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THE
BUTTERFLIES
OF THE
EASTERN UNITED STATES AND CANADA
WITH SPECIAL REFERENCE TO
NEW ENGLAND.
VOL. III.



T. W. Harris.

PORTRAIT OF DR. THADDEUS WILLIAM HARRIS.

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THE
BUTTERFLIES
OF THE
EASTERN UNITED STATES AND CANADA
WITH SPECIAL REFERENCE TO
NEW ENGLAND.

BY
SAMUEL HUBBARD SCUDDER.

IN THREE VOLUMES.

VOL. III.
APPENDIX, PLATES.



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BUTTERFLIES
OF THE
EASTERN UNITED STATES AND CANADA
NOT FOUND IN NEW ENGLAND.

You nymphs, call'd Naiads, of the windring brooks,
With your sedged crowns and ever-harmless looks,
Leave your crisp channels and on this green land
Answer your summons.

SHAKESPEARE.—*The Tempest.*

NYMPHALIDAE.
SUBFAMILY SATYRINAE.
OENEIS HÜBNER.

OENEIS MACOUNII.

Chionobas macounii Edwards, Canad. ent., Ont., 1888, 85 (1889); Trip to Nepigon, 12 xvii: 74-75 (1885); — Fletcher, Rep. ent. soc. (1889).

Imago. Head covered above with black brown scales and intermingled white hairs and elongated scales. Palpi heavily fringed with blackish hairs. Antennae luteous, clearer on the club than on the stalk; the latter sparsely flecked above with blackish brown scales with intermingled white ones. Thorax sparsely clothed above with pale brown hairs, below with black hairs; the femora covered with black hairs and scales, excepting at the tips which, with the luteo-castaneous legs, are pretty heavily covered with yellowish white scales; all the spines luteo-castaneous; claws slightly reddish.

Wings above brownish, sometimes burnt orange, varying in depth of tint in both males and females, some being much embrowned, others much paler; all the wings margined excepting on the inner edge with a broad blackish brown band, slightly broader on the fore wings than on the hind wings; all the nervures marked in brown. *Fore wings* with a narrow, arcuate, blackish brown stripe depending from the costal border, bordering the outer edge of the cell, extending outward slightly on the last median nervule; all generally obsolete in the male, distinct in the female; a roundish oval black spot with a white pupil in the middle of the lower subcostal and median interspaces, in the former occupying the whole width of the interspace, occasionally blind, especially in the median interspace; besides this, in the same row with them, there are occasionally found similar ocelli, smaller and almost invariably blind in the upper median and subcosto-median interspaces, especially the former; these last are

generally absent from the male, generally present in the female, and in one female before me which has no spot in the subcosto-median interspace there is a large ocellus in the next to the lowest subcostal interspace almost as large as the one below it and marked with a slender median longitudinal line of white scales. Normally the male has no sexual streak. In the *hind wings* a similar, smaller, round, generally white-pupiled ocellus is found a little before the middle of the outer half of the lower median interspace.

Beneath: *Fore wings* of the same ground color as above, perhaps a little paler, the costal margin with a broad brown border, finely irrorate, excepting at the tip, with black and white, the tip ashen flecked with black; the outer margin with a brown border, narrowing downward; the same dark bar depends from the costal margin at the outer edge of the cell, again more distinct in the female than in the male, but in addition to this there is, at least in the female, a very broad, obscure, median band washed in brown, broader than the width of the cell, crossing the whole wing and bent at the median nervure; this is generally almost entirely absent from the male; the ocelli of the upper surface are almost exactly repeated beneath, but in the exceptional female noted, there is no ocellus in the next to the lowest subcostal interspace. *Hind wings* varying very much in general color but the general effect is an ashen gray, deeper in some parts of the wing than in others and especially deepest along the outer margin and more especially in an exceedingly broad mesial or pre-mesial belt of irregular outline, more or less sinuous, approaching the base at the subcostal nervure, and the outer margin at the tip of the cell; this is usually more distinct in the female than in the male, but is never entirely absent; the ashen tints prevail along the costal border, especially on either side of the mesial belt, but in some specimens it covers the largest part of the wing; the broad mesial belt is more distinct at its margins than elsewhere and in some individuals this is almost the only token of its presence; the intermingling of colors on the wing is largely in the presence of short, transverse, tremulous threads of blackish brown on the paler brown ground; this is most distinct along the inner margin of the wing; fringe of all the wings black, narrowly interrupted in the middle of the interspaces with white; the extreme outer edge with a thread of black upon both wings; the only mark of an ocellus on the under surface is an extremely minute one, usually pupiled, in the same place as above, but a similar one is sometimes seen in the lower subcostal interspace where it is sometimes not pupiled, and the ocellus is more commonly present in the female than in the male. Expanse of wings ♂, 58-63 mm.; ♀, 64-69 mm.

The following account of the early stages is given by Fletcher (loc. cit.):—

Egg. Large, globular; rather higher than broad, flattened at top and bottom; coarsely ribbed from top to bottom with about twenty ribs, a few of which divide at the bottom; between these are zigzag furrows crossing from rib to rib. Eggs laid on 6th July hatched on 26th, the larva eating a narrow strip from the egg shell round the top and then pushing its way out leaving the egg-shell almost intact. Very few of the larvae ate their egg shells.

Caterpillar. *First stage.* The young larvae are larger [3 mm.] than those of jutta, and have the heads more hairy; there are also a few black spots about the head which do not occur in jutta. Upon the head and body of both species are some curious mammiform hairs. The larvae are very sluggish, and seem to like to perch upon dead leaves of grass during the daytime.

Second stage. The first moult took place about 18th August, after which the larvae were [8.4 mm.] in length. Head round, flattened in front, greenish white, punctured, bearing on each side three stripes continuous with the stripes of the body and composed of the black hollows of the roughened surface; the two upper stripes join at their tips just above the ocelli. General colour, dull, glaucous, greenish white, with brown stripes. On [the first thoracic] segment, just above and anterior to the spiracles is, on each side in both this species and jutta, one long thoracic bristle curved forward. Food, Carices and grasses.

Third stage. Ten days after moult. General appearance greenish gray, with red-

dish brown stripes which are deeper in color posteriorly. Head greenish white and deeply pitted; mandibles darkened at their tips; ocelli black. Marked on each side with three narrowing stripes of black, which are continuations of the markings on the body, and consist of the blackened pits of the surface of the head; the dorsal stripe divides and sends a branch down on each side of the frontal triangle; the other two stripes on each side of the head are extensions of the subdorsal stripe and lateral band of the body; they converge but do not quite meet above the ocelli, which the lower reaches.

The markings of the body are as follows: a conspicuous, narrow, mediodorsal stripe terminating between the anal horns, and bearing in the middle a narrow, white, broken line; below this a wide, white, subdorsal space, bearing in the middle a narrow, subdorsal line, with a waved, threadlike line on each side of it, and about half way to the edge of the subdorsal space; a conspicuous lateral band, which is pale in the centre; a stigmatal stripe, pale but clearly defined, and showing the supra- and infrastigmatal spaces above and below as clear greenish white lines; beneath the substigmatal fold is another brown band, with disconnected pale spaces in the centre. Spiracles small and black, but surrounded by a pale ring. Thoracic feet and prolegs greenish white and translucent. The whole body sparsely covered with short, clavate hairs. The anal horns half the length of the anal segment and bent upwards. Length, 12 mm. (Third stage communicated by J. Fletcher.)

Excepting Morley, at the eastern base of the Rocky Mountains of Alberta, Nepigon, at the northern extremity of Lake Superior, is the only known locality for this species, which must, nevertheless, have a wide distribution. It is single brooded, appearing early in July. The eggs hatch in about three weeks, slightly sooner if transported to the south, the caterpillars live as long or longer in their first stage, moult for the first time in the latter half of August and winter in the second stage. One carried through the winter by Mr. Fletcher revived April 25 and moulted May 15. The caterpillars are exceedingly sluggish, and in their first stage larger and more brilliantly marked than *Oeneis jutta*. Their latest changes have not been observed, though eggs distributed by Mr. Fletcher and myself in the summer of 1888 will, it is hoped, secure its further history. These are laid freely on grasses.

The butterfly has a very different flight from that of some species of the genus and belongs properly to a distinct section from *Oe. semidea*, and one to which *Oe. jutta* also belongs; its movements are swift and, notwithstanding their Satyrid character, are not altogether unlike those of *Basilarchia archippus*, which on the wing it much resembles. The eggs are subject to the attack of *Trichogramma intermedium* (89:8) which Mr. Fletcher reared, and the mortality among the growing caterpillars, from whatever cause, is very great; these feed readily upon both grasses and sedges.

OENEIS CALAIS.

Chionobas taygete Edw., Proc. acad. nat. sc. Philad., 1862, 57 (1862).

Chionobas calais Seudd., Proc. ent. soc. Philad., v: 7-10 (1865).

Oeneis chryxus pars Seudd., Bull. Buff. soc. nat. sc., ii: 240 (1875).

[Not *Oeneis taygete* Hübn., nor *Chionobas chryxus* Westw.]

Imago. Head, thorax and abdomen black, with ochraceous hairs. Antennae reddish yellow, annulated, especially above, with reddish brown; club reddish brown, black

tipped. Palpi with ochre yellow hairs, mingled with longer black hairs, which latter are especially prominent beneath and at the tip. Femora dusky; tibiae and tarsi pale yellow.

Wings above deep ochraceous brown, flecked with black on the basal half and along the costal and outer margin of both wings, eye-like spots before the margin, beneath marbled with ochraceous and brown; fringe dark brown, interrupted in the interspaces with grayish white. *Fore wings* ochraceous brown, the costal border marbled with black and grayish white, distinct next the base, forming a dark grayish band toward the tip, continued more broadly around the outer to the inner border as a dark brown band, the inner edge slightly crenulated, the outer edge distinctly black; a very broad band clouded with black, darkest at the borders, and somewhat tinged with ochraceous in the middle, crosses the middle of the wing; the nervure closing the cell is distinctly and narrowly edged with black; the outer border of the band starts from the dusky costal border beyond the cell at right angles to the last branch of the nervure, projecting outwards as a short tooth upon this nervure, is there bent at right angles toward the base, and immediately thereafter bends again and passes in broad crenations to the inner and subparallel to the outer border; the inner border of the band crosses the cell irregularly between the origin of the first and second median nervules and nearer the latter; below the cell, it passes from the origin of the first median nervule parallel to the costal border, but is lost before reaching the inner border. Between this band and the base the ochraceous is considerably flecked with brownish atoms, less distinctly next the band; in the broad ochraceous band next the outer border, occupying the space left between the two dark bands mentioned, are situated in the lowest subcostal, subcosto-median, and the lower median interspaces, large, roundish, inclined to be pyriform, blind, eye-like spots, that in the subcosto-median interspace a little smaller and rounder. *Hind wings*: Basal portion to the extremity of the cell fuscous, largely tinged with dull ochraceous, except above the cell; toward the base very indistinctly marked with faint fuscous and ochraceous; the outer limit of this fuscous basal portion is that of the outside of the middle band beneath; the outer border of the wing from the tip of the first subcostal nervule to the anal angle has a narrow dusky band, narrower than that of the fore wings, blackish on the inside where it is very slightly crenulate, paler along the middle, the edge black again; the marbling of the under surface shows indistinctly through upon the broad, ochraceous brown band which occupies most of the outer half of the wing, and in the interspace beyond the first and second median nervules is a round, black, blind, eye-like spot, smaller than any of those of the fore wings.

Beneath: *Fore wings* considerably paler than above; the middle band of the upper surface distinct only at the borders, the lower portion of the outer border straight, the middle space being of the ground color, with transverse, slightly wavy streaks, especially in the cell, of blackish brown; similar frequent streaks in the cell between the band and the base, the costal edge distinctly marbled with black and grayish white from base to apex, over which latter portion it is more diffused, though scarcely reaching the medio-submedian interspace, except next the outer border, where it extends at least to the third median nervule, and is bordered toward the base by a narrow band formed of continuous shallow lunules reaching neither the costal nor the inner border; next to which is a broad, ochraceous band, with infrequent transverse streaks of reddish brown, which never cross the nervures; the eyes as above, though more ovoid in form, and that of the lower median interspace very indistinctly white pupiled. *Hind wings* marbled with transverse bars and streaks of blackish brown and grayish white, tinged with pale ochraceous brown in the outer half of the wing, and with darker ochraceous brown in the middle of the band; at the base the bars are larger and about equally divided; in the band the darker ones are clustered along the borders so as to be continuous at the extreme border; in the outer half the marbling is pretty uniform, though less tinged with ochraceous next the middle band, the lighter colors prevailing throughout this portion; midway between the band and the outer border very indistinct pale yellowish white spots in the interspaces; the eye reduced to an indistinct, small, round, black spot; the outer border narrowly edged with black, not extending to either angle, a small white spot situated

upon it in the interspaces; the inner border of the middle band is formed of a series of right angles from the costal border till it has passed the median nervure; in the space above the cell it forms a right angle whose limbs are equal, projecting borderwards, in the cell one whose limbs are unequal projecting basewards, the short limb being the continuation of that of the interspace above, extending to the middle of the cell, whence it is directed to the origin of the first median nervule, is again bent here at right angles before reaching it, and continues to the internal nervure, whence it extends, bent slightly borderwards, to the inner margin; the outer border of the band starting from the costal border of the wing passes in one arch to the second subcostal nervule, here extends borderwards to the middle of the interspace opposite the extremity of the cell, and thence moves in a gradual crenulated curve, passing just beyond the extremity of the cell to the inner border; the band is broader than in most species of the genus, and is especially so on the median nervures; the nervures are all distinctly flecked with white. Expanse of wings, 56 mm.

This butterfly appears to be confined to the high northern regions of the eastern half of the continent, being thus far known only from Rupert House* at the southeastern extremity of Hudson Bay and Carbonear, Newfoundland. Nothing is known of its history or seasons.

CERCYONIS SPEYER.

CERCYONIS PEGALA.

Papilio pegala Fabr., Ent. syst., iii: 239 (1793).

Satyrus pegala Edw., Can. ent., xii: 51-54 (1880); — French, Butt. east. U. S., 242-243 (1886).

Cercyonis pegala Scudd., Bull. Buff. soc. nat. sc., ii: 241 (1875).

Satyrus alope form *pegala* Smith, Bull. Brookl. ent. soc., vi: 128-129 (1884).

Imago. Head covered with mouse brown and gray hairs, the fringe of the palpi with many black ones; the antennal stalk black brown, narrowly annulate at the base of the joints with white, the club luteous, a little infuscated.

Wings above dark brown with a chocolate tinge; the outer border with a faint, slender, pre-marginal, somewhat lunulate, narrow, blackish brown stripe, not greatly darker than the ground, and on the fore wings limiting in the lower half of the wing an exceedingly broad orange yellow band which traverses the wing beyond the middle, of nearly equal width throughout and extending from the costal to the submedian nervure, its inner margin gently arcuate or bent in the middle and lying wholly beyond the cell; in the upper outer corner of this broad belt and occupying the whole width of the lowest subcostal interspace is a large, round, black spot with a blurred margin, containing a distinct, though small caerulean blue pupil; in addition there is often in the middle of the lower median interspace a black point, or sometimes an incomplete ocellus. On the hind wings there is no such yellow band, but at a corresponding point of the lower median interspace, that is, a little beyond the middle of the interspace, is a black ocellus with a brownish yellow areola and a blue pupil; the areola sometimes obsolete, the whole nearly or quite as large as the permanent ocellus of the fore wing; fringe of all the wings of the ground color but on the lower portion of the outer margin of the fore wings a little paler; in all the wings preceded by a delicate black line at the extreme base of the fringe, and this, on the hind wings, by a pale brown line of similar width.

* This at least is the locality given by Edwards in his latest list; when he first described the species he gave it from Albany River,

which flows into Hudson Bay from the opposite direction. Drexel was the collector.

Beneath, the ground color is paler than above, the basal half of all the wings somewhat uniformly but irregularly striate with short, blackish brown, transverse striae having thread-like terminations, pretty equally distributed; the pre-marginal line of the upper surface is repeated beneath on the fore wings as a nearly straight and connected stripe, approaching the border on the lower half of the wing, crenulate above; on the hind wings usually more vague, broken into separate bars in the succeeding interspaces on the upper half of the wing, continuous only on the lower half; on both wings, but especially upon the hinder, followed without by more or less ashen tints; on the fore wings the band of the upper surface is repeated but is much more pallid; the upper ocellus frequently has a distinct yellow annulus edged with a blackish brown incomplete arcola, distinct, if at all, only above; the interior edge of the band is limited more distinctly beneath by a blackish brown edging and here has a sinuate direction, the lower half marked by the middle median nervule being removed inward somewhat beyond the upper half; a similar mesial stripe, similar in tint, width and irregularity, crosses the hind wing so as to mark off in a very vague and indistinct way a broad, extra-mesial band upon the hind wings like that upon the fore wing, only that it has no yellow coloring, and crossing the middle of this broad band is an irregular series of large, roundish or long oval, velvety black ocelli, nearly always with a narrow yellow annulus, surrounded by a broader and vaguer black brown areola, pupiled with a dot or more commonly a longitudinal streak or oval patch of caerulean blue; one of these ocelli occurs in every or nearly every interspace from the upper subcostal to the medio-submedian, that in the upper median being more frequently than any of the others blind or sub-obsolete, those in the lower subcostal and lower median interspaces being invariably the largest and as large as the large ocellus of the fore wing. Fringe of wings pale brown, the outer edge of the wings themselves marked by a blackish brown line, preceded by a line of similar width varying from white through ashen gray to brown in different individuals. Expanse of wings, 60-65 mm.

The male bears upon the upper wing a broad, oblique patch of dead brown matted scales crossing the middle of the lower half of the wing, its outer margin parallel to the outer border, its inner subparallel to the costal border, so that it broadens as it passes from above downward, being found principally in the lower median and medio-submedian interspaces near the base of the former but not reaching it, and accompanied by a small patch in the upper median interspace and a slightly larger one in the submedio-internal interspace.

The extent of this patch of scales separates the male noticeably from *Cercyonis alope*, from which it is usually to be distinguished by the absence of the lower ocellus of the extra-mesial band of the fore wing and the invariable presence of an ocellus on the upper surface of the hind wings.

Very common in the southern half of the states bordering the Gulf of Mexico, at least east of the Mississippi River, this butterfly is occasionally found at relatively high northern latitudes, but only along the sea coast, having been found as far as central New Jersey, where indeed, it is not uncommon.

No statements have been published regarding its history and seasons, so far as I have noted, except the remark by French to the effect that the caterpillar "is said to be gray, with one broad and one narrow white band. The food plant is coarse wild grass."

From the notes given by Edwards from different observers, it is evident that the butterfly is peculiarly a butterfly of the pine barrens, fond of hot sandy exposures, but seldom seen in open fields and given to alighting on erect tree trunks, especially of pines.

COENONYMPHA HÜBNER.

Coenonympha Hübn., Verz. bek. schmett., 65 (1816). Chortobius Guen., Doubl., List. Brit. Lep., 2d ed. (1859).

Imago. Head not large, broadly tumid and protuberant in front, especially below, above much depressed, transversely and deeply sulcate in front of the antennae, the whole face slightly broader than high. Antennae deeply inserted, the stalk of each scarcely nearer the side of the eye than its neighbor, very slender, about as long as the abdomen, composed of about thirty-three or thirty-four joints of which about eleven form the distinct club, tricarinate beneath, only the middle carina distinct, which increases gradually in size on the first three or four joints, beyond which it is equal, more than twice as stout as the stalk, terminating by the naked apical two joints in an abruptly rounded tip; in the middle of the stalk the joints are three times as long as broad, in the middle of the club the reverse. Palpi very slender and long, heavily fringed in a compressed plane beneath, the last joint excessively slender and unusually long, being fully half as long as the middle joint though scarcely a third its diameter. Eyes pretty large, full, naked.

Form of wings much as in *Neonympha*, with which it agrees in neuration, except in wanting the precostal nervure of the hind wings, beyond the merest spur, arising beyond and not at the divarication of the costal and subcostal nervures.

Fore legs excessively small, the tibiae not one-third the length of the hind tibiae; tarsi not one-half so long as the tibia, composed in the male apparently of a single unarmed joint. Hind tibiae slightly longer than hind femora. Legs cylindrical, a little flattened beneath; tibiae and tarsi divided, clothed and armed almost exactly as in *Neonympha*.

Clasps of male abdominal appendages forming exceedingly slender, straight, elongate blades.

Egg. Broadly truncate pyriform in shape, broadest near the middle of the basal half, above the broadest portion with numerous slightly elevated, vertical ribs united by tolerably frequent cross lines and terminating at the rim of the summit which is two-thirds as broad as the egg; below broadly convex.

Caterpillar at birth. Head large, rounded, with a dozen clubbed bristles like those of body on each hemisphere, symmetrically disposed. Body tapering slightly and with great regularity from the head to the tail, the last segment with two posterior, conical projections, one on either side. Several series of short, equal, rather coarse, clubbed bristles, not half so long as the segments, seated on small papillae, arranged in anterior subdorsal, posterior supralateral and median laterostigmatal series, one to a segment on all the segments, slightly altered on the thoracic, and a ventro-stigmatal series, two to a segment on the abdominal, one to a segment on the thoracic segments.

Mature caterpillar. Very long and slender, the head rounded and barely broader than the body, the latter uniform, tapering a very little on the terminal abdominal segments, clothed with the briefest possible pile, consisting of minute hairs on minute, profusely scattered papillae; abdominal segments divided into six sections of which all but the anterior section are equal, that almost twice as large as the others. Last abdominal segment with terminal forks shorter or no longer than the body of the last segment. Prolegs very short.

Chrysalis. Closely resembling that of *Cercyonis*, but much shorter and with fuller outlines.

Coenonympha contains a goodly number of species, all of which are found in the north temperate zone and particularly in the higher latitudes or altitudes. It is also far more richly represented in the Old World than in the New and in the latter is almost altogether confined to the western

half of the continent; indeed the species here described is the single one which is found in the eastern half and this extends across the continent.

The butterflies are weak winged insects of delicate texture and generally feeble and often vaguely defined markings, usually of some shade of buff; they belong to the first section of Satyrid genera as defined in the present work, the eggs being vertically ribbed and cross lined excepting at base, the young caterpillar having bent cuticular appendages, here very short, the mature caterpillar a smoothly rounded head uncrested by projections, and with short tails, the chrysalis a blunt anterior extremity, and the butterfly an angulate, inferiorly produced, outer extremity to the cell in the fore wings.

Notwithstanding that the genus is so much better developed in Europe than in America and in America is almost absolutely confined to the west, it was reserved for the indefatigable Edwards of West Virginia to give us our first knowledge of its early stages.

COENONYMPHA INORNATA.

Coenonympha inornata Edw., Proc. acad. nat. sc. Philad., 1861, 163 (1861).

Imago. Head covered with pale brownish yellow scales and hairs; palpi the same with a few scattered black ones; antennae clay brown, heavily flecked above with brownish, excepting generally at the extreme base of the joints.

Upper surface of the wings pale yellow buff, sometimes nearly uniform, at other times with the markings of the under surface showing through, especially where these are heavy; fringe concolorous with the surface. Beneath, the same ground color as above, at least upon the fore wings, but the basal half or three-fifths of the hind wings heavily or lightly begrimed with a more or less dense sprinkling of black scales; the same are also found at the extreme base of the fore wings, and to a very slight extent just beyond the middle of the wing upon the costal border; an extra-mesial, pallid or white band, with somewhat irregular contour, crosses the *fore wings* from the middle of the outer two-thirds of the costal border toward a point just within the termination of the inner margin; it is distinctly edged only upon the inner side, where the wing is slightly darker than elsewhere; it is of varying length and depth, sometimes very obscure; there is sometimes in the first inferior subcostal interspace, midway between the cell and the margin, or rather nearer the latter, a minute, white-pupiled, round black spot. *Hind wings* with a similar but more irregular and tortuous extra-mesial, pallid or white stripe of irregular width, being widest beyond the cell, the outer extremity of which it turns inward to meet. The outer margin of all the wings lined with a fine black thread. Expanse of wings, 31-36 mm.

From drawings by Gosse, Edwards finds this species occurring at Carbonear, Newfoundland. Excepting for this occurrence, the butterfly has not been taken east of Lake Winnipeg, having always been supposed to be a northern species of the western half of the continent, where it occurs not only in British America, as far as Vancouver Island and at Calgary and Edmonton (Geddes), but in Montana. Nothing is known of its transformations and seasons, excepting that in Newfoundland Gosse took it in July and August.

NEONYMPHA HÜBNER.

NEONYMPHA CORNELIUS.

Papilio cornellus Fabr., ent. syst., iii: 220 (1793).

Neonympha cornelius Scudd., Bull. Buff. soc. nat. sc., ii: 244 (1875).

Neonympha gemma Hübn., Zutr. samml. exot. schmett., i: 8, figs. 7-8 (1818);—French,

Butt. east. U. S., 235-237 (1886).

Satyrus gemma Boisd.-LeC., Lép. amér. sept., pl. 62, figs. 1-5 (1833).

Coenonympha gemma Edw., Can. ent., xi: 31-35 (1879).

Imago. Head covered with mingled dark brown, pallid and pale luteous hairs; the palpi with numerous longer or shorter black scales and hairs, especially above and below, leaving a very pale yellowish line along the outer and inner edge; the inside of the long inferior fringe wholly whitish; the basal third of the antennae blackish brown, the basal half of each joint flecked on the inner side with white scales, the coloring being broadest at the base, while a few white scales are scattered over the entire upper surface which, beyond the basal third, is dark brownish luteous; beneath, the antennae are clear luteous, excepting the last three or four joints of the club which are uniform brown throughout; tips of the joints upon the club brown above.

Wings above moderately dark mouse-brown, uniform on all the wings, excepting that the dark markings of the outer margin of the under surface of the hind wings are more or less repeated above in blackish brown clouds, especially in the interspaces beyond the cell, and that there is a denser flecking of the dark scales on the upper half of the outer margin of the fore wings, giving a slightly darker tone at this point; fringe concolorous, but made up of mingled lighter and darker brown scales and hairs. Under surface gray brown with an olivaceous tint, arising from a dense and uniform clothing of delicate olivaceous hairs; the surface more or less faintly and very minutely mottled and showing faintly traced upon the surface three fine, brown, transverse threads, subparallel to each other and the outer border; the middle one crosses the wing, bent at the main subcostal nervure a little beyond the outer limit of the cell so as to cut off, at the base of the outer median interspace, a rhomboidal piece of equal sides; the outer thread is obscure in the upper half of the wing, and in the lower half runs a little nearer the border than the mesial line, while the inner is at a slightly greater distance within the mesial line; these markings exist, or at least the inner pair, in a still more obscure or modified form upon the hind wings, but the principal markings of these consist of a large, oval, variegated patch at the margin of the wing, almost entirely within the subcostal and median interspaces, the ground of which is a cinnamon brown, heavily flecked with white scales and white hairs in place of olivaceous ones; but in addition there is in the middle of all the interspaces, excepting the lower half of the medio-submedian, a marginal series of short, thick, often confluent, longitudinal, minute patches of brilliant silvery nacreous scales, those in the upper median and subcosto-median interspaces lying confluent at the outer edge of a transverse, long oval, velvety black spot, edged narrowly with yellow scales and cut by yellow nervures into four subequal spots, to the centre of each of which a tongue of nacreous scales extends; at the upper inner border of this large variegated patch the cinnamon brown of the ground becomes conspicuous, since here is the point where it unites with the transverse mesial stripe which, influenced by this patch, is here deflected somewhat from its course to form an arching margin to it. Expanse of wings, 34-38 mm.

The following descriptions of the early stages by Edwards are given nearly in his own words:—

Egg. Subglobular, as high as broad, the base flattened; surface under a low power smooth, but under a high one seen to be reticulated throughout in 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. Duration of this stage from three to six days, according to the temperature.

Caterpillar. *First stage.* Head subpyriform, one-half broader than succeeding segment, broader than high, flattened frontally, and with a slight angular depression at summit; on each vertex a straight, round, divergent horn, thick at base, pointed at top; the horn when magnified is seen to be in three sections, each smaller than the one below it, giving out at the end one or two bristles; color of head and horns blackish brown. Body cylindrical, a little thickest in middle, tapering slightly both ways from fourth abdominal segment, and ending in two divergent tails, each of which is thick at base and rounded, tapers to a blunt point, which emits a white bristle; color of body white; over the surface scattering white hairs. In a few days, and during this stage, the color changes to whitish green, and stripes appear, green and white alternating from dorsum to feet. Length, 3 mm. Duration of this stage in August six days, in October nine, in April six.

Second stage. Head subpyriform, 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 the face, and there is a second such stripe in front. Body nearly the same shape as before, 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 the dorsal area a white stripe, another along base of body, and between these, on side, are two contiguous white lines; under side bluish green; feet and legs green. Length, 4.6 mm. Duration of this stage, in August five days, in October ten, in May seven.

Third stage. 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. Body of nearly the same shape, the tails longer; color pale green, the stripes as before. Length, 8.6 mm. Duration of this stage, in August five days, in May eight.

Fourth stage. In autumn: same shape; color soiled white, greenish on dorsum next head; the dorsal stripe dark, the subdorsal and basal brown. Length, 14 mm.

At four days from the moult: color now drab on dorsum, the median and subdorsal stripes darker; sides red-brown, the two lines buff; basal stripe yellow buff; under this a broad black-brown stripe the length of the body; tails drab, reddening at tips. Length, 18.3 mm.

Last stage. Head subpyriform, 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. Body 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. Length, 24.4 mm. In August, ten days from third moult to chrysalis.

The same in May, from eggs laid in April. Head sordid greenish white, front and back, the stripes brown, horns red-brown; color of body light yellow-green, the dorsal stripe darker, the subdorsal and lateral lines and basal stripe yellow; tails pink-tipped. From third moult to pupation five and six days. All the larvae, ten in number, of this April and May brood were green.

Chrysalis. 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 antennae cases and the projections all more yellow; the surface finely streaked brown, irregularly and mostly longitudinally; from posterior base of mesonotum to ninth abdominal segment 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. Length, 11.7-13.25 mm.; greatest breadth on abdomen, 3.6 mm.

From green larvae 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 butterfly is found throughout the southern states, from the southern part of West Virginia and Illinois to Florida and Texas, and extends also into Mexico (Monterey, Aaron) and Guatemala (Polochie valley, Butler). It seems to be restricted to the vicinity of running water, so that though the caterpillars seem to feed readily on almost any grasses, their natural food is probably some species found only near streams.

According to Edwards it is triple brooded in West Virginia, flying in April and May, in June and July, and from about August 20 to the end of September, the winter being passed in the caterpillar state when full grown. Eggs laid in April hatch in six days, in August in three or four days, and in October six days. According to Edwards, the caterpillar has but four stages, which are passed in from twenty-five to thirty or more days, according to the season, and the chrysalis hangs eight days in May. The caterpillar rests with the face upon the ground, so as to throw its horns forward in a reverse position to those of the tail.

NEONYMPHA MITCHELLII.

Neonympha mitchellii French, Can. ent., xxi: 25-27 (1889).

Imago. Head covered with mingled gray, black and brown hairs, paler in a stripe behind the eyes, and on the sides of the palpi; antennae honey yellow at tip, elsewhere brown, with white patches at the base of each joint. Thorax with legs above and below uniform mouse-brown.

Wings above uniform mouse-brown without markings, excepting a slightly darker edging to the outer border of the wings, on the hind wings preceded by a slightly paler line. Beneath, the same with a grayish suffusion caused by a profuse flecking of clay brown scales. *Fore wings* traversed by four narrow, ochre-yellow stripes, the inner nearly straight, crossing the outer half of the cell, the outer just within the outer margin, the other two arcuate in opposite senses and meeting above, enclosing a very large oval space, nearly one-third the size of the wing, and including in the middle, in the median and lower subcostal interspaces, a transverse series of four or five round or roundish ocelli, the middle ones largest, nearly filling the interspaces, composed of an outer rim of pale yellow scales surrounding a blackish purple spot, with a few metallic blue scales scattered through it. *Hind wings* with similar transverse stripes, the middle ones enclosing a longer oval, in which are six ocelli, situated in all the median and subcostal interspaces, larger than on the fore wings, but as there the middle ones largest, in this case three in number; especially the yellow edging is broader and the metallic flecking of the interior more distinct. Expanse of wings ♂, 32 mm.; ♀, 36 mm.

It differs from *N. areolatus* in its darker upper surface, but most markedly in the form of the extra-mesial spots and in the oval enclosure of both wings, the former of which are here circular or almost circular, while in *areolatus* they are very elongated in the direction of the interspaces.

This butterfly was first described since the publication of the first part of the present work, and nothing is known of its early stages nor of its distribution beyond that it was found in southern Michigan by Prof. J. N. Mitchell, who thinks that it occurs also in central Michigan. It was taken in dry upland meadows, and doubtless will be found over a considerable extent of territory in the near future.

CISSIA DOUBLEDAY.

CISSIA SOSYBIUS.

Papilio sosybius Fabr., Ent. syst., iii: 219 sc., li: 245 (1875).
(1793.)

Satyris sosybius Boisd.-LeC., Lép. Amér.
sept., pl. 63, figs. 1-4 (1833).

Cissia sosybius Scudd., Bull. Buff. soc. nat.

Neonympha sosybius Edw., Can. ent., ix:
229-231 (1877);—French, Butt. east. U. S. 240-
242 (1886).

Imago. Head covered with long, erect, brown and pale hairs and scales, the paler ones external to all masses; the palpi with white or yellowish white scales upon the sides, brownish black scales upon the upper surface and a heavy fringe of mingled black and white scale-hairs; antennae dark brownish luteous, the joints basally annulate or subannulate with white; the club almost entirely naked, fulvo-luteous below, fusco-luteous above.

The upper surface of the wings is uniform rich dark slate brown, the outer margin of all the wings marked with a black thread preceded by a more or less obscure narrow pallid stripe, more distinct upon the hind wings than the fore wings, limited interiorly, especially upon the lower portion of the hind wings, by a similar black thread; basal half of the fore wings in the male heavily covered with moderately long, delicate, blackish hairs, partially concealing raised scales which broadly border the basal half of the first median nervule and are found to some extent also in the lower portion of the cell.

Under surface pale slate brown rendered more or less grayish by a scattering of dull yellow scales; both wings crossed by two distinct transverse threads of brownish fuliginous, subparallel to the outer border, slightly tremulous but nearly straight, though more or less sinuous in the lower half of the hind wings; the inner crosses the wing somewhat further within the apex of the cell than the other is outside of it, and the outer is a little less than midway from the inner thread to the outer border; the outer border edged with black is preceded by a brownish fuliginous, straight line barely separated from the outer by a clay yellow thread, and preceded by a sinuous, subannulate, but otherwise similar thread; in the belt between the last and the extra-mesial thread is found on both wings a series of small, distinct annuli; these vary in distinctness and importance in different parts of the wings and in different individuals: on the fore wings the most important is in the lower inferior subcostal interspace and is blackish brown, nacreous-pupiled and with a pale, dirty yellow areola; the others in the interspace above and the succeeding interspaces as far as the lowest median nervule, are even at their best rarely pupiled, with a spot generally reduced to fuliginous brown, the areola enlarged at the expense of the interior spot and itself bordered narrowly by brownish fuliginous; on the hind wings the ocelli are more distinct and more brilliant, the most distinct and largest being those in the lowest subcostal and lowest median interspaces, where they are a rich blackish brown with a bluish nacreous pupil

and distinct yellow areola, bounded by a narrow, brownish fuliginous annulus which just reaches the nervules or in the lower subcostal interspace is crowded against them so as to make the whole spot short oval in a longitudinal direction; the other spots, at least at their best, are always pupiled, and slightly larger than the spots of the fore wing, though rarely much more distinct; they are usually found in all the interspaces from the upper subcostal to the medio-submedian inclusive, in the latter occupying the upper half of the interspace. Expanse of wings, 31-37 mm.

The following descriptions of the early stages are by Edwards, the phraseology and arrangement only altered to bring it into harmony with others in the present work.

Egg. Shape nearly that of a semi-ovoid, the base being flattened and the sides at base rounded, the surface under a low power smooth, but under a higher seen to be covered with shallow, thimble-like depressions; color greenish white. Laid July 16th, on grass, the female being confined in a bag over a tuft of grass set in a flower pot. Hatched July 20th.

Caterpillar. First stage. Head much larger than second segment, rounded, bilobed, rather broader than long, the vertices without processes, pilose, shining black. Shape of body cylindrical, but marked by five or six longitudinal tuberculated ridges; each tubercle sending out a clubbed white hair, some of which are curved forward, others back; color white. Length, 2.3 mm. Duration of this stage six days.

Second stage. Head considerably broader than first thoracic segment, rounded, a little depressed at top, angular at the sides below; color green, darker than body, much covered with fine, white, pubescent tubercles; ocelli and mandibles brown. Shape of body cylindrical, thickest in the middle, tapering evenly either way, so that the first thoracic segment is of about same breadth as the eighth abdominal; tail forked; color light green; covered with fine white tubercles, arranged in longitudinal rows, not quite regularly, each tubercle sending out a white hair; the space between the two dorsal rows is rather broader than between the rows elsewhere, presenting a clear green mediodorsal stripe; and at extreme edge of dorsum is also a green stripe, but narrower; legs, prolegs and under side green. Length, 5 mm. To moult seven days.

Third stage. Head no broader than the succeeding segment, yellow-green, shaped and marked as before. Shape of body as before, and similarly marked, the tubercles of unequal size: the largest arranged in the longitudinal rows, but many small ones placed on the ridges caused by the creasing of the several segments; color blue-green. Length, 9 mm. To next moult six days.

Fourth stage. Head emerald green, shaped as before. Body stout, thickest in the middle, rounding somewhat dorsally; color pale green; on either side of the darker mediodorsal stripe the row of white tubercles forms quite a broad stripe, another one at edge of dorsum, and another at base, over feet. Length, 10.7 mm. To next moult five days.

Last stage. Head rounded, broader than high, bilobed, and but little depressed at the suture, somewhat flattened frontally, broader than the first, equal to the second thoracic segment; covered with yellow, conical, fine points, arranged in close vertical rows, and at the same time in transverse rows also; the ocelli black; mandibles brown. Body cylindrical, obese, thickest in the middle, rounded dorsally, and sloping slightly to the seventh abdominal segment, then rapidly to last segment, which ends in forked, divergent tails; color emerald green, much covered with fine yellow tubercles placed on the ridges caused by the creasing of the segments, and with larger tubercles disposed in longitudinal rows; each tubercle giving out a fine and short white hair; at base of body the stripe is more heavily tuberculated than on dorsum; on either side of a clear dark green, mediodorsal stripe is a tuberculated stripe, and another at edge of dorsum; under side, legs and prolegs, nearly same green as above. Length, 19.3 mm. Duration of this stage seven days.

Chrysalis. Cylindrical, the abdomen stouter than anterior portion; mesonotum rounded, carinated; the head case truncated, scarcely projecting beyond the mesonotum, slightly arched at top, narrow, beveled at corners; the wing cases flaring a little on dorsal side, the neuration of wings seen distinctly; color green, on the abdomen

yellow-green; on either side of dorsum on abdomen is a small ridge, and on either side of this are three black dots, placed in pairs between the mesonotum and extremity; on either side below wing cases a brown stripe; the keel of mesonotum brown, and the wing cases are crooked along the principal nervures, and on the margin is a black dot at the end of each nervule. Length, 10 mm.; greatest breadth, 2.5 mm. Duration of this stage thirteen days.

This butterfly inhabits the southern half of the United States, from the Atlantic Ocean to and including the Mississippi Valley. It also extends beyond our border as far as Nicaragua (Butler), and occurs in the southern part of our middle States. It flies in company with *Neonympha cornelius* and *Cissia eurytus*, according to Edwards, "keeping within the edge of the forest, or, if in the open country, is always near timber." It is double brooded in West Virginia, flying in July and again in the latter part of the season. The eggs hatch in four days, the first stage of the caterpillar lasts for six days, and the others about the same, while the chrysalis hangs for thirteen days, so that the whole period from egg to butterfly is about seven weeks. How it passes the winter has not been stated.

SUBFAMILY NYMPHALINAE.

TRIBE APATURIDI.

CHLORIPPE BOISDUVAL.

CHLORIPPE CELTIS.

Apatura celtis Boisd.-LeC., Lép. Amér. sept., 210-211, pl. 57, figs. 1-4 (1833);—Edw., Butt. N. A., ii, *Apatura* i, 10 pp., 1 pl. (1875);—French, Butt. east. U. S., 215-217 (1886).

Dorocopa lycaon Scudd., Syst. rev. Am. butt., 9 (1872).

Apatura lycaon Ril., Traus. acad. sc. St. Louis, iii: 195-198, figs. 3-4 (1873); Rep. ins. Mo., vi: 137-140, figs. 39, 40 (1874).

? *Apatura alicia* Edw., Butt. N. Amer., i, *Apatura* i, 2 pp., 1 pl. (1868).

[Not *Papilio lycaon* Fabricius].

Imago. Head covered above with soft, very pale brown hairs; apical joint of palpi covered with dark brown scales and hairs, the rest of palpi silvery white, the dark brown of the apical joint extending slightly upon the apical portion of the upper surface of the middle joint and also flecking slightly the inner side; antennae blackish brown, above narrowly annulate with pale yellow; beneath, tips of the joints luteous and nearly naked throughout, excepting next the base, where it is flecked with pale yellow scales; club wholly luteous on all surfaces, excepting the upper portion of the basal half, which is heavily flecked with dark brown scales.

Wings above sordid or gray fulvous; on the *fore wings*, however, this ground color is restricted to the basal third, the rest of the wing, including all beyond the cell, the whole of the lower median interspace and half the medio-submedian interspace, dull blackish brown; within this blackish brown portion, the wing is crossed by two rows of conspicuous white spots, the inner row occasionally tinged with straw yellow; the outer row consists of three large, roundish white spots midway between the cell and the outer border, lying in a straight line in the upper median, subcosto-median and next to the lowest subcostal interspace, accompanied by a fourth smaller white spot, often annulate with black, in the lowest subcostal interspace farther toward the mar-

gin; the lowermost of these three spots is sometimes simple, sometimes, and then smaller, enclosed in a large black spot with a tawny annulus, which is the normal condition of a further succeeding spot in the same line, in the lowest median interspace, only that the white is reduced to a mere pupil or is totally absent; the inner series of pallid spots is strongly sinuous, lying midway between the cell and the outer row of spots, excepting the pair in the medio-submedian interspace, which seem at first sight to belong as much to the outer as to the inner series; there are two black bars crossing the cell, one at its outer limit, straight and subequal, the other usually broken into two spots beyond the middle of the cell; outer border marked by a pre-apical black-brown line on a lighter brown ground. *Hind wings* with a very sinuous series of oval, black spots with a tawny areola crossing the outer half of the wing in all the interspaces between the submedian and costal nervures; the second from the top, which is largest, outside and the lowest, which is smallest, inside of the straight line in which the others fall; the basal half of the wing shows more or less obscurely the markings of the under surface through the wing, but there is sometimes added a series of more or less obscure, pallid, triangular spots, crossing the middle of the wing in an arcuate line in the subcostal and median interspaces; outer margin marked by a pair of tolerably heavy, pre-marginal, blackish brown stripes, the outer nearly straight, the inner more or less crenulate; fringe of both wings pale, broadly interrupted by brown at the nervule tips.

Beneath, gray brown, clouded with dark brown, the markings of the upper surface repeated with variations. *Fore wings* with the cellular spots brownish orange edged with black, the extra-mesial white spots of the upper surface enlarged and margined interiorly with a distinct, strongly sinuous, blackish brown stripe which shows the double spot of the medio-submedian interspace to belong to this series rather than to the outer; of the spots in the outer series, that in the lowest subcostal and in the two median interspaces become distinct ocelli with rare exceptions, in which the spot is velvety black with a large white pupil, excepting in the lowest median where it is a mere dot surrounded by a distinct, brown edged, yellow annulus. *Hind wings* traversed by a very irregular, sinuous, slender, mesial, dark brown stripe, followed outside and inside, but especially outside, by a series of pallid lunules; while at the base of the wing, included in the cell and above it, are three or four slender, transverse bars of gray-brown, heavily margined with dark brown; the spots of the upper surface are repeated beneath as distinct ocelli, and one is added in the submedio-internal interspace opposite the tip of the abdomen; while that in the medio-submedian interspace is frequently double internally, being enclosed by a common outer ring of dark brown; these ocelli are generally faintly pupiled with pale blue and consist of a roundish oval, longitudinal, black brown spot, narrowly encircled with yellow and this with dark brown. Expanse of wings, 48-55.

The following descriptions of the early stages are those of W. H. Edwards, altered only to conform to the system employed in the present work:—

Egg. Color pale green; in shape nearly spherical, flattened at base, and having eighteen slightly prominent, vertical ribs and many fine, horizontal, equidistant striae.

Caterpillar. First stage. Head round, bilobed, twice the diameter of the second segment, black, covered with tubercles. Body whitish-green, cylindrical, thickest at first thoracic segment, tapering gradually to the last, which is slightly forked; surface covered with minute tubercles from each of which springs a short hair. Length, 2 mm.

Second stage. Head either black, or purple, or green, the mandibles and ocelli brown in case green prevails; at the vertices large, green, stag-horn processes, with three fleshy prongs at top, smaller prongs below and at base, and three along the side of the head below the horns, the tips usually purple or black. Body yellow-green, the dorsum covered by a band composed of yellow tubercles arranged in two longitudinal rows, with cross rows upon the anterior part of each segment, the remaining space on the posterior part of the segment green; along the side a crenated line, and below the spiracles a straight line, each formed of yellow tubercles; scattered tubercles over the whole upper surface; tail forked and roughly tuberculated. Length, 5 mm.

Third stage. Head brown, mottled in front with pale green, the horns enlarged. Body yellow-green above, blue-green at sides and beneath; the bands and lines as before; the tubercles much enlarged, prominent, irregular; tail more deeply forked. Length, 6.4 mm.

Fourth stage. Not essentially different. Length, 9 mm.

Last stage. Head subquadrate, longer than broad, punctate, covered with minute tubercles, green, with four pale, vertical stripes upon the front; mandibles and ocelli brown; horns small, yellow-green, each furnished with two short, terminal prongs, which are tipped with brown; other small prongs about the middle of the horns and at base, and along the top of the head, and three at sides of head. Shape of body subcylindrical, being somewhat flattened dorsally, very thick in middle, tapering regularly either way, the first thoracic segment being of about the same width as the last; the tail deeply forked; color yellow-green dorsally, the blue-green on the sides; the whole surface granulated, owing to minute tubercles on the sides and larger and irregular ones on the back; these last arranged in transverse rows, separated by deep creases, there being four rows to each segment; on either side of the dorsum a clear yellow line from head to end of tail, and between these a less distinct pale stripe, on which is set an oval yellow spot on the anterior end of each segment; often this stripe is wanting, and the yellow spots only appear; on the side a pale yellow wavy line and an infrastigmatal, straight line; under side and legs blue-green. Length, 30-33 mm.

The hibernating larvae at maturity differ from those described above principally in that the yellow spots of the dorsum have disappeared and given place to a longitudinal yellow line, making three similar lines on a dark green ground, the inner edges of the two exterior lines being whitish; the color of the whole body is greenish-yellow. In both the body stouter on the anterior segments, the horns reduced in size, the prongs less prominent.

Chrysalis. Compressed laterally; the outline of the under side convex, regular; the abdomen prominent dorsally, much arched, sharply carinated, the anterior edge of each segment on the keel produced and clubbed and marked on either side by a shining black dot; the last segment terminating in a long, bifurcated pad of hooklets; the thoracic segments depressed at an angle of forty-five degrees from the end of the keel, the sides excavated in the direction of base of wing; mesonotum angular, rounded somewhat at summit; the head case produced, subconic, the palpi cases prominent, pointed; color either delicate yellow-green or blue-green, finely specked with pale yellow over the whole surface; the venation of the wings distinct; a yellow line passes along the keel and to the mesonotum, at which it forks to the palpi cases; another passes along the posterior edge of the wing case, and is joined by an undulating line upon the side of the abdomen. Length, 21.6 mm.

This is a common butterfly of the southern half of the United States east of the Great Plains. It is not known to extend into Mexico.

“*Celtis* is exceedingly alert, restless, and inquisitive, active on the wing, but without sustained flight, and darts from one object to another so swiftly that the eye can scarcely follow it, alighting but for an instant on tree trunk or leaf, the dress of one passing, or the traveller’s horse. More than once it has sprung upon the net which I was carrying. Its usual attitude is expressive of its disposition, the wings erect, the head and antennae raised, suspicious of surprises. But it will haunt a favorite spot for days, and the collector has only to wait patiently a while and it may be captured. It is readily attracted also by a sugared bait, and a string of dried apples, saturated with syrup and suspended among the branches of the tree which it frequents, may be employed to advantage. Occasionally, I have seen it

upon flowers, but a rotten apple or fallen grape is much more to its taste, and especially, if there is any decaying or fetid animal matter in the vicinity, it will greedily settle upon it, and then loses all sense of danger and may be covered by the net without even attempting to rise." (Edwards.)

Riley says the butterflies appear in eastern Missouri by the middle of June and a second brood of butterflies during August, but that "they overlap each other so that a few of the later individuals of the first coexist with the earlier individuals of the second, and the butterflies may be found more or less abundantly from early June till September." Edwards says that in West Virginia some individuals hibernate, lay their eggs early in the spring and that these produce butterflies by the middle of June and that there is a second brood; but that the wintering caterpillars begin to feed early in May and produce their butterflies about the end of May.

The eggs "are attached rather slightly to the under side of a leaf, either singly or in small clusters not exceeding a dozen. In form they are nearly globular, with very delicate, longitudinal ribs and still finer transverse striae. In hatching, the enclosed larva pushes open the crown, which lifts like a cap. When first hatched, this larva is of a uniform yellow, sparsely covered with a few short hairs, and with a head which is jet-black and always hornless—thus differing materially from the head subsequently worn. The larvae of this, the first, brood feed for rather less than a month, when they transform and give out the second brood of butterflies during August. These lay eggs again, which in due time hatch. But the second brood of larvae thus hatching, instead of feeding with good appetite as did the first brood, is more lethargic from the start, and develops more slowly. Every worm, after passing through the second or third molt, ceases to eat; then shrinks in size and stations itself on the under side of a leaf. Here it changes its fresh green color for a dingy grayish brown (caused by more or less distinct purplish marks on a dingy yellow ground), the better to keep in conformity with that of its dying support, with which, eventually, it falls to the earth, and there hibernates. A heavy snow may cover it many inches deep; a drenching rain may soak it through and through; the mercury may sink 22° F. below, or rise 80° above zero; but this little worm is indifferent to all, and sleeps a profound torpid sleep from the first of October till vegetation starts anew the ensuing spring. The weather in St. Louis is often delightfully mild and even warm long after this larva has gone into winter quarters, but nothing short of the animating breath of the vernal year prompts it to renew the activity it lost the fall before." (Riley.)

In Mr. Edwards's opinion it is more probable that the caterpillar hibernates "hidden among the corky ridges of the bark of the tree."

The caterpillar feeds, like its congener, on *Celtis occidentalis*. "This larva is found when at rest on the under side of the leaf usually on

a carpet of silk, and often with a portion of the leaf bent around it. The lower part of the head is then drawn under the neck and the antlers thrown forward. In preparing for the chrysalis state, it spins on the under side of a leaf a little bunch of silk in which to entangle its anal prolegs. Sometimes, but not often, it partially covers itself with a curled leaf, or with two leaves drawn together. Here it rests for about two days, when the larval head and skin split open, and the soft and unformed chrysalis works them back to the extremity of its body. It then secures itself, knocks off the shrunken skin, and soon assumes the delicate green color marked with cream-yellow, and the elegant form which Nature has imposed upon it." (Riley.)

According to Edwards, the egg-state lasts in West Virginia three days, the successive larval stages three or four days each, or a total of twenty days for larval life, the chrysalis seven or eight days; so that all the changes from egg to imago are passed within a full month.

"Before the fourth moult the larva covers the surface of the leaf about its resting place with silk, and after the moult remains quiet for nearly two days, when it becomes active and feeds ravenously: the body now grows rapidly, lengthening about one-tenth inch daily, till it reaches maturity, five days after the fourth moult.

"Several of the larvae of the first summer brood raised by me, in 1873, stopped feeding after the second moult, and commenced their hibernation. Some composed themselves on the leaves in the glass in which they were kept, others directly on the sand at the bottom of the glass, in either case upon a coating of silk. The color of these larvae soon changed to brown, in which was to be seen, under the microscope, a mottling of vinous and green. The last fall brood all assume this color, and hibernate also after the second moult. And the earlier broods sometimes all hibernate, as I observed last season (1874)." (Edwards.)

Limneria fugitiva has been found attacking this insect by W. H. Edwards in West Virginia.

ANAEA HÜBNER.

Anaea Hübn., Verz. bek. schmett., 48 (1816);— (1875);—Kirb., Cat. diurn. Lep., 276 (1871).
Seudd., Proc. Amer. acad. sc., x:111 *Paphia* pars Anctorum. (Nom. praeocc.)

Imago. Head small, compact, closely appressed to the thorax. Front scarcely at all tumid, with rigidly straight sides, as broad only as the face view of one of the eyes and much higher than broad. Eyes moderately large, not very full, naked. Antennae separated at base by the width of the basal joint, their exterior bases close upon the margin of the eye; longer than the abdomen, straight, composed of about 37 joints, the club of about thirteen joints, but slightly larger than the stalk, which itself enlarges faintly from base to club; the latter terminates in a bluntly rounded apex, composed of four excessively short, naked joints which radiate outward and are together scarcely larger than one of the ordinary joints of the club. Palpi very compact, the

clothing compact, the inferior fringe double with a deep longitudinal carina between, fading out apically; the minute apical joint scarcely longer than the width of the equal, basally curving, slender second joint, the apparent size of which is doubled by its dense clothing.

Fore wings pretty strongly falcate, the costal margin with a strongly descending apical curve, the apex finely pointed. Cell hardly more than two-fifths as long as the wing, closed, the closing vein slight, with no recurrent nervule, largest in the middle, only slightly narrowed beyond, three times as long as broad; subcostal nervure with only two superior branches, the second arising far toward the apex; first inferior nervule originating before the apex of the cell. Hind wings with both outer and anal angles prominent, the former rounded, the latter rectangular, the upper median nervule produced to a distinct, equal tail. Cell closed by a barely perceptible thread, enlarging slightly just next the subcostal, which it strikes opposite a point midway between the two divarications of the median nervure.

All the legs short and stout. Fore legs clothed alike in both sexes, like the femora of the other legs, the tibiae of the male half as long as the hind tibiae, the tarsi half as long as the tibia, composed of a single, bluntly pointed joint. Other tarsi about as long as the tibiae, the first joint equalling the next three in length, the fifth longer than the second, all densely scaled above and beneath and furnished also beneath with four rows of rather stout, obliquely set, not closely crowded spines, the apical ones of each joint no larger than the others. Claws slender, strongly curved and finely pointed, the paronychial scarcely shorter than the claws, exceedingly slender and thread like.

Egg. Nearly spherical, a little higher than broad, somewhat flattened at base and slightly depressed at top, with a few parallel horizontal series of raised points encircling the shoulder of the egg (after Edwards).

Caterpillar at birth. Head rounded at summit. Body cylindrical, tapering from in front backward, with four longitudinal series of large tubercles, each supporting a hair, three of the rows above, the fourth below the spiracles on each side (after Edwards).

Mature caterpillar. Head well rounded on a front view, somewhat profusely covered with papilliform granulations, of which three or four larger ones are clustered at the top of each hemisphere. Body cylindrical, the anterior part of first thoracic segment strangled; otherwise nearly equal in anterior half of body, tapering posteriorly, the last segment entire and rounded posteriorly; whole body peppered with subequal granulations, very bluntly rounded at tip, bearing an exceedingly brief hair; segments obscurely divided into a large anterior section occupying more than half the segment and two smaller, subequal posterior sections. Legs stout at base, slender and short beyond; prolegs short and stout.

Chrysalis. Very short and stout, broader than high, transversely ridged above the wings in the middle of the abdomen, the ridge extending from the anterior limit of the fourth abdominal segment, at the sides, to the middle of the same on the dorsum; laterally carinate from the front edge of the lower surface backward over the basal wing tubercles, nearly but not quite to the hinder edge of the wings; behind the abdominal ridge, the abdomen tapers with exceeding rapidity to the small cremaster, the face of the globular tip of which is in the plane of the under surface of the body; this last below the lateral carina is regularly convex, less strongly than the dorsal surface; mesonotum gently arched, full, above on side view rounded, tectiform; body broadest at posterior margin of the wings, tapering gently and regularly forward to the basal wing tubercles, then rapidly to the narrow truncate front.

This is a tropical American type of butterfly with many species, one or two of which extend into the United States, and one passes northward to some distance up the valley of the Mississippi. Their robust form, warm upper surface, dead leaf under surface, falcate fore wings and tailed hind wings make them rather striking objects, though they show no great variety or beauty of pattern.

The transformations of several species are partially known. The caterpillars feed upon apetalous plants of allied families, Lauraceae, Piperaceae, Euphorbiaceae, and have some strangely curious habits. In the first half of their lives they live openly, devouring a single leaf from the tip base-ward, when not feeding resting on the spared midrib, and leaving bits of eaten leaf strung along the midrib by silken threads. When partly grown they change their habits completely, construct a nest from a single leaf just large enough for their body, which, whether it be a living leaf or one which by detachment dries up, they always quit to feed, retiring thereto immediately thereafter. The resemblance these habits bear to those of our *Basilarchia*, and the divergencies of the same are particularly interesting and worthy of study. It may throw some light upon the origin of the habits of one or the other type, especially in the particular custom of attaching frass to the midrib of the eaten leaf. It is the more curious, as these insects belong to different tribes of Nymphalinae.

ANAEA ANDRIA.

Anaea andria Scudd., Bull. Buff. soc. nat. sc., ii: 248 (1875).

Paphia glycerium Morr., Syn. Lep. N. Amer., 67 (1862);—Ril., Amer. ent., ii: 121-123, figs. 81-83 (1870);—Edw., Butt. N. Amer., i, *Paphia* 3 pp., 1 pl. (1871).

Paphia troglodyts French, Butt. east. U. S., 226-229 (1886);—Edw., Can. ent., xx: 41-45 (1888).

[Not *Paphia glycerium* Doubl.; nor *Pap. troglodyta* Fabr.]

Imago. Head covered above with vinous brown hairs; palpi gray, delicately variegated with darker and lighter brown, pallid, dark orange and yellow scales; antennae uniformly black brown above, beneath ferruginous, heavily flecked at the base of each joint with white scales; the club luteo-ferruginous beneath, above like the stalk, with the apical joint naked, ferruginous.

Wings above either rich dark orange, margined more or less deeply and distinctly with brown (♂); or, sordid, dull, and rather pale orange, heavily margined with dark brown and with a very irregular, transverse, broad, paler band crossing both the wings, edged on either side with dark brown (♀); the brown edging of the wings is dark, generally not distinctly bordered on the inner side, at least in the male, and toward the outer edge covered with a bluish bloom in fresh specimens; there is a narrow, transverse bar of blackish brown at the extremity of the cell of the *fore wings*, much more distinct in some specimens than in others; the transverse stripe of the female fades out before reaching the inner margin below, generally stopping at the submedian nervure; above, it forks, one fork directed toward the apex of the wing, the other at right angles to the costal margin; the extra-mesial belt of the *hind wings* in the female is formed of two portions narrowly united at their corners, the upper occupying more than half of the apical half of the costo-subcostal interspace, the remainder a belt broadening from above downward, fading out in the lower half of the wing; the blackish brown inner edge of this band is generally seen to a greater or less extent in the male.

Beneath uniform dry-leaf brown, more or less glaucous, the female generally with a strong vinous or ferruginous tint; the markings of the upper surface merely indicated below, and the whole of the wings flecked with minute spots or transverse threads of dark brown; the male is therefore much more uniform than the female, but, as special markings, are often found a pre-marginal series of clay brown points in the interspaces of the upper half of all the wings, besides a similar clustering of clay brown

scales in the middle of the costo-subcostal interspace of the hind wings, and occasionally a similar cluster in the subcosto-median interspace, where the extra-mesial dusky band crosses it; these markings are rarely seen in the female, but may be indicated in a trifling manner. Expanse of wings, ♂, 60-74 mm.; ♀, 66-78 mm.

The following descriptions of the early stages are borrowed from W. H. Edwards, with slight transpositions and alterations of terminology.

Egg. Nearly spherical, a little higher than broad, somewhat flattened at base and slightly depressed at top; surface smooth; crossed near the top—at about one-fifth distance from top to base—by two to four parallel rows of raised points, about twenty-two in the full circle; these seem to be placed in vertical lines; in some examples the rows are nearer together than in others, and there is often irregularity in the number or position of the points, some of the series wanting, or misplaced, in this last case lying between the rows. Color pale green.

Caterpillar. *First stage.* Head a little broader than first thoracic segment, rounded at top, outline that of a horseshoe, the front somewhat flattened; color yellowish; across the forehead a broad stripe of brown, within which are two little patches of the yellow ground, one on each lobe, and the stripe bends at right angles, and narrowing passes down each cheek; in a curve about the top in front, six small tubercles, and near the sutures two others, which with the second and fifth of the curved row make a cross row of four. Body cylindrical, tapering from first thoracic to ninth abdominal segment on dorsum and sides, the end of the ninth segment rounded; color brown green; the cross ridges on each segment studded with small, white, rounded tubercles, from the top of each coming a short, fine, white hair; there are also four rows on either side of large white tubercles, one to a segment, three above the spiracles, and one below the spiracles, each with a short, stiff hair; each of the basal row has a half circle of small tubercles, but larger than those over the dorsum on its lower side; under side, legs and prolegs nearly as above, a shade more green; the first, second, seventh and eighth abdominal segments are crossed by two or three rows of tubercles. Duration of this stage three to five days. Length, 2.3 mm.

Second stage. Head higher than broad, narrowing at upper part, depressed at suture; color of upper front greenish; over mandibles yellow white, at the back gray green; on each vertex a low, duplex, black process, the outer part larger and higher than the other, each with a black, short bristle at top; at back, on either side the suture, a duplex, small, yellow process, and others down the side of face at back; over the front minute tubercles as at first stage, and in addition three large, conical, white tubercles on either lobe, each three in triangle with base above, so arranged that four tubercles cross the forehead in line. Shape of body as before; color gray green; the dorsum of eighth and ninth abdominal segments discolored brown or blackish, and a subdorsal patch of same hue on the fourth and sixth segments; thickly covered with fine tubercles as at first stage; the rows of larger tubercles as before, ivory white, bell-shaped, the hair or process from top brown or black; the basal tubercles large, each with its crescent of smaller ones, on lower side. Length, 4.6 mm.

Third stage. Head shaped as before; the processes on vertex larger, triplex, shining black, two being in line across front, the outer one larger, the third lying behind and between the others; the back and the front face armed as before. Shape of body as before; tuberculated as before; color gray brown, discolored on posterior segments as before. Length, 6.3 mm.

Fourth stage. Head as at last previous stage, the front greenish black, the vertex processes black; of the four cones across front the outside ones were black, the others white with brown rings at base. Shape, armature and color of body as before; there is much variation in the extent of the black; on one example the second and seventh abdominal segments were quite black dorsally, on sides of the fourth and fifth ten black patches, on sides of the second and third thoracic and first abdominal segments paler black; another was pale black on the eighth and ninth abdominal segments, a very little of same on the first and second, and the sides of the fourth to sixth abdominal segments pale black. Length, 8.6 mm.

Last stage. Head subovate, depressed at top, the height to the breadth as eight to seven; color gray green, thickly covered with tubercles like those on body, small and large; among these are larger ones, three on either lobe in triangle, so disposed as to make a row of four across the forehead; these are white, with a brown rim about base, or the inner pair are white, the others black; on each vertex a triplex process as described at fourth stage, black; along the back and sides white processes, of which a duplex or bifid one, taller than elsewhere, stands on either suture; ocelli black. Body stout anteriorly, thickest at the second and third thoracic segments, tapering on dorsum and sides to the ninth abdominal segment, the end of the latter rounded and the dorsum much curved; color gray green, the first thoracic segment darker green; usually marked by patches of black on dorsum or sides of segments, after the second abdominal segment, but some examples have little, or it is pale colored, and others have none at all; entire upper surface studded with low, rounded tubercles, varying in size, but always small, placed on the cross ridges; these are whiter than the ground color, and from each proceeds a very short, straight white hair; under side, legs and prolegs a shade lighter than the upper; the first, second, seventh and eighth abdominal segments crossed by tubercles. Length, 33 mm. French gives the length of mature larva as 39 mm., and probably wild examples are larger than my bred ones.

Chrysalis. Shape much as in *Anosia plexippus*, the last segments retracted in the same way, so that the abdomen is greatly shortened, and the shape that of a dome; the head case short, narrow at top, and beveled to a sharp, slightly incurved ridge, the sides sloping, mesonotum prominent, carinated, rising posteriorly to a rounded point, the slope to top of head regular, and at about 45°; the depression behind shallow and broad; the dorsal edges of wing cases prominent; the sides excavated; color light green, granulated with whitish; the edges of wing case and top of head case whitish. Length, 16.5 mm.; breadth at mesonotum, 9.7 mm.; at abdomen, 10.2 mm.

The Mississippi Valley is the home of this butterfly, where it extends westward to the Great Plains, but not far to the eastward, and from southern Illinois to the Gulf. It is shy and difficult of capture, its flight exceedingly rapid "with a dry, whistling sound. Although easily alarmed, it seldom leaves a favorite locality, but continues to fly about until danger has passed. It is curious as the *Vanessas*, and I have several times taken it by standing motionless, when after numberless rapid circlings and dashes about me, it would suddenly alight on the ring of my net." (Edwards.)

Until recently our knowledge of the life history of this butterfly was due principally to the field observations of Mr. Muhleman and Dr. Hayhurst, both of whom were satisfied that there is but a single brood annually, which appears at the very end of the season at end of September and October, and goes into hibernation early in November. Dr. Hayhurst remarks "the food plant does not sprout up and leaf sufficiently to support the larva before 1st of July." But latterly Mr. Rowley, who furnished Mr. Edwards with the material for his fuller study of the early stages, asserts that there are at least two broods of the imago, and that there is a decided seasonal dimorphism in the two broods of the female.

The larva feeds on an annual, *Croton capitatum*, one of the *Euphorbiaceae*, which is tolerably common in Illinois, Missouri, Kentucky, and westward, where it is known by the name of goat-weed (Riley), and also on *C. monanthogynum*, as the butterfly is to be found where the first plant

does not grow but the latter does (French). Mr. Rowley has found them on both.

The eggs are usually laid singly on the under side of the leaf, and hatch in four or five days. "The young larva, soon after emerging, constructs for itself a perch on which it rests, after the manner of a [*Basilarchia*]. It is at the tip of the leaf, made by eating away along-side the mid-rib, and using this rib as the base, covering with silk and lengthening by chewed bits of leaf bound and held by the silk. One perch in first stage measured [7 mm.] in length, and on it the larva rested with the anterior segments arched, only the prolegs furnishing the support. But if there be two larvae on one leaf, the second perch may be made anywhere at the side. After the first moult the perch was lengthened and made heavier by binding it with larger pellets, so that it looked like a string of knobs, and the greatest length I observed was [10 mm.]. The young larva bears much resemblance in body and head to young [*Basilarchia archippus*], but is more like that larva at second stage than the first, and the head with its many tubercles and processes on vertices and at back still more resembles either second or third stage of [*archippus*] than the first.

"After the second moult, the perch is deserted, and a case is made by covering the upper surface of the leaf with silk, and bringing the edges together. The larva lies at first quite concealed, and eats the base of the leaf. Here the next moult takes place, and the larva then builds a new case, and goes outside to feed, after the habit of the nearly mature [*Euphocades*] troilus. By the time the fourth moult approaches, the larva is as long as the case, and the head will be exposed at one end, and tail at the other, the rounded case being a pretty good fit, rather loose." (Edwards.)

The goat-weed "has a peculiar wooly or hairy, whitish green appearance," says Riley, in his earlier account, "and in the month of September its leaves may frequently be found rolled up, with the larva inside. This roll of the leaf is generally quite uniform, and is made in the following manner: Extending itself on the midvein, with its head towards the base of the leaf, the larva attaches a thread to the edge, at about one-fourth the distance from the base to the point. By a tension on this thread, it draws this edge partly toward the opposite one, and fastens it there, being assisted in the operation by the natural tendency of the leaf to curl its edges inward. Fastening a thread here, it repeats the operation until the edges meet, and then it proceeds to firmly join them nearly to the apex, leaving a small aperture through which to pass the excrement. During hot days the larva remains concealed in the leaf, and towards evening comes out to feed, though sometimes it feeds upon its house, eating the leaf down halfway from base to point. It then abandons it and rolls up a new one. In the breeding cage, when placed in a cool, shady room, the larva seldom rolls up the leaves, but feeds at random over the plant, and when at rest simply remains

extended on a leaf. From this we may infer that its object in rolling the leaves is to shield itself from the rays of the hot August and September sun, for the plant invariably grows on high, naked prairies." (Amer. ent., ii: 121-122.)

"During the heat of the day it remains concealed, but towards evening comes out to feed, though sometimes it feeds upon its own house, eating the leaf halfway down from base to point, then abandoning it and rolling up a new one. When placed in a cool, shaded room, the larvae seldom rolled up leaves, but fed at random over the plant, and when at rest simply lay extended on the leaves. Many, though not all, of the rolled leaves that I cut open, were completely lined with a closely woven coating of strong, white silk. . . . When ready to transform, it spins a button of white silk on the under side of a leaf or branch, and, fastening the anal legs therein, doubles upon itself until the extremities meet. In this position it remains about twenty-four hours, when it suddenly throws off its larval skin and becomes a chrysalis. Some of my chrysalids were eighteen and twenty days before the butterfly emerged." (Edwards, Butt. N. A.)

The insect lives nearly a month in the caterpillar stage, the chrysalis state appears to vary from nine to twenty days, and according to Rowley the pupa is often found attached to a branch of the food plant.

TRIBE ARGYNNIDI.

SEMNOPSYCHE SCUDDER.

Semnopsyche Scudd., Bull. Buff. soc. nat. sc., ii: 253 (1875). *Argynnis* pars *Auctorum*.

Imago. Head large. Front more protuberant than in *Speyeria* but otherwise much as there, as is also the vertex, which is slightly less developed. Eyes very large and prominent, naked. Antennae inserted in deep pits, separated by the width of the third joint, considerably longer than the abdomen, composed of fifty-four joints, of which twelve or thirteen form the club, which is depressed cylindrical, fusiform-oval, a little more than twice as long as broad, nearly four times as broad as the stalk, the apex rounded, but the extreme tip produced to a point by the last joint; the broadest joint in the middle is about five times as broad as long and the longest joint of the stalk about three times longer than broad. Palpi moderate with a heavy, moderately brief and close, inferior fringe; joints much as in *Speyeria*.

Fore wings ample, the costal margin arched more even than in *Speyeria*, the apex very regularly rounded, the outer margin distinctly though slightly excised in the male. Second inferior subcostal nervule arising from the first inferior (where it forms the upper half of the closure of the cell) at its extreme base, without leaving a short pedicel before it as in *Argynnis* and *Speyeria*; last median nervule not so conspicuously arcuate as in *Speyeria*. Hind wings with the oblique excision of the anal angle more pronounced than in *Speyeria* by the considerable shortening of the internal nervure. The neuriation otherwise much as in *Speyeria*, but with less abruptly bent curves.

Fore legs slender, the tibia about two-fifths the length of the hind tibia, the tarsi of the male consisting of a long, tapering member as long as the tibia and with two brief joints faintly marked off at the apex. Hind tarsi considerably longer than the tibiae,

the first joint as long as the next three together, the fifth equal to the third. Claws as in *Speyeria* but stouter; paronychialia very slight, slender, closely appressed to the claw, not half its length, curving in an opposite direction, thread-like; pulvillus small, circular, on a long pedicel.

Egg. Closely resembling that of *Speyeria*, from which it apparently differs in the more numerous horizontal raised cross lines, making the quadrangular cells relatively broader than in *Speyeria*.

Mature caterpillar. To judge from Mr. Edwards's description, the only material at hand, the caterpillar agrees with that of *Argynnis* rather than that of *Speyeria* and is remarkable for the length of the laterodorsal spines of the first thoracic segment.

Chrysalis. This again agrees better with *Argynnis* than with *Speyeria* but I have no specimens for a proper study of its relations.

This genus comprises but the single species here described, to which reference is made for further details.

SEMNOPSYCHE DIANA.

Papilio diana Cram., Pap. exot., ii: 4, pl. 98, figs. D, E (1779). (1868); ii, *Argynnis* 7 (1876); Can. ent., vi: 121-124 (1874);—French, Butt. east. U. S., 153-155 (1886).
Argynnis diana Say, Amer. ent., pl. 71 (1824); Proc. ent. soc. Phil., iii: 431-433 (1864);—Edw., Butt. N. Amer., i, *Argynnis* 1 (1868); ii, *Argynnis* 7 (1876); Can. ent., vi: 121-124 (1874);—French, Butt. east. U. S., 153-155 (1886).
Semnopsyche diana Scudd., Bull. Buff. soc. nat. sc., ii: 259.

Imago. Head covered above with fulvous (♂) or black mingled with a few fulvous (♀) hairs; palpi fulvous with black hairs; antennae blackish fulvous above, fulvous beneath; the club excepting the extreme base and tip black.

Wings above black brown with a nearly uniform, purplish tinge on the basal three-fifths; beyond this the two sexes differ completely: In the male the dark basal color runs in the *fore wings* in narrowing threads along the nervule tips, half or more than half way to the margin giving a strongly lunulate boundary to the basal color; the outer third of the wing, or more than that above, is bright fulvous orange and is crossed by two series of black brown powdery spots, the inner more distinct than the outer, parallel to each other and the outer margin; the inner crosses the middle of the outer half of the wing, the outer is nearer to the outer border than to the inner series and the black-edged margin is preceded by a powdery thread of blackish brown enlarging into spots at the nervules. On the *hind wings* the dark basal portion is separated from the outer orange fulvous portion by a nearly uniform, arcuate line subparallel to the outer border, lunulate only in the subcostal interspace where, as also in the median interspaces, just outside the dark bordering, is a minute, powdery, blackish brown spot; extreme margin as in the fore wings.

In the female the black purplish color of the base is extended over the entire *fore wing*, but it includes in the outer half three series of bluish white powdery spots, the outer series and the middle spots of the middle series more solid; these three series run parallel to the outer margin; the outer and inner series consist of roundish spots, the middle of longitudinal bars, and these occur in nearly every interspace in the wing; and besides them there are three powdery dashes, the lowest inconspicuous, depending from the costal border within the inner series of spots. On the *hind wings* the color of the base is also extended to the margin but is deeper in tint excepting where it is traversed by the markings; these consist of a very brown, purplish blue, extra-mesial band broadly severed by the nervures, the inner limit of which is similar to the inner limit of the orange exterior of the female, distinct and black-edged; the outer is powdery and vague, terminating at about an interspace's width from the outer margin, and within this band, next its inner margin, is an arcuate series of five, large, round, blackish spots in the subcostal, subcosto-median and median inter-

spaces; there is a pre-marginal series of transverse, equal, purplish blue bars more or less flecked with white in the interior, forming a disconnected stripe.

Beneath, the color of the two sexes differs as much as above: In the male, the *fore wings* have much the general color of the upper surface but less pure in tone and excepting also that the basal half of the wing is much variegated by a series of tawny, transverse bars in the cell, the outer next its extremity, very largely powdery with silvery white scales, and a transverse, arcuate, mesial series of fulvous, longitudinal, quadrate or triangular bars a little beyond the extremity of the cell. *Hind wings* buff, paler in the outer than in the inner half, the latter being more or less ferruginous, the two parts separated by a broken blackish thread; there is also a transverse blackish thread crossing the upper half of the wing next the second divarication of the subcostal nervure, accompanied in the costo-subcostal interspace, as is also the outer thread, by a number of silvery white scales, a few of which are also sometimes found in the cell and at the extreme base of the costo-subcostal interspace; a pre-marginal series of flat, silvery lunules margined outside and to some extent inside with black scales.

In the female the color of the *fore wings* is that of the upper surface, excepting that it is paler and less bluish in tone externally; the extra-mesial series of spots is much as above but intensified and is preceded in all the interspaces by long and large, quadrangular or triangular, powdered patches of blue scales which are also found marking irregular, transverse bars in the cell; the other outer markings of the upper surface of the wing are scarcely repeated beneath, excepting in faint indications. *Hind wings* dingy chocolate brown at base, bluish brown beyond, limited by a faint, interrupted series of dark blue, slender, transverse bars, marking the same position as the limits of the two colors above; the silvery markings of the male are repeated vaguely and generally with more of a decided bluish tinge. Expanse of wings, male, 94 mm., female, 104 mm.

Egg. Conoidal, truncated, depressed at summit, marked vertically by about eighteen prominent, slightly wavy ribs, eight of which extend from base to summit, and form around the latter a serrated rim or crown; the remainder lie between these and end irregularly at one-half to three-quarters distance from base, sometimes squarely at one of the transverse striae, but often curve towards and unite with the long ribs; between each pair of ribs are equi-distant, transverse striae, about twelve in all, each one depressed in the middle and not often in line with the corresponding striae of the adjoining sections; the spaces between the ribs and striae excavated roundly. Height, 2.2 mm.; breadth at base, 2.3 mm.; at summit, .85 mm. [The measurements are surely much too great.]

Caterpillar. *First stage.* Head rounded in front and at the vertices, depressed in middle at top; color blackish brown, sparsely pilose. Body cylindrical, thickest at first and second abdominal segments, tapering slightly toward either extremity; color dull green, translucent; each segment from second thoracic to seventh abdominal marked by a transverse row of eight elongated, mostly obovate, tubercular, dark spots, the second on either side the dorsal line lying back of the rest; on the eighth abdominal segment a straight row of four spots, and behind this another of two spots; the first thoracic segment is narrow and is occupied dorsally by a blackish, oblong patch, on the front of which are four small, rounded tubercles, and immediately behind each of the two outer ones a similar tubercle; in addition to these, on either side of this segment are two spots like those upon the other segments; from each of the tubercular spots throughout spring one or two long black hairs, curved forward. Length, 2 mm.

Second stage. Head black. Body same shape as before; color olivaceous, mottled over the whole surface with brown; armed with six longitudinal rows of long, fleshy, black spines, each of which springs from a yellowish tubercle; these spines are somewhat tinted with fulvous at base, and from the sides and end of each proceed short, curved, black hairs; legs and prolegs dull green. Length, 3.8 mm.

Third stage. Front of head blackish brown, bristling with hairs; back of head, at the junction with segment behind, dull yellow. The segments from third thoracic to

seventh abdominal enlarged, on thoracic segments tapering forward more rapidly than before; color uniform obscure greenish brown; the spines as in the last stage, a dull yellow tubercle forming the base of each; legs black, prolegs dull green. Length, 7.6 mm.

Fourth stage. Head sub-conic, truncated, with a prominent vertex on either side, between which and the apex is a rounded depression, the front flattened, the lower angles rounded; color brown in front, dull yellow behind; the ocelli black. Color of body as in last stage, the upper surface with a silky gloss; the spines longer and more tapering, the basal third of each and the tubercle also orange; the bristles shorter; legs and prolegs black. Length, 17.8 mm.

Fifth stage. Head black. Color of body uniform deep chocolate brown; the spines as before, except those of the two dorsal rows on first thoracic and last four abdominal segments, all of which are black; the bristles shorter; between the dorsal rows on each segment are two whitish dots. Length, 25.4 mm.

Last stage. Head small, but broader than the segment behind, sub-conic, truncated and depressed at top, flattened in front, the lower corners rounded, the vertices prominent, the surface sparsely pilose; color brown, behind fulvous. Body cylindrical, fleshy, tapering at either extremity, each segment rounded; wholly velvety-black; armed with six rows of long, tapering, sharp, glossy-black spines, from each of which proceed several short, black bristles on the sides and one at the top; length of most of these spines, 5 mm.; on the first thoracic segment the two dorsal spines measure 7.5 mm. and are projected forward over the head; on each side of same segment is one other spine, starting from the posterior edge of the segment and back of the line of the dorsals, and these also are porrected; the remaining spines of the six rows radiate as if from a central axis, those of the stigmatal row being depressed so that their ends are on a level with the feet; the base of each spine deep orange or fulvous: between each pair of dorsals two whitish dots placed transversely; legs and prolegs black. Length, 63.5 mm.

Chrysalis. Cylindrical, with an angular excavation below the mesonotum; the whole surface finely corrugated; head-case square, transversely rounded, with somewhat prominent vertices; mesonotum prominent, compressed, carinated, rounded at summit and with a sharp tubercle at base on either side; two other tubercles just below and back of the head; wing-cases much elevated above the surface, the outer edges at base flaring; on the abdomen two dorsal rows of long, sharp tubercles, and smaller ones, corresponding to the first lateral spines on the larva, on the three or four middle segments; color of the anterior portions and of the wing cases light brown, streaked with darker shades; of the abdomen dark brown mottled on the sides with red. Length, 30.5 mm.; greatest breadth, 11 mm.

All the above descriptions of the early stages are copied from Edwards with slight transpositions and alterations of phraseology.

This butterfly appears to be an inhabitant of the hilly country of the south, following the Alleghanies, and a comparatively narrow belt westward at about the 38th parallel of latitude. How far west it reaches is unknown. No one appears to have found it west of the Mississippi since the time of Say, who says he has taken it in Missouri and the "Arkansaw" of that day.

It is a single brooded species, the males of which fly throughout July and August and the females throughout August and September. The eggs hatch in about fifteen days, the young larvae go at once into hibernation, and in the spring the successive stages of the caterpillar, which feeds on violets, occupy more than a fortnight each, while the chrysalis hangs for three weeks.



"Both sexes are conspicuous, the males from the strong contrast of color, and the females from their great size and the habit of alighting on the topmost flowers and resting with wings erect and motionless. It is an exceedingly alert and wary species, differing in this from our other *Argyn-nides*. At the slightest alarm it will fly high into the woods, near which, upon the narrow bottoms or river slopes it is invariably found. It is a true southern species, sensitive to cold, not to be looked for in the cooler part of the morning, but flying down from the forest when the sun is well up. From eleven to three o'clock is its feeding time" (Edwards).

There is scarcely another butterfly in the whole of North America in which the contrast between the sexes is so great as in the present species. This is the more striking since it belongs to a group remarkable for the similarity of markings in the two sexes, its next neighbor, *Speyeria idalia*, being the only one where an appreciable difference exists (except for the patches of androconia) and here it extends to the color only of a row of spots found in both sexes alike. This difference, as we have pointed out in the body of this work, is a clear case of parastatic mimicry, the mimicry affecting the female only (as most in need of such protection), and is the more surprising since the butterfly mimicked belongs to the only genus in our fauna, where, in other species, parastatic mimicry of a *Euploeid* butterfly occurs. If a butterfly of the genus *Basilarchia* needs protection and gains it by mimicry of *Anosia* or *Tasitia*, why should *Semnopsyche* take to imitating a normal *Basilarchia*? That it does closely resemble it any one can see, and the following passage from Edwards, writing of the discovery of the female, may be taken in evidence: "While breaking my way through a dense thicket of [iron-weed], hoping to find another *diana* [male], I came suddenly upon a large black and blue butterfly, feeding so quietly as to allow me to stand near it some seconds and watch its motions. It seemed to be a new species of *Limenitis* [*Basilarchia*], allied to *ursula* [*astyanax*], which it resembled in color."

It may also be pointed out that its range is altogether included within that of *Basilarchia astyanax*.

ARGYNNIS FABRICIUS.

ARGYNNIS ALCESTIS.

Argynnis alcestis Edw., Trans. Amer. ent. (1880);—Worth., Can. ent., x: 37-38 (1878); soc., v: 289-291 (1876); Can. ent., xii: 69-73 —French, Butt. east. U. S., 158-160 (1886).

Imago. Head and appendages as in *A. aphrodite*. Wings with the upper surface dark orange fulvous, the basal third of the wings slightly infuscated with dusky scales and tawny hairs, but to a much less extent and depth than in *aphrodite*; markings of both wings precisely the same in general character and position as there, excepting that they are less heavy; they consist in the *fore wings* of two pairs of sinuous or bent, slender, black bars crossing the cell, each pair partially encircling a fulvous spot; a sickle-shaped black bar at the extremity of the cell; a mesial, transverse, wholly inter-

rupted stripe, composed of moderately narrow black bars or lunules in all the interspaces above the submedian nervure, at very different distances from the outer margin, the general direction of the whole band being twice bent at a right angle, at the upper median and lower median nervules; in the middle of the outer half of the wing a transverse, almost straight series of round black spots, largest in the median nervules, becoming longitudinal streaks in the uppermost subcostal interspaces; and finally, between these last and the mesial band, the subcostal nervures are marked in black and accompanied by a powdery bar, depending from but not touching the costal margin; outer margin followed within, at the distance of half an interspace, by a black-brown stripe connected with the margin by powdery bars at the nervules, and preceded by a series of delicately formed black lunules in all the interspaces, wholly independent of each other and enclosing between them and the pre-marginal stripe faint orange spots, which are not wholly enclosed; fringe brown, interrupted with white or luteous. *Hind wings* excepting for their deeper and richer tone, wholly resembling those of *A. aphrodite*, and excepting, also, that the interrupted bent band of the lunules found in *aphrodite* is replaced here by transverse bars of smaller extent.

Beneath, the *fore wings* do not differ from those of *A. aphrodite*, excepting in the markings being less heavy, nor do the markings of the *hind wings* differ so far as regards the position, number, relations and form of the silvery spots; but the ground color is of a nearly uniform cinnamomeous, in the outer half of the wing more or less bathed with dull fulvous orange, excepting in the near vicinity of the spots; there is, herefore, in the outer half of the wing, between the two rows of silvery spots, a narrow stripe of lighter color, as in *A. aphrodite*, and, as there, the color is much the same as that bordering the margin of the wing; but the contrast is here very slight between this lighter band and the parts surrounding it, so as to make it far less conspicuous. Expanse of wings, 75-77 mm.

I give here Mr. Edwards's descriptions of the early stages, with such modifications of the phraseology as are necessary.

Egg. Conoidal, truncated, not so broad at base as in *S. idalia*, the sides less rounded; depressed at summit, marked vertically by about eighteen prominent, slightly wavy ribs, half of which extend from base to summit and form around the latter a serrated rim; the remainder end irregularly at two-thirds to three-quarters distance from base, sometimes squarely, at one of the striae, but usually curved towards and unite with the long ribs; between each pair of ribs are equidistant, transverse striae. Shape of *A. aphrodite* and *B. myrina*, being more slender, narrower at base, and less convex on sides than the other large species of this genus. In Mrs. Peart's magnified drawings the eggs of *A. alcestitis* and *B. myrina* are indistinguishable from each other.

Caterpillar. *First stage.* Head a little broader than any segment, rounded, slightly bilobed, somewhat pilose, color dark brown. Body cylindrical, thickest anteriorly, tapering backward, the dorsum sloping considerably; color brownish green, translucent; each segment, from the second thoracic to the eighth abdominal, marked by eight rows of tubercular dark spots, six of them placed on dorsum and upper part of sides, each spot giving out a long, black, clubbed hair, which is curved forward; the other two rows are beneath spiracles (one on each side), and consist of much smaller spots, each with two or three short hairs; still lower down, in a line over the legs, are points with fine hairs; on the first thoracic segment is a blackish dorsal patch, and on either side are two small spots, and all these are furnished with hairs; on the ninth abdominal segment is a row of four small spots, and behind it one of two. Length, 2 mm.

Second stage. Head subcordate, black, with many short, black hairs. Body thickest in middle; color yellow green, on dorsum mottled with brown, especially at bases of spines; six longitudinal rows of large spines, besides a row of very small spines along base of body, over the feet; the laterodorsal series begins at the first thoracic and runs to the ninth abdominal segment, one upon each segment; the two rows on the sides begin at the first abdominal segment, and of these the laterostigmatal series stops at the eighth abdominal segment, the lower continuing to the next, always but one on

each segment; on either side of the first thoracic segment are two minute tubercles with hairs, two also on the middle, and three on the last thoracic segment; between each of the thoracic segments, at the junction of the segments, is set a large spine, which lies between the laterodorsal spine and the next higher spine on each side; spines long, tapering, black, beset with many short and fine, black bristles; the spines on infrastigmatal row now rise from yellowish tubercles (but in some examples these spines were green, and rose from greenish tubercles); all others from black ones. Length, 3.8 mm.

Third stage. Head as before, except that on each vertex now appears a small, conical, black process. Shape of body as at previous stage; color black brown, the sides less dark than dorsum; the tubercles of the laterodorsal spines are pale buff on outer side, but black on dorsal side; the laterostigmatal spines have black tubercles, the infrastigmatal buff; the intermediate tubercles on anterior segments are yellow; the laterodorsal spines on the first thoracic segment are somewhat turned forward; but are no longer than others of same rows. Length, 5.6 mm.

Fourth stage. Head subcordate, much flattened frontally, and on the summit of each vertex is a small, sharp process as before; many small tuberculations over the face, each of which sends out a black hair; color of front head shining black, but the back is yellow. Color of body velvety black with a brown tint; spines much longer and heavier than before; the outer side of tubercles of the laterodorsal rows is now dull yellow; the spines of laterostigmatal row have very little yellow at base, and those of infrastigmatal are yellow at base and a little way up. Length, 7.6 mm.

Fifth stage. Head as before, much flattened; color black, orange at back. Color of body as at previous stage; spines black, both the laterodorsal and laterostigmatal very slightly colored, reddish yellow at base, scarcely visible except when viewed obliquely; the infrastigmatal and also the intermediate spines on anterior segments are all orange at base, and about half way up. In some examples the bases of lower spines and the back of the head were reddish yellow in the early part of this stage, but became orange later. Length, 12.7 mm.

Last stage. At first, the back of the head is a yellow orange. Color of body velvety black; the laterodorsal spines are drab at base, except those on the first two thoracic segments which are brownish yellow; all the spines of the other two rows are of same yellow as base, but the tubercles orange.

When full grown, the head is subcordate, deeply cleft, flattened in front, on each vertex a small, conical process; over the front many short, black hairs; color black, the back of head reddish yellow, sometimes dull yellow. Body cylindrical, of even thickness from the first to seventh abdominal segments, the segments rounded; color velvety black; spines long, slender, tapering, of about equal length; the long spines on first thoracic segment are directed forward, but are not longer than others; all the spines are beset with many short, black bristles; those of the laterodorsal rows are translucent brown at base, except on second and third thoracic segments where they are dull yellow; all of the others are dull yellow from base (including the tubercles) half way to top; tops of all spines and all the bristles black; legs and prolegs brown. Length, 35.6 mm. at rest; 45.7 mm. in motion; breadth at rest, 7.6 mm.; length of laterodorsal spines in middle of body, 3.8 mm.; height of supporting tubercle, .25 mm.

Chrysalis. Shape of *S. diana*, cylindrical, a little compressed laterally, the wing cases prominent and flaring at the base on ventral side; the whole surface finely corrugated; head case square, beveled at the sides, rounded transversely, the outline from top of mesonotum to extremity being arched; on either vertex a small, conical process; mesonotum carinated, followed by a deep, rounded excavation; on middle of either side of mesonotum a small, conical tubercle; on the abdomen two dorsal rows of similar tubercles and a row of small ones on each side; the color varies somewhat, some examples being red brown, irregularly mottled with black; on the wing cases red brown, and the black is limited mostly to the disks and nervures; others are drab and black, the wing cases finely streaked with black, otherwise drab; on the abdomen

the front part of each segment is black, the rest drab, irregularly serrated at the junction. Length, 25.4 mm.; breadth, 7.6 mm.

This butterfly occurs in the upper Mississippi Valley from Michigan to Montana, and is said to have also been taken in Colorado. It does not appear to have been found north of our boundary, nor south of latitude 40°, and is fond of the open country.

Its seasons are similar to those of our eastern species of *Argynnis*, but in one season about ten per cent of the caterpillars hatched by Mr. Edwards from one batch of eggs, fed and passed one or two, and in one instance three moults, but all of these died before the middle of November. The eggs hatch in twenty-five to thirty days, and in one instance the caterpillars passed their first moult in the spring, four weeks after having been brought into warmth, and their second in from fourteen to twenty-four days, while the precocious ones of the autumn spent only from five to seven days in their second stage. Mr. Edwards gives his experience as follows: "Nearly all the larvae became lethargic immediately after leaving the egg, having first devoured the egg-shells, but a few of a single brood in 1878, about ten per cent, fed and proceeded to first and second moults. These gradually died off after first and second moults, but one lived several days after third, and died about 14th November. In the fall the first moult was reached at about eighteen days from the egg. The remaining larvae were kept in a cool room, and such as survived were placed in a greenhouse 14th Jan. on violet, and began to pass first moult 11th Feb., or after twenty-eight days." The chrysalis hangs for three weeks or more. The caterpillar feeds readily on violets.

BRENTHIS HÜBNER.

BRENTHIS FREIJA.

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| <i>Papilio freija</i> Thunb., Diss. ins. suec., ii: 34, figs. 14, 14 (1791). | 55-56 (1793 ?). |
| <i>Brenthis freija</i> Scudd., Proc. Bost. soc. nat. hist., xvii: 299-303 (1875). | <i>Papilio dia lapponica</i> Esp., Eur. schmett., i, pl. 97, fig. 3 (1780). |
| <i>Papilio freya</i> Hübn., Eur. schmett., figs. | <i>Argynnis chariclea</i> Edw., in his catalogues. [Not <i>Pap. chariclea</i> Schneid.] |

Imago. Body covered above with greenish brown hairs, toward the extremity fulvous; beneath ochraceous; palpi with mingled ochraceous and black hairs below, mingled fulvous and black above; stalk of antennae white below, black above, with white annulations; club of antennae black, bright fulvous at the tip.

Upper surface of wings rather deep fulvous, marked with black, with black nervures. *Fore wings*: a narrow, broken band extends transversely and very irregularly across the wing, commencing and terminating a little beyond the middle of the costal and inner border; its general direction is at first toward a point on the outer border, two-thirds of the distance from the apex, next by a blind zigzag course toward the inner border at a point one-third of the distance from the base, and then straight toward the inner border; it is made up first of a nearly straight band which reaches the upper median nervule, then by three short transverse dashes in the three succeeding inter-

spaces, the first midway between the termination of the band and the last divarication of the median nervure, the second below that divarication, and the third outside of the second by its own width; within the mesial band are three narrow transverse bands crossing the cell, the innermost not reaching the median nervure; within these is a small lunule, opening outward; below the divarication of the median nervure is a short dash, suddenly bent inward, and then slightly upward; the extreme base of the wing is slightly dusky; at the outer border is a broad band, regularly angulated on inner border, enclosing a series of slender, transverse or linear, fulvous spots, seldom continuous, except at the apex, where they are larger; between this and the mesial band is a curved row of roundish spots, the lower one of which falls outside of the curve; at the apex this row merges into the outer band; between this band and the mesial there is on the costal border a dusky triangular spot, extending to the penultimate branch of the subcostal nervure. *Hind wings*: the mesial band extends, with a very irregularly zigzag course, from the middle of the costal border to a point between the subcostal and median nervures three-fifths of the distance from the base, and then, nearly at right angles, to the middle of the inner border; it is generally interrupted and then formed of five dashes: the first, in the costo-subcostal interspace, at a little less than one-half the distance from the base, is directed inward toward the inner border, about one-third the distance from the base; the second starting from outside the first crosses the subcostal nervure at right angles; the third at some distance outward crosses the subcosto-median and upper median interspaces, at right angles to the nervules; the fourth crosses the next interspace in the same general direction, but removed by its own width further toward the base; the fifth turned upward and starting just beyond the fourth, crosses the medio-submedian interspace; both the second and the third are occasionally bent; within this band, the subcostal nervure is broadly bordered with black scales from its divarication to its union with the median, and from the middle of the band so formed a band of equal width crosses the cell to the divarication of the median; in the middle of the cell is a rather large round spot, and in the costo-subcostal interspace is a black streak, parallel to the mesial band and midway between it and the base; the extreme base of the wing and the inner border are slightly dusky; the outer black border of the wing is rather broad, and within it is a row of large triangular spots, separated from the border by a narrow fulvous stripe, sometimes broken into spots; nearly midway between the row of triangular spots and the mesial band, but approaching the former, is a curved row of rather large round spots in the subcostal and median interspaces. Fringe of outer border dark brown, interrupted with ochraceous.

Beneath: *Fore wings* pale fulvous, with the markings of the basal half and the row of round spots repeated conspicuously; apex pale cinnamon red, the tip and a streak on costal border midway between it and mesial band, ochraceous; the black border of the upper surface wanting and replaced by very pale cinnamon red mingled with some ochraceous scales, the extremities of the nervules being ochraceous, tipped toward the round spots with large, triangular, scarcely sagittate, black spots. *Hind wings*: extreme base pale cinnamon red, with a white spot generally bordered with black between each of the principal nervures at their origin; at about two-fifths the distance from the base, a broad transverse band of pale cinnamon red crosses the wing, dusted profusely with ochraceous or white scales at its outer and inner limits, and especially where it crosses the spaces between the principal nervures; it is bordered within and without with black; the inner black border starts from the costal nervure opposite its divarication from the subcostal, crosses the interspace obliquely inward, takes a sweeping curve along the outer border of the cell back a little past the divarication of the median nervure, and crosses to the inner border by two crescents opening inward; the exterior border is composed of three parts: the first starts from the middle of the costal border and crosses the costo-subcostal interspace in a straight line parallel to the inner border; the second starts from the subcostal nervure opposite the origin of the first, and crosses in a straight, sometimes broken, line the next two interspaces, nearly at right angles to the nervures; the third, starting from the lowest branch of the subcostal nervure, passes to the inner border by a series of crescents opening outward,

parallel in general direction to the inner border; the narrow outer border of the wing is pale cinnamon red, resting upon which is a row of transverse, ovoid, white spots surmounted by triangular, somewhat sagittate spots of (sometimes blackish) cinnamon red; between these and the broad band the space is pale cinnamon red with scattered ochraceous scales, which, on either side of the last median nervule, near its extremity, form a considerable ochraceous space, more or less mixed with reddish scales; but the space between the broad band and the outer border is further occupied by a curving row of round, blackish spots, with intermingled reddish scales, bordered delicately with ochraceous; and also by a narrow, nearly straight band, slightly bent and less conspicuous in the middle, where it touches the outer border of the broad band, and formed of pale rosaceous scales, whitish toward the extremities. Expanse of wings, 38.5-43.5 mm. Described from males only.

This species is very closely allied to *B. montinus*, from which it differs principally in the following particulars; the color of the upper surface is not so deep; at the base and along the subcostal interspaces of the hind wings it is not so dusky; upon the lower surface the markings of the apex of the fore wings are much more conspicuous, as is also the broad mesial band of the hind wings, which here is of a very different tint from the base, while in *B. montinus* a difference is seldom, and then but slightly, discernible; the submarginal rows of sagittate spots and of round spots are also much more conspicuous, being frequently very nearly obliterated in *B. montinus*; the space between the arcuate row of round spots and the mesial band is much tinged in *B. freija* with rosaceous scales, giving it a peculiar appearance; these are present only in a slender band in *B. montinus*, and then are nearly obsolete; the darker parts of the outer border of the hind wings are darker than in *B. montinus*, being there somewhat pale cinnamon red, while here they are rather of cinnamon brown.

Freija is a circumpolar species in the strictest sense, being found on the northern shores of both worlds, and in each extending southward to the habitable zone. In the Old World its home stretches from Norway and Lapland to eastern Siberia, and in Russia it extends southward to the 60th degree of latitude. In the New World it occurs from Alaska to Labrador, where it is found upon both the eastern and the western coasts, and in the Rocky Mountain region extends as far south as Lake La Hache (Crotch), and Crow's Nest Pass, west of Ft. McLeod (Geddes). It is said by Edwards to occur in Colorado, but the specimens obtained there by Mead (to which he probably refers) belong to the next species, while those from Port Arthur and Nepigon north of Lake Superior, referred by him to *chariclea*, belong here.

To judge from the captures north of Lake Superior it is a late species, flying late in August and early in September, or at the very close of the season in that place. Evidently winter must be passed by the caterpillar just from the egg.

BRENTHIS CHARICLEA.

- Papilio chariclea* Schneid., Nест. mag. ent., v: 588 (1794). 98 (1831).
Brenthis chariclea Scudd., Proc. Bost. soc. nat. hist., xvii: 297-299 (1875). *Argynnis aretica* Zett., Ins. Lapp., 899 (1840).
?Papilio tullia O. Fabr., Fann. groenl., 192 (1780). *Argynnis boisduvalii* Somm., Boisd. Icon. Lép., i: 98, pl. 20, figs. 5-6 (1832).
?Melitaea tarquinius Curt., Ross. voy., app., *Argynnis freya* Edw., in his Catalognes. [Not. Pap. freija Thunb.]

Imago. Head and front of thorax covered with fulvous hairs; the upper surface of thorax and abdomen with brownish hairs, interspersed with fulvous upon the sides of the abdomen; below pale yellowish; palpi with pale hairs below, mingled fulvous and black upon the tip; stalk of antennae white below, black above, with fulvous annulations at the extremity of the joints; club of antennae black with narrow fulvous annulations.

Wings with the upper surface deep fulvous marked with black, with black nervures. *Fore wings* with a zigzag, wavy, occasionally broken band of moderate width, extending transversely across the wing, its inner edge starting at the middle of the costal border and terminating at the middle of the internal border; the general direction of the first third being outward, the second third nearly at right angles inward, the last third outward again nearly parallel to the first, but not turned so much outward; the band is formed, first, of a straight belt more or less irregular in outline, directed toward a point a little more than two-thirds the distance down the outer border, reaching the median nervure; second, either of two very deep lunules, the lower heaviest limb being parallel to the first band, or of two short, straight bands slightly connected above, having the same general direction, the lunules or bands occupying the next two interspaces; and third, of a broad shallow lunule or band occupying the next interspace and directed at right angles to the lower branch of the median nervure; the inner border behind the submedian nervure is up to this point dusky, as is the whole base of the wing nearly up to the divarication of the median nervure; within the mesial band there are three equidistant, transverse bands crossing the cell, and there is another short transverse blotch below the median nervure starting from between the two innermost of those above; the outer edge of the wing is more or less narrowly bordered with black, next to which is a row of triangular, slightly arrow-head shaped black spots, enclosing between it and the border a row of small, transverse, fulvous spots, which are usually larger and sometimes continuous at the apex; midway between the band of triangular spots and the mesial band is a slightly curving row of rather large, sometimes squarish spots, the lower one of which falls a little outside the curve, and the upper ones merge at the tip into the band of triangular spots; midway between this row and the mesial band, there is on the costal border a triangular patch, extending, parallel to the mesial band, to the lower branch of the subcostal nervure. *Hind wings*: the mesial band is directed first across the subcostal nervures at right angles to them, then sharply outward, reaching the upper branch of the median nervure at two-thirds the distance from the base, whence it turns toward the inner border with a sharply indented zigzag course, directed a little outward toward the anal angle; the whole base of the wing within this band is dusky, sometimes quite black, with the exception of from three to five irregularly shaped, variously sized, but generally small, fulvous spots upon the upper outer half; the markings upon the apical half of the wing are almost exactly as on the fore wings, except that the curving row of round spots has a deeper curve, the spots are more universally round, and increase in size toward the anal angle. The fringe of both wings is alternately light and dark brown.

Beneath: *Fore wings* pale fulvous, the markings of the basal half of the upper surface with the mesial band repeated, but with less distinctness, though there is no duskiess at the base, and the short streak below the median nervure just before its divarication meets a straight band coming at right angles from the junction of the

median and submedian nervures; the roundish spots in the curved row are smaller and more indistinct than above; covering that portion of the space between them and the mesial band, which is traversed by the subcostal nervures, is a triangular pale yellowish patch more distinct outwardly, with a transverse streak of pale cinnamon red across its middle; beyond the triangular patch the wing is pale cinnamon red, with a transverse streak of pale yellowish at the extreme apex; the sagittate spots are more delicate, and the nervules beyond them are distinctly yellowish or white. Basal half of the *hind wings* deep cinnamon red; there are three characteristic pearly white or silvery spots upon the basal half: the first is situated in the costo-subcostal interspace, its centre a little outside the divarication of the subcostal nervure; it is square or oblong, with the ends deeply excised and bordered with black, and has the lower outer angle cut off by the upper subcostal nervule; the second is triangular, the sharp apex outward, and is situated between the approximating branches of the subcostal and median nervures, is traversed obliquely at one-third the distance from the base by the transverse nervule, and extends to the white band crossing the middle of the wing; its base is concave, deeply bordered with black, and extends at one side narrowly along the lower edge of the subcostal nervure, reaching the first spot; the third, also triangular, occupies the medio-submedian interspace; its base as far as the divarication of the median is thus united to the second spot, but is encroached upon from the inside by the cinnamon red of the base of the wing, which, crossing the median nervule, occupies about one-half of its area and forms in the outer portion a triangular spot bordered with black; there are two minute spots of white along the middle of the subcosto-median interspace, the outer with a black centre, and another at the base of the costo-subcostal interspace; the costal nervure also is edged above with white throughout its extent; a narrow, zigzag black band extends across the middle of the wing, bordering the upper side of the second silvery spot on its course, itself generally very narrowly edged with white above; within this black band, next the inner border, the surface is frequently powdered with whitish or ochraceous scales; beyond the black band is another broader band of white or silvery lunules whose general trend is nearly straight, but slightly curved; it rests against the outer angles of the black band along the inner half of its course, often indistinct near the middle, and broader and less defined upon the outer half; the spaces left between the black and silvery band at the outer half are ochraceous yellow between the subcostal nervules, and cinnamon red between the costal and subcostal nervures; the outer border of the wing is narrowly edged with black, and has silvery triangular or lozenge shaped spots situated between the nervules, tipped with sagittate black spots; the space between these and the silvery band is of a pale cinnamon red with scattered ochraceous scales, which indeed occupy the greater portion of the interspaces upon either side of the upper median nervule; the row of round black spots of the upper surface is repeated beneath, though often but indistinctly. Expanse of wings, 38.5-45 mm.

This northern butterfly inhabits circumpolar lands on either side of the Atlantic, but extends much further southward on the western than on the eastern continent, being found on the latter only in Lapland, in the former not only in Greenland and Labrador, but in the west as far as Great Slave Lake, Crow's Nest Pass, west of Ft. McLeod (Geddes), and even Colorado (Mead), and in the east reaches the southern coast of Labrador, where it was taken by Couper at Natashquan. Edwards says it extends to the Pacific, but I have not seen it nor heard of any specific capture west of the Rocky Mountains.

Nothing is known of its seasons or history, except that it appears in Colorado early in the season, in May or early in June, according to Mr. Mead, so that winter can certainly not be passed as a caterpillar just from the egg. See also the notes on the preceding species.

TRIBE MELITAEIDI.

CHARIDRYAS SCUDDER.

CHARIDRYAS ISMERIA.

Melitaea ismeria Boisd.-LeC., Lép. Amér. sept., 168-169, pl. 46, figs. 1-4 (1833).

Dryas reticulata gorgone pars Hübn., Samml. exot. schmett., i, figs. 1, 2 [nec 3, 4] (1806-19).

Phyciodes cocyta pars Hübn., Verz. bek. schmett., 29 (1816).

Eresia carlota Reak., Proc. ent. soc. Philad., vi: 141 (1866).

Phyciodes carlota French, Butt. east. U. S., 174-175 (1886).

Melitaea nycteis Edw., Proc. acad. nat. sc. Philad., 1861, 161 (1861).

[Not *Mel. nycteis* Doubl.]

Imago. Head covered above with very pale brown and dusky hairs, behind the eyes heavily clothed below with white, above with mingled lighter and darker brown scales. Palpi silvery white on the basal half, passing beyond into brownish luteous, fringed below throughout, and above on the apical half, with long black hairs, the apical joint with blackish recumbent scales. Antennae black brown, annulated heavily with white at the base of each joint, the white scales forming a continuous thread along the under outer line, and marking the entire under surface of the club, excepting the edges; otherwise the club is naked and luteous, but on its broadest part much infuscated. Thorax covered above with mouse brown, delicate hairs, with a tinge of olivaceous, beneath with sordid white hairs. Legs heavily clothed with white scales, becoming clay brown on the upper surface of the tibiae and tarsi and extremity of the femora; fore legs with long white hairs.

Upper surface of the wings black brown, heavily marked with pale fulvous. *Fore wings* with the cell mostly fulvous, but marked with black in ring-like markings enclosing a fulvous, at the base a fusiform, spot; crossing the middle of the cell a pair of complete attingent spots, the upper subcircular, the lower cordiform; outer limit of the cell marked with a black thread, beyond which is a slight fulvous bar; there is an extra-mesial, tolerably broad band of interrupted fulvous spots, composed of two portions, an upper which runs subparallel to the outer margin of the cell, from the costal margin to the median nervure, broadest in the middle and narrowing at either extremity, but especially above; and of a lower portion of equal length, generally much broader in the middle than at the extremities, arcuate in form, its convexity inward; this is followed interiorly in the lowest median and medio-submedian interspaces by more or less fulvous, which sometimes includes the entire basal third of the medio-submedian interspace, but is then marked with a black longitudinal line returning upon itself; there is a sinuous series of subequal, round spots, white or fulvous in the upper half of the wing, fulvous in the lower, running subparallel to the outer margin, about midway between the extra-mesial band and the margin, but nearer if anything to the former; between this and the outer margin there is a greater or less number of interspatial spots, usually taking a more or less lunulate form, often obsolete, excepting that in the upper median interspace, which is almost always large, lunulate, sometimes with greatly elongated ends; these spots are of the same color as those preceding them in the same interspaces. *Hind wings* with irregular fulvous markings on the basal third of the wing, not uniform in different individuals; a mesial, fusiform, moderately broad, fulvous band, cut by the fuscous nervules, and midway between it and the outer border a slightly orange fulvous band of more or less disconnected spots, when most widely separated circular, including, in the subcostal, subcosto-median and median interspaces, a black, often faintly blue-pupiled, small, round spot; these are often followed externally by faint, powdery, whitish lunules, most

distinct and most extended in specimens showing the greater number of similar marginal markings on the fore wing, and especially in the female.

Beneath: *fore wings* pale fulvous, obscured with ashen and brownish fuscous in the apical half; the markings of the upper surface are vaguely repeated beneath, excepting at the outer margin; here they are somewhat different, consisting of white or whitish sagittate spots in each of the interspaces; and, excepting in the upper median interspace, generally made up of a series of overlying sagittate spots, that is of arrow-heads containing more than one pair of barbs. *Hind wings* gray brown, of a paler or deeper and warmer tint, often enlivened with variations in tone in different parts, heavily traversed with dull, silvery white markings, which are especially collected into a pair of transverse bands. besides the silvery white which margins the extreme base of the costal border and the inner border; the innermost of these crosses the middle of the cell and is narrow, and thrusts out a tongue which runs to the extremity of the cell; the outer crosses the wing slightly beyond the middle, marked near but not at its outer edge by an extremely irregular, zigzag thread of brown, which is more or less lunulate in form in each of the interspaces, but crosses both of the subcostal interspaces by a single angular marking, and the medio-submedian interspace with a single oblique line in continuation of the lower portion of the lunule of the preceding interspace; at the outer border in each interspace is a silvery lunule, which is nearly transverse in all the interspaces excepting the upper median, where it is very large and high, and in all is followed outwardly by a brown line, inwardly by a deep brown or blackish cloud, more or less extended; between these and the mesial silvery band a row of small, white-pupiled, black spots in most of the interspaces, in the medio-submedian interspace becoming a transverse, sigmoid bar. Expanse of wings ♂, 37-40 mm.; ♀, 44 mm.

Caterpillar. *Last stage.* Yellow, with blackish spines and three longitudinal blackish stripes. Head black, as well as the thoracic legs and the ventral surface; the other legs are yellow (Boisduval and LeConte).

Chrysalis. Ashen gray, with some paler light spots, and little dorsal tubercles nearly white (Boisduval and LeConte).

This butterfly is found over a wide extent of territory, being known south of Lat. 40° from the Atlantic to the Rocky Mountains, and at the higher levels of the west, even into the heart of Colorado, and as far north as Montana and, according to Geddes, at Brandon, Manitoba.

Little is known of its history or how many broods there are, or how it passes the winter. It flies in June in Colorado, according to Reakirt, and the caterpillar, which is figured by Boisduval and LeConte, is said to feed on *Helianthus trachelifolius*. It awaits a biographer.

SUBFAMILY HELICONINAE.

Heliconii pars Linn., Fabr., etc.; *Héliconides* coninae Bates; *Heliconina* Herr.-Schaeff.
pars Boisd.; *Heliconidae* Doubl.; *Heli-* Nereides Hübner.

Imago. Butterflies of medium or rather large size, with exceptionally elongated, slender bodies and elongated wings. Head large and broad.

Antennae inserted on the summit, not in a pit, exceptionally long and slender, straight, the joints so much elongated that there are rarely as many as forty joints in all, sparingly scaled, the club variable but rarely very broad, straight. Palpi rather slender, porrect.

Thorax rather slender; mesoscutellum angulate in front, entering the posterior face of the mesoscutum but little, never acutely; posterior margin paraboloid; metascuta and metascutellum as in *Euploeinae*.

Fore wings greatly elongated, rarely as little as twice as long as broad, the costal margin always pretty strongly arched. Costal nervure generally terminating near the middle of the outer half of the wing; generally one and only one of the four superior subcostal nervures emitted before the end of the cell; the latter is generally more than half as long as the wing, completely closed, the lower closing vein sometimes weak.

Hind wings always rounded, usually laterally elongate but sometimes normal, always entire. Neuration very variable, the costal usually running free to the outer angle, sometimes confluent with the subcostal for the greater part of its course, and running only half way to the angle; cell generally much elongated, generally closed; precostal recurved.

Legs very long and slender, the fore legs much atrophied, especially in the ♂, where the tarsus consists of a single unarmed joint; in the female, though divided, it is unprovided with armature.

Abdomen generally attenuated, expanding apically in the male to give place to the large, papilioniform, tumid and rather simple clasps which are the most conspicuous feature of the appendages.

Egg. Tall, nearly equal through the greatest part of its height, with gently convex sides and subconoidal summit, with a moderate number of vertical ribs connected by nearly as prominent, subcontinuous, cross lines, so as to form quadrangular cells not more than two or three times broader than high.

Caterpillar at birth. Head rounded and smooth with scattered long hairs. Body cylindrical with high and large papillae, bearing long and slender bristles, apically flaring, and arranged on either side, at least those above the spiracles, in two principal rows in the middle of the segments, besides a row, between the others, of minute, bristle bearing papillae next the hinder edge of the segments.

Mature caterpillar. Head smooth, excepting for a single coronal spine on each hemisphere like those of the body. Body slender, cylindrical, somewhat moniliform, with several rows of excessively long, acniform, and delicately and distantly spinigerous spines near the middle of the segments, only the uppermost row continuing uniformly upon the thoracic segments.

Chrysalis. Of very bizarre appearance, with protuberant, apically very arcuate wing-cases, more or less strongly produced and always appressed ocellar tubercles, a very deep and broad hollowing of the dorsum next the base of the abdomen, with a corresponding elevation of the mesonotum and third abdominal segment. Many tubercles, particularly upon the abdomen, may add much by their irregular development to the striking nature of the creature, which is still further increased by great variegation in the coloring.

This is one of the most interesting of all the subfamilies of butterflies, partly from its distribution, for though well endowed with representatives it is confined to the New World, and mostly to the tropics, but also because its members are often the subject of mimicry by other butterflies. For without exception, I believe, every one of its members which has been tested in life has been found to be the possessor of odors so evil that they can be detected by the unskilled human nose, and since the butterflies are all of lively color, presenting exceptionally striking contrasts, it has been well argued that these are warning colors which signify their distasteful qualities; or it may be that in view of their qualities, the possibilities of colorational design and magnificence have had fullest play. The most interesting paper upon this group is that by Bates on the spe-

cies of the Amazons, in which the theory of mimicry was first propounded (Trans. Linn. soc. Lond., xxiii). Regarding the position of this subfamily, some remarks will be found in the body of the present work on pp. 113-114.

AGRAULIS BOISDUVAL AND LECONTE.

Agraulis Boisd.-LeC., Lép. Amér. Sept., 142 (1833). *Dione* Auctorum (nec Hübn.).

Imago. Head moderately large, the face centrally tumid, rising beyond the level of the eyes, laterally with an oblique and sharp sulcus running to the outer base of the maxillae, and terminating above next the middle of the eye in a deep, abrupt, oval pit, directed toward the centre of the head; summit of head deeply and broadly sulcate mesially between the antennae, to a less degree transversely behind them; antennae rather longer than the abdomen, separated at base by nearly twice the width of the second joint, composed of about thirty-eight joints, of which the third, fourth and fifth are of about equal breadth, the middle joints of the stalk rather more than three times as long as broad, the subreniform club composed of eleven joints, rapidly enlarging on the first four, then subequal and nearly four times as broad as long, broadly rounded at tip, only two or three joints entering into the diminution of size, the whole club about three times longer than broad and more arcuate within than without, strongly depressed. Palpi moderately long and slender, the apical joint minute, round, oval, not an eighth as long as the cylindrical, sinuous, middle joint. Eyes naked.

Fore wings elongate with arched costa, rounded apex, gently sinuate outer and hind margins; cell closed, about two-fifths the length of the wing. Subcostal nervure with four superior branches, the first arising a little beyond the tip of the cell, the others at equal distances from each other, the second nearer the third than the first, halfway between the tip of the cell and of the wing. *Hind wings* rounded triangular, the costal and inner margins of about equal length, the outer margin moderately full, slightly crenulate. Cell open, the subcostal and median nervules somewhat approximate beyond it by the strong curvature of the upper branch of the latter, the subcostal forking at some distance before the median and very near the base.

Fore legs slender, the fore tibiae of the male scarcely half as long as the hind tibiae, the fore tarsus very slight, about three-fourths the length of the tibiae, composed of three joints of which the first is twice as long as the others together, the last half as stout and less than half as long as the middle joint, all unarmed and thinly clothed with hairs; hind tarsi a fifth longer than the tibiae, the first as long as the next three together, these decreasing regularly, the fifth as long as the second and a third longer than the fourth, all nearly naked and bristled above, armed beneath with four rows of fine and rather crowded, half recumbent spines, those of the outer rows growing larger from base to apex of each joint. Claws very long and slender, heeled at base, scarcely arcuate beyond, except for the downcurved point. Paronychia and pulvillus wanting.

Egg. Broad oval, slightly more than a fourth higher than broad, the sides pretty regularly convex, broadest scarcely below the middle, arching more rapidly near the summit; with about fourteen straight, not greatly but equally elevated, vertical ribs, and crossed by considerably more than that number of straight, subcontinuous and very regular, slightly raised bands, as wide as the ribs, breaking the surface up into very regular quadrangular cells, half as broad again as high.

Caterpillar at birth. Head smooth and well rounded, with no protuberances, the upper half with scattered, forward projecting hairs, as long as the depth of the head. Body cylindrical, nearly equal, with series of exceptionally large, high, conical papillae, each bearing a long and slender, equal, apically expanding bristle, about as long as the diameter of the body, arranged in four rows on either side, viz.: a laterodorsal series centrally placed; a laterostigmatal centrally placed; an infrastigmatal postcentral series,

and a ventrostigmatal ante-central series. Besides these there is a miniature series of the same general nature, but so small as to be easily overlooked, which is supralateral, just in front of the incisures.

Mature caterpillar. Head small, smooth, subquadrate, the face strongly flattened, the front outer angle of each hemisphere produced, papilliform, bearing a very long and slender, feebly and delicately thorny spine, like those of the body. Body cylindrical, moniliform, nearly equal, but tapering in front so that the first thoracic segment is much smaller and not larger than the head, supporting three series of long and very slender, aculiform spines seated on low, smooth papillae which melt into their base, the spines distantly, briefly and very delicately spinulose; they are arranged as follows: a supralateral series, one to a segment on all the segments, that on the first thoracic segment reduced to a mere conical papilla and bristle; a suprastigmatal series and an infrastigmatal on all the abdominal segments, all a little in advance of the middle, besides on the hind thoracic segment a single stigmatal spine at the anterior edge.

Chrysalis. Of an odd shape, as if formed of two very different subequal masses, one formed of the straight, tolerably regular, conical abdomen; the other of the straight, but very irregular remainder of the body, obliquely attached to the base of the abdomen; the ocellar prominences are rounded, obliquely compressed lobes, with denticulate margin and of no very great size; the basal wing tubercles form an anterior, conical, papilliform prominence, and a rounded and pinched lateral ridge; the mesonotum high, regularly and considerably arched, the metanotum and base of abdomen as considerably hollowed; the extremity of the wings protuberant, strongly rounded. There is on the abdomen a supralateral series of conical tubercles, particularly on the third segment, where they are largest and double, and on the fifth, sixth and seventh segments, where they decrease regularly in size; there are smaller, blunter, supralateral tubercles on the third and fourth segments, and on the front edge of the fifth to seventh segments a similar small one. Cremaster stout, the apical field of hooklets large and quadrate.

This is a tropical American group with very few species, one of which is common enough in our southern states. The external resemblance of the butterfly to the *Argynnidi* has led to its being long regarded as belonging with that group, which a study of the early stages was the first to show to be erroneous. The transformations of our species were figured long ago by Abbot, and have within a few years been minutely described by Edwards, but the earliest stages not quite accurately. The caterpillars are remarkably rapid in growth, and in Mr. Edwards's opinion there must be a large number of generations annually.

AGRAULIS VANILLAE.

Papilio vanillae Linn., Syst. nat., ed. x: 482 (1758);—Stoll, Suppl. Cram. pap. exot., 7-8, pl. 1, figs. 7a, b (1791);—Sepp, Pap. Sur., li:17-18, pl. 55 (1848).

Dryas phalerata vanillae Hübn., Samml. exot. schmett., i (1806-1816).

Dione vanillae Hübn., Verz. bek. schmett., 31 (1816).

Agraulis vanillae Boisd.-LeC., Lép. Amér. sept., 143-145, pl. 42, figs. 1-4 (1833);—Edw., Can. ent., xii:122-126 (1880);—French, Butt. east. U. S., 148-150 (1886).

Papilio passiflorae Fabr., Ent. syst., iii:60 (1793);—Smith-Abb., Lep. ins. Geo., i:23-24, pl. 12 (1797).

Imago. Head covered above with bright orange red hairs, enlivened by a few white ones, especially in a spot at the outer base of the antennae, and by a pair on either side behind the upper margin of the eye, and by a collar of white around the lower half of the eye. Palpi pure white without, orange red within; the outer half

of the middle joint and the whole of the apical joint black above; over the whole a few scattered black bristles. Antennae dead black with a few inconspicuous white scales at the base of each joint above, a little more conspicuous on the club; the club on its inner naked surface castaneous. Thorax covered above with orange red hairs, beneath with pure white hairs, excepting in two longitudinal, small, oblique streaks apparently covered by the middle and hind femora when these are closely packed beside the body; all the legs cinnamomeous above, the femora white beneath; most of the spines blackish.

Wings orange tawny, brighter and deeper in the male than in the female; all the veins of the *fore wing* marked in black, becoming rather fuscous in the basal fourth of the wing; two round, white pupiled, black spots in the cell, one in the middle of the upper half, the other just outside of it against its lower edge; outer margin of the cell marked by a pair of similar spots, usually confluent, and so forming a black bar depending from the subcostal nervure, broad above and tapering below, with a line of white scales in the centre of the part corresponding to the upper spot; a row of three oblique, roundish oval spots, the middle one a little outside the line, in the middle of the median and medio-submedian interspaces in the outer fourth of the wing; veins, especially those below the superior subcostal nervules, heavily bordered with blackish brown, in the median and submedian nervules expanding into a round apical spot, giving the nervules the appearance of large-headed pins. *Hind wings* with a broad black border, more distinct in the upper than in the lower half of the wing, enclosing in each of the interspaces a large, round or roundish, tawny spot, so large as often nearly to interrupt the band; just beyond the middle of the wing in the upper subcostal and upper median interspaces, and especially in the former, is a large black spot of irregular form and a small triangular spot at the extreme base of the subcostal interspace.

Beneath: *fore wings* of the same color as above but the whole apex of the wing changing to a dark olivaceous brown; the black spots of the upper surface not marginal are repeated beneath more or less distinctly, and are always accompanied by a large silvery pupil, excepting the spot in the medio-submedian interspace and often excepting also that in the lower median interspace; the dark olivaceous apex is marked near its interior border and next the upper margin with long streaks of pale straw yellow which often run in fine lines down the interspaces, but it is more conspicuously marked with a number of brilliant silvery spots often finely black-edged, of which the most important are three, two in the next to the lowest subcostal interspace and one in the subcosto-median interspace; a small spot in the last superior subcostal interspace is circular, all the others are more or less elongated; the cloudy black markings which repeat vaguely those of the upper surface at the extremity of the lower median nervules are often enlivened also by silvery spots. *Hind wings* dark brownish olivaceous, very brilliantly variegated by large and conspicuous glistening silvery spots; there is one near the base of the margino-costal, costo-subcostal, subcosto-median, medio-submedian, and internal interspaces, in all cases but the costo-subcostal interspace as near the base as possible and with that same exception all very much elongated and all black-edged; in the middle of the upper subcostal interspace is a very large, long oval spot cut above in the middle by a broad and deep incisure, sometimes entirely, always nearly, severing the spot; in the medio-submedian and submedio-internal interspaces are a pair of long oval spots, broadest next the base, the tip of the outer one nearly or quite reaching the margin of the wing; in the median interspaces is a pair side by side, that in the lower median interspace in the middle of the interspace, that in the upper nearer the base, also elongated, but that in the lower median interspace to a greater extent; all these spots are black-edged; they are followed by a marginal series of silvery lunules of considerable inequality in size, that in the interspace beyond the cell being particularly large, running half way toward the extremity of the cell and more or less club-shaped. Abdomen above of the color of the upper surface of the wing; beneath and at the sides white with a lateral orange line. Expanse of wings, 70-78 mm.

The following descriptions of the early stages are those of W. H. Edwards, altered only to conform to the present work:—

Egg. Conoidal, truncated, the top a little arched; the sides more or less convex, varying; the height to the breadth as nine to seven; marked by fourteen straight ribs, which are compressed and elevated, and run from base to top; crossed by about eleven striae,* horizontal, rather prominent; the spaces between the ribs and striae are quadrangular, the shortest side being with the long axis of the egg; these spaces are depressed and are either flat or slightly convex; the summit is covered with rows of cells, concentric, those of the outer two rows large, hexagonal and irregular, of the third row small, hexagonal; within these are eight small cells, not depressed, irregularly rhomboidal and forming an eight-rayed star; in the centre a minute star of six rays. Duration of this stage four to five days.

Caterpillar. *First stage.* Head nearly globular, flattened on lower front face; color brown; slightly pilose. Body cylindrical, thickest at first abdominal segment, tapering slightly to tail, the segments well rounded; color brownish orange, glossy; on either side the dorsal line on each segment after the middle thoracic segment is a laterodorsal row of short, conical, pale black tubercles, and two similar rows on either side, forming transverse rows of six tubercles, from the top of each of which springs a short, black hair; on first thoracic segment is a black, dorsal collar, with fine tubercles; legs brown. Length, 3.6 mm.

Second stage. Head obovoid, the sides quite convex, the face flattened, the top depressed, and on each conical vertex a simple, black process very similar to the body spines, but less tapering and much shorter, pointed at top and ending with a short, fine bristle; others disposed about it just as with the spines; a few hairs, long and short, on front face; color chocolate brown. Body same shape; nearly same color, less brown, more orange; armed with six longitudinal rows of long, tapering, black spines, at top subconic, each ending in a fine, short, black bristle; a few similar bristles about the spine from base up; on first thoracic segment a dark chitinous collar, broken at the dorsal line, and bearing minute, hairy tubercles; legs black. Length, 6 mm.

Third stage. Head as at second stage, glossy black; the vertices rather high, conical; the processes two-thirds as long as the dorsal spines on middle thoracic segment, irregularly tapering, slightly bent back, conical at top. Color of body dark (or red brown) orange, glossy; between supralateral and suprastigmatal spines a greenish brown band, not well defined, rather a discoloration, and about the seventh abdominal segment fading away; the spines long, all black and shining, from black tubercles; those of supralateral rows on last two thoracic segments longest, those of stigmatal rows on the first two thoracic segments nearly as long; collar on first thoracic segment black. Length, 7.6 mm.

Fourth stage. Head as before, but the vertices higher, and the processes longer and much recurved, resembling horns; face black on front, behind the head orange, but from base of each horn a black stripe passes down the back of the head; on the front are five minute orange spots, one at base of each horn, and three in a cross row below. Color of body now dark orange, glossy; a mediodorsal stripe of olive brown; a broad band of same hue fills the space between the supralateral and suprastigmatal spines from the first thoracic to the ninth abdominal segments, the lower part of body also olive brown, so that the orange is restricted to the dorsal area and lower part of sides; in some examples the band is macular, orange showing in it. Length, 20 mm.

Last stage. [Soon after change.] Color of body red orange, the mediodorsal stripe greenish, the lateral band pale black, and broadened, so as to come to the outer sides of the tubercles of the two rows; the base same color as the band; the orange restricted to a narrow band running with the spiracles. Length, 24 mm. Twenty-four hours after this moult the length was 30 mm., and one day after this was 38 mm.

[When full grown.] Head obovoid, deeply cleft, with high conical vertices, on each of which stands a stout, spinous, recurved process, 38 mm. long, black, in all respects formed like the body spines, except that it is less tapering, the upper two-thirds being of about uniform size; the tip conical and giving out a short, fine bristle; a few other

* See, however, the generic description.

like bristles about the sides; sides and back of head rounded, but the front much flattened; sparsely pilose; color of front black, with two vertical orange stripes, one on either side of and very near the suture; color of hind head, between the horns and down the sides greenish yellow, the lower part of the side black; also a black stripe runs back from base of the horn. Body cylindrical, thickest from middle thoracic to first abdominal segments, tapering to the ninth abdominal segment very gradually; furnished with six rows of long, tapering black spines, bluntly conical at top, from which springs a short and fine black bristle; a few similar bristles irregularly placed about each spine from base to top; . . . over the legs on each side of the thoracic segments is a black tubercle with hairs; the spines of supralateral rows on the anterior segments are longest, measuring 4 mm.; the snprastigmatal spines are quite uniformly 2.8 mm., and the infrastigmatal 2.3 mm.; color red-orange, with a broad mediodorsal band of greenish black and a broad, slate black band which occupies the space between the supralateral and suprastigmatal spines, and reaches to the farther sides of and embraces the tubercles of these rows; the base of body slate black, so that the orange is restricted above to two narrow stripes lying between the dorsal and the lateral black bands, and to another stripe running with the spiracles (these bands widened much after the moult and as this stage proceeded), the whole upper surface highly glazed; all the legs black. Length, 38 mm.; greatest breadth, 6 mm. There was some variation of color at maturity; some larvae had a gray line or stripe below spiracles; on one this line was white and extended the whole length, in another it disappeared at the first abdominal segment; the color of the dark band on upper part of side was greenish black, or slate black, varying with the point of view. From fourth moult to suspension fifty-nine to seventy-two hours; from suspension to chrysalis thirteen to fifteen hours.

Chrysalis. Long, slender, the thorax much compressed laterally, and the wing cases very prominent, forming a narrow carinated hunch, which rounds abruptly on posterior end; head case high, cylindrical, compressed transversely, the top sloping on the ventral side at about 45°; on each vertex a short (1.3 mm. long), ear-like process, excavated on the dorsal side, and crenated at the top; between these the top of head is twice incurved; at the base of head case, on dorsal side, a depression; the mesonotum large, prominent, compressed, carinated, followed posteriorly by a deep and broad depression; wing cases smooth, a little flaring at base, depressed in middle; abdomen slender and tapering; a row of minute, mediodorsal tubercles, and on either side of these a row of large, rounded ones, those of the anterior segments largest of all, and compressed laterally; colors very variable, some examples are buff with greenish markings, or on the abdomen greenish brown; the head and wing cases buff, the former with a slight red tint; on the depression at base of head case is a patch of clear pale pink on either side the dorsal line, and between, as also at the outer edges of these patches is a little black; top of head case pink and black, the processes dark brown at top and on dorsal side; mesonotum buff, mottled green, as is the dorsal side of abdomen; wing cases buff, with a greenish patch on middle and a stripe running with one of the interspaces of the wing next margin; on side of abdomen a reddish buff stripe, and below this a broad, greenish brown band; on ventral side a clear pink patch from end of wings down. Some were very black, the wing cases and anterior parts mottled in light and dark black; some had the wing cases, mesonotum and head case pink tinted, mottled all over with greenish black; the ventral edges of wing cases clear, pink buff; in all examples the two pink spots at base of head case and the stripe on abdomen appear, and in all there is a black, angular inscription like figure 3 or like V, on the ventral side of the wing case, about one-third the distance from base to end. Length, 26.7 mm.; depth, 8.6 mm.; breadth at base of wings, 6.6 mm.; at abdomen, 5 mm.

This butterfly, common enough in our southern states, has an immense distribution, being found southward upon continent and island as far as Argentine Republic, though Bartlett-Calvert does not include it in his list

of Chilian butterflies. In the United States it extends from Atlantic to Pacific, but not often north of 35° N. Latitude, though it occurs sparingly and occasionally as far as Pennsylvania and New Jersey on the Atlantic coast. Edwards says that on only two occasions have single specimens been taken in West Virginia.

There are many broods of this brilliant butterfly in the course of the year. As early as the end of March, Riley found eggs and caterpillars of all stages in southern California, so that it would probably be impossible to determine how many broods occurred in the year, for the caterpillars mature with great rapidity, the later stages being exceptionally brief, so that the whole round from egg to imago was accomplished in twenty-three days in one instance related by Mr. Edwards, and in another in twenty-one days. Dr. Wittfeld also writes me of butterflies appearing July 26, from eggs laid the first of the month. How the winter is passed is nowhere stated.

Dr. Wittfeld writes that the eggs are deposited chiefly on the tips of the leaves of the food plant, from one to six or eight being laid on one leaf; even if the leaf tips are already full of the eggs of its ally, *Apostrophia charithonia*, say from five to eighteen of them, *Agraulis* will lay hers close beside them; "in fact *Agraulis* is very injudicious and will deposit her eggs on dry grass, forty feet away from the food plant." Riley once saw the female laying eggs, which she did, when undisturbed, at the rate of seven eggs a minute; the eggs hatch in four or five days.

The caterpillars are very hardy and easy to raise, Dr. Wittfeld tells me; they feed on *Passiflora incarnata* in the United States, and other species of *Passiflora* further south, and when full grown will often travel great distances to suspend, and then do so on dry sticks, fence rails, etc., fully exposed to view. The chrysalis state lasts in several recorded instances as follows: in West Virginia, July 5-12 (Edwards); in Georgia, July 9-17 (Abbot); in Florida, July 18-26 (Wittfeld); in Surinam, May 28-June 1 (Stoll), six to eight days (Sepp), so that it may hang from four to eight days.

Dr. Wittfeld says he has seen from six to sixteen butterflies roost with closed wings on one bunch of grass.

According to Sepp the caterpillars and chrysalids of the two sexes may be distinguished by their color, but probably he judged from insufficient material, there being considerable individual variation. Dr. Riley observed that the full grown caterpillar he found in California "differed very much in colorational aspect from those which I am familiar with in the east. Instead of being uniformly vinous brown, it was of a beautiful leaden, or pale indigo-blue, with distinct, lateral, white stripes, and the black head was also marked with white; whereas in my eastern specimens the head is uniformly black."

This caterpillar is attacked in Missouri, according to Riley, by *Chalcis flavipes* (88:14, 15) and *Pteromalus puparum* (89:1, 2), and Judge Thomas has also raised the former from it in Georgia.

LYCAENIDAE.

SUBFAMILY LYCAENINAE.

TRIBE THECLIDI.

CALLICISTA GROTE.

Callicista Grote, Bull. Buff. soc. nat. sc., iii: Tmolus pars Butler.
107 (1876). Thecla pars Auctorum.

Imago. Front of head seen from the face of the same width as one of the eyes. Eyes moderately full, sparsely, briefly and uniformly pilose. Antennae very delicate, half as long again as the abdomen, separated at base by three-fourths the width of the front of the head, composed of about thirty joints of which eleven or twelve form the long ovate compressed club, which is three and a half times as long as broad, broadest beyond the middle, increases very regularly in size on the basal half, but terminates more abruptly in a slightly produced, rounded, naked tip, into which four joints enter; the broadest joints are about five times as broad as long, and about five times as broad as the stalk where the longest joints are about five times as long as broad. Palpi if appressed to the head would just fail of reaching the base of the antennae, slender, the apical of about the same length as the middle joint and very slender.

Outer margin of fore wings sinuate, the neurulation not affected in the male by the presence of the discal spot, being the same in both sexes. Cell half as long as the wing, truncate at tip and scarcely narrower than in the middle, the lower half closed by a feeble vein, the origin of the subcostal and median nervures much as in the female of *Mitura*. Hind wings with well rounded outer border, the lower median nervule produced to a thread-like tail, the outer two-fifths of the inner margin roundly and angularly excised. First median fork nearer the base of the wing than the subcostal fork.

Fore tibiae three-fourths the length of the hind tibiae, of the same length as the fore tarsi; the latter, in the male, bearing at the tip only a pair of downturned, scarcely arcuate spines, barely larger than the other spines. Hind tibiae and tarsi of equal length, the latter, excepting the apical joint, armed beneath with crowded, slender spines, excepting on the basal half of the basal joint very long, much longer than the width of the tarsi. Claws minute, bent with a rounded curve in the middle, finely pointed; paronychial broad at base and rounded with an inferior, upcurved, delicate, equal, compressed finger, half as long as the claws.

This genus is confined, so far as I know, to only a single species, whose range is given below; it is by no means impossible, however, that Central American forms, which I have not been able to examine, are to be referred here. Nothing is known of the earlier stages.

CALLICISTA COLUMELLA.

- Hesperia columella* Fabr., ent., syst., iii: 282 (1793).
Callicista columella Scudd., Bull. Buff. soc. nat. sc., iii: 107 (1876).
Thecla columella French, Butt. cast. U.S., 271-272 (1886).
Timolus eurytulus Hübn., Samml. exot. schmett., ii (1822-26).
Thecla eurytulus Godm.-Salv., Biol. centr. amer., Lep., ii: 96 (1887).
Lycaena modesta Mayn., Amer. nat., vii: 178 (1873).
Callicista ocellifera Grote, Bull. Buff. soc. nat. sc., i: 178-179 (1873).
Thecla istapa Reak., Proc. acad. nat. sc. Philad., 1866: 339 (1866).
Thecla salona Hew., Deser. Lyc., 31 (1868); Ill. diurn. Lep. 159, pl. 63, figs. 429, 430 (1874).

Imago. Head with the front pure white, tufted above with black, white and orange scales, the orange in a transverse line behind the antennae. Palpi white, the apical joint brown above. Antennae black brown, annulated at the base of the joints with white, excepting on the club; the three or four apical joints of the club orange.

Above: *fore wings* uniform dark brown, the outer margin with a black thread; fringe bluish white; the males with a quadrate black brown spot of special scales at the extremity of the cell, a little longer than broad, as long as the width of the cell; extremity of the cell marked in the female by a faint black bar. *Hind wings* of the same color as the fore wings but much suffused with blue, by scattered blue scales along the lower half, especially in the female; lower half of the wing with a pre-marginal series of round, blackish brown or brown, circular spots, that in the lower median interspace the largest and darkest; margin edged finely with black; fringe as above; the tail black, white-tipped.

Beneath, soft uniform slate brown; *fore wings* with a post-mesial bent series of slender white lunules edged to nearly the same depth externally with black brown; a marginal series of circular, pale brown spots, each surrounded by a faint, pallid annulus and followed interiorly by a series of pale brown lunules and these in the upper half of the wing by yellow sagittae; edge and fringe as above. *Hind wings* with a very irregular, interrupted, sinuous, mesial series of black spots encircled with white exteriorly and edged interiorly with orange; near the base of the cell and of the costosubcostal interspace, largest in the latter, a round, black spot enlivened with orange scales and annulated with white; all of these markings are minute; the outer border is marked in a manner similar to that of the fore wing, excepting that there is a large, conspicuous, black spot in the lower median interspace, occupying the entire width of the interspace, followed interiorly by an orange lunule, and a similar shade of orange sometimes follows the smaller white-capped spot in the upper median interspace, and a streak of orange follows in the same relation over the interspaces below. Expanse of wings, 26-29 mm.

This pretty butterfly belongs to the southernmost parts of the United States where it is found from Florida, including the Keys, and Georgia to Texas. It is also found beyond our territory in the Antilles and Mexico and even to Guiana, the Amazons and eastern Brazil. But that its northern extension may be greater than known is indicated by its capture near Buffalo, N. Y. by Reinecke.

The Buffalo specimen was taken July 13 and Maynard took it in southern Florida, December 25; beyond this we have no knowledge of the history of the species. Mr. Maynard says it is of retiring habits, frequenting the edge of shrubbery and keeping generally in its shade.

CALYCOPIS SCUDDER.

Calycopis Scudd., Bull. Buff. soc. nat. sc., iii: 108 (1876). Thecla pars Auctorum.

Imago. Front of head narrower than the face view of the eyes. Eyes moderately full, sparsely and briefly pilose, the pilosity briefer below than above, but otherwise uniform. Antennae delicate, half as long again as the abdomen, separated at base by almost or quite the width of the front, composed of thirty joints of which twelve form the long fusiform club; this is largest in the middle, tapers about equally toward either extremity, the tip rather bluntly pointed, about five or six times as long as broad, the middle joints about three times as broad as long, four times as broad as the stalk where the longest joints are about five or six times as long as broad. Palpi short; if appressed to the front they would fall far short of the base of the antennae, the last joint only moderately slender, apparently about three-fourths the length of the middle joint.

Outer margin of fore wing gently arcuate. Cell reaching the middle of the wing, the limiting external veins exceedingly and equally slight, transverse, the origin of the nervures much as in the female of *Mitura*, but the first branch of the median arising nearer the base than that of the subcostal nervure. Hind wings with the curve of the outer border not quite regular, being nearly straight in the middle, the middle and lowest median nervules developing a filiform tail of unequal length, the anal angle scarcely lobed and preceded on the inner margin by a slight oblique excision which is scarcely concave. First divarication of the median nervure considerably nearer the base than that of the subcostal.

All the legs very short, the fore tibiae and fore tarsi of equal length in the male, and about two-thirds as long as the hind tibiae or hind tarsi; the fore tibiae of male broken into the ordinary joints, armed apically only with a pair of downturned spines, differing in no respect from the other tarsal spines. First hind tarsal joint as long as the rest together, the under surface of the whole tarsus armed with delicate spines, infrequent on the basal, frequent on the apical half of the tarsus. Claws very small and delicate; paronychial slender, filiform, as long as the claw but nearly straight; pulvillus bullate.

This genus comprises at least half a dozen Central American forms and perhaps some additional South American, ranging at any rate from the middle of the United States to northern South America, as far as eastern Brazil. Their transformations are unknown, though it is apparent that Abbot reared the single species which occurs in the United States.

CALYCOPIS CECROPS.

Hesperia cecrops Fabr., ent. syst., iii: 270 (1793).

Calycopis cecrops Scudd., Bull. Buff. soc. nat. sc., iii: 108 (1876).

Rusticus armatus poeas Hübn., Samml. exot. schmett., i (1806-16).

Thecla poeas Boisd.-LeC., Lép. Amér. sept., 111-112, pl. 35, figs. 1-4 (1833);—French, Butt. east. U. S., 270-271 (1886).

Strymon beon Hübn., Verz. bek. schmett., 75 (1816).

Imago. Head with the face brown, edged laterally with brilliant white, tufted above with black scales; the eye encircled with white. Palpi black brown, annulated with silvery white. Antennae black brown, distinctly and rather broadly annulate with white at the base of each joint and over the whole of the base of the club, which otherwise is velvety black with an orange tip. Thorax covered above with dark brown hairs, many of them with a bluish tinge, beneath clay brown. Legs black, conspicuously annulated with white.

Above: *fore wings* uniform rich blackish brown, with a faint bluish reflection, in the female with a more distinct pale glaucous blue reflection from the inner two-thirds of the lower half. *Hind wings* the same, the lower half of the wing below the upper limit of the median nervure overlaid with dark blue, with the exception of the marginal markings becoming less distinct and paler in certain reflections, in the female always with more or less of a glaucous tint; the outer margin has a distinct black thread, preceded in many cases by a similar white thread, and this in the median and medio-submedian interspaces by a large roundish brown spot, free of blue scales; and finally, at the extreme anal angle, a minute orange spot or streak, surrounded by black and preceded by white; tails black, largely white-tipped.

Beneath, rather uniform pale slate brown, with a slight tint of buff. *Fore wings* with a straight orange line parallel to the outer margin running from the costal border to the lowest median nervure, striking the latter exactly in the middle; this line is finely edged externally by black and then by white; midway between this transverse line and the outer margin is a faint, sometimes obsolete, fuscous line in the subcosto-median and median interspaces; outer limit of the cell faintly marked by dusky scales. *Hind wings* with the outer limit of the cell marked as in the fore wings, but more distinctly and sometimes enlivened with orange; the straight orange line of the fore wings here becomes broader and generally darker and exceedingly irregular; as before, it is edged exteriorly with black and then with white, and on the lower half of the wing the white edging is again edged with black; its course may be described by following the direction of the white line; this crosses the upper interspaces as far as the upper median nervure exactly at its middle, as before in a very nearly straight line, occasionally shifted slightly in position at the nervules; it crosses the upper median interspaces in a straight, oblique course, as if its upper portion had been thrust inward nearly half way to the base of the interspace; it crosses each of the next two interspaces in a curved line bent toward the base at somewhat less than a right angle, and the lowest interspace in an oblique line directed inward; in the interspaces where the line is bent it encloses externally in the bent portion as much orange as lies internally; there is a marginal series of more or less ocellated spots, often obsolete in the upper half of the wing, but when present consisting of cloudy markings, of which the most distinct is a brownish annulus; but in the lower half of the wing, where the orange stripe is most variegated, these spots become large and conspicuous and ordinarily bright colored; they vary greatly, but are usually much variegated with orange, though sometimes not a trace of this exists; the spot in the lower median interspace is the most conspicuous and largest, and is either a blackish brown lunule in a pale brown setting, followed above by an arcuate black brown streak, or the black may be reduced and intensified and broadly surrounded by bright orange in the place of the pale brown, followed as before by a black arcuation; in the medio-submedian interspace the black is intensified and powdered with blue scales, and orange is rarely found excepting in continuation of an oblique streak which crosses the interspace next the inner margin, followed above by a slender thread of black, and this by white, and below at the anal angle by a small, round black spot, edged without and within with white. Expanse of wings, 21-28 mm.

This exquisite little butterfly is one of the many delights of the south. It is found from West Virginia and Kentucky southward, occasionally a little further north, and extends westward to the Great Plains. It reaches also beyond our borders, being found in the West Indies, Mexico, Guatemala and even Panama.

Nothing whatever is certainly known of its history or early stages, but in Florida it flies early in February. Abbot distinguished in his notes between three kinds of "purple hair-streak" butterflies: a

"great," a "small" and a "least," which in all probability refer respectively to *haesus*, *m-album* and *cecrops*. If, then, his "least" be *cecrops*, as is certainly highly probable, then he bred the butterfly in Georgia May 20, after twenty days in chrysalis, from a caterpillar feeding "on the large blue huckleberry," doubtless some species of *Vaccinium*.

THECLA FABRICIUS.

THECLA LORATA.

Thecla lorata Grote-Rob., Trans. Amer. ent. soc., i: 171-173 (1867).

Imago. "Male.—Allied to *Thecla falacer*, Bdv. and LeC. Head black; eyes circled narrowly with white; antennae black, annulate with white, the 'club' entirely black. Body above, black, the longer scales on thorax and abdomen with a paler somewhat brassy tinge. Beneath the abdomen is whitish, the under thoracic squamation is blackish gray; legs mostly whitish, blackish outwardly, subannulate, the tarsi touched with fuscous inwardly.

"Upper surface of wings of a uniform black or blackish, with a subdued brassy-brown reflection which becomes prominent in certain lights. An ovate sexual spot on the disc of primaries. Secondaries with two very unequal tails as in *T. falacer*, the lower the longer, fringed with white. Base of the fringes, from anal angle to the lower 'tail,' white, and at this place is a narrow, white, internal line in one specimen. Between the 'tails,' the fringes, which elsewhere are dark, are tipped with white.

"Under surface somewhat paler than upper, brownish black. An extra-basal common streak, composed of powdery dark blue scales, runs across both wings; this is slightly irregular, and is lost inferiorly among the longer scales which clothe the internal margin of the secondaries. Two short white lines on the disc of primaries enclosing an incomplete darker shaded spot or space as in allied species. Beyond, an interrupted, extra-discal, semilunate, white line, narrowly edged within by blackish scales and preceded by dark interspaceal shadings. An incomplete, bluish-white, subparallel, subterminal line, edged outwardly by blackish scales. Secondaries with two short, parallel, white lines on the disc, enclosing an analogous space to that on disc of primaries. An extra-discal semilunate and interrupted white line as on primaries, preceded by dark interspaceal shades; these are faintly edged within in one specimen by white scales, so that here the white line may be said to be geminate, enclosing a dark shade; on the subcostal interspace the series is interrupted, the lines being severed and brought nearer to the base of the wing, a detached spot is thus formed as is usual. A subterminal bluish white line, forming prominent lunules on the interspaces inferiorly, edges outwardly with black; along anal angle the black scales are followed by a fulvous streak, this by first white then black scales. Outside of the black scales edging the subterminal line on the next interspace above, is a patch of powdery blue scattered scales extending to the external margin; on the interspace above is a distinct, fulvous crescent, succeeded by black scales on the margin; the fulvous scales are faintly continued on the next succeeding interspace, which also shows a few scattered bluish-white scales. A narrow white line lies directly on the margin. Expanse, 1.2 inch. Length of body, .6 inch."

No one seems to have found additional specimens of this species, described from two males from Virginia, and accordingly I reproduce the original description. Possibly the species is not distinct from *T. calanus*, but I have never noticed in the latter the delicate line of blue scales near the base of the wings beneath, which appears to be a characteristic mark of the present form.

EUPSYCHE SCUDDER.

Eupsyche Scudd., Bull. Buff. soc. nat. sc., iii:112 (1876). *Thecla* pars Auctorum.

Imago. Head moderately large, compactly sessile. Front as broad as the face view of the eyes. Eyes rather fuller than usual, with a very sparse pilosity, so brief as to be scarcely perceptible. Antennae unusually short, being less than half the length of the fore wings and not very much longer than the abdomen, separated at base by hardly more than half the front, composed of not far from forty joints; the club very long and slender, and arising very gradually, so as to be difficult to delimit, but it is composed of not far from eighteen joints and is scarcely more than twice as stout as the stalk, bluntly rounded at the tip, which does not otherwise taper, and occupies nearly a third of the whole antenna; in the middle of the club the joints are less than twice as broad as long, and in the stalk the longest are not more than four times as long as broad. Palpi slender and rather long, the last joint very slender and elongated, as long as the middle joint, and if appressed to the head would surpass the base of the antennae.

Thorax unusually plump, the fore wings shaped much as in *Thecla*, the venation of the male not affected by the discal stigma. Cell half as long as the wing, much narrowed apically; course of the upper cross vein closing the cell oblique, arising from the first inferior subcostal nervure, as far beyond the origin of the latter, as that beyond the base of the second superior nervule, the lower cross vein closing the cell obsolete; first subcostal and median nervules arising a little beyond the middle of the cell. *Hind wings* with the whole lower half produced, the inner being much longer than the costal margin, the lower median nervules produced to filiform tails of greatly unequal length, the inner margin excised apically, the anal angle faintly lobed. Subcostal and median nervures first branching at equal distances from the base.

All the legs short but pretty stout, the fore tibiae as long as the fore tarsi, and only a little shorter than the hind tibiae, and about a third shorter than the hind tarsi, which are a sixth longer than the hind tibiae; fore tarsal joints of the male obscure, the last bluntly rounded at tip and furnished with a pair of spines differing in no way from the others, except in being directed at right angles downward. Hind tarsal joints clothed beneath inconspicuously with short and fine, recumbent spines; first joint equalling all the others. Claws exceedingly small and delicate, bent in the middle; paronychial slender, as long as the claw.

The early stages are known only by the illustrations given in Boisduval and LeConte's Iconography, which show nothing generically distinctive.

The genus is fairly well represented in the tropics of America, three or four species being known in North America, one of them inhabiting our southern states; some of the Central American forms extend to the Amazons, Guiana and Venezuela, and probably there are others in northern South America. Their transformations are known only through the United States species, mentioned below.

EUPSYCHE M-ALBUM.

Thecla m-album Boisd.-LeC., Lép. Amér. sept., 86-87, pl. 26, figs. 1-5 (1833);—French, Butt. east. U. S., 256-257 (1886);—Godm.-Salv., Biol. centr. amer., Lep., ii: 40 (1887).

Eupsyche m-album Scudd., Bull. Buff. soc. nat. sc., iii:112 (1876).

Thecla psyche Boisd.-LeC., Lép. Amér. sept., 88-89, pl. 27, figs. 1-5 (1833).

Imago. Head with the face black, edged externally with white, tufted above with black scales; the eye narrowly encircled behind with white. Antennae black, heavily annulated with white, excepting on the club which is black, the apex orange. Thorax

covered above with brown, having bluish and green reflections, and similar blue green scales, below with yellowish brown hairs; the legs more or less flecked and annulated with sordid white.

Wings above rich black brown, the disk more or less intensified, supplanted by brilliant, glossy, dark blue with green reflections. *Fore wings* with the costal edge orange; in the male the blue disk is limited by a line which follows the upper margin of the cell, passes in a strongly rounded curve to the middle of the upper median nervule and then runs subparallel to the outer margin to the inner margin; it encloses a discal triangular spot of dead brown androconia at the outer limit of the cell, its apex below; in the female the blue disk is confined to patches in the lower half of the cell, at the base of the lower median and the basal half of the medio-submedian and internal interspaces. *Hind wings*: in the male, the blue disk is limited by a curving line which passes above the cell, encloses a little of the upper subcostal interspace and runs toward the lower median nervule in a curve, constantly approaching the outer margin; in the female it occupies scarcely less space; anal angle marked by a bright, dark orange spot, flecked to a certain extent with blue scales, especially on the upper inner surface, followed without by the black edging of the whole outer margin, and within, above, by a small white spot; tails black, white tipped; fringe of all the wings pale brown, becoming white in the lower half of the hind wings.

Beneath, uniform mouse-brown. *Fore wings* crossed by a straight, narrow, white stripe, more or less interrupted by the nervures, edged more or less faintly on the inner side with dark brown, and running from the costal margin to the middle of the lowest median nervule at right angles to the costal margin; nearly midway between this and the outer margin, but parallel to the latter is a similar but very obscure and cloudy stripe, edged without, instead of within, by the dark brown, sometimes more or less obsolete. *Hind wings* with a similar, but if anything narrower, transverse, extra-mesial stripe, forming a very large, fine W or reversed M, whence the name; in character it is in most respects similar to that of the fore wings, being interrupted by nervures, sometimes shifted slightly in position by them, but runs from the upper subcostal nervule in a nearly straight course to the lower median nervule, in the medio-submedian interspaces forms the middle limbs of the M, and in the interspace below runs at right angles to its early course, crossing the middle of the costo-subcostal interspace as a short, slender, white bar, edged internally with black; midway between the M-streak and outer border is another series of white bars, often obsolete in the upper half of the wing, generally disconnected, sometimes scattered to form a powdery line, and then more or less bluish in tint; it is only in the lower half of the wing that it becomes distinct, and here it takes a course subparallel to the general trend of the extra-mesial stripe and is distinctly followed exteriorly with black; these two parts are separated by a large and brilliant, lighter or deeper orange, round spot in the lowest median interspace, a spot which is ordinarily accompanied at its exterior base by a small black spot, and is edged above with black; anal angle occupied by a deep black spot, followed above, interiorly, by a small white spot, exteriorly by a larger orange spot; and in the apical portion of the medio-submedian interspace a black spot, heavily powdered with blue, sometimes so that the blue almost supplants the black; this spot is edged above with white before meeting the tongue of the orange spot of the interspace below. Expanse of wings, 36-38 mm.

Caterpillar. *Last stage.* Head black. Body slightly pubescent, of a pale green with a yellowish tinge, a dorsal stripe and seven oblique, lateral streaks of a dull green, a stigmal yellow stripe, slightly shaded with dull green above. Length, 18 mm. (Boisduval and LeConte.)

Chrysalis. Gray brown, with the front part of the body and the wing cases pale, slightly greenish gray. Length, 11 mm.; height, 5 mm. (Boisduval and LeConte.)

This pretty butterfly occurs in the southern half of the United States, east of the Great Plains, and extends southward also into Mexico and

Guatemala, Costa Rica and Venezuela; it has occasionally been found in the southern portion of the northern half of the United States, being reported from New Jersey, Pennsylvania and Ohio.

Although the early stages of this butterfly were studied and figured in the last century by Abbot, and published by Boisduval and LeConte more than half a century ago, we have not yet any proper account of the history of the species. Abbot's notes, however, assure us that it winters in the chrysalis and is more than single brooded. He reared specimens September 5 and February 20, the former after sixteen days in the chrysalis, the latter from one that changed later than August. According to him, also, the caterpillar feeds on *Astragalus canadensis* and *A. glaber*, as well as on different oaks of which he specially mentions "black jack oak," which is perhaps *Q. catesbyi*. The only other published date of capture is one by Aaron who took it June 11 at Atlantic City, New Jersey. It is, therefore, very probably triple brooded in the south.

ATLIDES HÜBNER.

Atlides Hübner, Verz. bek. schmettt., 80 (1816); *Thecla* pars Auctorum.
—Butl., Cat. Fabr. Lep., 197 (1869).

Imago. Head not large, compact, the front slightly narrower below than above, above as broad as the eye on a face view. Eyes as in *Eupsyche*. Antennae much less than half as long as the fore wing, considerably longer than the abdomen, moderately stout, increasing in size from the middle outward, separated at base by nearly the width of the lower part of the front, composed of about thirty-five joints, the club hardly separable from the stalk, increasing with the utmost regularity to the middle of the outer half, beyond which there are about a dozen equal joints, less than twice as stout as the stalk, and only a little broader than long, and then a couple of joints serve to give the club a bluntly rounded tip; the longest joints of the stalk are barely three times as long as broad. Palpi very small indeed, the last joint, if appressed to the head, not reaching the base of the antennae by its own length, only moderately slender and half as long as the middle joint.

Fore wings shaped as in *Thecla* but with a relatively longer inner margin, the venation not affected by the exceedingly large discal stigma of the male, the cell considerably less than half as long as the wing, truncate at tip where it is hardly more than two-thirds its median width, the first superior subcostal nervule arising before the middle of the cell, the cell closed by feeble cross veins. Hind wings shaped much as in *Eupsyche*, with a larger anal lobe and preapical excision. Subcostal forking sooner than the median nervure.

Thorax large and massive. Legs pretty stout and very heavily clothed, the fore tarsi of male about a third shorter than the fore tibiae, scarcely more than half as long as the hind tarsi or the hind tibiae, which are about equal; fore tarsi of male faintly jointed, densely clothed with spines beneath like the others, the apical three or four very faintly arcuate, but not otherwise differing from the ordinary spines; first joint of hind tarsi fully as long as the three succeeding joints together, the apical pair of inferior spines of each joint slightly larger than the others. Claws exceedingly small, fine and strongly curved; paronychial forming a large, inferior, fringed hood concealing the basal half of the hook.

The early stages are known only through the illustrations of Boisduval and LeConte which show nothing generically distinctive with certainty.

This group comprises the largest of our Theclidi and reaches its highest development in the American tropics. Six or eight species are found in Mexico and Central America and some of them, as well as others, in the northern part of South America. A single one of them, described below, extends its range into the southern United States.

Their transformations are unknown except for the rude illustrations of our own species given by Boisduval and LeConte.

ATLIDES HALESUS.

Papilio halesus Cram. Pap., exot., ii: 3-4, pl. 98, figs. B, C (1779).

Thecla halesus Boisduval-LeC., Lép. Amér. sept., 83-85, pl. 25, figs. 1-5 (1833);—Frensch, Butt. east. U.S., 255-256 (1886);—Godman-Salv., Biol. centr. am., Lep. rhop., ii: 18-19 (1887).

Atlides halesus Butl., Cat. Fabr. Lep., 197 (1869).

Atlides dolichos Hübn., Zutr. exot. schmett., ii: 9, figs. 219-220 (1823).

Thecla juanita Scudder, Proc. Bost. soc. nat. hist., xi: 435-436 (1868).

Imago. Head black; a circular pearly white spot between the antennae, another just behind the summit of the eyes, a long and slender one in front of, and another behind the eyes; base and centre of the palpi white. Antennae black, the tip of the club brown; a transverse plume of mingled black and white hairs on the vertex, behind which is a collar of shorter white hairs. Thorax and abdomen well sprinkled above with bright blue scales on a brownish ground; thorax beneath black; a white dot on the sides at the base of either wing; legs black with occasional white scales. Abdomen beneath orange.

Wings above blackish brown; *fore wings* profusely suffused with bright blue (steel blue by reflected light) on the basal half, especially along the middle of the wing, but not between the divarications of the median nervure; fringe black, tipped with gray. *Hind wings* somewhat suffused with bright blue, especially along the area occupied by the median nervure and its divarications; there are two long tails: the upper is the extension of the middle median nervule, the lower, which is twice as long as the other, is the continuation of the lower median nervule; the internal area is slightly excised near the extremity and the portion beyond curved sharply over and beneath, at fully a right angle to the general plane of the wing; on the lower half of the outer margin of the wing are three spots, made of yellowish-brassy, greenish-brassy and bluish-brassy scales; that in the internal area is longitudinally oval, that between the median and submedian nervures transversely oval, and that between the tails transversely linear and least variable in coloration; the middle spot is also surmounted by a number of inconspicuous deep tawny scales; on the internal area there is another similar but irregularly shaped spot within but close to the outer one; internal area with long bluish gray hairs; fringe, as far as the longer tail, black, tipped with gray; beyond, white at extreme base; the outer parts black; wholly black beyond the spot on the anal angle.

Beneath, glossy grayish brown, lightest in tint toward the apices of the wings; extreme base of the *fore wings* velvety black with a longitudinally oblong-ovate, bright, very deep orange red spot at the base of the costal area, but scarcely reaching the edge of the wing. Extreme base of the *hind wings* velvety black with two bright, very deep orange-red spots: one circular, similarly situated to that on the fore wings, the other longitudinally oval, in the internal area; there is a transverse curving submarginal row of very bright, brassy-green, transversely ovate spots bordered with black, extending from the middle median nervule to the internal border; there is a row of marginal spots generally similar to those of the upper surface; the deep, tawny spots are, however, found in all the interspaces, are more conspicuous and between them and the submarginal row mentioned, is a row of transversely linear spots similar to the marginal spots. Expanse of wings, 51 mm.; length of lower tail, 18 mm.

Caterpillar. *Last stage.* Head testaceous yellow red. Body green, slightly pubescent; a slight dorsal stripe and nine oblique lateral bands of dull green, and a marginal stripe of greenish yellow at the substigmatal fold; thoracic legs of the color of the head. Length, 24 mm. (Boisduval and LeConte).

Chrysalis. Reddish, pointed with brown. Length, 18 mm.; height, 7 mm. (Boisduval and LeConte).

This fine butterfly, called the Great purple hair-streak by Abbot, is found in the southern half of the United States from ocean to ocean, and extends also into Mexico as far as Yucatan and perhaps into Costa Rica. Its northern boundaries are by no means well known, but though it has been found in Nevada according to Edwards (presumably southern Nevada), it does not appear to range so far north as *Eupsyche m-album*, the northernmost locality east of the Rocky Mountains being Illinois.

The caterpillar is said by Abbot to feed on *Quercus phellos* and *Q. cinerea*. Its seasons are very probably the same as those of *Eupsyche m-album*, as it is found flying at the time of peach blossoms in Florida and was raised by Abbot early in September from a chrysalis whose period was seventeen days.

TRIBE LYCAENIDI.

NOMIADES HÜBNER.

NOMIADES LYGDAMUS.

Polyommatus lygdamus Doubl., Entom., 209-211 (1842). (1876).

Glaucopsyche lygdamus Scudd., Syst. rev. Amer. butt., 33-34 (1872).

Nomiades lygdamus Senn., Bull. Buff. soc. nat. sc., iii: 117 (1876); Can. ent., viii: 23

Lycaena lygdamus Streck., Lep. Rhop.-Het., 84 (1874);—French, Butt. east. U. S., 284-285 (1886).

Lycaena lygdamas Edw., Butt. N. A., i: *Lycaena* 1, figs. 5-7 (1869).

Imago. Head in front white with a pair of vertical black stripes just within the lateral white edging, above covered with white, bluish white and black hairs. Palpi silvery white, the upper surface black brown, the fringe composed of black hairs without, white hairs within. Antennae with the stalk almost equally annulate with black and white, but the black rather in excess, the club black brown, white along the lower outer edge. Thorax covered above with blue white hairs, below a little paler; the legs sordid white, the tibiae annulate above with black.

Wings above pale, glistening pruinose blue, with faint greenish reflections, the male having the costal margin very narrowly, the outer margin narrowly, edged with black brown; the female almost wholly dark brown, blackish brown next the extreme edge and powdered heavily with blue scales, which almost entirely conceal the brown next the base but on the outer half of the wing are much more scattered and reach, on the fore wing, only the middle of the outer half of the wing; on the hind wing, however, the outer border, at least toward the anal angle.

Beneath, uniform, clear, dark slate brown, occasionally with a pallid ray following the interspaces in the outer half of the wing; in both wings there is a circular black

spot in the middle of the cell; its outer limit is marked by a black line or bar and there is a row, arcuate in the fore wing, sinuous in the hind wing, of tolerably large, round black spots, one in each of the interspaces, crossing the middle of the outer half of the wing; all these spots are encircled with white; the outer edge is finely marked with a black brown thread preceded by a similar white one; the arcuate row of extra-mesial spots of the fore wing is subparallel to the outer border, the uppermost spot in the lowest superior subcostal interspace retreating somewhat from it; on the hind wings the spots of this series are usually more perfectly circular than the corresponding spots of the fore wing, often slightly smaller than there, excepting that in the medio-submedian interspace which is double or when blended transverse; the two spots of the costo-subcostal and subcostal interspaces are removed inward further from the next portion of the series, which consists of a strongly arcuate row of four spots in the next succeeding interspaces as far as the medio-submedian; the spot in the latter again approaches the margin, while the small spot below it again recedes from it; in addition there is on the hind wings an entirely similar spot in the costo-subcostal interspace, above and a little outside of the spot in the centre of the cell. Expanse of wings ♂, 26-36 mm.; ♀, 38 mm.

The large size of the extra-mesial spots of the hind wings, where with their white edging they completely fill the interspaces as far as the scaly covering of the nervules, is one of the characteristic features of this species.

The range of this silvery blue butterfly is still imperfectly known. It certainly is found in the states bordering the Atlantic from the upper waters of the Susquehanna to Georgia, probably following the Appalachians. It also occurs beyond the Atlantic states, but only in the north, reaching westward to Ohio, Michigan and Wisconsin.

In Georgia, according to Abbot, it flies throughout March and occurs in pine woods, flying very swiftly. In West Virginia it appears early in April, according to Mr. Edwards, and flies throughout that month, as I have good specimens taken there at the end of April. Edwards says it is rare, "not more than half a dozen being seen in a season," and is usually found "in the garden or about houses." Nothing more of its history is known.

RUSTICUS HÜBNER.

RUSTICUS STRIATUS.

Lycaena striata Edw., Field and forest, iii: 88 (1877).

Imago. "Male. Expands 1 inch. Upper side dull pruinose blue, the secondaries of a gray shade; the wings delicate, allowing much of the marking of under side to be discovered above; primaries edged by an illy defined, fuscous line, a little expanded towards apex, secondaries by a clear, black line; fringes of primaries fuscous next to the marginal edge, white outside, of secondaries pure white. Under side gray white; both wings banded from base nearly to margin with pale fuscous; on secondaries these bands are macular; on primaries nearly regular, but the bands do not pass the lower branch of median; hind margins edged by a common series of pale fuscous, crenated spots, each enclosing a small, concolored, rounded spot, except next anal angle, where are two round, velvet black spots, the outer one largest; these are faintly margined by yellow and their surfaces a little sprinkled with brilliant metallic blue scales, mostly arranged along the edges.

"Female. Expands .95 inch. The costal and hind margin and base of primaries pale fuscous, the disk whitish, and a blue tint over basal area; on the disk appear four or five spots caused by the transparency of the wing; secondaries had the costal mar-

gin largely pale fuscous and the remainder of the wing nearly pure white, excepting along the hind margin, where there is a fuscous band enclosing rounded, white spots each of which itself encloses a fuscous spot on the marginal side; the inner spot on lower median interspace is blackish, under side as on the male."

This butterfly originally described as above by Edwards from specimens obtained at San Antonio, Texas, by Boll, is stated by him to have occurred also at Racine, Wisc. (Hoy). Nothing more is known of it; it presumably belongs to *Rusticus*.

TRIBE CHRYSOPHANIDI.

EPIDEMIA SCUDDER.

EPIDEMIA DORCAS.

Lgcaena dorcas Kirtb., Faun. bor. amer.,
iv: 299, pl. 4, fig. 1 (1837).

Epidemia dorcas Scudd., Bull. Buff. soc.
nat. sc., iii: 128 (1876).

Polyommatus anthelle Boisd. MSS., Doubl.,
List. Lep. Brit. Mus., ii: 53 (1847).

Polyommatus epixanthe pars Möschl.,
Stett. ent. zeit., xxxi: 114-115 (1870).

Imago. Head in front snow-white with a broad, median, black-brown stripe running down between the antennae almost to the base; above tufted with jet black, olivaceous and fulvous scales, the first in greatest abundance; a snow-white fringe behind the eye. Palpi white, excepting the apex of the middle joint and all of the apical joint but an inferior line and the extreme tip, which are blackish brown; the inferior fringe of mingled black and white hairs. Antennae black-brown, with moderately narrow, basal, white annulations on all the joints; the club itself velvety black above, sordid white beneath at the base, luteo-fulvous on the naked portions. Thorax covered with glossy black hairs, with intermingled tawny hairs, especially around the base of the wings; beneath covered with pure white scales and sordid bluish white hairs; the legs white, the terminal tarsal joints annulate with brown; the spines dark castaneous.

Upper surface of the wings having the disk either bronze brown with a violaceous reflection, most distinct at the extreme base (♂), or dark grisly brown with scarcely perceptible violaceous reflections (♀). The *fore wings* are marked by a blackish brown spot just beyond the middle of the cell, a black bar marking its termination, a small blackish brown spot in the medio-submedian interspace, just below the first divarication of the median nervure, and a transverse, sinuous series of spots crossing the middle of the outer half of the wing, obscure brown, circular and small in the male, quadrate and nearly filling the interspaces, as well as followed by narrower or broader, dull orange rays in the female, in all the interspaces between the lowest superior subcostal and the medio-submedian inclusive; the series is more irregular and sinuous in the female than in the male, and in the latter is nearly parallel to the outer margin; the outer border broadly margined with dark brown, as far as midway between this extra-mesial series of spots and the margin itself; in the male the spots in and at the extremity of the cell are a little more distinct than the others. *Hind wings* with a narrow, blackish bar closing the cell, and a little within the outer half of the wing a series of spots, whose relative importance in the two sexes is as on the fore wings, is found in the same interspaces as there; outer margin dark brown, not so dark as on the fore wings, and with no such distinct limitation, merging insensibly into the warmer tint of the disk; slight orange lunules are found, often subobsolete, in the medio-submedian and lower median interspaces, in the former more distinct and at the anal angle.

Beneath, nearly uniform, very pale orange buff; the hind wings, however, often grayer, sometimes pinkish in tone; the markings of the upper surface are fully re-

peated beneath, excepting the broad margin of the outside, which is indicated only by a series of dusky brown, interspaical spots at its inner limit, more obscure on the upper than on the lower half of the wing; neither do the spots differ in size or form in the two sexes, being larger and more distinct than those of the upper surface of the male, but round or oval, as in that sex above; there is in addition a minute black spot in the cell, midway between the extra-mesial spot and the base. *Hind wings* traversed by two series of fine and rather faint, black or blackish brown spots, which appear as the point of vague sagittate or lunulate spots pointed toward the outer margin, one extra-mesial, the other intra-mesial, and corresponding in position to the spots of the upper surface; these are often subobsolete; there is a submarginal series of faint, pale orange lunules, much more distinct on the lower than on the upper half of the wing, clear and well marked only next the anal angle; they generally take the form of thin, sagittate spots, and are deepest in color along their middle line, fading to yellow outwardly; they differ from the corresponding spots in the allied *E. epixanthe* in their sharp angulation. Expanse of wings ♂, 25 mm.; ♀, 29 mm.

This butterfly is found only in the Dominion of Canada, where it ranges from the southern coast of Labrador on the east to Lake Winnipeg and the Saskatchewan on the west, and even, according to Edwards, as far as Kodiak, Alaska. Geddes does not appear to have taken it in his collections west of Manitoba, so that it is hardly probable that it anywhere approaches near the southern borders of the Dominion, unless it does so about Nepigon, where it has not yet been found.

Couper found it in southern Labrador in July, but that is the only indication of its seasons which we have. In all probability it is single brooded. Nothing is known of the early stages.

PAPILIONIDAE.

SUBFAMILY PIERINAE.

TRIBE RHODOCERIDI.

CALLIDRYAS BOISDUVAL.

CALLIDRYAS SENNAE.

Papilio sennae Linn., Syst. nat., ed. x, i: 470 (1758).

Callidryas sennae Butl., Lep. exot., 59, pl. 23, figs. 1-4 (1871);—Scudd., Proc. Bost. soc. nat. hist., xvii: 208 (1875);—Edw., Trans. Amer. ent. soc., ix: 11-12 (1881);—French, Butt. east. U. S., 120-124 (1886).

Catopsilia sennae Klr., Syn. cat. diurn. Lep., 797 (1877).

Papilio marcellina Cram., Pap. exot.,

ii: 103, pl. 163, figs. a, b (1779);—Stoll, Ibid., Suppl., 13-14, pl. 3, fig. 1, a, b, c (1791).

Callidryas orbis ♀ Poey, Cent. Léop. Cuba, i pl. [1—upper and lower figures only] (1832).

Papilio eubule Cram., Pap. exot., ii: 36, pl. 120, figs. e, f (1779);—? Sepp., Surin. vlied., i: 85-86, pl. 39 (1848).

Phoebis eubule Hübn., Samml. exot. schmett., ii (1823-26).

[Not *Papilio eubule* Linn.]

Imago. Head tufted with mingled yellow and pink tipped, vinous scales and hairs of no great length. Palpi bright yellow, above like the head. Antennae yellowish

brown, paler toward the base, flecked above with pale blue scales, the apical joint wholly luteous.

Body covered above with pallid and pale greenish hairs, below with pale yellow scales and hairs, the legs pale luteous; the femora tinged with yellow, the tarsi slightly embrowned; the spines and claws concolorous, the tips of the latter brown.

Wings above pale lemon yellow, in the male uniform, excepting for the mealy edging, which is narrow; twice as wide on the fore wings as on the hind, with the interior border parallel to the margin on the hind wings, crenulate on the fore wings; in the female varying in depth from a sordid, greenish white, through a dull, rather sordid, lemon yellow (and then with very slight markings) to a deeper greenish yellow, very faintly tinged, especially on the hind wings with orange. *Fore wings* of female edged with dark brown, having a slightly ruddy tint, varying in depth in different individuals, in the most marked running as a narrow border, beginning on the costal margin, a little way beyond the cell, expanding as it goes until it reaches the apex, when the width is in general constant and about half an interspace, excepting that it is considerably crenulated, and, when not fullest developed, is seen to be composed of subconfluent, transverse, oval spots seated on the nervure tips; there is also a large, often double, roundish spot of the same brown, at the extremity of the cell, when double, the upper spot smaller than the lower, enlivened by a few clustered orange and yellow scales, following the transverse veins; there is also a bent series of powdery fleckings in all the subcostal and median interspaces, in the subcosto-median interspace removed nearly halfway to the cell; in those of the others which open upon the outer border, at a distance of about an interspace and a half from that border; in those which open on the costal border, nearer that border; this series of fleckings is sometimes entirely obsolete, sometimes developed so as to form oblique or broken sagittate spots in the interspaces. *Hind wings* of the female narrowly margined with long, oval, transverse, brownish spots at the tips of the nervules, separated from the extreme margin only by a slender orange line.

Beneath pale, sometimes very pale, greenish yellow, often with an orange tint. *Fore wings* with the outer margin rather broadly suffused with pinkish orange; the submarginal markings of the upper wing are repeated with greater distinctness and heaviness, but still as powdery markings, generally in the form of bars or lunules of orange ferruginous, flecked more or less, but never profusely, with black scales; besides this, the only marking is a spot, now almost invariably double and much larger, at the extremity of the cell, the central portion generally silvery, but more or less obscured, sometimes entirely obscured, with orange ferruginous, and margined with black, surrounded more or less with orange ferruginous; occasionally a third or fourth bit of silvery or orange scales is marked off from the main spot by the ferruginous surroundings in the smaller portion of the spot, which lies within the cell. *Hind wings* crossed by four parallel, nearly straight series of slender interrupted fleckings, subparallel to the outer margin: the first consists of two or three dots of clustered, ferruginous scales at the united root of all the veins, the extreme base of the costo-subcostal interspaces and in the costo-median interspace; the second crosses the wing obliquely at the first forking of the subcostal vein in a series of fleckings which run from the costal to the internal nervure, interrupted to the greatest degree at the subcostal fork; the third crosses the wing at the tip of the cell and runs from the costal margin, just before the tip of the first upper subcostal nervule, to the middle of the submedian nervure, very slender and much interrupted, excepting at the extremity of the cell, where it usually forms a tolerably broad and continuous belt of powdery ferruginous scales, flecked with black, and enclosing at the extreme base of the subcosto-median interspace and beside it in the lower subcostal interspace, a pair of circular or oval, bright silver spots, each with a slender, blackish ferruginous annulus; the last transverse series of fleckings is similar to the extra-mesial series of the fore wings, and is less regular than the others, formed mainly of four slender, powdery lunules in the median, subcosto-median and lower subcostal interspaces, in the upper median nearer the margin than in the other interspaces, where they are nearer the extremity of the cell than the outer

margin; the outer margin itself is usually margined with a pink orange flush, but not so broadly nor so constantly as in the fore wing, and at the extremity of the nervules are often seen black points. Expanse of wings, 60-66 mm.

1. Last stage. Head green. Body green, profusely covered with small, but very distinct and elevated black tubercles; a bright yellow stigmatal stripe the whole length of the body bordered above by deeper green. Legs green. Before changing it becomes yellow and shining. Length, 47 mm. (after Sepp and Stoll').

Chrysalis. Uniform green, the antennae and a slender lateral line yellow, according to Sepp, the whole chrysalis sometimes violet, or according to Stoll', changing to violet before change, when and when only little white flecks appear on the abdomen. The frontal tubercle is stouter than in *C. eubule* and the mesonotal arch hardly so strong. Length, 32.5 mm.; the same following the middle line of the body, 35.5 mm.; height in middle, 13.5 mm. (after Sepp and Stoll'). Sepp's figures are unquestionably the better.

This butterfly is an inhabitant of tropical America, mainland and island, and is not only found along our extreme southern coast, particularly in southern Florida, Texas and Arizona, but occasionally wanders up the Mississippi valley so as to have been taken as far north as southern Illinois. Edwards, in one of his catalogues, says it occurs occasionally in Nebraska; but as he afterwards transfers this statement to *C. agarithe*, it is probable that he formerly confounded the two species.

It is probably the caterpillar and chrysalis of this species which are figured by Stoll' and Sepp in the places indicated in the synonymy above. The caterpillar feeds upon different kinds of *Cassia*, and according to Sepp also on *Hypericum bacciferum*. Stoll' adds that it also feeds on species of *Citrus*, but this is improbable.* The chrysalis state lasts from eight to ten days. There are several broods annually, for Sepp says that the caterpillars may be found "en diverses époques de l'année."

CALLIDRYAS PHILEA.

Papilio philea Linn., Syst. nat., ed. xii, i: 764 (1767).

Callidryas philea Butl., Lep. exot., 92, pl. 35, figs. 1-4 (1872);—Seudd., Proc. Bost. soc. nat. hist., xvii: 208 (1875);—Edw., Trans. Amer. ent. soc., ix: 13-14 (1881);—French, Butt. east. U. S., 124 (1886).

Catopsilia philea Kirb., Syn. cat. diurn. Lep., 797 (1877).

Papilio aricie Cram., Pap. exot., i: 147, pl. 94, figs. a, b (1779).

Mancipium fugax argante Hübn., Samml. exot. schmett., i (1806-19).

Colias eorday Hübn., verz. bek. schmett., 99 (1816).

Colias hersilia Hübn., Verz. bek. schmett., 99 (1816).

[Not *Papilio hersilia* Cramer.]

Imago. Head tufted above with pink tipped, dark greenish brown scales and hairs. Palpi above the same, but on the sides wholly yellow or orange. Antennae dark brown with a castaneous tinge, the incisures and apical joint lighter, the stalk and base of club flecked with pale rosy scales. Body covered above with yellow and greenish yellow hairs, beneath with yellow and orange hairs and scales, the legs concolorous, the tarsi luteous becoming infuscated apically.

Above, fore wings either bright yellow with a greenish tinge, with a very broad and large, orange, sometimes rather pale orange, subquadangular bar or patch crossing the

*The caterpillar and chrysalis figured by Poey in the place noted above must be regarded as belonging only to the male butterfly

of the same plate, *C. orbis*, and the food plant of the caterpillar, *Caesalpinia pulcherrima*, to be referred to the same.

cell beyond the middle at right angles to the costal margin; extending above half way between the cell and the margin, below about to the centre of the medio-submedian interspace, its exterior margin crossing the cell above about midway between the base of the first and of the second subcostal nervules and below just including the extreme base of the upper median interspace, the whole rather broader than the cell and rounded beneath; the apical half of the costal and the upper half of the outer margin marked in black, most distinctly at the middle of the interspaces, those on the lower half of the wing being marked apically in the same way; besides there is a very broad exterior mealy band of raised scales, in the form of broad and very long lunules in the interspaces, separated apically only by the nervures, and extending to the depth of an interspace and a half in the lower half of the wing, as far as the cell above, even filling the whole of the upper subcostal interspaces and often present as a small patch in the apex of the cell itself (δ); or, sordid yellow often more or less pallid, sometimes with an orange tinge especially toward the outer border, with the marginal markings of the other sex to form distinct, tolerably large, transverse, oval, blackish brown spots, confluent with a narrow band at the apex of the wing, besides having an extra-mesial series of smaller and more or less powdery spots in all the subcostal and median interspaces, near the middle of the apical two-thirds of each interspace, forming thus a tolerably sinuous series, bent strongly at about right angles at the apex by the spots in the upper subcostal interspaces; besides these an obscure similar spot at the lower extremity of the cell cut by the transverse nervure (φ). *Hind wings* of the same color as the fore wings, the outer margin with a very broad suffused blush of yellow orange (δ) or red orange (φ) growing deeper in tone toward the outer margin, much broader (often covering half the wing) in the female than in the male and in both narrowing and fading above and below; it is accompanied in the female by tolerably large, transverse, oval, powdery, blackish spots barely before the margin seated on the nervules instead of, as on the fore wings, in the interspaces. In the male there is a very narrow, uniform area of raised scales along the outer margin.

Beneath orange buff, heavily flecked in the female with ferruginous orange. *Fore wings* with the dark markings of the upper surface of the female repeated in both sexes in ferruginous with these variations: the marginal markings of the male are even less distinct than in the same sex above, often quite absent; and the spot at the end of the cell is generally larger, accompanied by another seated on the upper transverse vein and both more or less heavily pupiled with silvery. *Hind wings* crossed, more heavily in the female than in the male, by an extra-mesial series of very powdery ferruginous, slender lunules corresponding to the similar series of the fore wings, besides similar, transverse, powdery, ferruginous bars forming a subcontinuous, narrow, bent, V-shaped stripe near the base of the wing below the subcostal nervure, accompanied by a bar edging interiorly the lower, outer margin of the cell and two small silvery ovals on either side of the extreme base of the last subcostal nervule, set at right angles to each other (more distinctly in male than female) and edged with ferruginous. Expanse of wings, 80-98 mm.

This *Callidryas*, like the preceding, is a tropical species, extending from Mexico to Bahia, but is apparently confined to the mainland and so invades the United States only at one point, so that, so far as known, it is only found constantly in Texas, but it, too, occasionally flies northward up the Mississippi valley and has been found even as far as northern Illinois (Evanston, Bontell) and Wisconsin (Racine, Hoy).

The early stages are quite unknown and no information is at hand regarding the history or seasons of the insect.

ZERENE HÜBNER.

Zerene Hübn., Verz. bek. schmett., 97 (1816); Megonostoma Reak., Proc. ent. soc. Philad.
—Scudd., Proc. amer. acad. sc., x: 291 (1875). ii: 356 (1863).

Imago. Head rather large, front quadrate, nearly flat, the lower half slightly projecting, slightly broader above than below, the upper part bent at an exceedingly broad angle with the lower, furnishing a somewhat depressed field for the antennal pits which are separated by their own width and reach behind the line, carinate, erect edge of the broad and mesially tumid vertex. Eyes large, full, naked. Antennae about as long as the abdomen, composed of thirty-two joints, the last double, of which about nine form the very gradually increased, abruptly terminated, cylindrical club, which is about twice as broad as the stalk, with indistinguishable proximal limits, not tapering distally, the largest joints (except the double apical joint) half as broad again as long, the longest joints of the stalk nearly three times as long as broad. Palpi small, short, compressed, compactly clothed, the middle joint compressed, regularly arcuate, equal, fully five times as long as broad, the last stout, oval, not much longer than the breadth of the middle joint.

Fore wings slightly falcate, the costal margin being well arched apically, the apex angular and the outer margin straight or even slightly excised above; inner margin full in its basal half. Subcostal nervure with three branches, the last forked and originating nearer the second than that the first, the second arising at the tip of the cell; the latter less than half as long as the wing and about three times as long as broad. Hind wings as in *Eurymus*, though somewhat longer.

Legs rather slender, the fore legs of the female differing from those of the male only in their greater length. Fore femora (comparisons with male only) as long as hind tibiae, more than half as long again as the fore tibiae, which equal the first joint of fore tarsi; the first joint of fore tarsi equalling the rest together. Hind femora two-thirds the length of the tibia which is a fifth longer than the first tarsal joint; the latter longer than the next three joints together, the fifth as long as the third. Claws very delicate, compressed, elongate, slender, gently arcuate, strongly beveled, slightly divaricate, cleft nearly to the heel, very finely pointed. Paronychial simple, forming a moderately stout, triangular, tapering and pointed lobe, closely appressed to the claw, reaching but little beyond the cleft and united at base beneath.

Egg. Fusiform, nearly three times as high as broad, largest a little below the middle, tapering more rapidly to the base which is about half as broad as the middle, than to the very slender, bluntly rounded top, with a considerable number of slightly and equally raised vertical ribs.

Caterpillar at birth. Dermal appendages of the body Indian-club shaped or long wine-glass shaped, nearly twice as long as the sections on which they are seated, but not more than a third as long as the segments, arranged in the following series, one to a segment in each: a laterodorsal on the anterior section; a supralateral series, scarcely behind the middle of the segments; a suprastigmatal, scarcely before the middle of each segment; and an infrastigmatal series, two to a segment.

Mature caterpillar. Closely agreeing in general appearance with *Eurymus*, but with a smooth, lenticular, suprastigmatal disk on the second and third thoracic segment.

Chrysalis. Resembling that of *Eurymus*, but with the mesonotum less elevated, and the frontal process apparently more highly developed.

This is an American type of *Rhodoceridi*, reaching its highest development in the United States, where two species occur, one eastern and syn-genic, the other western and antigenic, but several members are scattered

throughout Mexico and Central America and the northern parts of South America.

The butterflies are uniformly larger than the species of *Eurymus*, both groups being remarkably monotonous in this respect, though not without variation, but the bordering of the fore wing presents that remarkable irregularity, by its recession in the median interspaces, at least in the male, which gives it the dog's head pattern occurring also frequently in the genera allied to *Terias*, such as *Pyrisitia* among those here described.

In their transformations, so far as we know them, they seem to closely resemble *Eurymus*.

ZERENE CESONIA.

Papilio cesonia Stoll', Cram. Pap. exot. Suppl., 176-177, 382, pl. 41, figs. 2, 2 b (1791).

Zerene cesonia Hübn., Verz. bek. schmett., 97 (1816);—Samml. exot. schmett., ii (1822-26).

Colias caesonia God., Encycl. méth., ix: 87, 98-99 (1819);—Boisd., Spec. gén. Léop., i: 635-636 (1836);—French, Butt. east. U. S., 127-128, fig. 32 (1886);—Edw., Can. ent., xx: 21-24 (1888).

Megonostoma caesonia Reak., Proc. ent. soc. Philad., ii: 358 (1864).

Colias coesonia Boisd.-LeC., Léop. Amér. sept., 67-69, pl. 22, figs. 1-5 (1829-30).

Papilio sesonia Stoll', Cram., Pap. exot. Suppl., 176-177 (1791);—Mart., Psyche, pl. 2, fig. 5, 6 (1797).

Imago. Head covered above with mingled pale brown, pink, pallid and black hairs and pink scales; in front with pink-tipped pale yellowish scales. Palpi mingled yellow and pink, the latter predominating, with a few black hairs. Antennae heavily clothed with pink scales, partially erect, the apex and whole under surface of the club olivaceo-luteous. Thorax covered above with pale yellowish green hairs, beneath with pale yellow and yellowish buff hairs; the femora pale pink interiorly, very pale yellowish green externally; the tibiae pink above but yellowish beneath, as are the whole of the tarsi, though the latter are more or less tinged with pink above.

Wings above bright lemon yellow, sometimes suffused slightly, especially upon the hind wings and the outer half of the fore wings, with orange. *Fore wings* with the basal half above the cell, the basal third below it, black, heavily flecked with yellow scales and short yellow hairs; a round or transverse oval black spot, moderately large, at the extremity of the cell; the outer border very broadly and generally very deeply covered with chocolate black, which is limited interiorly by a very irregular line, clear and distinct in the male, powdery in the female; it is formed of three nearly equal divisions separated by the upper and lower median nervules; the upper third is strongly arcuate, runs from the costal margin to the upper median nervule, its convexity outward, so as to just cross to the base of the third superior subcostal nervule, and to terminate on the upper median nervule about as far beyond the cell as the width of the apex of the cell; the middle third crosses the median interspaces by at once transferring the outer limit halfway to the border of the wing, forming thus a deep quadrate excision of the marginal band which has a slight tooth baseward at the middle median nervule; the third portion varies in the two sexes; in both it traverses the medio-submedian interspace in a strong curve, convexity inward, running from the middle of the lower median nervule to a point on the submedian a little nearer the margin; below this in the male it runs obliquely to the middle of the inner margin; in the female it either continues in its original course or shows the same markings as the male in a vague powdery form; the tips of the subcostal nervures as they strike the costal margin marked in white more or less extensively. *Hind wings* with a pair of pale, faint, round orange spots, one at the middle of the apex of the cell, the other beside it in the lowest subcostal interspace, due to the transparency of the

wing; besides this there are no other markings excepting that in the male there is a narrow marginal black band running from just above the upper subcostal nervule to the middle median nervure, its inner border crenulate, occasionally broken by the nervules and limited to a narrower space; in the females indicated only by some powdery streaks upon the nervule tips in the upper half of the wing and by three or four small powdery spots at more than an interspace's distance from the margin; at the extreme base of the costo-subcostal interspace in the male, extending as far as the first divarication of the subcostal, is a large, quadrate, dull orange patch of special scales.

Beneath, uniform yellow, slightly less greenish than above; hind wings a little darker than the fore wings, occasionally flushed with pink along the costal and outer margin, particularly on the hind wings, and also on the same along the under surface of the subcostal and submedian nervures in the basal third of the wing, and supplanting the color of the spots of the same wing, excepting the silvery portions. *Fore wings* with a large, round, black spot, covering the apical margin of the cell with a large, circular, silvery pupil with somewhat irregular outline; the costal edge, the outer half of the costal margin and the outer margin narrowly edged with pink, sometimes interrupted by the nervures; occasionally a few points of pink or brown may be seen at more than an interspace's distance from the outer margin in the interspaces. *Hind wings* with a pair of circular silver spots, one covering the upper half of the cross-vein, uniting the subcostal and median interspaces at the tip of the cell; the other about one-third its size, resting on the outer subcostal nervule beside the former; each surrounded by a double ring of ferruginous, the inner broader, the space between the two more or less flecked with ferruginous; a pre-marginal series of small ferruginous or pinkish ferruginous scales in all the interspaces, but sometimes obsolete, at about the distance of an interspace and a half from the outer border. Expanse of wings, ♂, 59-63 mm.; ♀, 53-69 mm.

The following descriptions of the early stages are by Mr. Edwards, with the usual modifications:

Egg. Fusiform, thick in middle, tapering to a small, rounded summit; marked by about eighteen longitudinal ribs, these being low, narrow, the spaces between flat and crossed by many fine ridges. Color yellow green.

Caterpillar. *First stage.* Head rounded, a little depressed at top; on the face many rounded tubercles, each with depressed black hair; color pale yellow brown. Body cylindrical, thickest anteriorly; on the ridges of the segments many black points, each with a short, black hair; among these are black tubercles, some with long hairs, but most with white, clubbed appendages, which form three longitudinal rows on either side, one appendage in the row to the segment; "these rows are subdorsal, upper and lower lateral"; color greenish white, with a tint of brown. Length, 2 mm.

Second stage. Head rounded, nearly same green as the body, tubercles and hairs more numerous than before. The ridges of the body thickly beset with black points, each with black hair; among these are small tubercles of same color, mostly on middle of each ridge, with longer hairs; along base a yellowish, narrow stripe, and over it, on the second and third thoracic segments, a rounded black process; another larva showed this stripe only near the close of the stage, and had not the black process; color yellow green. Length, 2.6 mm.*

Third stage. Head yellow green, more thickly covered with small tubercles, scattered among which are others, larger. Color of body yellow green, with yellowish basal band; the processes on the thoracic segments as before, shining, black. Length, 5.3 mm.

Fourth stage. Head yellow green, a little lighter than body. Color of body yellow green, the band greenish white; the two processes on the thoracic segments present; on dorsum of the first thoracic and following segments are very small, black, rounded processes in cross line, and equidistant, placed on the second section of each segment; these are very variable in number; one larva had four on the first thoracic and two each on the other thoracic segments, no others; another had three on the first thoracic, one on one side, two on the other, six on the second, two on the third thoracic seg-

ment, and these last were larger than any others; six seems to be the full number on a segment, and they vary from that to one, present on some segments, and lacking on others, with no apparent regularity; so also the number of lateral processes differs much; one had these on all segments except the first thoracic, first, fifth and ninth abdominal segments, as the stage progresses a yellow stain appears on the band of each segment, and at last is often orange tinted. Length, 8-9.5 mm.

Fifth stage. Head round, slightly depressed at top with many fine black points, each with short black hair; color yellow green. Body cylindrical, of nearly even thickness from the second thoracic to seventh abdominal segments, thickly covered with small black tubercles, each of which gives a short black hair; color yellow green, light or dark; along base a yellow white band, with a dash of orange on each segment, and sometimes the orange is nearly continuous; over the band, on the second and third thoracic segments, a large, vitreous, black, rounded process, from the top of which comes a small hair, and around the base is a ring of black points; some larvae have additional processes of same character on the succeeding segments; but there is much variation; occasionally all are large as on the second thoracic segment, usually they are much smaller; in one example they diminish regularly on the abdominal segments; on dorsum of one or many segments are small black processes on the second ridge, varying from six to one, and often wanting; the same ridge is covered by a black band, sometimes present on every segment, sometimes only on the two or three anterior ones, with broken lines on dorsum or sides of the succeeding ones, frequently, however, wanting; in many examples the first ridge of every segment is bright yellow, and the complete series of black and yellow bands is often present; but others have the yellow bands broken up on middle and last segments, or lack them on these segments; others have a yellow line instead of band; and often there is no trace of yellow anywhere; some larvae, therefore, are wholly green, some green with yellow bands, some with black bands and no yellow, but more have both black and yellow, with variation as to extent of either; the black bands appear in the fifth stage, in examples which showed no trace of them in previous stage, and some larvae wholly green to end of fourth stage, at the moult took on all the bands; under side, legs and prolegs pale green. Length, 15-19 mm.

There was much change in the markings at the previous moult, but still more at this. Some which had been wholly green at this moult discover cross bands of black and yellow, one or both, and there was much variation in the extent of these bands.

Chrysalis. Shape of eurydice, compressed laterally, the thorax on ventral side prominent, rising to a narrow ridge; the abdomen tapering, conical, the mesonotum low, rounded, with a slight carina, followed by a shallow excavation, the head case produced to a point, a little curved up, with a regular slope on both dorsal and ventral sides, angular laterally; color bluish green over whole dorsal side, below, the abdomen yellow green; the wing and head cases dusky green, on the under side a brown crescent, on dorsum two rows of black dots from mesonotum to eighth abdominal segment, one to each segment, and a small black spot on either side abdomen; the whole surface except wings dotted or finely streaked with whitish. Length, 20 mm.; breadth at mesonotum and on abdomen, 4.6 mm.; greatest depth, 6 mm.

Another example gave same dimensions; the dorsum yellow green, ventral side of abdomen more yellow; a brown patch on under side of head case.

An abundant species of the southern and especially the southwestern states, extending from the Atlantic to the Pacific, and reaching down into Mexico and Guatemala, and found as well on the larger West India islands—Cuba, Jamaica and St. Domingo—it has been reported as far north as Kansas, Wisconsin, southern Ontario and Pennsylvania, but does not usually extend so far north in the east as it does in the central portion of the continent.

Notwithstanding its abundance, very little is known of its history or seasons, beyond what Boisduval and LeConte stated fifty years ago, and its early stages have only very recently been fully described by Edwards. According to Boisduval and LeConte, it appears first on the wing in May, reappears again for the entire summer and a part of the autumn, flies in clover fields, but is found in the pine woods of the south, and feeds in the caterpillar state on different kinds of *Glycine* and *Trifolium*, as well as, according to Abbot, *Dysodia chrysanthemoides*, one of the *Compositae*.

Abbot, who called this the clouded yellow butterfly, says it "continues to breed all the summer and autumn, is most common in the pine woods, and often settles, several together, to suck the moist places in roads and other places." He bred the butterfly May 2, after thirteen days in the chrysalis.

Edwards states that the eggs and young larvae were received by him from western Missouri August 2, caterpillars of all stages August 11, eggs and young caterpillars again on August 26 and October 8. Mr. Edwards found the duration of the egg in West Virginia about four days; of the successive larval stages from three to five days, the last a day longer, and the chrysalis from seven to ten days. The food plant in Missouri is stated by him to be *Amorpha fruticosa*, and in California, *A. californica*.

According to Rowley, the butterflies are found during every month from April to November, and show a seasonal dimorphism in the presence or absence of a rosy pink suffusion on the under surface in special areas. He writes thus to Mr. Edwards:—

"The females with red under the wings do not occur at all in the early summer broods. I took scores of butterflies this season in late April, all through May, June and July, and discovered not a streak on one of them. The first examples with red were taken in August. In September they were more numerous, while nearly every female of late October and November were either heavily streaked or solidly red below. I have yet to see a red under wing of earlier date than August. The feature is surely a seasonal one." (Can. ent., xx: 24.)

PYRISITIA BUTLER.

Pyrisitia Butl., Cist. ent., i: 35, 44 (1870). *Terias* pars Auctorum.

Imago. Head moderate, compact; front quadrate, protuberant below, but transversely flat; a mesial, transverse pit behind the antennae; vertex in no way tumid, but full posteriorly. Eyes tolerably large and full, naked. Antennae inserted in moderately deep pits, separated by the diameter of the basal joint, slender, fully as long as the abdomen, composed of twenty-nine or thirty joints, of which about nine form the slender, cylindrical, elongated, gradually incrassated club, which increases very gradually in size up to the antepenultimate joint, and then rapidly tapers to a bluntly rounded apex; the largest joint is about twice as broad as long, or as the stalk, the longer joints of the stalk about three times as long as broad. Palpi small, the clothing

very strongly compressed, the basal joint arcuate and pretty long, appressed to the head; the middle joint broad oval, not more than half as long again as broad; the third minute.

Fore wings rather long, with a strongly arched costal margin, a straight outer margin at right angles to the outer part of the costa and straight, long inner margin with rounded angle, the whole wing much more than half as long again as broad, the extremities of the costal and inner margins parallel. Costal nervure terminating a little beyond the cell, which is about half as long as the wing; subcostal nervure with three equidistant and not very distant superior branches, the second arising from the tip of the cell, the third forked. Hind wings rather long, rounded oval, with a broad, angular lobe at the extremity of the middle median nervure. No precostal nervure; vein closing the cell striking the last subcostal nervure a very little further from its origin than the last median from its base.

Legs very slender and delicate, not long. Fore femora in the male nearly half as long again as the hind femora, nearly twice as long as the fore tibiae, which are scarcely longer than the first joint of the tarsi, and only half as long as the whole tarsus. Hind tibiae half as long again as the fore tibiae, a little longer than the first tarsal joint, which equals the three succeeding joints, the fifth joint being as long as the third. Spines very fine and crowded. Claws exceedingly small and delicate, no longer than the width of the last joint, and slender, deeply cleft and strongly arcuate. Paronychial simple, forming a large, oval, pilose, inferior, lateral flap, as long as the claws, and nearly half as broad as long.

This American type of *Rhodoceri* is composed of a moderate number of species, whose home is in subtropical and tropical North America, occurring in South America only in the northernmost parts. Little or nothing is known of their history; the present species is the only one occurring in the United States.

PYRISITIA MEXICANA.

Terias mexicana Bois., Spec. gén. Léop., i: 655, pl. 19, fig. 1 (1836);—French, Butt. east. U. S., 137-138, fig. 34 (1886).

Abaeis mexicana Gey., Hüb., Zutr. exot.

Schm., v: 29-30, figs. 917, 918 (1837).

Terias boisduvaliana Feld., Reise Novara, 200 (1865).

Imago. Head covered with pink brown erect scales and hairs; palpi the same but with a greater or less number of pale yellow scales intermingled, especially at the base; antennae brown above, white beneath, at the sides annulate with white, the naked portion of the club ferruginous, the extreme tip dull luteous. Thorax covered above with bluish white hairs, below with yellow hairs; legs pale yellow, growing luteous toward the extremity.

Wings above white with a greenish tinge, heavily marked on the outer border with blackish brown. *Fore wings* having the costal edge marked with white at the tips of the subcostal nervules; the division between the light and dark portions of the wing is marked by a very irregular line, more irregular in the male than in the female; it starts from a little beyond the middle of the costal margin, runs in an oblique course to a little before the middle of the upper median nervule, then follows this nervule halfway or more than halfway to the margin, turns at nearly right angles, following the margin across the upper median and sometimes the lower median interspace, returns to its former distance from the margin by abruptly turning and following either the upper median (♂) or the lower median (♀) nervule, crosses the medio-submedian interspace transversely and then runs sharply outward, the base extending in a slender tongue a short (♀) or a great (♂) distance; extreme base of the inner margin flecked with brown, especially in the male. On the *hind wings* the outer bordering is distinct

and sharply defined in the male, generally indistinct, subobsolete or powdered in the female; in both it is narrow and is very irregular in its distribution, according to individuals, but in the males it is twice as broad in the lower subcostal as in the upper subcostal interspace; the upper third of the wing, limited by the lowest subcostal nervule, is tinged with orange yellow in the male, while in the female the whole wing is more or less tinged faintly with greenish yellow.

Beneath: *Fore wings* pallid, more or less tinged with yellow on the basal third, particularly in the female, and flecked with ferruginous at the apex especially next the margins; a minute, black or dark brown spot at the upper extremity of the cell. *Hind wings* pale yellow, more or less heavily but generally very lightly and delicately flecked with ferruginous in scattered dots or short transverse threads, which show a tendency to cluster into minute, regularly distributed spots along the basal half of the costal margin and in a straight, transverse streak which runs from close to the tip of the middle subcostal nervule to just within the extremity of the internal nervule, broken in the median interspaces; along the outer edge of this line the ferruginous dots and threads appear to cluster and to become more and more scattered as they outwardly depart from it; in addition to which there is usually a small ferruginous spot in the middle of the median interspaces; occasionally the whole wing is decidedly tinged with brownish ferruginous by the multiplicity of these markings, but the relative distribution still remains the same; there is also at the upper outer extremity of the cell a minute black spot. Expanse of wings, ♂, 33-44 mm.; ♀, 42-46 mm.

As becomes its name, Mexico is the proper home of this species, but it inhabits also a considerable territory in the southwestern United States, being found throughout most of Texas, Arizona and southern California, and east of it even extending occasionally northward not only into Kansas and Nebraska, but even into Iowa, Illinois and Wisconsin, and it has once been found in an extreme southwestern point in Ontario,—Point Pelee (Saunders).

Nothing whatever is known of its early history and no one has made any record of its seasons.

NATHALIS BOISDUVAL.

Nathalis Boisd., Spec. gén. Lép., i: 589 (1836).

Imago. Head moderately broad, especially above; front half as broad again as high, a little broader above than below, scarcely at all tumid, very uniform; vertex very broad posteriorly, somewhat tumid with a sharp and rather deep, transverse sulcation just behind the antennae. Eyes small, not full, naked. Antennae considerably shorter than the abdomen, widely separated, composed of about thirty-three joints, of which twelve or thirteen form the ovate flattened club which is a little more than twice as long as broad, is very broadly rounded apically, increases regularly on the basal half, and whose broadest joints are four times as broad as long or as the stalk, the longest joints of the stalk about three times as long as broad. Palpi long and very slender, the basal and middle joints of about equal length, the apical joint very short.

Fore wings long, nearly twice as long as broad, regular, the apex well rounded; costal margin gently arcuate to near the tip, one-fourth longer than the inner margin, the outer margin gently convex. Costal nervule longer than the cell; subcostal nervule with three equidistant and distant, superior, simple branches, the middle arising from the apex of the cell, which is about half as long as the wing. Hind wings elongate, well rounded, long in the subcostal region, half as long again as broad. No precostal vein; vein closing the cell striking the last subcostal and median nervules at equal distances from their base.

Legs very slender and delicate. Fore femora (males only examined) nearly a fourth longer than the hind femora, a little longer than the fore tibiae; the latter five-sevenths the length of the fore tarsi, or of the hind tibiae; first joint of fore tarsi as long as the next three together, the fifth as long as the third. Hind tibiae fully as long as the first two tarsal joints, the basal joint barely exceeding the next two together, all the tarsi covered with slender spines. Claws exceedingly delicate, elongated, deeply bifid, gently arcuate. Paronychial simple, formed of a single, slight, slender, triangular lobe not a third as long as the claw and appressed to it.

It is doubtful if this neat little genus of American Rhodoceridi, recognized more than fifty years ago, contains more than a single species or two. Yet it is found near the back bone of the continent from Missouri to Venezuela and is also found in at least the larger West India islands, though not known even in southernmost Florida. It is the smallest of Rhodoceridi.

Nothing is publicly known of the early stages, but Mr. Edwards has reared it (Can. ent., xx: 157).

NATHALIS IOLE.

Nathalis iole Boisdu., Spec. gén. Léop., i: 589-590 (1836);—Reak., Proc. ent. soc. Philad., vi: 134-135 (1866);—French, Butt. east. U. S., 116-117, fig. 31 (1886);—Cock., Can. ent., xx: 156-157 (1888).

Nathalis felicia Poey., Mem. hist. nat.

Cuba., 443-444, pl. 18, figs. 18-21 (1851).

Nathalis irene Fitch, Rep. ins. N. Y., iii: 167-168 (1859).

? *Nathalis luteolus* Reak., Proc. ent. soc. Philad., ii: 350-351 (1864).

Imago. Head covered with mingled yellow and black hairs and yellow scales. Palpi white excepting the apical half which is made up of mingled black and greenish yellow hairs and scales, with some intermingled white scales. Antennae testaceous, marked along the inner and especially on the under side, as well as at the apices of the joints interiorly, with silvery white; the club luteo-testaceous on the naked portion, blackish brown on the scaled, excepting where it is overlaid with white, as on nearly the whole of the under surface. Thorax covered with yellow and blackish brown hairs above, beneath with pale yellowish white hairs and yellowish scales; legs luteous, overlaid heavily on the femora and tibiae, very sparsely on the tarsi, with white scales; spines and claws luteous.

Wings above pale canary yellow with dark brown markings. On the *fore wings* the brown markings consist of a large apical spot which is bounded by a very oblique line which runs from a little beyond the middle of the costal border to the middle or scarcely below the middle of the outer border, there merging into the upper of the triangular spots which mark the tip of the lower median nervules; it is marked by a slight jog as it crosses the main subcostal nervure; in addition there is a small black spot in the middle of the outer half of the upper median interspace, and on the inner margin of the wing is a broad brown or blackish brown belt leaving only a yellow line between it and the margin, extending from the base almost to the outer extremity of the wing, and enlarged apically by merging in a large brown spot, occupying the middle half of the lower median interspace. *Hind wings* not unfrequently tinged with orange in the female and there more heavily marked than in the male; but in both there is a brown belt following the whole extent of the costo-subcostal interspace excepting its extreme apical portion where it abruptly terminates; and excepting, in the male, a basal yellow or orange elongated spot; the extremities of all the nervures in the upper half of the wing are also marked in brown, in the female occasionally connected along the margin with a faint indication of a transverse stripe in the middle of the outer half

of the wing, always more distinct in the upper than in the lower half of the wing and usually confined to the former; fringe of all the wings pale yellow, more or less mingled with brown next the brown parts of the wing.

Beneath: *fore wings* very pale greenish yellow with a slight and narrow (δ), or diffused and more distinct orange (φ) glow in the costal area; apex of the wing much flecked with brownish scales, especially in the female, where they sometimes form a spot almost as distinct as above; the markings of the inner margin of the upper surface are repeated beneath but often much obscured or made gray by a mingling of yellowish and brownish scales; but there is always in the outer half of the wing a distinct series of three roundish spots in the median and medio-submedian interspaces, that in the lowest median the largest. *Hind wings* with the same ground color as the fore wings (δ), or very much obscured by greenish brown so as to make the whole wing of a greenish gray color with a minute whitish spot at the divarication of the subcostal nervure and a pallid cloud in the outer third of the wing (φ). Expanse of wings, 22-30 mm.

This dainty little butterfly has a pretty wide distribution, chiefly in the southwestern United States and Mexico. Curiously it does not appear to occur in the United States anywhere east of Louisiana, although it is found in Cuba and Jamaica. It extends also throughout Mexico and into Central America, and in the United States from the Mississippi to the Pacific. How far north it occurs on the west coast I do not know, but both Mead and Reakirt report it from the Rocky Mountains of Colorado, at from 7500'-8000', and east of that it is found in Missouri and even in Illinois. I have seen it abundant about St. Louis.

It flies at the end of June and in July and doubtless at other times, but excepting that Cockerell took a specimen in southern Colorado on November 1, nothing further is anywhere reported regarding its seasons or history, and its early stages are quite unknown, though Mr. Edwards has followed them, and will doubtless soon publish the details.

TRIBE ANTHOCHARIDI.

SYNCHLOE HÜBNER.

Synchloe Hübn., Verz. bek. schmett., 94 (1816); Pieris pars Auctorum.
—Scudd., Proc. Amer. acad. sc., x:273 Anthocharis pars Auctorum.
(1875).

Imago. Head of moderate size, densely clothed with erect hairs. Front exceptionally protuberant and tumid, much broader than high, the middle projecting farther beyond the eyes than they in front of the antennal pits; above with a tolerably sharp and distinct longitudinal sulcation; behind the antennae a broad and very deep, transverse sulcation. Eyes not at all full, naked. Antennae much shorter than the abdomen, inserted tightly in deep pits, open outwardly, bringing the second joint to the level of the summit; separated by twice the diameter of the second joint; composed of about thirty-one joints, of which nine form an oval, flattened club, three times as long as broad, more than four times as broad as the stalk, increasing regularly in size on the basal half, broadly rounded and scarcely angulate at the tip, the broadest joints about four times as broad as long, the middle joints of the stalk about three times as

long as broad. Palpi very long and slender, projecting forward beyond the eye by the diameter of the latter, the terminal joint nearly equalling the basal in length, but not over a third as long as the middle joint.

Fore wings triangular, elongated, the apex produced; costal margin nearly straight, except at the extreme, roundly angulated tip, nearly a fourth longer than the inner margin; outer margin gently and pretty regularly convex. Third superior subcostal nervure doubly forked; cell scarcely more than half as long as the wing. Hind wings subquadrate in form, the costal margin distinctly, though broadly, angled before the tip of the rather short costal nervure, the part beyond subparallel to the inner margin.

Hind femora of male hardly more than two-thirds as long as the fore femora. Foretibiae half as long as fore femora; first joint of fore tarsi as long as tibia, or as the other subequal tarsal joints together. Hind tibiae nearly twice as long as hind femora, and scarcely shorter than first four tarsal joints; first tarsal joint scarcely longer than the next two together, the others subequal. All the spines very short and thin. Claws elongate, not very divaricate, equal and nearly straight on the basal half, beyond strongly curved, tapering, pointed and bifid. Paronychial forming a simple, tapering, bluntly pointed, pilose lobe, a little shorter than the claws.

Mature caterpillar. Body with the segments divided into six sections, of which the first is as large as the two succeeding. Besides the minute papillae bearing long, slender hairs everywhere scattered over the surface, there are a very considerable number of much larger, high, conical papillae, bearing stiff bristles, terminating in slender hairs, which are arranged rather more conspicuously in transverse series on the sections of the segments than in longitudinal rows, and they are found almost exclusively on the first, second and fourth sections; they are two or three times as numerous as in *Anthocharis*, and much less regular.

Chrysalis. Of the type of the tribe, but the front and hind halves of the body less bent than usual, though subequal, the dorsal surface being nearly straight from one extremity to the other, the ventral bent at a very broad angle. Frontal prominence slender, conical, pointed, as long as the wings.

Synchloe appears to be tolerably abundant in species, occurring in the north temperate regions of both hemispheres; in the Old World from ocean to ocean, in the New, as often happens in such cases, only in the western half of the continent. The characteristics of the group are very similar to those of other *Anthocharidi*, they being early spring butterflies, appearing but once a year upon the wing, but they seem never to have the tip of the fore wings adorned with an orange patch.

SYNCHLOE OLYMPIA.

Anthocharis olympia Edw., Trans. Am. ent. soc., iii: 266-267 (1871); Butt. N. A., ii: *Anthocharis* 1, figs. 1-4 (1874); — Streck., Lep. rhop. let., 64-65, pl. 8, figs. 9, 9 (1874); —

French, Butt. east. U. S., 117-118 (1886).

Zegris olympia Kirb., Syn. cat. diurn. Lep., 806 (1877).

Imago. Head loosely tufted with very long white hairs mingled with many black ones and with pale lemon yellow hairs and scales behind the eyes; palpi white, with a few black hairs intermingled in the fringe; antennae very pale luteous, rather lightly scaled with white externally, excepting the naked tip of the club, which is pale luteous, like the under surface, and excepting also a few scattered brown scales on the club and the parts of the stalk adjoining.

Wings above chalky white. *Fore wings* with an arcuate, transverse, blackish brown bar at the extremity of the cell, its convexity outward, with the apex half way to the extremity of the cell, bounded interiorly by a slightly arcuate line at right angles to

the costal margin, heavily flecked with black brown scales, which are more profuse next the interior limit of the patch at the costal and outer margins, and least heavy in a roundish patch, larger and clearer in the female than in the male, situated on the costal margin just without the darker interior edge; in addition the nervules in this portion of the wing are generally more heavily flecked with brown, and there is sometimes a slender white line down the middle of the interspaces; the costal margin as far as the tip of the cell irrorate with blackish brown, and the extreme base of the wing, especially beneath, heavily flecked with inky black scales. *Hind wings* with almost no markings except such as are due to their diaphanous nature; there are, however, three small black spots at the tips of the costal and two upper subcostal nervules, the first mentioned the largest, sometimes obsolete, and perhaps more distinct in the female than in the male.

Beneath: of the same white as above. *Fore wings* with the outer limit of the cell marked with a few blackish brown scales forming a dusky bar; midway between it and the apex of the cell a narrow, blackish brown bar descends to the main subcostal nervure, pretty heavily flecked, especially below, with greenish yellow scales; the costal margin above the cell is irrorate with black as above, but more distinctly, and there is found a faint wash of greenish yellow scales at the extremity of the last median nervule, following the nervule back for the width of an interspace. *Hind wings* exquisitely marked with greenish yellow, mingled with blackish fuliginous scales in very irregular, rather narrow, vermiculate stripes, in which the dark scales are usually not found at the extreme margins, which thus appear to be washed at their edges with yellow, the effect of the whole being a light greenish gray; these markings may be said to consist mainly of four separate parts: a narrow, transverse basal stripe, more regular than the rest, nearly equal throughout, running from the costal margin midway between the base and tip of the costal nervure in a straight course to the cell, transverse to the nervure, and then curving around toward the base of the wing; a second much more irregular stripe crossing the middle of the wing, starting from the costal margin at the tip of the costal nervure, and running in a nearly direct course, curved inward a little at the extremity, to the middle of the inner margin, crossing the extremity of the cell; it generally encloses a small, partly open white spot on the interior side in the first subcostal and on the outer side in the second subcostal interspace, and another one on the outer side at the extremity of the cell; it also sends a shoot at right angles to its course toward, but only half way to, the base of the inner margin at the median nervure; this shoot is as broad as the belt itself, and terminates abruptly with a little horn thrust toward the inner margin; the third is a large, semi-lunate, strongly arcuate spot, resting by its two horns and a large depending middle tooth upon the outer border at the two lowest subcostal and the last median nervules, and connected with the preceding by a gently sinuous stripe which follows the outer limit of the median nervure; near the tip of the costal margin, midway between this outer patch and the mesial belt, is the last portion of the marking, a rather narrow, slender bar depending from the margin, running as far as the middle subcostal nervule, where it nearly meets a slender horn projecting from the middle stripe; the entire under surface of the hind wings, and especially of the basal half, is very sparsely clothed with tolerably long, erect, white hairs. Expanse of wings, ♂, 40 mm.; ♀, 43 mm.

This butterfly is found in the states tributary to the Mississippi—Texas, Missouri, Kansas and Nebraska on the west, Indiana and Illinois (Bureau Co.) on the east, as well as West Virginia on the Kanawha River. It has only been taken at distant intervals, but doubtless extends over a wide extent of country between the Alleghanies and the Great Plains, south of about 40° N. Lat.

Like the allied species of *Anthocharis*, it flies early in the spring, appearing in West Virginia in April, but of its early stages or further history we

know nothing. Comparing it with another species of the genus, *ausonides*, Edwards says it is more delicate and less strong of wing, "and of a low, uncertain and tremulous flight. In West Virginia it accompanies gentiana, and might easily be mistaken for the female of that species, frequenting, with it, cultivated grounds, gardens and meadows."

SUBFAMILY PAPILIONINAE.

EUPHOEADES HÜBNER.

EUPHOEADES PALAMEDES.

Papilio palamedes Drury, Ill. nat. hist., i: pl. 19, figs. 1, 2 (1773);—Cram., Pap. exot., i: 146, pl. 93, figs. A, B (1779);—Edw., Can. ent., xiii: 119-123 (1881);—French, Butt. east. U. S., 94-97 (1886).

Papilio chalcas Fabr., Syst. ent., 453-454 (1775).

Euphœades chalcas Hübn., Verz. bek.

schmett., 83 (1816).

Princeps heroicus chalcas Hübn., Samml. exot. schmett., i (1806-24).

Papilio calchas Boisd.-LeC., Lép. Amér. sept., 17-19, pl. 5 (1829-30);—Boisd., Spec. gén. Lép., i: 337-338 (1836).

Papilio flavo-maculatus Goeze, Ent. beytr., iii: 87 (1779).

Imago. Head and body blackish brown, marked with a moderately broad, pale yellow stripe which runs from the tip of the patagia forward in a straight line to the inner edge of the eye, which it encircles, includes the palpi, and runs down the breast to the base of the fore legs; a similar yellow stripe follows down the middle and hind coxae, and the abdomen is marked with a broad, mid-lateral, yellow band which terminates on the clasp and occupies the middle of them; besides which there is a similar lateroventral band on the terminal two-thirds of the abdomen, fading out anteriorly to a thin line which runs angularly upward to the base of the hind coxae; antennae reddish chocolate, paler above than below, but the club infuscated, especially above.

Wings above blackish brown with a chocolate tinge, with a premarginal series of roundish, pale yellow spots and an extra-mesial series of large yellow spots, independent and generally triangular on the fore wings, more or less quadrangular and confluent on the hind wings. On the *fore wings* the spots of the submarginal series are tolerably uniform in size, round, and about one-half an interspace in diameter, their outer limits at an interspace's distance from the outer margin; though sometimes almost perfectly straight, the series is always sinuous to a slight degree, the spots in the two lower median interspaces being removed a little outward; the extra-mesial row of spots in the same interspaces is more irregular, those in the subcostal interspaces being as far removed from the submarginal spots as they from the margin, and are short, triangular or the uppermost quadrangular, elongate; the spots in the next four interspaces seem to run in a line slightly oblique to the general course of the series, the uppermost one being removed inward slightly, and the outermost outward; these are always larger, triangular, the apices inward, with the exception of that in the subcosto-median interspace, which, at least in the males, is frequently as broad or nearly as broad interiorly as exteriorly; the spot in the medio-submedian interspace is sublunulate, sometimes much broader than long, while that in the interspace below is subtriangular and elongate, its apex outward; there is besides, particularly in the males, rarely or but faintly in the females, a transverse bar in the cell, traversing the middle of its apical third, reaching neither limit, but more in the upper than in the

lower part of the cell; in the slender, subcostal interspaces between this spot and the outer upper spot of the extra-mesial series there are slender streaks of yellow followed in the penultimate, superior, subcostal interspace by a large, triangular, yellow spot, midway between the base of the interspace and the spot beyond; the general tone of the ground in the outer half of the wing is slightly darker than in the basal half; there are a few greenish yellow scales flecking the costo-subcostal interspace faintly above the apical half or more of the cell. *Hind wings*: the ground of the outer half of the wing is black, in more marked contrast with that of the base than on the fore wings; the submarginal series of spots consists of transverse, lunulate bars crossing almost the entire interspace, subparallel to the outer margin of the same interspace with the exception of that in the costo-subcostal interspace which is rather subparallel to the other spots; the spots of the extra-mesial band are completely confluent into a band, barely, if at all, interrupted by the nervures; it is moderately slender with regular, arcuate, interior margin, somewhat powdery, especially in the middle of its course, usually broader in the male than in the female, and somewhat irregular in its direction, its interior border in some cases crossing the wing at the apex of the cell, at other times beyond it by the entire width of an interspace (which is ordinarily the course in the female), and at others, at least in some males, including the tip of the cell in the band, in which case the outer limits of the cell are marked in black; the exterior margin of this belt is clearly marked in the upper part of the wing, passing in a series of strong arcuations as far as the middle of the wing; below which the limit of the band is more regular but obscured by a heavy powdery of greenish yellow scales which cover the greater portion of the median interspaces beyond the band, including by their absence obscure, black spots in the middle of the interspaces, directly following the band and which are seated upon vague, powdery spots of blue scales, extending as a faint band of lunules across the entire wing, generally snobsobolete and found only in the female; the anal angle is occupied by a large, black spot which is in continuation of the black spots of the preceding interspaces, including within it a large, blue, powdery lunule, followed behind in both sexes, and in front always in the female, sometimes in the male, by orange, which on the inner side infringes upon the yellow extra-mesial band; at the extremity of all the interspaces the dark fringe is interrupted by yellow which extends as a distinct lunule upon the ground of the wing itself.

Beneath, with the ground color a little paler than above; the *fore wings* with the same markings as above, slightly enlarged and with the transverse bar at the end of the cell distinct in both sexes; in addition there is a vague, powdery, straight, oblique stripe crossing the base of the wing and especially of the cell, which is in continuation, when the wings are spread, of a more distinct stripe which will be described upon the hind wings; this is always more distinct in the male than in the female, and is occasionally wholly absent from the latter. *Hind wings* with the basal half uniform, excepting for a deepening at the extreme base of the wing and for a yellow edging to the basal lobe previous to the tip of the precostal and a straight, or slightly arcuate, narrow yellow streak, broader above than below, which runs from the costal margin where it is sometimes paler, nearly to the middle of the first median nervule, following down this latter along its inner edge; the outer half of the wing is much variegated, the marginal lunules in the interspace are more distinct than above and are almost white; the submarginal series of lunules are also more highly developed but are pale orange with white ends, and that which occurs in the medio-submedian interspace is united with the marginal marking, showing its compound nature by the deep indentation of its inner side; the mesial band has become a series of closely adjoining, but distinct white lunules, heavily marked with orange, so as in many cases, especially in the female, to be more orange than white, but always white along the inner margin and here invariably removed farther toward the apex of the wing, never including the cell, although occasionally touching it in the male; they are margined externally with round, deep, black spots, including in each interspace a powdery spot which leaves only a lunulate black edging to the extra-mesial band; the powdery spot is more dense toward the

base of the wing, and is here caerulean blue, while beyond this the scales are more sparse, are greenish yellow and sometimes fill the larger part of the interspace nearly to the submarginal markings. Expanse of wings ♂, 100-109 mm.; ♀, 112-116 mm.

The following descriptions of the early stages are those given by Edwards with only such changes in phraseology as seem necessary.

Egg. Spherical, a little flattened at base; color greenish yellow.

Caterpillar. *First stage.* Head obovoid, a little depressed at top, smooth, shining, color yellow-brown, a shade darker than body. Body at the end of this stage cylindrical, greatly thickened from the second thoracic to second abdominal segments; beyond tapering to the eighth abdominal segment, then thickening to end, the back and sides after second abdominal a little incurved; the first abdominal segment has a thin square ridge and on each curve of same a thick fleshy process, longer than others on body, thickly beset with straight hairs; there are two rows of similar processes, supralateral, smallest on the narrow segments, colored as the segments they stand on, those on the eighth and ninth abdominal segments considerably larger than any others except on the first thoracic segment; besides the supralateral rows, are two subdorsal running the whole length of body, and one row on side, another along base; all these are small, simple tuberculations with hair on end; color of body brown-yellow marked with white; a white band, not very clearly defined, especially on its lower edge, passes along the side of the second thoracic to the fourth abdominal, turning up on the fourth abdominal to edge of dorsum, the two extremities there not quite meeting; the eighth and ninth abdominal segments are white; under side greenish brown; all the legs same. Length, 2.5 mm.; near the end of the stage, 7 mm.

Second stage. Head subcordate, finely granulated, shining yellow-brown, with fine hairs. Body with same general shape, at first the dorsum on the thickened segments is smooth and rounded, but after a few hours becomes flattened a little, and corrugated; the first thoracic segment has a thin, high, square topped ridge, the corners produced, and each bears a short thick process, pilose; on the eighth abdominal segment are two short subconical processes, on the next two like them but larger, and these four form part of the two supralateral rows, which are almost suppressed on the second to sixth abdominal segments but are distinct on the seventh, the two subdorsal rows of tubercles are minute; color of body yellow brown, darkest on posterior half, the anterior segments a little red-tinted; the white lateral band as before, but distinct, white; the dorsum and upper part of the side of the eighth and ninth abdominal segments and a little of the seventh pure white, the lower part of the side less pure, the shield sordid white; over the white band, on the third thoracic segment is a large, sub-oval, black ocellus in a narrow yellow ring; this ocellus is mostly occupied by a prominent, rounded, black process with many short black hairs on it. Length, 8.4 mm.

Third stage. Head as before, and it and the first thoracic segment are one color, honey yellow. Body of same shape, and as before, the dorsal area on thickened segments becomes corrugated and flattened and depressed some hours after the moult, and the depression is enclosed by an elevated oval rim; the second thoracic segment is a little excavated on dorsum on anterior part; the first thoracic segment is a square topped ridge, but the processes have passed away; on the eighth and ninth abdominal segments the processes as at previous stage, but the rest of the laterodorsal rows have disappeared, and in place of part of them are slight, rounded elevations, like those of the subdorsal rows; so that on the second thoracic segment there are two subdorsal and two laterodorsal rows of these knobs, but two subdorsal only on the last thoracic and first two abdominal segments, on the fifth and sixth abdominal segments are two subdorsal, little, round, lilaceous spots; color yellow brown to dark brown, the anterior parts having most yellow; the sides of the posterior segments of a black hue; the white side stripes as before; eighth and ninth abdominal segments white, the shield greenish brown above, but white below, and the anal claspers white; the white extends into the sides of the seventh segment, but the brown dorsal area runs back in a sharp point nearly to the eighth; on the last thoracic segment the eye-spot is large, flattened in front and there velvet-black, but behind this is a prominent, black, vitreous, bead-like elevation, smooth

and without hairs; instead of a complete and uniform ring there is a thickening of the yellow above and below the eye-spot, and the ends are narrowed, so that the appearance is much like that of eye-lids. Length, 9 mm. One larva differed from all the rest, being uniform light, yellow brown, the white area on the seventh and eighth abdominal segments yellowish.

Fourth stage. Head as before, but greenish yellow. Body with same shape and general color, the anterior segments a little darker, and their surfaces finely and thickly, but indistinctly, dotted green; the middle segments lighter colored and distinctly dotted green; the side bands salmon color, the last segments a redder salmon; ninth abdominal segment white above base at extremity; along base of body, with and a little above the spiracles, a white, macular band; on dorsum of ninth abdominal segment two small, conical, white processes (none on the preceding); on dorsum of first abdominal segment are two abbreviated bars of red lilac, one on each side, in the latero-dorsal row, and on the second to sixth abdominal segments is a small, rounded, lilac spot on each in same row; on the side of the fourth to sixth, one similar spot to each; on second thoracic to second abdominal segments low, rounded knobs as at previous stage; below the basal ridge is a small, indistinct, blue-lilac spot on each segment from the second to seventh abdominal segments; the ocellus as at previous stage, the buff ring now open at anterior side. Length, 20 mm.

Towards the last of this stage the brown area has a green tinge, and the green dots become quite distinct and the side bands are greenish; the circlet of the eye-spot changes to red-buff. Later the top of the anterior segments became olive green, the dorsum after the first abdominal segment light green, edged down the sides by dark green; the side band pale green, as are the last segments; under side pale, greenish brown; the lilac spots unchanged; the spots below spiracles blue.

Last stage. Head subovoid, bilobed, granulated, with a dull gloss; color olive green. Body cylindrical, the second thoracic to first abdominal segments much thickened, arched dorsally, then tapering to last; color dull, velvety green, on second and third thoracic and first, eighth and ninth abdominal segments nearly solid, but a little speckled with lighter green; the other segments light and dark green in fine markings; the basal ridge whitish green; under this is a fine black line from the second thoracic to eighth abdominal segments, and on the second to seventh abdominal is a subtriangular blue spot in black, edging on each segment just below the line; the first thoracic segment has a narrow, yellow ridge in front, nearly flat on top, the curves rounded; on anterior side of this and next it is a black, subdorsal dash on either side; behind the ridge is a black, rough, or shagreened narrow band; the scent-organs light, yellow-brown; on the side of the last thoracic segment is a black ocellus, upon which rises a rounded, vitreous, black process, the circlet orange red, having a black stripe within its anterior edge, and a blue spot on its upper outer side; on the first to seventh abdominal segments are four rows of small, blue-lilac spots, each in fine black ring, two of the rows being laterodorsal, two lateral; on the eighth abdominal segment only the two laterodorsal rows are present, on the ninth neither; on the dorsum of the first abdominal segment at posterior edge is a buff spot just outside the lilac spot and touching it. Under side deep ochre buff; feet and legs greenish brown. Length, 40 mm.

Gradually the larva changes, the specks disappear on the anterior and also on the last segment, so that the extremities are solid green; on the middle segments the specks and marks become less distinct; the ridge at base becomes yellow, the whole under side port wine color; all the lilac spots change to bluish, the two spots on the first abdominal segment to brown-buff.

Finally, before suspension, the whole surface becomes dull, ochrey yellow, the red of lower side becomes dull and yellowish, or dull salmon, the lilac spots on back change to pale black, but the spots below the basal ridge retain their blue color, but are dull.

Chrysalis. The ventral side highly arched, the dorsum much incurved, the former narrow at summit, particularly on the thoracic segments, rounded, the sides sloping; the dorsum rounded, the sides somewhat flattened to the lateral ridge, which is prominent, carinated, and extends from end to end; head-case long, flattened transversely

and about equally on the two sides, narrowest at base and widening gradually to the tips of the ocellar prominences; these are long, subpyramidal, divergent, the space between excavated roundly; mesonotum low, the sides very little convex, on the top a very small, pyramidal elevation; surface all finely granulated; color variable; one phase shows the whole dorsal side a delicate green, with a darker green medio-dorsal stripe from mesonotum to last segment; below mesonotum two subdorsal low red tubercles, one on either side; on either side of the abdominal segments two rows of dull lilac points, forming a cross row of four to each segment; whole ventral side one shade of green, a little darker than dorsum and less yellow; the lateral ridge cream color more or less marked by a red line, which broadens on the process of head; on the ventral side below the head two red dots near the middle line; a series of white dots along the margins of wing cases; below the ridge, on last segments, are traces of blue spots. Length, 35.5 mm.; breadth, 9.6 mm.

Another resembles the above described, except that there is a yellow shade over the dorsal elevation and the medio-dorsal stripe is red. Others are quite unlike these; the head case and mesonotum are yellow brown, and the rest of the dorsal side is yellow-brown with a pink tint; the stripe and the ridge brown; the dorsal spots blue, and dull blue spots below the ridge; whole under side light yellow-brown.

This fine butterfly seems to be confined to the southern half of the United States, east of the Mississippi, not extending into Texas nor reaching northward beyond Virginia so far as known. Cadet, Missouri, is the westernmost point from which I have heard of it. It appears to be peculiarly a butterfly of the southern Atlantic coast, where it is very common.

There would seem to be some doubt about the food plant of the caterpillar. Edwards quotes Dr. Wittfeld as obtaining the eggs and feeding the larvae on red bay, *Persea carolinensis*, a plant which Edwards could not obtain, but he reared them readily on *Sassafras*, a very closely allied genus of plants. Dr. Wittfeld, however, writes me that the food plant is *Magnolia glauca*, which he calls "red bay" (more properly "sweet bay") and Abbot long ago figured the larva upon *Magnolia glauca*. Possibly both of these plants are fed upon by it, but plainly Lauraceae form a part of its dietary.

In Florida there must be at least three broods annually, and the winter is passed by part in the chrysalis, by part in the imago state; for Dr. Wittfeld had the butterflies escape from wintering chrysalids early in February; obtained eggs, which must have come from at least a second brood, on June 6; these gave the butterflies at the end of July; other eggs obtained in the middle of August gave caterpillars which went into chrysalis for the winter in September; some September chrysalids gave the imago the same year, some early in the next. The egg period is five days in June; the caterpillars require about a month to mature and the chrysalis state lasts fifteen or sixteen days in July. Edwards found the egg-period four or five days in West Virginia and the successive larval stages four, two, three, four and nine days.

The eggs are usually laid on the upper side of tender leaves. The caterpillar lives *exposed* on the upper side of leaves, according to Dr. Wittfeld. Edwards says "they are sluggish, like the larvae of *troilus*, and in

general behave in same way, at all stages resting on a lining of silk, which they had spun on middle of the leaf, whereby the leaf is curled or drawn together so as to afford a concealment." But in New England, the caterpillar of troilus is *completely* concealed, the edges of the portion of the leaf used for shelter being tightly closed. "This," he continues, "they rarely leave, and then only when hungry, feeding on the end of the leaf until it becomes too small for a hiding place, after which they betake themselves to another leaf. But these larvae do not cut into the side of the leaf and fold down the cut portion as troilus [sometimes] does. This Dr. Wittfeld states in reply to my enquiries."

Dr. Wittfeld further says of the habits of the imago, as quoted by Edwards:—"Palamedes roosts on the highest tree it can find, oak or palmetto. I have seen four to six near sundown fluttering about the tree, where they finally settled and remained. Sometimes three or four so roost on one large palmetto leaf." And he adds in notes sent me "with spread wings," which appears very remarkable.

The insect is attacked by *Pteromalus vanessae* (89:3) which Dr. Riley reared in April from chrysalids sent by Mr. Barlow of Missouri.

PAPILIO LINNÉ.

PAPILIO BREVICAUDA.

Papilio brevicauda Saund., Pack. Guide ins., 245-246 (1868);—Edw., Can. ent., v:53-54 (1873); Butt. N. A., ii, Papilio viii (1875); viii B (1880); —Couper, Can. ent., vi:33-36 —(1874); Grub., Jen. zeitschr. naturw., xvii: 468-469 (1884); Pap., iv:85-86 (1884).

Papilio anticostiensis Streck., Lep. rhop. het., 10-12, pl. 2, figs. 2, 2 (1873); 49 (1873); 68.

pl. 8, fig. 13 (1874).

Papilio asterius var. *a. brevicauda* Streck., Cat. Amer. Macrolep., 71 (1878).

Papilio asterius var. *b. anticostiensis* Streck., Cat. Amer. Macrolep., 72 (1878).

Papilio polyxenes var. *brevicauda* Coup., Can. ent., iv:202 (1872).

Imago. Head and appendages as in polyxenes. Wings with the same colors as in that species. *Fore wings* rich black brown with precisely similar markings in the male and female, viz., a submarginal series of round yellow spots tending to become sublunulate on the lower half of the wing, double in the medio-submedian interspace, found in all the interspaces, at the centre at an interspace's distance from the border; an extra-mesial series of roundish triangular, large, sublunulate spots, their common exterior limit nearly straight, subparallel to the outer margin and removed from it by about two and a half interspaces in the middle of the wing; the inner extremity of all of them is powdery, the outer limit clearly defined; those in the medio-submedian and submedio-marginal interspaces are nearly quadrangular; above this they decrease regularly in size to the spot in the subcosto-median interspace, above which they increase again in the same degree, the spot occupying the extreme base of the outermost subcostal interspace interrupted by a large, long oval, blackish brown spot which occupies all or nearly all its entire width in the basal three-fifths of the spot, usually breaking it into two entirely distinct portions; in addition there is a large round spot, generally larger than any of the submarginal spots, surmounting the last divarication of the subcostal nervure, and a transverse bar of yellow marks the extremity of the cell. On the *hind wings* the markings are again precisely identical in the two sexes; the same two

series of spots that are found upon the fore wings are here repeated; the extra-mesial series as a narrow and nearly equal belt interrupted only by black nervures, bent beyond the cell, running from the costal margin, its interior limit at the middle of the margin, in a direction straight toward the anal angle, a direction which is bent beyond the cell so as to run to the inner margin, its outer limit removed from the anal angle by the width of an interspace; this belt is externally sharply defined, but interiorly is powdery; the outer limit is again lunulate and the spots in general are longer than broad, especially in the middle of the wing, and from the character of the interspace more or less cuneiform; the outer point of the cell is marked by a slight powdery patch of yellow scales; the outer series of yellow spots consists of widely separated, distinctly lunulate, clearly defined spots, their outer limits removed from the margin by the width of half an interspace; they are yellow, but occasionally show a slight tendency, especially in that in the costo-subcostal interspace, to be suffused with orange; that in the lowest median interspace becomes altered to a transverse, long oval stripe; at the anal angle is a large ocellus, composed of a large, central, black spot, seated on the margin surrounded by a broad annulus, yellow below and orange above: between these two rows of spots the interspaces are more or less heavily flecked with bright blue scales which, above the ocellus at the anal angle, form a distinct semi-annulate lunule; the fringe black brown interrupted in the interspaces opposite the spots with yellow.

Beneath: with the same colors as in *polyxenes*, and the markings of the upper surface mainly repeated, the males and females again not differing; all the yellow spots, however, especially upon the hind wings, but with the exception generally of the other spots of the fore wings, more or less heavily bathed in orange, especially mesially, the orange being frequently surrounded to a greater or less extent with yellow, which is here less brilliant than above. Between the two rows of spots of the hind wings the black ground is sprinkled sparsely and with tolerable uniformity with pale greenish yellow scales which are supplanted by lunules or sagittate spots of bright blue scales, more densely clustered a little beyond the outer margins of the extra-mesial spots and enclosing between them and the spots the black ground in the shape of slender equal bars of a deeper black than most of the ground; ocellus much as above. Expanse of wings, ♂, 74 mm.; ♀, 80-88 mm.

This interesting butterfly differs from *P. polyxenes*, to which it is most closely allied, in that both sexes are alike, corresponding to the colors and pattern of the male of *polyxenes*; but in addition the spots of the mesial band on the fore wings are more or less orange, and on the hind wings below are orange, broadly capped and margined with yellow; while the tails of the hind wings are only about one-third as long as in *polyxenes*, and the outer margin of the fore wings is distinctly convex.

The following descriptions of the early stages are those of Mr. Edwards, slightly modified in form:

Egg. Spherical, flattened at base; pale yellow.

Caterpillar. *First stage.* Head black, pilose. Body cylindrical, the anterior segments thickest, and a little arched; color pale black; a white patch on dorsum, on fourth and part of third abdominal segment; the spines are in six rows, one subdorsal and two on either side; these are black and rise from pale yellow tubercles; each sending out a few black hairs. Length, 2.5 mm.

Second stage. Head black, shining; with a white spot in front and one on either side. Body black-brown, the patch white and extending well down either side; the spines as before, their bases pale yellow. Length, 6.4 mm.

Third stage. Head as at previous stage. Body black, the patch as before; white marks over the feet; the bases of the spines chrome-yellow. Length, 10 mm.

Fourth stage. Head as before. Body black, with narrow, white stripes at the junctions of the segments; white also on the sides of third and fourth abdominal segments, but not on dorsum; white points on the last segment and over feet; the yellow at bases of spines is brighter. Length, 20.3 mm.

Last stage. Head obovate, either yellow green or pale green, marked in front by two

oblique, black stripes, which nearly meet at top; two others on the sides, and between the front and side stripes at base is a short, narrow stripe; on lower front face a rounded, black spot; the retractile horns bright yellow. Body cylindrical, slender, thickest at last two thoracic segments, tapering slightly from last thoracic to last abdominal segments, and rapidly toward the head; the surface smooth, the tubercles of previous stages being suppressed, except those of the two dorsal rows which are reduced and scarcely elevated, and under the glass are seen to have a pencil of very short hairs each; when at rest the anterior segments are contracted and arched; the middle of each, from the first thoracic to the eighth abdominal, crossed by a black stripe or narrow band, broken on the middle of side after the first abdominal segment; from the last thoracic segment, divided a second time near its extremity, a triangular section being cut off on the posterior side; on the ninth abdominal segment the band is divided into three spots, the central or dorsal one being rounded; behind these are two subdorsal, round spots, and on either side a long, oblique mark; the anal shield black; there is also a black stripe between each pair of segments, broadest on dorsum and diminishing to the middle of the side where it disappears; these are scarcely visible, except when the larva is in motion; there is also a line of small, black spots along base of body, one on each segment from the first thoracic to the second abdominal, and on the seventh to ninth abdominal, two on the third to sixth abdominal, and there is a spot over each leg and proleg; on each side are three rows of chrome-yellow spots, those of the two subdorsal rows being round and placed just within the tubercles, and on the front edges of the bands; so the spots of the other rows on the second and third thoracic and first abdominal segments are on the fronts of the bands; but after this they divide them, the middle row being round, the lower row straight and oblique, filling the space between the band and triangle; legs tipped black; color of body bright pea-green, changing to yellow green on the sides; or a creamy white, tinted dorsally with delicate green, fading into white on the sides. Length, 38 mm.

Another larva at maturity was black, with white lines between the segments, and pale green between some of them, especially the anterior ones and the last two; much white along base of body.

Chrysalis. Cylindrical, thickest in middle; the surface rough, corrugated; head case produced, ending in two subtriangular processes, the space between them concave; mesonotum prominent, pointed forward, subpyramidal; color green, on dorsum yellowish, on ventral side pale; the wing cases dark; on abdomen two subdorsal rows of small, rounded tubercles. Length, 25.4 mm.; greatest breadth, 7.6 mm.

This butterfly has a narrow and peculiar range, which shows it to have been an offshoot from the ancestors of *P. polyxenes* at no very distant epoch. It is known only from Newfoundland and the shores and islands of the Gulf of St. Lawrence, both north and south, as at Godbout and Percé.

It is single brooded and winters in the chrysalis. The butterfly flies in June and the first half of July, and is most abundant in the latter half of June; eggs have been obtained from June 14 for a month, but their period has not been stated; the caterpillars grow rapidly for so high a latitude, and begin to go into chrysalis toward the end of the first week in August; carried south some chrysalids gave out the butterfly the same year, one in eighteen days.

The eggs, according to Couper, are laid singly on the upper surface of a leaf, near the edge. The caterpillars feed on *Archangelica gmelini*, *Heracleum lanatum*, parsley, *Apium petroselinum*, and doubtless other Umbelliferae; when young they feed on the upper cuticle, and on cold

nights hide in the leaves; they are very susceptible to cold, prolonged darkness or confinement of any kind; when not feeding "they either rest upon the leaves in full sunlight, or bask upon the stones and coarse gravel among which their food plants grow. These stones are often heated by the sun during the day to a temperature of 90° to 100° F., and retain a part of the warmth over night." (Mead.)

HESPERIDAE.

TRIBE HESPERIDI.

RHABDOIDES* gen. nov.

Imago. Head large, compact, sessile, the front mesially and strongly tumid, much surpassing the front of the eyes, the lower edge marginate; vertex depressed, nearly flat. Eyes very large, very full, circular, naked. Palpi short and rather small, the basal joint tumid, larger apically than at base, produced apically on the outer side, no longer than broad; middle joint sub-cylindrical, rounded at each end, less than four times as long as broad; apical joint minute, ovate or subconic, not so long as the width of the middle joint. Antennae separated at base by three times the width of the basal joint, exclusive of the crook a fourth longer than the abdomen, composed of about forty-eight joints of which about twenty-eight form the very gradually incrassated, cylindrical or elongate, fusiform club, which is nearly as long as the stalk and bent rather beyond the middle, the crook tapering gradually to a delicate pointed tip; in the middle of the stalk the joints are about three times as long as broad; on the broadest part of the club about twice as broad as long.

Fore wings shaped as in *Achalarus*, with which also the neuration essentially agrees. Internal nervure delicate but distinct, short, distant from the submedian nervure and running into it. Hind wings rounded triangular, considerably longer than broad, especially in the male where the submedian area is produced, so that the outer margin is more rounded in the female than in the male; in both it is gently crenulate between the nervures; neuration as in *Achalarus* but with the subcostal and second median fork almost equally distant from the base.

Fore femora slightly longer than hind femora, nearly twice as long as fore tibiae, and almost as long as fore tarsi; first fore tarsal joint fully as long as the rest of the tarsus. Hind femur three-fourths the length of the hind tibia and half as long as tarsi; first joint of tarsus equalling the remaining joints together, the fifth equal to the fourth, all clothed beneath with three rows of slender spines, the apical ones of each joint larger than the others. Claws very small and delicate, bent in the middle and finely pointed. Paronychiae well developed, the upper lobe claw-like and as long as the claw, tapering but little, the other as long, forming a broad inferior flap.

The illustrations of the early stages by Abbot do not permit one to mention any generic features, excepting that the chrysalis is exceptionally slender and tapering for one of this group of *Hesperidi*.

This is a small group composed of a few species only, found exclusively in America and especially in the tropics; how far it ranges I am unable to say, but in the United States the only species known is that here described, whose early stages were figured long ago by Boisduval and LeConte from Abbot's drawings, and which give us all that is known of them.

**ράβδος*, a stripe.

RHABDOIDES CELLUS.

Eudamus cellus Boisd.-LeC., Lép. Amér. sept., pl. 73 (1833);—French, Butt. east. U. S., 371-372 (1886).

Spathilepia cellus Butl., Ent. monthl. mag., vii: 57 (1870).

Cecrops festus Gey., Hübn., Zütr. exot. schmett., v: 27, figs. 907, 908 (1837).

Figured also by Glover, Ill. N. A. Lep., pl. B, fig. 25; pl. F, fig. 13. ined.

Imago. Head covered above with mingled dull tawny and black-brown hairs; the palpi showing the former in preponderance upon the under side, becoming pallid on the basal joint beneath; antennae black-brown above, clay brown externally beneath, the naked crook fusco-castaneous.

Wings above black-brown with a chocolate tinge, the fringe mostly of the same, but interrupted, especially upon the upper half of the hind wing, with sordid white. Fore wings with a broad, mesial, transverse, pseudo-vitreous belt of amber, with a golden reflection, extending from the costal edge just before the middle, toward but not quite to the inner angle, stopping short at the submedian nervure; its interior border is nearly straight, its exterior less regular, showing a broad, arcuate excision above the middle median nervule, at which it broadens suddenly and is then convex to its bluntly rounded termination; midway between this belt and the apex of the wing is a small, silvery white, vitreous, straight bar depending from the costal margin, broken by the nervure into three subequal spots and generally followed at its outer lower corner by a contiguous minute spot.

Beneath, all the wings brown, with ferruginous and castaneous clouds, the *fore wings* marked as above, only that the broad band is white above the subcostal nervure, and has an indistinct, powdery limit at its lower extremity, where it reaches almost or quite to the inner margin; apex of the wing clouded with ferruginous and blackish brown, the latter in irregular and vague transverse markings, subparallel to the outer margin. *Hind wings* crossed by two not very distinct, rich, dark brown belts, one pre-mesial, the other extra-mesial, dividing the wing into thirds; they are both broad, with irregular borders, stopping short at the submedian nervure; a similar but often subobsolete narrower belt, composed of contiguous and confluent lunules, is found just previous to the outer margin, often rendered more conspicuous by a powdering of bluish white scales, which bring it into relief; at other times obscured by a covering of similar scales, and always indicated to a certain extent by paler lunulate intervals between it and the extra-mesial band. Expanse of wings, 43-54 mm.

Caterpillar. *Last stage.* Head black, with a large, bright orange spot at the front base of each hemisphere, lying at the bottom of a large, pale lavender spot, which covers more than half of the front. Body green, with a slender, darker green, dorsal line, a broad, pallid, stigmatal stripe, above which the sides are obscured with darker green; dorsal thoracic shield narrow, equal, black, the part of the segment in front very pale brownish yellow, like the legs and under surface. Length, 36.5 mm. Described from the figure by Boisduval and LeConte.

Chrysalis. Uniform pale yellowish brown, the incisures dusky. Length, 24 mm.; height, 5 mm. From Boisduval and LeConte.

This is a southern butterfly, occurring throughout the southern states from Georgia to Arizona, and as far north as West Virginia and Kentucky. It does not seem to be so common as the other larger Hesperidi of the same region, and Abbot expressly calls it rare. It occurs also in Mexico, as I have specimens from Putta, about 150 miles from Oaxaca on the Pacific slope.

Abbot bred the butterfly on April 25th, from a caterpillar which shut

itself up in its cocoon three weeks previously, and Maynard collected a specimen in Tallahassee, Fla., April 17. Nothing else is known of the seasons of the insect, which Abbot says frequents the sides of swamps. In his various manuscripts *Breweria aquatica*, one of the *Convolvulaceae*, is given as the food plant of the caterpillar, and upon this it is figured by Boisduval and LeConte.

THORYBES SCUDDER.

THORYBES ELECTRA.

Eudamus electra Lintn., Can. ent., xiii: 63-65 (1881).

Imago. Front of head dark brown. Locklet black, curving about half way over the eyes. Antennae about half the length of the anterior wings, dark reddish brown, marked inwardly with white at the joints, expanding rapidly into the club (the terminal half of the club lost). Palpi in length about equal to the diameter of the eyes, clothed with thick, bristly, dark brown hairs, some of which are white tipped; apical joint short, conical, projecting a little beyond the hairs.

Thorax above and beneath clothed with long, brown hairs, concolorous with the posterior wings. Legs dark brown; the posterior pair have the femur and tibia of the same length, bearing brown hairs which nearly equal them in length; tibiae armed with two pairs of spurs; tarsi twice as long as the tibiae, moderately spinose.

General color dark brown, approaching that of *pylades*; the fringe concolorous with the terminal portion of the wings, a little paler at their tips. Size of small [*Thanaos*] juvenalis. Primaries narrower than in [*Thorybes*] *pylades* Scdd. ♀, more rounded on the costa, and more oblique on the hind margin. Primaries with eleven transparent white spots, upon which an ordinary lens shows regular rows of small black scales, the spots as follows: near the end of the cell (apparently open) are two spots, separated by the cellular fold and extending to the enclosing veins (subdorsal and median), the upper one twice as large as the lower, and prolonged backward superiorly in one or two teeth, the lower one subtriangular in shape; above and in line with these two, in cell 10, is a small, elongated spot, the smallest on the wing, while beneath them and in range, in cell 2, extending from vein 2 to vein 3, is the largest spot on the wing, enlarged superiorly and excavated inwardly. Outside of this discal band of four spots, are seven others, bordered by dark brown, and arranged in an irregular curve, as follows: in cells 9, 8 and 7, three costo-apical spots, oblique to the costa; outside of these, in cell 6, a spot; in cell 5, still nearer the margin, another; in cell 4, a little further removed from the margin, another; these last three subtriangular in shape; in cell 3, extending from vein to vein, a subquadrate spot, placed farther from the margin, about equidistant with the lower costo-apical spot; these seven spots, commencing at the costa and omitting the fifth, show a regular increase in size. Outside of these transparent spots is a series of obscure, dark brown, intra-nervular, subterminal spots, which merge into the dark brown shade of the margin. Inside of these spots, the wing shows by oblique light a purplish reflection approaching a grape bloom, but more vivid, with the exception of the internal margin and two brown bands of the color of the outer margin and posterior wings; the bands extend from the subcostal to the internal vein; the outer and broader embraces the discal band of transparent spots in its outer margin, and the other crosses the median vein at its intersection by vein 2; a brown shade rests also on the base of the wing. The costal vein of the primaries intersects the costa nearly opposite the end of the cell; vein 8 reaches the margin at the extreme apex, not below it. Secondaries rounded, not prolonged at the anal angle as in *pylades*, nor excavated opposite the cell as in most [*species of Thanaos*]. Secondaries traversed, at about their outer

third, by a narrow, obscure brown band, inside of which the wing is dark brown; outside of this band, the subterminal series of brown spots of the primaries is continued.

Beneath, the purplish reflection of the upper surface appears only at the tip of the wing, the median and basal portions being dark brown, concolorous with the secondaries inside of the paler brown band; the obscure, intra-nervular brown spots of the upper surface are repeated and continued on the secondaries; the transparent spots are without the lines of brown scales.

Abdomen darker brown, reaching only to the pale band of the hind wings. Expanse of wings, 42 mm.; length of body, 9 mm.

The above description is that given by Lintner, with only such transposition as to make it agree with the order followed in the present work.

All that is known regarding this butterfly is the statement by Mr. Lintner that one specimen "was captured in Hamilton, Ontario, by Mr. J. Alston Moffat, in 1877, in company with another like it, which escaped capture. It is presumed to belong to *Thorybes*.

PHOLISORA SCUDDER.

PHOLISORA HAYHURSTII.

Hesperia hayhurstii Edw., Trans. Am. ent. soc., iii: 22 (1870). Am. butt., 51 (1872);—French, Butt. east. U.S., 367-368 (1886).

Nisoniades hayhurstii Kirb., Syn. cat. Lep., 631 (1871). *Helias hayhurstii* Hew., Cat. coll. diurn. Lep., 239 (1879).

Pholisora hayhurstii Scudd., Syst. rev.

Imago. Head and upper surface of palpi tufted with black and saffron scales, the former predominating; the palpi sordid white beneath; antennae blackish brown with clay brown under surface.

Wings dark ashen brown, enlivened by three sets of parallel arcuate bands of rich dark brown, one narrow and submarginal, the other two dividing the wings subequally, broad above and narrowing below; the middle of the three is the broadest and on the upper half of the wing much broader than the width of the cell; these bands are all obscure and cloudy, and in addition the wing is occasionally flecked very sparsely indeed and indiscriminately over the whole surface with pale bluish white scales. On the *fore wings*, depending from the middle of the outer half of the costal margin, are two minute silvery white spots often reduced to the merest dots in the superior subcostal interspaces; and there is occasionally present a similar dot, easily overlooked, near the base of the lower median interspace at the inner edge of the middle band. On the *hind wings* the transverse markings are narrower and generally more obscure, the middle band sometimes no broader than the others.

Beneath, nearly uniform dark gray brown, the outer third of the wings a very little lighter, all the wings obscurely mottled with slightly darker and lighter markings in which no definite pattern can be discovered, excepting occasionally with the utmost vagueness a repetition of the darker markings above; the white dots of the fore wing are sometimes present also below. Expanse of wings, 26-30 mm.

Egg. Broadly arched, the ribs very thin, about .1 mm. apart, .08 mm. high at highest, the cross lines frequent and straight, forming between them and the ribs quadrangular cells .025 mm. high, and .083 mm. broad, the surface profusely punctured with a remarkably uniform distribution, the punctae themselves being very uniform in size, about .0025 mm. in diameter and circular. Height of egg, .48 mm.; diameter, .69 mm. From specimens in glycerine.

Caterpillar. *First stage.* Head blackish castaneous; dorsal thoracic shield pale castaneous, the posterior edge blackish. Body white with a yellowish tinge. Legs and prolegs concolorous. Length, 1.5 mm.; breadth of head, .4 mm. From specimens in glycerine.

Second stage. Head black; dorsal thoracic shield blackish castaneous; body pale greenish yellow, all the legs and prolegs concolorous. Length, 2.75 mm.; breadth of head, .55 mm. From specimens in glycerine.

Third stage. Colors as before. Length, 4.5 mm.; breadth of head, .85 mm. From specimens in glycerine.

Fourth stage. Head black, densely clothed with delicate pallid hairs. Dorsal thoracic shield fusco-castaneous. Body green, the legs and prolegs concolorous. Length, 8 mm.; breadth of head, 1.75 mm. From specimens in glycerine.

Last stage. Head piceous, scabrous, including near the middle of the front of each hemisphere some slightly larger, piceous and smooth tubercles, the pile pale brown. Dorsal thoracic shield testaceous, paling behind. Body green, covered with the minutest possible papillae in the centre of small, circular bits of tougher integument, and bearing the minutest fungiform colorless bristles. Legs and prolegs concolorous. Spiracles testaceous. Length, 25 mm.; breadth of head, 2.75 mm. From blown specimens.

Chrysalis. Uniform pale castaneous, glistening, with no bloom, the apical third of the wing cases more or less blotched or discolored with fuliginous tints; rim of the prothoracic spiracle black; cremaster very dark castaneous above, apically blackish fuscous, the hooks luteo-castaneous; hairs of body rather abundant, long and pale fulvous. Length, 14 mm.; breadth, 4 mm. From dried specimens.

This butterfly inhabits all our southern states as far north as West Virginia and Maryland on the Atlantic coast, and west to Kansas and New Mexico.

Nothing is known of its seasons, excepting what I can give from notes furnished by Dr. William Wittfeld of Brevard Co., Florida. He obtained eggs on pigweed, presumably *Chenopodium*, July 25; these hatched in four days and the successive moults were passed August 2, 5, 8, 13, and the chrysalis was formed August 22, the duration of which is not stated. Evidently, then, there must be several broods a year. The eggs, according to Dr. Wittfeld, are always laid on the upper side of leaves; when irritated or in self defence, the full grown caterpillar ejects a greenish fluid from its mouth. The butterfly flies low and almost always in the woods, though it feeds at the edges of the same; excepting this, it is seldom to be found in open ground; it feeds or suns itself, alike on a leaf or on the ground, with spread wings.

TRIBE PAMPHILIDI.

OARISMA SCUDDER.

*Oarisma** Scudd., Syst. rev. Amer. butt., 54 (1872).

Thymelicus pars Auctorum.

Imago. Head broad, exceptionally depressed. Front transverse, three times as broad as high, slightly, broadly and roundly emarginate below, the lower outer angles strongly excised, slightly and uniformly tumid, surpassing considerably the front of the eyes. Whole vertex raised above the eyes, though flat, the eyes being set low. Antennae in slight depressions, very distant, being separated by four times the diameter of the basal joints, very short, being scarcely half as long as the elongated abdomen, and hardly more than a third as long as the fore wings, composed of about thirty-one

* *ὄαρισμα*, dalliance.

joints, of which about seventeen form a large and long, depressed, cylindrical club, comprising about two-fifths of the whole antenna, increasing very gradually in size, and bluntly rounded at apex, four or five naked joints entering into the diminution of size, with no sign of a crook; its stoutest part is just before it begins to taper, where it is about three times as stout as the stalk, and the joints are about four times as broad as long; on the stalk they become hardly twice as long as broad. Palpi very stout but pretty long, the apical joint very slender and elongated, porrect; the middle joint alone is as long as the eye, cylindrical and stout, being about four times as long as broad and nearly straight, the apical joint not much shorter, very slender, tapering to a fine point at base, not more than a fourth as broad as the middle joint.

Wings ample, the fore wings triangular, about two-thirds as long again as broad, the lower outer angle falling not much within the middle of the outer half of the costal margin; costal margin straight beyond the basal areuation; outer margin straight, excepting at the roundly angulated tip. Cell nearly two-thirds the length of the wing; third superior subcostal vein arising at about the middle of the wing. Hind wings triangular, with gently and regularly arcuate outer margin, the inner and costal margins of about equal length. Subcostal fork arising slightly nearer the base than the first subcostal fork.

Fore legs very small. Fore femora fully as long as the hind femora, a little longer than the fore tibiae; the latter not much longer than first joint of fore tarsi, and with an exceedingly small epiphysis; first joint of tarsi as long as the three following together. Hind tibiae about a third longer than hind femora, and about two-thirds as long as the tarsi, with two pairs of spurs; first tarsal joint considerably longer than the remaining joints together. Claws minute, very strongly arcuate, the paronychial forming a simple, equal, curved, round-tipped lobe beside and below it, of the same length.

This genus of stiff-looking skippers is composed so far as known of only a couple of forms, differing only in their size and the extent of the markings; they occur in the eastern Rocky Mountain region and eastward to the Mississippi valley, between latitudes 38° and 50°. They are simply marked with exceedingly short antennae and long club, and presumably belong to the first section of Pamphilidi as separated in this work, though nothing is known of their earlier stages. The butterflies appear on the wing once, in early summer.

OARISMA POWESHEIK.

Hesperia powesheik Park., Amer. ent., ii: 271-272 (1870).

Oarisma poweshiek Seudd., Syst. rev. Amer. butt., 54 (1872).

Thymelicus poweshiek French, Butt. east. U. S. 301 (1886).

Thymelicus poweshiek Edw., Cat. diurn. Lep. Amer., 67 (1884).

Thymelicus garita pars Edw., Cat. Lep. Amer., 49 (1877).

Ancyloxypha garita pars Streck., Cat. Amer. Macrolep., 175 (1878).

Figured by Glover, Ill. N. A. Lep., pl. Q. fig. 3, ined.

[Not *Hesperia garita* Reak.]

Imago. Head tufted above with bright tawny hairs, mingled at the base with many black scales, especially posteriorly; under surface of palpi with silvery white scales through which pass many black hairs; antennae bright tawny, the under surface of the club pallid; thorax covered with mingled brown and tawny hairs, beneath with dull silvery scales and white hairs; the femora and tibiae the same, excepting that the upper surface of the tibiae is very dirty yellow, as also nearly the whole of the tarsi.

Wings above rich dark brown with mulberry reflections. Fore wings heavily marked with bright golden tawny along the whole costal margin as far downward as the cell

and nearly to the apex of the wing, narrowing apically; scales of the same color often line and narrowly mark the nervures, especially the median in its upper field and the submedian, occasionally also flecking the inner border. *Hind wings* enlivened only by long, olivaceous, tawny hairs which cover profusely the basal third or more of the wing; fringe dark gray from a heterogeneous mingling of scales of many colors, especially pallid and fuliginous.

Beneath: *fore wings* very dark brown, the costal border broadly margined with very dull, mingled pallid and dull tawny scales, the former preponderating next the costal edge itself and also found marking all the nervures, even those which cross the dark brown parts of the wing; the outer margin in the subcostal and median region rather broadly and very heavily flecked with similar scales. *Hind wings* with the basal color of the same dark brown as the fore wings, but above the middle of the medio-submedian interspace very heavily flecked with white scales which always distinctly mark all the nervures and occasionally cover almost all the intervening interspaces; occasionally away from the nervures changing to a pale yellow, a color which edges the costal margin in its basal half. Expanse of wings, 31-34 mm.

This is a western butterfly, occurring in northern Illinois, Iowa and Nebraska, and also in Dakota, and according to Edwards in Montana and Colorado, though it may perhaps be questioned whether the neighboring *O. garita* be not here mistaken for this species, though Mead says it is not *garita* but perhaps a variety of *powesheik* which is found in the Yellowstone region of Montana. It flies in Iowa, Nebraska, and Dakota at the end of June according to Parker and Dodge, but nothing further is known about its history.

POTANTHUS SCUDDER.

*Potanthus** Scudd., Syst. rev. Amer. butt., 54 (1872). *Pamphila* pars Auctorum.

Imago. Head large, unusually broad. Front but little tumid, nearly four times as broad as high, but little, and only below, advanced in front of the eyes. Eyes large, moderately full, circular, naked. Antennae separated at base by much more than the face-breadth of the eyes, much longer than the abdomen, the slender stalk consisting of about twenty joints, the longest in the middle five times as long as broad, the club gradually and regularly incrassated (but incomplete in all specimens seen).

Fore wing slightly more than half as long again as broad, the lower outer angle falling well beyond the middle of the costal border; costal margin tolerably straight, except at base and extreme tip; outer margin gently convex. Costal nervure scarcely so long as the cell; third subcostal nervule arising hardly beyond the middle of the wing; cell a little less than two-thirds as long as the wing, fully five times as long as broad; first median nervule arising midway between the base of the wing and the second nervule, and very far before the origin of the first subcostal nervule. Hind wing well rounded, not elongate, only a very little longer than broad; outer margin regularly convex. First median nervule arising but little nearer the base than the subcostal fork.

Middle tibiae about five-sixths the length of the middle femora, and not greatly longer than the first tarsal joint, armed at tip with a pair of exceedingly long and slender spurs; first joint of tarsi as long as the next three together, the last joint no longer than the fourth, all armed beneath rather feebly with delicate, recumbent spines. Claws minute, strongly arcuate, no longer than the thickness of the joint. Paronychiae inferior, lateral, even slenderer than the claw, slightly shorter, a little arcuate, hardly tapering.

*πίνω, ἄνθος, one that drinks at a flower.

The only specimens at hand of this genus being imperfect, I am unable to characterize it as fully as I should otherwise have done. Still fewer points could have been touched upon, but for the generosity of the Rev. Dr. Holland in lending me the type of *Hesperia omaha*.

This is a small group of Pamphilidi composed of three or four species, all of which appear to be very rare, and almost nothing is known to me of their distribution and nothing of their history. They occur in western America from California and Colorado to, or nearly to, the Isthmus of Panama, and have also been taken on the Atlantic slope in the middle United States. They resemble not a little certain Australian types, but I have not been able to make a sufficient study of their structure.

POTANTHUS OMAHA.

Hesperia omaha Edw., Proc. ent. soc. Amer., 49 (1877);—French, Butt. east. U. S., Philad., ii: 21 (1863). 300-301 (1886).

Potanthus omaha Scudd., Syst. rev. Amer. *Hesperia mingo* Edw., Proc. ent. soc. Butt., 54 (1872). Philad., vi: 207 (1866).

Carterocephalus omaha Edw., Cat. Lep.

Imago. Head covered above with tawny and black hairs intermingled, tawny only in front; antennae blackish brown, annulate with tawny beneath, the whole under surface and the apical half of the club tawny.

Fore wings tawny, marked with very dark maroon brown; there is, especially, a long and broad, longitudinal belt, following the under surface of the median nervure as far as the tip of the cell, and just not reaching the inner border next the base; at its upper outer limit it is overlapped by another longitudinal belt occupying the base of the interspaces beyond the cell, infringing slightly upon the cell itself, and covering two-thirds of these interspaces; at its upper interior limit there is, confluent with it, a ray or triangular patch directed upward to the costal margin, which itself is marked more or less heavily with dark brown; besides there is a slender ray of the same color following the subcostal margin halfway across the cell, and the outer margin is marked with brown in various breadths; in the upper subcostal interspace the marking runs nearly halfway to the extremity of the cell; in the interspace beyond the cell it is not more than an interspace in width; below this it increases steadily in width by as much as the interspace is broadened, and the interior limit is here lunulate; there is practically thus left a dark brown wing with three large patches of tawny: a small, triangular patch near the apex, a longitudinal belt along the costal margin, and an oblique, extra-mesial, transverse belt. *Hind wings* with the same colors, mostly dark brown, with a small, circular, tawny spot in the cell opposite the first submedian forking, and a straight, but irregular, broad, transverse belt just beyond the middle of the wing, which broadens in the median interspaces and runs from the middle of the outer half of the submedian nervure to the last subcostal nervure, where it just fails of reaching the margin of the wing, in the subcostal interspaces being marked only by slight points; there is also a dash of tawny in the costo-subcostal interspace opposite the spot in the cell.

Beneath, the tawny markings of the upper surface are repeated throughout and are rendered more conspicuous, because the dark brown of the wings is heavily flecked with tawny scales, excepting along the edges of these markings, which brings them into greater relief, and excepting also in the lower half of the fore wings, where in the portion covered by the hind wings the dark markings are inky brown. Expanse of wings, 26 mm.

This species has been regarded by some as identical with *P. californicus*, but in the latter species the markings of the under surface of the hind wings are far less diver-

sified, the transverse, light colored band being indicated only by the dark and obscured edgings; and the upper surface of the fore wings shows on the costal margin a large, blackish brown, longitudinal bar on a line with and as large as the extra-mesial, tawny band.

Very little is known of this butterfly, which has been taken only in West Virginia and Colorado.

ERYNNIS SCHRANK.

ERYNNIS UNCAS.

Hesperia uncas Edw., Proc. ent. soc. Philad., ii: 19-20, pl. 5, fig. 3, 2 figs. (1863).

Pamphila uncas Kirb., Syn. cat. diurn. Lep., 600 (1871); French, Butt. east. U. S., 308-309 (1886).

Anthomaster uncas Scudd., Syst. rev.

Amer. butt., 57 (1872).

Hesperia ridingsii Reak., Proc. ent. soc. Philad., vi: 151 (1866).

Ocytes ridingsii Mead, Wheeler's report, v: 788 (1876).

Imago. Head tufted above with dull olivaceous and black hairs, the apical joint of the palpi black, the under surface of the palpi pallid; antennae black, heavily flecked beneath with white, excepting at the naked tip of the club, which is more or less enlivened with castaneous. Thorax covered above with dull gray, olivaceous hairs, beneath with dull, silvery white scales and whitish hairs; the legs clay brown.

Wings above rather dark slate brown, varying in depth of tint, and with glossy reflections. *Fore wings* usually marked with pallid, occasionally with tawny spots, of which there is a pair of confluent ones marking the extremity of the cell, and an extra-mesial series of spots forming a very irregular, oblique, subcontinuous band; it is composed of three elongated spots in the subcostal interspace, midway between the tip of the cell and the wing; a pair of subquadrate spots in the interspaces beyond the cell whose inner border is on a line with the outer border of the neighboring spots, and, obliquely continuous with these, three very unequal spots in the median and medio-submedian interspaces, that in the lower median interspace generally the largest, that in the medio-submedian very variable and more frequently fulvous to a greater or less extent, occupying the middle of the interspace; these spots, especially the latter ones, are most conspicuous in the female; in the male they are usually much reduced in size and those in the lower median and medio-submedian interspaces are subobsolete and in part obscured by the fulvous tone of all that portion of the wing which follows the discal stigma; this is composed very much as in its ally *E. metea*. *Hind wings* more or less suffused with pale tawny, more conspicuous in certain lights than in others, marked at the tip of the cell and crossed by an extra-mesial series of subcontinuous pallid spots, generally more or less tawny, which are the vague repetition of the more distinct spots of the under surface; fringe of all the wings sordid white, often more or less infuscated in the upper half of the fore wings and preceded by a thread of blackish brown.

Beneath, dull, dirty, olivaceous brown, a deeper olivaceous brown bordering all the markings, especially on the hind wings, and lending them greater perspicuity. The *fore wings* show in both sexes the markings of the upper surface of the female, but they are perhaps more conspicuously continuous, and terminate on the inner border in a large, vague, triangular, pallid spot; these show also a slight tendency to follow as threads down the nervures, and occasionally the outer half of the wing apart from them is heavily flecked with saffron scales. On the *hind wings* the extra-mesial band is very marked and almost invariably continuous, forming a bent band, bent at somewhat less than a right angle, composed of subquadrate spots, produced at all the angles along the nervure tips, and margined, externally at least, with dark brown, the upper

half of the band running from the costal nervure to the median in a straight line, having a direction from the middle of the costal border to the tip of the upper median nervure, the lower half in a direction from the outer angle of the wing to the middle of the inner margin; there are besides two spots within this: one at the lower apex of the cell, the other at the extreme base of the costo-subcostal interspace, the latter sometimes subconfluent with the outer spot of the same interspace; all these spots are dull, silvery white. Expanse of wings, 31-37 mm.

This butterfly has been credited to a wider range of territory than can perhaps be claimed for it, though it is certainly found from Pennsylvania to Colorado. As the species of this genus are difficult of separation unless considerable series are at hand for comparison and for the study of the abdominal appendages, determinations by those who do not make use of these means must be taken with qualification. It has been given as inhabiting the Rocky Mountain district from Dakota to Arizona. Nothing is known of its history, except that Mead found it in Colorado at Twin Lakes in July, "generally upon or near the dwarf lupines, which grew with bunch grass and low herbage, in open spaces between the plants of sage brush."

LIMOCHORES SCUDDER.

LIMOCHORES PALATKA.

*Hesperia palatka** Edw., Trans. amer. ent. soc., i: 287 (1867).

Limochores palatka Scudd., Syst. rev. Amer. butt., 59 (1872).

Pamphila bulenta Streck., Cat. Amer. macrol., 170-171 (1878).

Pamphila dion Edw., Can. ent., xi: 238-239 (1879);—French, Butt. east. U. S., 337-339 (1886).

[Not *Pamphila palatka* Edw., Chapm., French; nor *Hesperia bulenta* Boisdu-LeC.]

Head densely tufted above with tawny and black-brown hairs, which also cover the apical face of the palpi, excepting the apical joint which is wholly black-brown above, tawny beneath; rest of palpus covered with white scales like the head behind and beneath the eyes, gradually merging into tawny. Antennae black-brown above, annulated with tawny, beneath almost wholly tawny, the apical naked portion of the club, including the crook, orange castaneous. Thorax covered above with tawny, greenish yellow and pale green hairs; beneath with sordid pale greenish yellow; the femora tawny but purple at tip and on the lower portion of the anterior side; the tibiae and tarsi dull tawny, the latter infuscated apically.

Wings above black-brown, heavily marked with tawny, having in the males a decided gleam; in the *fore wings* of the female the brighter colors are mostly confined to an extra-mesial, curving, bent band broadened from above downward, bent in the interspaces beyond the cell, consisting of longitudinal spots clearly interrupted by the nervures, starting from the middle of the outer half of the costal border and ending with its interior edge at the middle of the submedian nervure; in addition the apical half of the cell is more or less suffused or streaked with tawny which is usually of a paler color than in the male. In the male the tawny occupies almost the entire disk excepting the infuscated, more or less strigate base and reaches as far toward the outer border as would correspond to the outer limits of the extra-mesial belt of the female, the outer black-brown bordering being of subequal width and of an average width of two interspaces; sometimes, and especially in northern specimens, the

* Typographical error for *palatka*.

costal border is more or less infuscated; the discal stigma consists of two moderately broad bars of velvety black, the upper and outer at the extreme base of the lower median interspace, following the median nervure, the lower and inner connected with the lower inner corner of the upper at its own upper outer corner, and traversing the medio-submedian interspace in a line nearly parallel to that of the upper portion of the stigma, but bent in the least possible degree downward; the two portions of the stigma are equal and each rounded at either end and about three and a half times longer than broad with slight individual variation. *Hind wings* with the disk more or less marked with fulvous tawny in the centre, leaving an extremely broad margin around the whole, and invariably cut distinctly by blackish fuscous nervules; it is occasionally reduced almost entirely to a single longitudinal ray in the subcosto-median interspace, where, when best developed, it is almost always more distinct than elsewhere, and extends from the apex of the cell more than half way to the margin of the wing; the whole disk of the wing is, moreover, heavily clothed with dark tawny hairs; fringe pallid, mixed with brown scales which nearly supplant the paler ones on the upper half of the fore wing.

Beneath dark brown, more or less enlivened with a sprinkling of tawny scales. *Fore wings* sprinkled with tawny scales having more or less of an orange tinge, especially above the median nervure, beneath which, previous to the extra-mesial band, which is less conspicuously repeated beneath in both sexes as in the female above, the wing is deeply infumated with blackish or blackish brown, which also follows the inner margin nearly to the tip and suffuses more or less the apical half of the median and submedian interspaces in both sexes, though the latter more commonly in the male than in the female; outer margin marked with a black brown thread and the fringe concolorous with the wing or a little more pallid on the lower half. *Hind wings* having the same general color as the upper half of the fore wings, excepting that a broad longitudinal belt of yellow tawny follows the subcosto-median interspace from the extremity of the cell more than half way to the margin, beyond which it gradually fades out, and another the whole of the medio-submedian interspace from base to margin, while the inner margin beneath this is slightly yellower than the main ground color; in addition the veins are frequently marked with yellow, but this feature is more common in northern individuals than in southern, those from Florida being frequently almost uniformly flecked with fulvous scales throughout, showing little or no sign of the broad yellow rays or of any distinction of nervures. Expanse of wings, ♂, 39-44 mm.; ♀, 42-49 mm. Described from 5 ♂, 5 ♀.

I judge that the description of the caterpillar referred to this species by Chapman does not belong to it because I have received from him named specimens of the imago from Florida which do not belong to this species but to an allied one which is intermediate between *Limochores pontiac* and *Limochores arpa*, sent me many years ago by Mr. Edwards under the specific name of *pallas*, but which has never been described under that name. Specimens of *dion*, kindly sent me by Professor French, compared with specimens from Florida, which had been compared at the time of its description with the type of Edwards's *palatka*, show them to be the same species.

The distribution of this butterfly is evidently little known, since it has been found only in the western Mississippi states—eastern Nebraska, northern Illinois and Indiana—and at Hamilton, Ontario, and then in northern Florida. Nothing is known of its earlier stages.

EUPHYES SCUDDER.

EUPHYES OSYKA.

- Hesperia osyka* Edw., Trans. Am. ent. soc., 345 (1886).
 1:288 (1867). *Euphyes osyka* Scudd., Syst. rev. Amer. butt., 59 (1872).
Pamphila osyka Kirb., Syn. cat. diurn. Lep., 607 (1871);—French, Butt. east. U. S., *Hesperia baets* Boisd., MS.

Imago. Head tufted above with bright saffron hairs, interrupted behind the antennae by a transverse belt of black-brown scales; basal half of the palpi silvery white, apical half saffron, mingled above with many black scale-hairs, the apical joint black; antennae black above, annulate with clay-brown beneath, the basal half of the club beneath clay-brown, the naked tip brighter. Thorax clothed above with brown scales and hairs of various depths of color, mingled with many greenish hairs, beneath sor-did white; the legs dark clay brown.

Wings above uniform dark blackish brown, with a very slight tawny gloss. Fore wings with a pair of small, pallid spots, a small, roundish spot at the extreme base of the upper median interspace, and another larger than it in the interspace below removed a little toward the base; these spots are larger in the female than in the male, and are accompanied in the latter by a row of two or three minute dashes of the same color, depending from the middle of the outer half of the costal border.

Beneath, uniform dark brown, with a purplish tinge, the lower half of the fore wings with a slight tawny tint; the markings of the upper surface are repeated, generally a little more distinctly. Expanse of wings, 23-31 mm.

This butterfly belongs to the Gulf States, where it has been reported from South Carolina and Georgia on the east, to Louisiana and Texas on the west; but as it has also been taken in northern Indiana, it must be found over a larger extent of territory than had been supposed.

Nothing whatever is known of its history or habits.

PRENES SCUDDER.

Prenes * Scudd., Syst. rev. Amer. butt., 60 (1872). *Pamphila* pars Auctorum.

Imago. Head broad, the front four times as broad as high, greatly excised laterally below, uniformly and considerably tumid, surpassing somewhat the front of the eyes. Vertex almost uniformly tumid with the front, and almost as considerably rising above the upper level of the eyes, with a transverse, coronal carina, slight and short, in the middle of the summit. Eyes large, full, circular, naked. Antennae inserted in shallow depressions, greatly separated, the space between equal to the whole height of the head, slender, of about the length of the long abdomen, composed of about thirty-eight joints, of which about half form the club, which is not more than half as long as the stalk, very gracefully elongate fusiform or Indian-club shaped, with a greatly attenuated, delicate, slender, tapering, pointed crook, composed of eight or nine joints, nearly or quite twice as long as the breadth of the club, and about half as long as it. Palpi short, the basal joints very thickly clothed, so as to appear very

*πρηνς, headlong.

large, but in reality the middle joint is bullate, only half as long again as broad, the apical joint slender, small, not so long as the width of the middle joint.

Fore wings elongate triangular, the lower outer angle falling a little outside the middle of the costal margin, the apex pointed; costal margin full next base, beyond distinctly though faintly and broadly excised; outer margin slightly sinuous, with a tendency to an angulate bend next the upper median nervule, and a faint excision in the lower median interspace. Second subcostal nervule originating before the middle of the wing; second median nervule arising opposite a point between the origin of the third and fourth subcostal nervule; cell nearly two-thirds as long as the wing. Hind wings triangular, the costal and inner margins of about equal length, the outer margin gently rounded, but mesially excised a little, so as to appear faintly bilobed. First median fork slightly more distant from the base than the subcostal.

Fore femora and hind femora of equal length, the former half as long again as its tibia, the latter four-fifths as long as its tibia; fore tibia hardly two-fifths as long as the fore tarsi, which are only a little shorter than the hind tarsi; first joint of hind tarsi as long as the remainder together, the last joint as long as the preceding. Claws minute, strongly bent in the middle, the paronychial simple, triangular, tapering lobes, as long as the claw and nearly concealing it on the side, but originating just below it.

This group of slender, sharp-winged and presumably very swift *Pamphilid* is tolerably numerous in species, which occur from the southern part of the United States, through the Antilles, Mexico and Central America to Venezuela. Two species occur in the United States, both of which occasionally reach the northern half. Nothing is known of their history or time of flight, excepting that on their northern edge they fly at the end of June.

PRENES OCOLA.

Hesperia ocola Edw., Proc. ent. soc. Philad., 332 (1886).
ii; 20, pl. 11, fig. 4 (1863).

Pamphila ocola Kirb., Syn. cat. diurn. 60 (1872).
Lep., 607 (1871); — French, Butt. east. U. S.,

Prenes ocola Scudd., Syst. rev. Amer. butt.,

Imago. Head covered above with mingled fulvous and blackish brown scales and hairs, the palpi similar, pallid beneath at the base, the apical joint and the outer anterior edge black; antennae black, clay brown beneath, especially on the body of the club. Thorax covered with dull tawny hairs above, beneath with dull brown and pallid hairs; the legs dark brown above, dull saffron beneath.

Wings above uniform dark brown with a very faint, dark tawny reflection. The fore wings with very simple markings, consisting of a minute, triangular, vitreous spot at the extreme base of the upper median interspace, a much larger, strongly lunulate, sub-triangular, vitreous spot at the extreme base of the lower median interspace, its outer margin as far removed from the previous spot as its own length, and a faint, brief, longitudinal streak of the same, lying upon the middle of the submedian nervure; in addition there is in the female a pair of very faint and minute dashes or dots close to the base of the last two superior subcostal interspaces, one directly above the other.

Beneath, warm dark brown; the base of the fore wings obscured with black, especially along the nervures; the markings of the upper surface of the female are repeated beneath in both sexes but the spot on the submedian nervure becomes sordid white, and all the spots have a tendency to be of larger size, and in addition there is

sometimes found a minute dot in the lower part of the interspace beyond the cell in line with both the upper and the lower series. The hind wings occasionally show exceedingly faint traces of a row of faint light spots crossing the upper half of the wing just beyond the middle. Expanse of wings, 34-40 mm.

The butterfly is found throughout the southern states, at least east of the Mississippi, and has also been found in the extreme northern part of Indiana and in eastern Pennsylvania, according to Edwards, so that it probably covers all the middle states as well.

We are entirely unacquainted with the life of the butterfly.

PRENES PANOQUIN.

Hesperia panoquin Scudd., Proc. Ess. inst., iii: 178-179 (1863).

Pamphila panoquin Kirb., Syn. cat. diurn. Lep., 608 (1871);—French, Butt. east. U. S., 331 (1886).

Prenes panoquin Scudd., Syst. rev. Amer. butt., 60 (1872).

Hesperia ophis Edw., Trans. Amer. ent. soc., iii: 216 (1871).

Hesperia cochles Latr., MS.

Imago. Head covered above with mingled brown and black scales and tawny and black hairs; palpi with mingled white and yellow scales and near the extremity with many black scale-hairs; the apical joint black only above, elsewhere clay-brown; antennae black-brown beneath with a line of clay-brown, the naked portion of the club very dark castaneous. Thorax covered above with greenish brown scales, tawny and brown hairs; beneath with dirty yellow hairs; the legs brown, more or less flecked with dull yellow, the tarsi darker above and paler beneath.

Wings above dark brown, somewhat variable in depth; when freshest, with a faint tawny reflection. *Fore wings* with a few small spots, usually pale dull yellow in the male, pallid in the female; there is a mere dot at the extreme base of the upper median interspace, a roundish, occasionally triangular spot near the base of the lower median interspace, midway between the previous spot and the extreme base of the interspace; also on a line with these there is sometimes found, more frequently in the ♀ than in ♂, a dot in the lower portion of the interspace beyond the cell, these three spots forming a single straight line in which they are equidistant; in rare instances there is in the female another dot in the upper portion of the same interspace beyond the cell on a line with the previous and subconfluent with the other in the same interspace; the female also shows a pair of short dashes in the subcostal interspace in the middle of the outer half of the wing, the upper the outer, and there is also within the cell at its lower outer extremity, subjacent to the spot in the lower median interspace, a short slender streak, while a similar and generally larger streak rests upon the submedian nervure, as far from the margin as the spot in the lower median interspace; these latter markings are often obsolete, especially in the male. The *hind wings* occasionally show the mark of the longitudinal streak of the under surface.

Beneath, rather paler than above; all the nervures of the hind wings marked in very pale yellow, which is also the case to a less extent upon the fore wings, in the submedian nervure and the nervules of the apex of the wing, which are narrowly marked. *Fore wings* with the markings of the upper surface of the female repeated beneath, generally with greater clearness and completeness. On the *hind wings* there are two conspicuous, long, white, longitudinal dashes, one in the interspace beyond the cell, running from its termination at least half way, sometimes three-quarters, to the outer margin; the other in the medio-submedian interspace from the extreme base

to the middle of the previous streak, following the line of the median nervure. Expanse of wings, 32-38 mm.

This butterfly is a species known best from the southern Atlantic states from South Carolina to Key West and Apalachicola, Fla. ; but it doubtless inhabits other parts of the south since the specimens upon which the species was originally based in all probability came from the vicinity of New Orleans. It has latterly been found in abundance by Aaron at Atlantic City, N. J.

We are totally ignorant of its life and early stages, excepting that Aaron found it in New Jersey the last of June and first of July.

THE
HYMENOPTEROUS PARASITES
OF
NORTH AMERICAN BUTTERFLIES.

BY L. O. HOWARD, WASHINGTON, D. C.

Why, here you have the awfulest of crimes
For nothing! Hell broke loose on a butterfly!
BROWNING.—*The Ring and the Book.*

IT was in March, 1887, when Mr. Scudder first wrote asking me to revise and extend the chapter on butterfly parasites written by Dr. A. S. Packard for his (Scudder's) book on New England Butterflies, but published under the title "Some Ichneumon Parasites of our New England Butterflies," in the Proceedings of the Boston Society of Natural History, Vol. XXI. I at once replied that I should be glad to attempt the task, and some little time was spent during the summer of 1887 examining Dr. Packard's types and other material sent me by Mr. Scudder. Learning, during a visit to Cambridge in the fall of 1887, that there was no immediate hurry for my manuscript, I postponed the work until the summer of 1888, and meantime corresponded with several gentlemen interested in butterflies, and brought together some additional material, which I have studied with that already at hand, and present the results herewith.

The larger part of the material which I have seen was sent me by Mr. Scudder. Some of it had already been studied by Dr. Packard, while the remainder had been subsequently reared by Mr. Scudder or his correspondents. Considerable material, both in the way of specimens and notes, was also placed at my disposal by Dr. C. V. Riley, from his old collection and from the collections of the National Museum and of the Department of Agriculture. Mr. W. H. Edwards has sent me a number of specimens with notes, and Judge W. B. Thomas of Athens, Ga., Mr. A. H. Mundt of Fairbury, Ill., and Mr. H. H. Lyman of Montreal, have all sent specimens and short notes. Professor Riley has kindly written for me the portion of the chapter relating to the important parasites of the Braconid subfamily Microgasterinae, as I felt that from his familiarity with these difficult forms he would do them infinitely better justice than I could my-

self. Mr. E. T. Cresson has also, with his customary kindness, made certain determinations for me in the Ichneumonidae, and has sent me copies of several of Holmgren's generic descriptions which were not accessible to me at Washington.

The chapter may be appropriately begun with a tabulated arrangement of the hosts from which parasites have been bred, placing opposite to each species of butterfly the parasites which have been reared from it, and the reverse. The main object of the chapter is, of course, to enable the observer to identify any parasites which he may have reared from butterfly larvae or pupae, supposing them to have been reared before, and I would advise him first, by examining this list, to ascertain what parasites have been reared from the insect in question, and then to compare the figures and descriptions of these particular species with the specimens he has reared. If he does not in this way satisfy himself, then let him run through the synoptical table of genera and the descriptions of species which follow, and it will not be difficult to ascertain whether his observation is a new one.

LIST OF HOSTS AND PARASITES.

Butterflies.	Parasites.	Butterflies.	Parasites.
Oeneis semidea.....	Ichneumon instabilis. ? Encyrtus montinus. Pteromalus chionobae. Tetrastichus semideae.	Polygonia faunus....	Ichneumon versabilis.
Oeneis macounii.....	Trichogramma intermedium.	Polygonia progne.....	Telenomus graptae. An undetermined Pteromalid.
Chlorippe clyton.....	Limneria fugitiva. Pimpla annulipes? Chalcis flavipes. Telenomus rileyi.	Euvanessa antiopa....	Hoplismenus morulus. Pteromalus vanessae. Pteromalus puparum. Derostenus antiopae. Telenomus graptae.
Chlorippe celtis.....	Limneria fugitiva.	Aglais milberti.....	Ichneumon rufiventris. Apanteles atalanta. Trichogramma intermedium.
Basilarchia archippus.	Ichneumon caliginosus. Limneria limenitidis. Apanteles limenitidis. Pteromalus puparum. Trichogramma minutum. Trichogramma minutissimum.	Vanessa atalanta.....	Microgaster carinata. Apanteles atalantae. Apanteles edwardsii. (A Braconid; note by Scudder; no specimen.) Pteromalus puparum. Eulophus sp.; known from its pupa only. Cirrospilus niger. Tetrastichus modestus. Trichogramma minutissimum.
Basilarchia astyanax..	An undetermined chalcid (Shurtleff).	Vanessa huntera.....	Ichneumon rufiventris. Apanteles carduicola. Microgaster; note by Riley; no specimen.
Polygonia interrogationis	Hoplismenus morulus. Apanteles sp. (cocoon only). Pteromalus vanessae. Tetrastichus modestus. Trichogramma intermedium. Telenomus graptae.	Vanessa cardui.....	Ichneumon rufiventris. Trogus exesorius. Exochilum mundum.
Polygonia comma.....	Glypta erratica. Pteromalus vanessae.		
Polygonia satyrus....	Pteromalus puparum.		

Butterflies.	Parasites.	Butterflies.	Parasites.
<i>Vanessa cardui</i> (cont.)	<i>Apanteles carduicola</i> . <i>Pteromalus puparum</i> . (An egg-parasite; note by Riley; no speci- men.)	<i>Pieris rapae</i> (cont.)	<i>Pteromalus puparum</i> . <i>Tetrastichus</i> sp.
<i>Juno coenia</i>	<i>Apanteles junoniae</i> . (An egg-parasite; note by Murtfeldt; no specimen.)	<i>Ascia monuste</i>	<i>Pteromalus vanessae</i> .
<i>Argynnis cybele</i>	<i>Apanteles argynnidis</i> .	<i>Iphiclides ajax</i>	<i>Trogus exesorius</i> . <i>Pimpla annulipes</i> . <i>Exochilum mundum</i> .
<i>Phyciodes tharos</i>	<i>Ichneumon instabilis</i> .	<i>Jasoniades glaucus</i> ...	<i>Trogus exesorius</i> . <i>Copidosoma turni</i> . <i>Trichogramma minu- tissimum</i> .
<i>Lemonias anicia</i>	<i>Apanteles koebeli</i> .	<i>Euphroeades troilus</i> ...	<i>Trogus exesorius</i> . <i>Cryptus</i> sp. <i>Apanteles emarginatus</i> .
<i>Euphydryas phaeton</i> ..	<i>Pteromalid</i> ; species un- known.	<i>Euphroeades palame- des</i>	<i>Pteromalus vanessae</i> .
<i>Anosia plexippus</i>	<i>Pteromalus archippi</i> . <i>Trichogramma inter- medium</i> .	<i>Heraclides cresphon- tes</i>	<i>Hemiteles utilis</i> . <i>Chalcis robusta</i> . <i>Pteromalus vanessae</i> .
<i>Agraulis vanillae</i>	<i>Chalcis flavipes</i> . <i>Pteromalus puparum</i> .	<i>Papilio polyxenes</i>	<i>Trogus exesorius</i> . <i>Trogus obsidianator</i> . <i>Apanteles lunatus</i> .
<i>Uranotes melinus</i>	<i>Anomalon pseudargioli</i> .	<i>Epargyreus tityrus</i> ...	<i>Ophion bilineatus</i> . <i>Limneria</i> sp. <i>Pteromalus puparum</i> .
<i>Thecla</i> sp.....	<i>Apanteles theclae</i> .	<i>Thorybes pylades</i>	Egg-parasite; note by Scudder; no speci- mens. <i>Apanteles</i> sp.
<i>Thecla calanus</i>	<i>Tetrastichus theclae</i> .	<i>Thanaos lucilius</i>	<i>Trichogramma inter- medium</i> .
<i>Thecla edwardsi</i>	<i>Tetrastichus saundersii</i> .	<i>Thanaos juvenalis</i>	<i>Microdus sanctus</i> . <i>Apanteles flavicornis</i> .
<i>Cyaniris pseudargio- lus</i>	<i>Anomalon pseudargioli</i> . <i>Apanteles cyaniridis</i> . <i>Hemiteles lycaenae</i> .	<i>Pholisora eatullus</i>	<i>Limneria fugitiva</i> . <i>Microdus sanctus</i> . <i>Apanteles pholisorae</i> .
<i>Heodes hypophlaeas</i> ..	<i>Ichneumon versabilis</i> . <i>Telenomus graptae</i> .	<i>Limochores taumas</i> ...	<i>Telenomus graptae</i> .
<i>Xanthidia vicippe</i>	<i>Apanteles cassianus</i> .	<i>Megathymus yuccae</i> ..	<i>Apanteles megathymi</i> . (Egg - parasite; eggs found punctured with exit-holes.)
<i>Eurema lisa</i>	<i>Pteromalus puparum</i> .		
<i>Eurymus philodice</i>	<i>Mesochorus scitulus</i> . <i>Apanteles</i> sp. <i>Pteromalus puparum</i> .		
<i>Pontia protodice</i>	(Said by Edwards to be parasitized by a small <i>Ichneumon</i> ; Butt. N. A., i, 35). <i>Pteromalus puparum</i> .		
<i>Pieris oleracea</i>	<i>Apanteles glomeratus</i> .		
<i>Pieris rapae</i>	<i>Mesochorus pieridicola</i> . <i>Apanteles glomeratus</i> .		

LIST OF PARASITES AND HOSTS.

Parasites.	Butterflies.	Parasites.	Butterflies.
<i>Ichneumon rufiven- tris</i>	<i>Aglaia milberti</i> . <i>Vanessa huntera</i> . <i>Vanessa cardui</i> .	<i>Hoplismenus morulus</i> .	<i>Polygonia interroga- tionis</i> . <i>Euvanessa antiopa</i> .
<i>Ichneumon caliginosus</i>	<i>Basilarchia archippus</i> .	<i>Trogus exesorius</i>	<i>Vanessa cardui</i> . <i>Iphiclides ajax</i> . <i>Jasoniades glaucus</i> . <i>Euphroeades troilus</i> . <i>Papilio polyxenes</i> .
<i>Ichneumon instabilis</i> ..	<i>Oeneis semidea</i> . <i>Phyciodes tharos</i> .	<i>Trogus obsidianator</i> ...	<i>Papilio polyxenes</i> .
<i>Ichneumon versabilis</i> ..	<i>Polygonia faunus</i> . <i>Heodes hypophlaeas</i> .	<i>Hemiteles utilis</i>	<i>Heraclides cresphontes</i> .

Parasites.	Butterflies.	Parasites.	Butterflies.
Hemiteles lycaenae...	Cyaniris pseudargiolus.	Pteromalus vanessae..	Polygonia interrogationis.
Cryptus sp.....	Euphœades troilus.		Polygonia comma.
Ophion bilineatus.....	Epargyreus tityrus.		Eu Vanessa antiopa.
Exochilum mundum..	Vaessa cardui.		Ascia monuste.
	Ipheclides ajax.		Euphœades palamedes.
Anomalou pseudargioli.....	Uranotes melinus.		Heraclides cressphontes.
	Cyauiris pseudargiolus.	Pteromalus sp.....	Polygonia progne.
Mesochorus pieridicola	Pieris rapae.		Euphydryas phaeton.
Mesochorus scitulus..	Eurymus philodice.	Pteromalus archippi..	Anosia plexippus.
Limneria fugitiva....	Chlorippe clyton.	Pteromalus puparum.	Basilarchia archippus.
	Chlorippe celtis.		Polygonia satyrus.
	Pholisora catullus.		Eu Vanessa antiopa.
Limneria limenitidis..	Basilarchia archippus.		Vanessa atalanta.
Limneria sp.....	Epargyreus tityrus.		Vanessa cardui.
Pimpla annulipes.....	Chlorippe clyton?		Agraulis vanillae.
	Ipheclides ajax.		Eurema lisa.
Glypta erratica.....	Polygonia comma.		Eurymus philodice.
Microdus sanctus....	Thanaos juvenalis.		Pontia protodice.
	Pholisora catullus.		Pieris rapae.
Apanteles glomeratus.	Pieris oleracea.		Epargyreus tityrus.
	Pieris rapae.	Eulophus sp.....	Vanessa atalanta.
Apanteles edwardsii..	Vanessa atalanta.	Cirrospilus niger....	Vanessa atalanta.
Apanteles megathyni.	Megathymus yuccae.	Derostenus antiopae..	Eu Vanessa antiopa.
Apanteles limenitidis..	Basilarchia archippus.	Tetrastichus semideae.	Oeneis semidea.
Apanteles lunatus....	Papilio polyxenes.	Tetrastichus sp.....	Pieris rapae.
Apanteles cyaniridis..	Cyauiris pseudargiolus.	Tetrastichus saundersii.....	Thecla edwardsii.
Apanteles argynnidis..	Argynnis cybele.		Thecla calanus.
Apanteles koebelei....	Lemonias anicia.	Tetrastichus modestus.....	Polygonia interrogationis.
Apanteles flavicornis..	Thanaos juvenalis.		Vanessa atalanta.
Apanteles emarginatus.....	Euphœades troilus.	Trichogramma minutum.....	Basilarchia archippus.
Apanteles theclae.....	Thecla sp	Trichogramma minutissimum.....	Basilarchia archippus.
Apanteles junoniae....	Junonia coenia.		Vanessa atalanta.
Apanteles carduicola..	Vanessa huntera.		Jasoniades glaucus.
	Vanessa cardui.	Trichogramma intermedium.....	Oeneis macouni.
Apanteles atalantae....	Aglais milberti.		Polygonia interrogationis.
	Vanessa atalanta.		Aglais milberti.
Apanteles pholisora..	Pholisora catullus.		Anosia plexippus.
Apanteles cassianus..	Xanthidia nicippe.		Thanaos lucilius.
Apanteles spp.....	Polygonia interrogationis.	Telenomus graptae....	Polygonia interrogationis.
	Eurymus philodice.		Polygonia progne.
	Thorybes pylades.		Eu Vanessa antiopa.
Microgaster carinata..	Vanessa atalanta.		Heodes hypophlaeas.
Microgaster ?sp.....	Vanessa huntera.		Limochores taumas.
Chalcis flavipes.....	Chlorippe clyton.	Telenomus rileyi....	Chlorippe clyton.
	Agraulis vanillae.		
Chalcis robusta.....	Heraclides cressphontes.		
Encyrtus montinus....	Oeneis semidea.		
Copidosoma turni....	Jasoniades glaucus.		
Pteromalus chionobae.	Oeneis semidea.		

In comparison I introduce here a list of the European parasites of the four butterflies which are common to Europe and North America.

EUROPEAN HYMENOPTEROUS PARASITES OF BUTTERFLIES COMMON TO EUROPE AND NORTH AMERICA.

- Euvanesa antiopa.* *Ichneumon fossorius* Ratz.: Ratzeburg, Ichn. d. Forstins.
Hoplismenus terrificus Wesm.: Giraud et Laboulbène, Liste d'éclosions d'insectes, Ann. Soc. Ent. France, 1877.
Pteromalus puparum L.: Kirchner, Cat. Hym. Eur.
- Vanessa atalanta.* *Hoplismenus plica* Wesm.: Giraud et Laboulbène, loc. cit.
Amblyteles armatorius Först.: Bignell, in Buckler's Larvae of British Butterflies, Ray Society, 1886.
- * *Hemiteles fulvipes* Gr.: Fitch, Entomologist, xiv: 139.
Limneria cursitans Holmgr.: Fitch, Entomologist, xvi: 66.
 * *Mesochorus sylvorum* Hal.: Fitch, loc. cit., 141.
Pimpla flavicans Fabr.: Rondani, Bull. soc. ent. ital., x: 31.
Microgaster spurius Wesm.: Giraud et Leboulbène, loc. cit.
Microgaster subcompletus Nees: Fitch, Entomologist, xiv: 142.
Microgaster deprimator Spin.: raised by Scudder, determined by Drewsen.
Apanteles sp.: Fitch, Entomologist, xiii.
- Vanessa cardui.* *Pteromalus puparum* (L.): Fitch, Naturalist, 1886: 213.
Ichneumon castigator Fabr.: Rondani, loc. cit.
Limneria exareolata Ratz.: Bignell, loc. cit.
Pimpla diluta Ratz. Ratzeburg, loc. cit.
Bracon variator Nees: Bignell, loc. cit.
Microgaster subcompletus Nees: Scudder.
Apanteles emarginatus Nees: Bignell, loc. cit.
- Pieris rapae.* *Campoplex conicus* Ratz.: Rosenhaur det. specimen in Mus. Comp. Zool., Cambridge.
 * *Hemiteles fulvipes* Gr.: Bignell loc. cit.
 * *Mesochorus aciculatus*: Bignell, loc. cit.
 * *Mesochorus splendidulus* Grav.: reared by Scudder, determined by Drewsen.
Microgaster glomeratus L.: Scudder, Kaltenbach.
Apanteles rubecula Marsh.: Bignell, loc. cit.
Apanteles glomeratus (L.): many authors.
 * *Diplolepis microgastri* Boh. Kaltenbach.
Monodontomerus aerus Walk.: Mayr, Europ. Torymiden
Monodontomerus dentipes Boh.: ibid.
Pteromalus puparum (L.): many authors.

* All probably hyperparasitic.

Analytical Table of Families.

Anterior wings with several closed cells.

Anterior wings with two recurrent nervures.....**ICHNEUMONIDAE.**

Anterior wings with but one recurrent nervure.....**BRACONIDAE.**

Anterior wings almost veinless.

Pronotum not reaching to tegulae.....**CHALCIDIDAE.**

Pronotum reaching to tegulae.....**PROCTOTRUPIDAE.**

Analytical Tables of Genera.

ICHNEUMONIDAE.

- First segment of the depressed, pedunculate abdomen bent towards apex.
 Ovipositor hidden or only slightly exerted.
 Abdomen ♀ acute at tip, last ventral segment retracted.
 Scutellum flat or convex, gradually sloping to apex.....**Ichneumon.**
 Scutellum gibbous, abruptly declivous behind.....**Hoplismenus.**
 Abdomen ♀ obtuse at tip, last ventral segment not retracted.....**Trogus.**
 Ovipositor distinctly exerted.
 Areolet incomplete.....**Hemiteles.**
 Arolet complete.....**Cryptus.**
- First segment of abdomen straight.
 Abdomen petiolate, compressed for at least posterior half.
 Cubito-discoïdal cell receiving both recurrent nervures.....**Ophion.**
 Cubito-discoïdal cell receiving but one recurrent nervure.
 Spiracles of metathorax oval or elongate.
 Apical margin of clypeus truncate.....**Exochilum.**
 Apical margin of clypeus acutely angled or pointed.....**Anomalon.**
 Spiracles of metathorax round.
 Arolet large, rhomboidal.....**Mesochorus.**
 Arolet small.....**Limneria.**
 Abdomen sessile.
 Ovipositor arising from a ventral cleft.....**Pimpla.**
 Ovipositor arising from apex of abdomen.....**Glypta.**

BRACONIDAE.

- Mesothoracic sutures distinct; marginal cell minute, remote from the apex of the wing.....**Microdus.**
 Mesothoracic sutures invisible; marginal cell large, reaching apex of wing.
 Wings with two submarginal cells, the second confused with the third.....**Apanteles.**
 Wings with three submarginal cells, the second more or less complete.....**Microgaster.**

CHALCIDIDAE.

- Tarsi 5-jointed.
 Hind femora much swollen.....**Chalcis.**
 Hind femora not much swollen.
 Middle tibiae with a strong apical spur.
 Club of antennae rounded.....**Encyrtus.**
 Club of antennae obliquely truncate.....**Copidosoma.**
 Middle tibiae with only a slight apical spur.....**Pteromalus.**
- Tarsi 4-jointed.
 Submarginal vein not broken.....**Cirrospilus.**
 Submarginal vein broken.
 Scutellum with two bristles near the middle.....**Derostenus.**
 Scutellum with four bristles, all behind middle.....**Tetrastichus.**
- Tarsi 3-jointed.....**Trichogramma.**

PROCTOTRUPIDAE.

But one genus—**Telenomus**—is considered.

FAMILY ICHNEUMONIDAE LEACH.

GENUS ICHNEUMON Linn.

Ovipositor hidden, or only slightly exerted; basal half or two-thirds of first abdominal segment slender, expanded at apex, its spiracles closer to apex of segment than to each other; areolet pentangular; mesonotum without parapsides; metathoracic spiracles linear or narrowly oval; petiole of abdomen not depressed; ♀ abdomen acute at tip, last ventral segment retracted; ♂ ventral segments 2—4 with a longitudinal fold; scutellum more or less flat, or simply convex, and then gradually sloping to apex; metathorax rarely bispinose.

Table of Species.

Abdomen uniformly dull red.....	rufiventris.
Abdomen entirely black.....	caliginosus.
Abdomen not unicolorous.	
Antennae fulvous at middle, with black tips.....	instabilis.
Antennae black above, lighter below.....	versabilis.

Ichneumon rufiventris Brullé. Pl. 88, fig. 1.*Ichneumon hunterae* Pack.*Ichneumon* sp. Pack.

Head, thorax and petiole of abdomen black, rest of abdomen dull, brick red, sometimes reddish brown. Head black, with the orbits part way up broadly marked with yellow, forming lanceolate, triangular spots, with the slender apex opposite the antennae. Base and sides of labrum yellow. Head wholly black in ♀. Palpi brown. Antennae in ♂ black; in ♀ black, with a white ring in the middle, about four joints usually being white. Wings smoky-violaceous. Fore legs brown, pale brown in ♂. Basal three-fourths of femora blackish, legs dark brown in ♀. Hind legs black, hind tibiae paler at base; hind femora reddish at base. Thorax black, sometimes yellow spots on scutum. Length (average), ♂, 12 mm., exp., 20 mm.; ♀, 15 mm., exp., 28 mm. (Adapted from Packard.)

[The following description of the colors was taken during life: Antennae blackish fuscous; the middle joints pale, but infuscated. Body piceous; abdomen very deep reddish orange, the belly tinged with yellow, the ovipositor infuscated; extreme base of the femora inconspicuously sanguineous. s. n. s.]

This species seems to be a quite common parasite of *Vanessa huntera* and *V. cardui*. I have seen two specimens, one male and one female, from Mr. Scudder, one female from Mr. Lyman, of Montreal, and Dr. Packard records a female from Virginia, all reared from this species. Mr. Cresson (Trans. Amer. Ent. Soc., vi: 173) also states that this species has been reared from *huntera*. Professor Riley has reared it from *cardui*, and Mr. Scudder has so recorded it in his article entitled "A Cosmopolitan Butterfly." Miss Caroline E. Huestis records it from *cardui* in the Canadian Entomologist for July, 1881. Mr. Scudder has also sent a single male, reared by Dr. Dimmock, from *Aglais milberti*.

This specimen mentioned by Dr. Packard as "*Ichneumon* sp.," is, as Dr. Riley states, *I. rufiventris*. The difficulty into which Dr. Packard fell concerning the white banded antennae and the black face, I have solved by

an examination of the specimen to which Dr. Packard referred, and which proves to be a female, and not a male as he supposed.

Mr. Cresson (Proc. Ent. Soc. Phil., iii: 179, 180) describes three varieties of this species, viz.: incertus, semicoccineus and californicus, differing chiefly in the coloration of the legs.

***Ichneumon caliginosus* Cresson.**

Female.—Black, subopaque, densely and finely punctured; clypeus shining with a few large punctures; antennae half the length of the body, black, the 10th to 15th joints white above. Thorax densely and confluent punctured, with an abbreviated impressed line on each side of the mesothorax in front; scutellum rather flat, smooth and shining, with a large white spot occupying nearly its whole surface and slightly indented posteriorly; metathorax scabrous, the elevated lines well defined, the central area large and transversely quadrate. Wings fuscous, nervure black, stigma piceous, arcolet 5-angular. Legs shining black, inner side of the anterior tibiae and tarsi whitish. Abdomen entirely black; the first segment broad and finely aciculate, the peduncle slender; basal foveae of the second segment deep and oblique; apical segments rather smooth and shining; ovipositor subexserted, yellowish. Length, 12.5 mm.; expanse of wings, 23 mm. (Adapted from Cresson.)

Mr. Seudder has sent me one female of this species reared from *Basilarchia archippus* September 5. The species has been captured in Canada, Colorado and Illinois.

***Ichneumon instabilis* Cresson.**

Ichneumon tharotis Packard.

Female.—Black or ferruginous, rather robust; head slightly narrowed beneath, the anterior orbits more or less red or yellowish; sometimes the head is entirely red, or the face and clypeus are varied with brown and yellowish or reddish; antennae moderately long, not robust, generally fulvous at base, yellow in middle and black at tips, sometimes only fulvous with tips black, or black at base, then fulvous, yellow and black; third joint elongate, longer than the fourth, which is subequal with the fifth; thorax often entirely ferruginous or more or less varied with ferruginous, sometimes black immaculate, except the scutellum, which is always yellow and polished; tegulae ferruginous, often with a reddish spot in front and another beneath; post-scutellum sometimes reddish; metathorax rugulose, the central area large and subquadrate; wings subhyaline, more or less stained with yellow, nervures brown, stigma pale honey-yellow; legs honey-yellow or ferruginous; the coxae, tips of posterior femora, of their tibiae and most of their tarsi black, sometimes the most part of the posterior legs is black; abdomen oblong-ovate, subconvex, slender at base, generally entirely ferruginous, sometimes the fourth and fifth segments above are black or fuscous, sometimes the second and third segments only are ferruginous, and sometimes the incisures of the segments are more or less blackish; beneath ferruginous or yellowish ferruginous, dusky or black at tip. Length, 10-12 mm.

Male.—This sex is exceedingly variable in color, some examples being almost entirely yellowish ferruginous, and others almost entirely black. Head black, with the anterior orbits and all beneath the antennae yellow; antennae long, slender, black above and brownish or fulvous beneath, the basal joint yellow beneath; thorax generally black, sometimes more or less varied with ferruginous, and in one specimen the mesothorax has four abbreviated, pale vittae; sometimes the thorax is black, immac-

ulate, except the scutellum, which is always yellow; generally, there is a spot or a sutural line before the wings, and a spot or line beneath; the post-scutellum is often reddish; legs honey-yellow: the fore anterior coxae often more or less yellow or honey-yellow, sometimes black spotted with yellowish beneath; the posterior coxae are generally black, sometimes more or less ferruginous, their trochanters generally half black and half honey-yellow; sometimes their femora are entirely black, or half black, generally only tipped with black, rarely entirely honey-yellow, their tibiae tipped with black; the general color of the legs varies from lemon-yellow to ferruginous; abdomen depressed, opaque, sometimes entirely yellowish ferruginous, but generally black, with the second and third, and sometimes part of the fourth segments ferruginous or yellowish ferruginous; the first segment is either entirely ferruginous, or black tipped with ferruginous, or with two apical yellow spots; the second and third segments are entirely ferruginous, or yellow stained with ferruginous; the fourth is either entirely black, or black spotted with ferruginous, or entirely ferruginous; the remaining segments are generally black or brown, often more or less varied with ferruginous; several specimens have the second and third segments bright yellow and the rest black. Length, 10.5 to 14.7 mm. (After Cresson.)

This is a very variable species. The specimen described by Dr. Packard as *Ichneumon tharotis* was an extreme variety of the female. It was reared by Mr. Scudder, June 2, from *Phyciodes tharos*. Mr. Cresson records it from Canada, Maine, Massachusetts, Connecticut, New York, New Jersey, Virginia, Georgia and Colorado, but does not know its host. During July, 1887, a single specimen of a variety of the male was received from Mr. Scudder, with the statement that he had reared it from the chrysalis of *Oeneis semidea*.

***Ichneumon versabilis* Cresson. Pl. 88, fig. 2.**

Male.—Dull black; line on anterior orbits, face, clypeus, mandibles, labrum, palpi, scape beneath, anterior margin of tegulae, line before, another beneath, scutellum, sometimes a spot or line behind, dot on four anterior coxae and trochanters beneath, their knees, tibiae and tarsi, anterior femora in front, posterior tibiae and tarsi except tips, sometimes two dots or a line at tip of first abdominal segment, and the second and third more or less, all bright yellow; occasionally the base of second and third segments is margined with dull ferruginous, and the apical middle more or less varied with black, sometimes interrupting the yellow on third segment into two spots, and in one specimen these are reduced to mere dots, and the yellow on second segment interrupted medially by a black line; wings subhyaline; postpetiole aciculated; gastrocoeli large and deep; antennae more or less pale beneath; posterior femora sometimes pale at base. Length, 12 to 13 mm. (From Cresson.)

Of this species I have seen two specimens of a variety of the male. Both were sent by Mr. Scudder. One specimen was obtained in Vermont from *Heodes hypophlaeas*, and the other by Dr. G. Dimmock from *Polygonia faunus*. It is recorded by Mr. Cresson from Canada and the United States. Both specimens were accompanied by the chrysalids from which they had emerged, and in each case the chrysalis was decapitated.

GENUS HOPLISMENUS Gravenhorst.

Parapsidal furrows of mesoscutum indicated anteriorly; mesoscutellum strongly elevated, abruptly declivous behind; metanotum always bispinose, metanotal spiracles

long, oval. Areolet of fore wings pentangular. More than half of first abdominal segment slender, its spiracles much nearer to apex than to each other; gastrocoeli large but shallow. Abdomen of ♀ acute at tip, the last ventral segment retracted; ♂ ventral segments two to four with a longitudinal fold.

Hoplismenus morulus (Say). Pl. 88, fig. 9.

Ichneumon morulus Say.

Ichneumon calcaratus Provancher.

Black; face, clypeus, scape beneath, and sometimes spot on scutellum, ♂, and annulus on flagellum, ♀, white or pale yellowish; tibiae and tarsi bright yellow; wings uniformly fuliginous. Length, ♂ ♀, 15 to 16.25 mm. (After Cresson.)

I have seen two specimens of this insect, one male and one female. One was sent me by Mr. Scudder and was reared by Miss Pierce from the chrysalis of *Polygonia interrogationis* at Cambridge. The other was sent me by Mr. H. H. Lyman of Montreal who reared it in August, 1875, from a chrysalis of *Euvanessa antiopa*, at Portland, Me. The parasite in issuing decapitates the chrysalis (88:16). Mr. Cresson records the species from Canada, Connecticut, New York, New Jersey and Virginia.

GENUS TROGUS Gravenhorst.

Mesonotum without parapsidal grooves; mesoscutellum strongly elevated, generally subpyramidal; metathoracic spiracles oval. Areolet of fore wings pentangular. First segment of abdomen bent at apex, basal half slender, apex much expanded, spiracles closer to apex than to each other; base of second segment with lateral pits (gastrocoeli); ♀ abdomen obtuse at tip, ovipositor hidden; the last ventral segment but slightly retracted, ventral segments four to eight smooth, flat, without longitudinal fold.

Table of Species.

Uniformly brown.....	exesorius.
Uniformly black.....	obsidianator.

Trogus exesorius Brullé. Pl. 88, fig. 3.

Entirely fulvo-ferruginous, legs paler, tibiae and tarsi golden yellow; antennae sometimes dusky or black above; wings uniformly fuliginous, with a strong aeneous or violaceous reflection. Length, ♂ ♀, 17 to 20 mm. (After Cresson.)

This is the most abundant of the butterfly parasites which have been sent me. It seems to be almost exclusively a parasite of the different species of swallow-tails. Dr. Packard says concerning its hosts and localities: "Bred from pupa of *Papilio asterias* [polyxenes] by Dr. Harris, E. Norton, E. T. Cresson, etc., appearing at Cambridge, June 20th; also from *P. troilus* [Euph. troilus] (Mark) and *P. turnus* [Jas. glaucus] (P. S. Sprague); also from *P. ajax* and *P. marcellus* [Iphiclides ajax] West Virginia (Norton)." Professor Riley reared it in Missouri from *Iphiclides ajax*, *Papilio polyxenes*, *Euphœades troilus* and *Jasoniades glaucus*. Mr. Mundt has reared it in Illinois from the first and last of these. Mr. Lyman has reared it at Portland, Me., from polyxenes, Professor Cook in Michigan from troilus, and Mr. W. H. Edwards in West Virginia from ajax. The

only exception to its parasitism upon swallow-tails is sent me by Mr. Mundt who reared it from *Vanessa cardui*. Mr. Cresson records the species as captured in Canada, New York, Pennsylvania, Delaware, Georgia and Illinois, and hazards the opinion that it will probably prove to be a synonym of *Ichneumon pennator* Fabricus.

Trogus obsidianator Brullé.

Deep black, immaculate; antennae orange-yellow; wings uniformly blackish fuliginous, with a strong aeneous reflection; first abdominal segment bicarinate, the carinae becoming obsolete before reaching the tip. Length, ♂ ♀, 20 to 22.5 mm. (After Cresson.)

This insect has been reared from the chrysalis of *Papilio polyxenes* by Professor Riley. Mr. Cresson records the species from Pennsylvania, Illinois, Georgia and Texas.

Genus **HEMITELES** Gravenhorst.

Metathorax with parapsidal grooves. Areolet of the fore wings pentangular in position, but incomplete, the outer nervure hyaline or wanting. Legs and antennae generally slender. Spiracles of first abdominal segment more approximate to each other than to the apex of the segment; gastrocoeli at base of second abdominal segment wanting; ovipositor distinctly exserted, short.

The species of this genus are as a rule parasites of parasites or, as they are called, "hyperparasites" or "secondary parasites." There is no well-proven exception to this rule on record so far as I know.

Table of Species.

Thorax marked with red; wings banded with brown.....	<i>utilis</i> .
Thorax black, immaculate; wings hyaline.....	<i>lycaenae</i> .

Hemiteles utilis Norton. Pl. 88, fig. 4.

Female.—Black; antennae, anterior portion of prothorax, shoulders and a spot at sides of mesothorax, the legs, including coxae and trochanters, red; middle of posterior femora and extremity of tibiae brownish. Wings hyaline, nervures brown, white at base; tegulae white; stigma brown, without a white spot at base; a large brown band extends from the base of the stigma across the wing; areolet surrounded with white nervures, the exterior nervure wanting. Abdomen oval from the second segment, black, polished, shining; joints 1 and 2 reddish at base and tip, the others margined with reddish posteriorly. Ovipositor a little longer than half the body, almost entirely reddish. Length, 3.75 mm.

This species is introduced into this paper for the reason that I find in the notes sent me by Mr. A. H. Mundt the statement that from an over-wintered pupa of *Heraclides cresphontes* he bred a parasite which was determined for him by Mr. Cresson as *H. utilis*.

It seems likely that there remains some yet undiscovered primary parasite of *cresphontes* from which this secondary parasite came.

Hemiteles lycaenae sp. nov.

Female.—Shining black. Mandibles and palpi bright lemon-yellow; antennae dull-piceous, honey-yellow at base; all legs, including coxae, honey-yellow; tegulae yellow and venter of second abdominal segment honey-yellow. Wings hyaline, with no infuscated band; nervures brown except at base, cubital nervure whitish, beyond incomplete; areolet, and subdiscoidal nervure also white beyond juncture with second recurrent nervure. Head, thorax and abdomen very delicately shagreened; surface of mesonotum with reticulate carinae; anterior and posterior border of dorsum of each abdominal segment perfectly smooth. Ovipositor sheaths one-fourth as long as abdomen. Length, 4.5 mm.; expanse, 7 mm.

Described from one female specimen received from Mr. W. H. Edwards who reared it from the larva of *Cyaniris pseudargiolus*. In this case also there is probably a primary parasite of which we have no knowledge.

Genus CRYPTUS Fabricius.

Female with joints of antennae thickened in a nodose manner at their tip; antennae elongate, filiform, third joint usually three or more times longer than thick (if shorter then the metathorax is not areolated), never thickened or expanded towards the middle. Areolet of fore wings completely enclosed, pentangular. Legs generally slender. Apex of first abdominal segment not much broader than the petiole, and but slightly bent; ovipositor distinctly exserted.

I have not been able to determine the butterfly parasite of this genus specifically as I know of it only through a note of Professor Riley's to the effect that he has bred a species of *Cryptus* from *Euphœades troilus*. The specimen cannot be found.

Genus OPHION Fabricius.

Face pubescent; clypeus truncate at apex; ocelli large, prominent. Thorax and legs glabrous; metathorax rounded behind, not rugose; intermediate tibiae with two apical spurs; wings hyaline, stigma distinct, well developed, areolet wanting, cubito-discoidal cell receiving both recurrent nervures. Abdomen petiolate, compressed; ovipositor short.

Ophion bilineatus* Say. Pl. 88, fig. 8.Ophion tityri* Pack.

Honey-yellow; head yellow; antennae honey-yellow; mandibles blackish at tip; thorax with two somewhat reddish brown, longitudinal lines, almost obsolete; wings with fuscous nervures; costal nervure and stigma honey-yellow; tegulae paler than thorax; second segment of abdomen hardly as long as first, and longer than second. Length, 8.75 mm. (After Say.)

Packard's type of *O. tityri* was a male specimen reared from *Epargyreus tityrus* June 26, 1848, and is from the old Harris collection. As soon as it came into my possession I forwarded it to Mr. Cresson who informed me that he saw no reason for considering it as more than a variety of *O. bilineatus* of Say. The brownish stripes on the thorax seem, however, to be entirely lacking and the mandibles are lighter in color.

Genus *EXOCHILUM* Wesmæl.

Apical margin of clypeus truncate. Spiracles of metathorax oval. Cubito-discoidal cell receiving but one recurrent nervure; marginal cell lanceolate; median and submedian cells not confluent, third discoidal present, not narrowed at base; cubito-discoidal cell receiving recurrent nervure in middle. Posterior femora unarmed; tarsal claws not pectinate; posterior tarsi with first joint about twice as long as second. Abdomen petiolate.

Exochilum mundum (Say).

Male.—Body black; head with the front, nasus and anterior orbits greenish-yellow; antennae fulvous yellow; three or four basal joints above black; the first joint beneath greenish yellow; trunk with rather dense, short hairs; wings purple black; abdomen much compressed; basal joint cylindrical; second segment as long as the first or a little longer, compressed towards the tip; anterior pair of feet yellowish before; intermediate pair with a line before and base of tibiae yellowish; posterior pair with the tibiae, excepting the tip, and the tarsi, excepting the terminal joint, fulvous-yellow. Length, 20-25 mm. (After Say.)

Mr. Mundt has bred this species from *Vanessa cardui* and *Iphiclides ajax*. The single specimen which he sent on and from which the species has been determined agrees with this description except that the posterior tibiae are black and the tarsi are dark gray.

Genus *ANOMALON* Gravenhorst.

Head buccate, or subbuccate; front with the median projection near the base of the antennae present or wanting, face more or less narrow. Clypeus indistinctly distinguishable, apex acutely angulate or apiculate. Antennae longer than the body, equal to it in length, or shorter. Metathorax punctate, often longitudinally sulcate (broadly, but not deeply). Abdomen compressed, joint 1 sublinear; terebra shortly exerted, valves towards apex usually dilated; legs slender, or the posterior are rather strong; posterior tarsi either incrassate or simple, linear, first joint about twice as long as second. (After Holmgren.)

The cubito-discoidal cell receives but one recurrent nervure, and this before the middle; the marginal cell is lanceolate; the third discoidal cell is present and is narrowed at base.

Anomalon pseudargioli sp. nov.

Female.—General color black and rufous. Face yellow, cheeks behind eyes rufous, vertex and occiput black with the usual yellow spots each side of ocelli; antennal scape yellow below, black above, pedicel and joint 1 of funicle black, rest of funicle rufous. Thorax black above and below, the outlines of the mesoscutum defined by an irregular, rufous band, which fails before and behind; mesoscutellum with its anterior half rufous; metanotum with a rufous band each side; front and middle legs yellow, hind coxae, femora and tibiae black with a rufous spot on coxae, and the femora with a varying amount of same color; wings perfectly hyaline, veins dark brown. First and second abdominal joints black, slightly rufous below; remaining joints rufous, with a dark shade along dorsal line, extending down more on the sides of joints 5 and 6, than on 3 and 4. Length, 13 mm.; expanse, 18 mm.

Described from four female specimens. Three were sent me by Mr. W. H. Edwards, who reared them in July from pupae of *Cyaniris pseudar-*

giolus, and one was sent by Mr. Scudder, who reared it from the chrysalis of *Uranotes melinus*.

Genus MESOCHORUS Gravenhorst.

Head transverse, short, not buccate. Clypeus not distinguishable. Eyes oblong-ovate. Antennae about as long as body, setose. Metathorax with a straight, superior area. Abdomen oblong-fusiform; first segment slightly curved, spiracles almost in the middle; last ventral segment with the female rather large; anal stylets of the male rather long, filiform; terebra of the female exerted for a short distance. Wings with a rather large rhomboidal, areolet. Legs moderate or slender. (After Holmgren.)

The species of *Mesochorus* are without doubt often hyperparasites; whether always so we cannot say with certainty.

Table of Species.

Thorax entirely black.....**pieridicolus**.
Thorax entirely yellow, or marked with yellow-brown.....**scitulus**.

Mesochorus pieridicolus (Packard).

Campoplex pieridicola Packard.

Female.—Black: head black on the vertex and occiput; orbits and front below the antennae bright yellow; a slight reddish tinge in the middle. Palpi pale honey-yellow. Antennae brown, pale yellowish at base, second joint pale brown above, third yellow, fourth and fifth pale yellowish brown, and thorax shining black, with fine, white, appressed hairs. Metanotum full, rounded, smooth, and polished, with a narrow mesial ridge. Tegulae and base of wings pale greenish-yellow. Wings clear; stigma pale brown; veins concolorous; areolet rather large, rhomboidal. Legs, including the coxae, honey-yellow; tarsi of fore and middle legs dusky towards the claws, those of the hind legs a little dusky, except on basal two-thirds of first joint, and growing darker toward the claws. Abdomen long and narrow, compressed towards the end, with a minute, slender ovipositor, not quite so long as the abdomen is wide, shining black with a yellowish band in the middle, the posterior edge of the second and anterior two-thirds of the third segment being yellow. There is a yellow dot at the end of the pedicel, being an extension of the pale yellow under surface of the three basal segments; end of abdomen obliquely truncated. Length, 4 mm. (After Packard.)

Dr. Packard described this species from a single specimen, and I have seen only his type. The specimen is labelled: "From *Pieris rapae*," and this is all the information which we have concerning it. It may or may not be a secondary parasite.

Mesochorus scitulus Cresson.

Male, Female.—Pale honey-yellow or luteous; head broad; spot covering ocelli, and tips of mandibles black; occiput of ♀ more or less fuscous; antennae long and slender, pale testaceous, sometimes slightly dusky, scape paler; mesothorax fuscous in ♀, honey-yellow with dusky sides in ♂; scutellum and region honey-yellow; disk of metathorax more or less blackish or fuscous; tegulae pale luteous; wings hyaline, iridescent, nervures and stigma luteous; legs pale luteous, apex of posterior tibiae and tips of tarsal joints dusky; abdomen fusiform, very slender at base, black above, with a large, discal, pale luteous spot covering apical half or two-thirds of second

and basal half, or two-thirds of third segments; venter pale luteous; ovipositor of ♀ longer than basal segment. Length, 1.5 mm. (After Cresson.)

This species was bred by Mr. Cresson (twenty-four specimens, together with four specimens of a *Pezomachus*) from a bunch of bright yellow cocoons (probably those of a *Microgaster*) found attached to a blade of grass in Pennsylvania.

I have seen three specimens of what seems to me to be this species in the National Museum collection at Washington which were received from Miss M. E. Murtfeldt of Kirkwood, Mo., Oct. 18, 1881 and by her said to be parasitic on some "large parasite" of *Eurymus philodice*.

Genus LIMNERIA Holmgren.

Head moderately large, transverse, not inflated; eyes naked, not emarginate; clypeus normal, not carinate or denticulate. Thorax longer than high; metathorax distinctly areolated, not produced at apex. Stigma of fore wings of moderate size; areolet small, usually triangular, often petiolate, sometimes absent. Abdomen moderately broad and moderately or slightly compressed towards apex, the incisures between segments very distinct; petiole slender, longer than the transverse post-petiole.

Table of Species.

Abdomen black.....	<i>fugitiva</i> .
Abdomen almost entirely rufous.....	<i>limenitidis</i> .

Limneria fugitiva Say.

Body black; antennae in both sexes black; mandibles and palpi white; tegulae white; wings hyaline, nervures black, whitish at base, areolet very small, petiolated from the radial cellule; metanotum not excavated behind, but with "somewhat raised lines"; abdomen arcuated, towards tip rather abruptly clavate; punctures very small; ovipositor as long as tip of abdomen; feet honey-yellow with a white reflection; posterior tibiae white with a black tip and base; posterior tarsi black, base of first joint white; in the male the white of the posterior tibiae is less obvious. Length, from 6 to 7.5 mm. (After Say.)

Say reared this species in Indiana from a "pretty white cylindric cocoon with maculated black bands."

As a butterfly parasite this species has been reared from *Pholisora catullus* by Professor Riley in Missouri, from *Chlorippe celtis* by Mr. W. H. Edwards in West Virginia, and from *Chlorippe elyton* by Mr. A. H. Mundt in Illinois.

Limneria limenitidis sp. nov. Pl. 88, fig. 5.

Male.—General color black. Palpi whitish; lower face with dense white pile; scape of antennae reddish below, blackish above, flagellum black; top of head and dorsum of thorax with sparse, fine white pile; tegulae dirty white, wings hyaline, nervures brown, costa black; all coxae black; front legs entirely light honey-yellow; trochanters, femora and tibiae of middle legs dark reddish yellow, tarsi much lighter and with each joint slightly dusky towards tip; first joint of hind trochanters black, second joint yellow; hind femora very dark rufous, lighter on the inner side; hind tibiae nearly black, spurs yellowish white; hind tarsi uniform in color with their tibiae, a very narrow band of white at base of first joint only. Abdomen rufous, except

joint 1, first four-fifths of joint 2, and first one-fourth of joint 3, its entire surface covered with very short pile. Punctuation of head and mesonotum identical, fine and close; metanotum with a more rugose punctuation, and with a faint median, longitudinal channel; two diverging carinae arise each side of this median channel, at front of metanotum, and meet two converging carinae at half the length of this sclerite. Length, 8 mm.; expanse, 12 mm.

Described from two male specimens, both reared from *Basilarchia archippus*, by Mr. W. H. Edwards, at Coalburgh, W. Va. One is labelled July 15, 1886, and of the other Mr. Edwards writes that it left the archippus larva at the latter's second moult. The cocoons of both individuals were also sent by Mr. Edwards. They are 6 mm. long and 2.5 mm. broad, of a regular oval shape and spun of grayish white silk; near either end is an irregular, interrupted black band, and upon each end are three or more black spots.

Genus *PIMPLA* Fabricius.

Head transverse, short, cheeks not swollen; clypeus distinct, depressed or subexcavated at apex; antennae porrect, filiform, scape excised at apex; eyes oblong, emarginate near base of antennae. Thorax robust, moderately elevated; scutellum with an obtusely rounded apex; metanotum low, spiracles oval or circular; tarsal claws simple, sometimes lobed at base with female; areolet of fore wings always complete, triangular. Abdomen sessile; in females of most species oblong or oblong-ovate, in males narrower, subcylindrical or sublinear; narrower than the thorax or very slightly broader, strongly, or faintly and thickly punctate; joints 2 to 7 usually transverse, sometimes subquadrate with the males, the ventral border of the two last with the females longitudinally fissured; joint 1 subquadrate, or scarcely longer than broad, rarely slightly shorter, usually with a longitudinal carina. Terebra usually shorter than abdomen, but may equal it in length or exceed it.

Pimpla annulipes Brullé. Pl. 88, fig. 6.

Male, female.—The head is sparsely and finely punctate, especially on the face, which is sometimes so pubescent as to appear opaque, and sometimes has the pubescence mostly removed so as to appear subpolished. A minute, glabrous tubercle on the disk of the face. The palpi are generally dull, dark rufous in ♀, sometimes pale rufous, sometimes almost whitish, but in the ♂ they are always whitish; the antennae are about four-fifths as long as the body; the 1st joint of flagellum in ♂, 3-3½ times, in ♀, 4-5 times as long as wide, the entire flagellum, ♂ ♀, tinged with rufous beneath. The thorax is finely and sparsely punctate above and below, and the metathorax is confluent and rather coarsely punctate, and usually more or less covered with fine, whitish pubescence so as to be opaque; the posterior declivity and a small area behind the scutel glabrous and polished, the two glabrous areas never quite confluent. Carinae all obsolete, except a small basal portion of the two central ones. The abdomen is confluent punctate and opaque; the usual tubercles are subobsolete, and the sides and extreme tips of the intermediate joints are often more or less tinged with sanguineous in ♀, sometimes conspicuously so, but never in ♂. In joint 1 the usual carinae scarcely extend halfway to the tip, and enclose between them a glabrous, circular, subbasal excavation. The ovipositor is half as long as body; the sheaths pubescent, scarcely tapered, and basally rather narrower than the last tarsal joint of the hind legs. Venter dull rufous, blackish at tip, sometimes all blackish, except extreme base. The legs are pale bright rufous, but in the front legs of more than one-fourth of the ♂ the trochanters are whitish; in the middle legs ♂ ♀, the second fourth of the tibiae is whitish, and very rarely the first fourth and the terminal half blackish exteriorly; and

in the hind legs the ♂ ♀ extreme tips of the femora and the whole tibia except the second fourth are black, and the tarsi are pale dusky, often with the base of each joint gradually a little paler. The areolet of the fore wings is mostly rhomboidal, very rarely subtruncate anteriorly, but never peduncled. Length, ♂, 3.5-11 mm; ♀, 5-12 mm. (After Walsh.)

This is a well-known parasite of many lepidopterous larvae. It has been reared from *Carpocapsa pomonella*, *Acrobasis juglandis*, *Aletia xyliana*, *Grapholitha olivaceana*, *Coleophora cinerella*, *Orgyia leucostigma*, and other unreared larvae. As a butterfly parasite it has been reared but once, viz. : by Mr. J. B. Smith, from a chrysalis of *Iphiclides ajax* at New York. It is also probably a parasite of *Chlorippe clyton*. Professor Riley has a pupa of this butterfly which has been broken open, revealing a large ichneumonid pupa which seems to be that of a female *Pimpla annulipes*.

Genus GLYPTA Gravenhorst.

Head transverse, short, cheeks not swollen, entire; clypeus slightly convex, apex round or subtruncate; antennae filiform; eyes nearly entire. Thorax robust; scutellum rounded at tip; metathoracic spiracles minute, subcircular; legs usually slender, tarsal claws with distinct pectinations, rarely simple or setose internally; wings generally with no areolet, rarely with a complete one. Abdomen sub lanceolate or linear, rarely ovate-elongate; joint 1 with a delicate, distinct carina; joints 2 to 4 with two oblique linear depressions; terebra of female at least as long as abdomen and issuing from apex; genital valvules of male usually incrassate, with obtuse apex, rarely narrower with acuminate apex.

***Glypta erratica* Cresson. Pl. 88, fig. 7.**

Female.—Black, shining; clypeus, mandibles, except tips, palpi, tegulae and line before, whitish; antennae brown-black, darker at base, apex and above; wings hyaline; legs, including coxae, yellowish-red; trochanters whitish beneath, posterior pair blackish above; intermediate tarsi fuscous, pale at base of joints; base and apex of posterior femora blackish; their tibiae black, with a white stripe *above*, not reaching the apex and interrupted by a black spot near base, the tarsi black, more or less white at base of joints; face with a median rounded swelling. Thorax minutely and closely punctured; metathorax rounded, smooth, shining, obsoletely punctured, apex enclosed by a well-defined arcuate carina; abdomen finely and densely punctured, the oblique lines deeply impressed, first segment with two sharply defined, longitudinal carinae at base, becoming obsolete on middle; venter piceous, ovipositor as long as abdomen. Length, 9 mm.

Male.—More slender than ♀; the metathorax above has two, more or less distinct, oblique carinae, and the anterior coxae are whitish. Length, 8 mm. (After Cresson.)

This parasite, which is said by Cresson to be a common species in New York, Delaware, Pennsylvania and West Virginia, was reared by Professor Riley in Missouri from a chrysalis of *Polygonia comma*.

FAMILY BRACONIDAE HALIDAY.

Genus MICRODUS Nees.

Maxillary palpi 5-jointed, labial 3-or 4-jointed. Face not produced or rostriform. Mesothorax distinctly trilobate. Mesopleura with a rugulose furrow. Three cubital areolets, the first confused with the praediscoidal (after Marshall).

Microdus sanctus (Say). Pl. 88, fig. 10.*Bassus sanctus* Say.

Body black; palpi tinged with piceous; thorax, pleura, pectus and the two anterior pairs of feet immaculate; wings blackish violaceous, with a hyaline literation in the middle; nervures black; separating nervure between the first cubital and the first discoidal cellules widely interrupted; second cellule triangular; cubital cellule rather large; metathorax and abdomen bright sanguineous, posterior coxae and thighs bright sanguineous, the intervening trochanter black; posterior tibiae dull sanguineous, their tips dusky, their tarsi blackish; ovipositor nearly as long as body, ferruginous with black valvules. Length, 7.5 mm. (After Say.)

Of this species I have seen two female specimens, one from *Pholisora catullus*, reared by Miss Murtfeldt at Kirkwood, Mo., (no date), and the other from *Thanaos juvenalis*, reared by Mr. Scudder, October, 1887, at Cambridge.

NOTE.—The remaining Braconidae, parasitic upon butterflies, belong to the subfamily Microgasterinae and have been treated at my request by Dr. Riley, and from this fact have been removed from this, their natural place, to the end of the chapter.

FAMILY CHALCIDIDAE WALKER.**Genus CHALCIS Fabricius.**

Antennae 13-jointed, short and stout, pubescent, inserted in the middle of the face, scape moderate, third joint minute; scutellum slightly bidentate; abdomen subpetiolated, pointed in the female, but not much produced, first segment about half its entire length; hind femora armed with large teeth. (After W. F. Kirby.)

Table of Species.

Hind femora black on the outer side.....**flavipes.**
Hind femora yellow on the outer side, with black marking.....**robusta.**

Chalcis flavipes Fabricius. Pl. 88, figs. 14, 15.*Chalcis ovata* Say.

Head black, with golden sericeous hair which is indistinct on the vertex; antennae testaceous beneath towards tip; thorax with dilated dense punctures, a little sericeous with golden hair; tegulae yellow; wings hyaline; nervures fuscous, at base yellowish; feet bright yellow; basal half of anterior pairs of thighs black; posterior thighs black with a yellow spot on the tip above, dentate along posterior edge; posterior tibiae piceous on basal incisure; terminal spine robust, shorter than the first tarsal joint; abdomen subovate, polished; first segment nearly glabrous, second segment hairy on each side; remaining segments hairy near their tips. Length, 5 mm. (After Say.)

I have previously recorded this parasite from *Chlorippe clyton* (See Bull. 5, Div. Ent., U. S. Dept. Agr., p. 8). It was reared by Professor Riley from pupae of *Agraulis vanillae* in Missouri, and it has also been sent me by Judge W. B. Thomas who reared it at Athens, Ga., from the same species. It was also reared from *Chlorippe clyton* by Professor Riley in Missouri.

***Chalcis robusta* Cresson.**

Black, clothed with a short, golden-yellow pubescence; head broader than the prothorax, the face, cheeks and occiput densely clothed with golden pubescence. Thorax closely and rather deeply punctured, opaque; scutellum somewhat produced behind, carinate at tip which is densely clothed with golden pubescence, as well as the extreme sides near the base; metathorax roughly rugose; tegulae bright yellow. Wings faintly tinged with pale fuscous. Legs, excepting the coxae, bright yellow; posterior coxae robust, polished; their femora much swollen, black within except near the tip, above and on the outside a large, oblique, black spot not reaching the upper margin, but confluent beneath with the black of the inside; in one specimen this spot is entire and not confluent beneath with the black of the inside, and the apical third within is yellow; lower margin armed with a row of nine or ten small, obtuse black teeth and a large obtuse one near the base; their tibiae curved, acute at tips; tarsi black at tips. Abdomen subsessile, robust, convex, ovate, sometimes faintly compressed and pointed at tip, smooth and polished, and the posterior margins of the apical segments more or less fringed with yellowish pubescence. Length, 6 mm. to 8 mm.; expanse of wings, 10-12 mm. (After Cresson.)

This large and handsome chalcid has been reared by Mr. H. G. Hubbard at Crescent City, Fla., from the chrysalis of *Heraclides crespontes*, from which it issued through a large hole in the thorax. It was originally described by Mr. Cresson from Cuba.

Genus *ENCYRTUS* Dalman.

Female.—Antennae 11-jointed, inserted not far from the border of the mouth, moderately thick, and, with the exception of the scape, very seldom compressed; the scape is often strongly broadened; the club is rounded, or with a slight oblique truncation at tip. The facial impression is rather large and often quite deep. The mesonotum is transversely arched, shagreened, and more or less lustrous; the scutellum shows a different sculpture. The wings are always developed and ciliated; the marginal vein is present, seldom very short; the stigmal is moderately long. The ovipositor is not so long as half the abdomen.

Male.—The flagellar joints are slightly or not at all compressed, and covered equally (not in half whorls) with hairs.

***Encyrtus montinus* Packard. Pl. 89, fig. 4.**

Female.—Scape of antennae somewhat broadened below near tip; pedicel cylindrical, twice as long as broad; first funicle joint longer than broad; succeeding joints increasing very slightly in width but not increasing in length; club nearly as long as preceding three funicle joints together, ovate, but little broader than sixth funicle joint. Fore wings cloudy, with a single, broad, clear band extending across the wing from just beyond the stigma to posterior border, curving slightly outwards; an oblique, hairless line also extends from the stigma across towards base of wing, and the course of one of the spurious veins is seen extending from the hairless line to the hyaline band. The mesonotum is very finely shagreened and is also covered with sparse, large punctures. The general color above is light metallic green; the head, pronotum, tegulae and tip of abdomen dull yellow; the whole body below and at sides dull yellow or testaceous; legs yellow, the hind thighs somewhat dusky above; antennal scape testaceous, pedicel and first four funicle joints yellowish brown with dark hairs, funicle joints five and six white with white hairs, club black with black hairs. Length, 2 mm.; expanse, 4 mm.

This description is drawn up from Mr. Sanborn's original specimen, which is a female, however, and not a male as Dr. Packard supposed, and from a captured female received from Mr. Scudder.

This species is a true *Encyrtus* and belongs to the *chalcostomus* group, approaching very closely to *E. lunatus* Dalm. It has no connection with *E. swederi* with which Dr. Packard compares it and which belongs to *Comys* Foerster. All of the *chalcostomus* group, including *lunatus*, are parasites of *Coccidae*, the only possible exceptions being *barbarus* and *rogenhoferi*, the habits of which are not known. Moreover, all are parasites of the genus *Lecanium*. All that we know of *E. montinus* is that it was "found alive in an old chrysalis case" of *Oeneis semidea* by Mr. Sanborn in the White Mountains, and there is nothing in this information to contradict the hypothesis that this specimen came from a *Lecanium*, perhaps on the same plant, and that its presence in the old chrysalis was purely accidental. It may be stated in further support of this view that no true *Encyrtus* is known in Europe to have been bred from a lepidopteron, and no species of the whole subfamily *Encyrtinae* from any Diurnal. *Encyrtus bucculatricis* Howard is the only American exception to the former rule. It is very probable, therefore, that *E. montinus* is not a butterfly parasite and I introduce the redescription for the reason only that it has been so considered by others. There is, however, still a bare possibility that it may yet turn out to be a parasite of the White Mountain species.

Genus COPIDOSOMA Ratzeburg.

Female.—The antennae arise near the border of the mouth; the scape is long and slender; the six-jointed funicle long and slender, or short and comparatively thicker; the club is either long, delicately bent and somewhat rounded at tip, or it is thicker and markedly obliquely truncate. This truncation is produced by the drying of a strip of more delicate membrane upon one side of the club. Front and vertex closely punctured, without larger deep punctures. The mesoscutum and often the scutellum have with most species a sculpture which was called by Ratzeburg "schuppig" (scaly), and also a thicker punctuation with round or aciculate punctures. The marginal vein is either lacking, or it is a little shorter than the stigmal. The wings are hyaline. The ovipositor is very long, but may also be entirely hidden.

Male.—The male resembles the female in the form of the body, in the punctuation, and also in the relative proportion of the wing veins, differing to a marked degree only in the antennae. These are given off near the border of the mouth as with the female; the scape is long and slender, the pedicel shorter than the first funicle joint; the funicle is rather thickly covered with short hairs (the hairs shorter than the joints), with the joints separated above more than below; the club is about as thick as the funicle. The base of the scutellum has a more or less delicate longitudinal carina, but no furrow.

Copidosoma turni (Packard). Pl. 89, fig. 5.

Encyrtus turni Packard.

Female.—Antennae short and curved; club large and strongly truncate obliquely from tip nearly to base; first funicle joint much shorter than pedicel and as thick as long; succeeding funicle joints widen to joint 6, which is considerably wider than long. Punctuation of face very delicate; mesoscutum delicately shagreened; mesoscutellum with a delicate scaly sculpture. Marginal vein of fore wings slightly shorter than the stigmal. Color: Head and mesoscutum bright metallic green or blue, sometimes head appearing blue and scutum green; pronotum and mesoscutellum copper-bronze; ab-

domen shining black with metallic green and blue reflections; antennae dark brown; all coxae dark with metallic reflections; all femora dark brown, the hind pair slightly metallic; all tibiae brownish for a little more than basal half, tip honey-yellow; all tarsi and tibial claws yellow. Length, 2 mm.; expanse, 3.9 mm.

Male.—Agrees with female in all characters mentioned except antennae. These arise in a deep groove half way between eyes and border of mouth. The scape is short, reaching only to middle of eyes; pedicel slightly shorter than first funicle joint; remaining funicle joints all subequal in length and width, with short hairs, and well separated from above; club consists of two joints, similar to funicle joints, easily distinguished, the last one rounded at tip. Color of the antennae, honey-yellow throughout.

The series of specimens of this species studied consists of seven females and one male, all obtained by E. Norton from *Jasoniades glaucus*. Most of the species of *Copidosoma* which I have studied infest small lepidopterous larvae, which they inflate upon pupating, giving to the caterpillar skin a swollen appearance, frequently stretching it until the cells of the little parasite can plainly be seen. In the absence of any notes concerning Mr. Norton's experience, I imagine that his specimens were reared from a *glaucus* larva which was not more than half grown.

GENUS *PTEROMALUS* Swederus.

Mandibles 4-dentate, the left rarely 3-dentate; cheeks often compressed; clypeus emarginate in middle; eyes sometimes hairy; antennae usually inserted slightly below middle of face upon a convex, slightly protruding portion; scape not short, ring-joints distinct, club not stylate. Thorax compact, not elongate; metanotum usually punctulate, spiracles rarely large. Wings with the stigmal vein usually shorter than the postmarginal, or equal to it in length; marginal not thickened; usually (always in male) immaculate. Abdomen often rotund; venter in male rarely with a straight fold. Posterior coxae broadly ovate, not pubescent at posterior base. (After Thomson.)

Table of Species.

Clypeus 2-dentate in middle.....	chionobae.
Clypeus not 2-dentate.	
Femora of female honey-yellow.....	archippi.
Femora of female brown, somewhat metallic.....	puparum.

***Pteromalus chionobae* sp. nov.**

Female.—Clypeus 2-dentate in middle at apex; antennae inserted somewhat below middle of face, scape reaches to anterior ocellus; flagellum well clothed with short white pile; facial impression well-marked; eyes smooth; metanotum with a strong and complete median carina, spiracles small, spiracular sulcus plain, but not reaching to acetabulum, neck punctate, border of acetabulum smooth, with a row of deep shallow punctures just above it. Postmarginal vein equal to stigmal in length, speculum small. Head and thorax densely punctulate; abdomen smooth, ovate, concave above. Color bronzy green; scape honey-yellow; pedicel below honey-yellow; femora brown, tibiae and tarsi lighter towards tip. Length, 3 mm.; expanse, 5.5 mm.

Two female specimens of this species were reared by Mr. Scudder in August, 1887, from a chrysalis of *Oeneis semidea*. The chrysalis was carefully dissected, but no more parasites could be found.

Pteromalus puparum Linnaeus. Pl. 89, figs. 1, 2.

Female.—Head a little broader than the abdomen, subtransverse, greenish bronze, closely punctate, slightly narrowing behind the eyes, vertex emarginate in middle; ocelli quite large, placed in a triangle; face quite flat, antennal grooves scarcely showing, cheeks quite long, convex, slightly compressed; eyes subovate, subconvex; clypeus emarginate at apex in the middle; mandibles armed with four acute teeth, apical one externally sinuate; antennae long, filiform, inserted in the middle of the face, bases close together, brown or fuscous, scape linear, yellow, joint 2 oblong, 3 small but distinct, 4 a little larger than 3, 5-10 equal in width but growing slightly shorter, club conico-elongate. Thorax moderately robust, above slightly convex, almost smooth, very closely squamoso-punctate; metanotum quite long, very punctate, nucha almost globose, no median carina, but strong, arcuate, lateral folds, spiracles not small, suboval, situate in the spiracular sulcus just behind the suture. Wings hyaline, subcostal cell broad, marginal vein delicate, longer than stigmal and a little shorter than postmarginal. Abdomen ovate, flat above, below slightly convex, sides rounded, a little shorter than thorax, considerably broader, joint 1 dark blue, not transverse but hidden in nucha. Coxae green, femora fuscous bronze, tibiae occasionally concolorous. Mesopleura delicately punctate.

Male.—Differs from female in its thinner, more strongly pilose antennae, oblong abdomen, aureus above, head broader than thorax, green, femora and tibiae always yellow. Length, 3 to 4 mm. (After Thomson.)

This insect is common to Europe and North America, and is the commonest parasite of *Pieris rapae*. It has also been reared from *Eurymus philodice* by Mr. Lyman, from *Eurema lisa* by Mr. Mundt, from *Agraulis vanillae* by Professor Riley, from *Polygonia satyrus* by Mr. W. H. Edwards, from *Euvanessa antiopa* by Mr. Ashmead, from *Vanessa atalanta* by Mr. Lyman, from *V. cardui* by Mr. Scudder, from *Basilarchia archippus* by Mr. Scudder, and has been caught ovipositing upon an *Epargyreus tityrus* larva by Professor Riley.

Pteromalus vanessae Harris. Pl. 89, fig. 3.

Dr. Harris' types of this species, I am informed by Mr. Henshaw, are not contained in the Harris collections at the Boston Society of Natural History, and as I know of no authentic description of the species, I am obliged to take it for granted, as Dr. Packard evidently did, that the *Pteromalus* commonly reared from *Euvanessa antiopa* and *Polygonia interrogationis* at the north is the one to which Harris gave this name.

I am unable, after close examination of the specimens reared from these butterflies, to satisfactorily distinguish them structurally from *puparum*, and am reluctantly compelled to consider for the present that *vanessae* is but a variety of *puparum*. The specimens in my possession reared from *antiopa* and *interrogationis* are at least a fourth larger than the largest females reared from *Pieris rapae*, and will average darker in color. I have no males reared from either of these butterflies, but males of the large form reared from *Heraclides cresphontes* resemble in all respects males reared from *rapae*.

Specimens of this form have been reared as follows: from *Heraclides crespontes* by W. H. Edwards, A. H. Mundt and Professor Riley; from *Euphocades palamedes* by Professor Riley; from *Ascia monuste* by Professor Riley; from *Polygonia comma* by myself; from *Evanessa antiopa* by many observers; from *Polygonia interrogationis* by many observers.

***Pteromalus archippi* sp. nov. Pl. 89, fig 3.**

Female.—Resembles in size and coloration *P. puparum* var. *vanessae*, except that all femora are honey-yellow, instead of dark brown or metallic. The punctation of the notum is deeper and closer and is identical on all segments. The nucha of the metanotum is scarcely elevated and is not at all globose; the median carina is faintly indicated, and the spiracular sulci are very deep, much curved and reach about half way to the acetabulum.

Described from three female specimens sent by Prof. A. J. Cook to Professor Riley, and reared September 13, 1887, from a chrysalis of *Anosia plexippus*. A note concerning the rearing has been published by Mr. C. P. Gillette in the *Canadian Entomologist* for July, 1888 (p. 133), in which he states that over fifty specimens of the parasite issued on the above date from a single chrysalis of *plexippus*.

GENUS DEROSTENUS Westwood.

Face usually sunken after death; vertex rarely acute, smooth; eyes large, usually hairy, usually emarginate interiorly; antennal grooves often furcate, sending a branch to the inner side of each orbit. Antennae inserted below middle of face; scape wholly or partly pale; ring joint usually distinct; funicle 3-jointed; club rarely two-jointed with both sexes. Pronotum plain, anterior margin acute; parapsidal sutures indistinct; sculpture faint, rarely subsquamous; metanotum often carinate. Wings ample, subcuneiform; costa longer than marginal; stigmal short, postmarginal usually longer, but rarely absent.

***Derostenus antiopae* (Packard). Pl. 89, fig. 7.**

Entedon antiopae Packard.

Male.—Postmarginal vein distinct. Scutellum with no median groove. Abdomen rotund, with a very short petiole. Scape of antennae long, cylindrical; flagellum with short hairs. Eyes slightly emarginate, not hairy. General color shining black; antennae with brown club and funicle, scape, pedicel and ring-joint yellow; all legs yellow (coxae cannot be seen); metanotum and petiole yellow-brown. Length, 1.6 mm.

The only specimen of this parasite known is a male. It is in poor condition and very dusty, and is glued firmly to a large card. It is marked "477," and is said to be from the old Harris collection. As its specific name indicates, it was reared from *Evanessa antiopa*.

GENUS CIRROSPILUS Westwood.

Head transverse; vertex not broad; eyes sparsely pubescent; genal sulcus distinct; clypeus not denticulate at apex; antennae inserted far below middle of face, distant at base, funicle 2-jointed, club 3-jointed. Thorax subdepressed above, pronotum not

short but transverse; mesonotum deusely minutely puuctate, and with deep sulci, continuons with the lines of the scutellum; scutellum depressed, with dorsal lines slightly converging towards apex; postscutellum large; metanotum not short, median carina distinct; costal cell of fore wings moderately broad, submarginal vein with five to six bristles. Abdomen subsessile, ovate, depressed above, hardly convex below. Mesopleura well separated, smooth. Posterior tibiae 1-spurred, coxae granulate externally. Body usually metallic and with pale markings.

***Cirrospilus niger* sp. nov.**

Female.—Shining black, with black bristles. Antennae yellowish below; all legs, including coxae, honey-yellow; abdomen yellowish below at base. Posterior border of pronotum perfectly smooth; anterior border of pronotum, all of mesoscutum and scutellum finely shagreened; metanotum without sculpture, with a very fine median, longitudinal suture through its anterior portion, and a corresponding carina through its posterior portion; spiracles of this segment perfectly round, prominent, lateral fringe of hairs white and strong. Abdomen lozenge-shape or nearly round, as broad as thorax, but much shorter. Length, 1.5 mm.; expanse, 3.25 mm.; greatest width of fore wing, .58 mm.

Male.—Differs from female in following respects: Abdomen long oval, considerably narrower in front, nearly as long as thorax and quite as wide, the first segment above bearing a large, light-brown, circular spot; all coxae shining black; hind femora black above, this color extending downwards at middle; front femora slightly dusky towards base above. Length, 1.6 mm.; expanse, 3.25 mm.; greatest width of fore wing, .49 mm.

A large number of both sexes of this species were reared by Mr. Scudder from the "tomb-stone" pupae of some unreared *Eulophus*, which had previously destroyed the half grown larva of *Vanessa atalanta*. It is, therefore, a hyperparasite.

GENUS TETRASTICHUS Haliday.

Head with a distinct genal sulcus; clypeus bidentate at middle of apex; ocelli usually placed in a curved line; eyes smooth or rarely pilose, ovate or subrotund; vertex narrow; impressed line before the ocelli usually distinct; antennae usually inserted a trifle below the middle of the face; scape very rarely reaching above the ocelli; ring-joint very small but easily seen, rarely conforming with the joints of the funicle; funicle 3-jointed; club 3-jointed, the last joint smaller, often setigerous. Pronotum with the posterior border, especially on the sides, hairy. Mesoscutellum with four bristles behind the middle, usually with two parallel, longitudinal, deeply impressed lines. Metanotum usually short, rarely punctulate; apex in the middle not produced, but angularly emarginate; often carinate; fimbriate border with 1 to 4 bristles. Wings clear; costa longer than marginal; no postmarginal; stigmal quite long, club distinct, unicus conspicuous; submarginal with 1 to 5 bristles. Abdomen ovate or conico-triangular; terebra rarely much exerted. Posterior tibiae 1-spurred, tarsi shorter than tibiae with joints subequal in length. Male antennae rarely with erect hairs, usually with long appressed hairs; ring-joint always distinct, usually transverse (adapted from Thomson).

Table of Species.

Mesoscutum with an impressed, median, longitudinal line.

Antennae inserted just above clypeus.....*semideae*.

Antennae inserted considerably above clypeus.

Wing veins pale.....*saundersii*.

Wing veins dark.....*theclae*.

Mesoscutum with no impressed line.....*modestus*.

Tetrastichus semideae (Packard).

Eulophus semideae Packard.

Male, female. — Antennae inserted slightly above clypeus. Mesoscutum with an impressed, median, longitudinal line. Mesocutellum with two parallel, impressed, longitudinal lines. Flagellum of male antennae with many long appressed hairs. Abdomen of female a little longer than thorax and about as broad, rounding out to joint 3 which is broadest, and thence, with straight sides, tapering to an acute point; the whole abdomen flattened and usually tilted upwards. Abdomen of male shorter and narrower than thorax, flattened and sub-oval. General color bluish green; antennae brown, darker in male than in female; all tibiae and tarsi honey-yellow; all coxae dark brown, yellowish at tips; front femora dark metallic except at tips; middle and hind femora dark brown except at tips. Length, 1.85 mm.; expanse, 3 mm.

This species has been reared in considerable number, from *Oeneis semidea* by Mr. Scudder who has sent me a goodly series.

Tetrastichus saundersii (Packard).

Eulophus saundersii Packard.

Of this species of Dr. Packard's there remain but three greatly mutilated specimens. The antennae of all are gone and all are pinned with large pins through the thorax so as to destroy the characters. The species from the wings does not belong to the *Eulophinae* but to the *Tetrastichinae*, and may provisionally to be placed in *Tetrastichus*. There is no hope of a proper placing of this species until it is reared once more. The best we can do is to reproduce Dr. Packard's original description:

Three females. A minute species compared with *semideae*, but otherwise closely allied to it in structure and color; the abdomen, however, is considerably shorter and thicker, being scarcely longer than the thorax, while in *semideae* it is as long as head and thorax together. Antennae of the same form as in *semideae* but much shorter, the joints between the second and the club being longer than broad, while in *semideae* they are twice as long as thick; they are brown and hairy. Wings much as in *semideae*, but the veins are much paler, less distinct. Legs colored much as in *semideae*. Trochanters brown, femora brown, pale at base, and whitish at tip; tibiae and tarsi white, except tarsal joints which are pale brown. Abdomen, like the rest of the body, deep blue with a greenish tinge, much shorter than in *semideae* and conical ovate, the tip not being at all produced. The body is smooth with very fine hairs. Length, 1 mm.

These specimens were reared by Mr. Saunders in Ontario from a chrysalis of a *Thecla* presumed to be *edwardsii*.

Tetrastichus theclae (Packard). Pl. 89, fig. 6.

Eulophus theclae Packard.

Male. — Antennae inserted considerably above clypeus. Mesoscutum with median longitudinal sulcus. Mesocutellum with two distinct, parallel, longitudinal sulci. Submarginal vein with two bristles. Antennal scape not reaching to the eyes. Abdomen broadly ovate, as long as thorax but considerably broader. General color very dark metallic blue-black; antennae brown with whitish pile; legs with all femora and coxae blue-black; all tibiae and tarsi yellowish white; last tarsal joint dusky. Length, 1.28 mm.; expanse, 3 mm.

Of this species I have seen 12 males all reared from chrysalis of *Thecla calanus*, presumably by Mr. Scudder.

Tetrastichus modestus sp. nov.

Female.—Smooth, no perceptible punctation. Antennae arise slightly above clypeus; scape reaches a little more than half way to top of eyes; flagellum, usually bent upon scape, reaches slightly below mouth; flagellum and especially club quite hairy. Mesoscutum with no median longitudinal sulcus; mesoscutellum with usual sulci; submarginal vein with two strong bristles. Abdomen rather longer than thorax, but not as broad, narrowly ovate in form. General color shining black, with very slight greenish reflections; antennae brown, with whitish pile; wing veins very light brown; all coxae, femora and tibiae dark brown, the coxae and femora sometimes black and glistening; femero-tibial articulations and tips of all tibiae yellowish white; all tarsi yellowish white. Length, 1 mm.; expanse, 2.4 mm.

Male.—Differs from female only in having a slightly longer scape, and longer, more hairy flagellum.

Described from four female, six male specimens reared by Mr. W. H. Edwards at Coalburgh, W. Va., from cocoons of *Apanteles edwardsii* Riley, spun by larvae which had issued from *Vanessa atalanta*, and from *Apanteles* cocoons, the adults of which have not been bred, but which were spun by larvae which issued from the larvae of *Polygonia interrogationis*.

All of these species of *Tetrastichus* are secondary parasites. No *Tetrastichus*, so far as known, is a primary parasite. The real host of none of Dr. Packard's is known. That of *modestus* is as indicated.

GENUS TRICHOGRAMMA Westwood.

Tarsi 3-jointed; front wings with regular rows of hairs, submarginal vein reaches costa, and, with marginal and stigmal, forms a regular arch; antennae 8-jointed—scape, pedicel, ring-joint, funicle (2), club (3)—; ring-joint very minute; funicle joints in female small and subequal in length and width; club large, obliquely truncate at tip. In the male the funicle joints are much larger and the club is of same width, tapering gradually to rounded tip.

Four described North American species, and a number of undescribed species have been examined, but it seems impossible to find structural characters of specific value. Certain series of individuals can be distinguished by color, and by color alone, and for convenience those reared from butterfly eggs are grouped into the following species. The specimens should be mounted in balsam and should be studied with a dark background and reflected light, as the dusky tints are mainly lost with transmitted light. If mounted dry upon tags, these delicate insects shrivel to such an extent that they are useless for study.

Table of Species.

Color dark brown.....	minutum.
Color pale honey-yellow.....	minutissimum.
Face bright yellow; abdomen and legs dusky yellow.....	intermedium.

Trichogramma minutum Riley.

I have been unable to find recognizable specimens of this species. Specimens preserved by Professor Riley, between two flakes of isinglass,

are spoiled. Structurally it is identical with the other forms. Coloration—ally it was described by Professor Riley in the following words: "It is inconspicuously marked, the body being dark brown, with the antennae and legs pale, and the wings iridescent.

The species was figured and described in the Third Report on the Insects of Missouri, p. 157, from specimens reared from the eggs of *Basilarchia archippus* in Missouri. From four to six parasites issued from each egg.

***Trichogramma minutissimum* Packard.**

Body uniformly pale testaceous or honey-yellow, legs and antennae scarcely paler than the body. Abdomen a little longer than the thorax, but no wider, seen from above. Antennae a little longer than in *minutum*, legs a little slenderer. Length, ♂ .25 mm. to .37 mm.; ♀, .38 mm.-.5 mm. (After Packard.)

[The following description of the colors was taken during life:—Body and head wax-yellow; face a little paler; eyes and ocelli dark orange; body with yellow-green internal blotches appearing through the skin; legs and antennae pale yellow, apical half of tarsi a little dusky. s. n. s.]

In the material sent me by Mr. Scudder I find eight slides of this species, three labelled from eggs of *Jasoniades glaucus*, three from eggs of *Basilarchia archippus*, and two from eggs of *Vanessa atalanta*.

***Trichogramma intermedium* sp. nov. Pl. 89, fig. 8.**

Male.—General color dirty yellow in effect; face bright yellow, eyes and ocelli red, antennae slightly dusky; mesonotum very light yellow-gray; metanotum yellow; abdomen above slightly darker than mesonotum; all coxae dusky, hind femora slightly dusky above, remainder of legs dull yellowish. Wings with a slight cloud below submarginal vein. The nearly straight line of hairs running downwards from tip of stigma consists of five hairs, the first one sometimes included in stigmal club, leaving only four apparent in the row. Average length, .55 mm.; average expanse, 1.0 mm.

Female.—Slightly smaller, and not quite so dark as male.

[The following description of the colors was taken during life: Honey-yellow, the abdomen pale and banded transversely with dusky; eyes and ocelli salmon-red; legs and antennae greenish olive; apical two-fifths of tarsi fuscous. s. n. s.]

Of this species Mr. Scudder has sent me six slides, four containing specimens reared from eggs of *Aglais milberti*, and two from eggs of *Thanaos lucilius*. Mr. James Fletcher has since sent me from Ottawa four specimens reared during the summer of 1888, from eggs of *Oeneis macounii*.

FAMILY PROCTOTRUPIDAE STEPHENS.

GENUS TELENOMUS Haliday.

Small, black, compact; abdomen acutely margined along the sides; antennae arising near the border of the mouth; anterior tibiae with one spur; anterior wings with a marginal and a stigmal vein; antennal club jointed; marginal vein shorter than stigmal; second abdominal segment longest; maxillary palpi 2-jointed; mandibles arcuate, slightly bidentate at apex.

Table of Species.

Male abdomen only three-fourths as long as thorax.....**graptae**.
 Male abdomen nearly or quite as long as thorax.....**rileyi**.

Telenomus graptae sp. nov. Pl. 89, fig. 9.

Male.—The nine funicle joints of the antennae are beaded and well separated, all joints subequal in width, joints 4 to 9 nearly as broad as long, joint 2 longest, joints 1 and 3 subequal, both shorter than 2, and longer than 4 to 9; club shorter than two preceding joints together, conical, sharply pointed. Thorax much arched and very finely pilose. Abdomen three-fourths as long as thorax. Color dark brown, nearly black, the abdomen darker than head or thorax; antennae uniform dark brown; all coxae and femora dark brown; front tibiae light brown, middle and hind tibiae dark brown; all tarsi dark honey-yellow; wing veins brown, well marked. Length, .875 mm.; expanse, 2.3 mm.

Female.—Differs from male only in antennae, in which the last three flagellar joints form a large club, the three joints well separated, and the last slightly obliquely truncate. From the basal joint of the club the funicle joints taper down in size for three joints.

Described from one male and one female. The male was reared by Mr. Scudder from an egg of *Polygonia progne*, and the female was captured June 15, by Mr. C. W. Woodworth on the White Mountains while in the act of ovipositing in an egg of *Euvanessa antiopa*. Both specimens are poorly mounted in balsam, and the characters are difficult to observe. Mr. Scudder has also sent a slide containing a single female *Telenomus*, which I hesitate, on account of its poor condition, to separate from this species. It was reared from an egg of *Heodes hypophlaeas*.

Since this description was written I have received another female from Mr. Scudder, which I cannot separate from this species and which was reared from the egg of *Limochares taumas* collected at Nepigon by Mr. Scudder in the summer of 1888. A single female was also reared from an egg of *Polygonia interrogationis* at Washington, August 6, 1887.

Telenomus rileyi sp. nov.

Male.—Proportions of funicle joints much as in *graptae*; club more oval and less acutely pointed; joints 1 and 2 of funicle much more constricted at base than at apex. Thorax somewhat less highly arched than in *graptae*. Abdomen nearly or quite as long as thorax. Pile of thorax not distinguishable under a moderate power. Color black, abdomen highly polished; scape and pedicel of antennae bright honey-yellow; joints of funicle yellow below, dusky above, last three joints (club) dark brown; all legs, including coxae, bright yellow, verging upon orange. Wing veins faint, dusky. Length, .72 mm.; expanse, 1.8 mm.

Described from three males reared by Professor Riley from eggs of *Chlorippe clyton* in Missouri.

FAMILY BRACONIDAE.

SUBFAMILY MICROGASTERINAE.

BY C. V. RILEY.

It is difficult to properly consider the Microgasters affecting the larvae of New England Rhopalocera without a careful revision of the whole group; but, at Mr. Howard's request, I have prepared the following notes which may not be without interest.

In the "Notes on North American Microgasters" (Trans. Acad. Sc. St. Louis, Vol. iv, No. 2, April, 1881) I have shown that the species are more variable than had been up to that time supposed, and that even in the manner of forming their cocoons, as well as in the character of the cocoons, there may be considerable variation in the same species. A large amount of additional material obtained since the publication of that paper, and in most cases connected with the host, has served to complicate the whole question of species, so that their delimitation becomes at times almost impossible. In short, a careful study of this group, as of most other groups well and fully represented, confirms the idea of the non-existence of species as such in nature, and renders it almost as easy to make a continuous series as to make well marked divisions. On the present occasion, however, it is not necessary to enter into a consideration of this general subject of species, except in so far as to warn the reader that the species here treated of are characterized as such more for convenience than anything else; that if I have avoided a strong disposition to lump and combine forms hitherto considered good species, it is purely to assist in recognizing the alliances; and that the average characters of assemblages rather than individual characters have been utilized.

In the terminology of parts there is need of greater precision than American authors, including myself, have hitherto employed; but I have often used scutellum for the prominent triangular piece, strictly the meso-scutellum; and postscutellum when including the more critically differentiated mesopostscutellum, metapraescutum and metascutum, as the characteristic fovea usually extends across this last. Metascutellum is used for the larger piece, which I have heretofore called the metanotum. In the genus *Apanteles* I have begun with *glomeratus*, making the description of this species most full, for obvious reasons and for purposes of comparison.

The group is a difficult one on account of the monotony of the coloring

and slight structural variations. Ordinarily there are no striking secondary sexual characters, the male being on the average somewhat the smaller.

Where not otherwise stated, the rearing has been done by myself.

GENUS APANTELES Foerster.

Maxillary palpi 5-, labial 3-jointed. Antennae 18-jointed. Eyes villose. Mesopleurae impressed with a smooth fovea. Abdomen sessile; suturiform articulation distinct. Radius of fore wings subobsolete; 2 cubital areolets, the 2d being open on the outer side, and thus confused with the 3d. Spurs of the hind tibiae never much shorter than $\frac{1}{2}$ the metatarsus. (After Marshall.)

Table of Species.

- Ovipositor long, as long as abdomen.
 - First abdominal tergite, sculptured above.....**megathymi. 3.**
 - First and second and base of third tergites sculptured.....**edwardsii. 2.**
- Ovipositor short, much shorter than abdomen.
 - First and second and more or less of third tergites sculptured.
 - Third tergite sculptured only at base.
 - All coxae black (entirely).
 - All femora partially black.
 - Face with distinct tubercle.....**koebeleri. 8.**
 - Face without tubercle.....**limenitidis. 4.**
 - All femora reddish, tips of hind femora blackish.
 - Face with a minute tubercle.....**lunatus. 5.**
 - Face without tubercle.....**argynnidis. 7.**
 - All coxae more or less reddish.
 - Face without tubercle.....**flavicornis. 9.**
 - Face with a distinct median tubercle.....**emarginatus. 10.**
 - Third tergite entirely sculptured.....**cyaniridis. 6.**
 - First and second tergites, only, sculptured.
 - Anterior and middle coxae yellow.....**glomeratus. 1.**
 - All coxae black.
 - More or less of all legs black.
 - Metascutellum with a slight median longitudinal ridge.....**theclae. 11.**
 - Metascutellum with no such ridge.
 - First tergite narrow behind.....**junoniae. 12.**
 - First tergite nearly as broad behind as base of second....**carduicola. 13.**
 - All legs yellow except coxae.
 - Punctuation of second tergite confined to borders.....**atalantae. 14.**
 - Second tergite closely punctate.....**pholisora. 15.**
 - All tergites polished.....**cassianus. 16.**

1. *Apanteles glomeratus* (Linn.). Pl. 88, fig. 12.

Microgaster pieridis Pack.

Apanteles pieridivora Riley.

Parasitic on *Pieris rapae* and *P. oleracea*.

Up to the publication of my paper already alluded to, it was not definitely known that this species occurred in North America, and I have already recorded (Ann. Rept. Entom., Dept. Agr., 1884, p. 323) the success of my efforts to colonize the species at Washington from cocoons received from Mr. G. C. Bignell of Plymouth, England, earlier attempts

which I made having failed. The importance of the introduction of this, one of the commonest parasites of *Pieris rapae* in Europe, and the interest attaching to it justified the trial. But for the last few years I have received many specimens, particularly from different parts of this country, of a *Microgaster* bred from *Pieris rapae* which bore a suspicious resemblance to the European *glomeratus*. The material before me includes, 1st: (from Europe) a perfect female which was received in 1879 by Mr. Howard from Dr. Gustav Mayr of Vienna; a large series in my own collection in the National Museum reared from the cocoons received from Mr. Bignell from England; other specimens descended from these last and reared in the District of Columbia, and two bunches of cocoons from Mr. Seudder collected in Europe in 1872; 2d: (reared from *Pieris rapae* in the United States) specimens from Prof. J. A. Lintner of Albany, N. Y., Mr. G. Haley of Brownfield, Me., Mr. E. W. Allis of Adrian, Mich., Prof. A. J. Cook of Lansing, Mich. and Mr. W. B. Alwood of Columbus, O., and finally four authoritative specimens of *Microgaster pieridis* (Pack.).

A careful study of all these specimens makes it impossible to separate the American bred forms from the European, from which fact it would seem evident that other importations must have taken place of late years besides that purposely made which I have already referred to. Indeed, as we shall see in considering the common and wide-spread *congregatus* (Say), one would be perfectly justified in looking upon it as an American representative of *glomeratus*, and while its different habit, and the slight differences which I point out make it possible and desirable to keep them under distinct specific names, yet the differences might with perhaps equal propriety be regarded as varietal, especially as *atalantae* is intermediate between them.

Thus it becomes in a measure a matter of mere speculation as to whether the more typical *glomeratus* in America is an entomophagic derivative of *congregatus* modified from breeding again in *Pieris rapae* or whether it represents earlier importations from Europe. We must not wonder at this difficulty in separating specifically allied European and American insects, when zoölogists are yet discussing the specific relations of many of the higher animals common to both countries, and opinions differ among the most competent to express them. In this country *glomeratus*, so far as the material indicates, is confined to *P. rapae*, while in Europe it is reared not only from the larva of this butterfly, but also from that of *Mancipium brassicae* and other species.

Length of body, ♀, 2.6—3 mm. Color black. Pilosity of head and thorax quite marked and white. *Head* with the punctation very fine, tolerably dense, but less so on the polished face and clypeus; a deep puncture or fovea each side at apex of the clypeus; *face* with two more or less well defined, slender carinae diverging from the base of the antennae forward, the space between them generally depressed, and in some cases short striae diverging from the carinae; eyes brown; mandibles either pale brownish or

honey-yellow; antennae black, the lower side of the basal joint and base of the flagellum often brownish; palpi from pale testaceous to quite yellow: *mesothorax coarsely punctate, polished and sparsely pubescent*; median carinae of metanotum complete but faint; scutellum polished, sparsely punctate; postscutellum very narrow, almost linear, with a central more or less circular, sometimes almost square fovea, having a central, longitudinal carina thickened at base; metascutellum rather coarsely and densely rugose, with a (generally) well defined, slender, median carina; tegulae brownish to black; wing venation normal; costa, stigma and radial vein quite dark brown, though occasionally lighter, the other veins paler; curve of radial vein more or less variable, sometimes quite angular; legs honey-yellow; posterior coxae black, sometimes brownish beneath, the others rarely brownish; tip of posterior tibiae either black or dusky or concolorous; hind tarsi generally dusky. *Abdomen* black, the two basal joints closely punctate, sometimes slightly rugoso-punctate; the first joint longer than broad, narrowest at base, gradually broadening posteriorly, the base deeply concave and highly polished, and the apical angles generally somewhat rounded; a more or less well defined, median carina on the second joint; lateral margin of both and generally of the third, honey-yellow to reddish, this color extending ventrally over the whole of two and sometimes of all three joints; rest of abdomen black, highly polished and with sparse and slender white hairs, arranged dorsally in one irregular row to each joint; ovipositor but slightly extending beyond tip—often entirely hidden from above according as it is extended or drawn up.

♂. Not separable except by the sexual differences common to the group.

The coloration of the legs as well as of the basal abdominal joints varies, the coxae being sometimes concolorous, i. e., all dusky and the femora exceptionally having no duskiness. The mandibles vary from yellowish-red to piceous. Described from some 150 specimens.

In the most complete European description at hand (Nees ab Esenbeck, Hym. Ichn. Aff., i, 181, 1834) the basal joint of the abdomen is made to form a rectangulum, due to the fact that the narrowing, highly polished base is generally hidden beneath the metascutellum, while the typical form accords more with our exceptional specimens having unicolorous femora. None of the specimens before me have the yellowish or reddish color on basal abdominal joints so broadened dorsally as to appear rufous with two large, black spots as described by Nees for the male.

The cocoons are formed in irregular masses of about 20-100 or more. They are ovoid and vary in color from very pale yellow to bright sulphur-yellow, the loose external and combining threads being generally the deeper in color, and the American specimens, as a rule, paler than the European. Nees describes them as pale testaceous. The color not only varies slightly but will depend upon the amount of exposure to bleaching weather.

I have pointed out (Am. Nat., 1882, p. 679) that Dr. Packard's name *pieridis* is preoccupied in the same genus and that his species was to be looked upon as a variety of *congregatus*. I therefore proposed the varietal name *pieridivora* for it.

The four specimens at hand, as also his description (Proc. Bost. Soc. Nat. Hist., xxi, 1880-2, p. 26), so far as it goes, agree well with glomer-

atus, and should now be considered synonymous with this last rather than a variety of *congregatus*, as I was inclined to place it prior to the study of *glomeratus*.

***Apanteles congregatus* (Say).**

Parasitic on various Sphingidae.

This species, as I have shown, (op. cit.) is extremely variable, having several entomophagic varieties which most authors would perhaps look upon as good species. It has not been reared from any of the Rhopalocera and is referred to here because of its close relationship to *glomeratus*; from which in its more typical form, it may be distinguished by the following characters:

More generally hairy. Face less polished, densely punctate and in place of the diverging carinae, a small, polished tubercle near and between the bases of antecunae and sometimes a faint indication of a median carina. Mesoscutum less polished, rather densely punctate and more pubescent; metascutellum with the lateral and posterior carinae more sharply defined and a median carina more often indicated. Legs more often concolorous and rarely with tips of femora and of tibiae dusky and still more rarely black. Wings with a rather darker tinge.

2. *Apanteles edwardsii* n. sp.

Parasitic on *Vanessa atalanta*.

Average length, 2.6 mm. ♀: Color black. Legs pale yellowish-brown. Pilosity sparse and white. *Head*: face with a more or less distinct carina; antennae piceous; palpi very light yellow. *Thorax*: metascutellum without carina but with posterior angles and slight elevation at middle of hind border rather distinct and polished; scutellum sparsely punctate and not more polished than the rest of thorax; tegulae light honey-yellow; wings normal, stigma and costa piceous, veins paler; radial vein angulated a little beyond middle; legs with all coxae and all trochanters honey-yellow; front and middle femora, tibiae and tarsi honey-yellow; hind femora honey-yellow, dusky at tip; hind tibiae honey-yellow, nearly black at tip; hind tarsi brownish. *Abdomen*: joint 1 with a longitudinal oval median fovea not extending to joint 2; joint 1 narrow, emarginate behind, side pieces piceous-brown; joint 2 transverse, broader than 1 and thrice as broad as long, the hind wider than anterior border; both 1 and 2 strongly punctate, 3 but slightly so at anterior border; ovipositor exerted, very long, extending more than the whole length of the abdomen, and yellowish-brown.

Approaches closely *A. cacoeciae* (Riley).

The cocoons are elongate, dense, pure white or varying to a dingy white, with scarcely any loose silk. The species has only been bred from young larvae.

Described from four females reared from *atalanta* by Mr. William H. Edwards.

3. *Apanteles megathymi* Riley.

Parasitic upon *Megathymus yuccae*.

I repeat here the description already published (Notes, etc., pp. 9-10).

Apanteles megathymi, n. sp. Length of body, 3 mm, ♂ ♀. Black; palpi whitish, antennae piceous; legs red, the coxae, and in the males the posterior femora and tarsi and the tips of the posterior tibiae, black or piceous, in the females the tips of posterior tibiae and the posterior tarsi dusky; wings, including the stigma, hyaline; tegulae and nervures white, the costa and the outline of the stigma testaceous. Mesonotum closely punctate, the punctures tending to unite to form striae, opaque, the scutellum polished, sparsely punctate; metathorax finely reticulate, divided into larger areas by regular ridges, two of these ridges enclosing a median ovate-lanceolate area, there being no median carina. Abdomen as long as the thorax, narrowing towards base; basal joint, excluding the less chitinized sides, longer than broad, and longer than the second and third joints taken together, delicately sculptured and with some scattered punctures of larger size; remainder of the abdomen smooth; second joint very short, separated from the third by a deep, but very narrow groove; the third joint twice as long as the second. The ovipositor is exerted and as long as the abdomen. The vein from the stigma forms with the basal vein of the areolet only a slight curve.

Described from many specimens bred from larvae of *Megathymus yuccae* received from South Carolina. The cocoons are spun in white masses, filling the silk-lined burrows of the Yucca-borer. The flies appear in April shortly after the time of appearance of the butterfly, and are more or less powdered with the waxy secretion of the caterpillar.

4. *Apanteles limenitidis* Riley.

Microgaster limenitidis Riley; Third *chae* Riley; Notes on N. A. Microgasters, p. 13.
Rept. Ins. Mo., p. 158. *Apanteles limenitidis* Riley; Packard,
Apanteles limenitidis Riley, form *flavicon-* Proc. Bost. Soc. Nat. Hist.

Parasitic on *Basilarchia archippus*.

This parasite commonly infests the last brood of larvae of *Basilarchia archippus* in Missouri, and as my original description was rather general, I have drawn up a more full characterization:

Average length ♂, 2 mm.; ♀ 2.5 mm. Color piceous-black with white pubescence. *Head*: with a perceptible but very slight median facial elevation below antennae; palpi whitish or testaceous. *Thorax*: mesoscutum coarsely punctate and with a faint median carina obsolete anteriorly; scutellum more polished; fovea of metascutum broad, subtriangular and with central depression; wings normal the basal vein of areolet but slightly angulate; legs with all coxae and trochanters black; front femora with basal half black; apical half honey-yellow (sometimes nearly all honey-yellow); front tibiae and tarsi honey-yellow; middle femora dark brown above, tibiae and tarsi honey-yellow; hind femora black; hind tibiae with basal half honey-yellow, apical half brown, spur yellow; hind tarsi brown above, paler below. *Abdomen* with joints 1, 2 and 3 punctate, the rest polished; 2 with a slight median carina; 1 and 2 yellowish at sides ventrally; ovipositor hidden.

The male differs but slightly, the front and middle femora being usually darker. One female has all legs yellow except extreme tip of hind femora.

Described from numerous specimens reared from *B. archippus* and others (var. *flaviconchae*) from cocoons found in fields infested with *Leucania unipuncta*.

The cocoons from *archippus* are from young larvae of autumn brood and are dull whitish, single and with little loose silk. Those of form *flaviconchae* are pale yellow and in masses with a small amount of loose silk.

5. *Apanteles lunatus* (Pack.).

Microgaster lunatus Pack., Proc. Bost. Soc. Nat. Hist., xxi, p. 28 (1880).

Parasitic on *Papilio polyxenes*.

This species was described by Dr. Packard from a single female bred by me from *Papilio polyxenes*. Mr. Scudder is not able to find the specimen, and hence I can only adopt Dr. Packard's description :

Body dull black, not shining, stout and thick. Head and antennae covered with an unusually dense silvery pile, the antennae rather thicker than in *M. pieridis*; palpi pale testaceous; front rather broad between the eyes; thorax dull black; metanotum with no median ridge. First subcostal cell instead of being irregularly oblong, is much broader and irregularly pentagonal. Fore and middle trochanters black, legs deep honey-yellow with a slight reddish tinge, outer third of tarsi pale brownish; hind femora reddish honey-yellow tipped with black, tarsi wholly black. Abdomen entirely black, granulated as usual on two basal segments, polished beyond, a faint dull testaceous spot on under side of first segment, not appearing above. Length, .13 inch.

I have one female in poor condition reared from *polyxenes* received from W. B. Thomas, of Athens, Ga. in 1885, which is apparently this species, and which is characterized by a minute tubercle on the face, by the scutellum being densely punctate and not polished and by the basal joint of palpi being black. The metascutellum has no carina but is heavily pilose. Abdominal joint 1 narrow, the hind border almost as wide as the joint is long, without carina, but with a strongly marked median tubercle, extending to anterior border of joint 2, with both joints and basal part of 3 strongly rugose. Ovipositor but slightly exerted, the sheath extending but a short distance beyond the tip of abdomen.

The cocoons are single, dense, dull yellow and with but little loose silk.

6. *Apanteles cyaniridis* n. sp.

Parasitic on *Cyaniris pseudargiolus*.

Length, 2.8 mm. ♀ : Pilosity sparse. Head : face without carina; palpi pale yellow. Thorax : mesoscutum with barely a trace of a carina; scutellum hardly more polished

and evenly and minutely punctate; the scapulae perfectly smooth and polished behind; metascutellum with the median carina divided around acetabulum; the lateral carinae starting each side of spiracle: wings normal, with stigma and costa very dark brown, the radial vein strongly angulated below its middle: legs with all coxae black; all femora and tibiae honey-yellow; trochanters dusky at base; hind femora dusky just at tip; hind tibiae with a dusky band at tip; hind tarsi dusky except at bases of joints; basal joint darker than the rest. *Abdomen* without a trace of yellow; dorsal plate of joint 1 broader posteriorly than long: of joint 2 with a well marked median carina extending slightly upon joint 3; joints 1, 2 and base of 3 well sculptured; ovipositor but very slightly protruding and not reaching beyond tip of abdomen.

Described from 3 specimens in my collection received from William H. Edwards, reared from *Cyaniris pseudargiolus*.

The cocoon is white with a tinge of lemon-yellow and surrounded with considerable loose silk.

7. *Apanteles argynnidis* n. sp.

Parasitic on *Argynnis cybele*.

Length of body, 2—2.2 mm. Color black. Pubescence white and quite dense. *Head*: profusely punctate: face without median carina or tubercle; mandibles yellowish-brown, palpi whitish; eyes black; antennae black, often brown or ferruginous beneath. *Thorax* more coarsely and densely punctate than the head, and with no median carina on mesoscutum; scutellum somewhat polished and sparsely punctate; fovea of postscutellum small, transverse, divided by a distinct median carina; metascutellum strongly rugose, with distinct median carina, the lateral ridges almost parallel, diverging somewhat anteriorly; tegulae brownish-black: wings hyaline; venation normal; costa dark brown, stigma and veins paler brown: legs reddish-yellow; all coxae black, anterior and median tarsi paler, almost whitish, brownish toward the end, their claws blackish; posterior femora and tibiae blackish toward tips; posterior tarsi dusky. *Abdomen* black; the two basal joints densely and confluent punctate, the third less so, and only at its basal half; joint 1 longer than broad, the concavity at its base deep and similarly sculptured; a faint indication of a median ridge on joint 2; flexible margins of the two basal joints scarcely apparent, somewhat yellowish or often almost black; remaining joints highly polished and sparsely hairy; venter black; ovipositor and its sheaths scarcely projecting.

The cocoon is dense, narrow, smaller than in *koebelei*; single or in small, exposed masses, dingy white, with a little loose silk surrounding.

This species also closely resembles *A. flaviconchae*, which differs, however, in being somewhat larger, in having a more densely punctate thorax and scutellum, in the entirely punctate third abdominal joint and in having the basal half of the anterior and median and the whole of posterior femora, black.

Described from 7 specimens, all females, bred from *Argynnis cybele* by William H. Edwards.

8. *Apanteles koebelei* n. sp.

Parasitic on *Lemonias anicia*.

Length of body 2.6—2.8 mm. ♀: color black. Pubescence short, dense and faintly

yellowish. *Head* finely punctate, somewhat polished; facial carina not well defined, but terminating in front of antennae in a distinct polished tubercle; mandibles reddish; palpi whitish, the basal joint of maxillary palpi black; eyes brown with paler inner border; antennae black in both sexes, scarcely as long as the body. *Thorax*: scutellum polished, sparsely punctate; fovea of post-scutellum circular, occasionally with a round, central granule; metascutum and metascutellum coarsely rugose, the median carina on latter distinct, the lateral carinae straight, diverging anteriorly; tegulae blackish; wings hyaline, venation normal; the radial vein angulated; costa, stigma and veins brownish black; legs, usually reddish with all coxae black and the extreme base of the anterior and median and apex of posterior femora more or less distinctly blackish; all tarsi more or less dusky. *Abdomen* black, laterally compressed beyond joint 3, and wedge-shaped; joint 2 and extreme base 3 rugose-punctate; joint 1 longer than broad, narrowest at base, broadening and almost as broad posteriorly as 2; concavity at base deep and not polished; median carina of joint 2 either very distinct or almost wanting; the other joints highly polished and sparsely hairy; flexible border of two basal joints rather narrow; venter black; the ovipositor short, exerted, its sheath black.

The ♂ is distinguished by the longer antennae, by the less compressed abdomen, by the palpi being dusky, the femora darker, the sides black along the whole length, the tibiae with a dusky tinge and the tarsi blackish. There is more variation in the carina on abdominal joint 2, being but feebly indicated in one specimen and wanting in a second.

There is some variation in coloration, and one female, smaller than the average, has the coloration of the male.

The cocoons are white, less satiny than in *flavicornis*, somewhat stouter, but similarly exposed and held together by loose silk.

Described from 15 specimens (12 ♀, 3 ♂), bred by Mr. A. Koebele from *Lemonias unicia*? from California.

This species resembles *A. limenitidis*, var. *flaviconchae* which is readily distinguished, however, by the want of median carina and facial tubercle, but its coarser and more densely punctate mesoscutellum, the coarser sculpturing of the basal abdominal joints and by the normally shaped abdomen.

9. *Apanteles flavicornis* n. sp.

Parasitic on *Thanaos juvenalis*.

Average length of body 2 mm. ♀: general color black; pubescence quite dense, short white. *Head*: face without carina or tubercle; mandibles honey-yellow; palpi white with the first joint of the maxillary palpi pale yellow; antennae brown above, yellowish-brown beneath. *Thorax*: mesonotum without or rarely with an indication of a carina; scutellum polished, without punctation; fovea of postscutellum very small, divided by a minute median ridge; metascutellum rugose, its median carina distinct; tegulae yellow; wings with the costa, stigma and radial vein brown, the other veins almost colorless; legs honey-yellow, the posterior coxae black; tip of posterior femora, tibiae and tarsi often dusky. *Abdomen* black and honey-yellow; basal joint somewhat longer than broad, narrowest at base; together with second joint and more or less of the base of the third, rugose-punctate; the second with a rather prominent median carina; the other joints polished; the margins of joints 1 and 2, whole of 4 and 5 and generally the posterior margin and angles of 3 and sometimes more or less of 6 and the greater portion of the venter honey-yellow; ovipositor very short, scarcely exerted.

♂ with the antennae entirely yellow and the abdomen above generally black.

The cocoons are narrow, satiny, pure white and spun in irregular masses loosely held together by some few threads, but not embedded.

Described from 17 specimens, bred from *Thanaos juvenalis* at Kirkwood, Mo.

The species is close to *emarginatus*, which is distinguished, however, by its larger size, by the black antennae (brownish beneath only in the male), by the frontal tubercle, the punctate scutellum, the coarser punctation of abdomen, the somewhat darker venation, and the cottony nature of the cocoon mass.

10. *Apanteles emarginatus* n. sp.

Parasitic on *Euphocades troilus*.

Length of body, 2.4 mm. to 2.6 mm. ♀: general color black; hairs white, very short. *Head*: punctation moderately coarse and dense; face with a distinct median tubercle near base of antennae; mandibles reddish-yellow, their tips brown; palpi pale testaceous; antennae black, basal joint reddish-yellow beneath, with black apex. *Thorax*: with punctation on mesoscutum dense and coarse, and with an indication of a median carina at posterior half; scutellum somewhat polished and sparsely punctate; postscutellum as in *glomeratus*; metascutellum closely and quite coarsely rugose, with an indication of a median and with a distinct, angulated, lateral carina; tegulae testaceous; wings as in *glomeratus*; legs reddish-yellow; hind coxae dusky on basal half; extreme tip of femora and more or less of hind tarsi often dusky or blackish. *Abdomen* with the two basal joints opaque, and with the base of the 3d densely and quite coarsely rugose; basal joint longer than broad, narrowest at base, which is not polished and only slightly concave; rest of the abdomen above highly polished and sparsely beset with slender white hairs; lateral margins of basal joints 1 and 2, a quite distinct, roundish spot each side of the 3, and the greatest portion of venter, reddish yellow; ovipositor with the outer sheaths black and stout, and reaching about 1 mm. beyond tip of abdomen.

♂ with the antennae more or less distinctly brownish beneath.

Described from 7 specimens marked from *troilus* by Mr. A. Koebele, in breedings at the Department of Agriculture; but as I have no notes other than the label, I feel some uncertainty about the host. In general appearance the species approaches *scitulus*, which is readily distinguished, however, by the absence of facial tubercle, coarser sculpturing and more yellow abdomen and legs.

The cocoons are very delicate, white and imbedded in a dense mass of white, cottony silk, having a faint yellow tinge.

11. *Apanteles theclae* Riley.

Parasitic on *Thecla* sp.

This species, described in my "Notes on N. A. Microgaster" (loc. cit.) has several times been reared by me from the larva of a *Thecla* found in Georgia and Alabama upon the cotton plant. The butterfly has not been

reared, and as it may prove to be a species found in New England, the description of the parasite is here quoted:—

Apanteles theclae: length 2 mm. ♂. ♀ black; palpi white; labrum, mandibles, and sometimes the antennae, piceous; tibiae and tarsi testaceous, the apical half of posterior tibiae and the posterior tarsi blackish. Wings hyaline; the tegulae, stigma, costa, beyond stigma, and the radius and veins at base of areolet, piceous. Antennae of the female much shorter than the body, of the male nearly as long as the body. Mesothorax closely punctured, opaque; metathorax not truncate, finely rugose-reticulate, and with a slight median, longitudinal ridge. Two basal joints of the abdomen with numerous distinct punctures; remaining joints often sparsely punctate; basal joint with the lateral margins narrow; ovipositor not exerted. Stigma short, triangular, radius descending from its middle and uniting at a considerable angle with the basal vein of the areolet.

12. *Apanteles junoniae* n. sp.

Parasitic on *Junonia coenia*.

Length of body ♂, 2.6 mm. Color black. Punctuation of head, thorax and scutellum dense, coarsest on thorax, very dense, fine and somewhat confluent on the head. *Head* with facial ridge not very distinct, though there is a slight, smooth projection close to and in front of the antennae; (palpi wanting) eyes brown; antennae black; the first joint and flagellum brownish beneath. *Thorax* with a slight median carina on posterior third of mesoscutum; fovea of postscutellum minute; metascutellum rugose, without median carina, its lateral carinae strongly angulated; tegulae honey-yellow; wings normal; costa brown, stigma yellowish brown, veins very pale yellowish; legs brownish-yellow, with all coxae black and posterior femora dusky. *Abdomen* black, of normal shape; joint 1 slender but slightly broader posteriorly than at base, and much narrower than 2, sides broadly bordered by a flexible, honey-yellow margin; the three basal joints sculptured. 1 and 2 densely and 3 less so; no median carina on 2; the other joints polished; venter honey-yellow as far as joint 3.

The cocoon is single, dense, yellowish-white, and covered with threads of loose silk.

This species closely resembles *A. cardicola* Pack., but differs from it in several points, more particularly in the shape of the first abdominal joint, which in *cardicola* is posteriorly almost as broad as joint 2, and which has the third joint smooth, the yellow borders almost wanting and the middle and posterior legs much darker.

Described from a single specimen, bred from *Junonia coenia*.

13. *Apanteles cardicola* Pack.

Parasitic on *Vanessa cardui*.

Microgaster cardicola Pack., Proc. Bost. Soc. Nat. Hist., xxi, p. 27 (1880).

Its characters are as follows:—

Average length, 3 mm. *Head* black; palpi pale testaceous. *Thorax* moderately and uniformly punctate; the metascutum without carina; the scutellum more highly polished; fovea of postscutellum broad and with a central pit; metascutellum without carina. *Abdomen* with ovipositor just showing at tip of body; dorsal plate of

joint 1 narrowest at base, its length exceeding its width at hind border, its lateral edges slightly arcuate and rounded behind; joints 1 and 2 rugose; rest of abdomen perfectly smooth, polished and with little trace of hairs; the radius of wings normal; stigma rather broad; radial vein strongly angled; coxae and trochanters black; basal one-third to one-half of front femora blackish, rest ferruginous and concolorous with tibiae; tarsi brownish, base of first tarsal joint paler; middle and hind femora blackish; tibiae ferruginous, with a slight dusky tinge; tarsi pale at base, becoming black towards claws.

11 specimens, all ♀, are before me bred by Mr. Scudder from *Vanessa cardui*, but no cocoons accompany them.

The species closely resembles *Apanteles theclae* Riley, but may be distinguished by having no median ridge on metascutellum, by the more closely punctate basal joints of abdomen, by the slightly larger size, by the more intense angulation of the radial vein, the lack of punctation beyond the second abdominal joint, and in the almost complete absence of hairs from the abdomen.

14. *Apanteles atalantae* Packard. Pl. 88, fig. 13.

Parasitic on *Vanessa atalanta* and *Aglaia milberti*.

Dr. Packard's colorational description (Proc. Bost. Soc. Nat. Hist., xxi, p. 27) which would apply to many different forms is as follows:

"Body jet black, polished; antennae blackish brown; palpi whitish; mandibles pale reddish, blackish at base. Legs with the coxae black; trochanters blackish at base, all beyond dark honey-yellow; terminal joint of tarsi a little dusky."

From limited material and the description I formerly considered this a variety of *congregatus* (Am. Nat., 1882, p. 670); but from a larger number of specimens since examined it may very well remain as a good species, intermediate in some respects between *glomeratus* and *congregatus* by comparison with which it may best be characterized.

From *glomeratus* it differs in the more convex, more densely punctate face without diverging carinae; in the lateral ridges of metathorax being more distinct. From *congregatus* it differs in being less hairy, in the less densely punctate face without distinct tubercle, and in its concolorous coxae. From both species it is distinguished by the smoother second joint of abdomen, the sculpture being confined to the lateral borders; by the stigma being shorter and darker, the angle of the radial vein more pronounced and above the middle of the vein, i. e., nearer to the stigma; and finally by the sheath of the ovipositor being broader, more strongly developed and projecting somewhat more beyond the tip of abdomen.

In some specimens, the middle portion of the first abdominal joint is also smooth and impunctate.

I have examined some 50 specimens from *atalanta* and 15 from *milberti* reared by Packard, and 2 specimens from *milberti* reared by William H. Edwards. There are no entomophagic differences whatever in the specimens.

The cocoons are arranged on end, side by side, in moderate masses, the whole covered with loose silk and the color pure white.

15. *Apanteles pholisora* n. sp.

Parasitic on *Pholisora catullus*.

Length of body, 2.4 mm.—2.7 mm. ♀: Color black with much reddish-yellow on abdomen. Pubescence rather dense and white. *Head*: punctation coarse and uniform; a deep puncture on each side of clypeus; facial carina quite distinct; mandibles yellowish-brown; palpi pale testaceous; eyes brown, antennae black, longer in the male than in the female, the basal joint often yellowish-brown, and the flagellum beneath, in both sexes frequently brownish. *Thorax*: scutellum sparsely punctate and somewhat polished; postscutellum very narrow, its median fovea small and often indistinct; metascutellum rugose, its median carina distinct, the lateral carinae straight and parallel with it; tegulae brownish; wings normal, the radial vein variable and either uniformly curved or more or less angulated; costa, stigma and radial vein light brown, the other veins paler; legs honey-yellow; anterior and median coxae brownish, the hind pair black; hind femora and tibiae blackish at tip; all tarsi slightly dusky, the posterior pair darkest; claws blackish. *Abdomen* narrow, slender, tapering gradually from joint 2 toward the end; basal joints 1 and 2 black and closely punctate; joint 1 longer than broad, narrowest at base, broadening gradually toward hind border where the angles are slightly rounded, the basal portion somewhat concave; joint 2 with a rather distinct median carina; remaining joints polished and sparsely hairy, their color variable, either entirely honey-yellow, with only the sutures blackish or with only 2 yellowish spots at the hind border of 3, with all gradations between these extremes; flexible lateral margin of 1 and 2 and often the whole venter, honey-yellow; sheath of ovipositor black and reaching somewhat beyond the tip of abdomen.

Resembles both *A. scitulus* and *A. emarginatus*. From the latter it is distinguished by the absence of the facial tubercle, by the denser and coarser sculpturing of the head and absence of median carina on posterior half of mesoscutum; by the median carina and straight lateral ridge on the metascutum and the more slender abdomen. From *scitulus* it differs in the smaller size, the more slender abdomen, with its carina and different sculpturing.

Described from 16 specimens, reared from *Pholisora catullus*, one by William H. Edwards, the rest by myself.

The cocoons are normal, perfectly white, with much loose silk adhering to them, and either single or in small masses.

16. *Apanteles cassianus* Riley.

Parasitic on *Xanthidia nicippe*.

This species was described by me (loc. cit., p. 12) from cocoons found at East St. Louis, Ill., upon *Cassia marylandica* with *Xanthidia nicippe* from which they had in all probability issued. I reproduce the description:

"Length, 1.5 to 2.2 mm. ♂ ♀. Black; palpi white; mandibles sometimes testaceous; knees, the four anterior tibiae; the basal half of posterior tibiae, and all the tarsi ex-

cepting at the apex and on the apical half of the basal joint of posterior pair, whitish; the anterior femora more or less piceous and the intermediate tibiae often tinged with testaceous. Wings hyaline, the veins white; the stigma, strongly in contrast, piceous; tegulae tipped with piceous. Antennae of the ♀ scarcely shorter than those of the ♂. Mesothorax opaque, the punctures shallow and obscure; metathorax opaque, without distinct sculpture, its upper face limited on each side by a carina exterior to the spiracles, a few slight ridges at the apex. Abdomen without punctures, lateral margins of the basal joint dark piceous, the central portion broad and with sharply defined sides; second joint with a broad, triangular central area marked off by two deep grooves which diverge from the middle of the anterior margin; ovipositor concealed. The radius forms with the basal vein of the areolet only a slight curve, but in one or two specimens there is a slight angle on the outer side at their point of union."

Since the description was published I have received two other specimens, one reared from *nicippe*, by Mr. William H. Edwards and one from *Eurymus eurytheme* by Mr. David Bruce in Colorado. The species is well marked especially by the sculpture of the second abdominal joint. The cocoons vary. Those from which my specimens were obtained are either dingy gray or pale yellowish, the former with five tolerably marked longitudinal ribs, the latter almost smooth. That from Mr. Edwards is intermediate.

GENUS MICROGASTER Latreille.

Maxillary palpi 5-, labial 3-jointed. Eyes villose. Antennae 18-jointed. Mesopleurae rarely with a rugulose fovea. Abdomen sessile; suturiform articulation distinct. Radius of the fore wing almost complete; three orbital areolets, the 2d often imperfect. Hind coxae elongate; spurs of the hind tibiae not shorter than half the metatarsus. Terebra more or less exerted. (After Marshall.)

***Microgaster carinata* Pack. Pl. 88, fig. 11.**

Parasitic on *Vanessa atalanta*.

Microgaster carinata Pack., Proc. Bost. Soc. Nat. Hist., xxi, p. 25 (1880).

This species was described by Dr. Packard from specimens bred by Mr. Scudder from *Vanessa atalanta*. Its characteristics from the material before me, rather than from the original description, are as follows:

Average length, 4 mm. ♀: Body black. Antennae brownish-black; palpi pale yellow. Wings with the stigma and veins brown. All coxae black; all trochanters black at base and yellowish at tip; front and middle femora, tibiae and tarsi honey yellow; the tarsi dusky at tip; hind femora and tibiae honey-yellow and dark at tip; hind tarsi dusky throughout. Abdomen with dorsum of joints 1 and 2 strongly rugose, the rugosity on joint 1 having a tendency to form into irregular, longitudinal lines toward the outer hind angles, the median carina being obsolete but with a decided elevation or tubercle on the hind border; anterior portion of joint 3 very slightly punctate; ovipositor quite long, reaching when extended beyond the length of the whole abdomen; the sheaths dark, quite pilose and two-thirds as long as abdomen. Venter with a large, honey-yellow spot each side at base.

Three females are before me from Mr. Scudder.

In my notes on *Microgasters* (Am. Nat., Aug. 1882, p. 679). I have

stated it to be a variety of *M. gelechia* (Riley) having then seen but one specimen. With the material before me it may, however, stand as a species, for, in addition to the colorational differences there pointed out and to the other colorational fact that in *gelechia* the yellow spot covers nearly or quite the whole of the dorsum of joints 5 and 6, structural differences are also noticeable in that the rugose elevations of first tergite in *gelechia* exhibit no tendency toward forming longitudinal lines behind and that the scutellum is much more strongly punctate than in *carinata*. The sheath of ovipositor is, also, less pilose.

THE
DIPTEROUS PARASITES
OF
NORTH AMERICAN BUTTERFLIES.

BY S. W. WILLISTON, NEW HAVEN, CONN.

But when he spide the joyous Butterflie
In this faire plot disacing to and fro.
Feareles of foes and hidden jeopardie.
Lord! how he gan for to bestirre him tho,
And to his wicked worke each part applie!
His heart did yearue against his hated foe,
And bowels so with rankling poyson swelde,
That searee the skin the strong eantagion helde.

SPENSER.—*Muioptomos*.

NOT many species of Diptera are known to be parasitic upon butterflies, either in Europe or America, and they are all, with the exceptions noted below, included in one family, the Tachinidae. In Europe, about fifteen species have been bred and recognized, belonging to the genera *Tachina*, *Masicera*, *Exorista*, and *Phorocera*. Others have been described by Robineau Desvoidy, but the difficulty, if not impossibility, of recognizing this author's species detracts almost wholly from the value of his observations. Doubtless there are many more to be recognized in Europe, yet we can hardly expect as large a number as in North America, for the reason that there is a greater diversity in the butterfly fauna of our country. All the species that are now known as true parasites upon our butterflies are included in the following lists. It will be noticed that they all, with one exception, belong to the same genera as do the European species. *Masicera* is sometimes difficult to distinguish from *Tachina*, in its narrowest sense; the three species described below, from the length of the third antennal joint, I have no hesitation in referring to *Masicera*. As several of the butterflies upon which some of the flies are parasitic are either cosmopolitan or introduced, it is not at all improbable that the parasites may, in the future, be found to be identical. As everyone who has given any attention to the Tachinidae is aware, the description of a species is insufficient to base a positive determination upon when the observed habitat is a remote one, and nothing more than an opinion can be hazarded till an actual and close comparison is made of specimens. Further, it is to be borne in mind that the identity of the host is only of negative value in

the determination of the parasite; while one may, with much probability, assume that a fly bred in America from *Vanessa atalanta* is *Exorista futilis*, yet it may be quite another species, and *E. futilis* may, with much probability, be also parasitic upon some other butterfly or moth. *Phorocera concinnata* Meigen has been found parasitic upon five species of *Vanessidi* and two species of *Pieridi*. So, also, *Exorista vulgaris* Fallen has been bred from *Pieris rapae*, *Cinclidia athalia*, *Procrustes coriarius* and *Plusia gamma*.

Two species of flies belonging to very different families have been sent me as having been bred from butterfly larvae. One of these, a species of *Phora* (89:16), may have been parasitic upon the living larva, but, more frequently, the larvae of these flies are found in decaying animal or vegetable matter. I cannot recognize the species among those hitherto described, and the preservation of the specimen will not warrant its description as new. The other, *Syneches pusillus* Loew, I was surprised to find, among the specimens sent by Mr. Seudder, bearing the label "*Lyc. neglecta* larva," with the chirography apparently that of Mr. W. H. Edwards. That there might be no error, however, I sent the specimen to that gentleman, who assured me that the label was his, and, furthermore, though he could not recall the specimen, that there could be no possibility of doubt in the labelling of the specimen, as indeed no one could suspect from Mr. Edwards's known reputation. The fact is one of much interest, as I cannot learn that any species of this family (*Empidac*) has hitherto been known to be parasitic in the larval state, though the members are pre-eminently predaceous in the adult stage. So far as I am aware, the known species of this genus are confined to Europe (*Pterospilus*), Africa, and America. A possible, if not probable, explanation of the parasitism in the present case is, that the larva had entered the butterfly caterpillar or chrysalis after hatching. The larvae of *Empidac*, so far as known, live in decaying wood, humus, etc.

The larvae of *Tachinidae* will be recognized by their headless, maggot-like appearance. They are thick, cylindrical, flattened below, the segments distinctly separated, with transverse and side swellings, either naked, or girdled with thin, short spines; the antennae are thick, wart-like, and the mouth has two, slightly curved, projecting hooklets. The puparium, formed by the larval skin, is elongate ellipsoidal in shape, of a deep brown or reddish brown color, with the ends obtusely rounded, the segmentation only feebly indicated, moderately smooth, without projections, save the two obtuse stigmatic tubercles at the hind end. The flies, it is needless to say, are cyclorrhaphous, that is, they escape from the pupigerous larval envelope through a circular opening made by bursting off the anterior segments.

In addition to the species described below, there were sent me by Mr.

Scudder a very much injured specimen of *Phorocera* from *Cinclidia harrisii* and a puparium from *Polygonia comma*.

[A detailed account of the actions of a *Tachina* in laying her eggs upon a caterpillar is given by Mr. A. C. Weeks (*Ent. Amer.*, iii, 126).]

LIST OF BUTTERFLIES AND THEIR DIPTEROUS PARASITES.

Hosts.	Parasites.	Hosts.	Parasites.
<i>Chlorippe celtis</i>	<i>Phorocera edwardsii</i> .	<i>Cyaniris pseudargiolus</i>	<i>Exorista theclarum</i> .
<i>Anaea andria</i>	<i>Phorocera edwardsii</i> .		<i>Syneches pusillus</i> .
<i>Polygonia comma</i>	Unknown Tachinid.	<i>Pieris rapae</i>	<i>Exorista hirsuta</i> .
<i>Eu Vanessa antiopa</i>	<i>Phorocera edwardsii</i> .	<i>Jasoniades glaucus</i> ...	<i>Masicera frenchii</i> .
	<i>Masicera</i> (<i>Phorocera</i> ?) sp.	<i>Heraclides cresphontes</i>	<i>Masicera rileyi</i> .
<i>Vanessa atalanta</i>	<i>Exorista futilis</i> .	" <i>Papilio</i> " sp.....	<i>Masicera archippivora</i> .
<i>Vanessa cardui</i>	<i>Exorista blanda</i> .	<i>Epargyreus tityrus</i> ...	<i>Acroglossa hesperidarium</i> .
<i>Argynnis cybele</i>	<i>Phorocera saundersii</i> .	<i>Thanaos brizo</i>	<i>Exorista blanda</i> , var. <i>proserpina</i> .
<i>Cinclidia harrisii</i>	<i>Phorocera</i> sp.		<i>Megathymus yuccae</i> .. <i>Phorocera comstocki</i> .
<i>Anosia plexippus</i>	<i>Masicera archippivora</i> .		
<i>Thecla calanus</i>	<i>Exorista theclarum</i> .		
<i>Thecla autolyceus</i>	<i>Exorista scudderii</i> .		

LIST OF DIPTEROUS PARASITES AND HOSTS.

Parasites.	Hosts.	Parasites.	Hosts.
<i>Acroglossa hesperidarium</i>	<i>Epargyreus tityrus</i> .	<i>P. edwardsii</i> (cont.)...	<i>Eu Vanessa antiopa</i> .
<i>Exorista futilis</i>	<i>Vanessa atalanta</i> .	<i>Phorocera saundersii</i> ..	<i>Argynnis cybele</i> .
<i>Exorista blanda</i>	<i>Vanessa cardui</i> .	<i>Phorocera comstocki</i> ..	<i>Megathymus yuccae</i> .
<i>Exorista blanda</i> , var. <i>proserpina</i>	<i>Thanaos brizo</i> .	<i>Phorocera</i> sp.....	<i>Cinclidia harrisii</i> .
<i>Exorista hirsuta</i>	<i>Pieris rapae</i> .	<i>Masicera archippivora</i> ..	<i>Anosia plexippus</i> .
<i>Exorista theclarum</i> ..	<i>Thecla calanus</i> .		" <i>Papilio</i> " sp.
	<i>Cyaniris pseudargiolus</i> .	<i>Masicera frenchii</i>	<i>Jasoniades glaucus</i> .
<i>Exorista scudderii</i>	<i>Thecla autolyceus</i> .	<i>Masicera rileyi</i>	<i>Heraclides cresphontes</i> .
<i>Phorocera edwardsii</i> ..	<i>Chlorippe celtis</i> .	<i>Masicera</i> (<i>Phorocera</i> ?) sp.....	<i>Eu Vanessa antiopa</i> .
	<i>Anaea andria</i> .	<i>Tachinid</i> sp.....	<i>Polygonia comma</i> .
		<i>Syneches pusillus</i>	<i>Cyaniris pseudargiolus</i> .

The following list of the European dipterous parasites of butterflies makes no pretensions to completeness; it contains all the references that I have been able to obtain with the resources at my command. Indeed, as it is, the number of references is chiefly due to the very great kindness of Professor Mik. Such a list, even were it quite complete so far as the literature is concerned, loses, alas, much of its value from the fact that not much reliance can be placed on the specific names of some of the authors. The yet unraveled synonymy, especially in the parasitic genera, of the European Tachinidae is frightful. May it never reach such a state in America! It is greatly to be regretted that we know so very little of this family of flies, perhaps the most important among all insects in its economic relations, in our own country. But, until the time shall arrive when a better knowledge is possible, may the heedless describer beware!

DIPTEROUS PARASITES OF EUROPEAN BUTTERFLIES.

Polygonia l-album.	Masicera pupiphaga Rondani, Bull. Soc. Ent. Ital., x, 32.
Eugonia polychloros.	Exorista inclinata Macquart, Ann. Soc. Ent. Fr., (2) vii, 386, 44. Tachina rustica Meigen. (Also parasitic on Liparis salicis, Bombyx quercus, B. neustria, fide Schiner, Fauna, etc., i, 474). Tachina larvarum Linné; Jahrb. u. d. Fortschr. d. Forstw., i, 278, 1837.
Hamadryas io.	Tachina agilis Meigen; Schiner, Fauna, etc., i, 477. Phorocera concinnata Meigen; Desvoidy, Hist. Nat. d. Dipt. etc. (Doria). Masicera vanessa Desvoidy, Hist. Nat. d. Dipt. etc., ii (Sturmia). Erycia vanessae Desvoidy, Ann. Soc. Ent. Fr., (2), vii, 170 (? Masicera). Masicera bremii Macquart, Ann. Soc. Ent. Fr., (2), viii, 476. Exorista puella Meigen; Desvoidy, Hist. Nat. etc. Tachina bella Meigen; Schiner, Fauna, etc., i, 478. (Also parasitic on Liparis dispar, Schiner, l. c.). Besaldia vanessae Rob. Desvoidy, Hist. Nat. etc. Phorocera iovera Desvoidy, Essai sur les Myod.
Eu Vanessa antiopa.	Phorocera concinnata Meigen; Desvoidy, Hist. Nat. etc. Phorocera antiopae Desvoidy, Essai sur les Myod.
Aglais urticae.	Tachina agilis Meigen; Schiner, Fauna, etc., i, 477. Exorista ferina Desvoidy; v. d. Wulp, Tijdschr. v. ent., xii, 17. Phryxe vanessae Desvoidy, Hist. Nat. etc.
Araschnia levana.	Phorocera assimilis Fallen; Schiner, Fauna, etc., i, 491. Phorocera concinnata Meigen; Desvoidy, Essai sur les Myod., 134, 8 (P. prorsae). Phorocera petrosa Desvoidy, Hist. Nat. etc. (Pales vernalis Desv.). Phryxe vanessae Desvoidy, Hist. Nat. etc. Phryxe puella Desvoidy, Hist. Nat. etc.
Vanessa cardui.	Tachina doris Meigen; Schiner, Fauna, etc., i, 476.
Argynnis sp.	Masicera vanessa Desvoidy, Ann. Soc. Ent. Fr., (2), viii, 158.
Cinclidia athalia.	Exorista vulgaris Fallen; Desvoidy.
Aurotis quercus.	Exorista confinis Fallen; Wachtl, Wien. Ent. Zeit., i, 278.
Mancipium brassicae.	Phorocera concinnata Meigen; Bouche, Naturg. d. Ins., 1834, 57, pl. v, ff. 15-19. Phorocera munda Meigen. Exorista hortulana Meigen; Benthin, Hamb. Ver. Naturw., 1887, 36.
Pieris rapae.	Phorocera concinnata Meigen; Desvoidy, Hist. Nat. etc. (Doria): Ann. Soc. Ent. Fr., (2), viii, 179 (P. viridis); Loew, in litt. Scudder. Phorocera pusilla Desvoidy, Ann. Soc. Ent. Fr., (2), viii, 181. Exorista vulgaris Fallen.
Papilio machaon.	Tachina larvarum Linné; V. d. Wulp, Tijdschr. v. Ent., xii, 18.

Table of species of dipterous parasites.

Proboscis slender, horny, projecting beyond the oral margin, with small labella; eyes bare.....	Aeroglossa hesperidarum.
Proboscis short, fleshy, with broad labella.	
Eyes bare; palpi yellow; second abdominal segment without anterior pair of bristles (Masicera).	
Second abdominal segment with a pair of posterior bristles.	
Antennae and abdomen wholly black (♂ ♀); claws and pulvilli of male elongate...	M. frenchii.
Third antennal joint at the base, and the sides of the abdominal segments largely red; claws and pulvilli of male not elongate.....	M. archippivora
Second segment without bristles; abdomen on the sides broadly red.....	M. rileyi

Eyes pubescent.

A row of well developed bristles on the lateral margins of the facial depression reaching nearly or quite to a point opposite the lowermost one of the frontal rows (Phorcera).

Antennae black; abdomen shining, the second segment with three pairs of bristles, the third with two pairs before the hind row.....**P. saundersii.**

Palpi and antennae more or less yellow; second abdominal segment with not more than two pairs of bristles.

Second and third abdominal segments with a pair of bristles toward the front; claws and pulvilli of male small.....**P. eomstoeki.**

Second and third segments without anterior pair of bristles, the posterior bristles strong.....**P. edwardsii.**

Above the vibrissal bristle, near the oral margin, there are only a few small bristles (Exorista).

Palpi yellow.

Abdomen at sides and tip broadly red; legs black.....**E. scudderi.**

Abdomen without red on the sides.....**E. blanda.**

Palpi black or dark brown.

Second abdominal segment with a median and posterior pair of bristles; abdomen in general bristly.....**E. hirsuta.**

Second segment with a posterior, but no median pair of bristles.

Abdomen black, marmorate with silver gray, the fourth segment brassy yellow pollinose.....**E. futilis.**

Abdomen largely shining black, no yellow pollen on the fourth segment...
E. theelarum.

ACROGLOSSA, gen. nov.

Allied to *Frontina*, but differs in the distinctly jointed arista, and in the slender proboscis. Front broad in both sexes, a little narrower in the male, nearly straight longitudinally, and but little convex transversely; arrangement of the bristles in the male, as follows: Two bristles near the upper angle of the eye, directed posteriorly; a pair just in front of the ocelli, directed exteriorly and anteriorly; two rows of moderately strong bristles on each side, the inner row descending on the sides of the face as low as the base of the third antennal joint. In the female, there is, in addition to the foregoing, two or three bristles on each side near the eye, directed anteriorly. Antennae rather slender, reaching nearly to the oral margin; third joint in the male fully three times, in the female scarcely twice, as long as the second; arista thickened nearly its whole length, distinctly jointed, the second joint long, and forming with the distal joint a more or less distinct angle. Margins of facial depression with a row of moderately stout bristles, reaching nearly as high as the base of the third antennal joint; sides of the face with bristles; cheeks without bristles, a row along the oral margin. Proboscis slender, horny, with small labella, projecting a short distance beyond epistoma; palpi slender, cylindrical. Eyes bare. Scutellum with three pairs of marginal bristles of nearly equal size; a smaller pair on the disk. Abdomen conically ovate, clothed with short, bristly hairs; second segment with a pair of stout bristles on the posterior margin; third and fourth segments each with a posterior row. Pulvilli of male elongate. First posterior cell open at some distance before the tip of wing; great cross-vein nearer to the angle of first posterior cell than to the anterior cross-vein.

The relationship of this genus is closest to *Frontina*, to which it bears not a little resemblance in the broad, bristly front and general appearance; the structure of the arista and proboscis, however, will immediately distinguish it.

Acroglossa hesperidarum Harris, MSS. Pl. 89, figs. 21, 26.

Male, female.—Front with a golden yellowish cast; face silvery white, the ground-color on the oral margin yellow. Antennae black, the first two joints and immediate base of the third yellowish red. Palpi reddish yellow; proboscis black. Mesonotum thinly pollinose, with four, rather broad, shining black stripes. Scutellum broadly reddish yellow. Abdomen black, with a broad, variable, gray, pollinose band on each segment; extreme tip red. Legs black. Wings grayish hyaline. Length, 11-12 mm.

Two specimens, from the Boston Society of Natural History, labelled, apparently by Harris, "293, N. H.," and bred by him from *Epargyreus tityrus*. The sides of the face in the male are scarcely a half the width of the median depression; in the female they are three-fourths or more as wide, the depression being smaller, and the sides wider. This, or an allied species, is not rare in collections.

Exorista futilis Say. Pl. 86, fig. 10.

Tachina (Exorista) futilis (Say) Osten Sacken, Canadian Entomologist, xix:161 (1887).

Male, female.—"Bottom of the antennal foveae silvery gray; the lower part of the cheeks likewise; lateral part of the face and the orbit of the eyes below and behind (genal and occipital orbit) brassy-yellowish, the coloring of the front being of a more saturate yellow than the lateral parts of the face; above the antennae, in the middle of the front, a brown stripe, attenuated posteriorly; it bifurcates on the vertex, enclosing the grayish, ocellar triangle; the hind plane of the head (occiput) gray. The row of frontal bristles consists: first, of three bristles pointing backwards, the uppermost of which is placed on the top of the vertex; second, of three shorter bristles pointing forward; third, of four or five bristles, which form diverging rows, descending on each side of the antennae, the last being a little below the end of the second antennal joint. Between the frontal bristles and the eyes, the front bears numerous little hairs; between these rows, on the ocellar triangle is the usual pair of bristles pointing forwards. The females have three supernumerary pairs of larger bristles, the first is placed behind the upper corner of the eye, the other two between the frontal row and the orbit of the eye. Among the above described smaller hairs, immediately below the last bristle, the brassy yellow color of the face shows a brown, changing spot, visible in an oblique light only; below this place, the lateral parts of the face are smooth; a short distance above the oral margin there is, on each side, the usual long bristle; above it, some shorter hairs reach to about one-quarter of the distance between the long bristle and the root of the antennae. Antennae black; second joint with grayish pollen, and with a crest of short, stiff bristles; third joint long, with parallel sides, more than three times the length of the second, not quite reaching the edge of the mouth. Eyes distinctly pubescent. Ground color of the thorax bluish-black, almost concealed by five stripes of gray pollen, with intermediate black lines; the gray stripes are especially apparent when viewed obliquely from the posterior end of the body; in this light the median stripe appears bifurcated posteriorly; the next pair abbreviated posteriorly; the lateral pair very broad anteriorly, over the humeri. Scutellum bluish-black, with gray pollinose reflections; its tip faintly brownish [or red]; on the hind edge there are six [or eight] bristles, the intermediate [apical] pair the shortest; above this pair, on the plane of the scutellum, another similar pair. Pleurae grayish pollinose. Abdomen black, marmorate with silvery gray; the fourth segment brassy yellow [pollinose]. The whole abdomen is covered with dense, short hairs; a pair of longer bristles near the hind margin of the first and second segments; a row of such bristles on the hind margin of the third segment, and a double row at the end of the fourth. Legs black; pulvilli brown; knees slightly brownish. Wings: the first posterior cell open (closed by the prolongation of the costal vein, however, which

nearly reaches the apex of the wing); the distance between the tips of the second and third veins is a little longer than that between the third vein and the apex of the wing; the elbow of the fourth vein without stump of a vein (a very minute one in one of the specimens); the great cross-vein oblique, parallel to the last section of the fourth vein; small cross-vein (in most specimens) opposite to about the middle of the distance between the tips of the auxillary and first vein. Length, 7 mm."

[The following description of the early stages was taken from the living specimens:—Larva yellowish white, tapering anteriorly and armed with a double curving black hook; blunt posteriorly and furnished with a pair of black circular warts each hollowed and having the annular ridge thus produced elevated into three slight prominences. Length, 13 mm.; breadth, 4 mm.; height, 3.25 mm.

The pupa case is short and thick, bluntly and equally rounded at either end; at the posterior extremity are two minute warts scarcely raised above the surface; on either side are two distant irregular rows of nearly continuous, longitudinal punctures; at the posterior end of each segment, occupying nearly one-third of it, is a band of minute raised points arranged to a certain extent in diagonal rows; the remainder of the surface is finely striated with transverse lines and also marked by shorter impressed lines, radiating from points on either side either connected with the two longitudinal rows of punctures or lying between them. The color is very dark reddish black, almost piceous. Length, 8.76 mm.; breadth, 4.4 mm. s. u. s].

"Bred from *Vanessa atalanta* (T. W. Harris and S. H. Scudder)."

Several bred specimens sent me by Mr. Scudder and others collected in the vicinity of New Haven, agree well with the type specimens of *Osten Sacken*; the only differences that I would note are included within the brackets. Very characteristic of the species is the changing spot on the sides of the face below the antennae.

***Exorista blanda* Osten Sacken. Pl. 89, fig. 11.**

Tachina (Exorista) blanda Osten Sacken, Canadian Entomologist, xix: 162, 1887.

"*Male*.—Distribution of the frontal bristles as in *E. futilis* ♂, that is, on each side, beginning with the vertex, three longer bristles pointing backwards, three shorter bristles before the antennae, and three or four bristles descending on the face, alongside the antennae. On the ocellar triangle a pair of bristles pointing forward. Between the row of frontal bristles and the eyes, a few scattered microscopic hairs; sides of the face bare. Front, face, and posterior orbit silvery white. Frontal stripe brown, rather narrow, enclosing posteriorly the grayish ocellar triangle. Antennae black, slightly tinged with brownish red on the first two joints; the third joint is very long, almost reaching the edge of the mouth. Only a few shorter bristles above the usual long, oral bristle. Palpi reddish yellow. Eyes pubescent. Thorax gray, with a slight yellowish tinge from an oblique point of view; two slightly divergent black lines do not reach beyond the middle; two lateral black stripes are interrupted at the suture and prolonged beyond it to the hind border, these lateral stripes are broadest in the middle and end in a point, anteriorly and posteriorly. Scutellum gray; two [larger and a smaller] macrochaetae on each side, a third intermediate, very small pair on the apex. Abdomen gray, with a slightly yellowish tinge, especially on the last segment; somewhat marmorate, with blackish cross-bands on the hind margins of the segments, and a longitudinal blackish line; the cross-bands appear more distinct and broader from an oblique point of view; the longitudinal line disappears when viewed sideways from above. A pair of macrochaetae on the hind margin of the first segment; two pairs on the second segment, one in the middle, the other on the hind margin; on the third segment a pair in the middle, and the usual row on the hind margin; two rows on the fourth segment. Legs, coxae and femora reddish; tibiae

reddish brown; tarsi brown. Pulvilli unusually large; ungues? (The wings in the described specimen are injured.) Length, 7 mm."

"A single specimen bred from *Cynthia* [*Vanessa*] *cardui* (C. V. Riley). This species is like *E. futilis* in the distribution of bristles on the front and in the structure of the antennae. It differs in the presence of an additional pair of macrochaetae in the middle of the second and of the third abdominal segments; also in the comparative smallness of the intermediate pair of macrochaetae on the apex of the scutellum."

In comparing the above description of Osten Sacken's with the type specimen, I find but one thing I would amend. Baron Osten Sacken describes the legs (femora and coxae) as "reddish." I would insert the word yellow after it. Whether this unusual light color is normal, and, if so, of varietal or specific value, I cannot decide; but in a specimen sent by Mr. Scudder, and bred from *Thanaos brizo*, I can not find any other important differences, aside from the sexual ones of the frontal bristles and pulvilli. The legs in this specimen are quite black, the tibiae only being a little reddish. Such distinct difference I have never seen in allied Tachinidae, but until further specimens are examined, it will be better to consider it varietal, and which may be indicated by the name *proserpina*. The front in both sexes is narrower than usual.

***Exorista hirsuta* Osten Sacken. Pl. 89, figs. 13-15.**

Tachina (Exorista) hirsuta Osten Sacken, Canadian Entomologist, xix, p. 163, 1887.

Male.—Face and cheeks silvery gray, the sides and cheeks changing in different reflections, the ground-color black, with the oral margin in front yellow; above the vibrissal bristle there are two or three small bristles, and above these there is a row of hairs, not reaching as high as the lowermost of the frontal bristles. Antennae black, reaching to near the oral margin; the third joint broad, with parallel sides, three or four times as long as the second joint; arista thickened for more than half of its length. Palpi dark brown or black. Front less thickly pollinose than the face, with a yellowish cast, the black ground-color more apparent above; median stripe broad, deep reddish brown. The single row of well-pronounced bristles descends below the base of the third antennal joint, there being three below the base of the antennae; posteriorly the row terminates in a stout, long, vertical, backwardly directed bristle; the two bristles in the same row in front of these are only a little stronger than the more anterior ones. Just without the two vertical bristles there is, on each side, near the angle of the eye, a smaller bristle directed outward and backward behind the vertical margin; in the middle there are two small bristles directed gently forwards; in front of the ocelli the usual pair of stout, anteriorly and outwardly directed bristles. Eyes pubescent. The bluish black, shining mesonotum shows very distinctly through the grayish dust, which leaves (when seen from behind) five stripes, the middle one of which is very slender; the bristles of the mesonotum are rather stout. Scutellum red at the tip; on each side the margin has three bristles, and at the tip there are two approximated, additional, weak ones. Abdomen black, with a broad, grayish, pollinose band at the base of the second, third and fourth segments, variable in different reflections; first segment with a pair of bristles behind, second with a median and posterior pair; third with a median pair and the usual posterior row; the bristly covering of the abdomen is, however, stronger and thicker than usual, so that these bristles are only moderately differentiated from the rest. Legs wholly black. Front femora pollinose behind. Wings grayish hyaline; tegulae nearly white. Length, 7 mm.

Female.—Like the male, except that the third antennal joint is comparatively

shorter and broader, the epistoma somewhat projecting, and the two usual, anteriorly directed, orbital bristles are present. The second abdominal segment has a pair of posterior bristles, as in the male.

Two specimens, the type, and a male from Mr. S. H. Scudder, both bred from *Pieris rapae*. Characteristic of the species is "on the fourth abdominal segment a number of macrochaetae, giving it a bristly appearance; the smaller hairs of the abdomen are more erect, longer and bristle-like than in *E. futilis* and *E. blanda*," as stated by Osten Sacken. It is possible that this species may be the same as *E. vulgaris* Meigen, parasitic in Europe upon *Pieris rapae*. The description applies. In the type specimen the two bristles on the posterior margin of the second abdominal segment are wanting and so described by Osten Sacken, but a careful examination discloses their scars.

***Exorista theclarum* Scudder. Pl. 89, figs. 17, 19.**

Tachina theclarum Scudder, Canadian Entomologist, xix, 165, 1887.

Male, female. — Face silvery gray, but little variable in different reflections, the ground-color of the sides below, and the oral margin in front, red; there are but four or five short, bristly hairs on each side, above the vibrissal bristle. Palpi black. Antennae black, reaching to the oral margin, the third joint rather broad, of equal width throughout, and four or five times as long as the second joint. Sides of the front more thinly gray pollinose, the shining blue-black ground-color easily apparent above; medial stripe moderately broad, reddish brown, acutely emarginate behind for the shining ocellar space; bristles arranged as in *E. hirsuta*, the uppermost two bristles of each lateral row just below the ocelli are stout and much stronger than the ones preceding them; below, the bristles descend on the side of the face as in *E. hirsuta*; among the frontal bristles are erect, fine black hairs; in the male, the bristle at the upper angle of the eyes and the orbital frontal bristles are wanting. Mesonotum shining blue-black, not thickly pollinose; when seen from behind, with the beginning of five distinct, slender stripes. Scutellum broadly red on its border; the margin on each side with three stout bristles, and, at its apex, with a moderately approximate pair, scarcely smaller than the others. Abdomen shining; on the third and fourth segments usually metallescent black; second segment with a broad, basal, pale gray, pollinose band, variable in different reflections; often a similar, narrower one on the third segment; anterior angles of the third segment in the male with a red spot; first and second segments each with a posterior pair of bristles, strongly differentiated from the erect, bristly hairs of the dorsum. Legs black. Wings grayish hyaline; tegulae white. Length, 5 mm.

Seven specimens, including the types; three bred from *Cyaniris pseudargiolus*, the fourth from the District of Columbia (Pergande), the fifth without locality (Connecticut?), and the types, bred by Mr. Saunders from *Thecla calanus*. The metallescent color, usually apparent on the posterior part of the abdomen, together with the small size, will help to render this species recognizable. Mr. Scudder's description, drawn from living specimens, speaks of the abdomen as "piceous," and it may be well to note that in many specimens the abdomen acquires a deeper opacity, with more obscurity of the lighter ground-color after death.

Exorista scudderi, n. sp. Pl. 89, fig. 20.

Male.—Face in ground-color yellow, with silvery white, variable sheen; the cheeks, except the narrow orbital margin are blue black, and but thinly dusted; there are but three or four small bristly hairs above the vibrissal bristle. Palpi reddish yellow. Antennae black, the third joint largely red at the base on the under side; third joint not broad, of equal width, truncate at the tip, scarcely twice the length of the rather long second joint. Front narrowed above, the sides in ground color black, with grayish or slightly yellowish pollen; median stripe broad, nearly twice as broad as the sides, in color reddish brown; the single row of bristles on each side of the front reaches to nearly opposite the base of the third antennal joint, the bristles themselves are thin and slender, scarcely differentiated in size from the vertical ones; the vertical bristles are arranged as in *E. hirsuta*, that is, with three pairs on the margin and one pair in front of the ocelli. The shining black ground color of the mesonotum leaves four broad and distinct gray pollinose stripes. Scutellum wholly black, thinly pollinose; its margin on each side with three bristles, and its apex with two small approximate ones. Abdomen black, the second and third segments apparently with variable pollinose bands; first segment with a posterior pair of bristles; second segment with a median and a posterior pair; third with a median pair and a posterior row; bristly hairs of abdomen rather long and erect and not strongly differentiated from the above mentioned bristles and those on the distal segments; the sides of the second and third segments broadly, the fourth segment wholly, yellowish red or reddish yellow. Venter reddish yellow, with a narrow median blackish stripe. Legs black. Wings grayish hyaline. Length, 6 mm.

One specimen, Texas (Belfrage), reared from *Thecla autolyceus*, May 15.

Phorocera edwardsii, n. sp. Pl. 89, fig. 52.

Female.—Face opaque white, scarcely at all variable; the cheeks below the eyes, only, show indications of the ground color. The lateral rows of bristles on the sides of the median depression are well-developed, and reach nearly or quite to the base of the third antennal joint and to opposite the last bristle of the frontal rows. Antennae black, the second joint reddish yellow; third joint reaching nearly to the epistoma, of equal width throughout, not narrow. Palpi reddish yellow. Sides of the front with a distinct brassy yellow tinge, broader than the median reddish brown stripe; near the orbit on each side there are two bristles directed anteriorly, and on the vertical margin there are two pairs situated near the upper angle of the eye; the outer one, the smaller of the two, is directed obliquely outward and backward, the inner one backward; behind the middle of the vertical margin there is an obsolete approximated pair of short hair-like bristles; the usual pair of anteriorly directed bristles in front of the ocelli is present. Mesonotum rather strongly gray pollinose, leaving four distinct broad, more shining stripes. Scutellum broadly reddish, its margin on each side with three stout bristles, its apex with a pair of small ones. Abdomen shining black; the second, third and fourth segments each with a broad, distinct, gray, basal band, variable in different reflections; first and second segments each with a pair of stout posterior bristles, second and third segments without median pair; the covering of the abdomen, aside from the bristles mentioned and those on the last segment, is composed of short decumbent bristles, strongly differentiated from the others. Legs wholly black; front femora gray pollinose behind. Wings grayish hyaline; tegulae white. Length, 7 mm.

[The following description of the puparium was taken during life:—Depressed cylindrical, rather short and thick, a little larger at the posterior end where there is a raised, prominent tubercle having at each lateral corner a prominent wart; on each side is a double row of impressed and sunken nearly continuous longitudinal furrows; the

surface is rough with transverse wrinkles and the color uniform dead black. Length, 8.25 mm.; height, 4.25 mm.; breadth anteriorly, 3.5 mm.; breadth posteriorly, 4.5 mm.; length of tubercles, .75 mm. S. H. S.]

Four specimens, bred from *Euvanessa antiopa* L. (G. Dimmock, L. 577), *Anaea andria* (C. V. Riley), and *Chlorippe celtis* (C. V. Riley, No. 48302, Oct. 9, '82.). The European parasite of this species, *P. concinnata* Meig., seems to be different. This species is respectfully dedicated to Mr. W. H. Edwards, the well known lepidopterist.

***Phorocera saundersii*, n. sp.**

Female.—Front and face black only thinly whitish dusted. Frontal stripe broad, black. Arrangement of bristles normal; the frontal rows descend further on the face than usual and turn outwardly nearly to the eyes, the bristles strong, and the four upper ones of the row directed backward. Antennae black, the third joint reaching nearly to the oral margin; arista thickened to near its end. Palpi reddish at the tip. Mesonotum shining metallescent bluish black, imperfectly concealed beneath the thin pollen. Distal half of the scutellum red; the median pair of marginal bristles approximate and small. Abdomen shining, metallescent black, thinly pollinose in an oblique light; first segment with a pair of bristles on the hind margin; second segment with three pairs of bristles, one pair near the front margin, another near the middle, and the third behind; third segment with two pairs, corresponding to the first two pairs of the second segment, and with the usual row behind; the bristles are well differentiated from the general covering of the abdomen, and towards the tip give a rather strongly hirsute appearance. Legs black. Wings grayish hyaline; last section of the fourth vein strongly concave after the angle. Length, 9 mm.

One specimen (Dr. Riley's collection), bred from chrysalis of *Argynnis cybele*.

***Phorocera comstocki*, n. sp.**

Female.—Front broad and convex, silvery gray pollinose on the sides; the median stripe distinctly less than one-third of the width; arrangement of bristles normal, the bristles themselves not very stout. Face in ground-color reddish-yellow, densely grayish white, pollinose; the moderately stout bristles of the edges of the facial depression reach nearly to a point opposite the lowest one of the frontal row, and below the base of the third joint of the antennae. First two joints, and base of the third of the antennae, reddish yellow, third joint not broad, four or five times as long as the second; arista thickened on less than half its length. Palpi yellow. Mesonotum densely pollinose, leaving two slender, posteriorly abbreviated stripes, and an outer, abbreviated and interrupted stripe on each side. Scutellum yellow on distal part. Abdomen elongate-conical, densely and broadly fasciate with gray; first segment without (apparently) a posterior pair of bristles; second segment with two pairs, towards the front and behind; third with an anterior pair, and the usual row behind. Legs black; last section of the fourth longitudinal vein more oblique than usual, and not curved. Length, 9 mm.

Two specimens, male and female (of Dr. Riley's collection), bred from *Megathymus yuccae*. The front of the male is broad, and the claws and pulvilli are not enlarged.

Masicera archippivora Riley. Pl. 89, fig. 18.

Tachina archippivora Riley, 3d Rep. Ins. Missouri, 150 (1871).

Female.—Face opaque gray; a row of moderate-sized bristles on the margin of the central depression, reaching two-thirds or more of the distance to the base of the antennae. Sides of the front opaque yellowish-gray, the ground color scarcely visible; the median posteriorly bifurcated, dark reddish-brown stripe, narrower than the sides. Bristles of the front normal, that is, arranged as in *Exorista futilis*, *hirsuta*, etc. Palpi yellow. Eyes bare. Antennae black, the basal half of the third joint, and more or less of the second, red or reddish; third joint from five to six times the length of the second; arista thickened for half of its length or more. Dorsum of thorax rather densely gray pollinose, with a yellowish cast, leaving four black stripes, the median two of which are slender, and abbreviated posteriorly. Scutellum gray pollinose, the tip yellowish red; bristles normal (three on each lateral margin, an apical pair, and a dorsal pair), stout, the apical pair approximated and small. Abdomen black, short, thickly gray pollinose, variable in different reflections; second segment with a posterior pair of bristles, no median bristles on this and the next segment; the general covering of short bristles well differentiated from the long bristles. Legs black. Wings grayish hyaline; tegulae white. Length, 5-6 mm.

Three specimens, bred from larvae of *Anosia plexippus* (Dr. Dimmock, L. 505). A male specimen, from Dr. Riley, bearing the label: "From larvae of *Papilio*, Greeley, Colo., July 31, '77," I cannot distinguish in the absence of other male specimens. The third antennal joint is more elongate and wholly black, and the pulvilli are not elongate.

[Dr. Dimmock's specimens came out of the nearly full grown larva of *Anosia* on July 20, pupated July 23, and the imagos appeared August 2-3.]

The above description is based upon specimens in a good state of preservation, but I am not at all sure that they are the same as the type of the species. Five specimens from Professor Riley, apparently including the originally described specimens, present certain differences that at first led me to deem them distinct. In most, the frontal stripe is narrow, as in the described specimens, but, in one (♀) it is distinctly broader than the sides of the front; the third antennal joint, furthermore, seems more rounded upon the posterior inferior angle, giving it a more pointed appearance. In all these specimens the side of the abdomen is more or less red. In size they vary not a little, some being distinctly larger, others distinctly smaller than the ones described. I suspect that they all pertain to one species, but further and careful observation is needed to remove the doubt.

Masicera frenchii, n. sp. Pl. 89, fig. 23.

Male, female.—Closely allied to *M. archippivora*, but distinguishable at once by the elongate pulvilli of the male. The antennae are broader, and wholly black; the frontal stripe is fully as broad as, or broader than, the sides. The facial depression is broader, and the color of both face and front more distinctly yellow. The grayish pollinose stripes on the shining blue-black mesonotum are less dense, as is also the grayish covering of the abdomen. The abdomen has no red on its sides. Length, 6.7 mm.

Five specimens, bred from *Jasoniades glaucus*, November 26, 1881. Moosehead Lake, Me. (S. H. Scudder).

Masicera rileyi, n. sp. Pl. 89, figs. 22, 24.

Male.—Front on the sides distinctly yellowish pollinose; the deep red median stripe a full third of the width of the front; the small bristle near the angle of the eye, and the small, median, vertical pair present, in addition to the usual stout, vertical, posteriorly directed, and the less stout, similarly directed pair on the upper part of the front; the lateral rows are composed of numerous, not very stout bristles, and reach to the base of the third antennal joint. The ground-color of the cheeks and face is chiefly yellow, partly concealed beneath the changeable pollen; the small bristles on the sides of the depression reach nearly to the middle. First two joints of the antennae yellow, the third black, rather narrow, and scarcely three times as long as the second. Palpi yellow. Mesonotum thinly pollinose, the usual stripes apparent from behind. Scutellum, except the narrow base and lateral margin, reddish yellow; the apical pair of bristles very small and approximate. Abdomen yellowish red, with a broad median stripe, and the hind margins of the posterior segments black; the abdomen is clothed rather thickly with recumbent, bristly hairs, and the bristles, which are confined to the hind margin of the third and the fourth segment, are not large or conspicuous. Legs pitchy black; claws and pulvilli small. Wings as usual. Length, 7-8 mm.

Three males and four females from Dr. Riley, labelled: "153, parasitic on [Heraclides] cressphontes," and "358, Feb. 24, '80." The female shows but little difference from the male, aside from the lateral orbital bristles; the third antennal joint appears to be a little broader.

Masicera (Phorocera?) sp.

A single male specimen, from Professor Riley, bearing the label: "June 23, '79, par. on antiopa," I am not quite sure whether to locate under *Masicera* or *Phorocera*. The under portion of the eye is very sparsely hairy, almost doubtfully so, but the absence of median bristles on the abdominal segments indicates a closer relationship to *Masicera*. The front and face are yellowish pollinose, the frontal stripe a third of the width of the rather narrow front. Antennae black; palpi yellow. Leg black, somewhat pitchy; claws and pulvilli elongate and large. From *M. rileyi*, the narrower front, more black abdomen, and especially the elongate claws and pulvilli will distinguish it. To *M. frenchii*, the relationship is closer, but the third joint of the antennae is shorter (in *frenchii* the third joint is four or more times as long as the second), and the abdomen is not wholly black. From the species of *Phorocera* here described, the entire absence of bristles on the second segment of the abdomen will distinguish it. Should the characters above given serve to fix the species, it may be called *M. dubia*.

ADDITIONS AND CORRECTIONS.*

Page 11, note. The statement here regarding *Pamphila mandan* is inaccurate (see correction p. 1565). *For Coolidge, read Chapman.*

14, 16. The head lines should read *Butterflies.*

14, line 19, *for montivagus, read montivaga.*

15. *For Thestor (twice) read Tomares.*

16. For a fuller account of the structure and action of *Curetis*, see de Nicéville's *Butterflies of India*, iii: 7-8.

33, 35. In the head lines, *for caterpillar, read chrysalis.*

47. Muscular system; lines 6 and 7 *should read*: and above, some to the bases . . . as a lever, but the mass to the upper wall, serving to flatten the thorax and so raise the wings; besides, etc.

71, lines 6 and 8. *Mabille's* name should certainly have been added to the French, and de Nicéville's to the English names.

72-75. A somewhat extraordinary disquisition, in opposition to the views here maintained, views which seem to be very poorly apprehended by the writer, will be found in the *Can. ent.*, xxi, nos. 4, 5 (1889).

84, line 13, *for contracted, read contrasted.*

107, line 17. *For medium, read median.*

114, last lines but 2 and 8. *For larger, read longer.*

117. Characteristics of the Satyrinae. Notes on the transformation of the members of this subfamily are given by Edwards, *Can. ent.*, xxi: 63-68 (1889).

120, line 22. I have later, *Excursus XL*, mentioned some odoriferous *Satyrinae*, and de Nicéville tells me they are not uncommon in India and the odor is always fragrant.

149. Oeneis jutta. Further notes on the history of this species are given by Fyles, *Can. ent.*, xxi: 12-13 (1889).

152, line 28. *For Gideon, read Gamble.*

153, line 20. I learn that *jutta* was discovered by Prof. C. H. Fernald at the Orono-Stillwater bog, in 1879, before Mr. Braun came to Bangor.

155, line 8. *Juniper* is a local name in Maine and the maritime provinces for the American larch, *Larix americana*.

165, line 14. The comma should be a semicolon.

168, line 5. *For Stenacke, read Stewiacke.*

180. Enodia portlandia. An interesting account and abundant illustrations of this insect in all its stages will be found in Edwards's *Butterflies of N. A.*, iii, part v.

193, first column of synonymy, line 15, *for Neonymaha, read Neonympha.*

203. Neonympha phocion. This butterfly is described in all its stages by Edwards, with his customary wealth of illustration, in the *Butterflies of North America*, 3d series, part vi, Dec. 1888.

209. The head line should read: The genus *Cissia*.

231. The head line should read: The genus *Chlorippe*.

247. Parasites. *Pimpla annulipes* should probably be added; see p. 1885.

248, first and last lines, *for ovata Say, read flavipes Fabr.*

273, line 1, *for caudicans, read candicans.*

Line 17, *for say, read says.*

274, line 22, *for were, read was; for their, read these.*

285, line 15, *for* , *read Vaccinium.*

* Evident typographical errors are not noted.

296. Hybrids. B. ARTHECHIPPUS. Dr. Hagen assures me that Edwards's description and mine were based upon the same individual.

315, line 6, *for* erect on, *read* on erect.

326, lines 43, 44, the quotation should end with the word numerous.

327. Oviposition. Mr. Edwards tells me that Mrs. Peart observed one case in which the final egg of a chain had eleven ribs, when all the others had nine. Could a second female have *possibly* placed an egg upon a chain laid by another!?

338, line 5. Mr. Edwards assures me that there is no doubt that the specimen came from McKenzie River.

Food plants. Mr. Edwards has seen a female lay an egg on a gooseberry bush, and obtained the egg.

377, line 16. *For* Doxocopa, *read* Chlorippe.

Last lines. For further notes on butterflies at sea, see Entom., xxi:161-162, June, 1888.

379, Eugonia j-album. Add to the synonymy: *Eugonia j-album* Scudd., Foss. butt., 43, 44, pl. 1, fig. 4 (1875).

392, line 32, and **394**, lines 6, 12, *for* Inachis, *read* Hamadryas.

394. Euvanessa antiopa. For further brief notes on the sound produced by this butterfly, see Insect life, i:221.

403. Food plants. Grove (Jouru. N. Y. micr. soc., Oct. 1887) says he has found the caterpillar on the ailanthus tree, the castor bean and geranium! but his description of a colony on a castor bean leaf makes one think he has mistaken some other caterpillar for that of *E. antiopa*.

406. Life history. *Antiopa* is reported by Jenner Weir as having been seen in flight on a warm December day by Haydon at Moose Factory, Hudson Bay! (Entom., xv:115).

407. Hibernation. Grove found a colony of "at least fifty" under a foot bridge over a small creek in December, hanging by their feet; when breathed upon they showed signs of life.

410, line 27, *for* Inachis, *read* Hamadryas.

419, lines 11, 18, *for* Inachis *read* Hamadryas.

437, line 21, *for* Inachis *read* Hamadryas.

441, in the synonymy, *for* Papilo amiralis, *read* Papilio amiralis.

455. Parasites. *Pteromalus puparum* is to be added to the list that attack *Vanessa atalanta* in this country, and from the chrysalids of *Eulophus* referred to were only reared a secondary parasite, *Cirrospilus niger*. To the European parasites should be added *Pimpla flavicans* Fabr., according to Rondani.

476, line 22, *for* formed, *read* found.

477. Aberrations. Another instance of *Vanessa cardui elymi*, the fore wings very like the specimen in the Harris collection, but the hind wings also suffused, is described and figured by Clark (Entom., xiii:73-74).

479, last paragraph. De Nicéville writes me that *V. cardui* is by no means confined to the mountains, but is to be found almost everywhere in India, though very rare in Calcutta.

481. Food plants. Riley writes that "a correspondent, Mr. J. G. Barlow of Cadet, Mo., has found larvae of *cardui* feeding abundantly upon *Malva sylvestris*," and he adds: "A species of what I believe is a *Malva*, though I have not had it determined, is a common food plant of the species along the New Jersey Coast, and it feeds here in Washington on *Chrysanthemum* and *Helianthus*."

486. Enemies. To the European parasites, must be added, on Rondani's authority, *Ichneumon castigator* Fabr.

492, line 26, *for* *H. charitonia*, *read* *A. charithonia*.

493, line 21, *for* it takes, *read* they take.

496, line 13 from bottom should end in a colon, "this" having the sense of "the following."

518, line 15 from bottom, *for* born, *read* borne.

570, line 16, *for* do, *read* does.

572, line 12 from bottom, the \mathcal{J} sign should precede discernible.

614, line 7 from bottom (and in several other places), *for* Schoharie *read* Schoharie.

697, line 5, *for* Virburnum, *read* Viburnum.

717, line 26, *for* mimicy, *read* examples of mimicry.

740. **Life history.** Although, as recorded on p. 737, *A. plexippus* was exceedingly abundant in the northern half of New England in the autumn of 1888, and the winter of 1888-1889 was unprecedentedly mild, with an exceptionally early spring, no butterflies had been observed, so far as I can learn, up to May 30 (the present writing), when one was heard of; all of which accords perfectly with the account of the life history given in the text.

753, line 15 from bottom, the comma should come after surface.

758, lines 7-8. *Thais*, and therefore in the highest probability *Thaites*, does not belong, as I thought on insufficient examination, to the *Parnassidi* but to the *Papilionidi*. The egg is precisely as in the swallow tails, and the division of the segments of the caterpillar as well.

770, second paragraph. The chitinous annuli of the first stage of the caterpillars of the *Lycenidae* cannot be said to be unique, for the crateriform annuli of the *Hesperiidae* must be regarded as homologous structures.

776. **The early stages of the *Lemoniinae*.** When I wrote this section, and indeed until some time after its publication, I had never seen Sepp's *Papillons de Surinam*, by the later obtaining of which I am obliged to make some modifications. Thus, Sepp asserts that the caterpillar and chrysalis referred by Stoll' to *Euselasia crotopus* do not belong here, but to the immediate neighborhood of the one whose transformations he figures as *Papilio maumeae*, and which is catalogued by Kirby under *Nymphidium*, thus transferring the insect from the *Nemeobiidi* to the *Lemoniidi*. This, considering the other mistakes made by Stoll', and the confident expressions of Sepp, we could easily believe; only it is a little curious that Sepp says of his insect that the caterpillar is processionary, which Bar also asserts of *Euselasia gelon*; it is of course in no way impossible that such a feature should occur both in *Euselasia* and *Nymphidium*, but taken in connection with the evident error of either Stoll' or Sepp, it is not a little strange, and some verification of the observations is evidently required; our present knowledge of the early stages of the family will hardly permit us to judge which was in error.

Sepp figures no less than six species of *Lemoniinae* with their early stages, and oddly enough, considering the few that are given by Stoll', two of Stoll's species are repeated by him, which enables me to make some rectifications. One of these is in *Helicopsis cupido* (see p. 779); here I have evidently made the mistake of taking for the cast-off larval skin what Stoll' had intended for the front view of the larva, looking out of one end of its nest in a rolled up leaf. Stoll's representation is very poor, but the point brought out regarding the size of the head is the same, and is warranted by Sepp's far better figure; here, too, is evidently the better source of the statement I thought without warrant, that the caterpillar constructed a nest much after the manner of the leaf rollers, which Sepp's figure distinctly shows, and which he also distinctly states, adding that it is more closely rolled, and the open end closed when the caterpillar is about to change to chrysalis.

The other butterfly whose transformations are given by both authors is *Stalactis callope*, which Sepp tells us lays eggs in a mass, the caterpillars remaining in company until they change. The figure represents the caterpillar as having the same proportions as Stoll's, but the head a little larger, and the same shield on the anterior and posterior segments of the body; but what I had taken for black points on the intermediate segments are now shown, in the light of Sepp's figure, to be not mediodorsal, but laterodorsal or supralateral, and to be merely the bases of the series of supposed fasciated hairs; these, however, in Sepp's figures, certainly do not represent fasciated hairs, but what are apparently long and tapering spiniferous filaments. As to the chrysalis, Stoll' and Sepp are again opposed; the chrysalis given by Sepp, though closely resem-

bling Stoll's in the markings, is far stouter and more regularly ovate, but like it shows a dorsal surface and no head. The account of its position by Stoll is given on p. 781; Sepp gives a very different one: the caterpillar attaches itself by the abdomen to a branch, or often a leaf, and after having *spun another band around its body* changes to a chrysalis.

The four remaining butterflies given by Sepp alone, belong, like the last, to the Lemoniidi.

The first is *Mesene nigrocinctus*. The caterpillar is more distinctly onisciform than any other Lemoniid, no sign of the head appearing in the figure, so that it is difficult, if not impossible, to divine which is the head end; it is much less than twice as long as broad, oval, but more pointed at one end, apparently the head end, than the other, and seems to be tectiform, the mediodorsal line ridged, and uniformly and sparsely covered with stiff, erect, tapering bristles, as long as the width of the body. Little can be said of the chrysalis as the details are poorly given, but it is of about the same size and proportions as the caterpillar, the tail more pointed than the head, and covered with similar but rather more delicate bristles, with no sign of fasciation. Sepp distinctly says it is girt about the middle.

The next is *Metacharis erythromelas*. This has much the general form of an ordinary Lycaenid larva, but has the front portion a little swollen, somewhat like an *Amblypodia*, and is slender posteriorly, the whole creature fully three times as long as its greatest width; the head does not appear distinctively as such, and is apparently, at least in part, retractile within the swollen mass behind it, and, moreover, this is further indicated by Sepp's expression that "in walking, the caterpillar advances its head." The sides of the body along the infrastigmatal fold are furnished with little triangular, fleshy processes, concealing the legs; the whole body is sparsely clothed with long, delicate, gently curving, erect, and apparently delicate hairs, with no sign of fasciation or special distribution; besides, says Sepp, they are covered with a white powder, which spreads also on the leaves where they crawl, but which is less apparent as the caterpillar grows larger. The chrysalis, which is rather obscurely drawn, partly on account of the white powder which appears still to cling to it, is not very unlike a Lycaenid chrysalis, but tapers more in a conical form on the abdomen, like the Lemoniinae generally; it is a little more than twice as long as broad, without prominences, bluntly rounded at the front, which apparently terminates with the prothorax, covered with large spots and with a few long bristles, not so long as those of the caterpillar. It is girt around the middle.

The third is *Nymphidium mammeae*, already referred to. Here the caterpillar wholly resembles in general appearance, with only specific differences, the caterpillar attributed by Stoll to *Euselasia crotopus*, with its two erect, stiff filaments behind the head, "points très élevés," Sepp calls them; it is considerably slenderer, however, than Stoll represents it. The chrysalis is also similar in shape in every respect, though of very different and livelier colors. Sepp adds that the eggs are laid in a mass and the caterpillars live in company, and are processionary, eating little and growing slowly. The chrysalis is so tightly girt around the middle as to prevent all movement.

The last instance is an allied insect called *Papilio caricae* by Sepp, clearly of a different genus, but placed by Kirby in *Nymphidium*, as by Bates before him. The caterpillar has the same form as the last, is a little less than three times as long as broad, but has no erect bristles behind the head; the head, however, has a rounded, vertical prominence on either side and has a radiating frill of aculiform bristles as long as the head, encircling the hinder face; a few short hairs are seen at the extremity of the body which otherwise is apparently naked. An interesting point in its natural history is that it lives on the upper side of leaves exposed, and is always surrounded by very small ants; this being the only instance known to occur, so far as I am aware, among the Lemoniinae. The chrysalis is hesperidiform, a little more than three times as long as broad, the bluntly rounded front apparently terminated by the prothorax, and a subconical, pointed abdomen; it is girt around the middle.

Sepp is careful to give the food plants of his insects, by which it appears that there

is as much range among the Lemoniidi as among the Nemeobiidi. Thus *Nymphidium caricæ* feeds on *Inga vera*, one of the Leguminosae, the same family which nourishes *Lemonias*; *Nymphidium mammeæ* on the Mamay apple, *Mammea americana*, one of the Guttiferae; *Mesene nigrocinctus* on *Paulinia pinnata*, one of the Sapindaceae; *Stalachtis calliope*, whose food is not given by Stoll', on the *Sappodilla*, of the Sapotaceae; and *Metacharis erythromelas* on *Phoradendron trinervium*, one of the Loranthaceae.

These additional data show that the conclusions stated on p. 783 regarding the possible distinction between the Nemeobiidi and Lemoniidi in their early stages are not wholly warranted. In the first place it becomes necessary, until verification, to throw out of consideration the two species of *Euselasia* and the two of *Nymphidium* until their accuracy is guaranteed by new experiments; and again there is no sign of any fasciation in the clothing of the caterpillar of *Mesene* and *Metacharis*, and not only are the chrysalids of both these species girt, but, according to Sepp and contrary to Stoll' and Bates, the same is true of *Stalachtis*.

On the other hand these additional instances of known transformations strengthen the position assumed that the transformations and early stages of the Lemoniinae do not differ sufficiently from those of the Lycaeninae to warrant the separation of the two groups as distinct families.

776, note. Sepp figures a very similar but certainly not identical caterpillar (witness the length of the fleshy filaments) as that of *Mechanitis polymnia*.

777, line 25, for it, read the latter.

787, line 11. It was Sara Coleridge. She wrote: "Butterflies are *better* flies—larger flies, the largest sort of flies that you meet with." See her *Memoir and Letters*.

792, line 3, read male.

Line 42, for not all, read not at all.

793. General characteristics. De Nicéville (*Butt. India*, iii: 5) gives tables of the genera of Indian butterflies in which he has detected secondary sexual distinctions in the form of patches of special scales or tufts of hairs, on the fore or hind wing or both, in which twenty of the thirty-two genera of his work are included, and an excellent account is there given of the habits of the family. De Nicéville also gives, p. 11, a list of a considerable number of mimicking and protected genera of Indian Lycaeninae, prepared by Doherty.

796. Attendance of ants on caterpillars. A most extraordinary account is given by Mrs. Wylly of the action of ants in herding Lycaenid larvae (*Journ. Bomb. nat. hist. soc.*, iii: 166-167, 1888), which gives force to Thwaites's observations. Sepp also states that the larva of one of the Theclidi of Surinam is attended by ants, as well as of one of the Lemoniidae, both of which statements have never been verified or repeated with any other members of their respective groups, so far as I am aware, and indicate how much we have to learn.

797. De Nicéville brings together (*Butt. India*, iii: 9) several instances of chrysalids of Lycaeninae attached by the tail only, and either so firmly attached as to be held rigidly in a horizontal position, or, as in *Poritia*, *Spalgis* and *Tajuria*, hanging freely, and he thinks the exceptions to the ordinary position and girding "many." But two of his instances are based wholly upon the illustrations of Moore who also figures one of the Pierinae in a similar, evidently false, position, and, therefore, little dependence is to be placed upon them. I do not mean to deny the occurrence of free hanging chrysalids among the Lycaeninae, but I think each supposed instance needs to be verified by additional observation; one instance, which may be accidental, is not enough, for if the girth is accidentally broken, the chrysalis, in most instances, would naturally fall and hang by the tail.

813. I failed to note that I had taken *S. titus* in the American Fork Cañon, Utah.

825, line 24, read not further raised.

833. Life history. Mr. Fletcher obtained two eggs of *I. nippon* on May 16th, laid on the young shoot of white pine, just pushing forth. I am inclined to think that it is just here that all eggs are laid on Coniferae by butterflies.

848, line 26, *read* not further raised.

868, second line of poetical quotation, *for* Eit, *read* Lit.

881, line 3, *for* where the, *read* where they.

882, second paragraph. Dr. Fitch observed this caterpillar attacking plums, as long ago as 1870, as appears from the following passages found among his notes:—

“June 5, 1870. Noticed a young Smith's Orleans plum, now grown to over a half inch in length, having a conical hole eaten in its side, passing deep in, through the centre. First thought this the work of some bird; but looking further saw the next plum below eaten through and through till it was now nearly all consumed and this worm with its head sunk into the hollow remaining part of the plum, and its body clinging to the upper end of the fruit stem. Put the worm into a tumbler with a young wild plum and leaves.

“June 6, 1870, it has eaten a hole deep in the side of the plum on which it stands with its head sunk down into this hole, and has discharged a profusion of soft wet feces of a dull pale yellow color, some adhering to the side of the plum, but most of them fallen down to the bottom of the tumbler.

“June 10, it has now eaten out all the inside of the plum, making a hollow cavity in it, consuming about a third of the plum and has fastened itself to the paper covering the tumbler—fixing its hind end to the paper, and with several silk threads forming a loop to hold the fore part of its body up in contact with the paper—these threads commencing separately and spread apart at their ends, and drawn together and sunk into the suture between the thorax and abdomen. It has thus taken on its pupa form, held against the paper with its back downwards.”

I add his descriptions of the early stages:—

“*Larva* 0.55 long, 0.20 thick, regular oval or a little more narrowed at hind end, bluntly rounded at each end, sutures very distinct, marked by transverse constrictions, except the two last, which are less plain. Twelve segments, the anterior ones, after the head, shortest, and slightly increasing in length backward. No projecting processes. Surface closely bearded with short hairs. Color bright apple green. A faint pale greenish-yellow dorsal line, bordered each side by a faint green stripe—this yellow line ending on the fourth segment from the tip, and these last segments have a deeper green dorsal stripe faintly bordered each side with pale greenish yellow. The back occupied on each side by oblique faint stripes of green and greenish yellow, alternating; the yellow stripes beginning a little back of each breathing pore, and embracing the pore, and passing diagonally forward and upward across the two segments next forward of the pore, to the green dorsal stripes bordering the dorsal line. Breathing pores very small, glossy, nankin yellow dots. Lower part of each side green, with a slender, pale yellow stripe. Underside and legs dull whitish.

“*Pupa* 0.35 long, and about 0.20 wide and 0.20 high, oval, broadest beyond the middle, the anterior third of its length slightly narrower than it is farther back; anterior end bluntly rounded; hind end gradually tapered to a bluntly rounded tip. Abdominal segments distinctly marked by impressed transverse sutures. Head separated from the body by a similar transverse suture, its anterior side rounded, the line bounding it forming about a third part of a circle. Color dull yellowish brown, mottled with black, the whole surface bearded profusely with gray hairs, except on the flattened underside. The spiracles forming a row of white dots along each side; and in the suture at base of head, near its outer end on each side is a short streak resembling white pruinous matter.

“July 1st found it hatched a *Thecla* butterfly, lying dead on bottom of tumbler.” His description of the same enables me to determine it to be *Thecla liparops*.

907, line 35, *for* continues, *read* continue.

960, line 29, *for* *Astralagus*, *read* *Astragalus*.

962, line 16-13 from bottom. As stated above in these additions, Sepp asserts that the caterpillar of “*Thecla*” ingae, and of *Nymphidium caricae*, the latter one of the *Lemoniinae*, are likewise attended by ants, and presumably for the same cause as the larvae of *Lycaenidi*.

Last line. See preceding note.

967, line 23, *for* Labache, *read* La Hache.

1070, line 16, *for* Terias, *read* Eurema.

1071, line 25, *for* frost, *read* first.

1100, foot note, *for* Long, *read* Lang.

1122. **Life history.** Mr. Fletcher sends me the first specimen, a male, taken or seen by him at Ottawa in 1889, May 24, and it has much the appearance, as he remarks, of having hibernated.

1125. **Enemies.** The reference to *Megorismus* is unfortunate; the specific name is unpublished, and it is by accident that it was referred to *E. philodice* as a host. The clusters of cocoons referred to doubtless belonged to some *Apanteles*, of which *Mesochorus* was a hyperparasite.

1127, col. 1, line 4, *read* edusa; col. 2, line 7, *read* eurytheme.

1136. **Enemies.** The asilid fly was afterwards determined by Riley as a species of *Stenopogon*.

1162, line 10, *for* usually, *read* unusually.

1210, line 5, *for* napa, *read* rapa.

1224, lines 24, 25. This statement requires modification. *Thais*, at least, belongs to the *Papilionidi*; see, above, the correction for p. 758.

1261, in the line of Greek, omit the second comma.

1279, line 20, after *annulipes*, insert (88:6).

1280, column 1, under General, *add*: 88:6. *Pimpla annulipes*, a parasite.

1344, line 24, *for* humeralis, *read* utilis (88:4).

Under General in List of Illustrations, *add*: 88:4. *Hemiteles utilis*, a parasite.

1378. In the synonymy, *for* *Gonulurus*, *read* *Goniurus*.

1394, line 5. *read* (41:2).

1422, line 16, *for* *Ipomaea* *read* *Ipomoea*.

1455, line 6, *for* *Polygonia faunus*, *read* *Polygonia comma*.

1511. **Food plants.** Professor C. H. Fernald informs me that he reared this species in the spring of 1889, from caterpillars feeding on choke cherry, *Prunus virginiana*.

1529, line 23, *for* *tessellata*, *read* *montivaga*.

1594, lines 17, 18. In writing this I overlooked observations of my own on *Calpodes*, made many years ago and recorded on pp. 1755-1756.

1648. **Comparisons.** In several places *for* *P[amphila]*, *read* *E[rynnis]*.

1715, line 9. The species here referred to as *L. palatka*, is not the *palatka* of Edwards, but his *pallas*. See p. 1864.

1794, 2d column of synonymy, line 1, *read* *troglodyta*.

CORRECTIONS IN THE EXPLANATIONS OF PLATES.

3:12-13. These should be interchanged. 12 represents *P. i. umbrosa*; 13, *P. i. fabricii*.

49:4. The scales in *b* and *e* are from the middle of the stigma itself.

63:7-8. These should be interchanged. 7 represents the ovary cells; 8, the mesoderm cells.

74. The plate was printed in nineteen colors.

83. This plate was printed in twenty-two colors.

88:4. Should read *Hemiteles ntilis*.

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PART VIII, containing pages 89-104, 1049-1216, plates 7, 13, 28, 45, 57, 65, 73 and the map of the distribution of *Pieris rapae*, June 1, 1889.

PART IX, containing pages 1217-1400, plates 8, 29, 36, 48, 58, 69, 77 and the portrait of Harris, July 1, 1889.

PART X, containing pages 1401-1552, and plates 15, 17, 30, 49, 59, 66, 85 and 87, August 1, 1889.

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EXPLANATION OF PLATE 1.

Butterflies in color.—Nymphalidae, especially Satyrinae.

Printed in color from eight stones by Thomas Sinclair and Son, after drawings by L. Trouvelot. All of natural size. Where both surfaces are given, the detached wings represent the under surface.

- | | |
|---|--|
| 1. <i>Cercyonis nephele</i> ♀. Both surfaces. | 7. <i>Anosia plexippus</i> ♂. Both surfaces. |
| 2. <i>Cercyonis alope</i> ♀. Both surfaces. | 8. <i>Cissia eurytus</i> ♂. Both surfaces. |
| 3. <i>Enodia portlandia</i> ♂. Both surfaces. | 9. <i>Oeneis semileia</i> . Body and upper surface of ♀; under surface of ♂. |
| 4. <i>Cercyonis nephele</i> ♂. Upper surface. | 10. <i>Satyrodes eurydice</i> ♂. Both surfaces. |
| 5. <i>Basilarchia archippus</i> ♀. Both surfaces. | |
| 6. <i>Cercyonis alope</i> ♂. Upper surface. | |



EXPLANATION OF PLATE 2.

Butterflies in color. — Nymphalidae (Nymphalinae).

Printed in color from eleven stones by Thomas Sinclair and Son, after drawings by J. Henry Blake (figs. 1, 4-7, 9) and L. Trouvelot (figs. 2, 3, 8). All are of natural size. Where both surfaces are given, the detached wings show the under surface.

1. *Vanessa cardui*. Both surfaces.
2. *Vanessa huntea* ♂. Upper surface.
3. *Vanessa huntea* ♀. Both surfaces.
4. *Eureanessa antiopa*. Both surfaces.
5. *Basilarchia arthemis* ♂. Both surfaces.

6. *Vanessa atalanta* ♀. Both surfaces.
7. *Aglais milberti*. Both surfaces.
8. *Basilarchia astyanax* ♂. Both surfaces.
9. *Basilarchia proserpina* (*astyanax-arthemis*) ♂. Both surfaces.





EXPLANATION OF PLATE 3.

Butterflies in color.—Nymphalidae (Nymphalidi).

Printed in color from eleven stones by Thos. Sinclair and Son, after drawings by J. Henry Blake (figs. 1-4, 6-13) and Sidney L. Smith (fig. 5). Natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|--|---|
| 1. <i>Polygonia comma dryas</i> ♂. Both surfaces. | 9. <i>Eugonia j-album</i> ♂. Both surfaces. |
| 2. <i>Polygonia faunus</i> ♀. Lower surface. | 10. <i>Polygonia interrogationis umbrosa</i> ♀. Lower surface. |
| 3. <i>Polygonia comma harrisii</i> ♂. Both surfaces. | 11. <i>Polygonia gracilis</i> ♂. Both surfaces. |
| 4. <i>Polygonia comma dryas</i> ♀. Lower surface. | 12. <i>Polygonia interrogationis fabricii</i> ♂. Both surfaces. |
| 5. <i>Polygonia progne</i> ♂. Both surfaces. | 13. <i>Polygonia interrogationis umbrosa</i> ♂. Both surfaces. |
| 6. <i>Polygonia faunus</i> ♂. Both surfaces. | |
| 7. <i>Polygonia comma harrisii</i> ♀. Lower surface. | |
| 8. <i>Polygonia interrogationis fabricii</i> ♀. Lower surface. | |



EXPLANATION OF PLATE 4.

Butterflies in color.—*Nymphalidae*, especially *Argynnidi*.

Printed in color from ten stones by Thos. Sinclair and Son, after drawings by L. Trouvelot (figs. 1-3, 5-8) and G. A. Ponjade (fig. 4). Natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|--|---|
| 1. <i>Argynnis aphrodite</i> ♀. Both surfaces. | 5. <i>Brenthis myrina</i> ♀. Both surfaces. |
| 2. <i>Argynnis aphrodite</i> ♂. Both surfaces. | 6. <i>Argynnis atlantis</i> ♂. Both surfaces. |
| 3. <i>Speyeria idalia</i> ♀. Upper surface. | 7. <i>Argynnis cybele</i> ♀. Both surfaces. |
| 4. <i>Hyppatus bachmanii</i> ♂. Both surfaces. | 8. <i>Speyeria idalia</i> ♂. Both surfaces. |

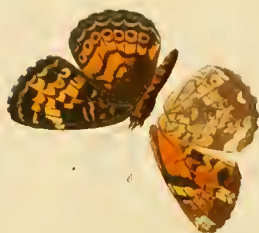


EXPLANATION OF PLATE 5.

Butterflies in color. Nymphalidae (esp. Melitaeidi) and Lycaenidae (Chrysophanidi).

Printed in colors from eight stones by Thomas Sinclair and Son, after drawings by L. Trouvelot (figs. 1-4, 6, 10, 13-15) and Sidney L. Smith (figs. 5, 7-9, 11, 12). Natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|---|---|
| 1. <i>Phyciodes tharos morpheus</i> ♂. Both surfaces. | 8. <i>Feniseca tarquinius</i> ♀. Both surfaces. |
| This is the form called var. A by Edwards. | 9. <i>Chrysophanus thoe</i> ♂. Both surfaces. |
| 2. <i>Euphydryas phaeton</i> ♀. Both surfaces. | 10. <i>Cinclidia harrisii</i> ♀. Upper surface. |
| 3. <i>Phyciodes tharos morpheus</i> ♀. Both surfaces. | 11. <i>Heodes hypophlaeas</i> ♂. Both surfaces. |
| This is the form called var. B by Edwards. | 12. <i>Chrysophanus thoe</i> ♀. Upper surface. |
| 4. <i>Cinclidia harrisii</i> ♂. Both surfaces. | 13. <i>Brenthis bellona</i> ♂. Both surfaces. |
| 5. <i>Epidemia epixanthe</i> ♀. Upper surface. | 14. <i>Brenthis montinus</i> ♂. Both surfaces. |
| 6. <i>Charidryas nycteis</i> ♀. Both surfaces. | 15. <i>Brenthis bellona</i> ♀. Both surfaces. |
| 7. <i>Epidemia epixanthe</i> ♂. Both surfaces. | |



EXPLANATION OF PLATE 6.

Butterflies in color.—*Lycaenidae*.

Printed in color from fifteen stones by Thos. Sinclair and Son, after drawings by J. Henry Blake. Natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|---|--|
| 1. <i>Cyaniris pseudargiolus neglecta</i> ♂. Both surfaces. | 12. <i>Cyaniris pseudargiolus lucia</i> ♀. Both surfaces. |
| 2. <i>Calephelis borealis</i> ♂. Both surfaces. | 13. <i>Thecla acadica</i> ♂. Both surfaces. |
| 3. <i>Cyaniris pseudargiolus violacea</i> ♂. Both surfaces. | 14. <i>Thecla calanus</i> ♀. Both surfaces. |
| 4. <i>Cyaniris pseudargiolus neglecta</i> ♀. Upper surface. | 15. <i>Thecla ontario</i> ♂. Both surfaces; copied from Edwards. |
| 5. <i>Cyaniris pseudargiolus violacea</i> ♀. Upper surface. | 16. <i>Thecla edwardsii</i> ♂. Both surfaces. |
| 6. <i>Rusticus scudderii</i> ♂. Upper surface. | 17. <i>Mitura damon</i> ♀. Both surfaces. |
| 7. <i>Rusticus scudderii</i> ♀. Both surfaces. | 18. <i>Mitura damon</i> ♂. Both surfaces. |
| 8. <i>Cyaniris pseudargiolus lucia</i> ♂. Both surfaces. | 19. <i>Incisalia irus</i> ♂. Upper surface. |
| 9. <i>Everes comyntas</i> ♂. Both surfaces. | 20. <i>Uranotes melinus</i> ♀. Both surfaces. |
| 10. <i>Everes comyntas</i> ♀. Upper surface. | 21. <i>Incisalia niphon</i> ♀. Upper surface. |
| 11. <i>Thecla liparops</i> ♀. Both surfaces. | 22. <i>Incisalia irus</i> . ♀. Both surfaces. |
| | 23. <i>Incisalia niphon</i> ♂. Both surfaces. |
| | 24. <i>Strymon titus</i> ♂. Both surfaces. |
| | 25. <i>Incisalia augustus</i> ♀. Both surfaces. |
| | 26. <i>Strymon titus</i> ♀. Both surfaces. |



EXPLANATION OF PLATE 7.

Butterflies in color. — *Pierinae*.

Printed in color from twelve stones by Thos. Sinclair and Son, after drawings by J. Henry Blake (figs. 2-10, 12), Sidney L. Smith (fig. 1) and G. A. Poujade (fig. 11). Natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|--|--|
| 1. <i>Pontia protodice protodice</i> ♂. Both surfaces. | 7. <i>Eurymus interior interior</i> ♀. Both surfaces. |
| 2. <i>Pontia protodice protodice</i> ♀. Both surfaces. | 8. <i>Eurymus philodice philodice</i> ♀. Upper surface. |
| 3. <i>Pieris oleracea cruciferarum</i> ♀. Both surfaces. | 9. <i>Eurymus philodice</i> ♂. Both surfaces. |
| 4. <i>Eurema lisa</i> ♂. Both surfaces. | 10. <i>Eurymus interior laurentina</i> ♀. Both surfaces. |
| 5. <i>Eurema lisa</i> ♂. Both surfaces. | 11. <i>Pieris rapae novangliae</i> ♂. Both surfaces. |
| 6. <i>Eurymus philodice pallidice</i> ♀. Both surfaces. | 12. <i>Pieris rapae rapae</i> ♂. Both surfaces. |



EXPLANATION OF PLATE 8.

Butterflies in color.—Papilionidae (Papilioninae).

Printed in color from fifteen stones by Thos. Sinclair and Son, after drawings by J. Henry Blake (figs. 1, 2, 5) and L. Trouvelot (figs. 3, 4). All are of natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|--|---|
| 1. <i>Jasonides glaucus turnus</i> ♂. Both surfaces. | 4. <i>Euphœades troilus</i> ♂. Both surfaces. |
| 2. <i>Papilio polyxenes</i> ♀. Upper surface. | 5. <i>Euphœades troilus</i> ♀. Upper surface. |
| 3. <i>Papilio polyxenes</i> ♂. Both surfaces. | |



EXPLANATION OF PLATE 9.

Butterflies in color.—Hesperiidae (Hesperidi).

Printed in color on twelve stones by Thos. Sinclair and Son, after drawings by G. A. Poujade (figs. 1-7, 9-14), L. Trouvelot (fig. 8) and J. Henry Blake (fig. 15). Natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|--|--|
| 1. <i>Thanaos persius</i> ♂. Both surfaces. | 9. <i>Thanaos brizo</i> ♀. Upper surface. |
| 2. <i>Pholisora catullus</i> ♂. Both surfaces. | 10. <i>Thanaos horatius</i> ♂. Both surfaces. |
| 3. <i>Thnos brizo</i> ♂. Both surfaces. | 11. <i>Achalarus lycidas</i> ♂. Both surfaces. |
| 4. <i>Thanaos lucilius</i> ♂. Both surfaces. | 12. <i>Thanaos martialis</i> ♂. Both surfaces. |
| 5. <i>Thorybes pylades</i> ♂. Both surfaces. | 13. <i>Thanaos jurenalis</i> ♂. Both surfaces. |
| 6. <i>Thanaos icelus</i> ♂. Both surfaces. | 14. <i>Thanaos jurenalis</i> ♀. Upper surface. |
| 7. <i>Thanaos horatius</i> ♀. Upper surface. | 15. <i>Thanaos terentius</i> ♀. Both surfaces. |
| 8. <i>Epargyreus tityrus</i> ♂. Both surfaces. | |



EXPLANATION OF PLATE 10.

Butterflies in color.—Hesperidae (Pamphilidi).

Printed in color from ten stones by Thos. Sinclair and Son, after drawings by G. A. Poujade,—excepting figs. 1 and 19 which are by L. Trouvelot. All are of natural size. Where both surfaces are given, the detached wings show the under surface.

- | | |
|---|---|
| 1. <i>Amblyscirtes samoset</i> ♀. Both surfaces. | 17. <i>Limochores taumas</i> ♂. Both surfaces. |
| 2. <i>Pamphila mandan</i> ♂. Both surfaces. | 18. <i>Polites peckius</i> ♂. Both surfaces. |
| 3. <i>Amblyscirtes samoset</i> ♂. Both surfaces. | 19. <i>Thymelicus aetna</i> ♂. Both surfaces. |
| 4. <i>Amblyscirtes vialis</i> ♂. Both surfaces. | 20. <i>Limochores bimacula</i> ♀. Upper surface. |
| 5. <i>Erynnis metea</i> ♂. Both surfaces. | 21. <i>Limochores taumas</i> ♀. Upper surface. |
| 6. <i>Poanes massasoit</i> ♀. Both surfaces. | 22. <i>Polites peckius</i> ♀. Upper surface. |
| 7. <i>Ancyloxipha numitor</i> ♂. Both surfaces. | 23. <i>Limochores manataaquia</i> ♀. Upper surface. |
| 8. <i>Atrytone zabulon zabulon</i> ♀. Both surfaces. | 24. <i>Limochores bimacula</i> ♂. Both surfaces. |
| 9. <i>Atrytone zabulon pocahontas</i> ♀. Both surfaces. | 25. <i>Thymelicus mystic</i> ♂. Upper surface. |
| 10. <i>Atrytone zabulon</i> ♂. Both surfaces. | 26. <i>Thymelicus mystic</i> ♀. Both surfaces. |
| 11. <i>Erynnis metea</i> ♀. Upper surface. | 27. <i>Euphyes verna</i> ♀. Upper surface. |
| 12. <i>Anthomaster leonardus</i> ♀. Upper surface. | 28. <i>Limochores manataaquia</i> ♂. Both surfaces. |
| 13. <i>Erynnis sassacus</i> ♀. Upper surface. | 29. <i>Euphyes metacomel</i> ♀. Both surfaces. |
| 14. <i>Anthomaster leonardus</i> ♂. Both surfaces. | 30. <i>Euphyes metacomel</i> ♂. Upper surface. |
| 15. <i>Thymelicus aetna</i> ♀. Upper surface. | 31. <i>Lerema hianna</i> ♂. Both surfaces. |
| 16. <i>Erynnis sassacus</i> ♂. Both surfaces. | 32. <i>Lerema hianna</i> ♀. Upper surface. |
| | 33. <i>Euphyes verna</i> ♂. Both surfaces. |

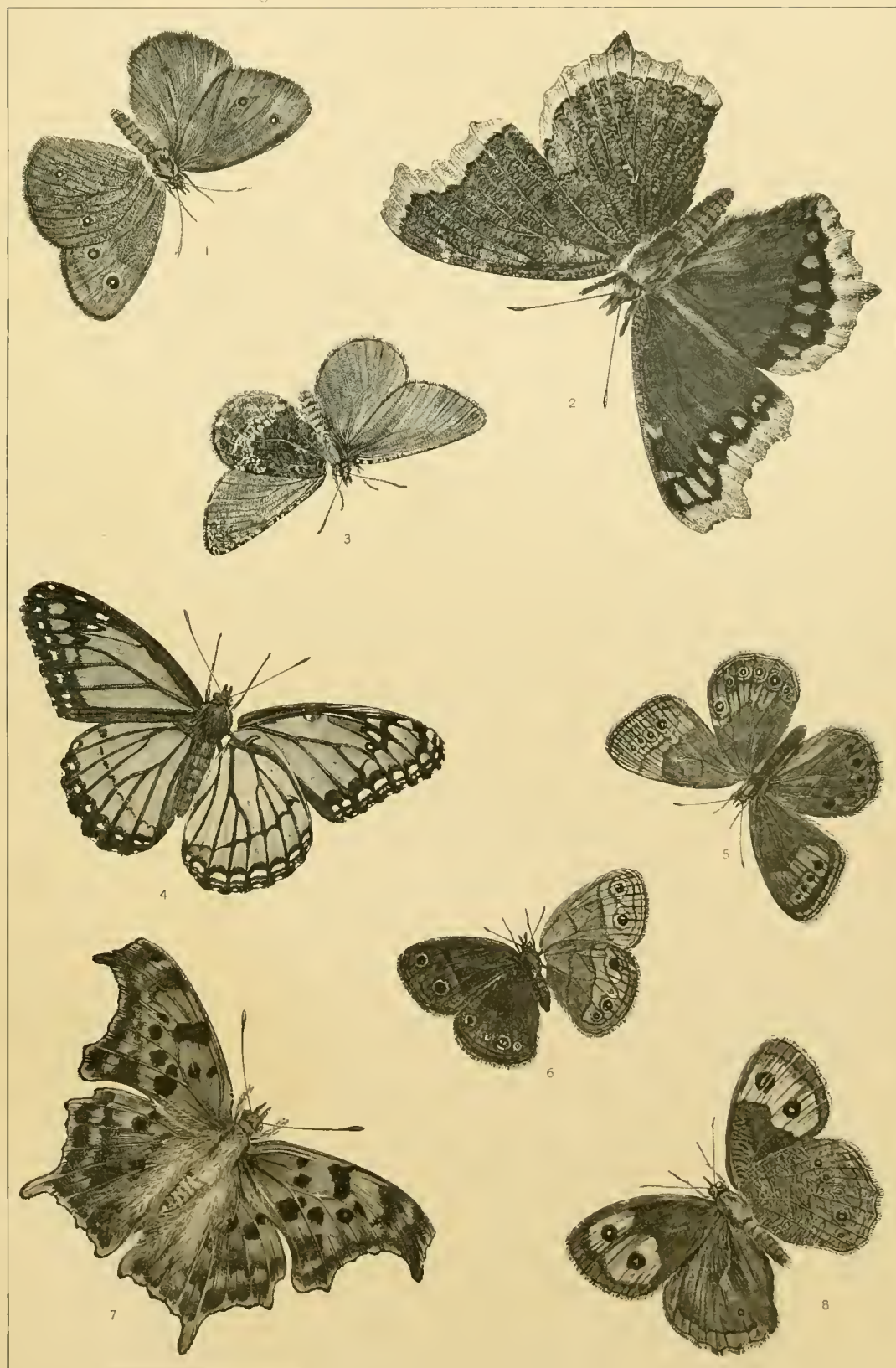


EXPLANATION OF PLATE 11.

Butterflies in black.—Nymphalidae.

Printed at the De Vinne Press from new electrotypes from the original woodcuts engraved by Henry Marsh for the third edition of Harris's *Insects injurious to vegetation*. In figs. 1, 3, 4, 5, 6 and 8 the middle pair of legs is shown in front. Where both surfaces are given, the under surface is at the right.

- | | |
|--|--|
| 1. <i>Cercyonis nephele</i> . Both surfaces. | 5. <i>Satyrodes eurydice</i> . Both surfaces. |
| 2. <i>Euphanta antiopa</i> . Both surfaces. | 6. <i>Cissia eurytus</i> . Both surfaces. |
| 3. <i>Oeneis semidea</i> . Both surfaces. | 7. <i>Polygonia interrogationis</i> . Upper surface. |
| 4. <i>Basilarchia archippus</i> . Both surfaces. | 8. <i>Cercyonis alope</i> . Both surfaces. |

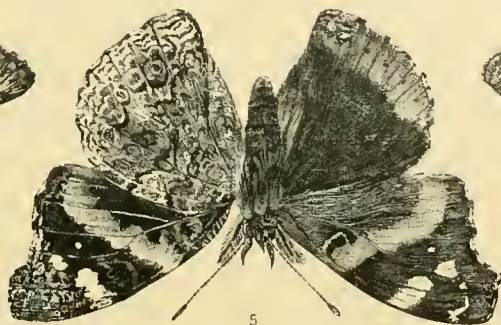


EXPLANATION OF PLATE 12.

Butterflies in black.—Nymphalidae (Nymphalinae).

Printed at the De Vinne Press from new electrotypes from the original woodcuts engraved by Henry Marsh for Harris's Insects and lent by C. L. Flint, Esq. In figs. 1, 2, 3, 4, 11 and 12, the middle pair of legs is shown in front. Where both surfaces are shown, the under side is at the right.

- | | |
|---|--|
| 1. <i>Phyciodes tharos marcia</i> ♂. Both surfaces. | 8. <i>Brenthis bellona</i> . Side view, showing under surface. |
| 2. <i>Euphydryas phaeton</i> . Both surfaces. | |
| 3. <i>Phyciodes tharos marcia</i> ♀. Both surfaces. | 9. <i>Vanessa huntera</i> . Both surfaces. |
| 4. <i>Brenthis myrina</i> . Both surfaces. | 10. <i>Aglais milberti</i> . Upper surface. |
| 5. <i>Vanessa atalanta</i> . Both surfaces. | 11. <i>Argynnis aphrodite</i> . Both surfaces. |
| 6. <i>Brenthis bellona</i> . Both surfaces. | 12. <i>Speyeria idalia</i> . Both surfaces. |
| 7. <i>Vanessa cardui</i> . Both surfaces. | |



EXPLANATION OF PLATE 13.

Butterflies in black.—*Lycaenidae*, *Papilionidae*, *Hesperiidae*.

Printed by the De Vinne Press from new electrotypes from the original woodcuts engraved by Henry Marsh for the third edition of Harris's *Insects injurious to vegetation*, and lent by C. L. Flint, Esq. Where both surfaces are shown, the under side is at the right.

- | | |
|--|--|
| 1. <i>Incisalia nippon</i> . Both surfaces. | 9. <i>Atrytone zabulon</i> . Both surfaces. |
| 2. <i>Pieris oleracea</i> . Upper surface. | 10. <i>Jasoniades glaucus</i> . Both surfaces. |
| 3. <i>Incisalia augustus</i> . Both surfaces. | 11. <i>Anthomaster leonardus</i> ♂. Both surfaces. |
| 4. <i>Cyaniris pseudargiolus lucia</i> ♂. Upper surface. | 12. <i>Polites peckius</i> ♂. Both surfaces. |
| 5. <i>Heodes hypophlaras</i> . Both surfaces. | 13. <i>Ancyloxipha numitor</i> . Both surfaces. |
| 6. <i>Eurymus philodice</i> ♀. Both surfaces. | 14. <i>Polites peckius</i> ♀. Both surfaces. |
| 7. <i>Cyaniris pseudargiolus lucia</i> . Side view with under surface. | 15. <i>Thorybes pylades</i> . Both surfaces. |
| 8. <i>Eurymus philodice</i> ♂. Both surfaces. | 16. <i>Limochores taumas</i> ♂. Both surfaces. |
| | 17. <i>Thanaos brizo</i> . Both surfaces. |



EXPLANATION OF PLATE 14.

Butterflies in black. — Mostly Nymphalidae and Lycaenidae.

Electrotyped and printed at the University Press from wood cuts engraved by John Andrew and Son. When both surfaces are shown the under surface is at the left. All are of natural size.

1. *Polygonia satyrus* ♂. Both surfaces; California.
2. *Everes comyntas* ♂. Both surfaces.
3. *Polygonia faunus* ♂. Both surfaces.
4. *Euptoieta claudia* ♀. Both surfaces; Massachusetts.
5. *Phyciodes batesii* ♂. Both surfaces; New York.
6. *Erora laeta* ♂. Upper surface; copied from Edwards's Butterflies of North America.
7. *Neonympha phocion* ♂. Both surfaces; Georgia.
8. *Nomiades couperi* ♂. Both surfaces; Anticosti.
9. *Erora laeta* ♀. Both surfaces; engraved from a photograph by John M. Blake; specimen lent for the purpose by the Yale College museum, Maine.
10. *Nomiades couperi* ♀. Both surfaces; Anticosti.
11. *Thecla calanus* ♂. Both surfaces.
12. *Heracles cressphontes* ♂. Both surfaces; from a specimen reared by Mr. H. S. Seagrave, from caterpillars found in the Botanic Garden, Cambridge.
13. *Uranotes melinus*. Both surfaces.
14. *Polygonia satyrus* ♀. Under surface; California.
15. *Junonia coenia* ♂. Both surfaces; from a specimen taken in Massachusetts by Mr. F. H. Sprague.
16. *Calephelis borealis* ♂. Both surfaces; Illinois.
17. *Oeneis jutta* ♀. Both surfaces; from a specimen captured in Maine by Mr. Carl Braun.

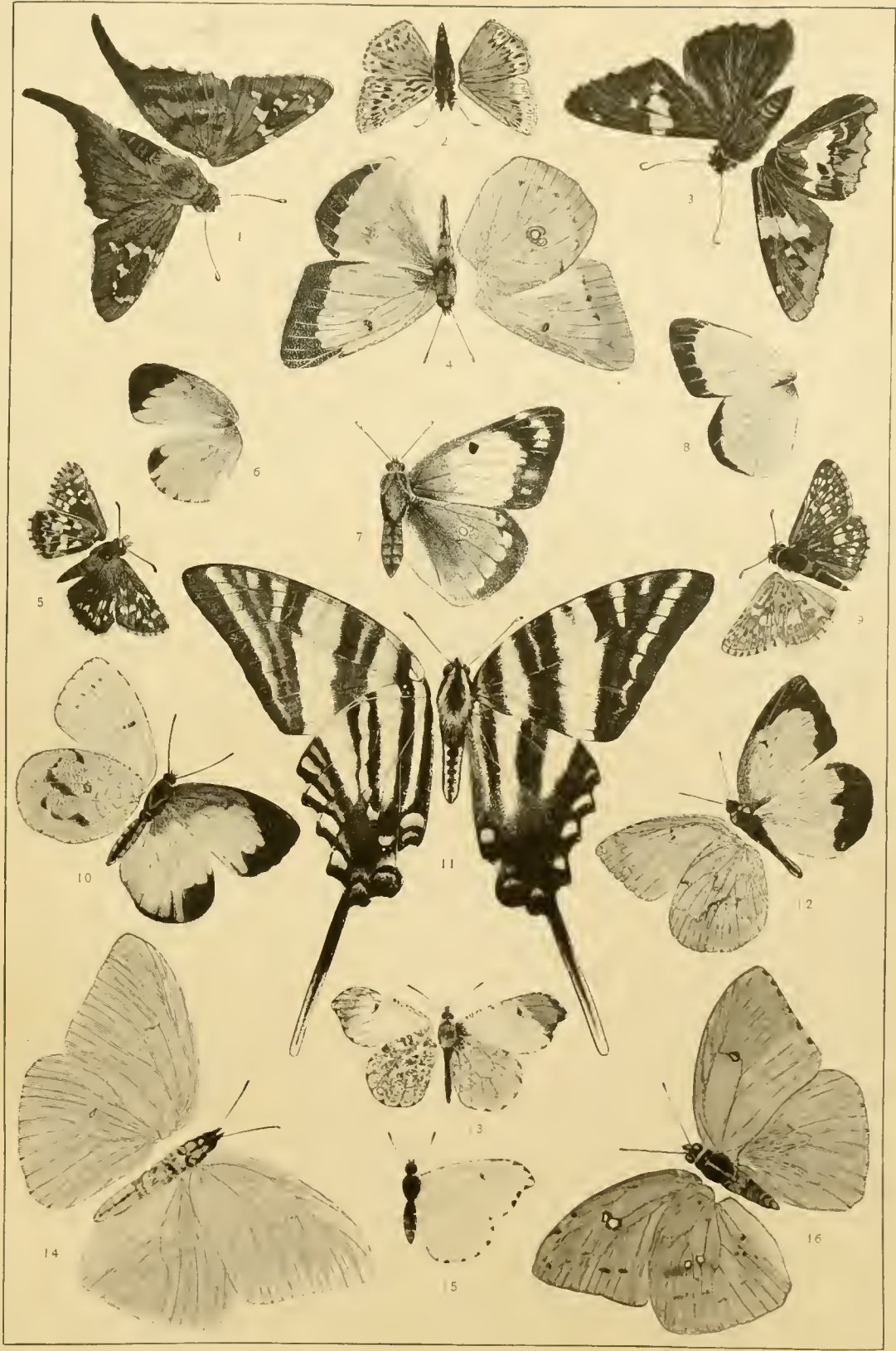


EXPLANATION OF PLATE 15.

Butterflies in black.—Papilionidae, Hesperidae.

Electrotyped and printed at the University Press from woodcuts engraved by John Andrew and Son, after photographs. Where both surfaces are shown, the under surface is at the left.

1. *Eudamus proteus* ♂. Both surfaces; Georgia.
2. *Thanaos ausonius* ♂. Both surfaces; from the type, by favor of Mr. J. A. Lintner; New York.
3. *Epargyreus tityrus* ♂. Both surfaces; New England.
4. *Eurymus eurytheme* ♂. Both surfaces; Iowa.
5. *Hesperia centaureae* ♂. Both surfaces; Labrador.
6. *Eurema lisa* ♀. Upper surface; New England.
7. *Eurymus eurytheme* ♀. Upper surface; Mississippi Valley.
8. *Eurymus interior* ♂. Upper surface; Cape Breton.
9. *Hesperia montivaga* ♂. Both surfaces; Missouri.
10. *Xanthidia nicippe* ♀. Both surfaces; West Virginia.
11. *Ipheclides ajax* ♂. Both surfaces; West Virginia.
12. *Xanthidia nicippe* ♂. Both surfaces; West Virginia.
13. *Anthocharis genutia* ♂. Both surfaces; Pennsylvania.
14. *Callidryas cubule* ♂. Both surfaces; Florida.
15. *Anthocharis genutia* ♀. Upper surface; Texas.
16. *Callidryas cubule* ♀. Both surfaces; Florida.

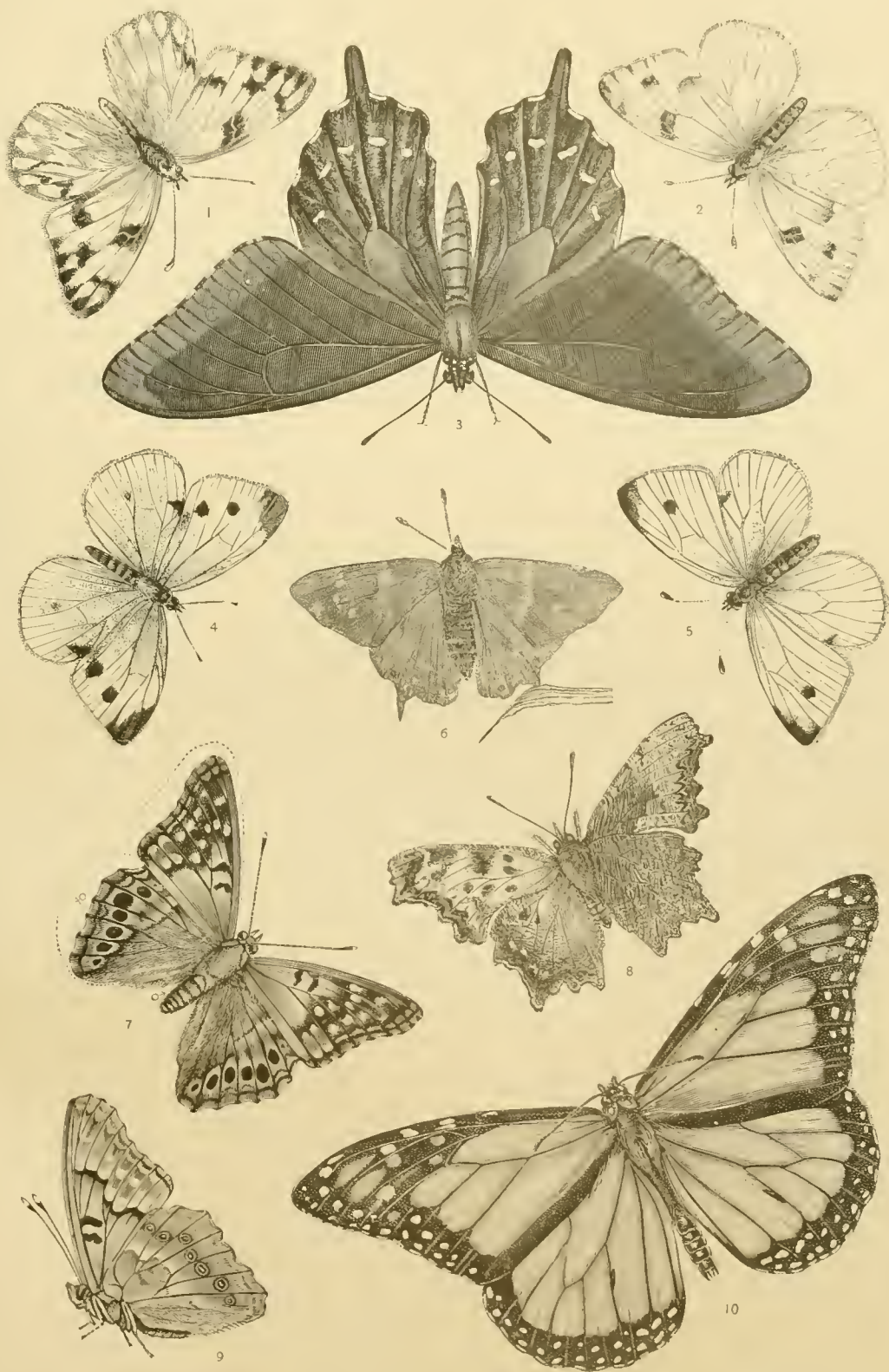


EXPLANATION OF PLATE 16.

Butterflies in black.—Nymphalidae, Papilionidae.

Printed at the University Press. The woodcuts from different sources. Figs. 1-5, 7, 9, 10 were purchased of C. V. Riley; fig. 6 was engraved by Henry Marsh after a drawing by J. Henry Blake; and fig. 8 was lent by Dr. A. S. Packard. All are of natural size.

- | | |
|--|---|
| 1. <i>Pontia protodice</i> ♀. Upper surface. | 7. <i>Chlorippe clyton</i> ♂. Upper surface; the dotted line indicates the contour of the left wings of the female. |
| 2. <i>Pontia protodice</i> ♂. Upper surface. | 8. <i>Polygonia progne</i> . Both surfaces, the under on the right. |
| 3. <i>Laertius philenor</i> . Upper surface. | 9. <i>Chlorippe clyton</i> ♂. Under surface. |
| 4. <i>Pieris rapae</i> ♀. Upper surface. | 10. <i>Anosia pterippus</i> ♂. Upper surface. |
| 5. <i>Pieris rapae</i> ♂. Upper surface. | |
| 6. <i>Prodryas persephone</i> , a fossil butterfly from the tertiaries of Colorado, of the family Nymphalidae. | |



EXPLANATION OF PLATE 17.

Butterflies in black.—Hesperiidae.

Reproduced by photogravure from india-ink drawings by J. Henry Blake. All the figures are of natural size, and where both surfaces are shown, the left is the under side. Printed without reduction by the Boston Photogravure Co.

1. *Erynnis manitoba* ♀. Both surfaces; Colorado.
2. *Limochares pontiac* ♀. Upper surface; Illinois.
3. *Lerema accius* ♂. Upper surface; Alabama.
4. *Erynnis manitoba* ♂. Both surfaces; British Columbia. The same specimen served for the illustration in the Memoirs Bost. soc. nat. hist., ii. pl. 10, fig. 11.
5. *Limochares pontiac* ♂. Both surfaces; New York.
6. *Oligoria maculata*. Both surfaces; Florida.
7. *Lerema accius* ♀. Both surfaces; Alabama.
8. *Atalopedes huron* ♀. Upper surface; Missouri.
9. *Erynnis attalus* ♀. Upper surface; Texas.
10. *Hyalephila phylaeus* ♂. Both surfaces; Alabama.
11. *Thymelicus brettus* ♂. Both surfaces.
12. *Erynnis attalus* ♂. Both surfaces.
13. *Hyalephila phylaeus* ♀. Upper surface; Florida.
14. *Calpodus ethlius*. Both surfaces.
15. *Thymelicus brettus* ♀. Upper surface.
16. *Atalopedes huron* ♂. Both surfaces; Texas.
17. *Atrytone logan* ♀. Both surfaces; Rhode Island.
18. *Thorybes bathyllus*. Both surfaces; Massachusetts.
19. *Atrytone logan* ♂. Upper surface; Iowa.
20. *Phycanassa viator*. Both surfaces; Massachusetts.

Drawn from the type of *Ocytes seminole*.



EXPLANATION OF PLATE 18.

Geographical distribution in North America. — Nymphalidae (Euploeinae, Satyrinae).

Printed in color by Julius Bien & Co.

Euploeinae.

1. Distribution of *Anosia plerippus*.

Satyrinae.

2. Distribution of *Oeneis jutta*.

3. Distribution of *Cereyonis alope*.

4. Distribution of *Cereyonis nephele*.

5. Distribution of *Enodia portlandia*.

6. Distribution of *Satyrodes eurydice*.

7. Distribution of *Neonympha phocion*.

8. Distribution of *Cissia eurytus*.



EXPLANATION OF PLATE 19.

Geographical distribution in North America.—Nymphalidae (Nymphalinae).

Printed in color by Julius Bien & Co.

APATURIDI.

1. Distribution of *Chlorippe clyton*.

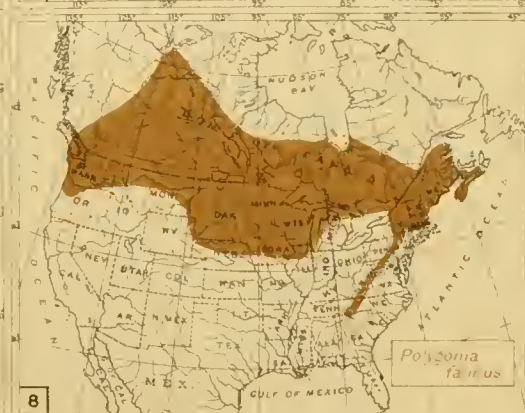
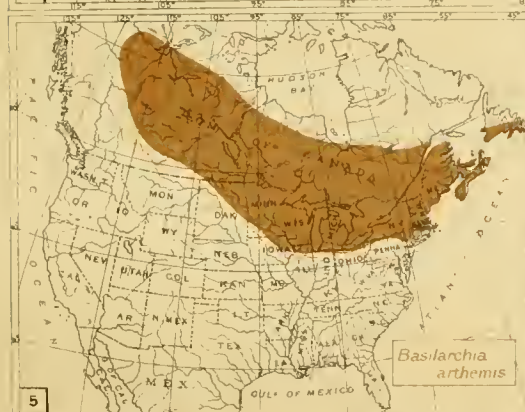
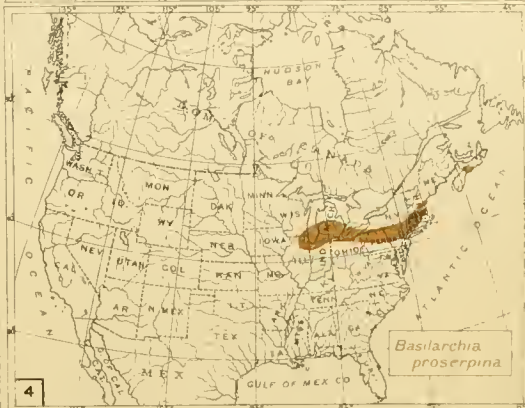
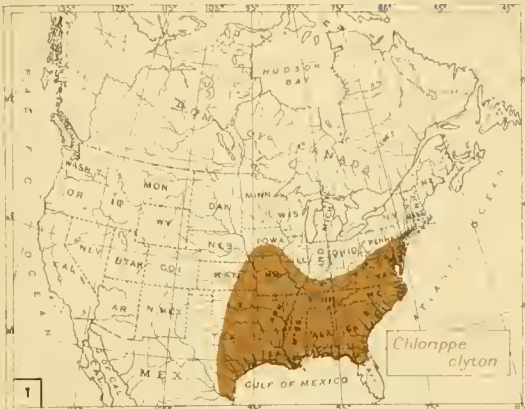
NYMPHALIDI.

2. Distribution of *Basilarchia archippus*.
3. Distribution of *Basilarchia astyanax*.
4. Distribution of *Basilarchia proserpina* (*astyanax-arthemis*).

5. Distribution of *Basilarchia arthemis*.

VANESSIDI.

6. Distribution of *Polygonia progne*.
7. Distribution of *Polygonia gracilis*. The belt in the extreme north-west indicates the presence of the species in Alaska.
8. Distribution of *Polygonia faunus*.

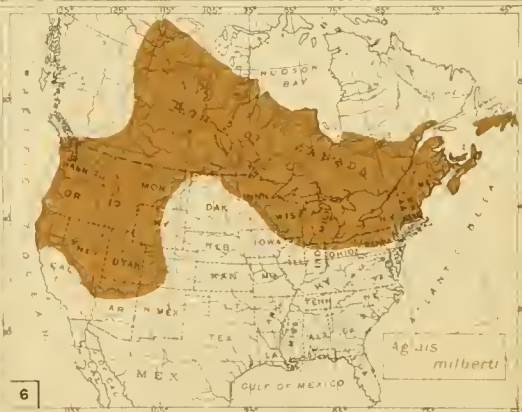
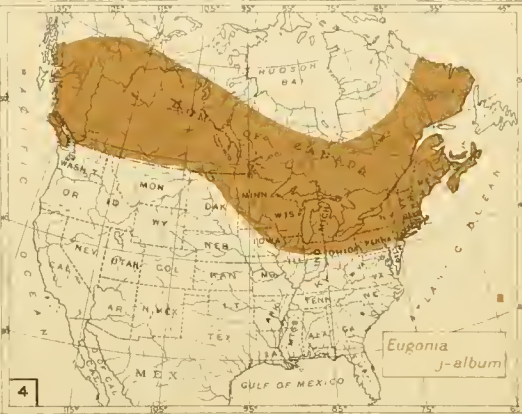
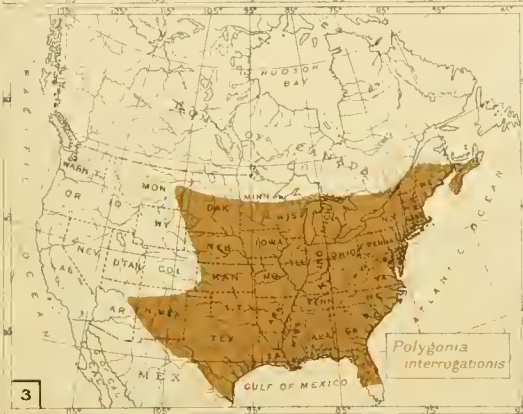
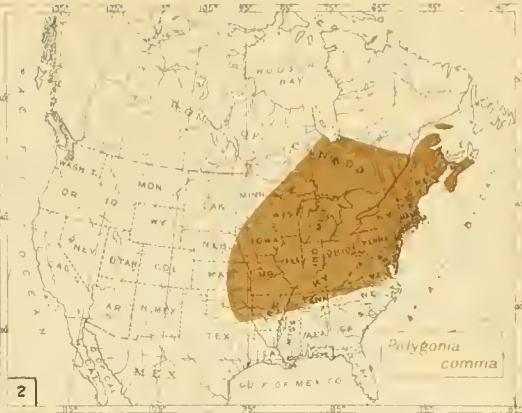
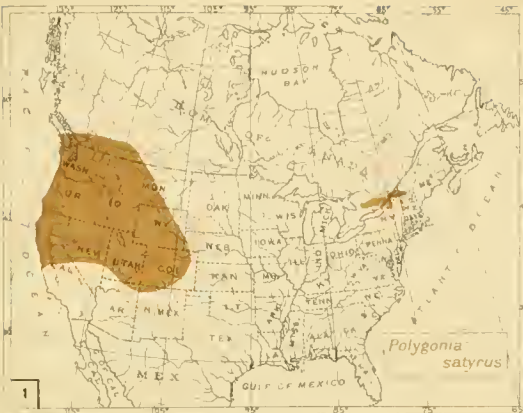


EXPLANATION OF PLATE 20.

Geographical distribution in North America.—Nymphalidae (Nymphalidi).

Printed in color by Julius Bien & Co.

- | | |
|---|---|
| 1. Distribution of <i>Polygonia satyrus</i> . | 5. Distribution of <i>Eurænassa antiopa</i> . |
| 2. Distribution of <i>Polygonia comma</i> . | 6. Distribution of <i>Aglais milberti</i> . |
| 3. Distribution of <i>Polygonia interrogatrix</i> . | 7. Distribution of <i>Vanessa atalanta</i> . |
| 4. Distribution of <i>Eugonia j-album</i> . | 8. Distribution of <i>Vanessa huntera</i> . |



EXPLANATION OF PLATE 21.

Geographical distribution in North America.—Nymphalidae (Nymphalinae, Libytheinae).

Printed in color by Julius Bien & Co.

NYMPHALIDI.

1. Distribution of *Vanessa cardui*.
2. Distribution of *Junonia coenia*.

ARGYNNIDI.

3. Distribution of *Euptoieta claudia*.
4. Distribution of *Speyeria idalia*.

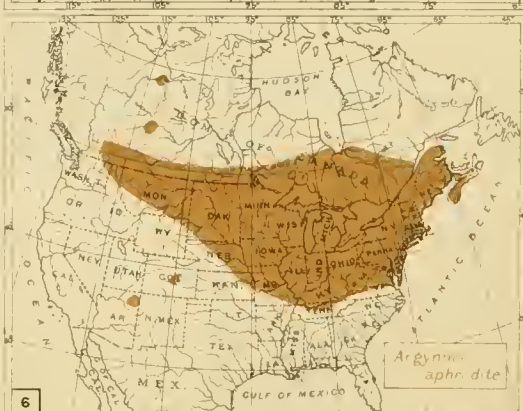
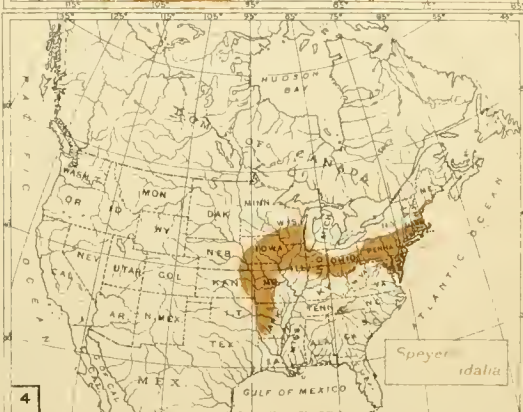
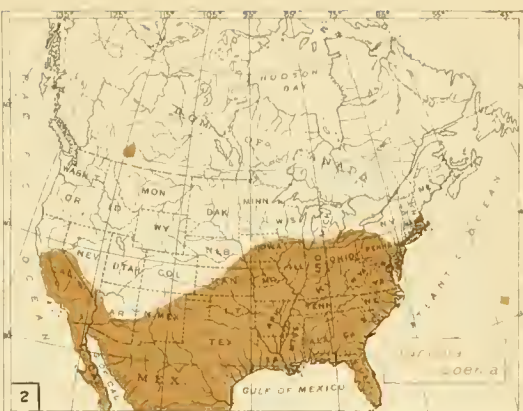
5. Distribution of *Argynnis cybele*.

6. Distribution of *Argynnis aphrodite*.

7. Distribution of *Argynnis atlantis*.

LIBYTHEINAE.

8. Distribution of *Hypatus bachmanii*.



EXPLANATION OF PLATE 22.

**Geographical distribution in North America. — Nymphalidae (Nymphalinae),
Lycaenidae (Lemoniinae).**

Printed in color by Julius Bien & Co.

ARGYNNIDÆ.

1. Distribution of *Brenthis myrina*. The extension of the color to the extreme north-west indicates the presence of the species in Alaska.

2. Distribution of *Brenthis bellona*.

MELITÆIDÆ.

3. Distribution of *Phyciodes tharos*.

4. Distribution of *Phyciodes batesii*.

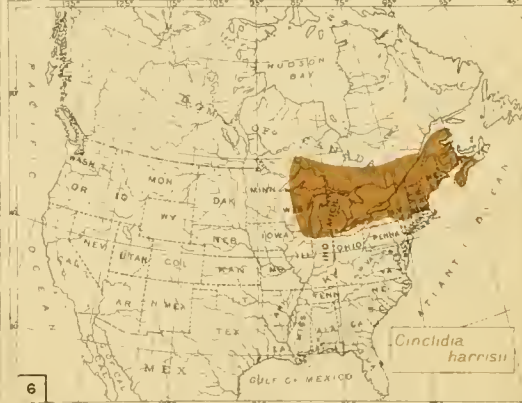
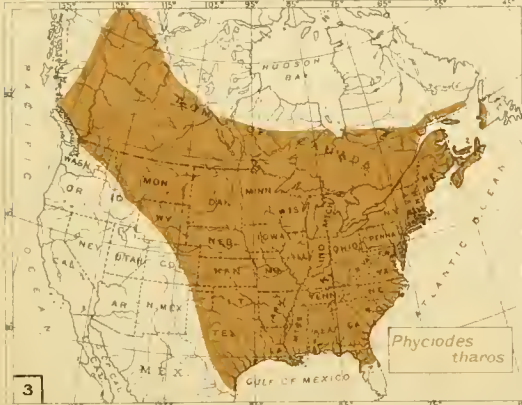
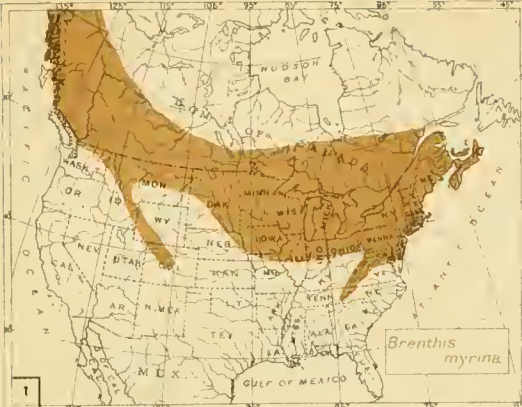
5. Distribution of *Charidryas nycteis*.

6. Distribution of *Cinclidia harrisii*.

7. Distribution of *Euphydryas phaeton*.

LEMONIINÆ.

8. Distribution of *Calephelis borealis*.

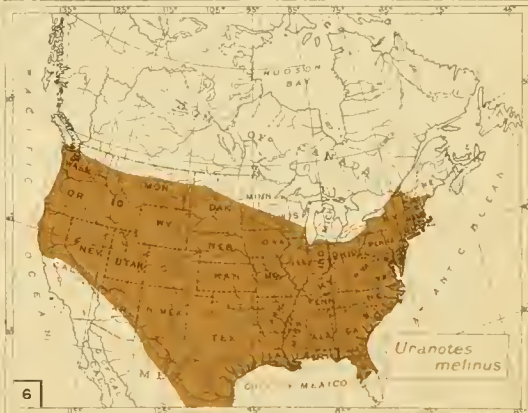
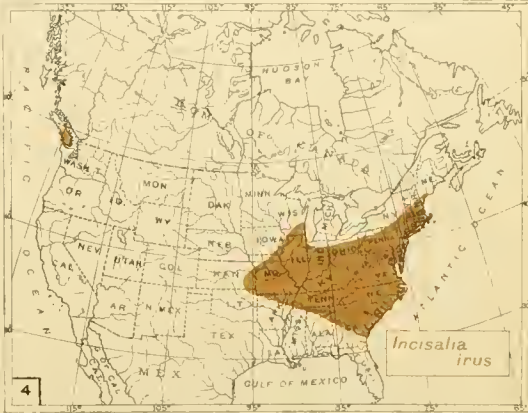
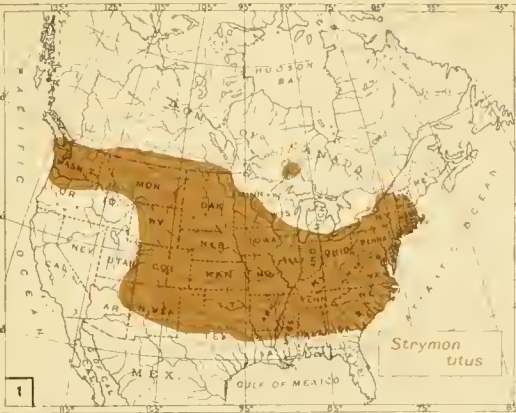


EXPLANATION OF PLATE 23.

Geographical distribution in North America. — Lycaenidae (Theclidi).

Printed in color by Julius Bien & Co.

- | | |
|--|--|
| 1. Distribution of <i>Strymon titus</i> . | 5. Distribution of <i>Incisalia augustus</i> . |
| 2. Distribution of <i>Erora laeta</i> . | 6. Distribution of <i>Uranotes melinus</i> . |
| 3. Distribution of <i>Incisalia nippon</i> . | 7. Distribution of <i>Mitura damon</i> . |
| 4. Distribution of <i>Incisalia irus</i> . | 8. Distribution of <i>Thecla ontario</i> . |



EXPLANATION OF PLATE 24.

Geographical distribution in North America.—Lycaenidae (Lycaeninae).

Printed in color by Julius Bien & Co.

THECLIDI.

1. Distribution of *Thecla liparops*.
2. Distribution of *Thecla calanus*.
3. Distribution of *Thecla edwardsii*.
4. Distribution of *Thecla acadica*.

LYCAENIDI.

5. Distribution of *Everses comyntas*. Central California should have been included.

6. Distribution of *Cyaniris pseudargiolus*; the oblique bars indicate the special range of *C. p. lucia*; the vertical bars that of *C. p. pius*; and the horizontal bars of *C. p. violacea nigra*. The oblique bars in the extreme left upper corner indicate the occurrence of *C. p. lucia* in Alaska.

7. Distribution of *Nomiades couperi*.

8. Distribution of *Rusticus scudderii*.



EXPLANATION OF PLATE 25.

**Geographical distribution in North America.—Lycaenidae (Lycaeninae),
Papilionidae (Pierinae).**

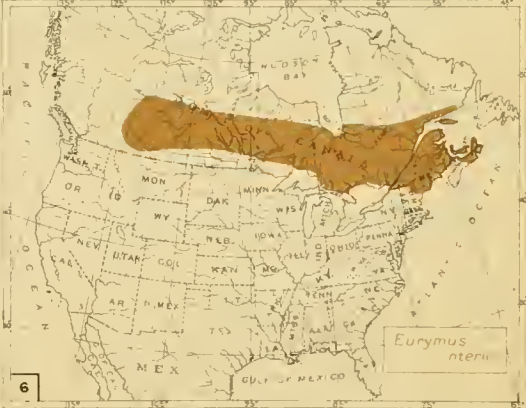
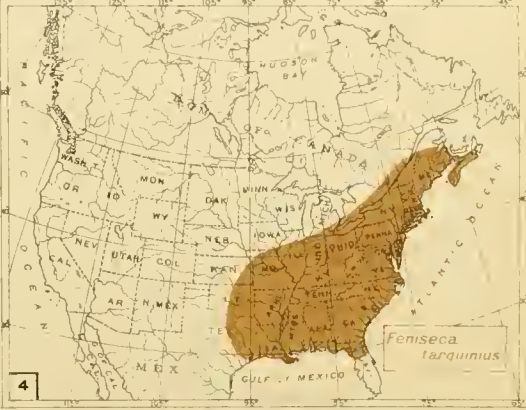
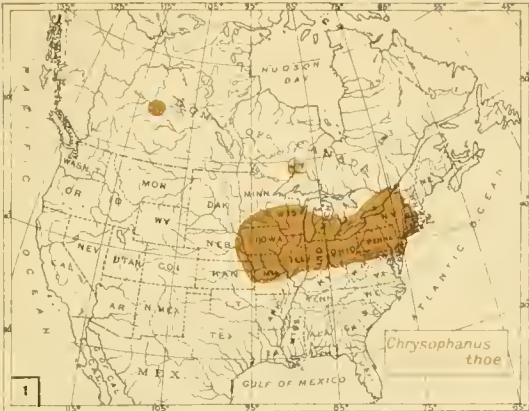
Printed in color by Julius Bien & Co.

CHRY SOPHANIDI.

1. Distribution of *Chrysophanus thoe*.
2. Distribution of *Epidemia epixanthe*.
3. Distribution of *Heodes hypophlaeas*.
4. Distribution of *Feniseca tarquinius*.

RHODOCERIDI.

5. Distribution of *Callidryas eubule*.
6. Distribution of *Eurymus interior*.
7. Distribution of *Eurymus philodice*.
8. Distribution of *Eurymus eurytheme*.



EXPLANATION OF PLATE 26.

Geographical distribution in North America.—Papilionidae.

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RHODOCERIDI.

1. Distribution of *Xanthidia nicippe*.
2. Distribution of *Eurema lisa*.

ANTHOCHARIDI.

3. Distribution of *Anthocharis genutia*.

PIERIDI.

4. Distribution of *Pontia protodice*.
5. Distribution of *Pieris oleracea*.

PAPILIONINAE.

6. Distribution of *Laertias philenor*.
7. Distribution of *Iphiclides ajax*.
8. Distribution of *Jasoniades glaucus*. The barred portion indicates the special range of *J. g. glaucus*.

. The distribution of *Pieris rapae* is given on a separate folding map.



EXPLANATION OF PLATE 27.

Geographical distribution in North America.—Papilionidae, Hesperidae.

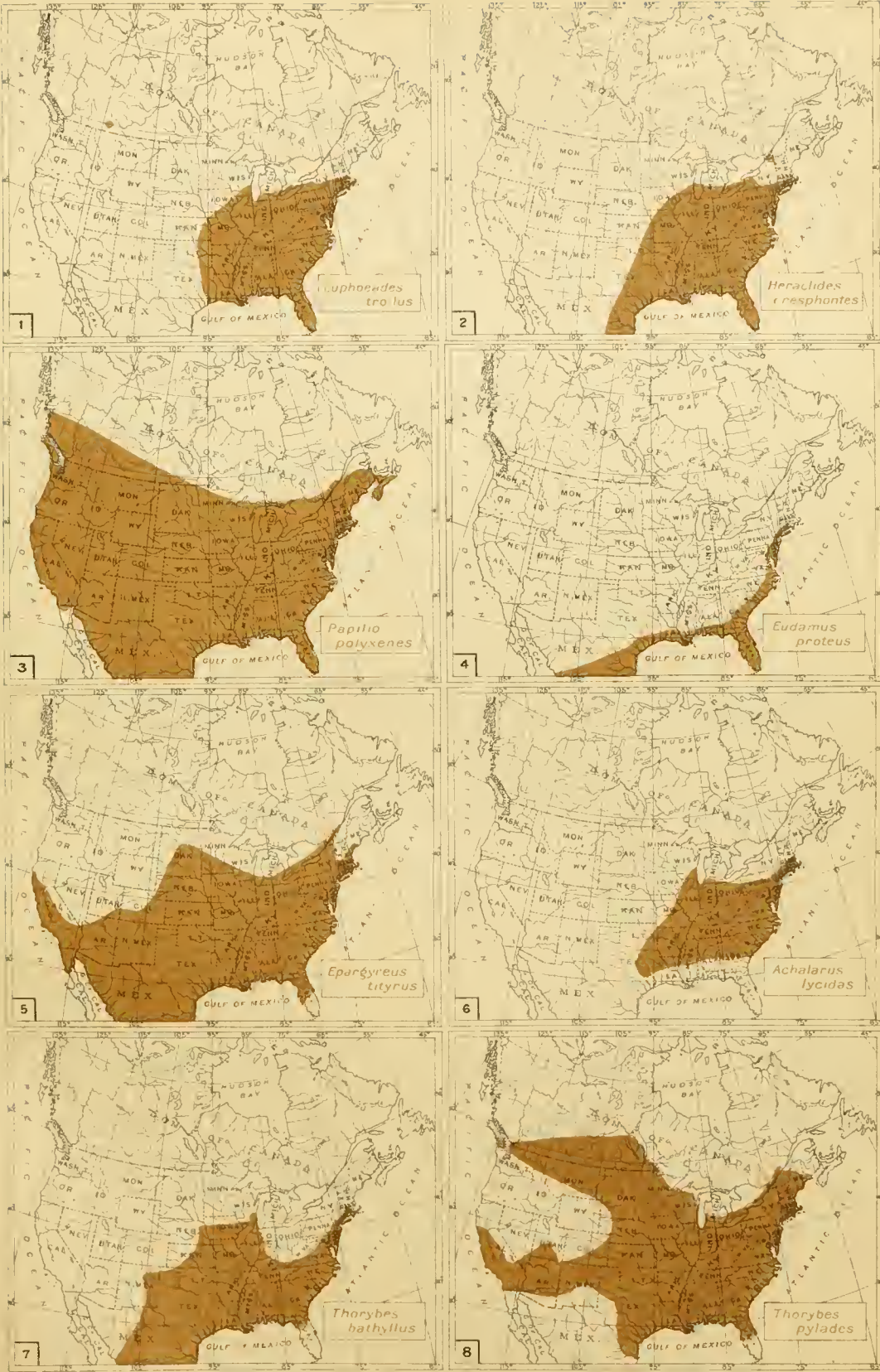
Printed in color by Julius Bien & Co.

PAPILIONINAE.

1. Distribution of *Euphœades troilus*.
2. Distribution of *Heracles cresphontes*. Some localities mentioned in the text were learned since the printing of the map.
3. Distribution of *Papilio polyxenes*.

HESPERIDI.

4. Distribution of *Eudamus proteus*.
5. Distribution of *Epargyreus tityrus*.
6. Distribution of *Achalarus lycidas*.
7. Distribution of *Thorybes bathyllus*.
8. Distribution of *Thorybes pylades*.



EXPLANATION OF PLATE 28.

Geographical distribution in North America.—Hesperidae (Thanaos).

Printed in color by Julius Bien & Co.

- | | |
|--|---|
| 1. Distribution of <i>Thanaos persius</i> . | 5. Distribution of <i>Thanaos martialis</i> . |
| 2. Distribution of <i>Thanaos lucilius</i> . | 6. Distribution of <i>Thanaos terentius</i> . |
| 3. Distribution of <i>Thanaos icelus</i> . | 7. Distribution of <i>Thanaos juvenalis</i> . |
| 4. Distribution of <i>Thanaos brizo</i> . | 8. Distribution of <i>Thanaos horatius</i> . |



EXPLANATION OF PLATE 29.

Geographical distribution in North America.—Hesperidae.

Printed in color by Julius Bien & Co.

HESPERIDÆ.

1. Distribution of *Pholisora catullus*.
2. Distribution of *Hesperia montivaga*.
3. Distribution of *Hesperia centaurear*.

PAMPHILIDÆ.

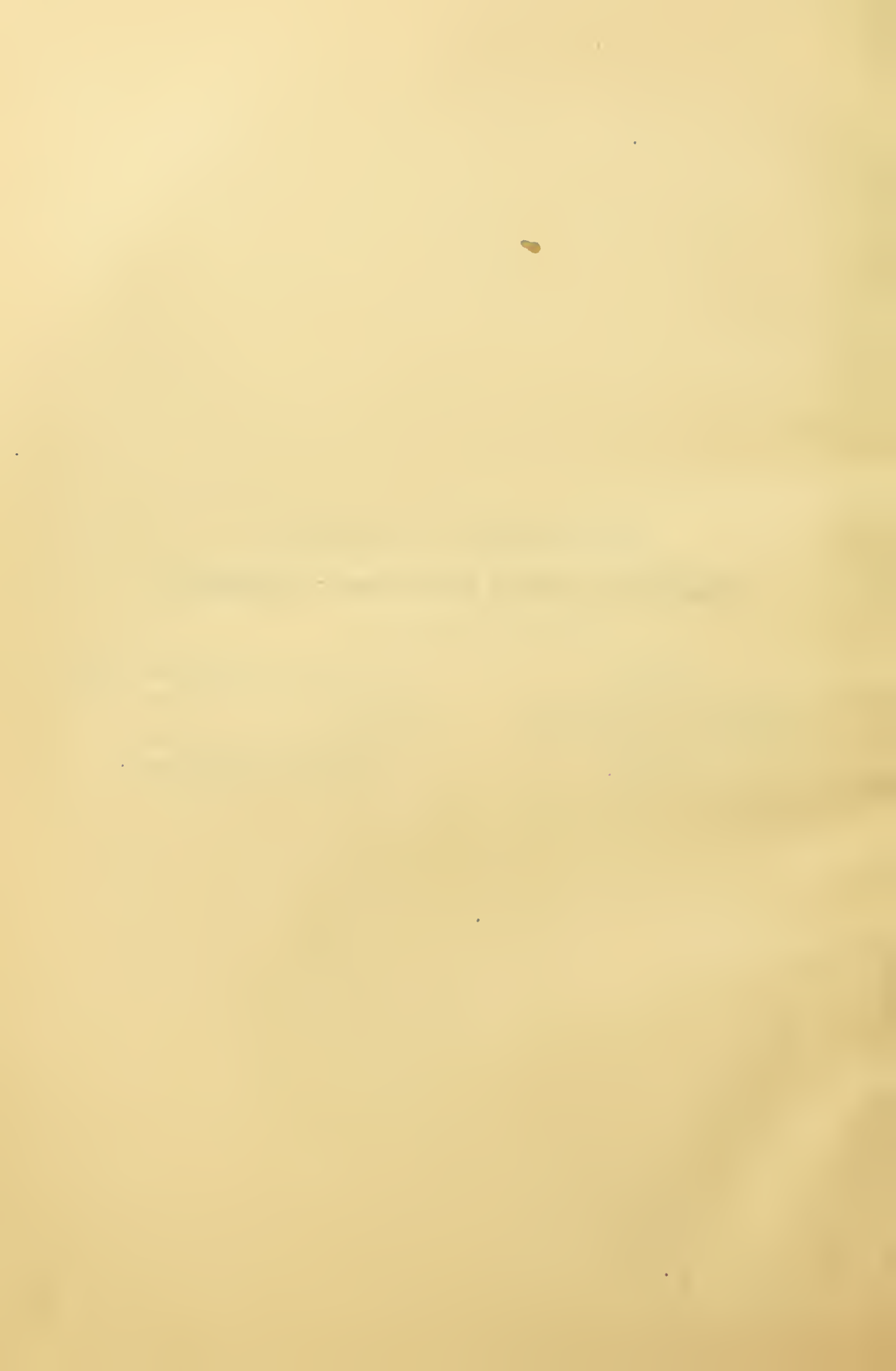
4. Distribution of *Ancylozippa numitor*.

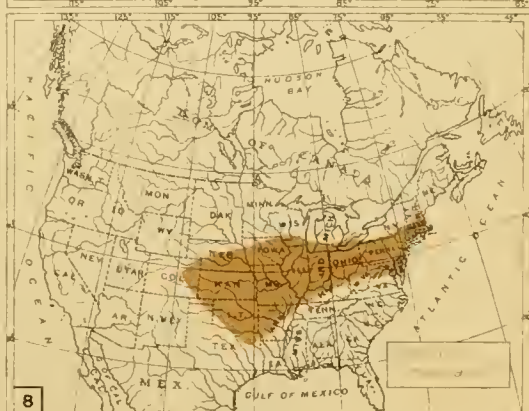
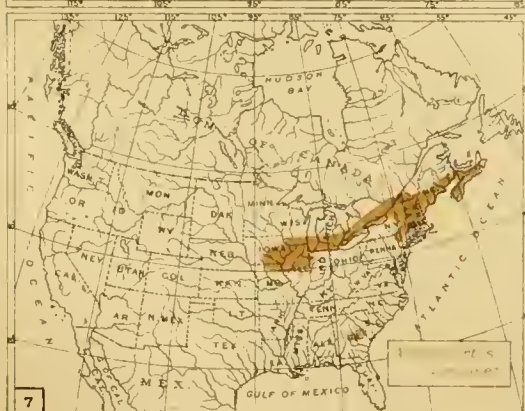
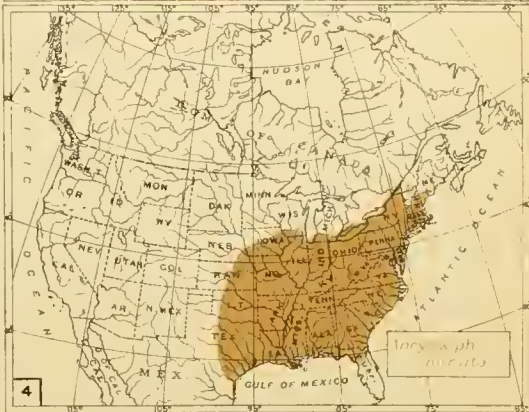
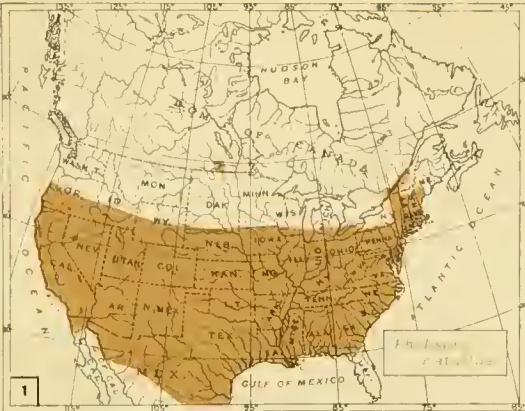
5. Distribution of *Pamphila mandan*. The belt in the upper left hand corner indicates its occurrence in Alaska.

6. Distribution of *Amblyscirtes vialis*.

7. Distribution of *Amblyscirtes samoset*.

8. Distribution of *Poanes massasoit*.



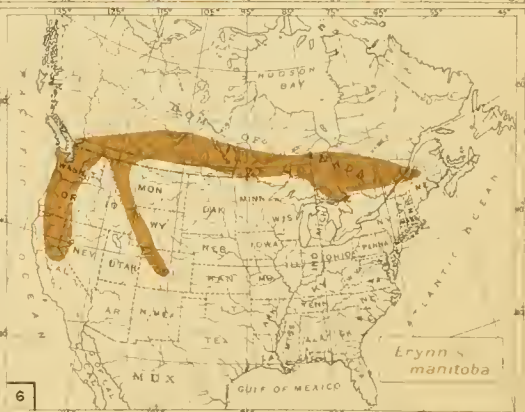
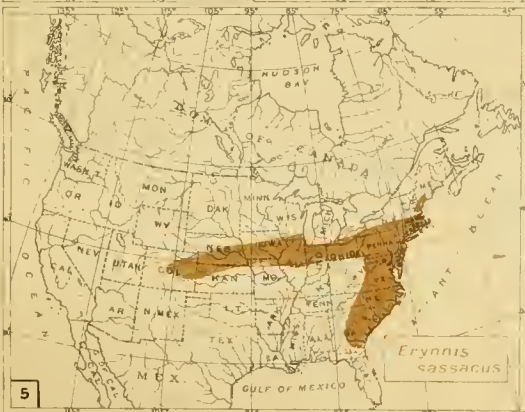
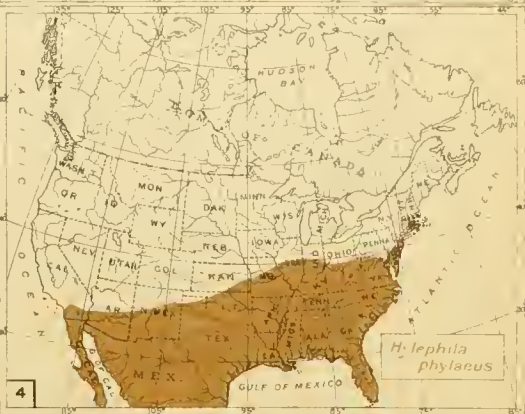
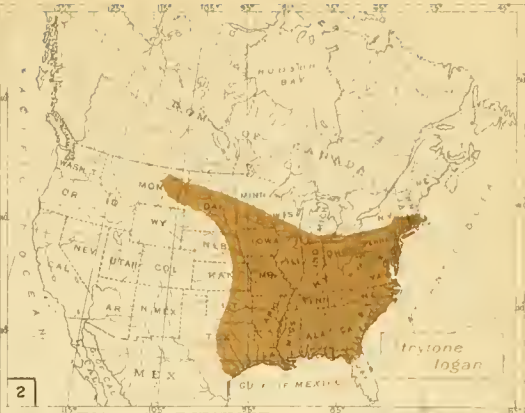
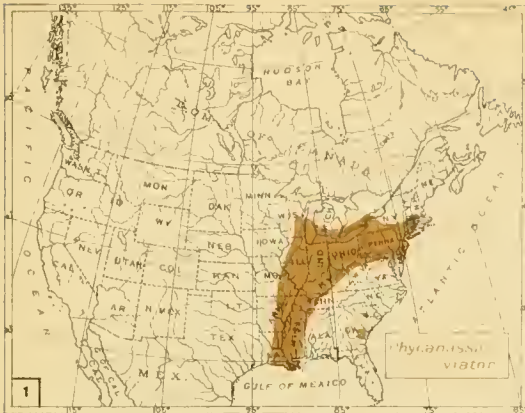


EXPLANATION OF PLATE 30.

Geographical distribution in North America.—Hesperidae (Pamphilidi).

Printed in color by Julius Bien & Co.

- | | |
|--|--|
| 1. Distribution of <i>Phycanassa viator</i> . | 5. Distribution of <i>Erynnis sassacus</i> . |
| 2. Distribution of <i>Atrytone logan</i> . | 6. Distribution of <i>Erynnis manitoba</i> . |
| 3. Distribution of <i>Atrytone zabulon</i> . | 7. Distribution of <i>Erynnis metea</i> . |
| 4. Distribution of <i>Hylephila phylaeus</i> . | 8. Distribution of <i>Erynnis attalus</i> . |



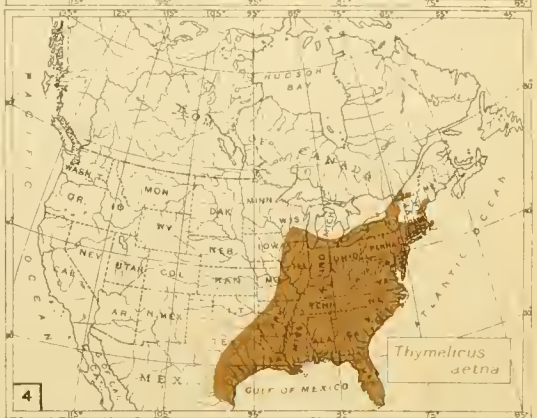
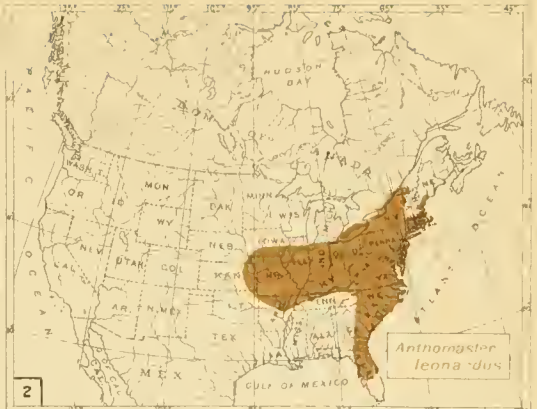
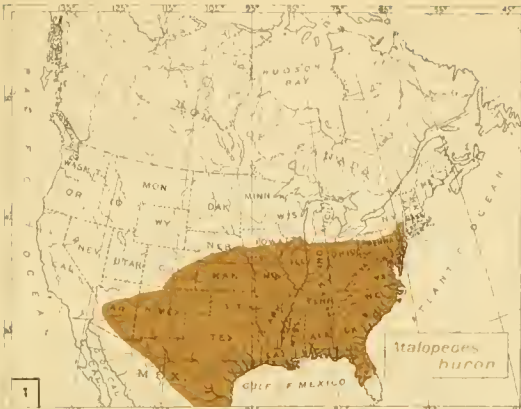
EXPLANATION OF PLATE 31.

Geographical distribution in North America.—Hesperidae (Pamphilidi).

Printed in color by Julius Bien & Co.

- | | |
|---|--|
| 1. Distribution of <i>Atalopedes huron</i> . | 5. Distribution of <i>Thymelicus brettus</i> . |
| 2. Distribution of <i>Anthomaster leonardus</i> . | 6. Distribution of <i>Thymelicus mystic</i> . |
| 3. Distribution of <i>Polites peckius</i> . | 7. Distribution of <i>Euphyes metacomet</i> . |
| 4. Distribution of <i>Thymelicus aetna</i> . | 8. Distribution of <i>Euphyes verna</i> . |



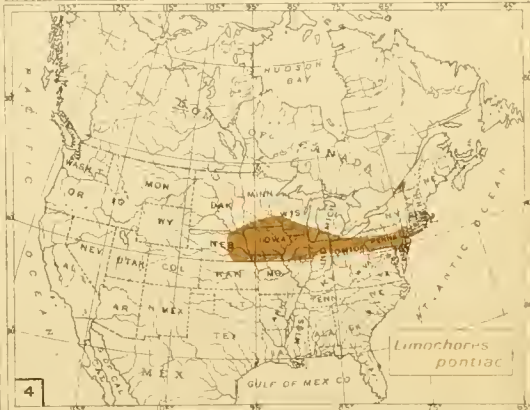
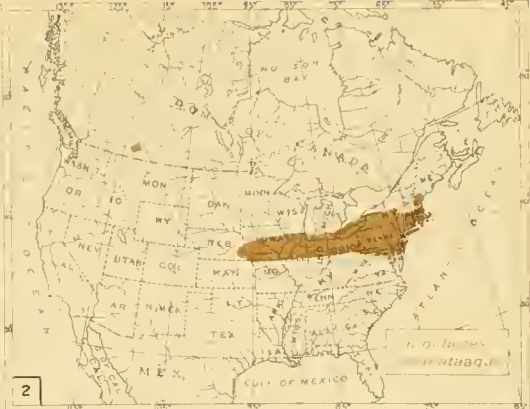
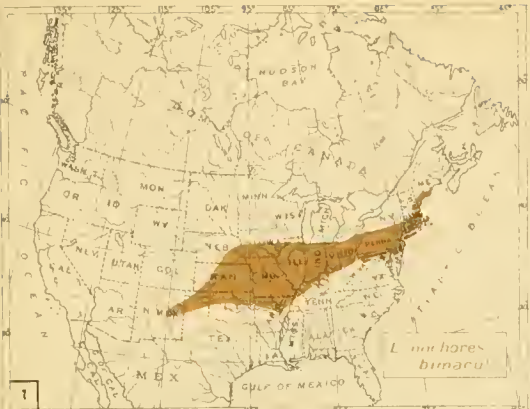


EXPLANATION OF PLATE 32.

Geographical distribution in North America.—Hesperidae (Pamphilidi).

Printed in color by Julius Bien & Co.

- | | |
|--|---|
| 1. Distribution of <i>Limochores bimacula</i> . | 5. Distribution of <i>Calpodes ethlius</i> . |
| 2. Distribution of <i>Limochores manataauqua</i> . | 6. Distribution of <i>Oligoria maculata</i> . |
| 3. Distribution of <i>Limochores taumas</i> . | 7. Distribution of <i>Lerema seccius</i> . |
| 4. Distribution of <i>Limochores pontiac</i> . | 8. Distribution of <i>Lerema hianna</i> . |

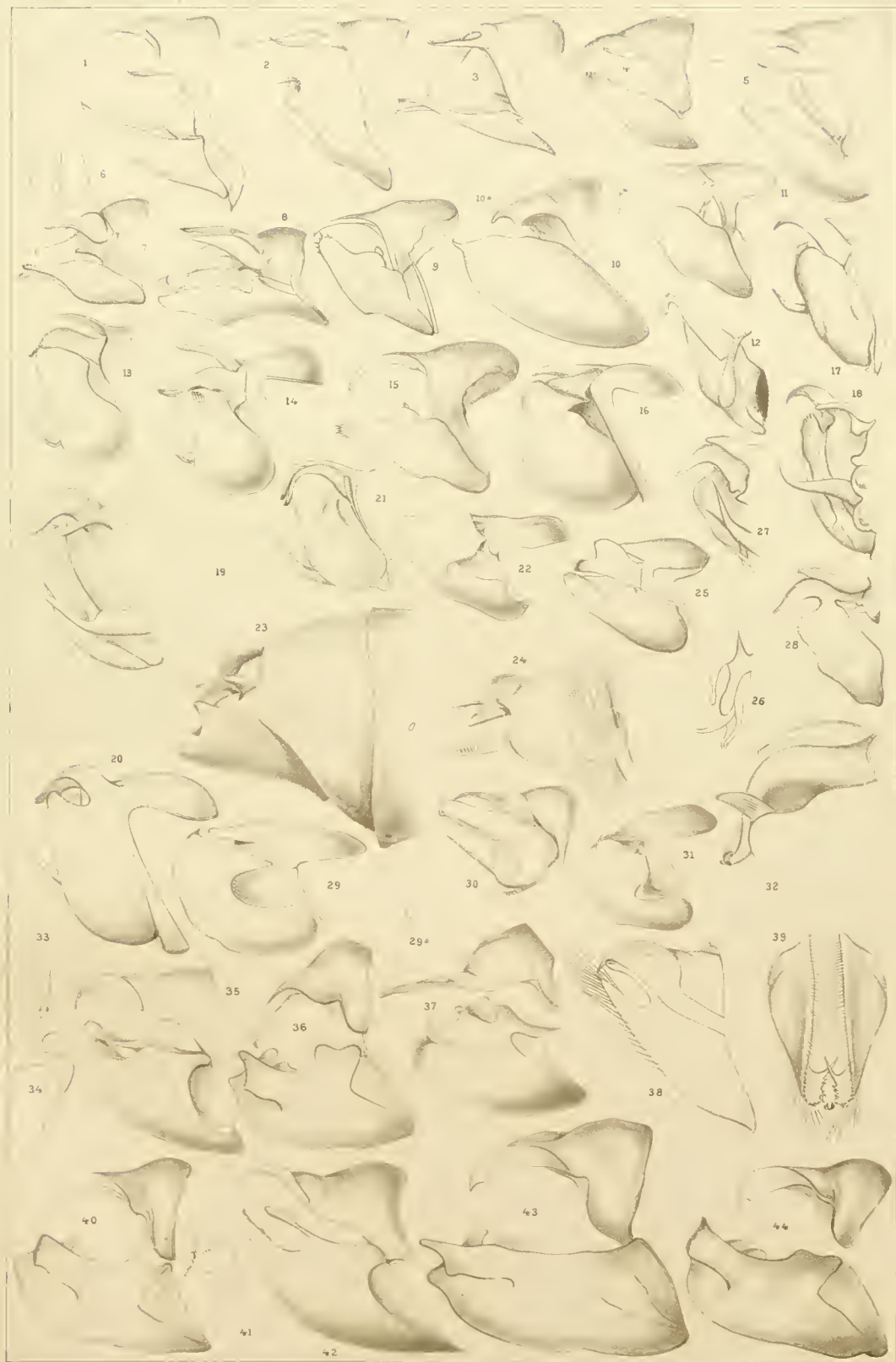


EXPLANATION OF PLATE 33.

Male abdominal Appendages.—Nymphalidae.

For nearly all the figures of this plate I am indebted to my friend Edward Burgess, Esq. Figs. 21, 32, 38 and 39 are by J. H. Emerton. Figs 10a and 29a by myself. All show a side view, unless otherwise specified.

1. *Cercyonis alope* $\frac{1}{1}^3$.
2. *Satyroides eurydice* $\frac{1}{1}^3$.
3. *Enodia portlandia* $\frac{1}{1}^3$.
4. *Oeneis semidea* $\frac{1}{1}^3$.
5. *Oeneis jutta* $\frac{1}{1}^3$.
6. *Cissia eurytus* $\frac{1}{1}^3$. Top view of upper organ.
7. *Cissia eurytus* $\frac{1}{1}^3$.
8. *Neonympha phocion* $\frac{1}{1}^3$.
9. *Basilarchia arthemis* $\frac{1}{1}^3$.
10. *Chlorippe clyton* $\frac{1}{1}^3$. 10a, top view of extremity of upper organ.
11. *Basilarchia archippus* $\frac{1}{1}^3$.
12. *Basilarchia archippus* $\frac{1}{1}^3$. Clasp seen from the middle.
13. *Polygonia progne* $\frac{1}{1}^8$.
14. *Polygonia comma* $\frac{1}{1}^8$.
15. *Basilarchia astyanax* $\frac{1}{1}^3$.
16. *Polygonia faunus* $\frac{1}{1}^8$.
17. *Eugonia j-album* $\frac{1}{1}^3$.
18. *Eugonia j-album* $\frac{1}{1}^3$. Inside view, with right clasp removed.
19. *Polygonia interrogationis* $\frac{1}{1}^8$. Inside view, with right clasp removed.
20. *Polygonia interrogationis* $\frac{1}{1}^8$.
21. *Polygonia gracilis* $\frac{1}{1}^8$.
22. *Vanessa huntera* $\frac{1}{1}^3$.
23. *Anosia plexippus* $\frac{8}{1}$. The false clasp forming a part of the eighth segment almost entirely conceals the real clasp.
24. *Anosia plexippus* $\frac{8}{1}$. The eighth segment removed, exposing the whole of the real clasp.
25. *Aglais milberti* $\frac{1}{1}^3$.
26. *Aglais milberti* $\frac{1}{1}^3$. Top view of right half.
27. *Euvanesa antiopa* $\frac{1}{1}^3$. Inside view, with right clasp removed.
28. *Euvanesa antiopa* $\frac{1}{1}^3$.
29. *Vanessa atalanta* $\frac{1}{1}^3$. 29a, top view of tip of upper organ.
30. *Junonia coenia* $\frac{1}{1}^3$.
31. *Vanessa cardui* $\frac{1}{1}^3$.
32. *Polygonia satyrus* $\frac{1}{1}^8$.
33. *Brenthis myrina* $\frac{1}{1}^8$. Top view of tip of upper organ.
34. *Brenthis myrina* $\frac{1}{1}^8$. Distal half of right clasp from beneath.
35. *Brenthis myrina* $\frac{1}{1}^8$.
36. *Argynnis atlantis* $\frac{1}{1}^0$.
37. *Euptoicta claudia* $\frac{1}{1}^8$.
38. *Brenthis bellona* $\frac{1}{1}^8$.
39. *Brenthis bellona* $\frac{1}{1}^8$. Inferior view of clasps.
40. *Argynnis aphrodite* $\frac{1}{1}^0$.
41. *Brenthis montinus* $\frac{1}{1}^8$.
42. *Brenthis montinus* $\frac{8}{1}$. Extremity of right clasp from beneath.
43. *Speyeria idalia* $\frac{1}{1}^0$.
44. *Argynnis cybele* $\frac{1}{1}^0$.

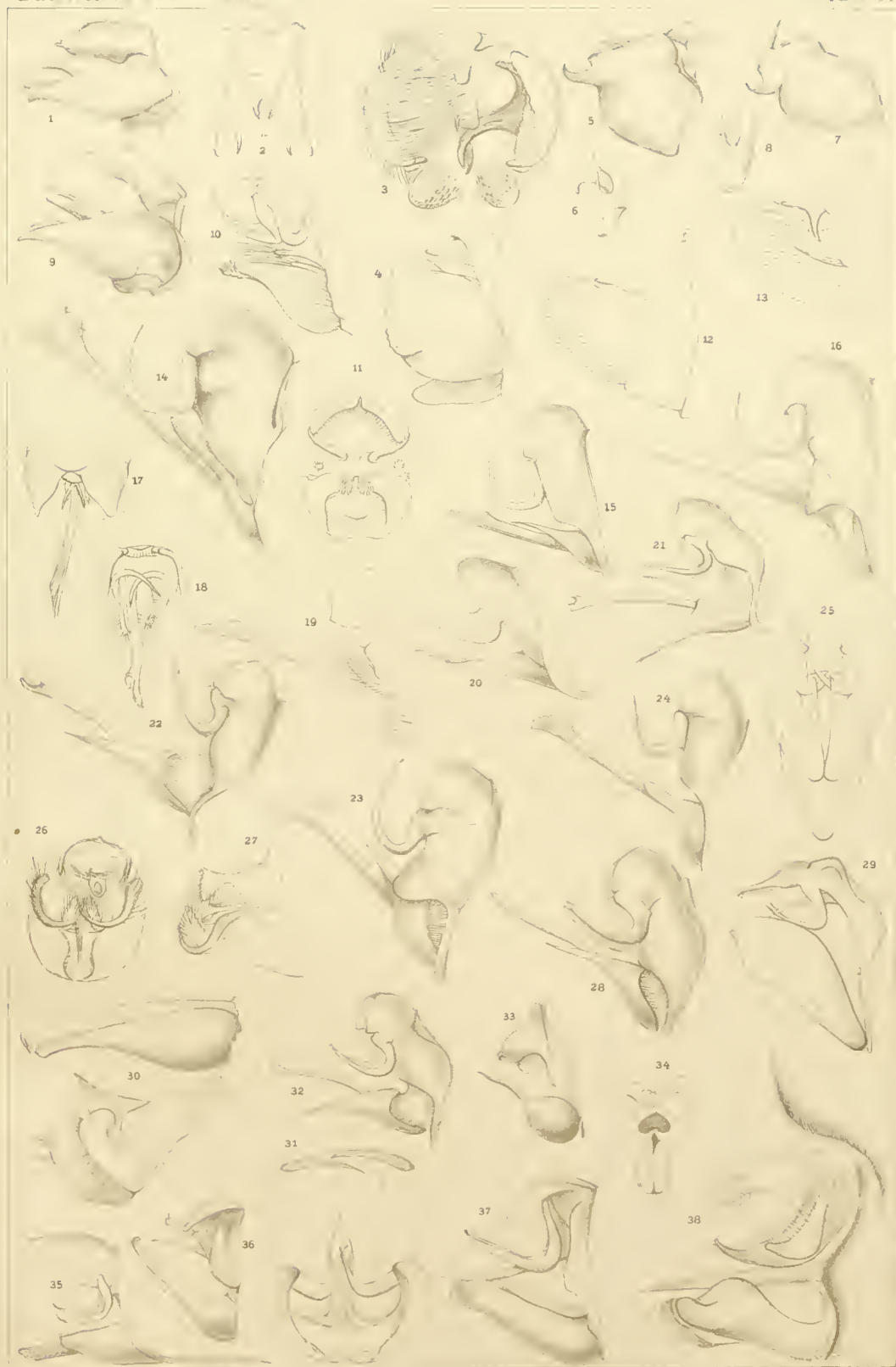


EXPLANATION OF PLATE 34.

Male Abdominal Appendages.—Nymphalidae (Melitaeidi, Libytheinae) and Lycaenidae.

Most of the figures were kindly drawn for me by Edward Burgess, Esq. Figs. 3, 4, 10-13, 17-19, 26, 27, 30, 31 and 38 are by J. H. Emerton. Unless otherwise specified, all show a side view. Lithography by B. Meisel.

1. *Phyciodes tharos* $\frac{1}{1}$.^s
2. *Phyciodes tharos* $\frac{1}{1}$.^s Top view in outline, somewhat diagrammatic.
3. *Euphydryas phaeton* $\frac{1}{1}$.^s Posterior view, the hairs left on one side.
4. *Euphydryas phaeton* $\frac{1}{1}$.^s
5. *Charidryas nycteis* $\frac{1}{1}$.^s
6. *Charidryas nycteis* $\frac{1}{1}$.^s End view of right clasp, or from the top of fig. 5.
7. *Cinclidia harrisii* $\frac{1}{1}$.^s Upper organ not shown.
8. *Cinclidia harrisii* $\frac{1}{1}$.^s End view of right clasp.
9. *Phyciodes batesii* $\frac{1}{1}$.^s
10. *Calephelis borealis* $\frac{1}{1}$.^s
11. *Calephelis borealis* $\frac{1}{1}$.^s Posterior view.
12. *Hypatus bachmanii* $\frac{1}{1}$.^s
13. *Hypatus bachmanii* $\frac{1}{1}$.^s Right clasp removed to show interior aspect and hook of upper organ.
14. *Thecla edwardsii* $\frac{1}{1}$.^s
15. *Thecla ontario* $\frac{1}{1}$.^s
16. *Thecla academica* $\frac{1}{1}$.^s
17. *Thecla liparops* $\frac{1}{1}$.^s Top view.
18. *Thecla liparops* $\frac{1}{1}$.^s Posterior view.
19. *Thecla liparops* $\frac{1}{1}$.^s
20. *Uranotes melinus* $\frac{1}{1}$.^s
21. *Incisalia niphon* $\frac{1}{1}$.^s
22. *Incisalia irus* $\frac{1}{1}$.^s
23. *Strymon titus* $\frac{1}{1}$.^s
24. *Thecla calanus* $\frac{1}{1}$.^s
25. *Thecla calanus* $\frac{1}{1}$.^s View from below in outline.
26. *Everes comyntas* $\frac{2}{1}$.^s Posterior view from below.
27. *Everes comyntas* $\frac{2}{1}$.^s
28. *Mitura damon* $\frac{1}{1}$.^s
29. *Rusticus scudderii* $\frac{1}{1}$.^s
30. *Nomiades couperi* $\frac{2}{1}$.^s The drawing has unfortunately been engraved upside down.
31. *Nomiades couperi* $\frac{2}{1}$.^s View from beneath.
32. *Incisalia angustus* $\frac{1}{1}$.^s
33. *Cyaniris pseudargiolus* $\frac{2}{1}$.^s
34. *Cyaniris pseudargiolus* $\frac{2}{1}$.^s Posterior view.
35. *Feniseca tarquinius* $\frac{1}{1}$.^s
36. *Epidemia epixanthe* $\frac{1}{1}$.^s
37. *Chrysophanus thoe* $\frac{1}{1}$.^s
38. *Heodes hypophlaeas* $\frac{2}{1}$.^s



EXPLANATION OF PLATE 35.

Male Abdominal Appendages.—Papilionidae, Hesperidae.

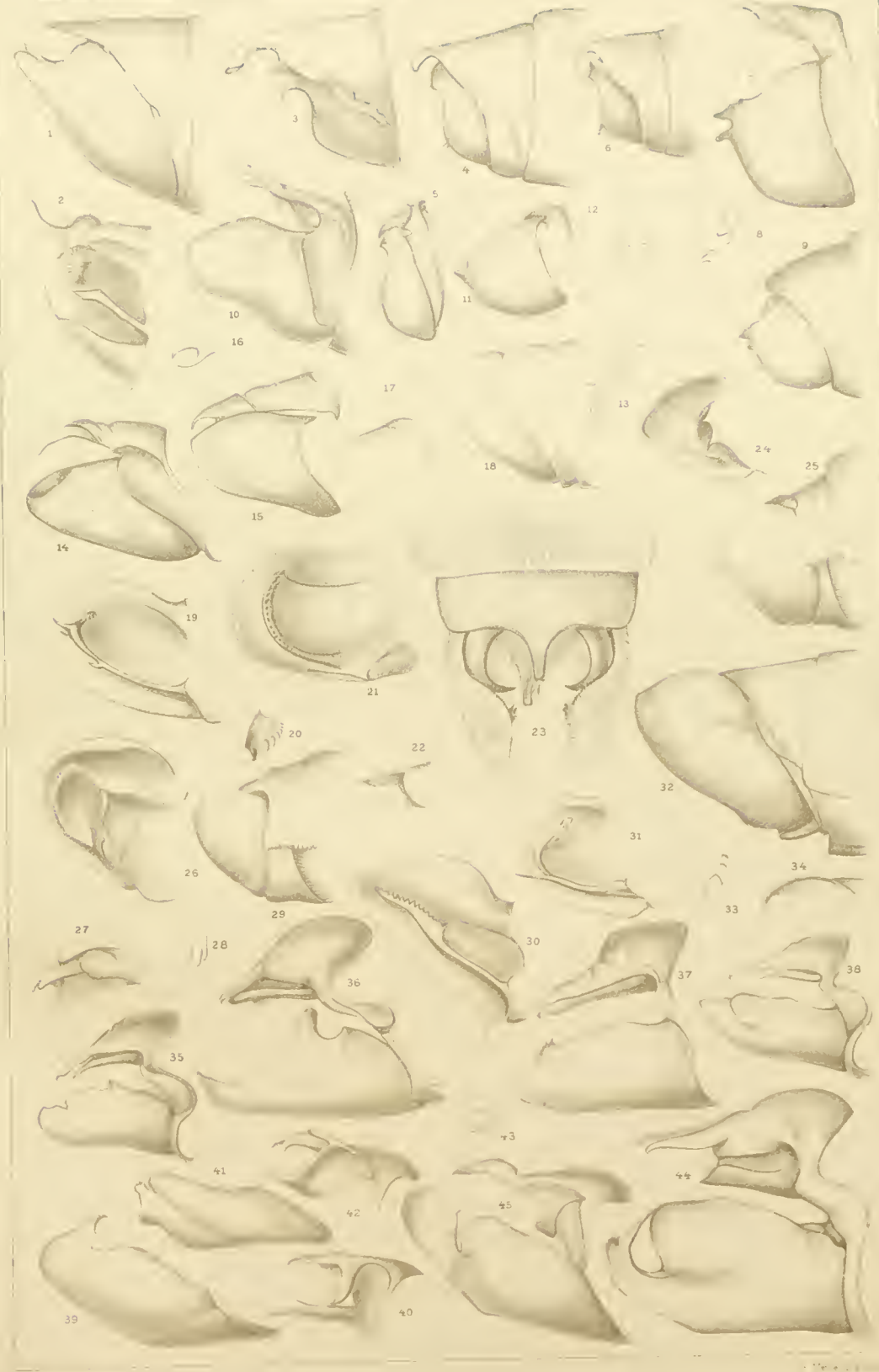
All the dissections and drawings were made by my friend Edward Burgess, Esq., excepting figs. 3, 21-23 by J. H. Emerton and fig. 43 by myself. Unless otherwise stated, they represent side views.

PAPILIONIDAE.

1. *Callidryas eubule* $\frac{2}{1}$. Upper organ not seen.
2. *Callidryas eubule* $\frac{2}{1}$. Interior view by removal of right clasp.
3. *Eurymus interior* $\frac{1^3}{1}$. Upper organ not seen; part of eighth abdominal segment removed.
4. *Eurymus philodice* $\frac{1^3}{1}$. Upper organ not seen.
5. *Eurymus philodice* $\frac{1^3}{1}$. Eighth segment removed.
6. *Eurymus eurytheme* $\frac{1^3}{1}$.
7. *Xanthidia nicippe* $\frac{1^8}{1}$.
8. *Xanthidia nicippe* $\frac{1^8}{1}$. Edge of right clasp, seen from behind.
9. *Xanthidia nicippe* $\frac{1^3}{1}$. Upper organ nearly concealed.
10. *Pieris rapae* $\frac{1^3}{1}$.
11. *Eurema lisa* $\frac{1^8}{1}$.
12. *Eurema lisa* $\frac{1^8}{1}$. Outline of clasps from behind.
13. *Eurema lisa* $\frac{1^8}{1}$. Upper organ.
14. *Anthocharis genutia* $\frac{1^8}{1}$.
15. *Pieris oleracea* $\frac{1^4}{1}$.
16. *Pieris oleracea* $\frac{1^4}{1}$. Extremity of upper organ.
17. *Pontia protodice* $\frac{1^3}{1}$. Upper organ.
18. *Pontia protodice* $\frac{1^3}{1}$.
19. *Euphœades troilus* $\frac{1^3}{1}$. Interior view of left clasp.
20. *Euphœades troilus* $\frac{1^3}{1}$. Extremity of toothed spine, seen from above.
21. *Heraclides cresphontes* $\frac{2}{1}$. Interior view of left clasp.
22. *Heraclides cresphontes* $\frac{2}{1}$. Extremity of upper organ.
23. *Heraclides cresphontes* $\frac{2}{1}$. Top view.
24. *Laertias philenor* $\frac{2}{1}$. Interior view of left clasp.
25. *Laertias philenor* $\frac{2}{1}$.
26. *Iphiclides ajax* $\frac{1^3}{1}$. Interior view of left clasp.
27. *Iphiclides ajax* $\frac{1^3}{1}$. The upper organ seen by removing a part of the eighth abdominal segment.
28. *Iphiclides ajax* $\frac{1^3}{1}$. Top view of extremity of upper organ.
29. *Iphiclides ajax* $\frac{2}{1}$. Eighth segment mostly in place, concealing upper organ.
30. *Papilio polyrenes* $\frac{2}{1}$.
31. *Jasoniades glaucus* $\frac{2}{1}$. Interior view of left clasp.
32. *Jasoniades glaucus* $\frac{2}{1}$.
33. *Jasoniades glaucus* $\frac{2}{1}$. Tip of curved spine, seen from behind.
34. *Jasoniades glaucus* $\frac{2}{1}$. Extremity of eighth abdominal segment.

HESPERIDAE.

35. *Thorybes pylades* $\frac{1^3}{1}$.
36. *Epargyreus tityrus* $\frac{1^3}{1}$.
37. *Endamus proteus* $\frac{1^8}{1}$.
38. *Thorybes bathyllus* $\frac{1^3}{1}$.
39. *Hesperia montivagus* $\frac{1^8}{1}$. Clasp.
40. *Hesperia montivagus* $\frac{1^8}{1}$. Upper organ.
41. *Pholisora catullus* $\frac{1^8}{1}$. Clasp.
42. *Pholisora catullus* $\frac{1^8}{1}$. Upper organ.
43. *Pholisora catullus* $\frac{1^8}{1}$. Extremity of upper organ from above.
44. *Achalarus lycidas* $\frac{1^8}{1}$.
45. *Hesperia centaureæ* $\frac{1^8}{1}$.

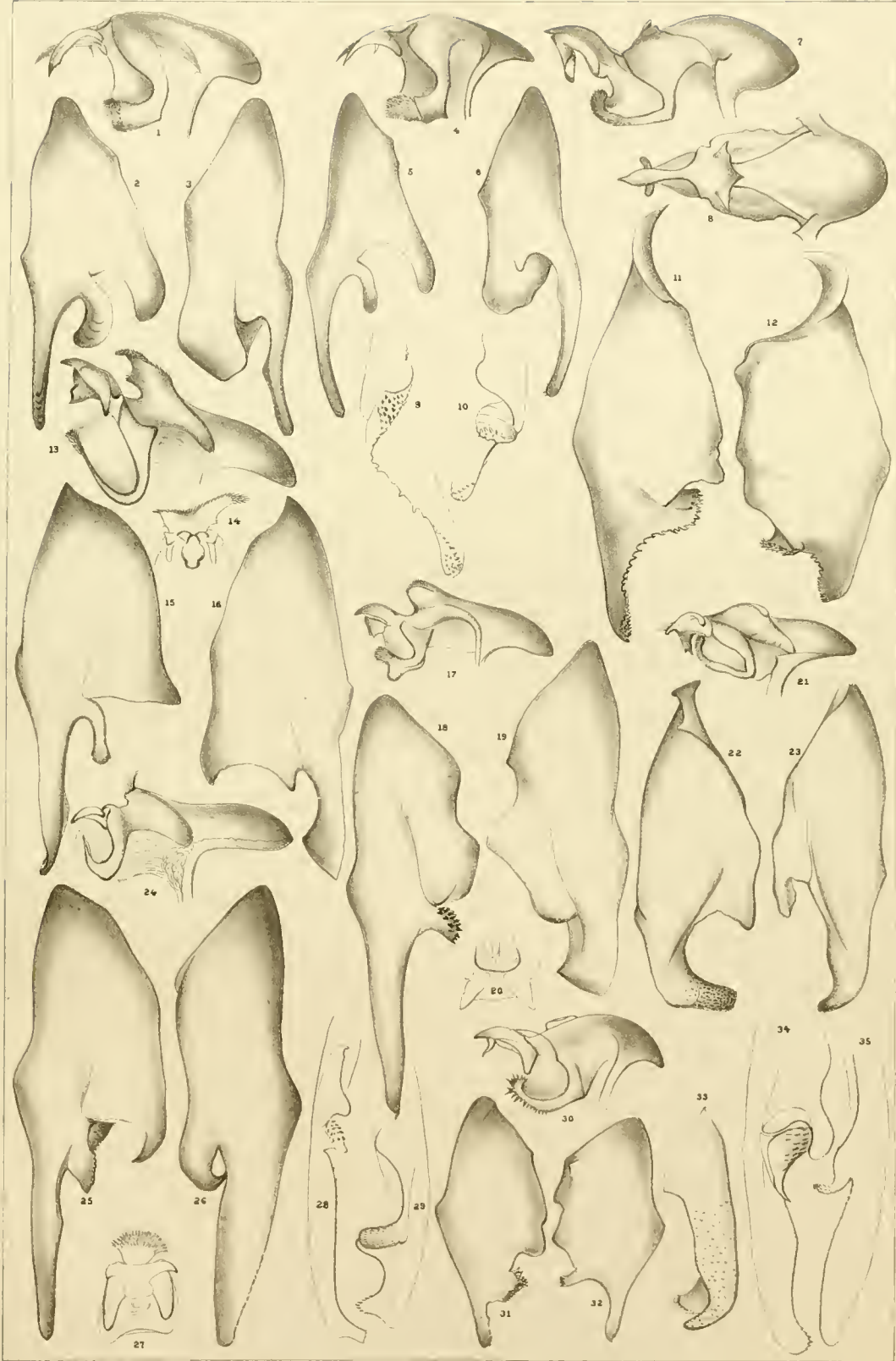


EXPLANATION OF PLATE 36.

Male abdominal appendages.—Hesperiidae (Thanaos).

With the exception of Fig. 33 (by J. H. Emerton), all the original drawings were made by my friend Edward Burgess, Esq., and are magnified twenty diameters. The clasps of the two sides are drawn separately to show the asymmetry.

- | | |
|--|--|
| 1. <i>Thanaos persius</i> . Side view of upper organ. | 20. <i>Thanaos terentius</i> . Top view of extremity of upper organ. |
| 2. <i>Thanaos persius</i> . Side view of left clasp. | 21. <i>Thanaos martialis</i> . Side view of upper organ. |
| 3. <i>Thanaos persius</i> . Side view of right clasp. | 22. <i>Thanaos martialis</i> . Side view of left clasp. |
| 4. <i>Thanaos lucilius</i> . Side view of upper organ. | 23. <i>Thanaos martialis</i> . Side view of right clasp. |
| 5. <i>Thanaos lucilius</i> . Side view of left clasp. | 24. <i>Thanaos juvenalis</i> . Side view of upper organ. |
| 6. <i>Thanaos lucilius</i> . Side view of right clasp. | 25. <i>Thanaos juvenalis</i> . Side view of left clasp. |
| 7. <i>Thanaos brizo</i> . Side view of upper organ. | 26. <i>Thanaos juvenalis</i> . Side view of right clasp. |
| 8. <i>Thanaos brizo</i> . Top view of upper organ. | 27. <i>Thanaos juvenalis</i> . Posterior face of upper organ. |
| 9. <i>Thanaos brizo</i> . Top view of left clasp. | 28. <i>Thanaos terentius</i> . Top view of left clasp. |
| 10. <i>Thanaos brizo</i> . Top view of right clasp. | 29. <i>Thanaos terentius</i> . Top view of right clasp. |
| 11. <i>Thanaos brizo</i> . Side view of left clasp. | 30. <i>Thanaos icelus</i> . Side view of upper organ. |
| 12. <i>Thanaos brizo</i> . Side view of right clasp. | 31. <i>Thanaos icelus</i> . Side view of left clasp. |
| 13. <i>Thanaos horatius</i> . Side view of upper organ. | 32. <i>Thanaos icelus</i> . Side view of right clasp. |
| 14. <i>Thanaos horatius</i> . Posterior face of upper part of upper organ. | 33. <i>Thanaos ausonius</i> . Side view of end of right clasp, with inner view of tip of left clasp. |
| 15. <i>Thanaos horatius</i> . Side view of left clasp. | 34. <i>Thanaos juvenalis</i> . Top view of left clasp. |
| 16. <i>Thanaos horatius</i> . Side view of right clasp. | 35. <i>Thanaos juvenalis</i> . Top view of right clasp. |
| 17. <i>Thanaos terentius</i> . Side view of upper organ. | |
| 18. <i>Thanaos terentius</i> . Side view of left clasp. | |
| 19. <i>Thanaos terentius</i> . Side view of right clasp. | |

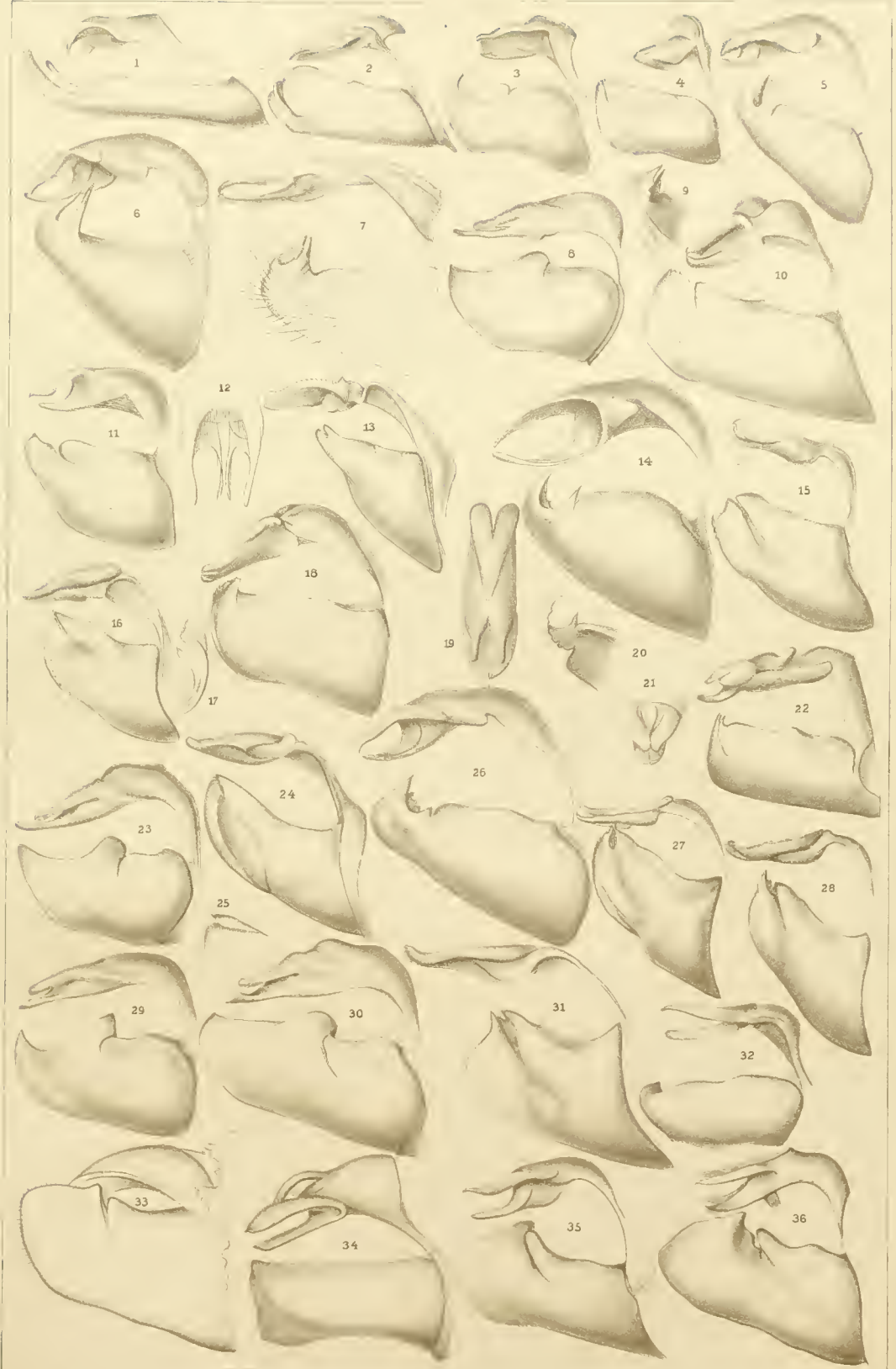


EXPLANATION OF PLATE 37.

Male Abdominal Appendages.—Hesperidae (Pamphilidi).

All the drawings and the original dissections were kindly made by my friend, Edward Burgess, Esq., excepting Figs. 7 and 33, which were drawn by J. H. Emerton. All are magnified eighteen diameters, excepting fig. 3, which is magnified twenty-five diameters.

- | | |
|---|--|
| 1. <i>Ancylozippa numitor</i> . Side view. | 19. <i>Poanes massasoit</i> . Top view of upper organ. |
| 2. <i>Pamphila mandan</i> . Side view. | 20. <i>Erynnis sassacus</i> . Interior view of tip of clasp. |
| 3. <i>Amblyscirtes vialis</i> . Side view. | 21. <i>Atalopedes huron</i> . Tip of upper organ from above. |
| 4. <i>Amblyscirtes samoset</i> . Side view. | 22. <i>Atalopedes huron</i> . Side view. |
| 5. <i>Erynnis manitoba</i> . Side view. | 23. <i>Euphyes metacommet</i> . Side view. |
| 6. <i>Erynnis metea</i> . Side view. | 24. <i>Polites peckius</i> . Side view. |
| 7. <i>Erynnis attalus</i> . Side view. | 25. <i>Polites peckius</i> . Interior view of tip of clasp. |
| 8. <i>Poanes massasoit</i> . Side view. | 26. <i>Anthomaster leonardus</i> . Side view. |
| 9. <i>Erynnis manitoba</i> . Interior view of tip of clasp. | 27. <i>Thymelicus brettus</i> . Side view. |
| 10. <i>Phycanassa viator</i> . Side view. | 28. <i>Limochores manataaquia</i> . Side view. |
| 11. <i>Atrytone logan</i> . Side view. | 29. <i>Limochores bimacula</i> . Side view. |
| 12. <i>Lerema accius</i> . Upper organ from above. | 30. <i>Limochores pontiac</i> . Side view. |
| 13. <i>Hylephila phylaeus</i> . Side view. | 31. <i>Thymelicus mystic</i> . Side view. |
| 14. <i>Erynnis sassacus</i> . Side view. | 32. <i>Lerema accius</i> . Side view. |
| 15. <i>Thymelicus aetna</i> . Side view. | 33. <i>Oligoria maculata</i> . Side view. |
| 16. <i>Limochores taumas</i> . Side view. | 34. <i>Calpodes ethlius</i> . Side view. |
| 17. <i>Atrytone zabulon</i> . Posterior view of tip of clasp. | 35. <i>Euphyes verna</i> . Side view. |
| 18. <i>Atrytone zabulon</i> . Side view. | 36. <i>Lerema hianna</i> . Side view. |



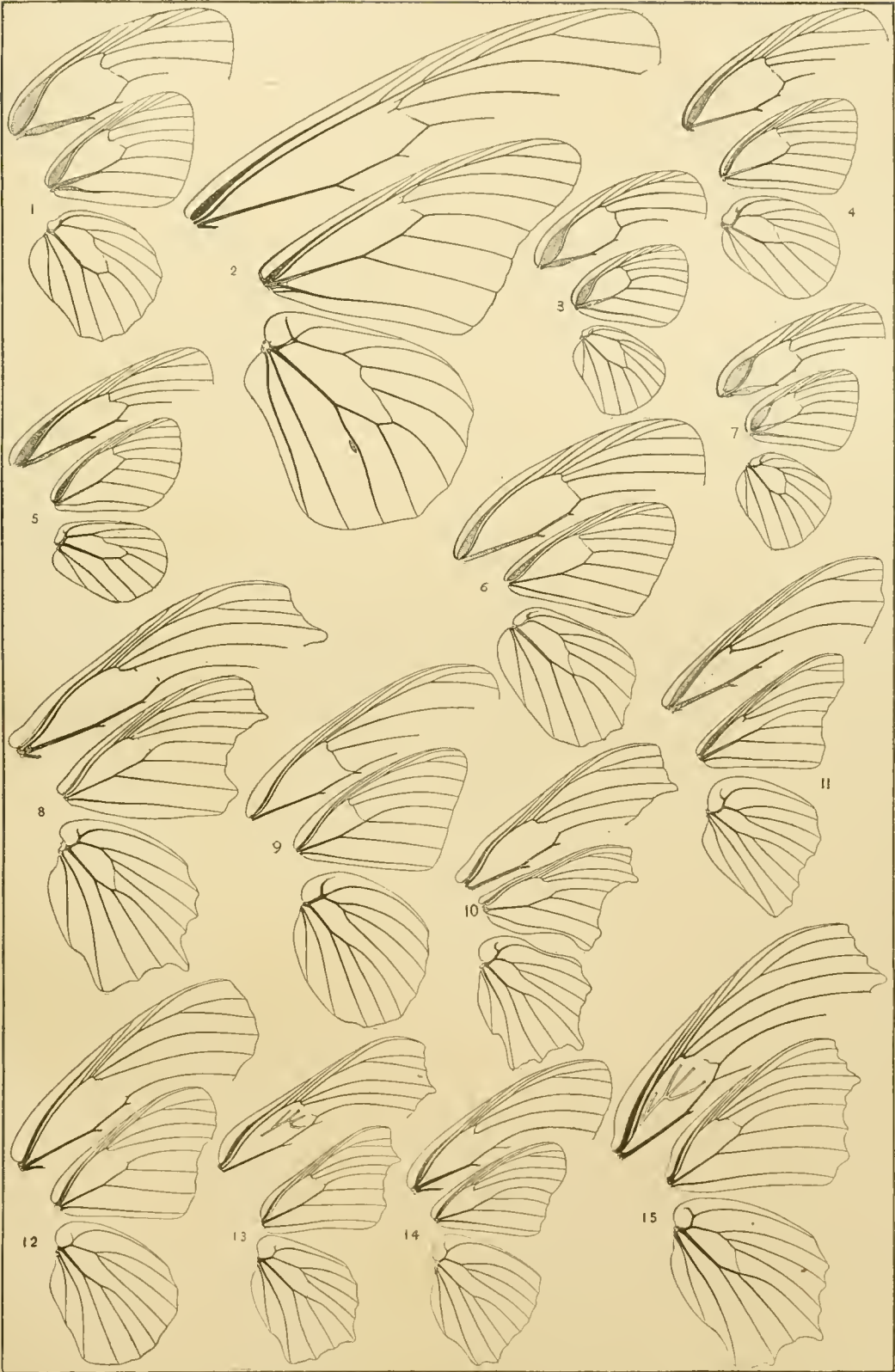
EXPLANATION OF PLATE 38.

Outline and Neuration of Wings.—Nymphalidae.

Drawn in ink by J. H. Emerton from bleached specimens. Photographic relief-plate prepared by the Boston Photogravure Co. Printed at the University Press. The complete figures are all of natural size; the others enlarged $\frac{3}{2}$.

1. *Cercyonis nephele*.
2. *Anosia plexippus*.
3. *Cissia eurytus*.
4. *Satyrodes eurydice*.
5. *Oeneis semidea*.
6. *Enodia portlandia*.
7. *Neonympha phocion*.
8. *Eugonia j-album*.
9. *Basilarchia arthemis*.

10. *Polygonia comma*.
11. *Chlorippe clyton*.
12. *Vanessa huntera*.
13. *Aglaïs milberti*. The independent sketch in the cell shows, on a larger scale, the origin of the nervules next the upper apex of the cell.
14. *Junonia coenia*.
15. *Euranessa antiopa*. The independent sketch in the cell is as in fig. 13.



EXPLANATION OF PLATE 39.

Outline and Neuration of Wings.—Nymphalidae, Lycaenidae.

Drawn in ink by J. H. Emerton from bleached specimens. Photographic relief-plate prepared by the Boston Photogravure Co. The complete figures numbered 1 to 9 are of natural size, those numbered 10 to 24 enlarged $\frac{3}{2}$; the enlarged portion of the front wing is in the one case $\frac{3}{2}$, in the other $\frac{2}{3}$.

NYMPHALIDAE.

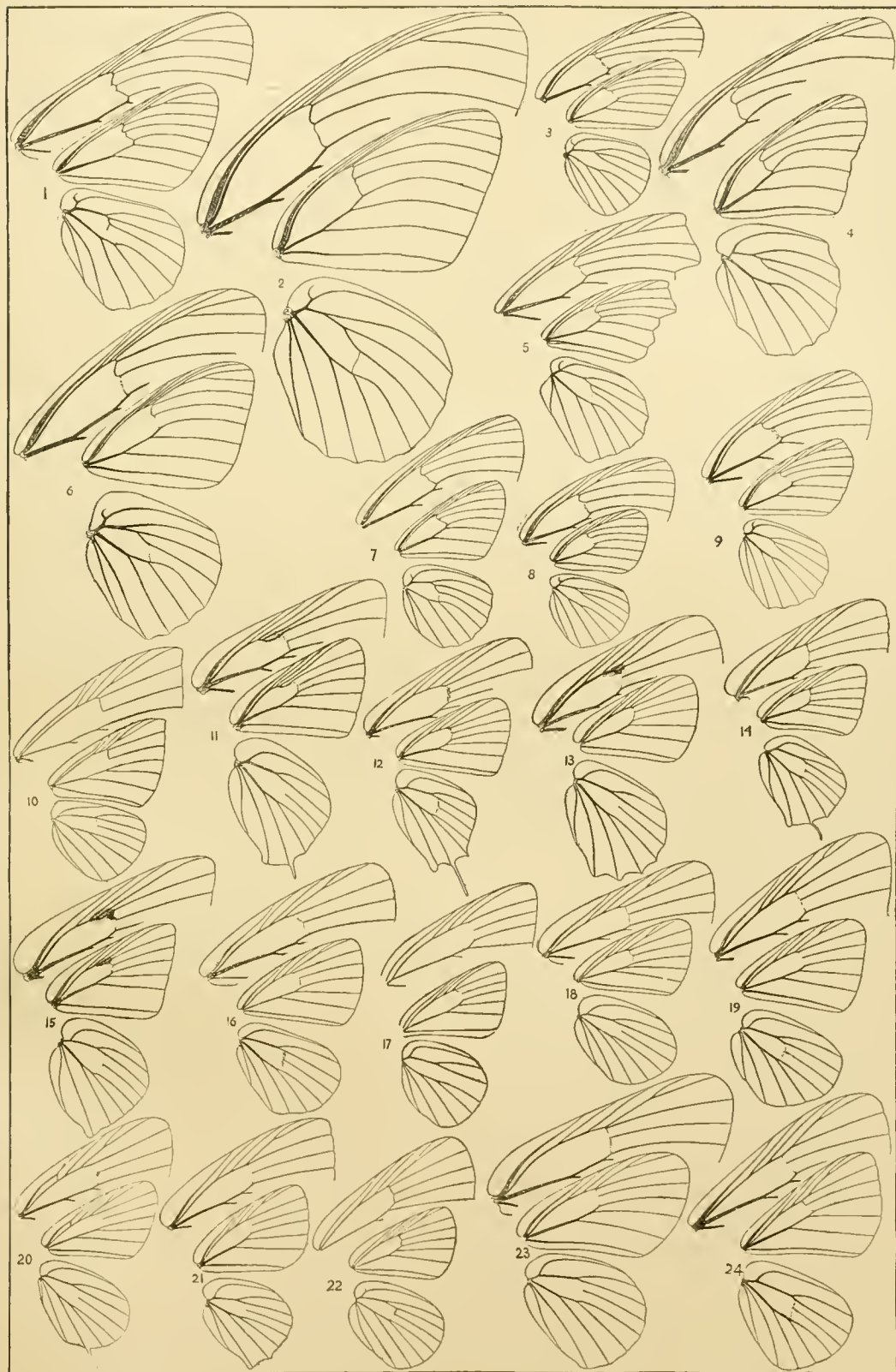
1. *Euphydryas phaeton*.
2. *Speyeria idalia*.
3. *Cinclidia harrisii*.
4. *Euptoieta claudia*.
5. *Hypatus bachmanii*.
6. *Argynnis atlantis*.
7. *Brenthis myrina*.
8. *Phyciodes tharos*.
9. *Charidryas nictetis*.

LYCAENIDAE.

10. *Calephelis borealis*. The internal nervure of fore wings and precostal nervure of hind wings not shown.
11. *Thecla edwardsii*.
12. *Uranotes melinus*.

13. *Incisalia niphon*. The figure does not properly show the apical excision of the inner margin of the hind wing.

14. *Mitura daemon*.
15. *Strymon titus*.
16. *Cyaniris pseudargiolus*.
17. *Erora lacta*. Lowest subcostal nervule of hind wing accidentally omitted.
18. *Rusticus scudderii*.
19. *Nomiades couperi*.
20. *Everses comytas*.
21. *Heodes hypophlaeas*.
22. *Epidemia epicranthe*.
23. *Chrysophanus thoe*.
24. *Feniseca torquinius*.

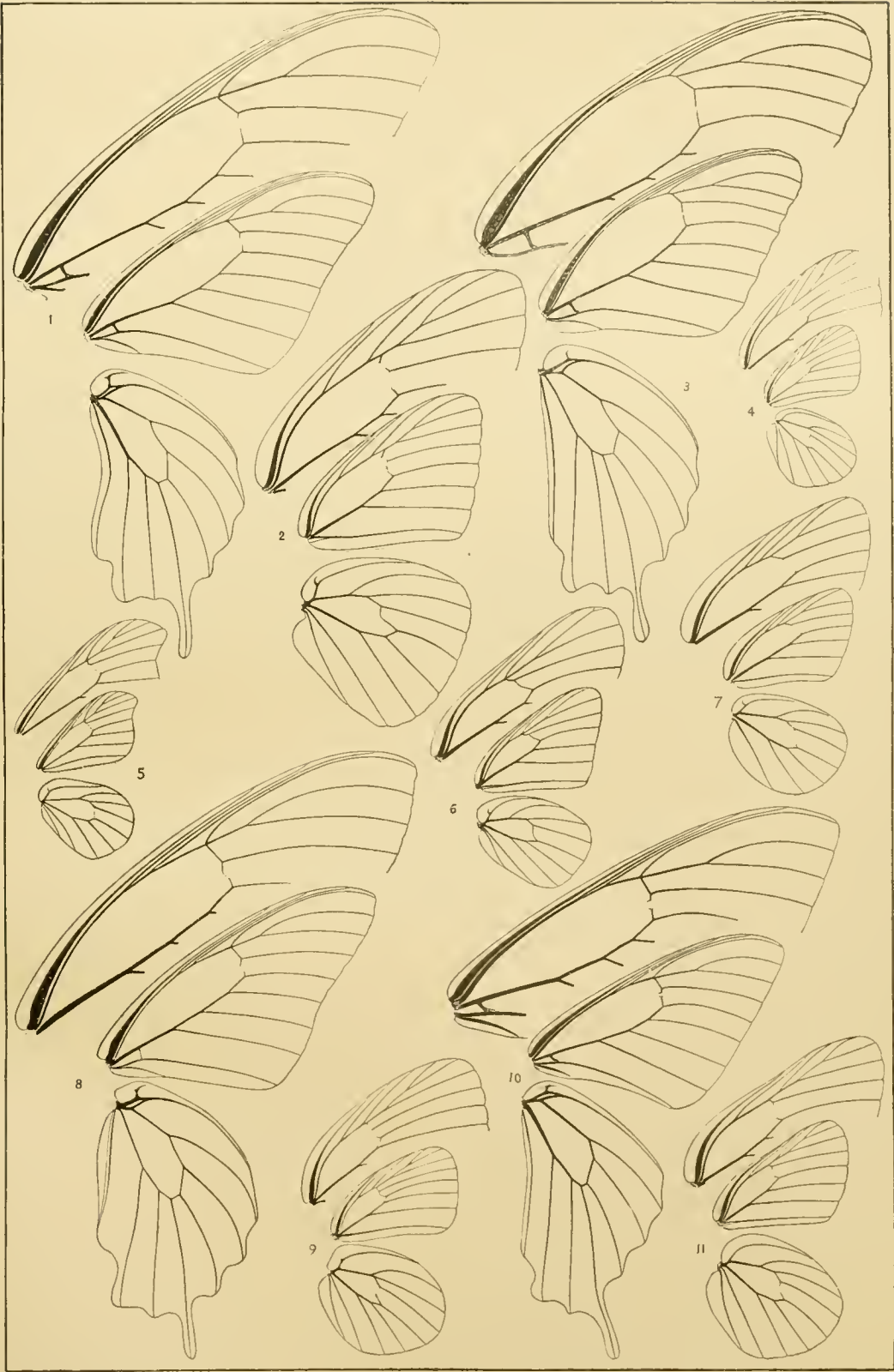


EXPLANATION OF PLATE 40.

Outline and Neuration of Wings.—Papilionidae.

Drawn in ink by J. H. Emerton from bleached specimens. Photographic relief-plate prepared by the Boston Photogravure Co. The complete figures are of the natural size; the others enlarged $\frac{1}{2}$.

- | | |
|---------------------------------|---------------------------------|
| 1. <i>Papilio polyxenes</i> . | 7. <i>Pieris oleracea</i> . |
| 2. <i>Callidryas eubule</i> . | 8. <i>Laertias philenor</i> . |
| 3. <i>Euphocades troilus</i> . | 9. <i>Xanthidia nicippe</i> . |
| 4. <i>Eurema lisa</i> . | 10. <i>Jasoniades glaucus</i> . |
| 5. <i>Anthocharis genutia</i> . | 11. <i>Eurymus philodice</i> . |
| 6. <i>Pontia protodice</i> . | |



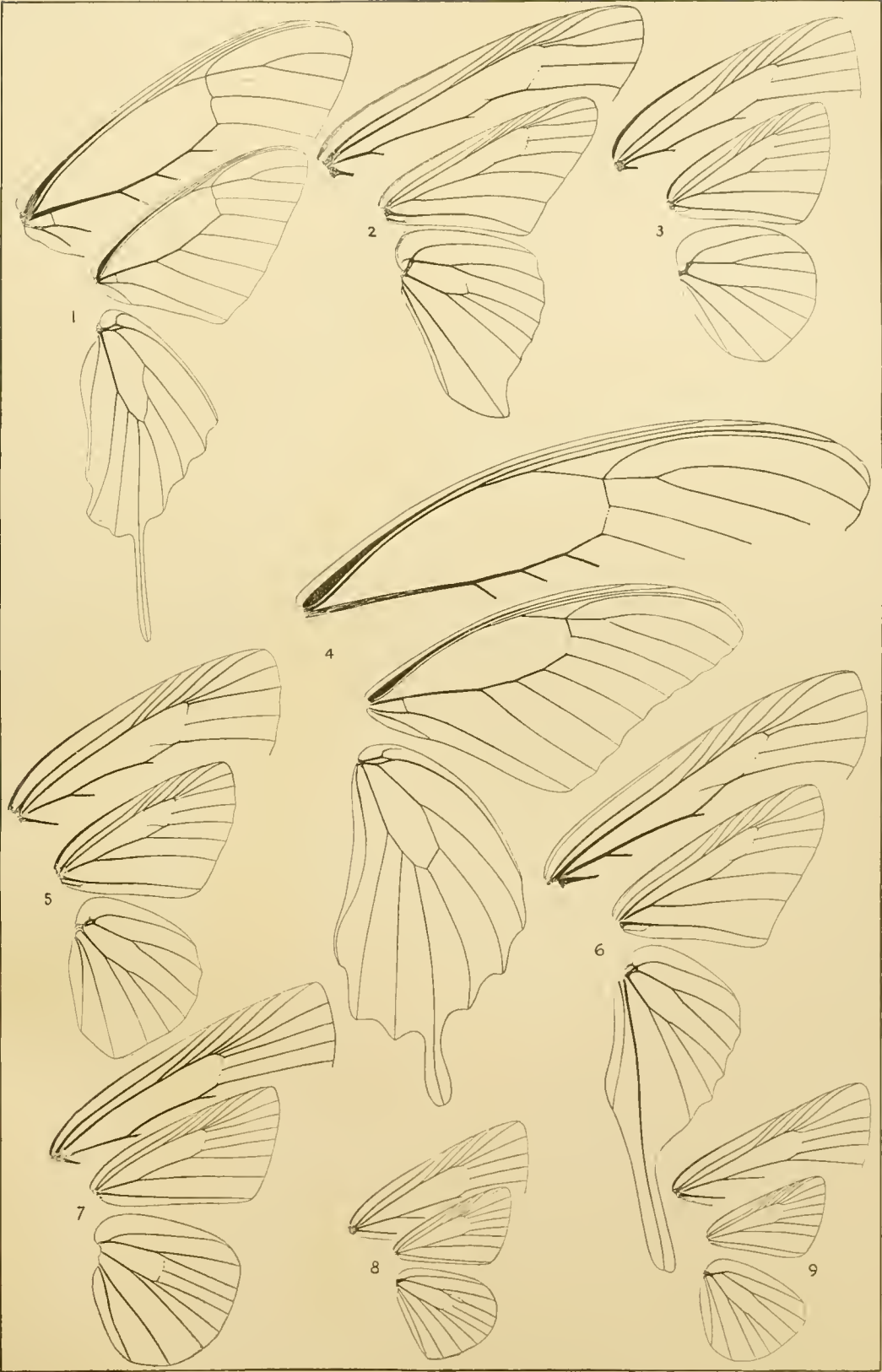
EXPLANATION OF PLATE 41.

Outline and Neuration of Wings.—Papilionidae (Papilioninae), Hesperidae (Hesperidi).

Drawn in ink by J. H. Emerton from bleached specimens. Photographic relief-plate prepared by the Boston Photogravure Co. Fig. 1 is of natural size, the separate part of fore wing $\frac{3}{2}$; fig. 4 is $\frac{2}{3}$ natural size, the separate part of fore wing $\frac{1}{4}$; all the others are enlarged $\frac{3}{2}$, the separated parts of fore wings $\frac{2}{1}$.

1. *Iphiclides ajax*.
2. *Epargyreus tityrus*.
3. *Thorybes pylades*.
4. *Heraclides cresphontes*.
5. *Achalarus lycidas*.

6. *Eudamus proteus*.
7. *Thanaos juvenalis*.
8. *Pholisora catullus*.
9. *Hesperia montivagus*.

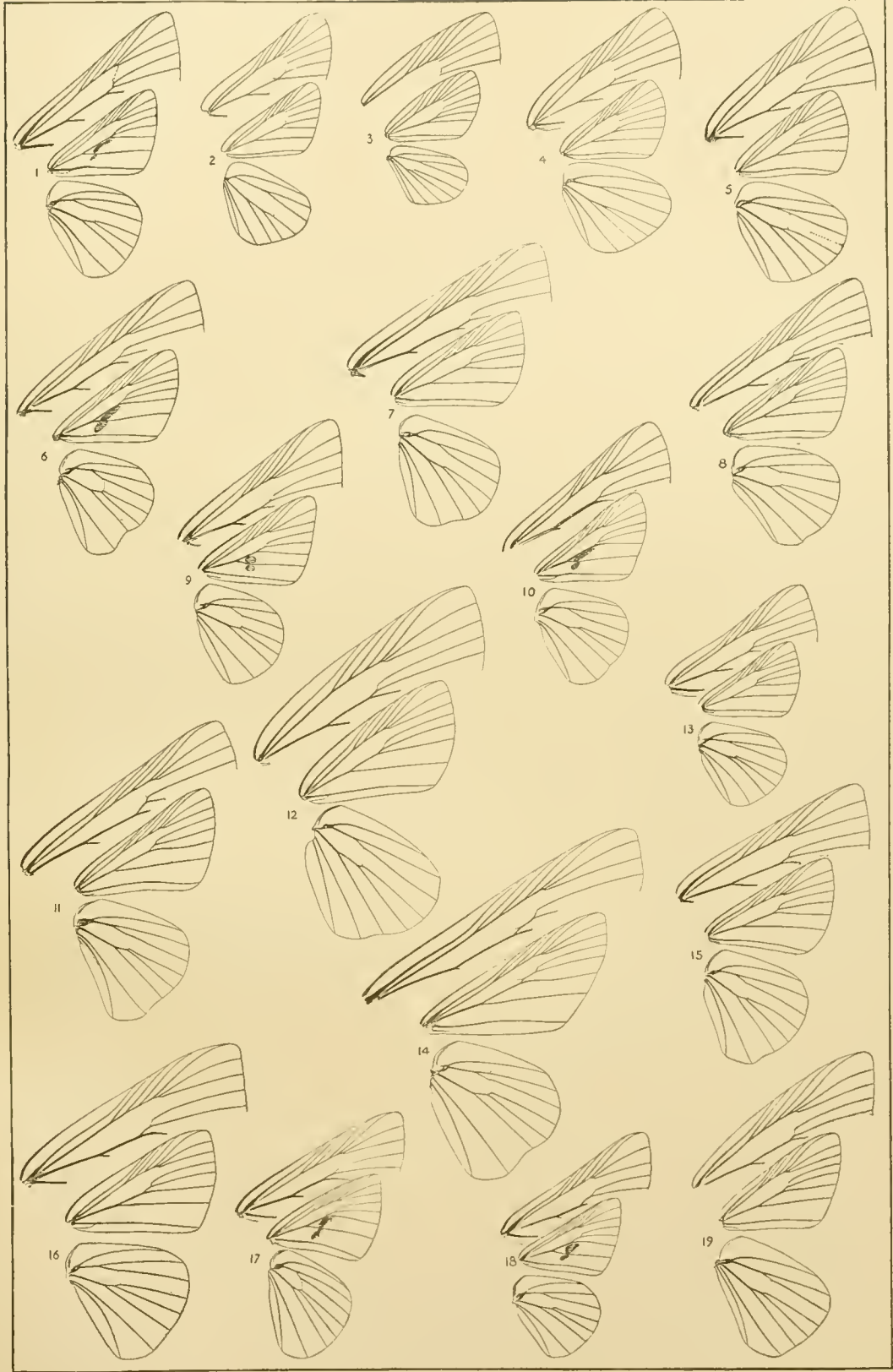


EXPLANATION OF PLATE 42.

Outline and Neuration of Wings.—Hesperiidae (Pamphilidi).

Drawn in ink by J. H. Emerton from bleached specimens. Photographic relief-plate prepared by Boston Photogravure Co. The complete figures enlarged $\frac{3}{2}$, the others $\frac{2}{1}$. The stigma of the wings of the males is shown as they appear after the bleaching process.

- | | |
|---------------------------------|------------------------------------|
| 1. <i>Erynnis metea</i> . | 11. <i>Atalopedes huron</i> . |
| 2. <i>Pamphila mandan</i> . | 12. <i>Phycanassa viator</i> . |
| 3. <i>Ancyloxypha numitor</i> . | 13. <i>Polites peckius</i> . |
| 4. <i>Amblyscirtes vialis</i> . | 14. <i>Calpodus ethlius</i> . |
| 5. <i>Poanes massasoit</i> . | 15. <i>Anthomaster leonardus</i> . |
| 6. <i>Hylephila phylacus</i> . | 16. <i>Oligoria maculata</i> . |
| 7. <i>Atrytone zabulon</i> . | 17. <i>Euphyes metacomet</i> . |
| 8. <i>Thymelicus mystic</i> . | 18. <i>Limochares taumas</i> . |
| 9. <i>Thymelicus aetna</i> . | 19. <i>Lerema accius</i> . |
| 10. <i>Erynnis sassacus</i> . | |

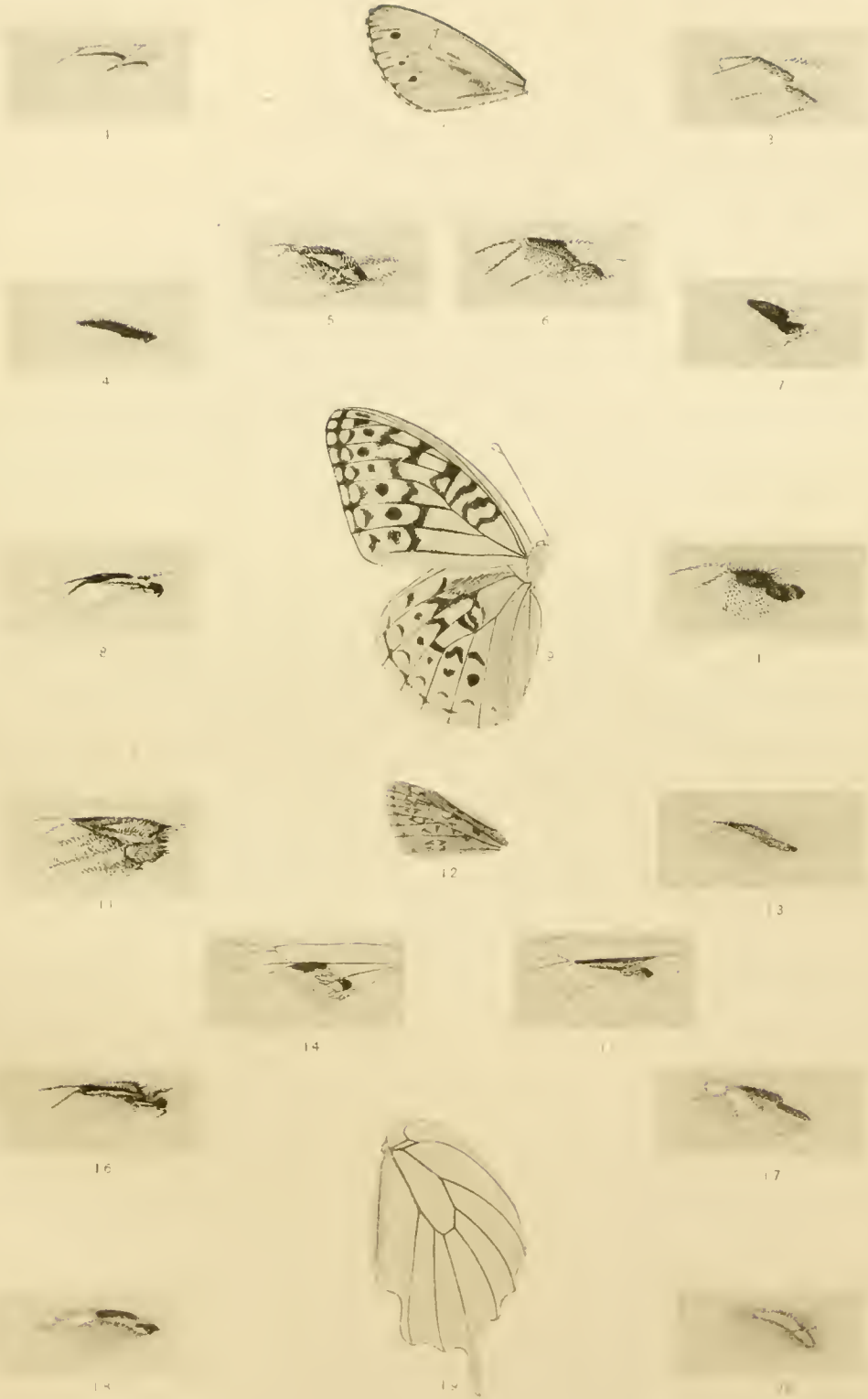


EXPLANATION OF PLATE 43.

Wing patches and folds found in male butterflies.

Figs. 1, 3-8, 10, 11, 13, 16, 17, 20 were drawn in pencil by J. H. Emerton; figs. 2, 9, 12, 14, 15, by Henri Metzger. Reproduced photographically by the gelatine process by the Boston Photogravure Co.

1. *Erynnis metea* $\frac{5}{2}$. Discal stigma of fore wing.
2. *Oeneis jutta* $\frac{1}{1}$. Showing oblique streak across fore wing.
3. *Limochores manataaquia* $\frac{5}{2}$. Discal stigma of fore wing.
4. *Hylephila phylaeus* $\frac{5}{2}$. Discal stigma of fore wing.
5. *Thymelicus brettus* $\frac{5}{2}$. Discal stigma of fore wing.
6. *Thymelicus mystic* $\frac{5}{2}$. Discal stigma of fore wing.
7. *Limochores taumas* $\frac{5}{2}$. Discal stigma of fore wing.
8. *Erynnis manitoba* $\frac{5}{2}$. Discal stigma of fore wing.
9. *Argynnis cybele* $\frac{1}{1}$. Wings of one side, showing the apparent thickening of the median branches and submedian vein of the fore wing; and the row of hairs above the subcostal vein of the hind wing.
10. *Limochores pontiac* $\frac{5}{2}$. Discal stigma of fore wing.
11. *Atalopedes huron* $\frac{5}{2}$. Discal stigma of fore wing.
12. *Thanaos juvenalis* $\frac{1}{1}$. Showing open costal fold of fore wing.
13. *Euphyes metacomet* $\frac{5}{2}$. Discal stigma of fore wing.
14. *Thymelicus actna* $\frac{5}{2}$. Discal stigma of fore wing.
15. *Erynnis sassacus* $\frac{5}{2}$. Discal stigma of fore wing.
16. *Anthomaster leonardus* $\frac{5}{2}$. Discal stigma of fore wing.
17. *Euphyes verna* $\frac{5}{2}$. Discal stigma of fore wing.
18. *Polites peckius* $\frac{5}{2}$. Discal stigma of fore wing.
19. *Laertias philenor* $\frac{1}{1}$. Showing fold of inner margin of hind wing, when opened.
20. *Lerema accius* $\frac{5}{2}$. Discal stigma of fore wing.



EXPLANATION OF PLATE 44.

Wing patches and folds found in male butterflies.

After pencil drawings by J. H. Emerton. Reproduced photographically by the gelatine process by the Boston Photogravure Co.

1. *Thecla calanus* $\frac{3.5}{1}$. Stigma at upper outer termination of cell, to show the comparative size and arrangement of scales in and about the stigma. The lower margin is toward the apex of the wing.

2. *Anosia plexippus* $\frac{3.5}{1}$. Part of the lowest median nervule of left hind wing with its accompanying fold or pouch, concealing the androconia.

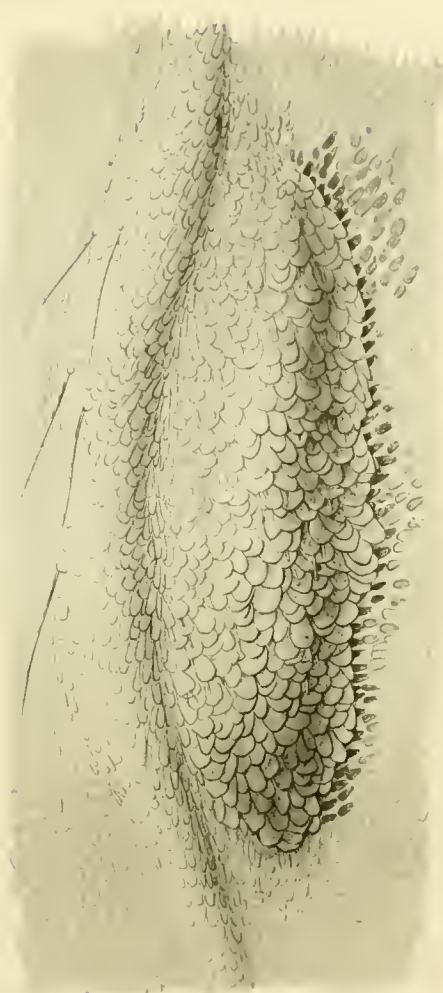
3. *Anosia plexippus* $\frac{3.5}{1}$. Cross section of the same through the middle of the pouch. Taken from a dry specimen.

4. *Speyeria idalia* $\frac{15.0}{1}$. Fragment of one of the median veins of fore wing, showing the feathered

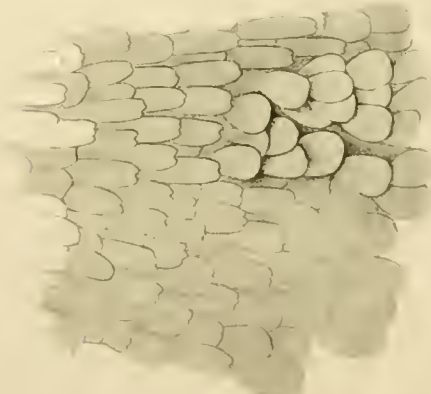
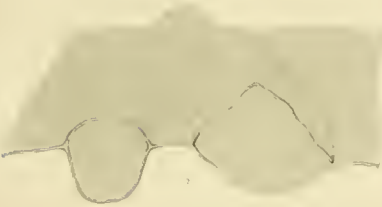
androconia mingled with the scales covering the vein. In fresh specimens, the broad scales on the sides of the vein nearly meet over the top and still further conceal the androconia. The lower edge of the figure looks toward the outer margin of the wing.

5. *Callidryas eubule* $\frac{1.0}{1}$. Showing the patch of erased scales near the base of the second inferior subcostal interspace.

6. *Callidryas eubule* $\frac{15.0}{1}$. Part of the base of the same interspace, still further enlarged, to show the differing form of the raised scales.



2

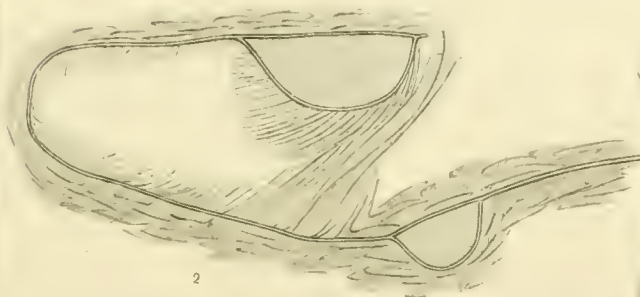
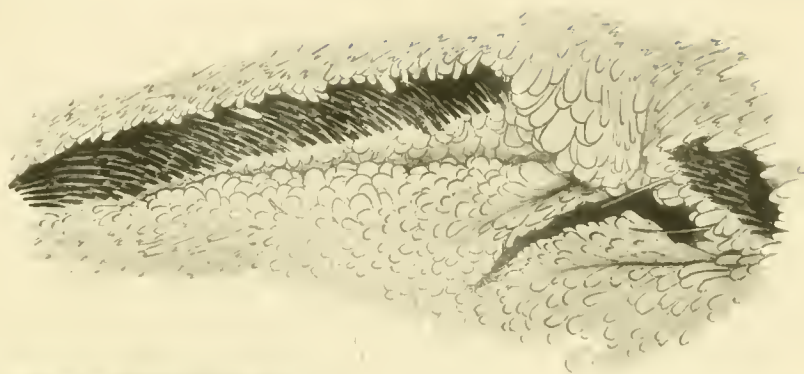


EXPLANATION OF PLATE 45.

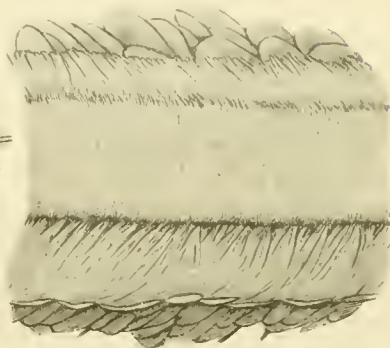
Wing patches and folds found in male butterflies.

From pencil drawings by J. H. Emerton. Reproduced photographically by the gelatine process by the Boston Photogravure Co.

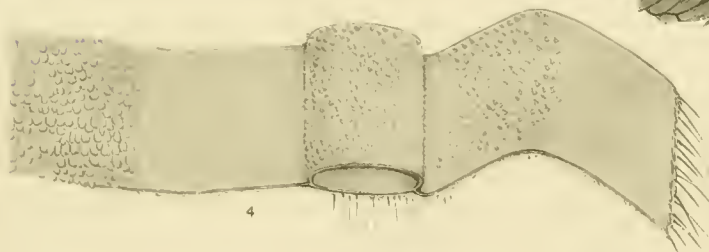
1. *Erynnis sassacus* $\frac{3}{1}^0$.
2. *Thanaos brizo* $\frac{7}{1}^0$. Cross section of the costal fold, involving two veins.
3. *Thanaos brizo* $\frac{3}{1}^0$. The same fold opened, the costal edge uppermost.
4. *Laertias philenor* $\frac{7}{1}^0$. A piece from the inner margin of the upper surface of the left hind wing (the margin itself at the right), with the fold opened to expose the androconia.
5. *Laertias philenor* $\frac{7}{1}^0$. The same, showing a cross section, with the inner flap of the fold turned back to its usual position; the inner edge of the wing is at the left, above.
6. *Thymelicus aetna* $\frac{4}{1}^0$.



2



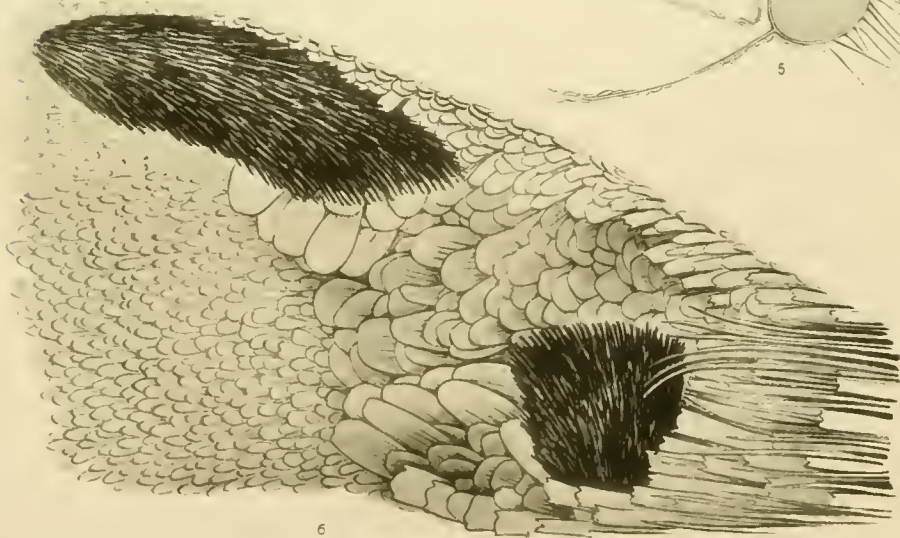
3



4



5



6

EXPLANATION OF PLATE 46.

Scales of the male Imago. -- Nymphalidae. Lycaenidae. Papilionidae.

Lithographed by B. Meisel. All the drawings are by J. Henry Blake and are highly magnified.

1. *Oeneis semidea*. From upper surface, fore wing.
2. *Oeneis jutta*. From the oblique streak of the fore wing.
3. *Cercyonis nephele*. From base of medio-submedian interspace, fore wing.
4. *Cissia eurytus*. From base of medio-submedian interspace, fore wing.
5. *Anosia plexippus*. From the edge of pouch on hind wing.
6. *Anosia plexippus*. From the edge of pouch on hind wing.
7. *Anosia plexippus*. From the edge of pouch on hind wing.
8. *Anosia plexippus*. From the vein next the pouch.
9. *Anosia plexippus*. From the interior floor of the pouch.
10. *Anosia plexippus*. From the interior floor of the pouch.
11. *Speyeria idalia*. From lowest median nervule, fore wing.
12. *Argynnis cybele*. From lowest median nervule, fore wing.
13. *Argynnis aphrodite*. From lowest median nervule, fore wing.
14. *Argynnis atlantis*. From lowest median nervule, fore wing.
15. *Charidryas nycteis*. From base of median interspace, upper surface, fore wing.
16. *Hypatius buchmanii*. From upper surface, fore wing.
17. *Calephelis borealis*. From upper surface.
18. *Thecla liparops*. From discal patch, fore wing.
19. *Thecla ontario*. From discal patch, fore wing.
20. *Thecla edwardsii*. From discal patch, fore wing.
21. *Thecla acadica*. From discal patch, fore wing.
22. *Thecla calanus*. From discal patch, fore wing.
23. *Mitara damon*. From discal patch, fore wing.
24. *Incisalia angustas*. From discal patch, fore wing.
25. *Incisalia irus*. From discal patch, fore wing.
26. *Incisalia niphon*. From discal patch, fore wing.
27. *Strymon titus*. From discal patch, fore wing.
28. *Noniades couperi*. From upper surface.
29. *Rusticus scudderii*. From upper surface.
30. *Cyaniris pseudargyolus*. From upper surface.
31. *Everses comyntas*. From upper surface.
32. *Callidryas eubule*. From margin of upper surface hind wing, in the submedian interspaces.
33. *Callidryas eubule*. From margin of upper surface fore wing, in lower subcostal interspaces.
34. *Chrysophanus thor*. From upper surface.
35. *Epidemia epiyanthe*. From upper surface.
36. *Xanthidia nictippe*. From near the extremity of the middle median nervule, upper surface, fore wing.
37. *Eurymus philodice*. From precostal area, upper surface, hind wing.
38. *Eurymus interior*. From precostal area, upper surface, hind wing.
39. *Pieris oleracea*. From upper surface.
40. *Pieris rapae*. From upper surface.
41. *Anthocharis genutia*. From upper surface.
42. *Laertias philenor*. From inner side of fold of inner margin, hind wing.



EXPLANATION OF PLATE 47.

Scales peculiar to the male Imago.—Hesperidi.

Lithography by B. Meisel. Drawings by J. Henry Blake. All the drawings are highly magnified. Unless otherwise stated, all the figures under one number are drawn to the same scale.

1. *Eudamus proteus*: *a*, chain-bristle from interior of costal fold; *b*, *c*, two forms of androconia; *d*, cover-scale from lip of costal fold.

2. *Achalarus lycidas*: *a*, obspatulate curving androconium; *b*, cover-scale from lip of costal fold; *c*, part of chain-bristle from interior of costal fold.

3. *Thanaos persius*: *a*, pediform bristle from interior (not so highly magnified as the others); *b*, short androconium; *c*, one-pronged rod from interior; *d*, two-pronged rod from interior; *e*, long androconium; *f*, cover-scale from lip of costal fold.

4. *Thanaos lucilius*: *a*, bunch of pediform bristles from interior (not so highly magnified as the others); *b*, scaphiform androconium; *c*, long androconium; *d*, one-pronged rod from interior; *e*, seed-shaped androconium; *f*, cover-scale from lip of costal fold.

5. *Thanaos juvenalis*: *a*, *b*, two forms of androconia; *c*, *d*, two forms of cover-scales from lip of costal fold; *e*, pediform bristle from interior (less magnified than the others).

6. *Thanaos icetus*: *a*, cover-scale from lip of costal fold; *b*, seed-shaped androconium; *c*, scale from inside of lip of costal fold; *d*, flagellate triangular scale from interior; *e*, fabiform androconium from beneath the costal vein; *f*, cover-scale

from lip of costal fold (of slightly different enlargement from the others).

7. *Thanaos brizo*: *a*, twisted ribbon from interior; *b*, cover-scale from lip of costal fold; *c*, cover-scale from lip of costal fold (with *f*, of different enlargement from the others); *d*, short pointed rod from interior; *e*, long pointed rod from interior; *f*, straight bristle from interior (with *c*, of different enlargement from the others).

8. *Thanaos martialis*: *a*, seed-shaped androconium; *b*, cover-scale from lip of costal fold; *c*, pediform bristle from interior; *d*, pointed rod from interior.

9. *Thanaos terentius*: *a*, ribbon-shaped androconium; *b*, scaphiform androconium; *c*, seed-shaped androconium; *d*, fusiform androconium; *e*, cover-scale from lip of costal fold (of different enlargement from the others); *f*, pediform bristle from interior (of independent enlargement).

10. *Thanaos horatius*: *a*, *b*, two forms of androconia to same enlargement; *c*, *d*, two forms of cover-scales from lip of costal fold to same enlargement, but different from preceding; *e*, pediform bristle from interior, independent enlargement.

11. *Epargyreus tityrus*: *a*, spatulate androconium; *b*, flagellate rod-bristle from interior of costal fold.





EXPLANATION OF PLATE 49.

Scales peculiar to the male Imago.—Pamphilidi.

Lithography by B. Meisel. Drawings by J. Henry Blake. All the drawings are highly magnified, those of the same figure to the same degree, unless otherwise specified.

1. *Erynnis sassacus*; *a*, from heart of stigma (different enlargement from the remainder); *b*, from base of stigma; *c*, from inner stigma; *d*, from inner stigma; *e*, from upper edge of inner stigma.

2. *Erynnis manitoba*; *a*, pronged rod from basal patch; *b*, pronged rod from middle patch; *c*, pronged rod from apical patch; *d*, from heart of stigma; *e*, from below basal patch; *f*, from above outer patch; *g*, from heart of stigma (independent enlargement); *h*, from below basal patch; *i*, from below basal patch; *k*, from below outer patch; *l*, from below the stigma.

3. *Atalopedes huron*; *a*, from above the stigma; *b*, from upper edge of outer patch; *c*, from basal

patch; *d*, from heart of stigma; *e*, from field below stigma; *f*, pronged rod from base of stigma; *g*, from basal patch; *h*, from upper edge of outer patch; *i*, from vitreous spot of lower median interspace in the female; *k*, pronged rod from base of stigma.

4. *Limnophora taumas*; *a*, pronged rods at base of stigma; *b*, from field below stigma; *c*, from above middle of stigma; *d*, from field below stigma; *e*, from field below stigma; *f*, from heart of stigma (independent enlargement); *g*, from above middle of stigma; *h*, from above middle of stigma; *i*, from above middle of stigma.

EXPLANATION OF PLATE 50.

Scales peculiar to the male Imago.—Pamphilidi.

Lithography by B. Meisel. Drawings by J. Henry Blake. All the drawings are highly magnified, and in the same figure are drawn to one scale, unless otherwise specified.

1. *Thymelicus brettus*; *a*, from field below stigma; *b*, from heart of stigma; *c*, from heart of stigma; *d*, from heart of stigma; *e*, from heart of stigma; *f*, from base of stigma; *g*, from base of stigma.

2. *Polites peckius*; *a*, from extreme base of stigma; *b*, from base of stigma; *c*, from field below stigma; *d*, from heart of stigma (independent enlargement); *e*, from base of stigma; *f*, from heart of stigma (independent enlargement); *g*, from base of stigma; *h*, from extreme base of stigma.

3. *Thymelicus mystic*; *a*, from field below stigma; *b*, from heart of stigma (independent enlargement); *c*, from heart of stigma; *d*, from extreme base of stigma; *e*, from heart of stigma; *f*, from extreme base of stigma; *g*, from extreme base of stigma.

4. *Limochores pontiac*; *a*, from extreme base of stigma; *b*, from heart of stigma; *c*, from next the extreme base of stigma; *d*, from field below

stigma; *e*, from field below stigma; *f*, from above extreme tip of stigma; *g*, from above the apical streak; *h*, from the extreme base of the stigma.

5. *Limochores manataaqua*; *a*, from field below stigma; *b*, from extreme base of stigma; *c*, from field below stigma; *d*, from heart of stigma; *e*, from field below stigma; *f*, from heart of stigma (independent enlargement); *g*, from above apical streak; *h*, from above apical streak.

6. *Euphyes verna*; *a*, from extreme base of stigma; *b*, from vitreous spot in lower median interspace of male; *c*, from extreme tip of stigma; *d*, from vitreous spot in lower median interspace of female; *e*, from extreme tip of stigma; *f*, from heart of stigma (independent enlargement); *g*, from extreme tip of stigma; *h*, from extreme tip of stigma; *i*, from extreme tip of stigma; *k*, from extreme tip of stigma; *l*, from extreme tip of stigma.

EXPLANATION OF PLATE 51.

Scales peculiar to the male Imago.—Pamphilidi.

Lithography by B. Meisel. Drawings by J. Henry Blake. All the drawings are highly magnified, and in each figure, unless otherwise specified, are drawn to one scale.

1. *Anthomaster leonardus*; *a*, from extreme base of stigma; *b*, from extreme tip of stigma; *c*, from field below stigma; *d*, from field below stigma; *e*, from heart of stigma (independent enlargement); *f*, from field below stigma; *g*, from field below stigma; *h*, from extreme base of stigma; *i*, from heart of stigma.

2. *Limochores bimacula*; *a*, from heart of stigma; *b*, a complete jointed bristle from basal patch, with same enlargement as the rest; *c*, from heart of stigma; *d*, from basal patch; *e*, from lower edge of stigma; *f*, from basal patch; *g*, a cover-scale.

3. *Lerema hianna*; *a*, from base of stigma; *b*, from tip of stigma; *c*, from tip of stigma; *d*, from base of stigma.

4. *Euphyes metacomet*; *a*, from vitreous spot in lower median interspace of female; *b*, from base of stigma; *c*, from base of stigma; *d*, from heart of stigma (independent enlargement).

5. *Thymelicus aetna*; *a*, from base of stigma; *b*, from base of stigma; *c*, from heart of stigma (independent enlargement); *d*, from field below stigma; *e*, from base of stigma (independent enlargement); *f*, from field below stigma; *g*, from field below stigma; *h*, from tip of stigma; *i*, from tip of stigma; *k*, from centre of stigma.

6. *Lerema accius*; *a*, from heart of stigma (independent enlargement); *b*, from above apical streak of stigma; *c*, from stigma; *d*, from the vitreous subcostal spots of the female.

EXPLANATION OF PLATE 52.

Eyes, Tongue, Antennae, Palpi, and Legs of Imago.—Nymphalidae.

Drawn by J. H. Emerton, excepting the specially enlarged legs in Figs. 2, 3 and 7, which are by Henri Metzger. Lithography by B. Meisel.

Lettering f , fore-leg from side; f' , apex of fore-tarsus from side; f'' , the same from above; m' , apex of middle tarsi from side; m'' , the same from above; μ , palpus from side. Various enlargements.

1. *Satyroides eurydice*.

2. *Anosia plerippus*.

3. *Cissia eurytus*.

4. *Ceregonis alope*.

5. *Enodia portlandia*.

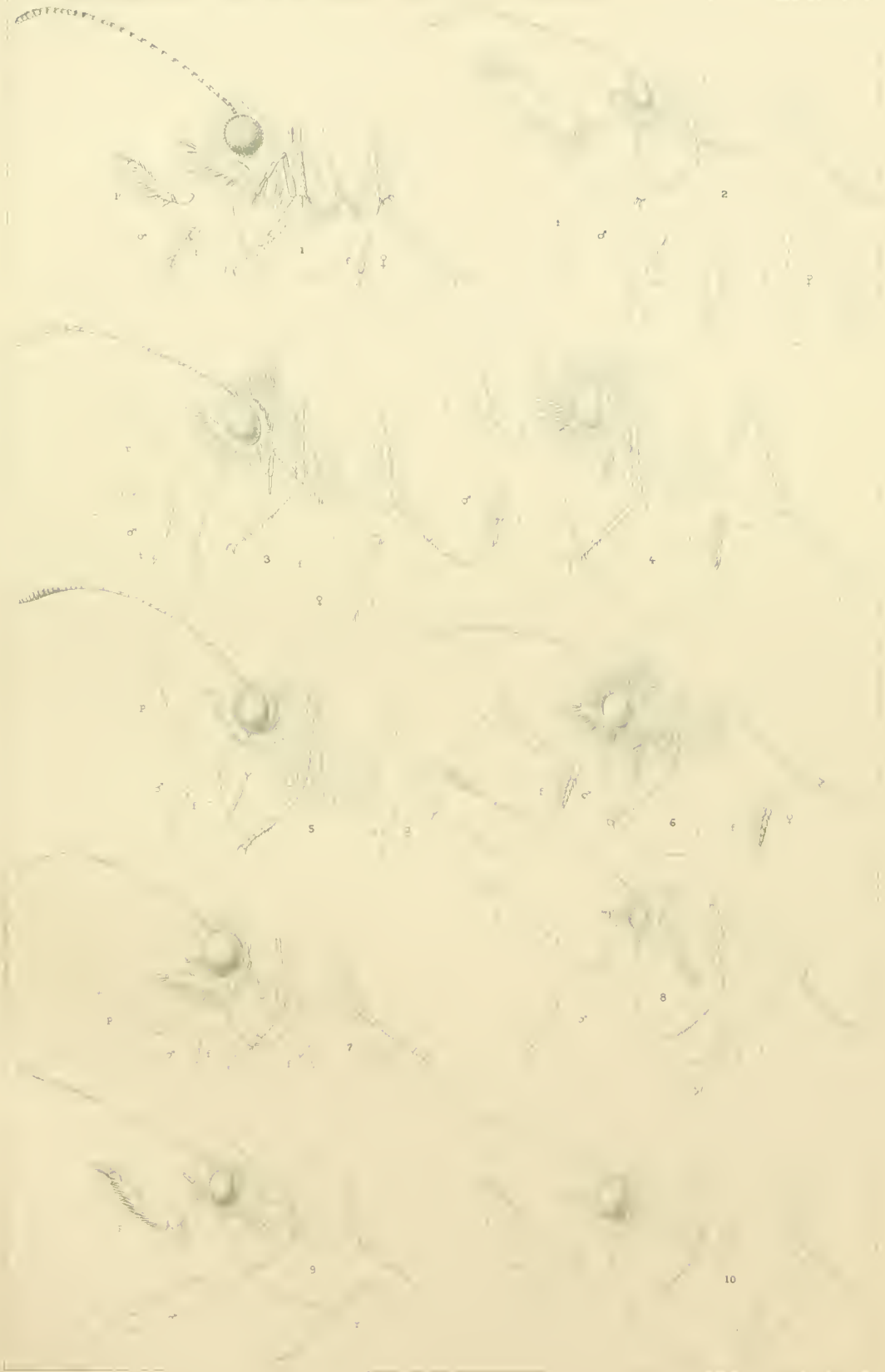
6. *Oeneis semidea*.

7. *Neonympba phocion*.

8. *Polygonia faunus*.

9. *Basilarchia astyanax*.

10. *Chlorippe clyton*.



EXPLANATION OF PLATE 53.

Eyes, Tongue, Antennae, Palpi and Legs of Imago.—Nymphalidae.

Drawn by J. H. Emerton, excepting figs. Sm^t, Sm^u, which are by Henri Metzger. Lithography by B. Meisel.

Lettering: *f*, fore-leg from side; *mt*, apex of middle tarsi from side; *mu*, the same from above; *p*, palpus from side. Various enlargements.

1. *Aglais milberti*.
2. *Argynnis aphrodite*.
3. *Euptoieta claudia*.
4. *Euvanessa antiopa*.

5. *Vanessa huntera*.
6. *Eugonia j-allan*.
7. *Speyeria idalia*.
8. *Junonia coenia*.



EXPLANATION OF PLATE 54.

Eyes, Tongue, Antennae, Palpi and Legs of Imago.—Nymphalidae and Lycaenidae.

Drawn by J. H. Emerton, excepting the detached and enlarged legs and tarsi of figs. 5, 6 and 7, which are by Henri Metzger. Lithography by B. Meisel.

Lettering: *f*, fore-leg from side; *f'*, apex of fore tarsi from side; *m'*, apex of middle tarsi from side; *m''*, the same from above; *p*, palpus from side. Various enlargements.

- | | |
|--------------------------------|---------------------------------|
| 1. <i>Brenthis bellona</i> . | 6. <i>Hypatus bachmanii</i> . |
| 2. <i>Phyciodes tharos</i> . | 7. <i>Calephelis borealis</i> . |
| 3. <i>Charidryas nycteis</i> . | 8. <i>Thecla edwardsii</i> . |
| 4. <i>Cinclidia harrisii</i> . | 9. <i>Uranotes melinus</i> . |
| 5. <i>Euphydryas phaeton</i> . | 10. <i>Mitura damon</i> . |



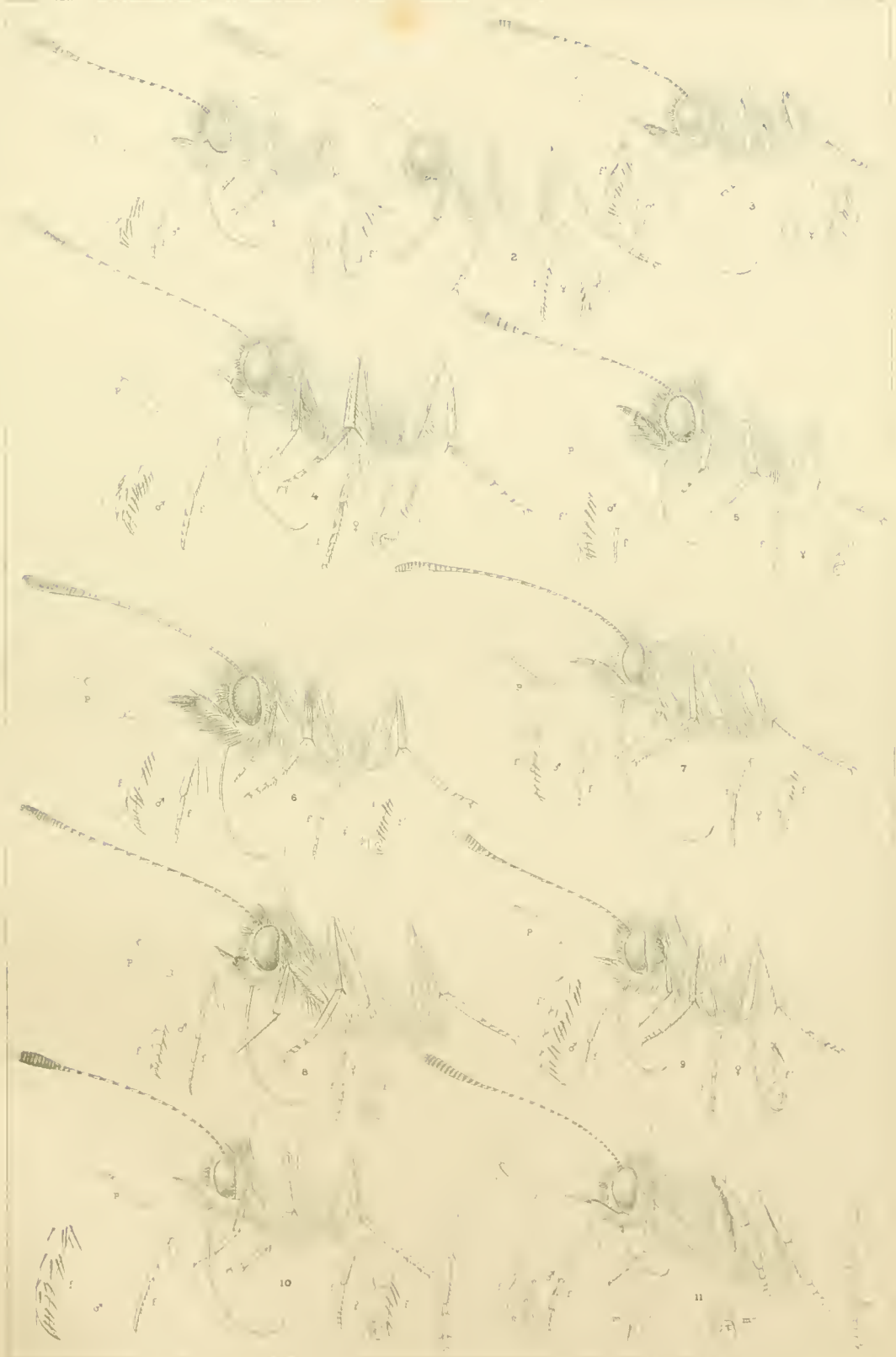
EXPLANATION OF PLATE 55.

Eyes, Tongue, Antennae, Palpi and Legs of Imago.—Lycaeninae.

Drawn by J. H. Emerton, excepting figs. 8f ♂ ♀, 8f' ♂ ♀ and 11 m, m', m'', which are by Henri Metzger. Lithography by B. Meisel.

Lettering: *f*, fore-leg from side; *f'*, apex of fore tarsi from side; *m*, middle leg from side; *m'*, apex of middle tarsi from side; *m''*, the same from above; *p*, palpus from side. Various enlargements.

- | | |
|------------------------------------|----------------------------------|
| 1. <i>Incisalia augustus</i> . | 7. <i>Rusticus scudderii</i> . |
| 2. <i>Erora laeta</i> . | 8. <i>Chrysophanus thoe</i> . |
| 3. <i>Everes comyntas</i> . | 9. <i>Epidemia epicanthe</i> . |
| 4. <i>Strymon titus</i> . | 10. <i>Heodes hypophlaeas</i> . |
| 5. <i>Cyaniris pseudargiolus</i> . | 11. <i>Feniseca tarquinius</i> . |
| 6. <i>Nomiades couperi</i> . | |



EXPLANATION OF PLATE 56.

Eyes, Tongue, Antennae, Palpi and Legs of Imago.—Papilionidae.

Drawn by J. H. Emerton, excepting figs. 1f, f'', m', m'', which are by Henri Metzger. Lithography by B. Meisel.
Lettering: *f*, fore leg from side; *f''*, apex of fore tarsi from above; *m'*, apex of middle tarsi from side; *m''*, the same from above; *p*, palpus from side. Various enlargements.

- | | |
|-------------------------------|---------------------------------|
| 1. <i>Callidryas cubule</i> . | 6. <i>Pieris oleracea</i> . |
| 2. <i>Eurymus philodice</i> . | 7. <i>Anthocharis genutia</i> . |
| 3. <i>Eurema lisa</i> . | 8. <i>Laertias philenor</i> . |
| 4. <i>Xanthidia nicippe</i> . | 9. <i>Iphiclides ajax</i> . |
| 5. <i>Pontia protodice</i> . | |



EXPLANATION OF PLATE 57.

Eyes, Tongue, Antennae, Palpi and Legs of Imago. — Papilionidae and Hesperidi.

Drawn by J. H. Emerton, excepting figs. 6f, 6f'', which are by Henry Metzger. Lithography by B. Meisel.

Lettering: *a*, antennal club from above; *f*, fore leg from side; *f''*, apex of fore tarsi from above; *p*, palpus from side. Various enlargements.

1. *Achalarus lycidas*.

2. *Papilio polyxenes*.

3. *Heraclides cresphontes*.

4. *Jasoniades glaucus*.

5. *Eudamus proteus*.

6. *Euphœades troilus*.

7. *Thanaos horatius*.



EXPLANATION OF PLATE 58.

Eyes, Tongue, Antennae, Palpi and Legs of Imago. — Hesperidae.

Drawn by J. H. Emerton, excepting the separate details of the legs in fig. 1, which are by Henri Metzger. Lithography by B. Meisel.

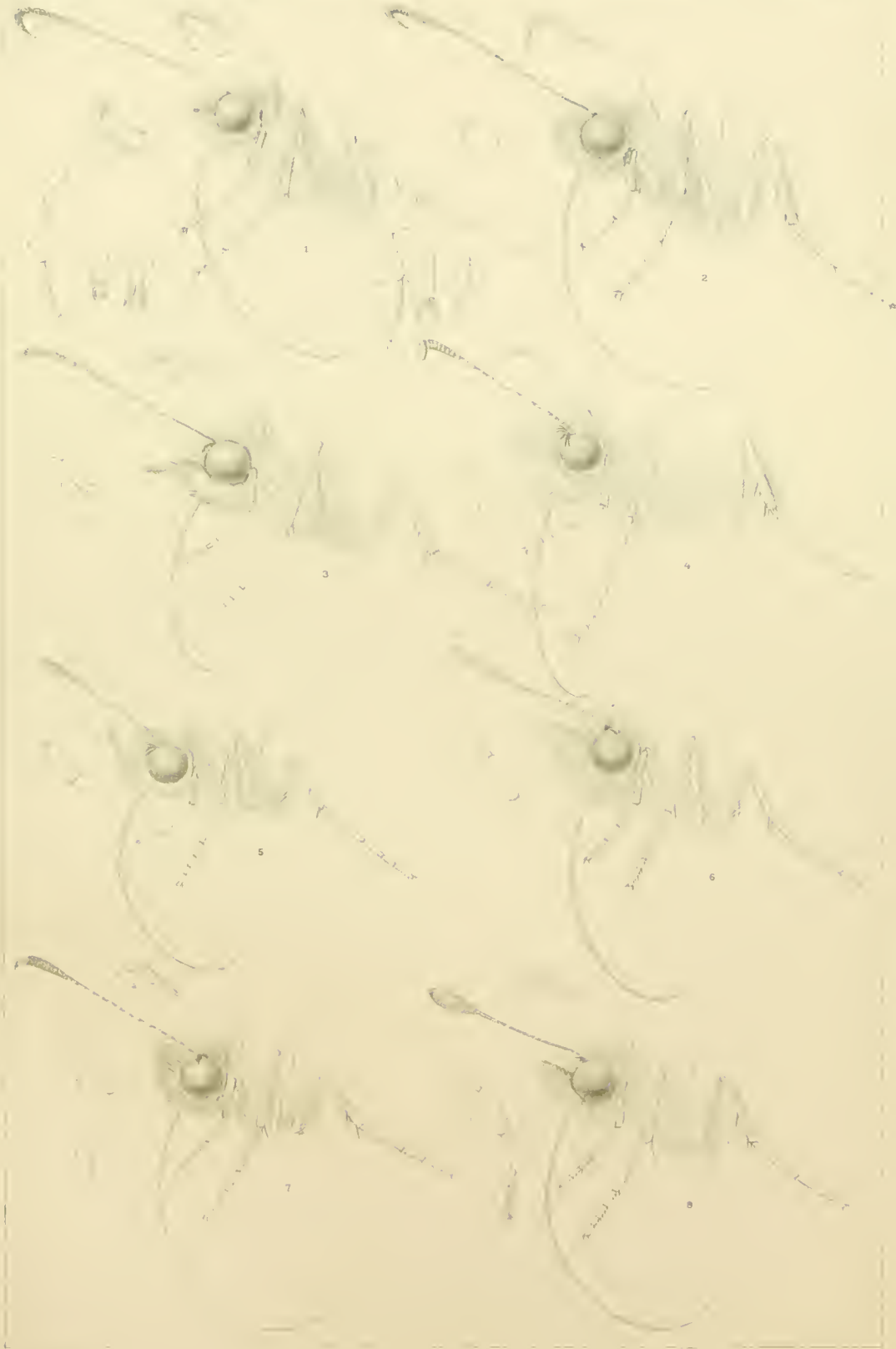
Lettering: *a*, antennal club from above; *f*, fore leg from side; *ft*, apex of fore tarsi from side; *fu*, the same from above; *m*, middle leg from side; *mt*, apex of middle tarsi from side; *mu*, the same from above; *p*, palpus from side; *t*, inner side of fore tibia. Various enlargements.

HESPERIDI.

1. *Epargyreus tityrus*.
2. *Thorybes pylades*.
3. *Pholisora catullus*.
4. *Hesperia montivaga*.

PAMPHILIDI.

5. *Ancylozipha numitor*.
6. *Pamphila mandan*.
7. *Amblyscirtes vialis*.
8. *Erynnis metea*.



EXPLANATION OF PLATE 59.

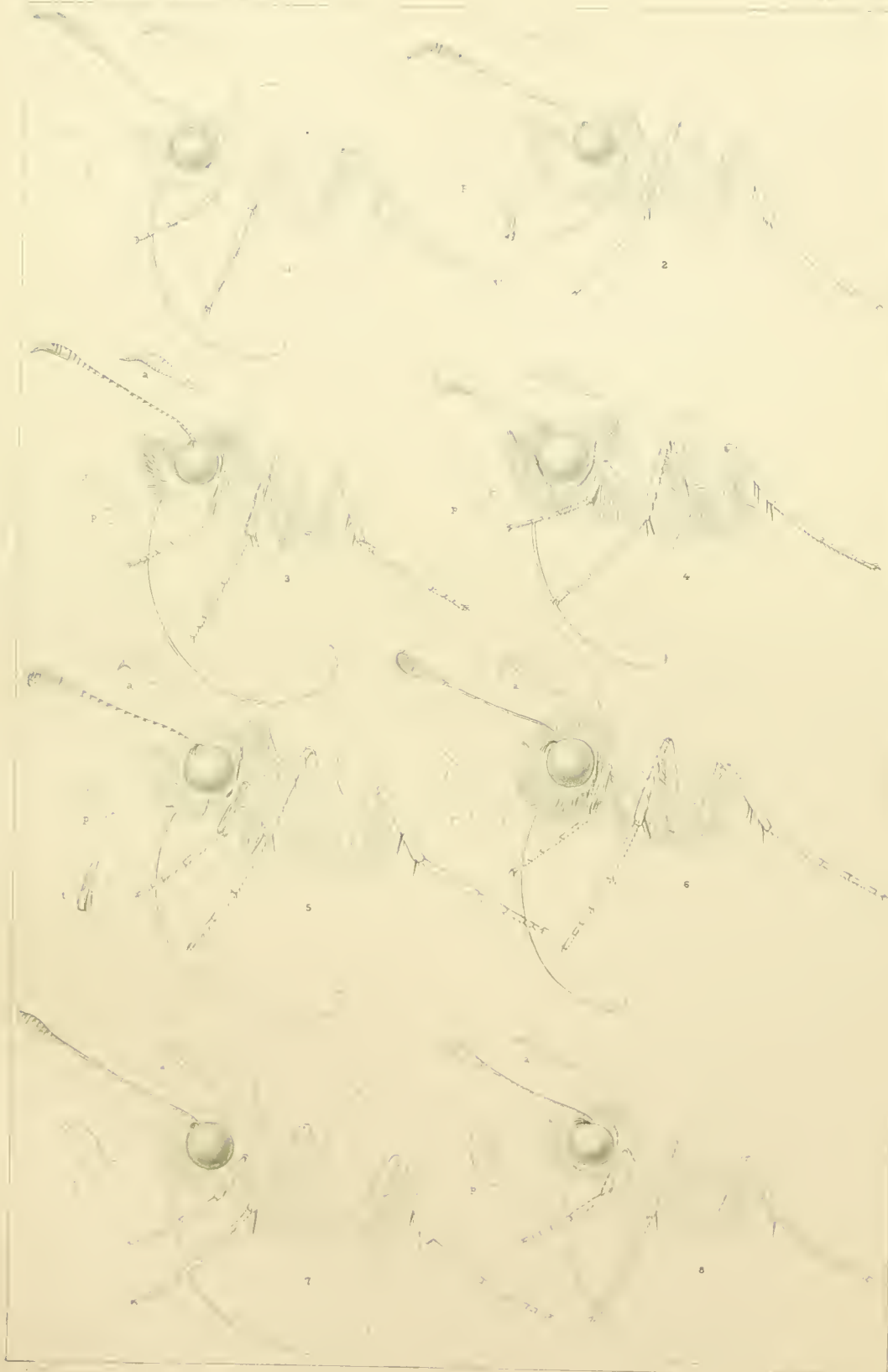
Eyes, Tongue. Antennae. Palpi and Legs of Imago.—Pamphilidi.

Drawn by J. H. Emerton. Lithography by B. Meisel.

Lettering: *a*, antennal club from above; *p*, palpus from side; *t*, inner side of fore tibiae. Various enlargements.

1. *Poanes massasoit*.
2. *Phycanassa viator*.
3. *Atrytone zabulon*.
4. *Hylephila phylaeus*.

5. *Polites peckius*.
6. *Atalopedes huron*.
7. *Anthomaster leonardus*.
8. *Erynnis sassacus*.



EXPLANATION OF PLATE 60.

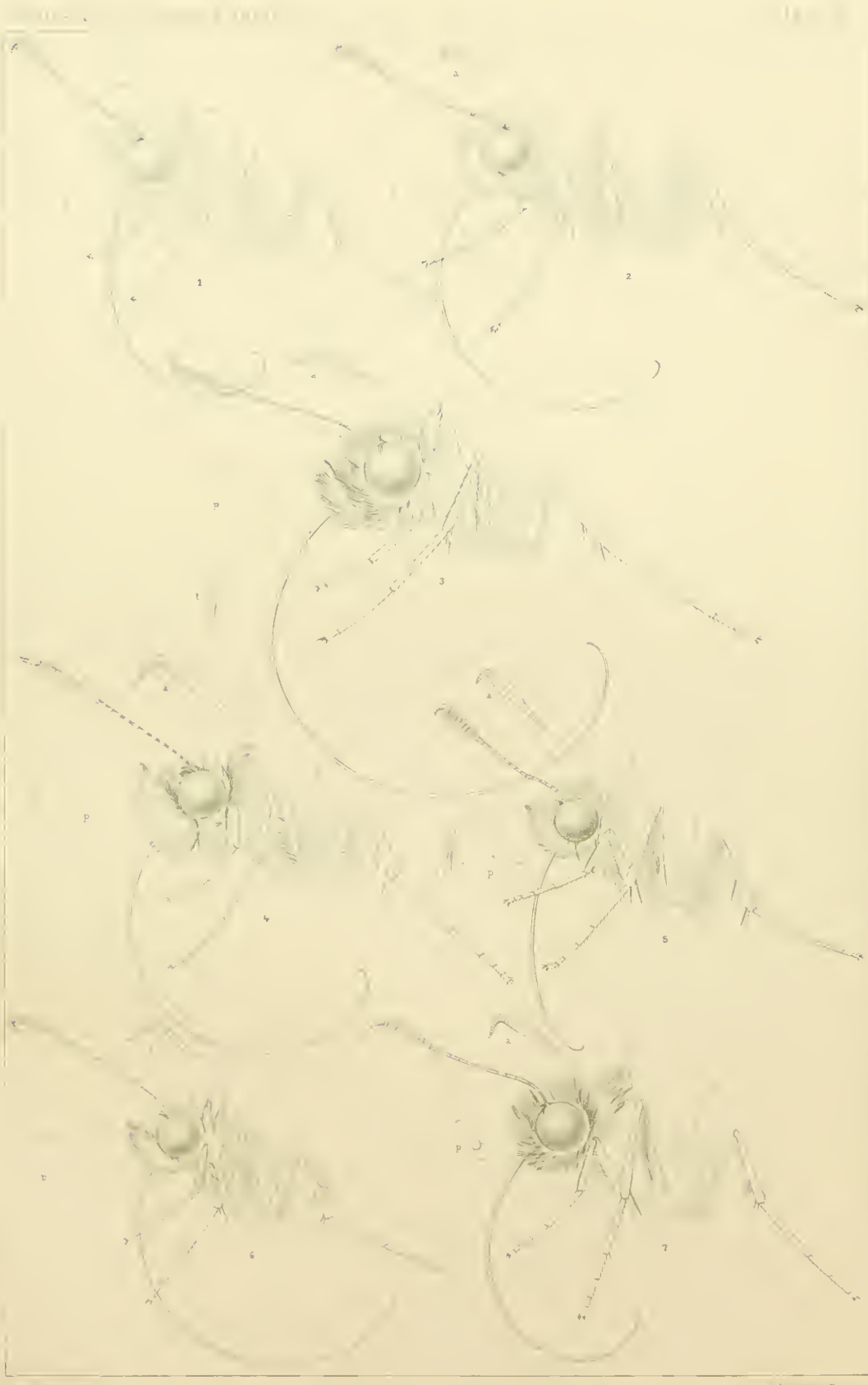
Eyes, Tongue, Antennae, Palpi and Legs of Imago.—Pamphilidi.

Drawn by J. H. Emerton. Lithography by B. Meisel.

Lettering: *a*, antennal club from above; *p*, palpus from side; *t*, inner side of fore tibia. Various enlargements.

1. *Thymelicus aetna*.
2. *Thymelicus mystic*.
3. *Calpodes ethlius*.
4. *Oligoria maculata*.

5. *Limochores taumas*.
6. *Lerema accius*.
7. *Euphyes metacomet*.



EXPLANATION OF PLATE 61.

Anatomical Details of Imago, mostly External.

Lithography by B. Meisel. Figs. 1-16, 37, 53-57 were drawn by Henri Metzger; figs. 38, 45, 49, 58, 59 by Edward Burgess; figs. 36, 46-48 and 50 by J. H. Emerton; and the remainder by the author.

1. *Argynnis aphrodite* $\frac{1}{2}$. Neurulation of hind wing, ♂.
2. *Argynnis aphrodite* $\frac{1}{2}$. Neurulation of hind wing, ♀.
3. *Cissia eurytus* $\frac{1}{2}$. Neurulation of fore wing, ♂.
4. *Cissia eurytus* $\frac{1}{2}$. Neurulation of fore wing, ♀.
5. *Thecla calanus* $\frac{1}{2}$. Neurulation of fore wing, ♂.
6. *Thecla calanus* $\frac{1}{2}$. Neurulation of fore wing, ♀.
7. *Chrysophanus thoe* $\frac{1}{2}$. Neurulation of fore wing, ♂.
8. *Chrysophanus thoe* $\frac{1}{2}$. Neurulation of fore wing, ♀.
9. *Eurymus philodice* $\frac{1}{2}$. Neurulation of fore wing, ♂.
10. *Eurymus philodice* $\frac{1}{2}$. Neurulation of fore wing, ♀.
11. *Cissia eurytus* $\frac{2}{3}$. Front view of head, denuded.
12. *Cyaniris pseudargiolus* $\frac{2}{3}$. Front view of head, denuded.
13. *Jasoniades glaucus* $\frac{2}{3}$. Front view of head, denuded.
14. *Epargyreus tityrus* $\frac{2}{3}$. Front view of head, denuded.
15. *Papilio polygenes* $\frac{1}{2}$. Neurulation of fore wing, ♂.
16. *Papilio polygenes* $\frac{1}{2}$. Neurulation of fore wing, ♀.
17. *Polygonia interrogationis umbrosa* $\frac{1}{2}$. Outline of hind wing.
18. *Polygonia interrogationis fabricii* $\frac{1}{2}$. Outline of hind wing.
19. *Polygonia comma dryas* $\frac{1}{2}$. Outline of hind wing.
20. *Polygonia comma harrisii* $\frac{1}{2}$. Outline of hind wing.
21. *Polygonia faunus* $\frac{1}{2}$. Outline of hind wing.
22. *Polygonia gracilis* $\frac{1}{2}$. Outline of hind wing.
23. *Polygonia progne l-argentum* $\frac{1}{2}$. Outline of hind wing.
24. *Polygonia progne c-argentum* $\frac{1}{2}$. Outline of hind wing.
25. *Basilarchia archippus* $\frac{1}{2}$. Outline of fore wings of a battered specimen, as caught flying.
26. *Cercyonis atope*. Papilla of tongue, much enlarged.
27. *Cissia eurytus*. Papilla of tongue, much enlarged.
28. *Basilarchia archippus*. Papilla of tongue, much enlarged. (The lateral filament is a mistake.)
29. *Vanessa atalanta*. Papilla of tongue, much enlarged. (Drawn too slender and uniform.)
30. *Junonia coenia*. Papilla of tongue, much enlarged.
31. *Speyeria idalia*. Papilla of tongue, much enlarged.
32. *Argynnis cybele*. Papilla of tongue, much enlarged.
33. *Basilarchia astyanax*. Papilla of tongue, much enlarged.
34. *Eucanessa antiopa*. Papilla of tongue, much enlarged.
35. *Vanessa cardui*. Papilla of tongue, much enlarged. (Drawn with rim thorns too short.)
36. *Polygonia faunus*. Cuticular processes of the food reservoir, much enlarged.
37. *Vanessa atalanta* $\frac{2}{3}$. Side view of head and front part of thorax, denuded, to show the form and position of the prothoracic lobes and patagia.
38. *Anosia pterippus*. Magnified cross section of scale, to show the striated surface and the relation of the scale to the membrane of the wing, below.
39. *Brenthis myrina*. Papilla of tongue, much enlarged.
40. *Phyciodes tharos*. Papilla of tongue, much enlarged.
41. *Charitryas nycteis*. Papilla of tongue, much enlarged.
42. *Cinctidia harrisii*. Papilla of tongue, much enlarged.
43. *Euphydryas phaeton*. Papilla of tongue, much enlarged.
44. *Thecla liparops*. Papilla of tongue, much enlarged.
45. *Anosia pterippus*. Cuticular processes of the food reservoir, much enlarged.
46. *Polygonia faunus* $\frac{2}{3}$. Side view of a part of the digestive tract, to show the relation of the food reservoir to the crop and stomach; the position is the same as in the next figure.
47. *Polygonia faunus* $\frac{2}{3}$. Side view of the digestive tract in the abdomen, to show the size relation of the food reservoir (jabot) to the stomach.
48. *Euphacodes troilus* $\frac{1}{2}$. Vagina of female after pairing, seen from beneath. The chitinous ribbon with its projecting points and crinkled margin, normally concealed, is torn from its membranous attachments and left partly protruding.
49. *Anosia pterippus* $\frac{1}{2}$. End of ♂ abdomen, showing the extensible pencil of hairs nearly extruded.
50. *Oeneis semiope* $\frac{2}{3}$. Side view of the digestive tract in the abdomen, to show the size relation of the food reservoir to the stomach.
51. *Strymon titus*. Tip of papilla of tongue, much enlarged.
52. *Pieris rapae*. Papilla of tongue, much enlarged.
53. *Basilarchia astyanax* $\frac{2}{3}$. Portion of the tongue, showing the relations of neighboring papillae.
54. *Vanessa cardui*. Extremity of the tongue, showing the disposition of the papillae, enlarged.
55. *Eucanessa antiopa*. Extremity of the tongue, with papillae, enlarged.
56. *Euphacodes troilus*. Extremity of the tongue, with papillae, enlarged.
57. *Amblyscirtes rialis*. Extremity of the tongue, with papillae, enlarged.
58. *Anosia pterippus* $\frac{2}{3}$. Extremity of the female abdomen, side view.
59. *Anosia pterippus* $\frac{2}{3}$. Inside lateral view of the walls of the extremity of male abdomen; *h. s.*, sheath in which the extensible pencil of hairs is enclosed; *rm.* the retracting muscle which withdraws it; *pr.* compare pl. 62, fig. 4.



EXPLANATION OF PLATE 62.

Anatomy of *Anosia plexippus*.

The original drawings were made from dissections of his own by Mr. Edward Burgess, and most of them published (in larger form) in his paper in the Anniversary Memoirs of the Boston Society of Natural History, 1880. Fig. 5, however, was made for this work, from dissections of his own, by Mr. J. H. Emerton.

In all the figures the segments of the thorax are indicated by Roman, of the abdomen by Arabic, numerals.

1. External anatomy of the female butterfly, side view: *a*, antenna; *o*, occiput; *cl*, clypeus; *mx*, maxilla; *p*, labial palpus; *s*, scutum; *sm*, scutellum; *psm*, postscutellum; *epm*, epimerum; *eps*, episternum; *cx*, coxa; *tr*, trochanter; *f*, femur; all these parts receive a special number indicating the segment of the thorax to which they respectively belong; *sp*, prothoracic spiracle; *w¹, w²*, fore and hind wings; *sp³, sp⁸*, third and eighth pairs of spiracles. Membranous portions dotted.

2. Internal anatomy of the same, as seen on a side view. (The body wall, tracheae and fat bodies are removed). Numerals as before: *ph*, pharynx; *sd*, *sgl*, salivary duct and gland of right side; *oe*, oesophagus; *fr*, food reservoir; *st*, stomach; *i*, small intestine; *c*, colon; *r*, rectum; *a*, anus; *mv*, malpighian vessels; *h*, heart or dorsal vessel; *ao*, aorta; *ac*, aortal chamber; *br*, brain; *g¹*, suboesophageal ganglion; *tg*, compound thoracic ganglia; *ag¹, ag⁴*, first and fourth abdominal ganglia; *cp*, copulatory pouch; *v*, vagina; *o*, oviduct; *oo*, its external opening; *r.ov*, base of right ovarian tubes turned down to expose the underlying organs; *l.ov*, left ovarian tubes in position; *oo.c*, their termination in four cords; *sp*, spermatheca; *a.gl¹*, part of the unpaired accessory gland; *a.gl²*, one of the paired

accessory glands, of the other of which only the base is shown. Other letters as in fig. 1.

3. Horizontal section through the extremity of the male abdomen: *p*, penis with its extensor *ep*, and retractor *rp*; *pb*, penis bulb; *ps*, sheath; *de*, ductus ejaculatorius; *hb*, hair bundle cut off; *sm*, intersegmental muscles.

4. Lateral view of the same abdomen showing the genitalia in position: *t*, testis; *vd*, the double vas deferens; *pr*, internal process of the ninth segment, affording the attachment of the retractor penis, its posterior wall cut away; *c*, clasp; *fc*, false clasp. Other letters as in figs. 2 and 3.

5. Internal anatomy of the female pupa, about three to four days old, as seen on a side view. (The lateral wall and tracheae are removed.): *ts*, tarsus; *cr*, cremaster. Other letters as in figs. 1. and 2.

6. Internal anatomy of the male caterpillar. (The body wall, tracheae, fat bodies and muscles of the body wall are removed.): *sv*, spinning vessel of one side; *dv*, dorsal vessel; *t*, testis; *s*, spinneret; *soy*, suboesophageal ganglion; *nc*, nervous cord: *g³, g⁶, g⁹*, third, sixth and ninth ganglia. Other letters as in fig. 2. The salivary glands and the convolutions of the malpighian vessels concealing the intestines are not shown.

EXPLANATION OF PLATE 63.

Embryology of *Eu Vanessa antiopa*.

Lithographed in three colors by B. Meisel. All the figures are drawn with a camera lucida by C. W. Woodworth from sections about .00025 inch thick. Figures 1, 2, 5, 7 and 8 were made with a one-fifth, the others with a three-fourths objective.

1. Section of a small piece of the ovariole of a freshly emerged butterfly, showing two egg-chambers; *p*, peritoneal membrane; *t.p*, tunica propria; *ep*, epithelial cell; *n*, their nuclei; *e*, egg-cell; *g*, germinal vesicle, the nucleus of the egg cell.

2. Section of a single egg chamber considerably further advanced. Lettering the same as in Fig. 1. *n. p*, nutritive process.

3. An oblique section of an egg, showing the migration of the blastoderm cells.

4. A section near one end, showing the process of blastoderm formation.

5. Yolk cells, when all but the last row of yolk granules have degenerated.

6. Section of an egg after the completion of blastoderm formation.

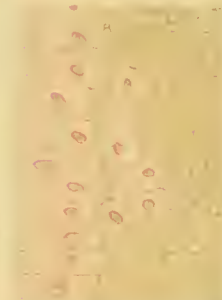
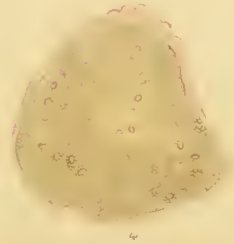
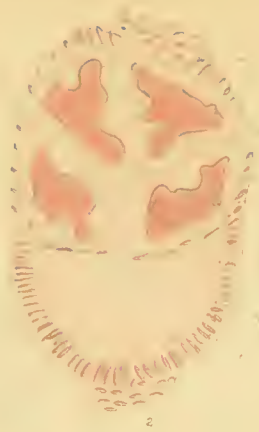
7. Portion of ventral plate, with mesoderm (?) cells.

8. Portion of ventral plate, showing ovary cells.

9. Cross section of egg at about the time of the beginning of the formation of the amnion.

10. Longitudinal section of the same.

11. Section of the egg after the completion of the embryonic membranes; *am*, amnion; *s. m*, serous membrane.



EXPLANATION OF PLATE 64.

Eggs enlarged and partly in color.—Nymphalidae.

Printed by B. Meisel from five stones. All the single eggs show a side view. Figs. 1, 4, 6, 7, 15, 22, 23, 31, 35, 42 and 43 were drawn by Mary Peart; fig. 2 by J. H. Blake; figs. 3, 5, 8, 9, 14, 16, 17, 21, 25-29, 33, 34, 37-39 and 41 by J. H. Emerton; figs. 10, 18-20, 32, 36 and 40 by S. H. Seudder; figs. 11 and 30 by A. Assmann; and figs. 12, 13 and 24 by L. Trouvelot. Drawings of figs. 6, 15 and 42 were kindly lent by Mr. W. H. Edwards.

1. *Anosta plexippus*. $\frac{1}{1}^5$. From an original by Konopicky.
2. *Oeneis jutta*. $\frac{2}{1}^0$. Colored.
3. *Cercyonis nephele*. $\frac{2}{1}^5$. Plain.
4. *Enodia portlandia*. $\frac{1}{1}^4$. Outline.
5. *Cissia eurytus*. $\frac{3}{1}^5$. Plain.
6. *Chlorippe clyton*. $\frac{2}{1}^5$. Colored.
7. *Chlorippe clyton*. $\frac{1}{1}$. A cluster on a leaf; copied from Edwards.
8. *Oeneis semidea*. $\frac{4}{1}^0$. Plain.
9. *Neonympha phocion*. $\frac{2}{1}^0$. Plain; from a specimen preserved in glycerine and partly shrunken; restored.
10. *Satyrodes eurydice*. $\frac{2}{1}^0$. Outline.
11. *Cissia eurytus*. $\frac{6}{1}^5$. Portion of the surface.
12. *Basilarchia astyanax*. $\frac{1}{1}^6$. Plain.
13. *Basilarchia archippus*. $\frac{2}{1}^0$. Colored.
14. *Junonia coenia*. $\frac{3}{1}^5$. Plain; from a specimen in glycerine.
15. *Basilarchia arthemis*. Colored.
16. *Polygonia interrogationis*. $\frac{6}{1}$. Plain; a hanging pile.
17. *Polygonia interrogationis*. $\frac{2}{1}^5$. Colored.
18. *Polygonia comma*. $\frac{3}{1}^0$. Plain.
19. *Polygonia comma*. $\frac{1}{1}$. Plain; two piles hanging from a leaf.
20. *Polygonia comma*. $\frac{1}{1}$. The same.
21. *Polygonia faunus*. $\frac{2}{1}^5$. Plain; from a specimen in alcohol.
22. *Argynnis atlantis*. $\frac{2}{1}^0$. Colored; from an original by Konopicky.
23. *Euptoieta claudia*. Colored; from an original by Konopicky.
24. *Vanessa atalanta*. $\frac{2}{1}^5$. Colored.
25. *Polygonia progne*. $\frac{3}{1}^5$. Plain.
26. *Euvanessa antiopa*. $\frac{2}{1}^5$. Colored.
27. *Brenthis bellona*. $\frac{2}{1}^5$. Plain.
28. *Brenthis myrina*. $\frac{2}{1}^5$. Plain.
29. *Phyciodes tharos*. $\frac{1}{1}$. A cluster on an aster leaf, plain.
30. *Vanessa cardui*. $\frac{2}{1}^0$. Plain.
31. *Phyciodes tharos*. $\frac{2}{1}^5$. Colored.
32. *Charidryas nycteis*. $\frac{3}{1}^0$. Outline.
33. *Euvanessa antiopa*. $\frac{2}{1}^0$. A cluster encircling a twig, plain.
34. *Speyeria idalia*. $\frac{3}{1}^0$. Plain.
35. *Argynnis aphrodite*. $\frac{2}{1}^4$. Colored; from an original by Konopicky.
36. *Aglais milberti*. $\frac{3}{1}^0$. Plain.
37. *Euphydryas phaeton*. $\frac{2}{1}^0$. Colored; the color taken from a drawing by Trouvelot.
38. *Brenthis montinus*. $\frac{2}{1}^0$. Plain; from a specimen taken from the body.
39. *Argynnis cybele*. $\frac{3}{1}^0$. Plain.
40. *Aglais milberti*. $\frac{1}{1}$. A cluster on a nettle leaf, plain.
41. *Cinclidia harrisii*. $\frac{4}{1}^0$. Colored; an infertile egg.
42. *Hyppatus bachmanii*. $\frac{3}{1}^0$. Colored.
43. *Euphydryas phaeton*. $\frac{1}{1}$. A cluster on a leaf of *Chelone*; copied from Edwards.

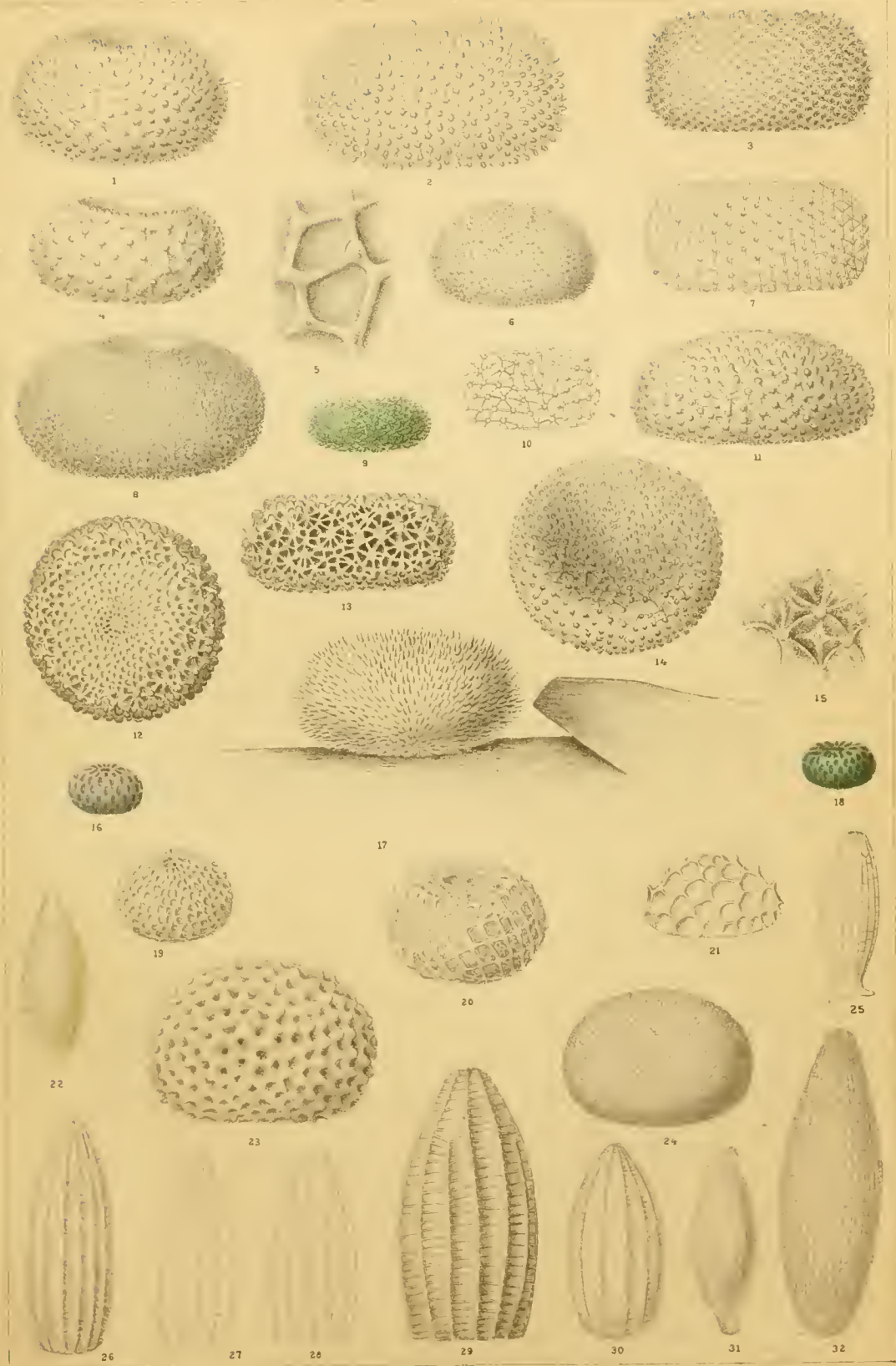


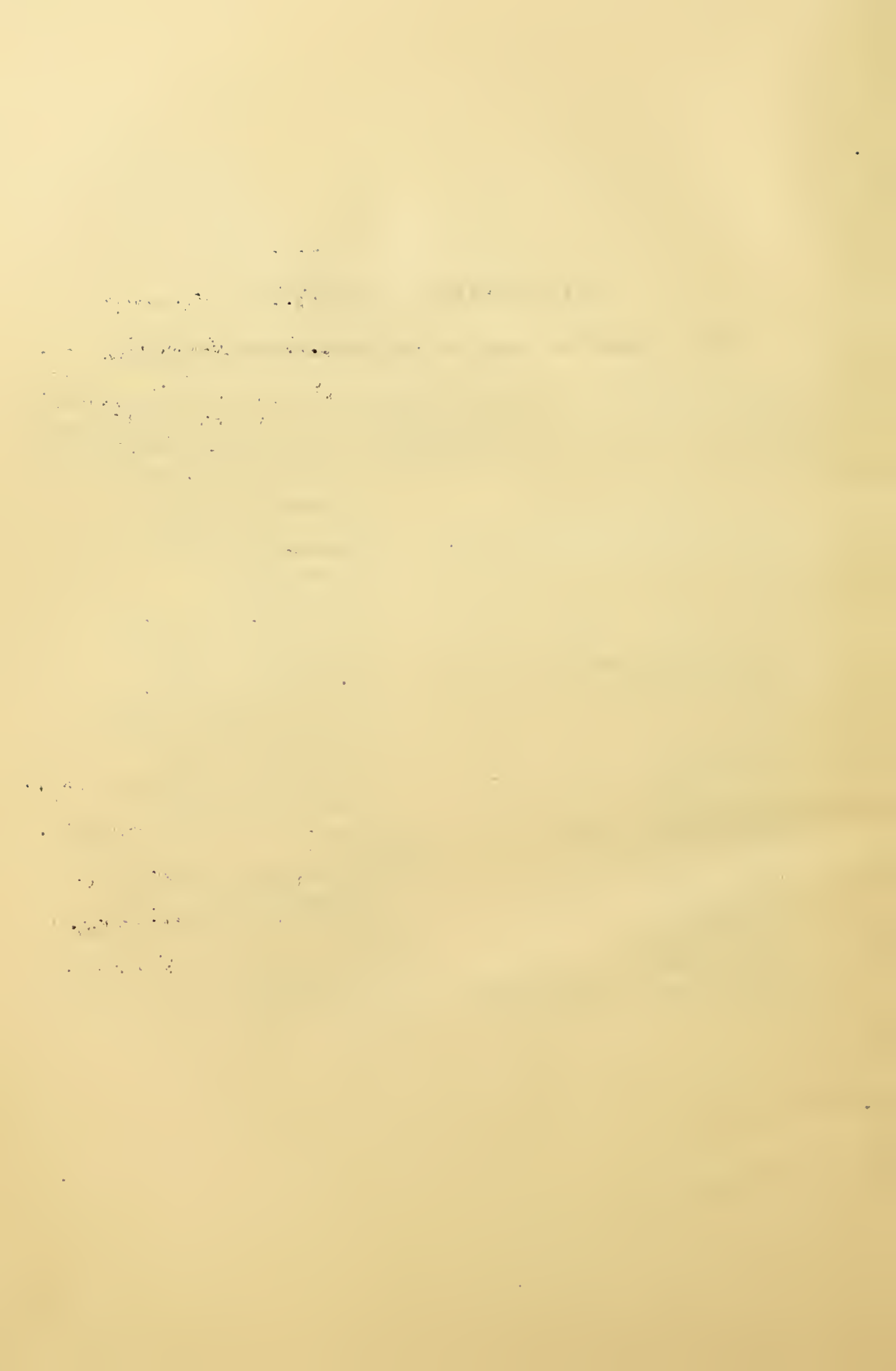
EXPLANATION OF PLATE 65.

Eggs enlarged and partly in color.—*Lycaeninae*, *Pierinae*.

Printed by B. Meisel from four stones. Figs. 1, 4-6, 11-13, 17, 24, 26, 29, 30 and 32 were drawn by J. H. Emerton; figs. 2, 3, 7, 10 and 23 by A. Assmann; figs. 8 and 20 by J. H. Blake; figs. 9, 14, 15, 22 and 31 by Mrs. Mary Peart; figs. 16, 18, 19, 21 and 25 by L. Trouvelot; and figs. 27 and 28 by S. H. Seudder. All are highly magnified; the enlargements specified are only approximate.

1. *Thecla acadica* $\frac{4.6}{1}$. Plain; side view.
2. *Thecla edwardsii* $\frac{5.0}{1}$. Plain; side view.
3. *Thecla calanns* $\frac{5.0}{1}$. Plain; side view.
4. *Mitura damon* $\frac{6.3}{1}$. Plain; side view.
5. *Uranotes melinus* $\frac{5.0.0}{1}$. Plain; a part of the surface sculpture.
6. *Uranotes melinus* $\frac{4.3}{1}$. Plain; side view.
7. *Incisalia nippon* $\frac{4.5}{1}$. Plain; side view.
8. *Erora lacta* $\frac{5.0}{1}$. Plain; side view.
9. *Incisalia irus* $\frac{3.0}{1}$. Colored; side view.
10. *Incisalia irus* $\frac{3.5}{1}$. Plain; side view.
11. *Strymon titus* $\frac{4.3}{1}$. Plain; side view.
12. *Rusticus scudderii* $\frac{4.5}{1}$. Plain; top view.
13. *Rusticus scudderii* $\frac{4.5}{1}$. Plain; side view.
14. *Cyaniris pseudargiolus* $\frac{6.0}{1}$. Plain; oblique view.
15. *Cyaniris pseudargiolus* $\frac{2.5.0}{1}$. Plain; a part of the surface sculpture.
16. *Epidemia epixanthe* $\frac{1.4}{1}$. Colored; side view.
17. *Thecla liparops* $\frac{5.4}{1}$. Plain; side view, attached to a twig of shad bush.
18. *Cyaniris pseudargiolus* $\frac{2.0}{1}$. Colored; side view.
19. *Chrysophanus thoe* $\frac{2.2}{1}$. Plain; side view.
20. *Everes comyntas* $\frac{5.0}{1}$. Plain; oblique view.
21. *Heodes hypophlaeas* $\frac{3.5}{1}$. Plain; side view.
22. *Eurymus eurytheme* $\frac{2.0}{1}$. Colored; side view.
23. *Epidemia epixanthe* $\frac{4.4}{1}$. Plain; side view.
24. *Feniseca tarquinius* $\frac{4.3}{1}$. Plain; side view.
25. *Eurymus philodice* $\frac{2.0}{1}$. Plain; side view.
26. *Pontia protodice* $\frac{3.0}{1}$. Plain; side view; from a specimen in alcohol.
27. *Pieris oleracea* $\frac{2.7}{1}$. Plain; side view.
28. *Pieris rapae*. $\frac{2.7}{1}$. Plain; side view.
29. *Anthocharis genutia* $\frac{4.6}{1}$. Plain; side view.
30. *Callidryas eubule* $\frac{2.8}{1}$. Plain; side view; from a crushed specimen mounted on a slide.
31. *Xanthidia nictippe* $\frac{2.0}{1}$. Plain; side view; from an original drawing by Konopicky.
32. *Eurema lisa* $\frac{4.5}{1}$. Plain; side view.





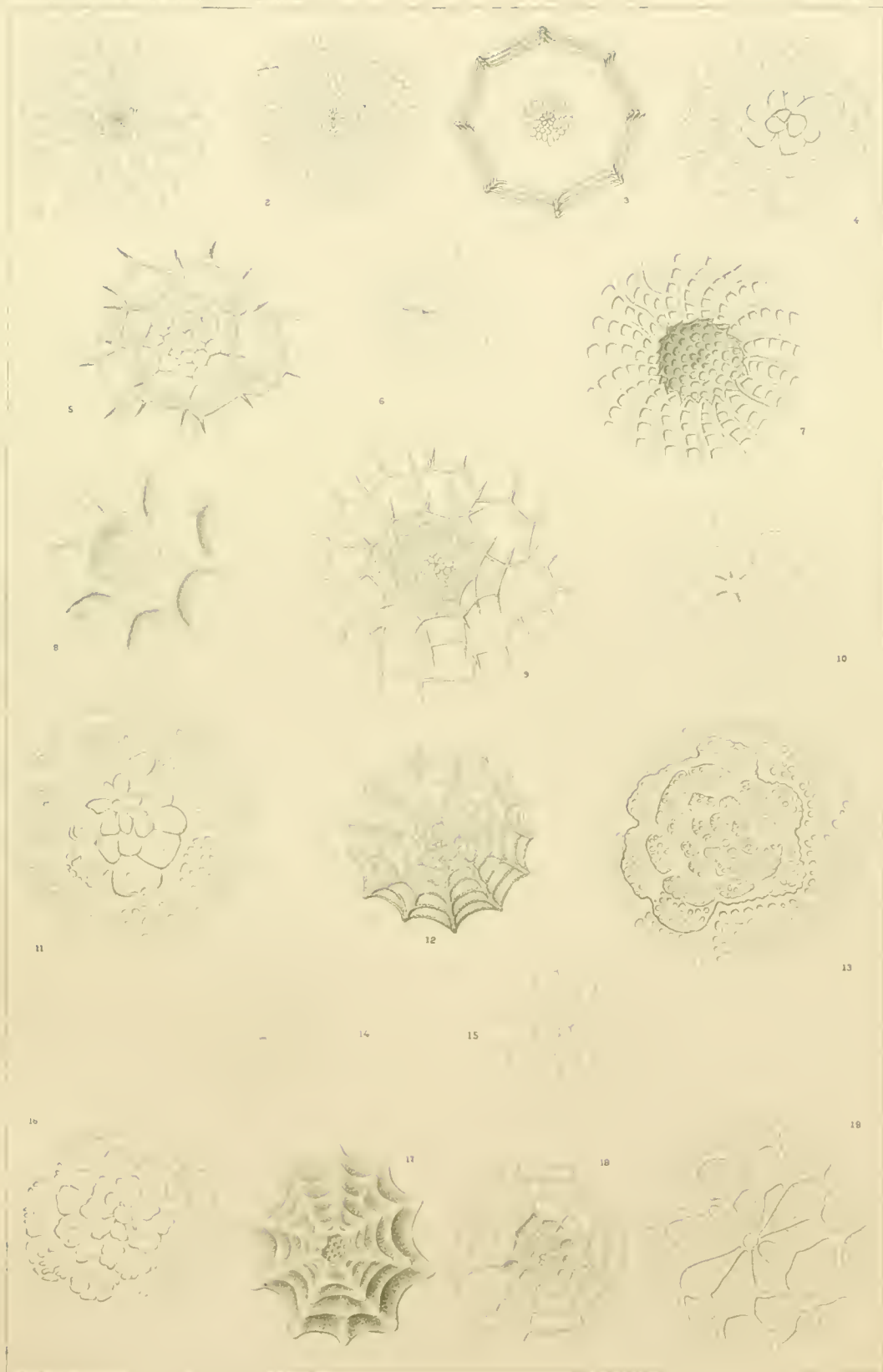


EXPLANATION OF PLATE 67.

Upper Aspect and Micropyles of Eggs.—Nymphalidae.

Printed by B. Meisel. All the figures are highly magnified. Figs. 1-3, 7, 9, 12, 17, and 18 were drawn by A. Assmann. Figs. 4, 6, 8, 10, 11, 13-16 and 19 by J. H. Emerton; and Fig. 5 by Konopicky.

- | | |
|--|---|
| 1. <i>Cercyonis alpe</i> . From an empty shell. | 11. <i>Argynnis aphrodite</i> . From a specimen mounted in jelly. |
| 2. <i>Satyrodes eurydice</i> . From an empty shell. | 12. <i>Argynnis egbele</i> . From an empty shell. |
| 3. <i>Eucanessa antiopa</i> . From an empty shell; the part around the micropyle was mostly eaten away in the escape of the caterpillar. | 13. <i>Argynnis atlantis</i> . From a specimen mounted in jelly, seen from the under surface; the irregular circle is accidental. |
| 4. <i>Anasia plexippus</i> . From a specimen mounted in jelly. | 14. <i>Cinclidia harrisii</i> . |
| 5. <i>Basilarchia arthemis</i> . | 15. <i>Phyciodes tharos</i> . |
| 6. <i>Eucanessa antiopa</i> . | 16. <i>Brenthis montinus</i> . From a specimen taken from the body and mounted in jelly. |
| 7. <i>Vanessa cardui</i> . From an empty shell. | 17. <i>Brenthis bellona</i> . From an empty shell. |
| 8. <i>Euptoieta claudia</i> . | 18. <i>Brenthis myrina</i> . From an empty shell. |
| 9. <i>Basilarchia archippus</i> . From an empty shell. | 19. <i>Speyeria idalia</i> . From a specimen in jelly. |
| 10. <i>Polygonia faunus</i> . | |



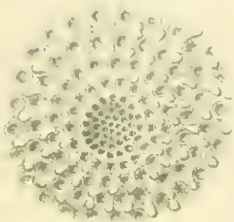
EXPLANATION OF PLATE 68.

Upper Aspect and Micropyles of Eggs.—Lycaenidae. Papilionidae.

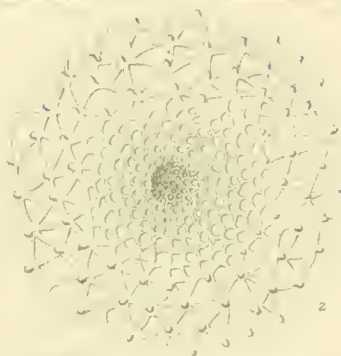
Printed by B. Meisel. All the figures are highly magnified. Figs. 1, 2, 7, 8, 10, 11, 13-16, 18 and 20 were drawn by A. Assmann; figs. 3, 4, 9, 12, 17 and 19 by J. H. Emerton; fig. 5 by J. H. Blake, and fig. 6 by Mrs. Mary Peart.

- | | |
|--|--|
| 1. <i>Thecla calanus</i> . From an empty shell. | 11. <i>Epidemia epixanthe</i> . From a dead specimen. |
| 2. <i>Thecla edwardsii</i> . From an empty shell. | 12. <i>Everes comyntas</i> . From a section mounted in |
| 3. <i>Uranotes melinus</i> . From a section mounted | jelly. |
| in jelly. | 13. <i>Chrysophanus thoe</i> . From a dead specimen. |
| 4. <i>Strymon titus</i> . From a section mounted in | 14. <i>Eurymus philodice</i> . From an empty shell. |
| jelly. | 15. <i>Pieris oleracea</i> . From an empty shell. |
| 5. <i>Everes comyntas</i> . From a living egg. | 16. <i>Pieris rapae</i> . From an empty shell. |
| 6. <i>Cyaniris pseudargiolus</i> . | 17. <i>Pieris rapae</i> . From a section mounted in |
| 7. <i>Incisalia niphon</i> . From an empty shell. | jelly, and far more correct than the preceding. |
| 8. <i>Incisalia irus</i> . From an empty shell. | 18. <i>Jasoniades glaucus</i> . From an empty shell. |
| 9. <i>Feniseca tarquinius</i> . From a section mounted | 19. <i>Heraclides cresphontes</i> . From a section |
| in jelly. | mounted in jelly. |
| 10. <i>Heodes hypophlaeas</i> . From an empty shell. | 20. <i>Euphœades troilus</i> . From an empty shell. |

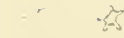
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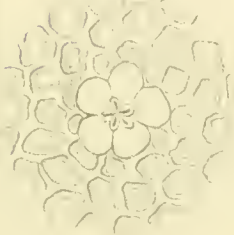
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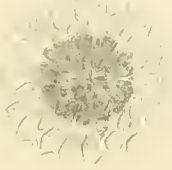
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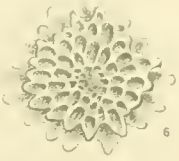
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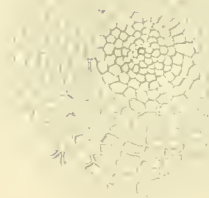
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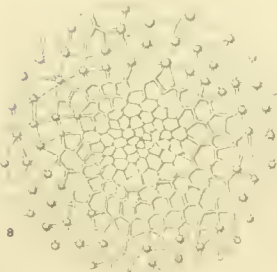
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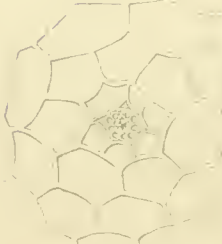
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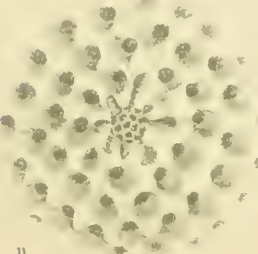
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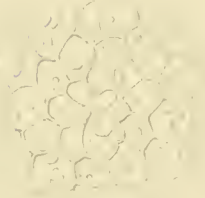
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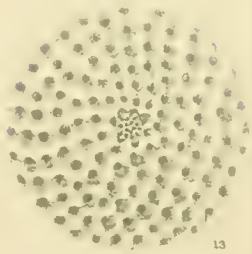
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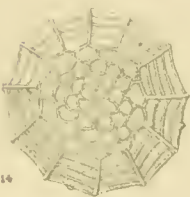
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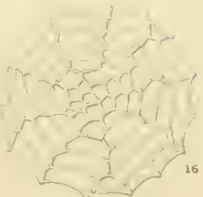
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18



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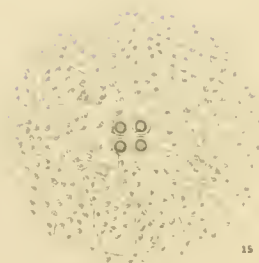
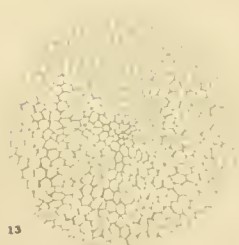
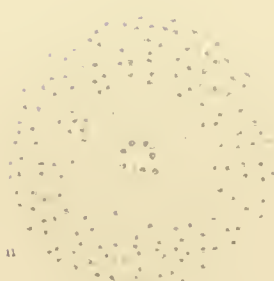
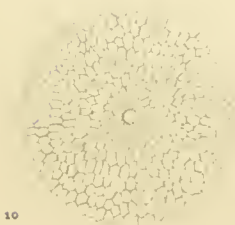
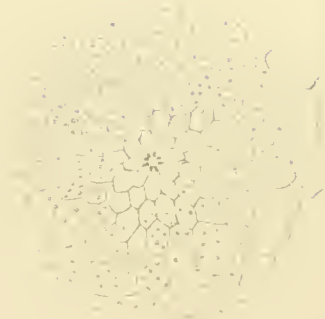
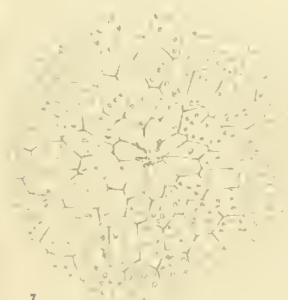
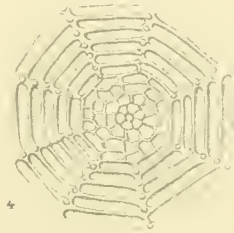
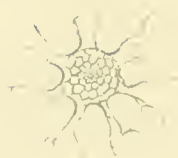
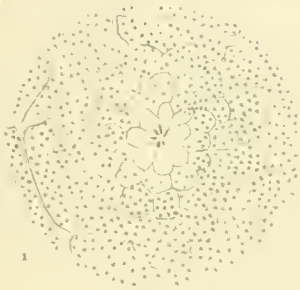


EXPLANATION OF PLATE 69.

Upper Aspect and Micropyles of Eggs.—Hesperiidae.

Printed by B. Meisel. All the figures are highly magnified. Figs. 1, 3, 6-9, 11, 12, 14 and 15 were drawn by J. H. Emerton; figs. 4, 5, 10 and 13 by A. Assmann; and fig. 2 by S. H. Scudder.

1. *Thanaos persius*. From a section mounted in jelly and viewed from beneath.
2. *Pholisora catullus*. Drawn from a living specimen.
3. *Thanaos lucilius*. From a section mounted in jelly, seen from the upper surface.
4. *Thanaos brizo*. From an empty shell.
5. *Thorybes pylades*. From an empty shell, from which the parts directly about the micropyle have been eaten away.
6. *Thanaos lucilius*. From a section mounted in jelly and viewed from the inner surface.
7. *Amblyscirtes vitalis*. From a section mounted in jelly and viewed from beneath.
8. *Ancylozipha numitor*. From a section mounted in jelly and seen from beneath.
9. *Thanaos martialis*. From a section mounted in jelly and viewed from beneath.
10. *Atrytone zabulon*. From an empty shell.
11. *Anthomaster leonardus*. From a section mounted in jelly and viewed from above.
12. *Erynnis sassacus*. From a section mounted in jelly and seen from beneath.
13. *Thymelicus mystic*. From an empty shell.
14. *Limochores manataaqua*. From a section mounted in jelly and viewed from beneath.
15. *Calpodus ethlius*. From a section mounted in jelly and viewed from above.

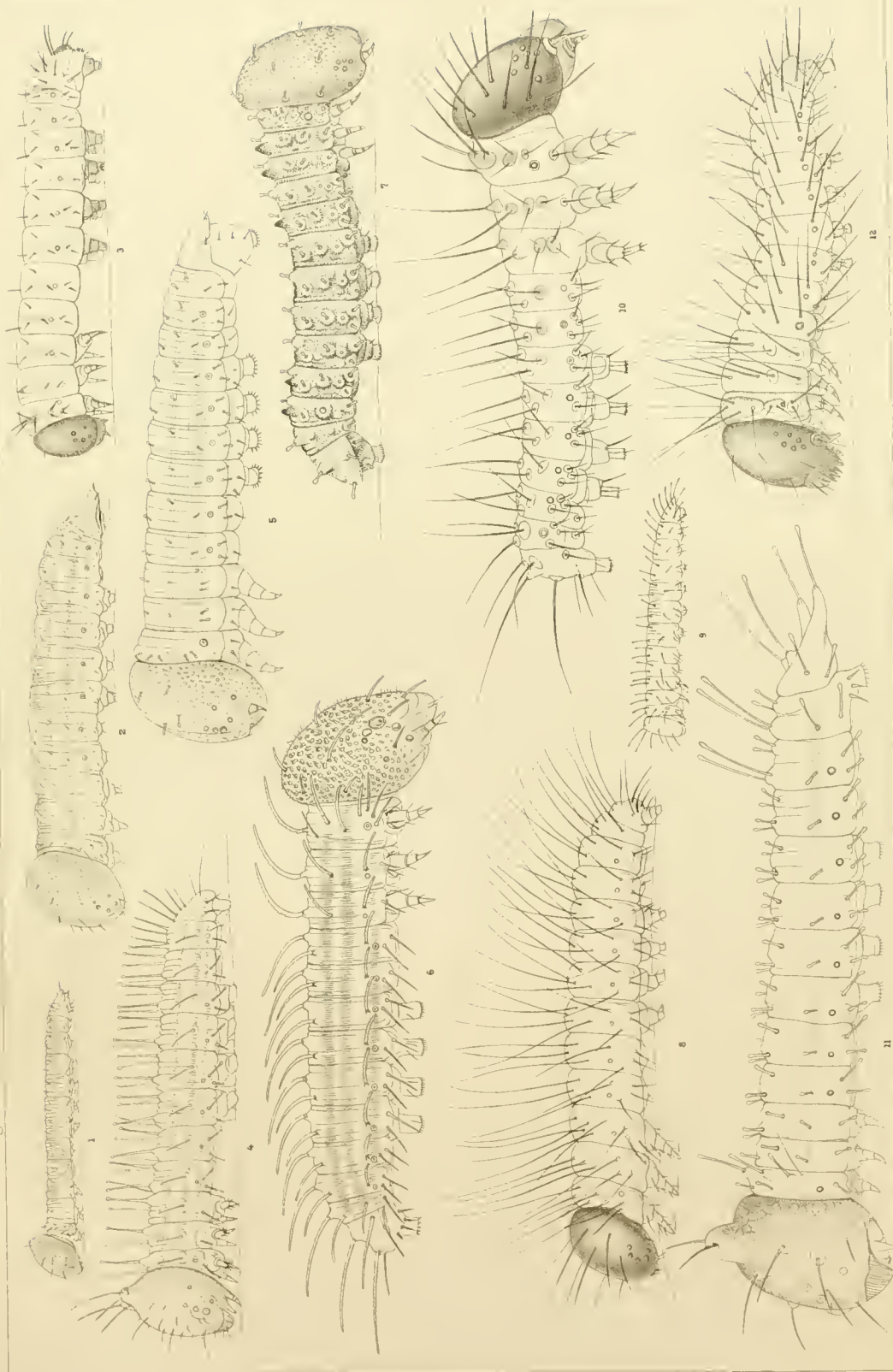


EXPLANATION OF PLATE 70.

Caterpillars at Birth.—*Nymphalidae*.

Drawings from nature by J. H. Emerton, excepting Figs. 1 and 2, which are by J. H. Blake, and Fig. 9, by Mrs. Mary Peart, the last kindly lent by W. H. Edwards, Esq. Greatly enlarged. Printed on stone by B. Meisel.

- | | |
|--------------------------------|-----------------------------------|
| 1. <i>Satyrodes cerydice</i> . | 7. <i>Basilarchia archippus</i> . |
| 2. <i>Oeneis jutta</i> . | 8. <i>Polygonia faunus</i> . |
| 3. <i>Amosia pterippus</i> . | 9. <i>Encodia portlandia</i> . |
| 4. <i>Cissia cerytus</i> . | 10. <i>Vanessa atalanta</i> . |
| 5. <i>Oeneis semiothis</i> . | 11. <i>Neonympha phocion</i> . |
| 6. <i>Cerygonis atope</i> . | 12. <i>Euranessa antiopa</i> . |



EXPLANATION OF PLATE 71.

Caterpillars at Birth.—*Lycaenidae*.

All the drawings are by J. H. Emerton, excepting fig. 3, which is by J. H. Blake. Greatly enlarged. Printed on stone by B. Meisel.

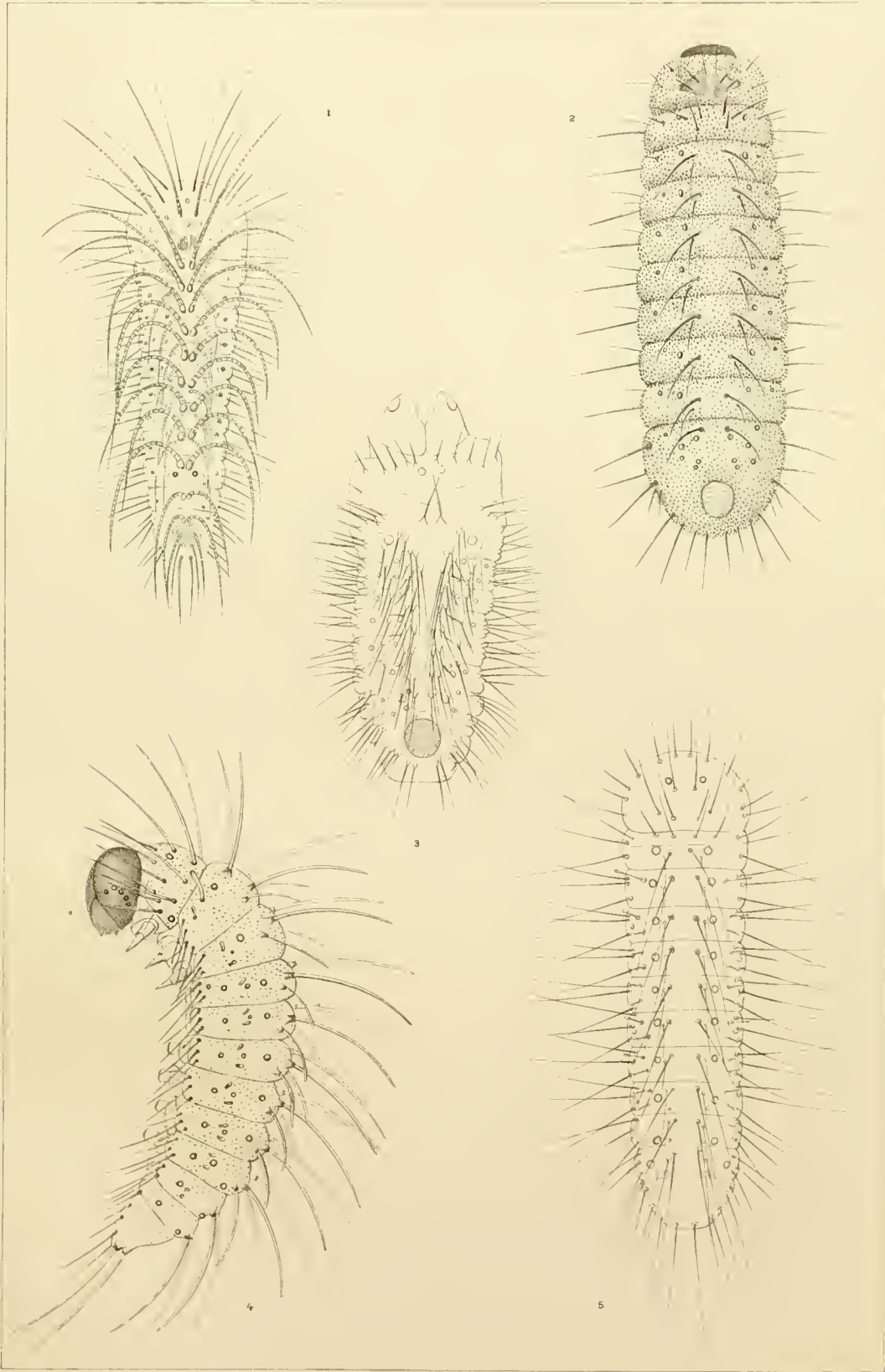
1. *Heodes hypophlaeas*.

2. *Thecla liparops*.

3. *Mitura damon*.

4. *Rusticus scudderi*. The short bristles on the sides should be small, circular lenticles.

5. *Everes comyntas*.

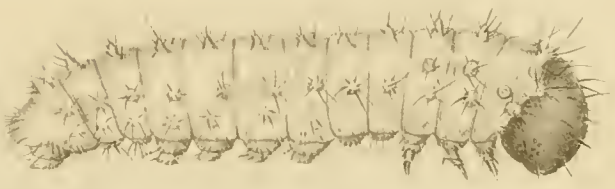
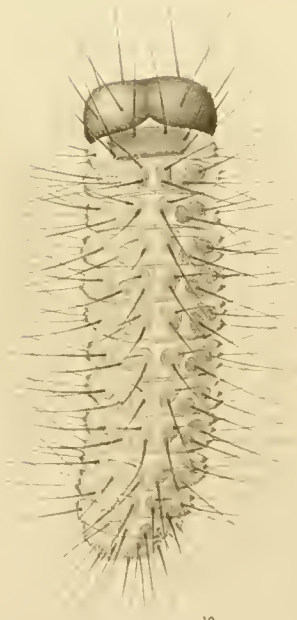
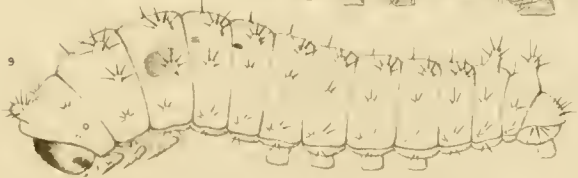
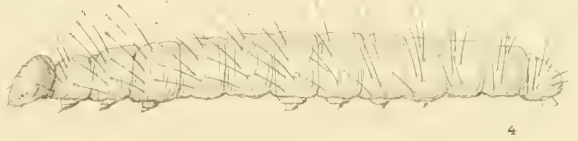
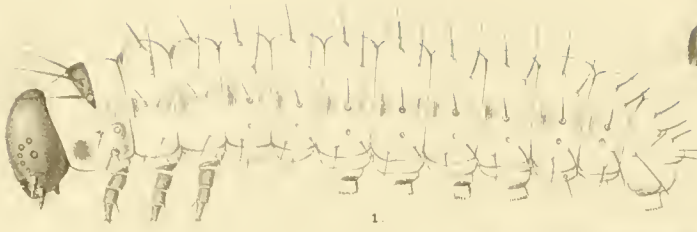


EXPLANATION OF PLATE 72.

Caterpillars at Birth.—*Nymphalidae*, *Papilionidae*.

Drawn from nature by J. H. Blake (figs. 2, 3, 4, 7, 8, 11) and J. H. Emerton (figs. 1, 5, 6, 9, 10). Greatly enlarged.
Printed on stone by B. Meisel.

- | | |
|--------------------------------|---|
| 1. <i>Cinclidia harrisii</i> . | 7. <i>Laertias philenor</i> . |
| 2. <i>Brenthis myrina</i> . | 8. <i>Euphœades troilus</i> . |
| 3. <i>Eurymus philodice</i> . | 9. <i>Euphœades troilus</i> . Second stage. |
| 4. <i>Pieris rapae</i> . | 10. <i>Speyeria idalia</i> . |
| 5. <i>Argynnis aphrodite</i> . | 11. <i>Papilio polyxenes</i> . |
| 6. <i>Phyciodes tharos</i> . | |

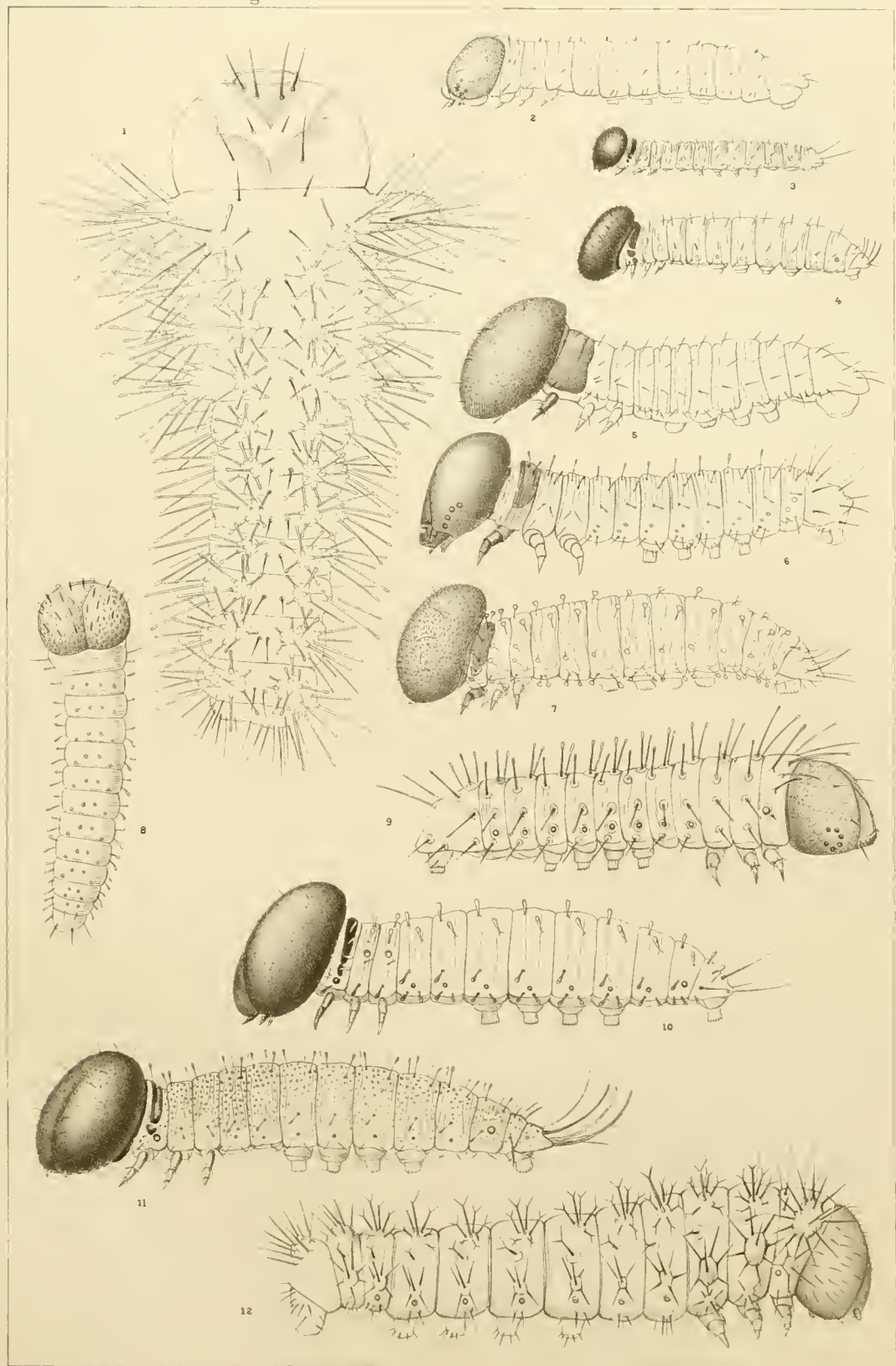


EXPLANATION OF PLATE 73.

Caterpillars at Birth. — Papilionidae, Hesperidae.

All the drawings are by J. H. Emerton, excepting fig. 3, which is by J. H. Blake. Greatly enlarged. Printed on stone by B. Meisel.

- | | |
|--|--|
| 1. <i>Heraclides cresphontes</i> . From a specimen mounted in glycerine. | 8. <i>Epargyreus tityrus</i> . |
| 2. <i>Thanaos lucilius</i> . | 9. <i>Anthocharis genutia</i> . From a specimen mounted in balsam. |
| 3. <i>Limochares manataaquae</i> . | 10. <i>Anthomaster leonardus</i> . |
| 4. <i>Ancyloxipha numitor</i> . | 11. <i>Thymelicus aetna</i> . |
| 5. <i>Thorybes pylades</i> . | 12. <i>Iphiclides ajax</i> . From a specimen preserved in glycerine. |
| 6. <i>Achalarus lycidas</i> . | |
| 7. <i>Erynnis sassacus</i> . | |



EXPLANATION OF PLATE 74.

Caterpillars mostly mature.—Nymphalidae.

Printed in color from sixteen stones by Julius Bien & Co. after drawings by J. H. Emerton (figs. 2, 6-8, 13, 19, 23, 28, 29, 37), G. A. Poujade (figs. 10, 27, 30, 31, 35, 36), L. Trouvelot (figs. 4, 17, 24, 26, 34), Mary Peart (figs. 5, 9, 16, 38), J. H. Blake (figs. 1, 11, 18), W. Saunders (figs. 3, 14), J. Burckhardt (figs. 21, 25), Miss M. E. Blatchford (fig. 32), A. Agassiz (fig. 15), R. H. Stretch (fig. 33), C. V. Riley (fig. 20), G. Willis (fig. 12), and S. H. Scudder (fig. 22). Figs. 9, 16, 26, and 38 were kindly lent by Mr. W. H. Edwards; and figs. 15, 21 and 25 by Mr. A. Agassiz.

The figures are of natural size and show a side view unless the contrary is stated.

1. *Oeneis semidea*. Penultimate stage.
2. *Oeneis semidea*. Drawn from a blown specimen with the aid of colored sketches.
3. *Cissia eurytus*.
4. *Oeneis semidea*.
5. *Anosia plexippus*.
6. *Cissia eurytus*.
7. *Oeneis semidea*. Just hatched; dorsal view, enlarged.
8. *Neonympha phocion*. From blown specimens and drawings of John Abbot.
9. *Satyrodes eurydice*.
10. *Cissia eurytus*. From an alcoholic specimen and drawings by W. Saunders.
11. *Oeneis jutta*. Just hatched; dorsal view, enlarged.
12. *Neonympha phocion*. Copied from Abbot's figures in the British Museum.
13. *Cissia eurytus*. Penultimate stage; dorsal view.
14. *Cissia eurytus*. Plain and enlarged.
15. *Oeneis semidea*. Dorsal view.
16. *Enodia portlandia*.
17. *Basilarchia astyanax*.
18. *Cercyonis alope*.
19. *Basilarchia archippus*.
20. *Chlorippe clyton*. Dorsal view.
21. *Basilarchia astyanax*. Dorsal view.
22. *Basilarchia archippus*. Plain outline, to show the attitude sometimes assumed.
23. *Polygonia interrogationis*. From a blown specimen.
24. *Basilarchia archippus*.
25. *Basilarchia astyanax*. Plain.
26. *Basilarchia arthemis*.
27. *Polygonia interrogationis*. Copied from Abbot's drawings in Boisduval's possession.
28. *Euranessa antiopa*. From a blown specimen.
29. *Junonia coenia*. From a blown specimen.
30. *Junonia coenia*. Copied from Abbot's drawing in Boisduval's possession.
31. *Polygonia progne*. Drawn from an alcoholic specimen, aided by colored sketches.
32. *Polygonia faunus*.
33. *Polygonia satyrus*. Mostly dorsal.
34. *Tanessa huntera*.
35. *Tanessa atalanta*. From a specimen preserved in alcohol.
36. *Aglais milberti*. From an alcoholic specimen.
37. *Tanessa cardui*. From a blown specimen.
38. *Polygonia comma*.



EXPLANATION OF PLATE 75.

Caterpillars mostly mature. — Nymphalidae (Argynnidi, Melitaeidi), Lycaenidae.

Printed from stone in eighteen colors by Julius Bien & Co. after paintings by Mrs. Mary Peart (figs. 4, 7-11, 13, 22, 23, 39, 45), L. Trouvelot (figs. 3, 16, 18-20, 25, 26, 40, 42), G. A. Poujade (figs. 14, 15, 28, 29, 31, 35, 44), J. H. Emerton (figs. 2, 5, 12, 33, 34, 37, 43), George Willis (figs. 21, 24, 32, 41), J. H. Blake (figs. 27, 30, 36, 38), Mrs. Edwards (fig. 17), Miss M. E. Blatchford (fig. 1) and C. V. Riley (fig. 6). Figs. 8-11, 13, 17, 22, 23, 39 and 45 were kindly lent by W. H. Edwards, Esq., and fig. 6 by Dr. Riley. Figs. 28, 29, 31, 35 and 44 were by his kind permission copied from the originals in the possession of the late Dr. Boisduval.

The figures are of natural size and show a side view unless otherwise stated.

1. *Brenthis bellona*.
2. *Brenthis myrina*. From a blown skin. The front pair of spines should not be apically enlarged.
3. *Brenthis myrina*.
4. *Argynnis cybele*.
5. *Brenthis bellona*. View mostly dorsal; not fully grown. After sketches by Miss M. E. Blatchford.
6. *Euptoieta claudia*.
7. *Euptoieta claudia*. Dorsal view.
8. *Phyciodes tharos*. Front view of head.
9. *Phyciodes tharos*. Dorsal view.
10. *Speyeria idalia*. View mostly dorsal.
11. *Euphydryas phaeton*.
12. *Charidryas nycteis*. From a blown skin.
13. *Cinclidia harrisii*. One of the abdominal segments enlarged.
14. *Cinclidia harrisii*. From a specimen preserved in alcohol.
15. *Charidryas nycteis*. From a specimen about to pupate.
16. *Thecla acadica*. Dorsal view.
17. *Thecla acadica*. Dorsal view.
18. *Thecla acadica*. Partly dorsal and partly lateral.
19. *Hypatus bachmanii*.
20. *Thecla catanus*. Dorsal view.
21. *Uranotes melinus*. Copied from Abbot's drawing in the British Museum, Vol. xvi, fol. 37, tab. 176.
22. *Incisalia irus*. Caterpillar eating a plum.
23. *Incisalia irus*. The same; dorsal view.
24. *Incisalia niphon*. Copied from Abbot's painting in the British Museum, Vol. xvi, fol. 36, tab. 112.
25. *Thecla edwardsii*. Dorsal view.
26. *Thecla catanus*. Dorsal view.
27. *Thecla liparops*.
28. *Incisalia irus*. Copied from a painting by Abbot in Dr. Boisduval's library.
29. *Cyaniris pseudargiolus*. Copied from the painting by Abbot in Dr. Boisduval's library.
30. *Mitura damon*. Enlarged about $\frac{2}{3}$.
31. *Mitura damon*. Copied from the painting by Abbot in Dr. Boisduval's library.
32. *Thecla liparops*. View mostly dorsal. Copied from Abbot's painting in the British Museum, Vol. xvi, fol. 39, tab. 111.
33. *Feniseca tarquinius*. Penultimate stage, slightly enlarged.
34. *Feniseca tarquinius*. Dorsal view.
35. *Strymon titus*. Copied from the painting by Abbot in Dr. Boisduval's library.
36. *Rusticus scudderii*. Third stage, dorsal view, enlarged.
37. *Everes comyntas*. Dorsal view.
38. *Rusticus scudderii*. Much enlarged.
39. *Cyaniris pseudargiolus*.
40. *Cyaniris pseudargiolus*. Dorsal view.
41. *Feniseca tarquinius*. Copied from the painting by Abbot in the British Museum, Vol. xvi, fol. 35, tab. 80.
42. *Heodes hypophlaeas*. Dorsal view.
43. *Feniseca tarquinius*. A twig of alder covered with plant lice (*Schizoneura tessellata*), in the midst of which is a larva feeding.
44. *Everes comyntas*. Copied from the painting by Abbot in Dr. Boisduval's library.
45. *Cyaniris pseudargiolus*. View mostly dorsal, enlarged.



EXPLANATION OF PLATE 76.

Caterpillars, mostly mature.—Papilionidae, Hesperidae (Hesperidi).

Printed in color from fifteen stones by B. Miesel, after paintings by J. H. Emerton (figs. 4, 5, 11-13, 16, 17, 19, 21-23, 29), L. Trouvelot (figs. 9, 10, 18, 25-27, 33), Mrs. Mary Peart (figs. 1, 6, 7, 28, 30), Jacques Burekhardt (figs. 15, 24, 35), Miss M. E. Blatchford (figs. 3, 14), George Willis (figs. 32, 34), J. H. Blake (figs. 8, 20), C. V. Riley (fig. 31) and G. A. Ponjade (fig. 2). Figs. 1, 28 and 30 were kindly lent by W. H. Edwards, Esq., figs. 15, 24 and 35 by Dr. A. Agassiz, figs. 3 and 14 made for me by Miss Blatchford, and fig. 31 given me by Dr. Riley. Fig. 2 was copied from the original in the possession of the late Dr. Boisduval by his permission.

The figures are of natural size and show a side view unless otherwise stated.

1. *Eurymus eurytheme*. Partly dorsal, partly lateral.
2. *Callidryas eubule*. Copied from the original by Abbot in Dr. Boisduval's library.
3. *Eurema lisa*. Copied from the original by Abbot in the Oemler collection at the Boston Society of Natural History.
4. *Callidryas eubule*. From a blown skin and colored sketches made by Dr. A. W. Chapman.
5. *Anthocharis genutia*. From a blown skin.
6. *Xanthidia nicippe*.
7. *Pontia protodice*.
8. *Pieris oleracea*.
9. *Pieris oleracea*.
10. *Eurymus philodice*.
11. *Pieris rapae*.
12. *Pieris rapae*.
13. *Laertias philenor*. From a blown specimen and descriptions.
14. *Ipheclides ajax*. Copied from Abbot's original in the Raddon-Gray collection at the Boston Society of Natural History.
15. *Jasoniades glaucus*. Taken just before pupation.
16. *Heraclides crespontes*. From a blown specimen.
17. *Papilio polyxenes*. In second stage.
18. *Euphocaules troilus*.
19. *Euphocaules troilus*. In third stage; plain.
20. *Laertias philenor*.
21. *Laertias philenor*. In third stage; dorsal view.
22. *Euphocaules troilus*. In third stage; dorsal view.
23. *Achalarus lycidas*. Dorsal view.
24. *Papilio polyxenes*. In fourth stage; dorsal view.
25. *Thorybes pylades*.
26. *Jasoniades glaucus*. Dorsal view.
27. *Papilio polyxenes*.
28. *Jasoniades glaucus*. First stage; much enlarged.
29. *Thorybes pylades*. Dorsal view.
30. *Epargyreus tityrus*. Partly dorsal, partly lateral view.
31. *Epargyreus tityrus*. The original was painted in oil on canvas.
32. *Thorybes bathyllus*. From Abbot's original in the British Museum, Vol. xvi, fol. 47, tab. 173.
33. *Epargyreus tityrus*.
34. *Endamus proteus*. From Abbot's original in the British Museum, Vol. xvi, fol. 45, tab. 10.
35. *Epargyreus tityrus*. In third stage.



EXPLANATION OF PLATE 77.

Caterpillars, mostly mature.—Hesperiidae.

Printed in eighteen colors by Julius Bien & Co., after paintings by Mrs. Mary Peart (figs. 2-5, 10, 21, 23, 25-28, 30-33, 35), George Willis (figs. 11, 13, 16, 17, 29), J. H. Emerton (figs. 7, 12, 14, 20, 24, 36), G. A. Poujade (figs. 9, 18, 19, 34), L. Tronvelot (figs. 6, 22), Mrs. T. L. Mead (fig. 1), Miss M. E. Blatchford (fig. 15) and William Saunders (fig. 8). I am indebted to W. H. Edwards, Esq., for the kind loan of figs. 1-5, 10, 21, 23, 25-28, 30-33 and 35, and to Mr. Saunders for the gift of fig. 8. Figs. 18, 19 and 34 were copied, by his permission, from the originals in the late Dr. Boisduval's possession.

Unless otherwise stated, the figures are of the mature caterpillar, of the natural size, and show a side view.

1. *Thanaos icelus*. Partly lateral, partly dorsal view.
2. *Thanaos juvenalis*. Front view of head, enlarged.
3. *Thanaos juvenalis*. Side view of one segment, enlarged.
4. *Thanaos juvenalis*. Front view of head, fourth stage, enlarged.
5. *Thanaos juvenalis*. Fourth stage.
6. *Thanaos juvenalis*.
7. *Thanaos persius* ♀. Dorsal view.
8. *Thanaos lucilius*. Front view of head.
9. *Thanaos lucilius*. Drawn from a specimen preserved in alcohol, aided by colored sketches by W. Saunders.
10. *Thanaos juvenalis*. Partly lateral, partly dorsal view.
11. *Thanaos juvenalis*. Copied from Abbot's original in the British Museum, Vol. xvi, fol. 48, tab. 174.
12. *Thanaos brizo*. Fourth stage; dorsal view.
13. *Thanaos martialis*. Copied from Abbot's original in the British Museum, Vol. xvi, fol. 50, tab. 136.
14. *Hesperia montivaga*. From a blown specimen lent by C. V. Riley.
15. *Thanaos persius*. Dorsal view.
16. *Pholisora catullus*. Copied from Abbot's original in the British Museum, Vol. xvi, fol. 52, tab. 84.
17. *Hesperia montivaga*. Copied from Abbot's original in the British Museum, Vol. xvi, fol. 54, tab. 137.
18. *Thanaos brizo*. Copied from the original by Abbot in Dr. Boisduval's library.
19. *Hylephila phylaeus*. Copied from the original by Abbot in Dr. Boisduval's library.
20. *Calpodus ethlius*. Drawn from a blown specimen and colored after a drawing by Abbot.
21. *Pholisora catullus*. Fourth stage; partly dorsal, partly lateral view.
22. *Atrytone zabulon*.
23. *Pholisora catullus*.
24. *Amblyscirtes vialis*.
25. *Euphyes verna*.
26. *Euphyes verna*. Dorsal view.
27. *Limochares taumas*. Fourth stage.
28. *Atalopedes huron*.
29. *Amblyscirtes samoset*. Copied from the original by Abbot in the British Museum, Vol. xvi, fol. 53, tab. 85.
30. *Atalopedes huron*. Third (?) stage; dorsal view.
31. *Atalopedes huron*.
32. *Anthomaster leonardus*. First stage.
33. *Anthomaster leonardus*. Second stage.
34. *Thymelicus aetna*. Copied from Abbot's original in the library of Dr. Boisduval.
35. *Limochares taumas*.
36. *Lerema accius*. Copied from Abbot and Smith's Lepidopterous insects of Georgia.

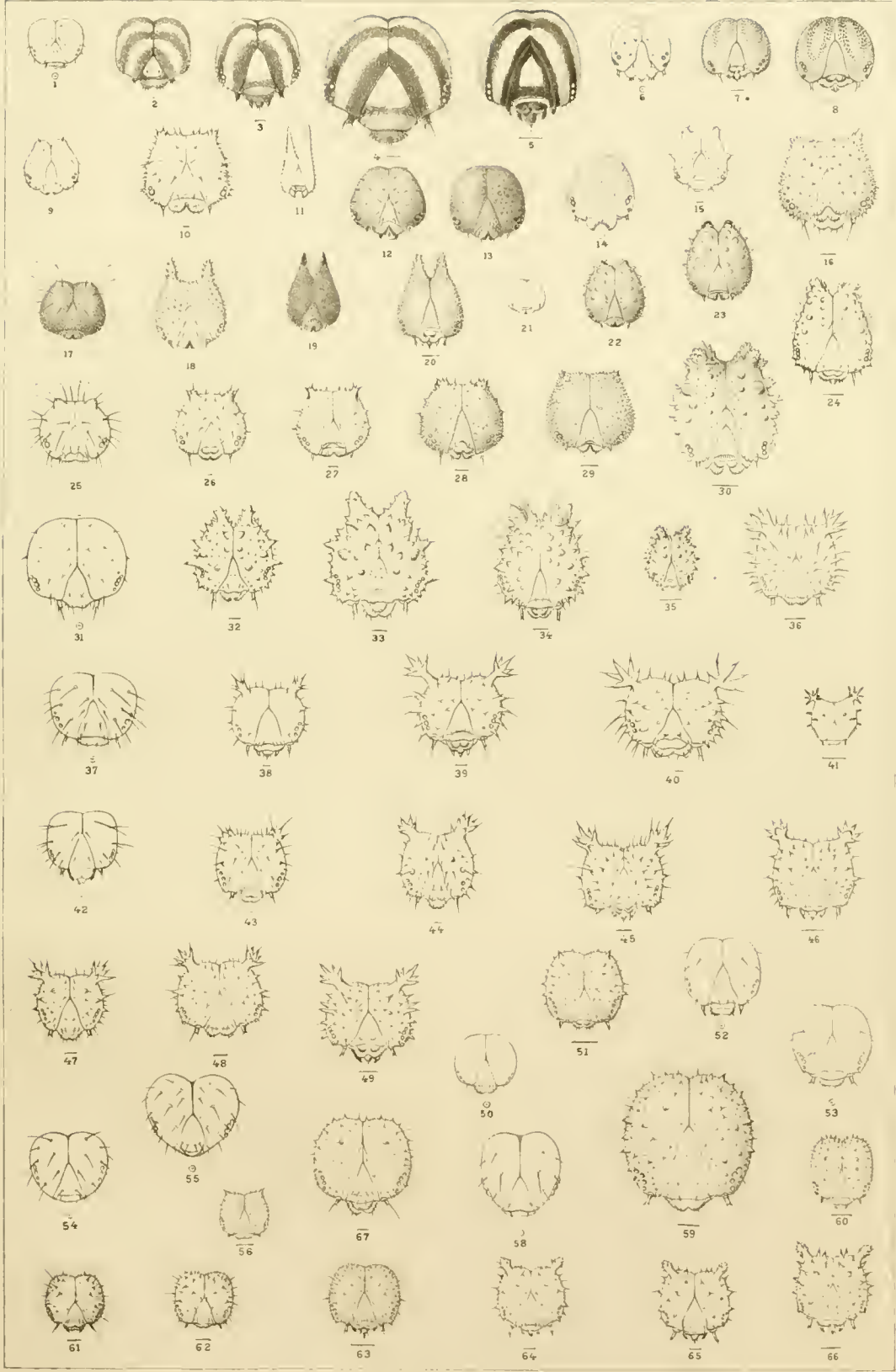


EXPLANATION OF PLATE 78.

Front views of Heads of Caterpillars at different Stages.—Nymphalidae.

Printed in lithography by B. Meisel. All the drawings are by J. Henry Blake, excepting fig. 11, which is by H. Metzger, and figs. 12, 13, 17-19, 21-23, which are by Mrs. Mary Peart, and were kindly lent for use on this plate by W. H. Edwards, Esq. The enlargement is shown in most cases by the short line beneath each figure.

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| 1. <i>Anosia plexippus</i> . First stage. | 34. <i>Basilarchia archippus</i> . Fourth stage. |
| 2. <i>Anosia plexippus</i> . Second stage. | 35. <i>Basilarchia archippus</i> . Fifth stage. |
| 3. <i>Anosia plexippus</i> . Third stage. | 36. <i>Polygonia comma</i> . Fifth stage. |
| 4. <i>Anosia plexippus</i> . Fourth stage. | 37. <i>Polygonia interrogationis</i> . First stage. |
| 5. <i>Anosia plexippus</i> . Fifth stage. | 38. <i>Polygonia interrogationis</i> . Second stage. |
| 6. <i>Oeneis semidea</i> . First stage. | 39. <i>Polygonia interrogationis</i> . Third stage. |
| 7. <i>Oeneis semidea</i> . Fourth stage. | 40. <i>Polygonia interrogationis</i> . Fourth stage. |
| 8. <i>Oeneis semidea</i> . Fifth stage. | 41. <i>Polygonia interrogationis</i> . Fifth stage. |
| 9. <i>Satyrodes eurydice</i> . First stage. | 42. <i>Polygonia faunus</i> . First stage. |
| 10. <i>Satyrodes eurydice</i> . Second stage. | 43. <i>Polygonia faunus</i> . Second stage. |
| 11. <i>Satyrodes eurydice</i> . Fifth stage. | 44. <i>Polygonia faunus</i> . Third stage. |
| 12. <i>Cereyonis alope</i> . First stage. | 45. <i>Polygonia faunus</i> . Fourth stage. |
| 13. <i>Cereyonis alope</i> . Third stage. | 46. <i>Polygonia faunus</i> . Fifth stage. |
| 14. <i>Oeneis jutta</i> . First stage. | 47. <i>Polygonia progne</i> . Second stage. |
| 15. <i>Neonympha phocion</i> . First stage. | 48. <i>Polygonia progne</i> . Third stage. |
| 16. <i>Neonympha phocion</i> . Fifth stage. | 49. <i>Polygonia progne</i> . Fifth stage. |
| 17. <i>Enodia portlandia</i> . First stage. | 50. <i>Eucanessa antiopa</i> . First stage. |
| 18. <i>Enodia portlandia</i> . Third stage. | 51. <i>Eucanessa antiopa</i> . Fifth stage. |
| 19. <i>Enodia portlandia</i> . Fourth stage. | 52. <i>Vanessa huntera</i> . First stage. |
| 20. <i>Enodia portlandia</i> . Fifth stage. | 53. <i>Vanessa huntera</i> . Second stage. |
| 21. <i>Basilarchia arthemis</i> . First stage. | 54. <i>Aglais milberti</i> . First stage. |
| 22. <i>Basilarchia arthemis</i> . Second stage. | 55. <i>Aglais milberti</i> . Second stage. |
| 23. <i>Basilarchia arthemis</i> . Third stage. | 56. <i>Aglais milberti</i> . Third stage. |
| 24. <i>Basilarchia arthemis</i> . Fifth stage. | 57. <i>Aglais milberti</i> . Fourth stage. |
| 25. <i>Cissia eurytus</i> . First stage. | 58. <i>Vanessa atalanta</i> . First stage. |
| 26. <i>Cissia eurytus</i> . Second stage. | 59. <i>Vanessa atalanta</i> . Fifth stage. |
| 27. <i>Cissia eurytus</i> . Third stage. | 60. <i>Vanessa huntera</i> . Fifth stage. |
| 28. <i>Cissia eurytus</i> . Fourth stage. | 61. <i>Vanessa cardui</i> . Third stage. |
| 29. <i>Cissia eurytus</i> . Fifth stage. | 62. <i>Vanessa cardui</i> . Fourth stage. |
| 30. <i>Basilarchia astyanax</i> . Fifth stage. | 63. <i>Vanessa cardui</i> . Fifth stage. |
| 31. <i>Basilarchia archippus</i> . First stage. | 64. <i>Junonia coenia</i> . Third stage. |
| 32. <i>Basilarchia archippus</i> . Second stage. | 65. <i>Junonia coenia</i> . Fourth stage. |
| 33. <i>Basilarchia archippus</i> . Third stage. | 66. <i>Junonia coenia</i> . Fifth stage. |



EXPLANATION OF PLATE 79.

Front views of Heads of Caterpillars at different Stages.—Nymphalidae (Argyn- nidi, Melitaeidi), Lycaenidae, Papilionidae.

Printed in lithography by B. Meisel. All the drawings are by J. Henry Blake, excepting fig. 51, which is by J. H. Emerton. The enlargement is in most cases shown by the short line beneath the figure.

1. *Euptoieta claudia*. Fifth stage.
2. *Speyeria idalia*. First stage.
3. *Argynnis aphrodite*. First stage.
4. *Argynnis cybele*. First stage.
5. *Argynnis cybele*. Fourth stage.
6. *Argynnis cybele*. Fifth stage.
7. *Brenthis myrina*. First stage.
8. *Brenthis myrina*. Third stage.
9. *Brenthis myrina*. Fifth stage.
10. *Brenthis bellona*. Third stage.
11. *Brenthis bellona*. Fifth stage.
12. *Phyciodes tharos*. First stage.
13. *Phyciodes tharos*. Third stage.
14. *Phyciodes tharos*. Fourth stage.
15. *Phyciodes tharos*. Fifth stage.
16. *Charidryas nycteis*. Second stage.
17. *Charidryas nycteis*. Third stage.
18. *Charidryas nycteis*. Fourth stage.
19. *Charidryas nycteis*. Fifth stage.
20. *Cinclidia harrisii*. First stage.
21. *Cinclidia harrisii*. Second stage.
22. *Cinclidia harrisii*. Third stage.
23. *Cinclidia harrisii*. Fourth stage.
24. *Cinclidia harrisii*. Fifth stage.
25. *Thecla acadica*. Fifth stage.
26. *Thecla liparops*. Fifth stage.
27. *Mitura damon*. Fifth stage.
28. *Cyaniris pseudargiolus*. Fifth stage.
29. *Euphydryas phaeton*. Third stage.
30. *Euphydryas phaeton*. Fourth stage.
31. *Euphydryas phaeton*. Fifth stage.
32. *Rusticus scudderii*. First stage.
33. *Rusticus scudderii*. Third stage.
34. *Rusticus scudderii*. Fourth stage.
35. *Rusticus scudderii*. Fifth stage.
36. *Eueres comyntas*. First stage.
37. *Eueres comyntas*. Second stage.
38. *Eueres comyntas*. Fifth stage.
39. *Heodes hypophlaeas*. First stage.
40. *Heodes hypophlaeas*. Fifth stage.
41. *Epidemia epixanthe*. First stage.
42. *Incisalia irus*. First stage.
43. *Feniseca tarquinius*. Third stage.
44. *Feniseca tarquinius*. Fourth stage.
45. *Feniseca tarquinius*. Fifth stage.
46. *Eurymus philodice*. First stage.
47. *Eurymus philodice*. Third stage.
48. *Eurymus philodice*. Fifth stage.
49. *Pontia protodice*. Fifth stage.
50. *Pieris oleracea*. First stage.
51. *Pieris oleracea*. Third stage.
52. *Pieris oleracea*. Fifth stage.
53. *Pieris rapae*. Fifth stage.
54. *Anthocharis genutia*. Fifth stage.
55. *Eurema lisa*. Fifth stage.
56. *Papilio polyxenes*. First stage.
57. *Papilio polyxenes*. Second stage.
58. *Papilio polyxenes*. Third stage.
59. *Papilio polyxenes*. Fourth stage.
60. *Papilio polyxenes*. Fifth stage.
61. *Eurymus eurytheme*. Fifth stage.
62. *Heracles cressphontes*. First stage.
63. *Heracles cressphontes*. Second stage.
64. *Heracles cressphontes*. Third stage.
65. *Heracles cressphontes*. Fourth stage.
66. *Heracles cressphontes*. Fifth stage.
67. *Callidryas cubale*. Fifth stage.
68. *Xanthidia nicippe*. Fifth stage.
69. *Euphacodes troilus*. First stage.
70. *Euphacodes troilus*. Second stage.
71. *Euphacodes troilus*. Third stage.
72. *Euphacodes troilus*. Fourth stage.
73. *Euphacodes troilus*. Fifth stage.

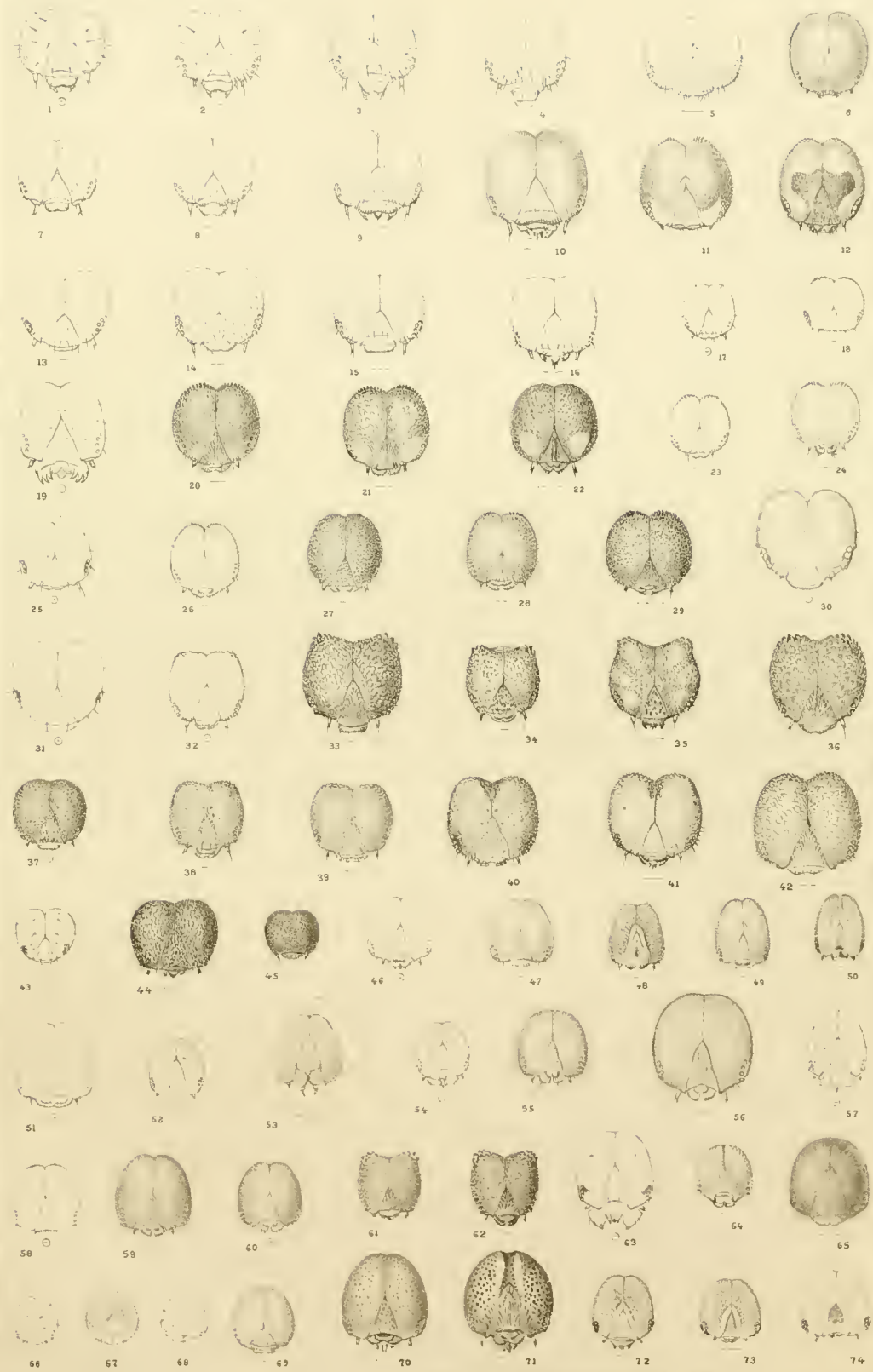


EXPLANATION OF PLATE 80.

Front views of Heads of Caterpillars at different Stages.—Papilioninae, Hesperiidae.

Printed in lithography by B. Meisel. All the drawings are by J. Henry Blake, excepting fig. 53 by S. H. Seudder, and figs. 66-68, which were made by Mrs. Mary Peart and kindly lent by W. H. Edwards, Esq. The enlargement is shown in most cases by the short line beneath each figure.

- | | |
|---|--|
| 1. <i>Laertias philenor</i> . First stage. | 40. <i>Thanaos persius</i> . Fourth stage. |
| 2. <i>Laertias philenor</i> . Second stage. | 41. <i>Thanaos persius</i> . Fifth stage. |
| 3. <i>Laertias philenor</i> . Third stage. | 42. <i>Thanaos juvenalis</i> . Third stage. |
| 4. <i>Laertias philenor</i> . Fourth stage. | 43. <i>Pholisora catullus</i> . First stage. |
| 5. <i>Laertias philenor</i> . Fifth stage. | 44. <i>Pholisora catullus</i> . Fifth stage. |
| 6. <i>Thorybes bathyllus</i> . Fifth stage. | 45. <i>Hesperia montivaga</i> . Fifth stage. |
| 7. <i>Jasoniades glaucus</i> . Second stage. | 46. <i>Amblyscirtes vialis</i> . First stage. |
| 8. <i>Jasoniades glaucus</i> . Third stage. | 47. <i>Amblyscirtes vialis</i> . Second stage. |
| 9. <i>Jasoniades glaucus</i> . Fourth stage. | 48. <i>Amblyscirtes vialis</i> . Third stage. |
| 10. <i>Jasoniades glaucus</i> . Fifth stage. | 49. <i>Amblyscirtes vialis</i> . Fourth stage. |
| 11. <i>Eudamus proteus</i> . Fourth stage. | 50. <i>Amblyscirtes vialis</i> . Fifth stage. |
| 12. <i>Eudamus proteus</i> . Fifth stage. | 51. <i>Ancyloxipha numitor</i> . First stage. |
| 13. <i>Iphiclides ajax</i> . Second stage. | 52. <i>Erynnis metea</i> . First stage. |
| 14. <i>Iphiclides ajax</i> . Third stage. | 53. <i>Amblyscirtes vialis</i> . Head of first stage, seen through the egg-shell to show position and relative size before hatching. |
| 15. <i>Iphiclides ajax</i> . Fourth stage. | 54. <i>Atrytone zabulon</i> . First stage. |
| 16. <i>Iphiclides ajax</i> . Fifth stage. | 55. <i>Atrytone zabulon</i> . Fourth stage. |
| 17. <i>Achalarus lycidas</i> . First stage. | 56. <i>Atrytone zabulon</i> . Fifth stage. |
| 18. <i>Achalarus lycidas</i> . Second stage. | 57. <i>Polites poekius</i> . First stage. |
| 19. <i>Epargyreus tityrus</i> . First stage. | 58. <i>Thymelicus mystic</i> . Second stage. |
| 20. <i>Epargyreus tityrus</i> . Third stage. | 59. <i>Thymelicus mystic</i> . Fourth stage. |
| 21. <i>Epargyreus tityrus</i> . Fourth stage. | 60. <i>Limochores taumas</i> . Second stage. |
| 22. <i>Epargyreus tityrus</i> . Fifth stage. | 61. <i>Limochores taumas</i> . Third stage. |
| 23. <i>Achalarus lycidas</i> . Fourth stage. | 62. <i>Limochores taumas</i> . Fourth stage. |
| 24. <i>Achalarus lycidas</i> . Fifth stage. | 63. <i>Limochores manataaqu</i> . First stage. |
| 25. <i>Thorybes pylades</i> . First stage. | 64. <i>Limochores manataaqu</i> . Second stage. |
| 26. <i>Thorybes pylades</i> . Second stage. | 65. <i>Euphyes verna</i> . Fifth stage. |
| 27. <i>Thorybes pylades</i> . Third stage. | 66. <i>Anthomaster leonardus</i> . First stage. |
| 28. <i>Thorybes pylades</i> . Fourth stage. | 67. <i>Anthomaster leonardus</i> . Second stage; should more closely resemble fig. 66. |
| 29. <i>Thorybes pylades</i> . Fifth stage. | 68. <i>Atalopedes huron</i> . First stage. |
| 30. <i>Thanaos juvenalis</i> . First stage. | 69. <i>Atalopedes huron</i> . Second stage. |
| 31. <i>Thanaos lucilius</i> . First stage. | 70. <i>Atalopedes huron</i> . Fourth stage. |
| 32. <i>Thanaos lucilius</i> . Second stage. | 71. <i>Atalopedes huron</i> . Fifth stage. |
| 33. <i>Thanaos lucilius</i> . Third stage. | 72. <i>Calpodus ethlius</i> . Third stage. |
| 34. <i>Thanaos lucilius</i> . Fourth stage. | 73. <i>Calpodus ethlius</i> . Fourth stage. |
| 35. <i>Thanaos lucilius</i> . Fifth stage. | 74. <i>Calpodus ethlius</i> . Fifth stage. |
| 36. <i>Thanaos juvenalis</i> . Second stage. | |
| 37. <i>Thanaos persius</i> . First stage. | |
| 38. <i>Thanaos persius</i> . Second stage. | |
| 39. <i>Thanaos persius</i> . Third stage. | |



EXPLANATION OF PLATE 81.

Nests and Webs of Caterpillars.—Nymphalidae.

Printed on stone by B. Meisel. Figs. 1-3 and 5-8 are by S. H. Scudder, and figs. 4, 9-11 by J. H. Emerton. All are of natural size.

1. *Eu Vanessa antiopa*. Showing the web left on a despoiled twig of elm by the repeated marchings of a colony.

2. *Vanessa atalanta*. The drooping sewn leaf of a nettle inhabited by the half grown caterpillar, open at the bottom.

3. *Aglais milberti*. A nest from a nettle leaf opened, to show the manner in which the base is cut before drawing the sides together.

4. *Aglais milberti*. Nest of a nettle leaf, seen from the side.

5. *Basilarchia arthemis*. The hibernaculum formed of a leaf of the cherry birch (the lower leaf of the twig), showing its resemblance to the young springing leaf (in the middle), and the bursting bud (at the top) of the same twig.

6. *Vanessa atalanta*. Base of a nettle leaf which has served as a nest, to show the way in

which it has been eaten at the base, to permit its readier bending.

7. *Basilarchia archippus*. Manner in which the tip of a willow leaf is eaten by the young caterpillar.

8. *Basilarchia archippus*. Another leaf, similarly eaten, with the caterpillar on its perch. The bundle of frass is not shown.

9. *Polygonia comma*. Concealment of the larva under an elm-leaf, the edges of which, having been deeply cut on either side near the base, are caught together beneath by a few stitches.

10. *Vanessa cardui*. Nest in a group of thistle leaves.

11. *Vanessa huntera*. Close nest formed of a mass of petals of *Guaphalium* entangled in web. See also Pl. 83, fig. 63.



EXPLANATION OF PLATE 82.

Nests of Caterpillars. — Nymphalidae (Melitaeidi), Papilioninae. Hesperidae, (Hesperidi).

Printed on stone by B. Meisel. The drawings by J. H. Emerton (figs. 1-6, 8, 9), S. H. Scudder (figs. 7, 10) and C. V. Riley (fig. 11).

1. *Thanaos juvenalis*. Nest in the partly eaten leaf of the scrub oak.

2. *Thanaos juvenalis*. A very close nest on a similar leaf, found completely closed at the end of the season and containing a parasitized caterpillar.

3. *Euphydryas phaeton*. The winter nest made of the head of *Chelone*, as it appears in winter when contracted, and containing an entire colony of partly grown caterpillars.

4. *Euphœades troilus*. Nest of a leaf of spice-bush, made by a caterpillar in its second stage.

5. *Euphœades troilus*. A similar nest, made by a caterpillar in its first stage.

6. *Euphœades troilus*. A similar nest, made by a caterpillar in its third or fourth stage.

7. *Thanaos persius*. Nest of a poplar leaf, as made by a very young caterpillar.

8. *Cinclidia harrisii*. Nest formed of the summit leaves of *Diplopappus*, woven together with a thin web.

9. *Epargyreus tityrus*. A cocoon found at the base of a tree-trunk and made of coarse saw-dust (the borings of a beetle) entangled in web.

10. *Thanaos lucilius*. Nest of a young caterpillar, made by folding the leaf of columbine.

11. *Epargyreus tityrus*. Nest formed by fastening together several adjoining leaves of *Gleditschia*.



EXPLANATION OF PLATE 83.

Chrysalids, in color and in outline.—Nymphalidae.

Printed in color from sixteen stones by Julius Bien & Co., after drawings by J. H. Emerton (figs. 2, 3, 5, 9, 10, 16, 17, 28, 41, 42, 44, 45, 47-50, 52, 53, 56-64), S. H. Scudder (figs. 18, 19, 21, 22, 24-27, 29-32, 34-36), G. A. Poujade (figs. 1, 11, 13, 20, 39, 40, 43, 51, 66, 67), L. Trouvelot (figs. 4, 37, 38, 46, 54, 55, 65), Mrs. Mary Peart (figs. 6, 14, 23), J. H. Blake (figs. 7, 8), Miss M. E. Blatchford (fig. 33), C. V. Riley (fig. 15) and George Willis (fig. 12). Figs. 6, 14 and 23 were kindly lent by W. H. Edwards, Esq.

Unless otherwise stated, all the figures are of natural size and when colored drawn from the living object.

1. *Anosia plexippus*. Side view, drawn from an alcoholic specimen and colored sketches.
2. *Anosia plexippus*. Side view in outline.
3. *Anosia plexippus*. Dorsal view in outline.
4. *Oeneis semidea*. Side view. The abdomen is much too dark.
5. *Oeneis semidea*. Dorsal view in outline.
6. *Euodia portlandia*. Side view.
7. *Cercyonis nephele*. Side view.
8. *Cercyonis nephele*. Dorsal view in outline.
9. *Satyrodes eurydire*. Side view; drawn from a specimen preserved in alcohol.
10. *Neonympha phocion*. Side view; drawn from a dried specimen and Abbot's paintings.
11. *Neonympha phocion*. Side view; copied from Abbot's original in Dr. Boisduval's library.
12. *Basilarchia astyanax*. Side view; copied from Abbot's original in the British Museum, Vol. XVI, fol. 23, tab. 3.
13. *Basilarchia astyanax*. Side view, from a dried specimen.
14. *Basilarchia arthemis*. Side view.
15. *Chlorippe clyton*. Side view.
16. *Chlorippe clyton*. Side view in outline.
17. *Chlorippe clyton*. Dorsal view in outline.
18. *Basilarchia archippus*. Ventral view in outline.
19. *Basilarchia archippus*. Side view in outline.
20. *Basilarchia archippus*. Side view; from a dried specimen.
21. *Polygonia interrogationis*. Dorsal view in outline.
22. *Polygonia interrogationis*. Side view in outline.
23. *Basilarchia arthemis*. Dorsal view in outline.
24. *Polygonia interrogationis*. Outline of mesothoracic tubercle from the side.
25. *Polygonia interrogationis*. The same, from another specimen.
26. *Polygonia interrogationis*. Outline of head from in front, enlarged.
27. *Polygonia comma*. Outline of head from in front, enlarged.
28. *Cissia eurytus*. Side view.
29. *Polygonia comma*. Outline of mesothoracic tubercle from the side.
30. *Polygonia comma*. The same, from another specimen.
31. *Polygonia faunus*. Outline of head from in front, enlarged.
32. *Polygonia progne*. Outline of head from in front, enlarged.
33. *Polygonia faunus*. Side view.
34. *Polygonia faunus*. Side view in outline.
35. *Polygonia faunus*. Ventral view in outline.
36. *Eugonia j-album*. Outline of mesothoracic tubercle from the side.
37. *Polygonia progne*. Side view.
38. *Polygonia progne*. Side view.
39. *Polygonia comma*. Side view; copied from Abbot's original in Dr. Boisduval's library.
40. *Polygonia interrogationis*. Side view; from a dried specimen.
41. *Polygonia satyrus*. Side view; from a dried specimen.
42. *Polygonia satyrus*. Ventral view in outline.
43. *Aglais milberti*. Side view; from a dried specimen.
44. *Eugonia j-album*. Side view; from a dried specimen.
45. *Eugonia j-album*. Ventral view in outline.
46. *Polygonia comma*. Side view.
47. *Polygonia comma*. Side view in outline.
48. *Polygonia comma*. Dorsal view in outline.
49. *Aglais milberti*. Side view in outline.
50. *Aglais milberti*. Dorsal view in outline.
51. *Euraessa antiopa*. Side view; from a dried specimen.
52. *Vanessa atalanta*. Side view in outline.
53. *Vanessa atalanta*. Dorsal view in outline.
54. *Vanessa huntera*. Side view.
55. *Vanessa atalanta*. Side view.
56. *Junonia coenia*. Side view in outline.
57. *Junonia coenia*. Dorsal view in outline.
58. *Euraessa antiopa*. Side view in outline.
59. *Euraessa antiopa*. Dorsal view in outline.
60. *Vanessa cardui*. Side view.
61. *Vanessa cardui*. Side view in outline.
62. *Vanessa cardui*. Dorsal view in outline.
63. *Vanessa huntera*. Dorsal view in outline.
64. *Vanessa huntera*. Side view, hanging within a nest formed in captivity immediately before pupation. See also Pl. 81, fig. 11.
65. *Junonia coenia*. Side view.
66. *Junonia coenia*. Side view; copied from Abbot's original in Dr. Boisduval's library.
67. *Junonia coenia*. Side view; from a dried specimen.





EXPLANATION OF PLATE 84.

Chrysalids, in color and in outline.—Nymphalidae (Argynnidi, Melitaeidi), Lycaenidae, Pierinae.

Printed on stone in fifteen colors by B. Meisel, after drawings by J. H. Emerton (figs. 5, 11, 18, 20, 27, 31, 45, 47, 48, 54, 56, 59, 61-65), G. A. Poujade (figs. 8, 10, 17, 24, 29, 30, 37, 38, 40, 42, 43, 49, 50, 60), Mrs. Mary Peart (figs. 3, 6, 21, 23, 26, 32, 33, 44, 51, 52, 53, 66, 67), L. Trouvelot (figs. 7, 12, 19, 22, 25, 28, 35, 36, 55, 57, 58), S. H. Scudder (figs. 1, 2, 13-16), George Willits (figs. 34, 39, 46), Mrs. T. L. Mead (fig. 4), C. V. Riley (fig. 9) and J. Henry Blake (fig. 41). Figs. 4, 21, 23, 26, 32, 33, 44 and 53 were kindly lent by W. H. Edwards, Esq., and figs. 24, 30, 37, 40, 42, 43, and 60 were copied from Abbot's originals in the possession of the late Dr. Boisduval, by special permission.

Unless otherwise stated, all the figures are of natural size and when colored, drawn from the living object.

1. *Argynnis cybele*. Outline, side view.
2. *Argynnis cybele*. Outline, dorsal view.
3. *Argynnis cybele*. Side view.
4. *Speyeria idalia*. Side view.*
5. *Argynnis aphrodite*. Side view.
6. *Argynnis atlantis*. Side view.
7. *Euphydryas phaeton*. Side view.
8. *Euptoicta claudia*. Side view.
9. *Euptoicta claudia*. Side view.
10. *Brenthis bellona*. Side view.
11. *Brenthis bellona*. Side view.
12. *Brenthis myrina*. Side view.
13. *Brenthis myrina*. Outline, side view.
14. *Brenthis myrina*. Outline, dorsal view.
15. *Euphydryas phaeton*. Outline, side view.
16. *Euphydryas phaeton*. Outline, dorsal view.
17. *Cinclidia harrisii*. Side view.
18. *Cinclidia harrisii*. Outline, dorsal view.
19. *Charidryas nycteis*. Side view.
20. *Phyciodes tharos*. Outline, dorsal view.
21. *Phyciodes tharos*. Side view.
22. *Phyciodes tharos*. Side view.
23. *Hypatus bachmanii*. Side view.
24. *Hypatus bachmanii*. Side view. Copied from a drawing by Abbot in Dr. Boisduval's library.
25. *Thecla calanus*. Side view.
26. *Incisalia irus*. Side view, enlarged.
27. *Thecla calanus*. Side view.
28. *Thecla liparops*. Side view.
29. *Thecla edwardsii*. Side view. Taken from a dead specimen.
30. *Mitura damon*. Side view. Copied from Abbot's drawing in Dr. Boisduval's library.
31. *Mitura damon*. Side view, enlarged $\frac{1}{2}$.
32. *Incisalia irus*. Plain, dorsal view.
33. *Incisalia irus*. Plain, side view.
34. *Incisalia irus*. Side view. Copied from Abbot's original in the British Museum, vol. xvi, fol. 42, tab. 12.
35. *Thecla acadica*. Side view.
36. *Cyaniris pseudargiolus*. Side view.
37. *Strymon titus*. Side view. Copied from Abbot's original drawing in Dr. Boisduval's library.
38. *Incisalia niphon*. Side view. Drawn from a dead specimen.
39. *Uranotes melinus*. Side view. Copied from Abbot's original in the British Museum, vol. xvi, fol. 37, tab. 176.
40. *Incisalia niphon*. Side view. Copied from Abbot's drawing in Dr. Boisduval's library.
41. *Rusticus scudderii*. Side view, enlarged $\frac{1}{2}$.
42. *Everes comyntas*. Side view. Copied from Abbot's drawing in Dr. Boisduval's library.
43. *Cyaniris pseudargiolus*. Side view. Copied from Abbot's original in Dr. Boisduval's library; formerly used in Boisduval and LeConte's Iconography.
44. *Cyaniris pseudargiolus*. Side view, outline $\frac{1}{2}$.
45. *Feniseca tarquinius*. Side view.
46. *Feniseca tarquinius*. Side view. Copied from Abbot's original in the British Museum, vol. xvi, fol. 35, tab. 80.
47. *Everes comyntas*. Side view, enlarged $\frac{1}{2}$.
48. *Everes comyntas*. Side view.
49. *Heodes hypophlaeas*. Side view.
50. *Chrysophanus thoe*. Side view. From a dead specimen.
51. *Xanthidia nicippe*. Side view.
52. *Xanthidia nicippe*. Outline, dorsal view.
53. *Eurymus eurytheme*. Side view.
54. *Eurymus philodice*. Outline, dorsal view.
55. *Eurymus philodice*. Side view.
56. *Eurema lisa*. Side view.
57. *Pieris oleracea*. Side view.
58. *Pieris rapae*. Side view.
59. *Anthocharis genutia*. Side view.
60. *Callidryas eubule*. Side view.
61. *Callidryas eubule*. Outline, side view.
62. *Callidryas eubule*. Outline, dorsal view.
63. *Pieris oleracea*. Outline, side view.
64. *Pieris oleracea*. Outline, dorsal view.
65. *Pieris rapae*. Outline, dorsal view.
66. *Pontia protodice*. Outline, dorsal view.
67. *Pontia protodice*. Side view.



EXPLANATION OF PLATE 85.

Chrysalids, in color and in outline—Papilioninae. Hesperidae.

Printed in twenty-one colors by Julius Bien & Co., after drawings by J. H. Emerton (figs. 2, 3, 5, 6, 8-10, 12, 15-20, 40, 43, 46, 48), Mrs. Mary Peart (figs. 11, 21, 25, 36, 41, 44, 47), George Willis (figs. 23, 24, 29, 35, 37, 45), G. A. Poujade (figs. 4, 13, 28, 38, 39, 42), L. Trouvelot (figs. 1, 7, 22, 26, 32, 33), S. H. Scudder (figs. 30, 31), Mrs. Theodore L. Mead (fig. 27), Jacques Burekhardt (fig. 14) and J. H. Blake (fig. 34). Figs. 11, 21, 25, 27, 36, 41, 44 and 47 were kindly lent by W. H. Edwards, Esq., and fig. 14 by Dr. Alexander Agassiz. As will be seen, a considerable number of the figures of Hesperidae have been copied from original drawings made by Abbot in the last century.

All the figures are of natural size and viewed from the side unless the contrary is stated.

- | | |
|---|---|
| 1. <i>Jasoniades glaucus</i> . | 28. <i>Thorybes pylades</i> . |
| 2. <i>Jasoniades glaucus</i> . Outline, dorsal view. | 29. <i>Pholisora catullus</i> . After the original by |
| 3. <i>Jasoniades glaucus</i> . Outline. | Abbot in the British Museum, Vol. xvi, fol. 52, tab. |
| 4. <i>Jasoniades glaucus</i> . From a dead specimen. | 84. |
| 5. <i>Euphocades troilus</i> . Outline, dorsal view. | 30. <i>Thanaos lucilius</i> . Outline. |
| 6. <i>Euphocades troilus</i> . Outline. | 31. <i>Thanaos lucilius</i> . Outline, dorsal view. |
| 7. <i>Euphocades troilus</i> . Outline. | 32. <i>Thanaos lucilius</i> . |
| 8. <i>Heracides cresphontes</i> . From a dead specimen. | 33. <i>Thanaos juvenalis</i> . |
| 9. <i>Heracides cresphontes</i> . Outline, dorsal view. | 34. <i>Thanaos persius</i> . |
| 10. <i>Heracides cresphontes</i> . Outline. | 35. <i>Hesperia montivaga</i> . After Abbot's original |
| 11. <i>Iphiclitides ajar</i> . | in the British Museum, Vol. xvi, fol. 54, tab. 137. |
| 12. <i>Iphiclitides ajar</i> . Outline, dorsal view. | 36. <i>Pholisora catullus</i> . |
| 13. <i>Papilio polyxenes</i> . From a dead specimen. | 37. <i>Thanaos martialis</i> . From Abbot's original |
| 14. <i>Laertias philenor</i> . Dorsal view. | in the British Museum, Vol. xvi, fol. 50, tab. 136. |
| 15. <i>Laertias philenor</i> . Outline, dorsal view. | 38. <i>Thanaos brizo</i> . Copied from Abbot's original |
| 16. <i>Laertias philenor</i> . Outline. | in Dr. Boisduval's library. |
| 17. <i>Laertias philenor</i> . Three quarters view. | 39. <i>Hylephila phylaeus</i> . Copied from the same |
| From a dead specimen, colored after Abbot and | source. |
| Smith. | 40. <i>Amblyscirtes vialis</i> . |
| 18. <i>Papilio polyxenes</i> . Outline, dorsal view. | 41. <i>Pholisora catullus</i> . Outline. |
| 19. <i>Papilio polyxenes</i> . Outline. | 42. <i>Thymelicus aetna</i> . Copied from the original |
| 20. <i>Laertias philenor</i> . | by Abbot in Dr. Boisduval's library. |
| 21. <i>Achalarus lycidas</i> . | 43. <i>Atalopedes huron</i> . From a dried specimen. |
| 22. <i>Epargyreus tityrus</i> . | 44. <i>Limochores taumas</i> . |
| 23. <i>Eudamus proteus</i> . From the original by | 45. <i>Amblyscirtes samoset</i> . After the original by |
| Abbot in the British Museum, Vol. xvi, fol. 45, | Abbot in the British Museum, vol. xvi, fol. 53, tab. |
| tab. 10. It has been accidentally put upon the | 85. |
| stone back uppermost. | 46. <i>Lerema accius</i> . After Abbot's original in |
| 24. <i>Thorybes bathyllus</i> . From Abbot's original | the collection of the Boston Society of Natural |
| in the British museum, Vol. xvi, fol. 47, tab. 173. | History. |
| 25. <i>Epargyreus tityrus</i> . | 47. <i>Atalopedes huron</i> . |
| 26. <i>Epargyreus tityrus</i> . | 48. <i>Calpodus ethlius</i> . From a dried specimen and |
| 27. <i>Thanaos icelus</i> . | drawings by Abbot. |

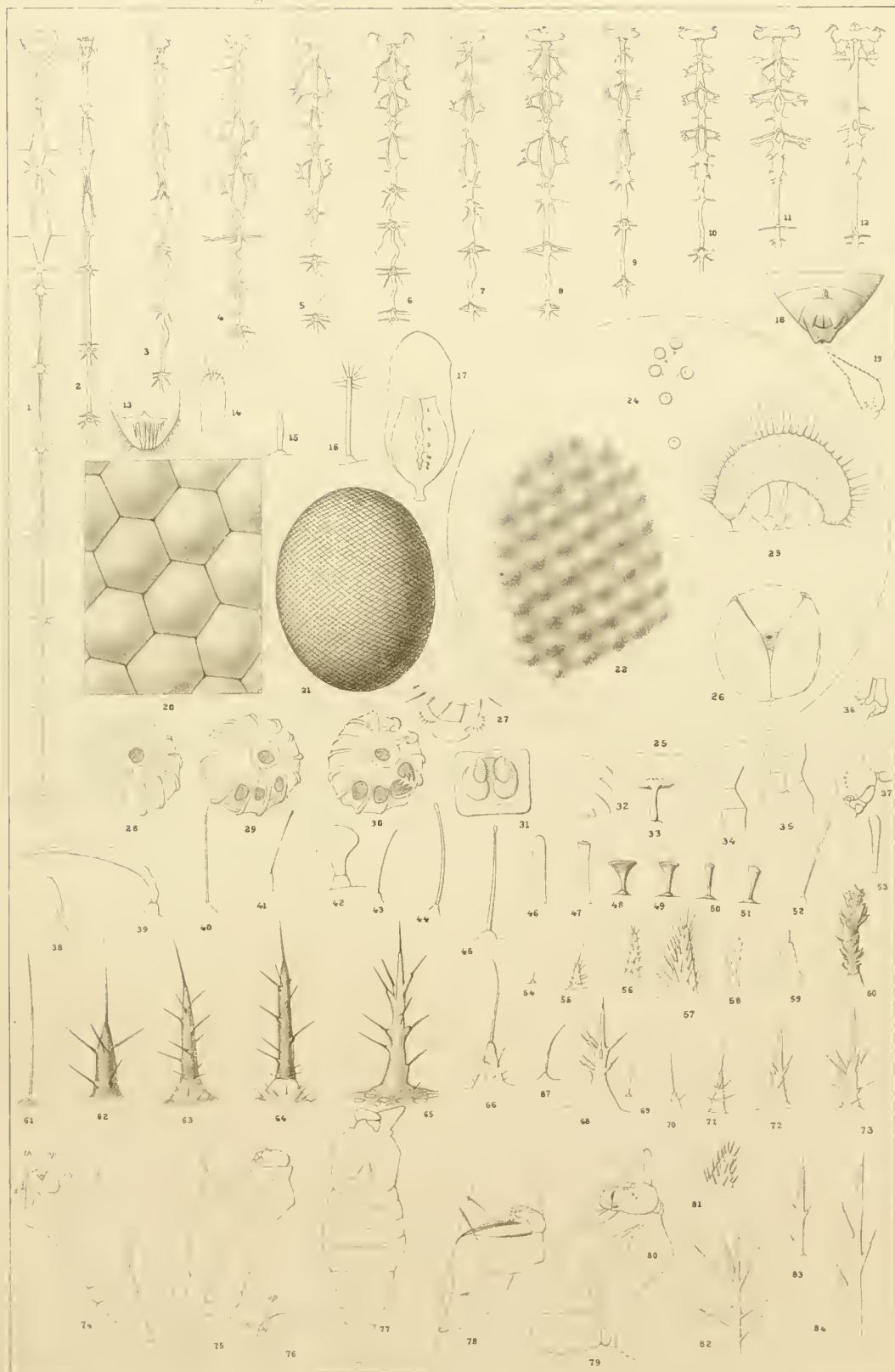


EXPLANATION OF PLATE 86.

Anatomical details of early stages, mostly external.

Lithography by B. Meisel. Figs. 2-13, 18, 19, 31, 33-39, 42, 44, 53, 57, 60, 68, 81, 83 and 84 were drawn by Henri Metzger; figs. 1, 14-17, 26, 27, 32, 40, 41, 43, 45-47, 52, 54-56, 58, 59, 66, 67, 69-80 and 82 by S. H. Seudder; figs. 20-25, 28-30, 61-65 by J. H. Emerton; and figs. 48-51 by Mrs. Mary Peart, lent by W. H. Edwards, Esq. Figs. 2-12 are copied from Newport, Phil. trans., 1834, pl. 15-16, reduced considerably.

1. *Anosia plexippus*. Main nervous system of the larva.
2. *Aglais urticae* of Europe. Main nervous system of the full grown larva.
3. The same, half an hour before changing to a pupa.
4. The same, immediately after becoming a pupa.
5. The same, one hour after changing.
6. The same, seven hours after changing.
7. The same, twelve hours after changing.
8. The same, eighteen hours after changing.
9. The same, twenty-four hours after changing.
10. The same, thirty-six hours after changing.
11. The same, forty-eight hours after changing.
12. The same, fifty-eight hours after changing.
13. *Eurymus philodice*. Under surface of last abdominal segment of larva.
14. *Rusticus scudderii*. Extensile organ on the sides of the eighth abdominal segment of the larva.
15. The same. Dermal appendage of the pupa.
16. The same. Dermal appendage of the pupa.
17. *Anosia plexippus*. Dorsal vessel in the posterior half of the pupa. The figures indicate the abdominal segments, the limits of which are marked by the dotted lines.
18. *Oeneis semidea*. Under surface of hinder end of pupa, to show the absence of cremastral hooks.
19. *Satyrodes eurydice*. Side view of head of larva.
20. *Euphœades troilus*. Some facets of the eye of imago, about $\frac{5}{16}$.
21. The same. The eye of the imago $\frac{1}{16}$.
22. The same. Some half formed facets of the pupal eye, about $\frac{5}{16}$.
23. The same. Ocellar ribbon of the pupa $\frac{1}{16}$.
24. The same. Ocelli of the larva $\frac{1}{16}$.
25. The same. One ocellus of same, about $\frac{5}{16}$.
26. *Epargyreus tityrus*. Shrouds made by the larva for attachment of the cremastral hooks of the pupa, about $\frac{1}{2}$.
27. *Thecla liparops*. Proleg of larva as seen from above.
28. *Thanaos lucilius*. Egg showing the first attack on the shell by the enclosed larva.
29. The same, fifteen hours later.
30. The same, two hours still later, showing the mandibles at work.
31. *Pieris rapae*. Prolegs of larva as seen from beneath.
32. *Pieris oleracea*. Mandible of caterpillar at birth.
33. *Heodes hypophlaeas*. Dermal appendage of chrysalis.
- 34, 35. *Euphœades troilus*. Variations in the structure of the ocellar tubercles of the pupa.
36. *Pieris rapae*. Side view of head and first segment of the thorax of the caterpillar, to show the glandular swelling on under surface of latter.
37. *Anosia plexippus*. Side view of head of larva.
38. *Satyrodes eurydice*. Dermal appendage of caterpillar at birth.
39. *Ceryonis alope*. Dermal appendage of caterpillar at birth.
40. *Cissia eurytus*. Dermal appendage of caterpillar at birth.
41. The same. Appendage in second stage.
42. *Eurymus philodice*. Dermal appendage of caterpillar at birth.
43. *Pieris rapae*. Dermal appendage of caterpillar at birth.
44. *Pieris oleracea*. Dermal appendage of caterpillar at birth.
45. *Thorybes pylades*. Dermal appendage of caterpillar at birth.
- 46, 47. *Thanaos lucilius*. Dermal appendages of caterpillar at birth.
- 48-51. *Thanaos juvenalis*. Dermal appendages of caterpillar at birth.
52. *Limchores manataaqua*. Dermal appendage of caterpillar at birth.
53. *Limchores taumas*. Dermal appendage of caterpillar at birth.
54. *Cinclidia harrisii*. Dermal appendage of caterpillar at birth.
55. The same. Appendage in third stage.
56. The same. Appendage in fourth stage.
57. The same. Appendage in fifth stage.
58. *Basilarchia archippus*. Dermal appendage of caterpillar at birth.
59. The same. Appendage in second stage.
60. *Basilarchia astyanax*. Dermal appendage of last stage of larva.
61. *Vanessa atalanta*. Dermal appendage of first stage of larva.
62. The same. Appendage in second stage.
63. The same. Appendage in third stage.
64. The same. Appendage in fourth stage.
65. The same. Appendage in fifth stage.
66. *Aglais milberti*. Dermal appendage of fourth stage of larva.
67. *Polygonia comma*. Dermal appendage of first stage of larva.
68. *Polygonia progne*. Dermal appendage of last stage of larva.
69. *Vanessa cardui*. Dermal appendage of first stage of larva.
70. The same. Appendage in second stage.
71. The same. Appendage in third stage.
72. The same. Appendage in fourth stage.
73. The same. Appendage in fifth stage.
74. *Euphœades troilus* $\frac{1}{2}$. Malformed pupa still carrying part of the larval head, seen from the right side; *r. h.*, right hemisphere of larval head; *l. h.*, left hemisphere of same; *op.*, ocellar prominence of chrysalis; *s.*, prothoracic skin.
75. The same, seen from the left side.
76. Head of the last, a little enlarged; *o. p.*, ocellar prominence of chrysalis; *m.* mandibles of larva; *l.*, labium of same.
77. The same; dorsal view, showing larval head on left, ocellar tubercle on right.
78. The same, seen from one side in front and fore-shortened $\frac{1}{2}$.
79. The same as the next, enlarged.
80. The anterior extremity of fig. 78, enlarged.
81. *Brenthis myrina*. Dermal appendage of full grown larva.
82. *Polygonia faunus*. Dermal appendage of full grown larva.
83. *Euvanessa antiopa*. Dermal appendage of fourth stage of larva.
84. The same. Appendage of full grown larva.



EXPLANATION OF PLATE 87.

Miscellaneous Structural Details in all Stages.

All the figures are borrowed from earlier publications. Figs. 3, 5, 9, 16, 23, and 25 from Mr. Burgess's article in the American naturalist; figs. 14 and 19 from Mr. Edwards's paper in the Canadian entomologist; figs. 7 and 20 from Mr. Riley in various publications; figs. 17 and 18 are copied from Mr. Holmgren's paper in the Entomologisk tidskrift; and fig. 22 from Mr. Frohawk's notice in the Entomologist; all the others are from my "Butterflies." Printed at the University Press, Cambridge.

1. *Epargyreus tityrus*. Last segment of body of chrysalis, showing (a) the cremaster $\frac{1}{2}$, and (b) the cremastral hook $\frac{1}{2}$.

2. *Hamadryas io* (of Europe). Undeveloped wing as it appears in the interior of the caterpillar $\frac{1}{4}$.

3. *Anosia plexippus*. Interior view of the bottom of the head of the imago to show the top of the pharyngeal sac and the muscles which distend it $\frac{1}{10}$. *cl*, clypeus; *cor*, cornea of the eye; *oe*, oesophagus; *fm*, frontal muscles; *dm*, dorsal muscles; *lm*, lateral muscles; *pm*, muscles moving the palpus.

4. *Eurymus philodice*. Ventral view of the front portion of the chrysalis, showing the separate piece (b) covering the base of the tongue $\frac{1}{2}$; *t*, tongue sheath; *a*, antennal sheath; *1*, *2*, first and second pairs of legs.

5. *Anosia plexippus*. Longitudinal section of the head of imago to show the pharyngeal sac $\frac{2}{10}$. *mx*, left maxilla (the right removed); *mfl*, floor of mouth cavity or pharyngeal sac; *oe*, oesophagus; *ov*, oral valve; *sd*, salivary duct; *dm*, *fm*, dorsal and frontal muscles which open the sac. Above the sac are seen the cut ends of the transversely encircling muscles which close the sac.

6. *Euphœades troilus*. Ventral view of front portion of chrysalis, showing the sheaths of the various appendages $\frac{1}{2}$. *t*, tongue sheath; *a*, antennal sheath; *1*, *2*, first and second pairs of legs. Compare fig. 15.

7. *Chlorippe clyton*. Front view of the head of the caterpillar at different stages. *a*, at first stage; *b*, at second; *c*, at third; *d*, at fourth; *e*, at fifth. The natural size is indicated by the lines adjoining.

8. *Xanthidia nicippe*. Club of antenna of imago, seen from the inner lower side, to show the shallow pits in each joint $\frac{2}{5}$.

9. *Anosia plexippus*. Longitudinal section of one of the maxillæ of the imago to show the interior muscles (*m*) which coil it, and the nerve (*n*) and trachea (*tr*) which pass through it. About $\frac{1}{125}$.

10. *Anosia plexippus*. Side view of front end of caterpillar to show the vesicle on under surface of the first thoracic segment $\frac{1}{2}$. At the right it is seen from beneath and behind, showing the transverse slit at apex.

11. *Epargyreus tityrus*. Side view of front end of the chrysalis, showing at * the thoracic spiracle $\frac{1}{2}$.

12. *Epargyreus tityrus*. Cocoon and chrysalis, the front of the former removed to expose the latter

and show the two Y-shaped shrouds by which it is suspended $\frac{1}{4}$. Cf. pl. 86, fig. 26.

13. *Eucanessa antiopa*. Leg of third thoracic joint of caterpillar seen from behind $\frac{1}{2}$.

14. *Cyaniris pseudargiolus*. Extensile organs on the eighth abdominal segment of the caterpillar $\frac{3}{10}$. *a*, with the spicules expanded; *b*, when partially withdrawn; *c*, one of the spicules still further enlarged. Cf. fig. 19.

15. *Euphœades troilus*. The same as fig. 6, with the covering of the legs and part of the wing removed on one side, to show how the hind tibia and tarsus are concealed beneath the wings, outside of the antennæ $\frac{1}{2}$.

16. *Anosia plexippus*. Head of caterpillar seen from beneath $\frac{1}{10}$. *lb*, labrum; *md*, mandible; *mx*, maxilla with two palpi; *lm*, labium with one pair of palpi; *s*, spinneret; *a*, antenna (the bristle not shown); *o*, ocelli.

17. *Oeneis jutta*. Caterpillar, second stage $\frac{1}{4}$.

18. *Oeneis jutta*. Caterpillar, third stage $\frac{1}{4}$.

19. *Cyaniris pseudargiolus*. Dorsal view of terminal segments of the caterpillar $\frac{1}{4}$. *a*, spiracles; *b*, extensile organs; shown in fig. 14; *c*, transverse vesicle.

20. *Anosia plexippus*. Showing changes from caterpillar to chrysalis $\frac{1}{4}$. *a*, suspended caterpillar just before rending of the skin; *b*, limp chrysalis, just before the cremaster is withdrawn; *c*, chrysalis just after withdrawal of cremaster. Ideal figures, illustrating the old view of pupation.

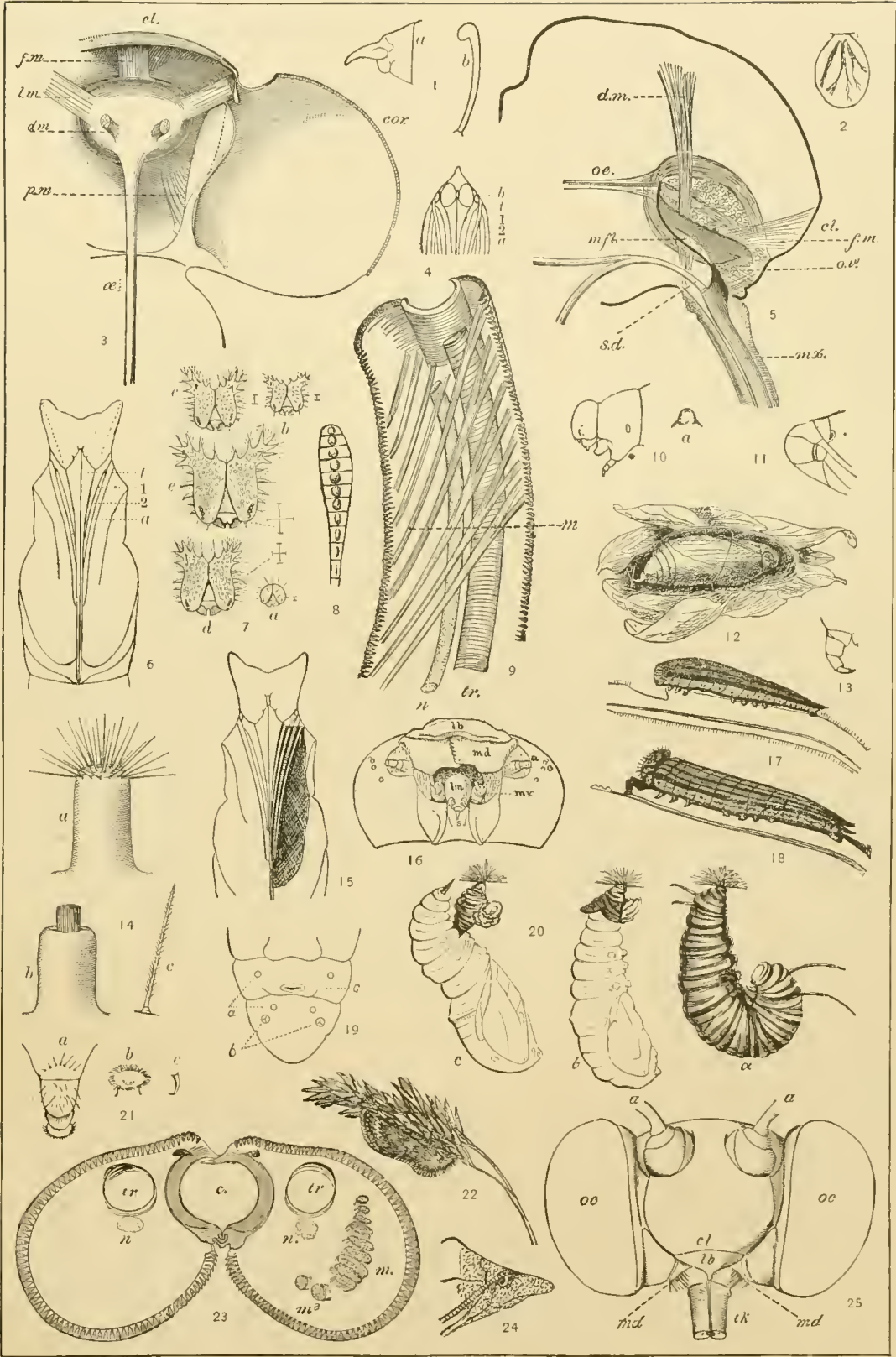
21. *Eucanessa antiopa*. Proleg of caterpillar; *a*, seen from the side $\frac{2}{5}$; *b*, circlet of hooks at tip, seen from beneath $\frac{1}{2}$; *c*, one of these hooks $\frac{1}{2}$.

22. *Thanaos tages* (of Europe). Imago at rest for the night on one surface of a head of grass, which is bowed by its weight.

23. *Anosia plexippus*. Cross section of the spiral tongue of the imago, the anterior portion uppermost, to show the mode in which the two halves unite to form a central canal through which the fluid food ascends $\frac{1}{25}$. *c*, central canal; *tr*, tracheæ; *n*, nerves; *m*, m^2 , muscles of one side.

24. *Euphœades troilus*. Side view of head of chrysalis to show the eye $\frac{1}{2}$.

25. *Anosia plexippus*. Front view of denuded head of imago $\frac{1}{10}$. *oc*, compound eyes; *a*, base of antennæ; *cl*, clypeus; *lb*, labrum; *md*, mandible, edged with bristles; *tk*, base of maxillæ or spiral tongue.



EXPLANATION OF PLATE 88.

Hymenopterous Parasites of North American Butterflies.

Lithography by B. Meisel. Figs. 4, 5, 6, 9, 10, 11, 12, 14 and 15, were drawn by George Marx; figs. 3, 8 and 13 by James H. Emerton; figs. 1, 2 and 7 by Emerton and Marx, and fig. 16 by Henri Metzger. The enlargement is indicated by the lines at the side.

1. *Ichneumon rufiventris*.
2. *Ichneumon versabilis*.
3. *Trogus exesorius*.
4. *Hemiteles humeralis*.
5. *Limnertia limenitidis*.
6. *Pimpla annulipes*.
7. *Glypta erratica*.
8. *Ophion bilineatus*.
9. *Hoplismenus morulus*.

10. *Microdus sanctus*.
11. *Microgaster carinata*.
12. *Apanteles glomeratus*.
13. Cocoons of *Apanteles atalantæ*.
14. *Chalcis flavipes*.
15. *Chalcis flavipes*. Hind femur from side.
16. Chrysalis of *Polygonia interrogationis*, as cut by *Hoplismenus morulus* in escaping.

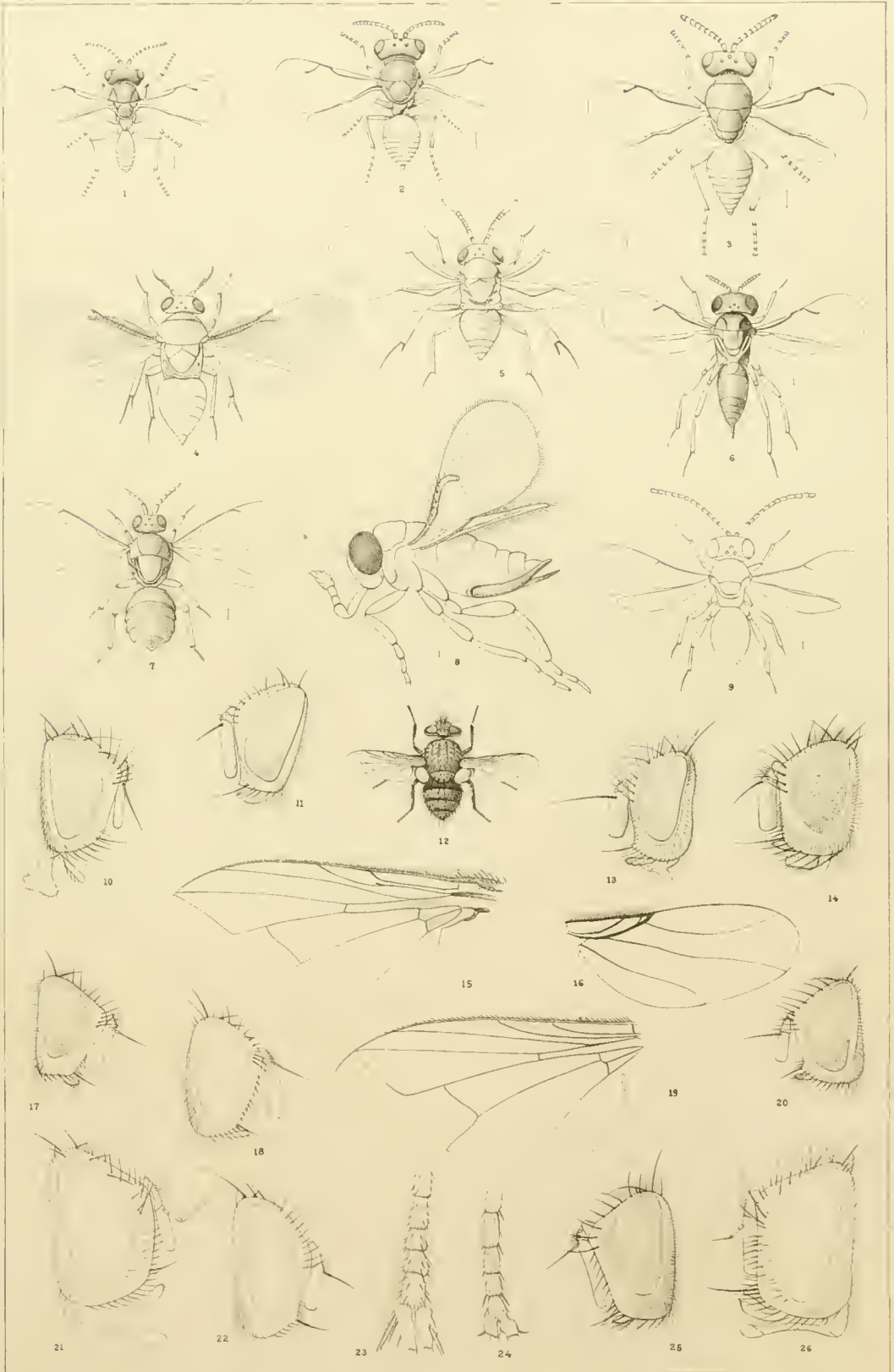


EXPLANATION OF PLATE 89.

Hymenopterous and Dipterous Parasites of North American Butterflies.

Lithography by B. Meisel. Figs. 1-3, and 12 were drawn by James H. Emerton; figs. 4-9 by George Marx; figs. 10, 14, and 16-26 by S. W. Williston; and figs. 11, 13 and 15 by Edward Burgess. All the figures are enlarged; the enlargement of figs. 1-9 is indicated by the lines at the side of the figure.

- | | |
|---|--|
| 1. <i>Pteromalus puparum</i> ♂. | 15. <i>Exorista hirsuta</i> ♀. Wing. |
| 2. <i>Pteromalus puparum</i> ♀. | 16. <i>Phora</i> sp. Wing. |
| 3. <i>Pteromalus vanessae</i> . | 17. <i>Exorista theclarum</i> ♂. Side view of head. |
| 4. <i>Encyrtus montinus</i> . | 18. <i>Mascicera achippivora</i> . Side view of head. |
| 5. <i>Copidosoma turni</i> . | 19. <i>Exorista theclarum</i> . Wing. |
| 6. <i>Tetrastichus theclae</i> . | 20. <i>Exorista scudderi</i> ♂. Side view of head. |
| 7. <i>Derostenus antiopae</i> . | 21. <i>Acroglossa hesperidarum</i> ♀. Side view of head. |
| 8. <i>Trichogramma intermedium</i> . | 22. <i>Mascicera rileyi</i> ♂. Side view of head. |
| 9. <i>Telenomus graptae</i> . | 23. <i>Mascicera frenchi</i> ♂. Tarsus. |
| 10. <i>Exorista futilis</i> ♀. Side view of head. | 24. <i>Mascicera rileyi</i> ♂. Tarsus. |
| 11. <i>Exorista blanda</i> ♂. Side view of head. | 25. <i>Phorocera edwardsii</i> ♂. Side view of head. |
| 12. <i>Phorocera edwardsii</i> ♀. | 26. <i>Acroglossa hesperidarum</i> ♂. Side view of head. |
| 13. <i>Exorista hirsuta</i> ♀. Side view of head. | |
| 14. <i>Exorista hirsuta</i> ♂. Side view of head. | |

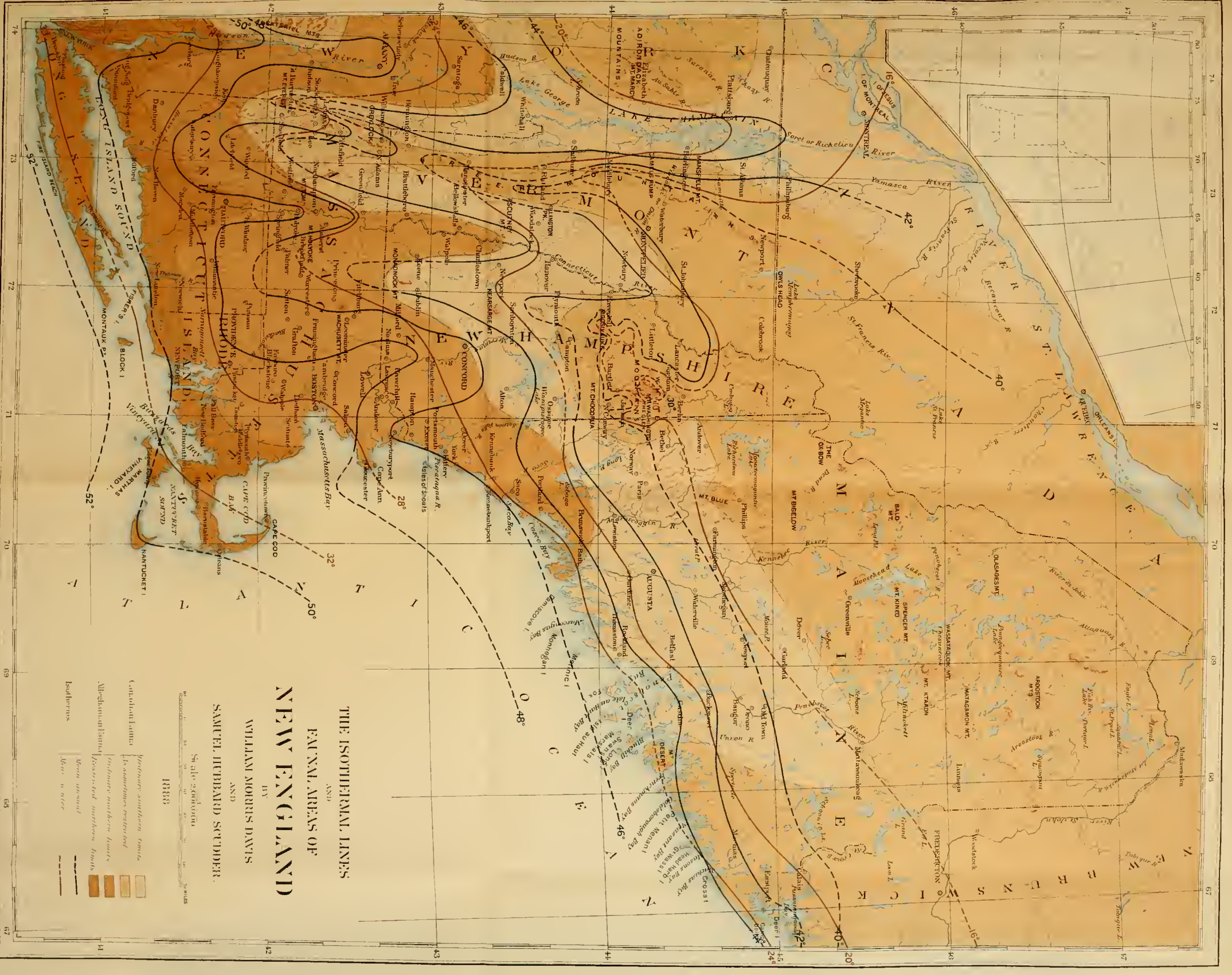




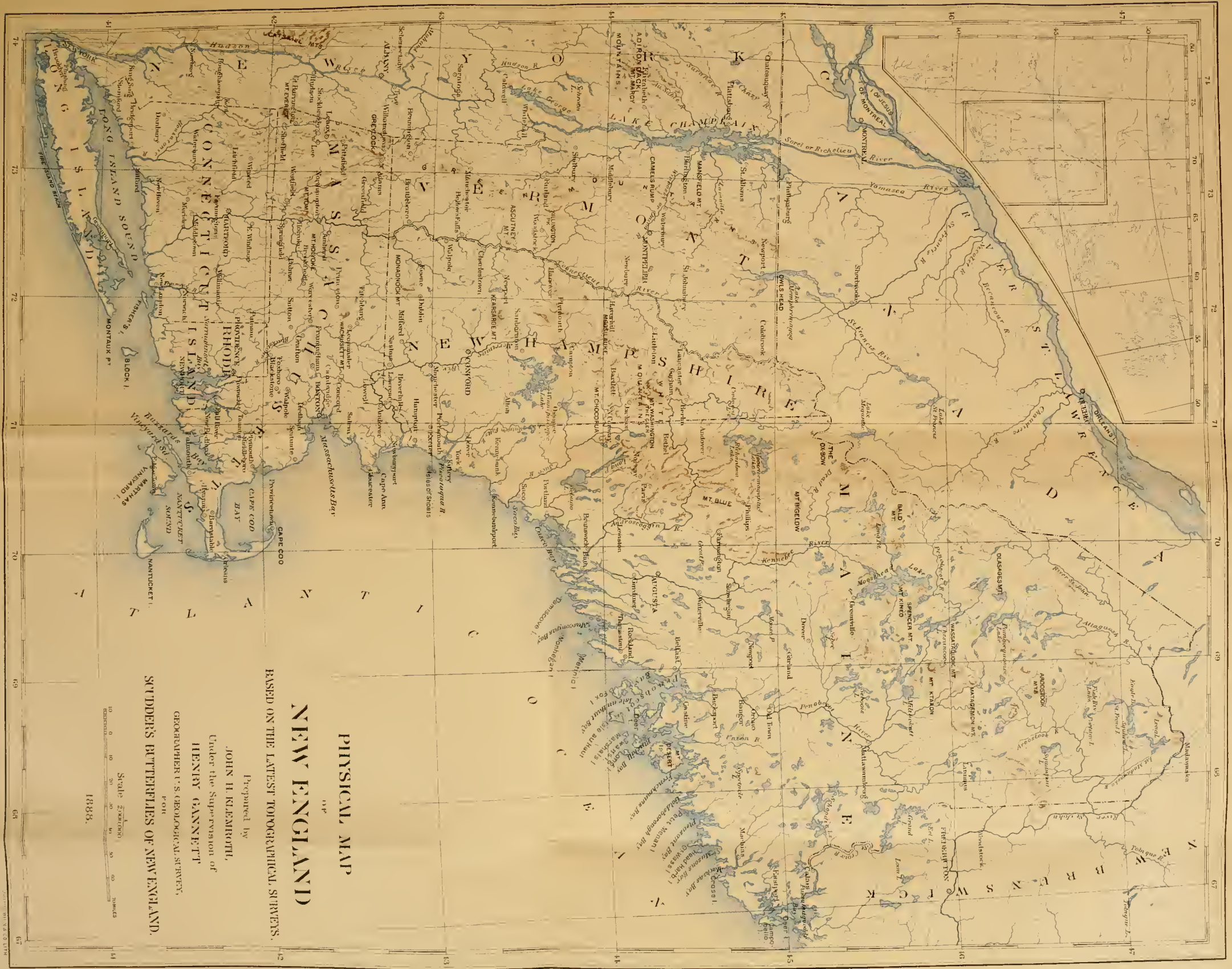
Map of the Great Range, White Mountains, N. H.

This map has been prepared to show the extent of the alpine districts of the White mountains, to illustrate Excursus I. It is based upon that prepared and published by Mr. W. H. Pickering in his little *Walking Guide to the Mt. Washington Range*. His lines have been followed for the contours, streams, paths and forest limits. Some slight additions have been made, and by the use of colors the extent of the forest region and the division of the alpine region into two districts have been clearly shown. The difference in the height of the forest line in different parts of the range, as modified by the exposure or the proximity of deep ravines (first made apparent by the measurements of the late Professor Guyot) are here well brought out, but probably require some modification. The heights of the contour lines are in English feet. The heights of the several mountain summits are taken from Guyot's measurements of nearly thirty years ago. Doubtless more correct determinations are found in Prof. E. C. Pickering's figures. viz.—Washington, 6293'; Clay, 5554'; Jefferson, 5736'; Adams, 5819'; Madison, 5381'; Monroe, 5396'; Franklin, 4923'; Pleasant, 4781' (See Appalachia, iv.:321.)

The path leading to the summit of Mt. Madison from the west branch of the Peabody River should have been marked Osgood Path and not Watson Path.





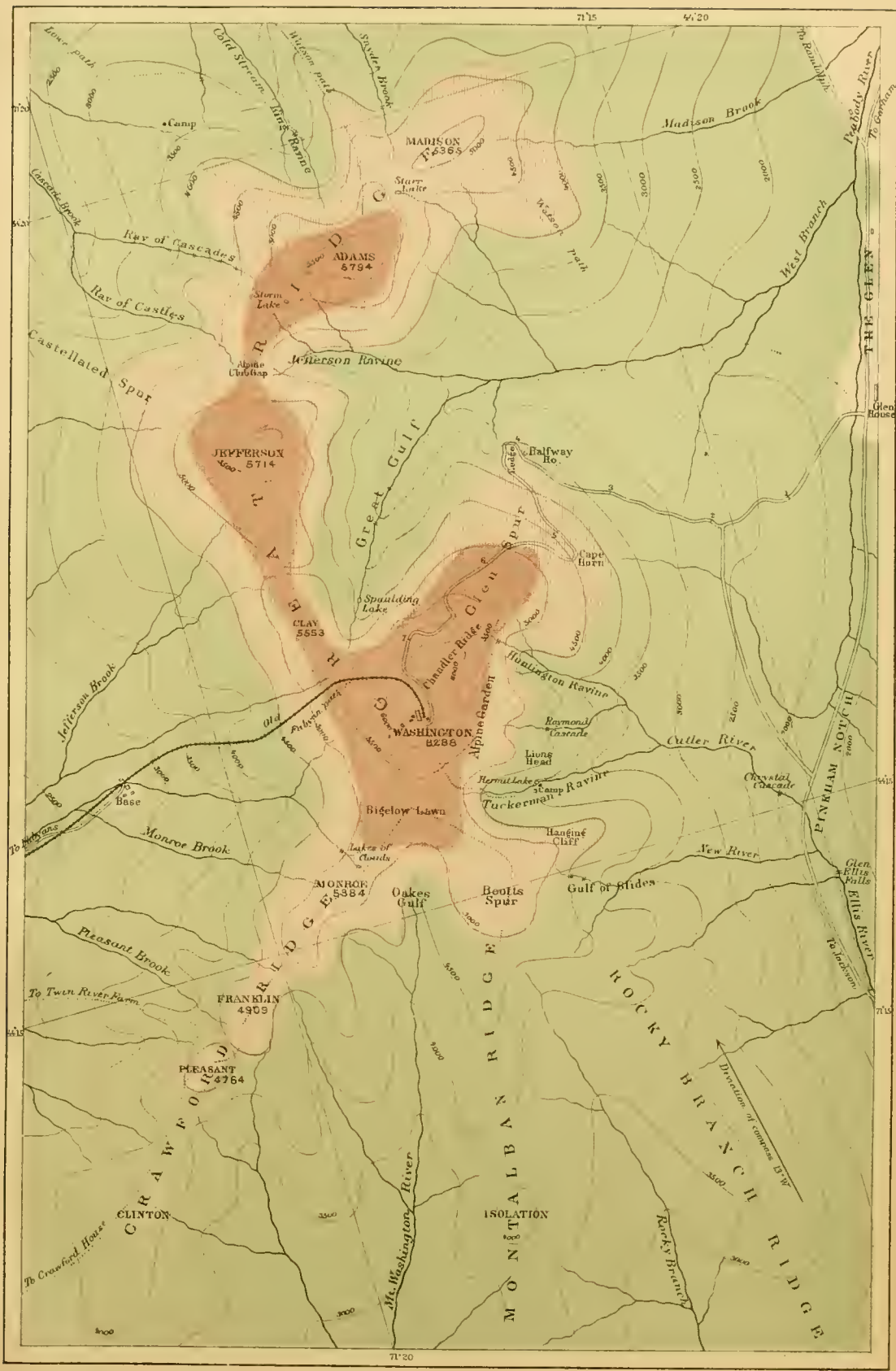


PHYSICAL MAP

OF NEW ENGLAND

BASED ON THE LATEST TOPOGRAPHICAL SURVEYS.

Prepared by
JOHN H. KLENBROTH,
Under the Supervision of
HENRY GANNETT
FOR THE
GEOLOGICAL SURVEY,
UNITED STATES GOVERNMENT.
PUBLISHED BY THE
UNITED STATES GOVERNMENT PRINTING OFFICE,
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1888.



THE ALPINE DISTRICTS OF THE GREAT RANGE, WHITE MTS. N. H.

Upper Alpine or Rocky District
 Lower Alpine or Scrub District
 Forest Region
 Clearings

— Foot paths

1: Cascades

1 2 Kilometers 3 4 5
Miles 1 2 3 4 5





