at 7,800 feet, or about 500 feet above the tree line. This specimen does not differ from those of the valley, 3,000 feet below. The form you mention (*Brucei*), which partly lacks the eye spots, I do not find.

“*Epipsodea* occurred at McLean, altitude 1,900 feet, in 1884, though not so common as it is at Laggan, and the localities were open grassy flats.”

The eggs sent me by Mr. Bruce, in 1888, were laid by a female of this var. BRUCEI, not wholly destitute of spots, there being two or three black points on

EREBIA III.

fore wings, as in Fig. 6. The outcome was a single male, true type *Epipsodea*, scarcely banded beneath, out of chrysalis 12th May, 1888. This is shown on the Plate, Fig. 1. The eggs were laid 8th July and hatched 20th. On 25th, there were seven young larvæ. The first one passed first moult 27th July, the second moult 4th August, the third moult 28th August. The others lingered in their stages, but by 15th September, five had passed third moult. They were at all times kept out of doors, and cool weather now coming on they ceased feeding gradually. On 29th October, I found but three larvæ, all in lethargy, two of the five having disappeared. In November, I took them to Clifton Springs, as before stated. On 5th April, 1888, I received them again, two alive and wide awake as I opened the box. These were at once placed on grass, and in five minutes thereafter were feeding. On 15th April, one passed its fourth moult, the other on 17th. On 30th April, I noticed that one was bringing together leaves of the grass and forming a sort of loose cylinder. It was in the middle of a pretty dense tuft, the leaves of which were three to four inches long. On one of these the larva rested, holding by its prolegs, and was spinning a few threads and drawing the leaves down and about it. Before night the inclosure was complete. Nearly a score of leaves were held, mainly by threads at top and bottom, that is, above and below the larva, making a pretty close covering, but open by spaces so that most of the side, and the head, were exposed to view. The larva rested head up, back arched. Mr. Scudder, in *But. N. E.*, has well characterized this structure as "an imperfect cocoon." Pupation took place on the night of 1st-2d May. Some hours after, when the chrysalis had hardened, I cut away the leaves one by one. There were fifteen of them, and the pupa rested upright, its lower end one and a half inch above ground, in an angle formed by three leaves. As I cut one of these, it turned over and fell, showing itself to be unattached. In fact, the cremaster was found to be furnished with but straight bristles, very short (Fig. *g*⁵), and there were no hooks by which attachment could be had. As before stated, a male of the typical form came from this chrysalis on 12th May.

I had received young larvæ of this species from Mr. Bean, at Laggan, 25th July, 1886, they having hatched *en route*. I lost all but one of these. It passed first moult 2d August, the second moult 10th August, and soon after became lethargic. I kept it at Coalburgh, and brought it into the house middle of January, 1887, apparently healthy. But a month later it unaccountably disappeared.

Mr. Bruce had also sent eggs from Colorado which reached me 28th July, 1886. From these, five larvæ reached second moult, and went into hibernation, and died during the winter. From the behavior of the different lots of larvæ, it appears that hibernation may take place at either second or third moult.

EREBIA III.

This, therefore, is the complete history of an *Erebia* from egg to imago, and, so far as I know, the first such that has ever been published of one of the genus. To get drawings of the several stages, it was necessary to send them to Mrs. Peart, at Philadelphia, through the mails, some five hundred miles, with risk of loss or damage. Indeed, the second larva was in Philadelphia in its last stage, and being returned to me, imperfectly pupated on the way, and died.

The genus *Erebia* comprises many species, nearly all of which are European and Asiatic. Dr. Staudinger, in 1871, enumerated forty-eight, many of them boreal, others alpine, the latter found as far to the south as the Pyrenees, Alps, Caucasus, and Himalayas. Great Britain is credited with three species, and, in Buckler's *Larvæ of British Butterflies*, Vol. I, on Plate VI, are figured the mature larva and pupa of one of these, *E. Blandina*, and the young larva of another, *E. Cassiope*. In the text, Mr. Buckler relates that he raised the larva of *Blandina* from the egg, obtaining pupa and imago; and a brief description of the several stages is given, that of the larval being imperfect, as nothing is said of the several moults. Nor is it told how the larva pupated. Nevertheless, the plate represents the pupa resting nearly upright on a tuft of grass, but not at all inclosed. It looks very much like the pupa of *Epipsodea*. So an incomplete description is given of the stages of *Cassiope*, but how pupation took place is not told, nor is there a figure to show. The young larva as figured has forked tails, and therefore, I apprehend, it must have been drawn after the first moult.

In North America are eight or nine species, three at least of which are said to be old world, namely, *Tyndarus*, *Discoidalis*, and *Disa*. One species heretofore erroneously credited to North America, on the authority of Doubleday, *E. Vesagus*, belongs to the Andes, in South America.

The group is a very interesting one, and together with *Chionobas*, and some others, embraces those members of the Rhopalocera, or Diurnals, which are nearest the Heterocera, or Moths, allied to them in important characters in each of the four stages. The resemblances of the larvæ and pupæ are particularly striking. The latter are destitute of cremastral hooks in *Erebia*, in *Chionobas*, even of bristles, and pupation takes place, sometimes on the bare ground, sometimes in or on the sod, in one case, as we have seen, in an imperfect cocoon; sometimes in a real cocoon beneath the surface of the ground; or the larva goes into the ground and pupates naked, in a cavity made by the movements of its body, after the manner of nearly all the Sphingidæ. Before this Volume closes, I propose to illustrate these phases, in several species, and to make it plain that in the arrangement of the Diurnals the Satyrinæ are naturally at the bottom of the series, instead of at the top, where some recent systematists have, without sufficient ground, placed them.

EXPLANATION OF THE PLATE.

EPIPSODEA, 1, 2 ♂, 3, 4 ♀, 5 ♂; var. BRUCEI, 6, 7 ♂.

a EGG; *a*² micropyle, magnified.

b YOUNG LARVA; *b*² dorsum of two segments, magnified.

*b*³ 12th and 13th segment, side view; *b*⁴ dorsum of 13.

*b*⁵ process of 2d segment, *b*⁶ same of middle segment.

*b*⁷ same of 13.

c section of segment 7, after 1st moult, side; *c*² dorsum.

*c*³ dorsal view of 13; *c*⁴ process of dorsum, middle segment; *c*⁵ of 13.

d Larva at 2d moult, magnified; *d*² section of middle segment across dorsum; *d*³ side view of 13; *d*⁴ process on dorsum, middle segment.

e section of segment 7 after 3d moult, side; *e*² dorsum; *e*³ process on dorsum, middle segment.

*f*² Larva at six days after 4th moult, magnified.

f MATURE LARVA, natural size; *f*³ head; *f*⁴ dorsal view of 13; *f*⁵ side view same; *f*⁶ tubercle and process of dorsum.

g CHRYSALIS, as formed in tuft of grass, a little enlarged; *g*², *g*³ same, considerably enlarged; *g*⁴ cremaster, side view; *g*⁵ same, under side; *g*⁶ processes on cremaster.

NOTE. — Since the foregoing paper was printed, I have seen the Canadian Entomologist for December, 1889, and learn therefrom (Vol. XXI, p. 238) that Dr. Henry Skinner has received examples of EPIPSODEA caught in Assiniboa, about 325 miles west of Winnipeg; and with them one of the var. BRUCEI, mentioned as var. SINE-OCCELLATA.







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