

Article V.—LIFE HISTORIES OF NORTH AMERICAN SPECIES OF THE GENUS *CATOCALA*

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In anticipation of the forthcoming 'Illustrations of the North American Species of the Genus *Catocala*' to be published shortly as one of the Memoirs of The American Museum of Natural History, we offer the following notes on the early stages of a number of species of *Catocala*. These notes are the outcome of extensive breeding experiments carried on by us during several seasons and, for the most part, deal with species of which the early stages were either partially or totally unknown; in a few instances we have amplified, for reasons stated in the text, existing descriptions. Figures of the mature larvæ, as well as enlarged drawings of the head and certain body segments of nearly all the species included here, will be published in connection with the above mentioned Memoir.

We take this opportunity of expressing our thanks to the numerous correspondents who have materially aided us in securing ova of the various species.

Catocala innubens Guenée

OVUM.—Rather more than hemispherical; strongly ribbed vertically with about 35 to 40 ribs, half of which attain the micropylar area which is sharply defined by an encircling raised rim, the remaining ribs arising interspaceally at the equatorial zone and usually unbranched; micropyle slightly raised and separated from rim by a faint depression; numerous faint transverse ribs; base flat; color gray. Diameter, 1 mm.

LARVA.—*Stage I*.—Head pale whitish, with brown vertical stripe. Body whitish, with three brown lateral stripes and a fourth subspiracular stripe; on the first four abdominal segments tubercle V has a brown dash behind it, which is possibly an incipient fifth stripe. Length, 3 mm.

FOOD-PLANT.—Honey locust (*Gleditschia triacanthos*).

A description of the remaining stages is given by G. H. French in Can. Ent., XX, p. 170; further notes on the larva are recorded by R. R. Rowley in Ent. News, XXI, p. 107.

Our own observations on the larval stages showed only three molts, but we imagine we must have overlooked one of the early ones, as four molts is the minimum number we have met with in any other *Catocala* larvæ.

Catocala piatrix Grote

OVUM.—Hemispherical; strongly ribbed vertically with about 35 ribs, about half of which reach to just before the micropylar area; the remainder arising interspaceally in the equatorial zone and scarcely ever branching; micropyle surrounded by a raised rim and consisting of very minute cells; base flat; color liver-brown. Diameter, .9 mm.

LARVA.—*Stage I*.—Head yellowish. Body pale yellow-green, with black tubercles and three brown lateral stripes, the lower of which is much broken.

Stage II.—Head white, lined longitudinally with black-brown. Body pale olive-brown, with pale geminate dorsal line and three similar lateral ones.

Stage III.—Head whitish, lined rather variably with black and red-brown, the latter color predominant at apex and on cheeks. Body pale gray-green, tinged below tubercle III with blackish; a pale geminate dorsal stripe bordered faintly with black and coalescing on prothorax and rear abdominal segment; two lateral stripes above tubercle III and a third one below this tubercle, all bordered with black lines; beneath yellow-green, with black patches. Legs pale orange.

Stage IV.—Similar to preceding stage but lateral black area more prominent and border lines to stripes very clear and marked.

Stage V.—Head reddish, streaked with brown except for a white vertical streak in front. Body as before but stripes are more or less merged in the ground color and the dark border lines are the most prominent feature; each pale stripe shows a faint dark dotted central line.

Stage VI.—Head either unicolorous red or heavily shaded with black apically and laterally. Body pale greenish-gray, shaded laterally with blackish, without warts or lateral filaments; tubercles small, whitish. The border lines of the previous stage still persist but are broken up into numerous dots and not very prominent. Length, full-grown, 70 to 80 mm.

FOOD-PLANTS.—Walnut, hickory, and butternut.

The description given by G. M. and E. A. Dodge of the mature larva in *Can. Ent.*, XXXIII, p. 299, differs so much from our own observations, especially in the very characteristic color of the head, that we have grave doubts as to the correctness of the authors' identification of the larva. Mr. R. R. Rowley (*Ent. News*, XX, pp. 13, 133) records an amount of variation in the larva far greater than any we have remarked although we have bred the species several years in succession from ova laid by captured females and also from those collected under hickory bark; the matter will require further investigation.

Catocala epione Drury

OVUM.—Rather more than hemispherical, quite different from any of the known ova of the black-winged forms; micropyle composed of about twenty-five minute cells encircled by two rather irregular rows of slightly larger cells; from this area about nineteen ribs arise and run vertically to base of egg, being augmented by about nineteen others arising slightly below the point of origin of the first group; these are crossed by numerous faint transverse ribs; base flat; color grayish. Diameter, 1.4 mm.

LARVA.—*Stage I*.—Pale gray with three lateral red-brown lines and a fourth subventral one; tubercles black with rather long setæ. Head reddish, frontally gray. Much larger than is usual among hickory-feeders, resembling in this respect one of the oak-feeders. Length, 3 to 4 mm.

Stage II.—Head whitish, with two longitudinal geminate black lines, the inner one being slightly curved. Body pale purplish gray, with three white lateral stripes and a geminate dorsal one slightly widening on the abdominal segments into the characteristic diamond patches; tubercles small, black.

Stage III.—Head pale, longitudinally lined with black with slight open V above the apex of clypeus. Body pale powdery gray, with the stripes as in the preceding stage but each one bordered on both sides by a dark line; the stripes themselves are only slightly paler than the ground color.

Stage IV.—Head pale flesh-color, longitudinally lined with black, the lateral striations uniting to form a more or less geminate black border to the lobes. Body light gray, very powdery; markings essentially as before, but the pale stripes are almost merged in the ground color and the black border lines stand out correspondingly more distinctly, giving the general appearance of geminate dorsal black lines and seven lateral lines of which the first is just above tubercle II, the second below same, the third and fourth between tubercles II and III, the fifth crossing tubercle III, the sixth spiracular, and the seventh crossing tubercle V; posterior portion of each segment tinged with ochreous in the position of the stripes of earlier stages; no filaments, tubercles small, slightly ochreous; beneath with purple-black patches. Prolegs pinkish, lined laterally with black.

Stage V.—Head pale umber brown, deeper apically, with broad black encircling band, curved forward somewhat between the apices of the lobes; frontally with longitudinal brown lines. Body cylindrical, without humps or filaments; whitish gray, powdery; the lines of the preceding stage are broken into dark spots and between them secondary dark spots occur forming a rather evident subdorsal dark stripe which accentuates the pale

centrodorsal diamond stripe, and two less-marked lateral stripes; in the areas representing the pale stripes of former stages the dark spotting is paler than in the interspaceal areas. Legs pale umber; prolegs tinged with pinkish-brown and bordered posteriorly by a stripe of similar color. Length, 45–50 mm.

FOOD-PLANTS.—Various kinds of hickory (*Hickoria* spp.). The record of oak as a food-plant (Wormsbacher. Zeitsch. Wiss. Ins. Biol., VIII, 1912, p. 257) is probably erroneous.

Catocala habilis Grote

OVUM.—Belongs in the same group with *residua*, *neogama*, etc., being flat, circular, with saucer-shaped base and raised rim around point of greatest diameter; micropylar area consisting of about 45 small, hexagonal cells; radial ribs well marked, numbering about 30 at the rim and 12–14 at micropyle; transverse ribbing distinct; color brown. Diameter, 1 mm.

LARVA.—*Stage I*.—Head brown, flat. Body green-gray, with three broad reddish lateral stripes; tubercles and setæ, black.

Stage II.—Head black. Body with dorsal area purple-gray and lateral area deep purple crossed by two whitish lines.

Stage III.—Head black, slightly streaked with white frontally. Body blackish, with geminate pale dorsal line, two pale lateral lines above spiracle, and a third one below same; beneath whitish.

Stage IV.—Head flat; whitish, heavily lined with black of which the most prominent feature is an open V mark, heaviest across the apices of the lobes and descending as a thin line along the sides of the clypeus to the mouth. Body rather shiny blackish, with pale geminate dorsal line, the two component parts not coalescing or only very slightly so; three pale lateral lines.

Stage V.—Much as before but head blacker. Body smooth shiny black, marbled with whitish; dorsal and lateral stripes as before, the lowest one slightly yellowish; tubercles black, except tubercle V which is tinted with orange; no filaments; beneath greenish white. Legs pale.

Stage VI.—Head flat, whitish, heavily marked with black laterally, so that entire lateral portion is often completely shiny black; frontally a sort of W mark is evident. Body shiny, deep black-brown, marbled with whitish; dorsal geminate line fairly distinct; dorsal tubercles orange; lateral pale stripes I and II obscure but present, with further white marbling interspaceally; a rather distinct dark spiracular band is present due to increase in the dark marbling; below the spiracle stripe III is distinctly

yellow-orange with tubercles V and VI also bright orange; this entire region is heavily mottled with brownish; lateral tubercles small, blackish; no filaments. Legs pale-brown; prolegs still paler brown.

Stage VII.—Head flat, pale, with broad blackish lateral band, broadening at mouth, a dark patch at the posterior portion of the suture dividing the two lobes and a reddish brown or blackish line crossing the apices and breaking up below them into streaks which descend irregularly towards the mouth. Body, in general appearance, deep black-brown, due to heavy dotting over a pale ochre ground color; pale dorsal geminate line broadening out slightly at the rear of each segment; two pale lateral lines very indistinct except on thoracic segments; a dark spiracular band below which the mottling is distinctly lighter brown with stripe III rather more yellowish and also mottled; legs pinkish-brown; tubercles ochreous, V and VI being tinged with orange, setæ short, white; no filaments; beneath greenish white with the usual dark blotches. Length, 50 mm.

FOOD-PLANT.—Hickory.

Seven stages is rather remarkable for a *Catocala* larva and is only, so far as we know, equalled by *vidua*; our notes are verified by preserved material before us.

The mature larva has been described by both Dodge (Can. Ent., XXXIII, 1901, p. 276) and Rowley (Ent. News, XX, 1909, p. 134).

***Catocala robinsoni* Grote**

In 1913 we bred a series of the form *curvata* from a batch of flat ova, laid in overlapping rows, found beneath the bark of a shell-bark hickory. Unfortunately, other work prevented us from obtaining a detailed description of any of the various stages except the final one which is as follows.

LARVA.—Head flat frontally, lobes rounded apically, pale gray with a heavy black lateral border to each lobe continued and joined behind the apices; frontal portion slightly marbled with purple-brown forming an inverted V mark in the region of the clypeal apex. Body pale fleshy-brown, mottled with dark dots; the dorsal diamond patches are followed by a more or less prominent subdorsal dark band edged with a distinct dark line; a blackish spiracular band; tubercles minute, black, arising from a creamy base; no humps or lateral filaments; spiracles smoky with black rim. Length, 60 mm.

FOOD-PLANT.—Hickory.

It is apparent from the above description that the larva is closely related to that of *residua* but still more so to that of *habilis*.

Catocala residua Grote

OVUM.—Very flat; base slightly convex; the sides rising to a rather pronounced rim which encircles the egg at the point of its greatest diameter. The surface of the egg from this rim to the micropylar area, which is only slightly raised above the plane of the rim, is strongly ribbed; about 35 to 40 ribs radiate inward towards the micropyle from the rim but only a small proportion actually attain the micropylar area; these strong radial ribs are crossed by numerous minute transverse ones forming a network on the whole upper surface, the meshes of which increase in width as they approach the outer rim; micropyle composed of numerous minute cells; color olive-brown. Diameter, 1 mm.

LARVA.—*Stage I.*—Head blackish-brown. Body pale whitish gray, with three reddish-brown lateral stripes, equidistant, the first on a level with tubercles I and II (dorsal tubercles); a fourth similar subspiracular stripe rather broken and indistinct; tubercles black with short setæ.

Stage II.—Head black, shaded with white. Body purple-gray with geminate white dorsal line enclosing the customary diamond-shaped dorsal patches which are rather elongate; three distinct white lateral lines; tubercles black; ventrally paler.

Stage III.—Head white, streaked longitudinally with black forming an open V frontally above the clypeus. Body brown-gray; a geminate pale dorsal stripe bordered by dark lines, irregular in course, joining in the centre of each segment and thus forming dorsal diamond patches with dark centers which are formed by the inner dark border lines partially coalescing; three pale lateral stripes as in preceding stage, but now bordered by dark lines.

Stage IV.—Head whitish, striped longitudinally with black, the most prominent stripe descending from the prothorax over the apex of each lobe to about the level of the point of the clypeus where it branches; a stripe of almost equal thickness ascends from the base of the palpi about half the height of the lobe; the clypeus has a central dark streak. Body whitish, slightly ochreous dorsally, especially toward rear of segments; dorsal tubercles slightly orange-tinged. The stripes of the preceding stage with their dark border lines are still present but are not so distinct, being only slightly more ochreous than the general ground color; the dark border lines on the contrary are very prominent so that the general appearance is that of an ochreous gray larva with a broken dorsal brown line, a waved subdorsal one above tubercle II, and six brown lateral lines; lateral tubercles black; no lateral filaments.

Stage V.—Head grayish, streaked with black much as before; the heavy dark stripe over apices of lobes has assumed an orange tint; the one above the palpi is still dark and heavy. Body gray-brown, rather smooth, with no dorsal warts or humps; tubercles orange. General appearance much as in preceding stage. The pale stripes have been practically absorbed into the general ground color; the dark lines show a tendency to break up into numerous spots and are bordered on each side by a fine white line. Between the dark lines, in the areas forming the interspaces between the white stripes of previous stages, there is a tendency for secondary dark spots to appear, especially in spiracular region where a more or less prominent dark spiracular band is thus formed; no lateral filaments; beneath whitish. Legs pale ochreous.

Stage VI.—Head whitish, with prominent angled black streak above the palpi reaching only slightly above the region of the ocelli; numerous vertical brown lines joined in a fine brown network, the most prominent of which is a vertical streak across the apex of each lobe. Body smooth, pale gray, with a slight whitish bloom. Appearance much as before. The secondary dark dots have become very numerous forming more or less prominent subdorsal and spiracular dark bands; tubercles orange-yellow; no filaments. Prolegs whitish with lateral black streak. Length, 50 to 60 mm.

FOOD-PLANT.—Hickory.

The full-grown larvæ are very similar to those of *retracta*, but may at once be distinguished by the entire absence of lateral filaments. We succeeded in rearing a good series of this species from ova received from Mr. R. R. Rowley of Louisiana, Missouri. The resulting imagines were all typical *residua* in the contrasting maculation of primaries and the brown fringes of secondaries. A single ovum received from Mr. Reiff of Boston as *obscura* showed no difference as a larva and produced an imago with primaries entirely similar to those of our Missouri series, but having the fringes of secondaries slightly tinged with white at their extreme apex. A single one of our bred Missouri specimens showed a similar coloration. We should not be surprised if *residua* with entirely white fringes on secondaries might occur.

***Catocala retracta* Grote**

Prof. French has given a very complete account of the ovum and larva of this species (Can. Ent., XXVI, 1894, p. 97) in which he records six larval molts.

We have bred this species in large numbers from ova received from R. R. Rowley of Louisiana, Missouri, and also from Miss Berry of Vinton, Iowa.

We observed only six larval stages (i. e. five molts) and preserved material of all these stages before us seems to verify this conclusion. We think that Prof. French described an advanced stage of the first larval instar as "after first moult." We append brief notes on the stages, as noted by us, which will serve to amplify in certain directions Prof. French's excellent description.

LARVA.—*Stage I.*—Head black-brown. Body gray with three lateral brown lines; tubercles black.

Stage II.—Head black, lined with white frontally. Body purple-black with geminate dorsal white line and three lateral ones.

Stage III.—Resembles greatly the larva of *C. residua*. Head white, heavily lined vertically with black, with open V mark above clypeus. Body blackish, with geminate pale dorsal stripe bordered with brown line and partially coalescing to form diamond patches towards the rear of first four abdominal segments; three pale lateral stripes with similar dark border lines.

Stage IV.—Head white, heavily lined with black. Dorsal and lateral stripes as before, bordered with black and distinctly paler than the ground color. Tubercle I orange, tubercle II usually black. Very similar to *residua* but with lines rather more distinct and the dorsal diamond patches on abdominal segments rather broken.

Stage V.—Head whitish, with black longitudinal stripes and rather heavy purple-red stripe at apex. Body rather dark smoky black, due to heavy black secondary dots on a pale ground; a geminate dorsal stripe forming more or less distinct diamond patches; lateral pale stripes slightly evident, with heavy border lines tending to break up into dots; the interspaces between pale stripes filled with dark dots, tending to form dark subdorsal and spiracular bands; tubercles orange; lateral filaments present, which at once distinguishes the species from *residua*.

Stage VI.—Head flat, lobes rounded, whitish, with numerous longitudinal purplish striations; a heavy black streak from above palpus to below apex of lobe, angled inward in the region of the ocelli; apex with bright brown streak. Body pale, creamy, very heavily sprinkled with black dots and streaks; the pale dorsal diamond patches with centrodorsal black band are fairly distinct; these are bordered by a dark subdorsal band containing the orange dorsal tubercles; laterally the three pale stripes, separated by two black bands may, in a general way, be traced; of these interspaceal dark bands, the spiracular one is broadest and most distinct; the dark bands on the fifth abdominal segment are intensified in color so as to almost give the appearance of a transverse dark band; lateral tubercles pale purplish; filaments whitish. Legs and prolegs pale purplish. Length, 50 mm.

FOOD-PLANTS.—Hickory and walnut.

Catocala vidua Abbot and Smith

Prof. French, in his otherwise very excellent description of the larval stages (Can. Ent., XX, 1883, p. 28), has overlooked one of the early molts, viz., the second. We have bred the species in numbers and found that there were six molts and therefore seven larval stages, and have before us at the present moment, as conclusive evidence, preserved material representing all these stages. The differences between the second and third larval stages are only slight, the latter stage showing the development of dark border lines to the pale lateral stripes.

The ovum is quite similar to that of *resecta* Grote but smaller, being remarkably small for the large size of the imago.

Catocala lacrymosa Guenée

OVUM.—Circular, rather flat, but not nearly so much so as in *residua*; base of egg saucer-shaped, the sides rising almost perpendicularly to a point about one-third the total height of egg, where a very slight rim is formed at the point of the greatest diameter of the egg; from this rim the sides slope gently inwards and upwards to the micropyle, the whole upper surface being thus distinctly convex. From the micropyle, which consists of a rosette of small cells, well defined radial ribs descend to the rim, branching dichotomously shortly below micropyle and numbering, at the rim, about 35. These ribs are continued across the rim down the sides towards the base and are crossed over the whole surface of the egg by numerous fine transverse ribs forming a network of cells which decrease in width towards the micropyle; color purplish-brown. Diameter, 1.1 mm.

LARVA.—*Stage I*.—Head brown. Body pale gray, with black tubercles and three brown lateral lines.

Stage II.—Head rather pale gray streaked with white frontally in lower portion and with prominent black streak, rather inwardly oblique, crossing the apex of each lobe and descending to below apex of clypeus. Body pale gray dorsally with faint geminate dorsal line enclosing an open chain of diamond patches; laterally red-brown with three white lines.

Stage III.—Head pale, striped longitudinally with black; a prominent black stripe descending from the apex of each lobe along the suture to about the level of the apex of clypeus; below this, a white stripe to the mouth parts. Body rather pale gray-brown with geminate pale dorsal stripes and three lateral ones bordered on each side by a brown line; tubercles black, more or less ringed with white basally.

Stage IV.—Head white, lined longitudinally with black with V-shaped mark on each lobe centrally and heavy black vertical dash at apex of lobes; a black streak from base of palpus half way up the cheek. Body whitish, rather variegated with black which tends to form subdorsal patches on the first and second abdominal segments between tubercle II and tubercle I of the following segment. These patches are formed by a suffusion of the lower black border of the dorsal stripe mentioned in the previous stage and the upper one of the first lateral stripe which dark line is very distinct all through its course. The same tendency is shown between the lower border of the second lateral stripe and the upper border of the third one, giving the impression of a broken spiracular dark band. The other border lines are fainter and tend to break up into dots, whilst the stripes themselves are hardly as pronounced as in the previous stage. A slight blackish suffusion extends dorsally across the posterior portion of the fifth abdominal segment and the anterior portion of the sixth. Tubercles more or less tinged with orange, dorsal tubercles on eighth and ninth abdominal segments being conical and prominent. No dorsal hump. Sparse white lateral filaments. Legs and prolegs pale. Length, 25 mm.

From ova received from Mr. R. R. Rowley of Louisiana, Missouri, we were only successful in raising larvæ to this stage on hickory. There are probably still two more stages, at least. The pale, rather variegated appearance and the lateral filaments would point towards association with the *vidua* group.

Catocala neogama Abbot and Smith

OVUM.—Very similar to those of *residua* and *lacrymosa*; flat, circular, the base saucer-shaped with the sides rising to a rather poorly defined rim encircling the egg at about one-half of its height; the upper surface of the egg has its sides sloping gently inward and upward to the micropylar area which consists of numerous, small hexagonal cells, rather larger, however, than usual; the radial ribs are distinct, about 35 to 40 in number, of which about 16 touch the micropylar area; transverse ribbing rather more distinct than in allied species; the ribbing is continued below the rim; color brown. Diameter, 1 mm.

LARVA.—*Stage I.*—Head black-brown. Body pale gray with three brown lateral lines, the lower of which is often broken; tubercles black.

Stage II.—Head black, mottled with white. Body purplish-brown, in early stages rather banded in appearance owing to the segmental incisions being paler; a geminate dorsal line enclosing the usual diamond patches; three pale lateral lines; tubercles black, II being rather large.

Stage III.—Head whitish-ochre streaked with black. Body rather dark black-brown, deepest on first four abdominal segments on each side of the pale geminate dorsal stripe, giving the appearance of a broken dark subdorsal stripe crossing tubercles I and II; first two lateral stripes very closely approached and at times almost confluent, the upper border of the first stripe being very irregular in outline; stripe three as in preceding stage; all pale stripes bordered by a dark line. Legs blackish.

Stage IV.—Head as before, pale ochreous streaked longitudinally with black, a short stripe crossing the apex of each lobe being the heaviest. Body rather pale gray heavily lined with black; pale dorsal diamond patches distinct, rather yellowish, with heavy black lateral shading on the first two abdominal segments filling in the entire interspaceal area to first pale lateral stripe; the posterior portion of the fifth and the anterior portion of the sixth abdominal segments are crossed by a transverse dark ring cut by the pale dorsal stripes; three lateral stripes as before with dark-lined edges; tubercles with slight orange tint.

From ova received from R. R. Rowley of Louisiana, Missouri, we were only successful in rearing larvæ to the above stage; there are probably two more stages, making six in all, as is usual in this group.

FOOD-PLANTS.—Hickory and walnut.

Descriptions of the mature larva have been given by G. M. and E. A. Dodge (Can. Ent., XXXIII, 1901, p. 299) and W. Beutenmüller (Bull. Amer. Mus. Nat. Hist., XV, 1902, p. 385).

***Catocala parta* Guenée**

OVUM.—Hemispherical; micropyle a collection of small cells surrounded by a slight circular raised rim outside of which is a single row of small encircling cells; about eighteen vertical ribs arise from this area, branching rather irregularly after a short distance and producing 35 to 40 ribs toward base of egg; faint cross-ribbing; color brown blotched with yellow. Diameter, 1 mm.

LARVA.—*Stage I.*—Very small when freshly emerged. Head pale brown. Body dirty gray, with three rather broad lateral red-brown stripes; later in the same stage, brown with paler dorsal area and three whitish lateral stripes.

Stage II.—Head pale brown, with narrow black border and slight dark marbling. Body dorsally pale olive, laterally smoky brown; markings very obscure, consisting of three pale lateral stripes margined by darker lines.

Stage III.—Much as in preceding stage. Head with apices of lobes tinged with orange. Body pale olive, with paler dorsal diamond patches and lateral stripes bordered with fine black lines; all maculation very obscure; a small dorsal orange wart on fifth abdominal segment with slight dark lateral shade below it.

Stage IV.—Head flat; flesh-color, mottled with pale purplish, with orange apex and strong black lateral border. Body pale brown, with paler geminate dorsal stripe forming the usual diamond patches; three lateral pale stripes, bordered with black lines, with subdorsal interspaces often darker, giving the appearance of a broken dark subdorsal band; small ochreous transverse dorsal wart on fifth abdominal segment with mere suggestion of a dark lateral shade but with interspaceal dark stripes rather prominent in this region; tubercles orange. Resembles greatly, in this stage, the full-grown larva of *irene*.

Stage V.—Practically as before; dark bands in interspaces between pale stripes rather better defined; transverse wart larger, extending laterally to tubercle II; on eighth abdominal segment, tubercle II conical and prominent. Length, 40 mm.

FOOD-PLANT.—Willow.

The above notes were made from ova laid by a female from Utah; we were unsuccessful in bringing the larva to maturity. There is probably one more larval stage before pupation.

The mature larva has been described by W. Beutenmüller (Bull. Amer. Mus. Nat. Hist., XVI, 1902, p. 387).

Catocala luciana Strecker

OVUM.—Similar to that of *C. briseis* and its allies.

LARVA.—*Stage I.*—Similar to those of allied species. Head reddish. Body dark, dirty green, gradually paling during growth; lateral area purplish brown, crossed by three parallel lines of the ground color; beneath pale greenish.

Stage II.—Head whitish, streaked with brown on cheeks laterally and towards rear. Body greenish gray, with paler dorsal band broadening to slight diamonds on centre of segments; laterally black-brown with stripes as before, the most dorsal one limiting the dark area (except on segments with prolegs where it encroaches on the light area, leaving only a narrow band in rear of the small dorsal transverse tubercle on segment V).

Stage III.—Head pale ochreous, tinged with orange posteriorly and with slight black broken streaks laterally on cheeks. Body light olivaceous,

with dorsal pale band rather prominent and edged by dark wavy lines; three pale lateral bands, wavy and edged by black, these lines being more prominent than the bands themselves; black lateral oblique patch on fifth and sixth abdominal segments, narrowing dorsally behind small orange transverse tubercle; tubercles small, orange; slight black lunate mark on eighth abdominal segment.

Stage IV.—Head whitish, strongly orange posteriorly, this color extending to prothoracic segment; a black lateral line extending down to palpi and rather broken dorsally but distinctly joined behind the apices. Body whitish, sprinkled with dark dots which tend to form a broken subdorsal dark band; stripes lost in the ground color but the dark border lines, broken into spots, tend to give a general striped appearance; brown patch laterally above last two pairs of prolegs, crossed by darker band; prominent orange transverse wart; black lunate mark on eighth abdominal segment dorsally; tubercles orange; rear segment slightly orange.

Stage V.—Head pale flesh-color, mottled with purplish strigæ and tipped with orange posteriorly, with black lateral lines from base of palpi to rear of head; these lines not joining behind apices. Body pale gray, the anterior half of all abdominal segments washed with light brown (quite distinctive); a rather distinct subdorsal blackish band and a similar spiracular one; a dorsal black line dividing the pale diamond patches; tubercles and transverse wart orange; black lunate line behind eighth abdominal but no lateral patch; beneath pinkish with black patches; sides well filamented.

FOOD-PLANT.—Willow.

A description of the larval stages has already been given by R. R. Rowley (Ent. News, XXIV, 1913, p. 197) but, as his description is not very detailed and as it is possible, as he himself states, that he had the larvæ of two species mixed (the other being possibly *verecunda*), we have thought it advisable to supplement his notes by the above description drawn up from material received from Minneapolis, Minn.

***Catocala irene* Behr**

OVUM.—Similar to those of *C. californica* and *C. faustina*.

LARVA.—*Stage I.*—Scarcely to be distinguished from those of *C. faustina* or *C. verecunda*. Head pale red-brown. Body greenish-gray, shading into purplish laterally and with three pale lateral lines of the ground color.

Stage II.—Head whitish, marbled with blackish stripes, with slight tinge of orange apically. Body pale gray-green, laterally greenish-black

with three pale waved stripes; a faint dorsal stripe with diamond shaped enlargements. Length, 11 mm.

Stage III.—Head pale with brown marbling, shaded with orange at apex and with black lateral border-lines, not meeting dorsally. Body light olive-brown with pale dorsal and lateral stripes as before, bordered with deep brown, the lower border of stripe II and the upper one of III especially prominent; transverse wart on fifth abdominal segment reddish with ochreous apex and shaded laterally with black; a black-brown lateral shade below this wart, broken by the pale stripes, deepest in color above stripe III and tending to extend along its dorsal margin towards anal segment; dorsal tubercles orange, larger and conical on eighth abdominal segment with slight black lunate marks behind them not meeting dorsally. Length, 17 mm.

Stage IV.—Head pale whitish, slightly orange apically below which is some brownish marbling; a black border line. Body very pale ochreous, with darker subdorsal stripe bordering the centrodorsal pale diamond patches and composed of numerous dots; a similar dark spiracular band, very heavy across the rear of the fifth abdominal segment. Pale stripes I and II of previous stage almost confluent, owing to lack of definite border lines and similarity to the ground color. Tubercles and transverse wart on fifth abdominal segment small, orange; a mere suggestion of a dark lateral shade on rear portion of fifth abdominal segment.

Stage V.—Head as before. Body pale ochreous caused by heavy brown sprinkling on a very pale ground; a prominent black-brown subdorsal stripe and a similar spiracular one; the dorsal diamond patches very distinct on account of the dark bordering band; a small orange wart dorsally on the fifth abdominal segment not broader than the diamond patches; dorsal tubercles orange with base black; those of the eighth abdominal segment conical but not prominent. Legs and prolegs pale flesh-color. The whole larva presents a rather flattened appearance. Length, 50 to 60 mm.

FOOD-PLANT.—Willow and poplar.

This larval description was drawn up from material of the var. *valeria* Hy. Edwards, received from Provo, Utah; in 1913, we only succeeded in rearing the larva to the third stage on willow; in 1914, using poplar as a food-plant, we brought several larvæ to maturity but all died before pupating.

Catocala faustina Strecker

The life-history published by us in *Psyche*, XX, p. 199, should be referred to *C. verecunda* Hulst; further breeding experiments conducted by us, in which the ova of known females were kept separate, brings us to the conclusion that *faustina* and *verecunda* are good species; ova of this latter species

hatch from one to two weeks earlier than do those of *faustina*; the young larvæ emerge from the whole batch of eggs at practically the same time, whilst *faustina* larvæ emerge singly, or in small numbers, over a very extended period of time, and it can happen that from a single batch of eggs one may have at the same time full grown larvæ and those just emerging. *Verecunda* may be bred fairly successfully in this section of the country on male willow catkins, but we have found great difficulty with *faustina* and, although we have succeeded in bringing a few larvæ to maturity, they have always died before pupation took place.

The ovum and first three larval stages are similar to those of *verecunda*; the last two stages show points of distinction as follows.

LARVA.—*Stage IV*.—Head whitish, lined and marbled with purple-brown, with rather prominent apical protuberances of a distinct orange color and narrow black lateral lines extending down to ocular region. Body slender, pale ochreous brown, marbled and dotted with small blackish dots and streaks; tubercles orange; hump of fifth abdominal segment large, orange, spotted with black; the pale dorsal band, enlarging somewhat into diamond marks, is defined laterally by rather darker colored subdorsal bands composed of fine black-brown speckles and bordered on each side by dotted dark lines; below this is a broad lateral irregular band bordered ventrally by a narrower darker spiracular band, below which the ground color is again paler; the lateral brown patch below the dorsal wart is only faintly visible, most noticeable on spiracular band; dorsal tubercles on eighth abdominal segment with orange color rather extended laterally, tending to form the usual lunate mark; filaments well developed. Length, 37 mm.

Stage V.—Head broad, front somewhat concave with two rather prominent apical bulges; general color whitish, heavily striated with dull purplish frontally above clypeus, with the apical bulges salmon-pink; a fine black lateral line to cheeks slightly broken behind the apices. Body rather flat and slender; color much as in preceding stage, being light olivaceous-brown with a rather definite pale dorsal stripe bordered by darker subdorsal stripes which, behind tubercle II on each segment, tend to deepen in color; dorsal wart of fifth abdominal segment prominent, ochreous, lined with black; the lateral brown shade is only visible in the stigmatal area where it shows as a lunate brown stripe; dorsal warts and a lunate mark behind tubercle II of eighth abdominal segment, deep orange; stigmata ringed with black. Prolegs, anal plate, and claspers, shaded with pinkish. Length, 57 mm.

FOOD-PLANT.—Willow.

Catocala briseis Grote

OVUM.—Hemispherical; the micropyle, situated at apex of egg, consists of several concentric rows of minute cells surrounded by a very slight rim, beyond which is an irregular encircling row of somewhat larger, irregularly hexagonal cells; the usual vertical ribbing is present, consisting of about 15 to 18 ribs arising from the micropylar area and branching irregularly to form 38 to 40 ribs at base of egg; fine transverse ribbing; color brown, mottled with yellowish. Diameter, 1.1 mm.

LARVA.—*Stage I (just emerged)*.—Head flat; pale red-brown. Body dirty green-gray, with three indistinct, rather broad, red-brown lateral stripes and traces of a fourth subventral line; general appearance without a lens is black-brown. Length, 3 mm.

After feeding, the lateral area becomes red-brown with three pale lateral stripes. Can at once be distinguished from the first stage of *unijuga* by its reddish head.

Stage II.—Head whitish ochre, marbled with black. Body blackish, with broad dorsal whitish area shading into ochreous laterally below tubercle II; this stripe is even in width and rather narrow on the thoracic segments, then broadening on the first four abdominal segments and extending to the region of tubercle V, narrowing again almost to a line behind a small black transverse dorsal wart on the fifth abdominal segment; on the first four abdominal segments an ochreous line crosses the pale area on the level of tubercle II; faint traces of pale lines crossing the dark lateral area. In later stages, the colors merge and are not nearly so contrasting.

Stage III.—Head pale purplish gray, tipped with orange and with a black lateral line bordering lobes. Body light brown, marbled strongly by longitudinal lines; on the first three abdominal segments two of these lines form indistinct subdorsal W marks behind tubercle II; laterally the segments are slightly tinged with black as far as the fifth abdominal segment; this segment has a small black or orange transverse dorsal wart, lateral and posterior to which the remaining segments are almost entirely velvety black, with the exception of a narrow dorsal pale stripe.

Stage IV.—Head pale, marbled with purplish, tipped with orange, bordered laterally not very heavily with black; the bands scarcely meeting behind apex of head. Body light brown, with numerous waved and dotted black lines which tend to form W marks dorsally behind tubercle II; dorsal pale diamond patches fairly distinct, due to bordering dark areas; wart on fifth abdominal segment orange brown, with a deep brown lateral patch extending to prolegs and crossed by three black bands. Tubercles, orange;

tubercle II on eighth abdominal segment raised, conical and followed by slight black oblique streak.

Stage V.—Head pale flesh-color, shading into orange apically, below which is purplish marbling; a rather narrow black border line. Body rather slender; purplish-brown, heavily dotted with black; dorsal tubercles distinct, orange; lateral tubercles small, pale; distinct dorsal diamond patches defined by dark dotted lines; two pale lateral stripes and a third subspiracular one are fairly distinct, especially on the rear portion of the fifth abdominal segment where they cross a diffuse light-brown patch and are accentuated on their margins by black shading; transverse wart on fifth abdominal segment purplish, lined with black, with the lateral patch of preceding stage paler and less defined, being light brown; fringes whitish-pink; beneath pale purple-pink, with deep black spots. Legs and prolegs pinkish. Length, 60 mm.

We were very successful in breeding large numbers of this species from ova received from various points in Northern Ontario and Manitoba; both poplar and willow were used as food-plants with equally good results.

***Catocala grotiana* Bailey**

OVUM.—Very similar to that of *C. briseis* but larger.

LARVA.—*Stage I*.—Head reddish-black, marked laterally with gray but not strikingly so. Body dirty gray, reddish laterally, crossed by three wavy pale lines of ground color. Legs and prothoracic shield black.

Stage II.—Head pale ochreous, tinged with red and lined with black. Body laterally blackish, crossed by three pale waved lines; dorsally on the first eight segments, pale ochre broadening somewhat on the first abdominal segment and forming more or less of a diamond-shaped patch pitted by the dark tubercles and having a general checkered effect; a small dark transverse tubercle on fifth abdominal segment, posterior to which the remaining segments are almost uniform black with the exception of a narrow pale dorsal line.

Stage III.—Head pale, tipped with orange and with lateral black borderlines. Body whitish-yellow, lined with rows of black dots, especially evident preceding tubercle III, and just dorsad of same; broken black subdorsal patches may be present or absent; a black transverse dorsal wart on fifth abdominal segment with a heavy black lateral patch descending to prolegs; black dorsal crescents on rear of eighth and ninth abdominal segments.

Stage IV.—Head whitish, strongly tipped with orange below which is a black streak parallel to side of clypeus; lobes with purplish marbling and

black border lines. Body whitish, with irregular black dotting and streaks partially outlining the dorsal diamond patches; several dots and streaks above the spiracle; tubercles pale orange; dorsal wart on fifth abdominal segment tipped with orange, with a strong black lateral patch crossed above prolegs by broad whitish-pink curved stripe; black dots behind tubercle II on seventh abdominal segment and black crescent behind those of the eighth segment; fringes white. The amount of black present in this stage is quite variable.

Stage V.—Head flesh-colored, tipped with orange and heavily mottled below this color with purple which forms a perpendicular line descending from apex of lobe to above palpus and an inner line parallel to edge of clypeus and curving at apex to join the former line; black border to lobes broken behind the apices. Body pale whitish ochre, sprinkled with brown dots mixed with black; the black color defines the dorsal diamond patches on the rear portion of the first four abdominal segments and forms a few dots and streaks above the spiracle, especially on prothorax; wart on fifth abdominal segment arising from a heavy black base; lateral black shade much broken and crossed by a pale stripe above and below the spiracle; an oblique black stripe on eighth abdominal segment between tubercles II and III; fringes whitish. Legs faintly pink; prolegs whitish, striped with black on posterior side.

FOOD-PLANTS.—Willow and poplar.

The larva, which shows considerable affinity to *briseis* in the early stages, is vastly different when mature, approaching much closer to *pura* and *relicta* in appearance and amply establishing the validity of the species. The ova, from which we successfully reared several adults, were received from Provo, Utah.

Catocala unijuga Walker

OVUM.—Scarcely distinguishable from that of *briseis*; very slightly larger.

LARVA.—*Stage I.*—Head black. Body deep greenish black, with pale gray dorsal area and three faint stripes laterally. The black head at once separates it from *briseis* and allied species.

Stage II.—Head pale, heavily mottled with black. Body jet-black, except dorsally where there is a broad pale ochre band with a tendency to form diamond patches as far as the fifth abdominal segment, posterior to which it narrows to almost a line; on the first abdominal segment this band expands laterally towards the spiracular area; faint traces of three pale lateral lines.

Stage III.—Head flesh-color, heavily encircled with black and with frontal black M. Body laterally largely blackish, crossed by indistinct pale ochreous bands giving a mottled appearance; a prominent pale ochreous dorsal stripe, enlarging into diamond patches and spreading laterally over the whole first abdominal segment and partially over the second segment; slight black transverse dorsal wart on fifth abdominal segment, with lateral black shade extending to prolegs.

Considerable variation exists in the different broods in the amount of black coloring. Some have the lateral area much marbled with pale ochreous so that the general color appears to be pale ochreous with the borders of the diamond patches composed of strong geminate black lines broken on the fore part of each segment; in such cases, the black lateral patch on the fifth abdominal segment stands out much more clearly.

Stage IV.—Head small for the size of the body, heavily lined with black in front and with broad black lateral border; apices tipped with orange. Body mixed black and gray, due to a heavy black sprinkling on a pale ground which is almost covered; dorsal diamond patches fairly distinct, outlined by punctiform black lines; the anterior portion of first abdominal segment usually paler, as is also the fifth abdominal segment at times; small transverse wart dorsally on fifth abdominal segment, tipped with orange with a deep black lateral patch extending to between the prolegs; a black crescent dorsally on posterior portion of eighth abdominal segment; tubercles small, pale orange.

Stage V.—Head flesh-color, shading into orange apically with very heavy black lateral border; frontal black markings consist of a streak through center of clypeus, two streaks parallel to the upper part of clypeus, and a streak from the apex of each lobe to the mouth. Body light ochreous so heavily mottled with black that the general appearance is blackish with pale mottlings; dorsal tubercles pale ochreous, rather distinct; the most distinct features of the maculation are the pale dorsal diamond patches bordered with blackish and a pale stripe above the spiracle; laterally the first abdominal segment is often paler than the remainder of the body and the fifth abdominal is more heavily shaded with black, this being the remains of the patch of previous stages; transverse wart small, pale, marked with black laterally at base; tubercles II on the eighth abdominal segment rather larger than on other segments and with the usual black oblique streak behind; beneath pinkish with black spots; fringes pale.

FOOD-PLANTS.—Willow and poplar.

Rowley (*Ent. News*, XIX, 1908, p. 115) records five molts, but this is evidently an error; the normal number in this group is four.

We bred good series of adults from batches of ova received from various localities in Ontario and Manitoba.

Catocala semirelictica Grote

OVUM.— Similar to those of *C. briseis* and *C. unijuga*.

LARVA.— *Stage I*.— Head red. Body dirty green, with three pale lateral stripes; dorsal area slightly paler.

Stage II.— Head pale, faintly marbled with darker lines and encircled by a narrow black line. Body pale ochreous; laterally black with three pale lines; the dorsal ochreous area extends laterally to the spiracular area on the first abdominal segment and also on the posterior portion of the fifth and the anterior portion of the sixth abdominal segment, which distinguishes the stage at once from similar ones of either *unijuga* or *briseis*; tendency to diamond patches on the mid-abdominal segments dorsally.

Stage III.— Head pale, marbled with darker lines, tipped with orange, and bordered narrowly with black. Body pale ochre, marbled with deeper ochre in the shape of longitudinal lines and marked laterally with black which forms a species of zigzag black lateral line, broken on the first abdominal segment; a small dorsal transverse wart on fifth abdominal segment with a black lateral patch; tubercles orange.

Stage IV.— Head flesh-colored, rather broadly suffused with orange apically, marbled with purplish, and with a faint and broken black border. Body whitish, evenly striate longitudinally with black, closely approached, dotted lines, slightly tinged with ochre-brown laterally above the fringe; transverse wart of fifth abdominal segment tipped with ochreous, with indistinct black broken lateral shading extending to between prolegs; a black crescent behind tubercle II on the eighth abdominal segment; fringes whitish.

Stage V.— Head pale flesh-color, tinged with orange at apex rather broadly, marbled frontally with purplish with narrow black lateral border, more or less broken towards apex of lobes. Body whitish, evenly and heavily lined and marbled with black dots which at times form a prominent subdorsal stripe outlining the pale dorsal diamond patches; in other cases this subdorsal dark stripe is scarcely recognizable; transverse wart on the fifth abdominal segment ochreous, arising from a black base; the lateral black shade is reduced to some broken black streaks and dots, merely a slight accentuation of the general dark mottling; at times a dark spiracular stripe is fairly evident but this is often absent. Dorsal tubercles orange; lateral fringes white; spiracles pale ochreous, ringed with black; beneath whitish, with black patches. Legs pale orange; prolegs whitish.

FOOD-PLANT.— Poplar.

The mature larva is closely allied to that of *pura* and quite distinct from

those of *briseis* or *unijuga*. The ova from which we reared this species were received from Hymers, Ontario; the resulting imagines were strongly shaded with white before and beyond the reniform and with a prominent submedian black streak.

***Catocala nevadensis* Beutenmüller**

OVUM.— Similar to that of *C. pura*.

LARVA.— *Stage I*.— Head dull red-brown. Body greenish gray, with paler dorsal area and three waved lateral lines.

Stage II.— Head whitish, with slight pink tinge and marbled slightly with black. Body pale creamy dorsally, with tendency to form the usual diamond patches; laterally olive-brown, crossed by three pale lines; below lines I and II are small lateral black patches on the rear of segments as far as fifth abdominal segment, which has a black lateral patch extending from a small transverse dorsal wart as far as line III; posterior to this segment the interspaceal area between the pale lines is rather heavily black. The olive-brown lateral area with its black dots renders the larva quite distinct from allied forms.

Stage III.— Head flesh-color, tipped with orange and faintly bordered by a broken black line much as in *semirelicta*. Body light olive-brown, with pale ochreous dorsal diamond patches and three lateral lines more or less bordered with black-brown, especially the diamond patches on rear of first four abdominal segments; there is a tendency on the posterior portions of the first two abdominal segments for the pale dorsal area to spread laterally, coalescing with the first pale stripe; transverse wart on fifth abdominal segment, orange, small, with heavy black lateral patch extending to prolegs; a black crescent posterior to tubercle II on eighth abdominal segment; tubercles, small, orange.

Stage IV.— Paler than in preceding stage. Head whitish, tinged with orange apically below which are brown marblings; laterally a narrow black-brown border composed of two parallel lines reaching from apex of lobes to region of the ocelli. Body whitish, with orange tubercles and an orange-brown transverse wart on the fifth abdominal segment; the lateral oblique black shade is broken up into some black markings in the region of tubercles II and IV; pale stripes faintly visible with border lines broken up into dots; a dark oblique line behind tubercle II on the eighth abdominal segment.

Stage V.— Very close to *pura*. Head pale flesh-color shading into orange apically, with purplish markings below apex and a narrow black lateral border line. Body pale greenish white, heavily pitted with brown

in more or less longitudinal rows; dorsal diamond patches relieved by dark shade lines; wart on fifth abdominal segment rather large, bounded laterally by tubercle II which is orange; the wart itself is dull orange with black marbling; no lateral shade; fringes whitish; spiracles pale, with black rim; beneath greenish white, with black patches. Legs pale ochreous.

FOOD-PLANTS.—Poplar and willow.

***Catocala concumbens* Walker**

OVUM.—Rather more than hemispherical; very similar to that of *cara*; micropylar area, however, neither raised nor depressed, consisting simply of a number of small hexagonal cells situated at apical area of egg; from this area 18 to 20 radial ribs descend to the base of the egg; in the equatorial region secondary ribs arise independently in the interspaces between these main ribs, and these secondary ribs branch shortly once or twice before reaching basal area, so that the lower portion of the lateral area is lined with 60 to 70 ribs; fine transverse cross ribbing is present; color brown. Diameter, 1 mm.

LARVA.—*Stage I*.—Head pale red-brown. Body green-gray, with three brown lateral stripes and a similar subventral one.

Stage II.—Head white, heavily marbled with black-brown. Body deep purple-gray with geminate dorsal pale line and three lateral pale lines; beneath whitish.

Stage III.—Head white, apices of lobes orange with black longitudinal streaks, sides of cheeks with more or less black network. Body dorsally light brown, with pale geminate whitish dorsal stripes bordered by a brown line and coalescing towards the rear of each segment enclosing the usual diamond patches; laterally deep purplish with three pale stripes, the upper being well marked and forming the border line between the light dorsal and the dark lateral regions; on fifth abdominal segment dorsally a well-defined black transverse wart. Legs ochreous; prolegs blackish.

Stage IV.—Head whitish, streaked and marbled heavily with blackish purple; apex of lobes orange; a rather broad black lateral border to lobes. Body purplish-brown; the geminate dorsal stripe and three lateral stripes of the preceding stage may still be traced by their paler color and border of dark dotted lines; tubercles orange; dorsal wart of fifth abdominal segments prominent, reddish-brown; a pale brown oblique shade laterally on posterior portion of fifth and anterior portion of sixth abdominal segments crossed by the pale lateral stripes; tubercles II of eighth abdominal segment

with short oblique black stripes proceeding from them forward and downward; lateral filaments, short, whitish; beneath, whitish. Length, 30 mm.

Stage V.—Head pale pinkish, streaked heavily with deep purplish, tipped with orange and with broad black lateral band. Body deep purple brown, sprinkled with blackish dots; slight pale transverse wart on fifth abdominal segment and light brown lateral shade as before crossed by darker subdorsal and subspiracular bands; tubercles orange; lateral fringes short, pinkish; eighth abdominal segment dorsally with black crescent behind tubercles II; beneath pinkish. Legs light brown. Length, 60 mm.

FOOD-PLANTS.—Different kinds of low willows.

The final larval stage has been already noted by several authors (Saunders. Proc. Ent. Soc. Phil., II, 1863, p. 29) and Rowley has briefly recorded all the stages (Ent. News, XXI, 1910, pp. 112, 113).

***Catocala illecta* Walker**

OVUM.—Base flat; apex considerably flattened; otherwise hemispherical; micropylar area rather more extended than usual, consisting of small cells; from this area about 30 rather broad but scarcely raised radial ribs, a few of which are branched, descend to the base; these ribs are not prominent and under the lens have a granular appearance.

The ova are apparently laid in groups in crevices of the bark and then overlaid with a sort of thin albuminous cement as in *ultronia* and allied species, thus rendering observation difficult as the cement is not soluble in water. Our description was drawn up from a few unfertile ova, laid in a crevice of a paper bag, received from Prof. R. R. Rowley of Louisiana, Missouri.

The number of larval stages is not yet known but is presumably five, with the normal number of four molts.

***Catocala abbreviatella* Grote**

OVUM.—Hemispherical; the micropylar area rather extended and consisting of small, irregularly hexagonal cells; remainder of egg with strong vertical, unbranched ribs, about 18 to 22 in number, which nearly all attain the micropylar area, there being only an occasional rib inserted interspaceally in the equatorial zone; faint transverse ribbing; base flat; color gray. Diameter, 1 mm.

Received through the kindness of Mr. C. E. Dodge, who was successful in obtaining a few eggs from a Nebraskan female in the summer of 1914; the larvæ, unfortunately, did not hatch.

Catocala coccinata Grote

OVUM.—Rather large; hemispherical; base flat; micropyle situated in a circular group of minute cells at apex of egg, surrounded by a slightly raised rim, beyond which are a couple of irregular rows of somewhat larger cells; surface of egg prominently ribbed with about 19 rather coarse vertical ribs, nearly all of which attain the micropylar area; transverse ribbing very faint; color brown. Diameter, 1.2 mm.

LARVA.—*Stage I*.—Head black. Body pale gray, with prominent black tubercles with long setæ; on first four abdominal segments are lateral brown patches, and there are six longitudinal brown lines.

Stage II.—Head pale, lined with black. Body purplish gray with three pale ochreous lateral stripes, to which the six dark lines of the preceding stage act as border lines; tubercles black.

Stage III.—Paler than the preceding stage. Head heavily marked with black. Body pale purplish, with longitudinal dark lines enclosing alternate light and dark spaces and forming a geminate pale dorsal stripe enlarging into the characteristic diamond patches and three pale lateral stripes; dorsally on the fifth abdominal segment is a strong black hump.

Stage IV.—Head pale in the lower portion; apical area creamy orange, this color descending half way down along the sides of the lobes and enclosing a dark, blackish, mottled patch; a black lateral line bordering lobes. Body purple-gray, with the stripes of the preceding stage less distinct; on the first abdominal segment above tubercle III a slightly paler patch; on fifth abdominal segment dorsally a very strong fleshy horn-like wart; prominent dorsal warts on the eighth abdominal segment bearing an enlarged tubercle II and bordered posteriorly with black; faint ochreous shade laterally on fifth and sixth abdominal segments crossed by indistinct darker lines; tubercles orange; lateral fringe present.

Stage V.—Head grayish in lower portion with black spot on each side of the clypeus; apically whitish with faint orange tinge below which is a dull purplish tint slightly marbled with whitish; a faint black lateral border line. Body purplish-gray heavily speckled with darker dots; all stripes of preceding stages indistinct, the pale dorsal diamonds slightly relieved by darker subdorsal bordering stripe; the upper dark border line of the first lateral stripe and a broken wavy line on a level with tubercle III rather distinct; all tubercles orange; a rather indistinct pale patch on the first abdominal segment laterally, shaded with darker posterior to tubercle III; prominent conical smoky-brown horn on the 5th abdominal segment bordered anteriorly at base with whitish; posterior to this horn the pale dorsal

stripe is quite evident bordered by a darker line; a pale brown lateral shade over fifth and sixth abdominal segments crossed by two dusky stripes, the upper (spiracular) being very distinct; on eighth abdominal segment tubercle II is very prominent, conical, with the usual oblique brown dash behind it; fringes white; beneath greenish white tinged with pink.

FOOD-PLANT.—Oak.

***Catocala ultronia* Hübner**

OVUM.—Laid in single rows in a crevice of bark (or fold of paper bag in confinement) and covered with a species of albuminous waterproof cement; circular, flattened greatly at both base and apex and resembling a miniature Dutch cheese; the sides show faint vertical ribbing, the ribs being broad, unbranched and of a rather granular character; color light brown. Diameter, 1 mm. The egg shows great similarity to that of *illecta*.

LARVA.—*Stage I*.—Head flat, pale red-brown, whitish frontally. Body of a general dirty black rather rough (after eating, smoother) appearance with small jet black tubercles which have long setæ. Under a lens the ground color is dirty gray-brown with three indistinct lateral red-brown stripes and a fourth broken subventral one; beneath dull olive.

Stage II.—Head dull red-brown streaked with black and whitish. Body deep greenish-gray with faint pale dorsal diamond patches and two waved lateral white lines.

Stage III.—Head pale ochre marked with black. Body deep black-brown lined with ochreous; dorsal tubercles reddish; fifth abdominal segment with a prominent dorsal hump and a lateral reddish patch preceded by pale shading; dorsally on first two abdominal segments pale streaks before tubercle II.

Stage IV.—Head bordered laterally with black, apex tipped with pinkish-red and marbled with purplish forming a slight blotch below the red color. Body pale to dark purplish with long pointed red-brown horn dorsally on the fifth abdominal segment shaded posteriorly with black; a ruddy lateral patch on same segment extending to between the prolegs and often preceded by pale shading; pale dorsal diamond patches and lateral stripes faintly visible; on first two abdominal segments there is often a white spot anterior to tubercle II; tubercles small, orange, arising from a whitish base; posterior to tubercle II on the eighth abdominal segment a black crescent; fringes pinkish.

Stage V.—Head pale purplish mottled with white frontally and shaded apically with pink; a heavy black border line. Body deep purplish heavily

mottled with black dots; on fifth abdominal segment a prominent dorsal red-brown pointed horn-like wart shaded with black around its base, and a rusty brown lateral patch crossed by a darker spiracular stripe and often preceded by whitish shading; dorsal tubercles pale orange, those of the first abdominal segment often preceded by a white dot, which is of rarer occurrence on the following segment; lateral tubercles small, whitish; lateral pale stripes scarcely to be traced; dorsal stripe rather evident behind the horn-like wart; an oblique black stripe posterior to tubercle II on the eighth abdominal segment and slight black sprinkling on the seventh one; fringes pinkish; beneath bright pink. Legs purplish marked with black.

FOOD-PLANTS.— Wild cherry, plum, and apple.

A description of the mature larva was given by Saunders in Can. Ent., VI, 1874, p. 147.

Catocala mira Grote

OVUM.— Practically similar to that of *ultronia*, circular, flattened strongly at both ends, with faint lateral ribbing; eggs laid in rows in a crevice and cemented over with a whitish waterproof mass.

LARVA.— *Stage I*.— Head pale red. Body dirty gray, with three broad lateral reddish lines and a fourth subventral one; tubercles black.

Stage II.— Head whitish, heavily marbled with black leaving a small space frontally. Body deep gray, paler dorsally, with three irregular whitish dorsal lines; tubercles black. When fully grown traces of pale dorsal diamond patches and a small red dorsal wart on the fifth abdominal segment are evident.

Stage III.— Head heavily marbled with black with traces of white dashes frontally; apex of each lobe strongly bulging so that viewed from the side the head appears concave frontally. Body dark gray on thoracic segments, paler dorsally on first four abdominal segments, posterior to fifth abdominal segment almost black with the exception of a narrow pale dorsal stripe; first four abdominal segments with geminate black subdorsal lines posterior to tubercle II; fifth abdominal segment with strong horn-like dorsal wart tipped with red and shaded with black at the base; a black lateral patch descending to between the prolegs; tubercles black.

Stage IV.— Head with two strong apical humps, deep black-brown with white shading frontally below the apex of the clypeus; a black streak on each lobe parallel to the side of clypeus and terminating in a small round dot-like patch; humps tipped with orange; lobes laterally heavily lined with black. Body pale gray, speckled with black with no very evident lines; slight blackish markings behind tubercle II on the first four abdominal segments;

dorsally on the fifth abdominal segment the pointed horn-like wart is reddish-brown and laterally there is a brown patch crossed by three blackish stripes; tubercles orange, II being fairly large and followed on the eighth abdominal segment by a short oblique black stripe; filaments whitish. Length, 25 mm.

Stage V.—Head whitish above the mouth parts, with black streak as in preceding stage; upper half deep brown with the apex tinged with red and strongly bulging; a double black border line laterally, filled with brown, beyond which the color is paler grayish, heavily mottled. Body whitish to greenish-gray sprinkled with dark dots and with orange-red tubercles; a prominent pointed red horn dorsally on the fifth abdominal segment, and an olive-brown shade laterally crossed by three darker stripes; posterior to tubercle II dorsally the dark dotted lines define diamond patches on each segment, otherwise no distinct stripes are visible; fringes white; beneath greenish-white with black spots.

FOOD-PLANT.—Thorn (*Crataegus*).

From a few ova received from Prof. Rowley of Louisiana, Missouri, under the name of *polygama* we were successful in rearing several imagines of what we believe to be *mira* Grote. According to the larva this species must be very close to *crataegi* Saunders, whose original description was largely drawn up from the larva; as, however, we were unable to make our larvæ entirely fit in with Saunders' description and as we have never had the opportunity of breeding the true *crataegi* we keep the species separate. The adults differ from *crataegi*, just as indicated by Grote, in the lack of contrasting shades on primaries and the deeper yellow of secondaries; Grote's figure (III. Essay Pl. IV, fig. 43) is however very misleading and like most of the figures in the work far too highly colored. Hampson (Cat. Lep. Phal., XII, p. 166) makes both *mira* and *blandula* forms of *crataegi*, but *blandula* is certainly distinct as our breeding results have shown, and *mira* in our opinion should also be considered a valid species until at least the larval history of *crataegi* is fully known.

***Catocala blandula* Hulst**

OVUM.—Similar to those of *ultronia* and *mira*; circular, flat at both ends, cheese-shaped, laid in rows in a crevice and covered with a white, water-proof cement.

LARVA.—*Stage I*.—Head pale ochreous brown. Body pale olive-gray, with five red brown lateral lines, the first subdorsal on a level with tubercles I and II, the second above tubercle III, the third below III, and tending to broaden around lower edge of same partially enclosing the spiracle, the

fourth on a level with tubercle V, much broken and not continued beyond the fourth abdominal segment, the fifth below tubercle V and at the base of the prolegs; beneath are faint traces of central reddish-brown patches. Length (just emerged), 4 mm.

Stage II.—Head pale gray marbled with black-brown which forms two stripes running obliquely backward from vertex of clypeus to apex of head. Body now appears dirty black-brown with the pale whitish color of the previous stage showing distinctly as a dorsal stripe forming diamond-shaped enlargements as far as the fourth abdominal segment and posterior to this evenly broad; two whitish waved lateral lines in the area between tubercles II and III, the latter tubercle being just touched by the lower line; on the first four abdominal segments the dorsal diamond patches are only separated from the first pale lateral line by a thin black line and show traces of a centrodorsal dark line and a broken dark line anterior to tubercle II; below tubercle IV is a third pale lateral line; tubercles with the exception of I rather large, black, laterally usually ringed with white; spiracle ringed with white. When full-grown traces of a white dorsal wart on fifth abdominal segment are visible.

Stage III.—Head whitish marbled with black, stripes as before but connected apically with a black lateral band which curves around sides of head to the ocellar region. Body pale whitish marbled and marked with velvety black; dorsal pale line of previous stage much broadened on metathoracic and first two abdominal segments into Λ shaped patches with apex pointing forward and situated between tubercles II of each segment; these marks are greatly accentuated by broad velvety black shading extending forward from tubercle I of the following segment and broadest at the apex of the Λ which is filled with a cream-colored shade; on the third and fourth abdominal segments these marks are present but much reduced in size; posterior to the fifth abdominal segment the dorsal stripe is evenly broad and the whole lateral area more or less suffused with black, sharply defined anteriorly by a line anterior to tubercle II of the fifth abdominal segment which shows dorsally a small orange wart; tubercle II slightly tinted with orange, especially on rear segments; traces of three pale waved lateral lines; lateral area on anterior portion of fifth abdominal segment rather paler, only slightly mottled with olive-brown; slight traces of lateral filaments. Length, 18 mm.

Stage IV.—Head pale gray marbled with brown with black blotch near the apex of each lobe tipped above with orange; a black encircling band. Body green-gray, tubercles orange, II being rather large; a small orange dorsal hump on the fifth abdominal segment and a lateral orange patch extending to the anterior portion of sixth segment; there is a heavy sprink-

ling of black dots which form more or less broken longitudinal lines; the most prominent feature is the deepening of the dark, subdorsal lines bordering the dorsal diamond patches on the metathorax and first four abdominal segments and the lateral line just below tubercle II, these now forming W marks more or less filled in with black and enclosing tubercle II; a short oblique black line posterior to tubercle II on the eighth abdominal segment; lateral filaments pale; beneath white with black central patches. Length, 30 mm.

Stage V.— Head whitish marbled with pale purplish which forms a blotch below apex of head and above which is a slight pink shade; a black lateral bordering band, descending to palpi and tinted with orange in its upper half. Body green-gray to purple-gray, heavily mottled with olive-brown dots; dorsally the lines of dots bordering the dorsal diamond patches are fairly distinct on the rear portion of each segment; tubercles orange, II being quite prominent; the dorsal hump on the fifth abdominal segment is slightly larger than tubercle II, gray, lined with pinkish, rather truncate and pointed backward; tubercle II of the eighth abdominal segment conical, margined posteriorly with orange and black; yellow-orange patch laterally on fifth abdominal segment broken by pale dorsal stripe and crossed by deeper supra- and subspiracular bands; filaments whitish. Length, 42 mm.

FOOD-PLANT.— Thorn (*Crataegus*).

A few ova of this species were received from Hymers in Northern Ontario and successfully reared to the imaginal stage. The larva is quite distinct from that of *mira* and the species is undoubtedly a valid one.

***Catocala similis* Edwards**

OVUM.— Similar to that of *mira* and laid in a similar manner.

LARVA.— *Stage I.*— Head and tubercles black. Body pale gray with three brown lateral lines and a fourth subspiracular one.

Stage II.— Head black. Body light purple-brown with pale grayish dorsal stripe showing traces of diamond patches, two whitish lateral stripes, and traces of a pale subspiracular stripe.

Stage III.— Much as in preceding stage, head slightly lined with white; a geminate pale dorsal stripe broadening at intervals to form diamond patches; three pale waved lateral stripes with dorsal border lines; a slight black wart dorsally on the fifth abdominal segment; tubercles black.

Stage IV.— Head white, tipped with orange and heavily marbled with black, leaving a white stripe on each side of the clypeus. Body purple-brown with stripes of preceding stage much fainter and border lines broken

up into dots giving a general mottled appearance; on fifth abdominal segment a small black dorsal wart, tipped with orange, and a diffuse blackish lateral shade; tubercles, notably II, orange with black oblique dash posterior to II on the eighth abdominal segment.

Stage V.—Head white, slightly tipped with reddish below which is heavy purple-brown marbling; a narrow black lateral border-line to lobes. Body rather evenly dark brown, very heavily mottled; dorsally the diamond patches are visible on the rear portion of each segment and laterally faint traces of pale stripes may be discovered; on the fifth abdominal segment is a small transverse dorsal wart, blackish, tipped with white, posterior to which the rear portion of the fifth and the anterior portion of the sixth segments are rather darker than the general ground color; tubercles pale reddish with a whitish base, tubercles I and II on first abdominal segment being however often black with a slight whitish patch lateral to them. Legs pinkish. Length, 35 to 40 mm.

FOOD-PLANT.—Oak.

Catocala micronympha Guenée

OVUM.—Similar to those of *ultronia*, *mira* and *similis*, laid in a crevice and cemented over in the same manner.

LARVA.—*Stage I*.—Head brown-black. Body pale gray with traces of a brown stripe on a level with tubercle II; two lateral brown stripes, the second one touching a series of brown spots resting on tubercle III of which those on the first four abdominal segments are most prominent; traces of a subspiracular brown line; tubercles black.

The young larva is quite typical of the oak-feeders.

Stage II.—Head white frontally with an open black V above the apex of the clypeus and two dark dots; laterally striated with black. Body much as before when freshly over the molt but later approaching close to the following stage, owing to a darkening of the ground color.

Stage III.—Head white frontally with a black dot on each side of the clypeus and a black V mark above the apex of same; between the forks of this V and laterally on lobes are longitudinal black striations. Body pale yellowish, shaded on the segments posterior to the fifth abdominal with black; a white geminate dorsal line forming diamond patches as far as the fifth abdominal segment, these being defined outwardly with blackish posterior to tubercle II on each segment; three pale lateral stripes edged with brown and traces of lateral brown patches; a small white wart dorsally on the fifth abdominal segment and a not very pronounced blackish lateral shade; beneath white with strong black patches. Prolegs pale.

Stage IV.—Very similar to the preceding stage with dark subdorsal patches on the rear of the first four abdominal segments accentuated and black lateral patch stronger.

Stage V.—Head whitish tipped with orange-brown, below which is a black network of lines; a black bordering stripe to lobes composed of interlaced lines and filled with orange in its upper portion. Body whitish-gray dotted and streaked with black; pale dorsal diamonds rather distinct owing to the black bordering lines of dots; lateral to these on the posterior half of the first four abdominal segments are black shade dashes enclosing tubercle II; tubercles orange, ringed with black; hump of the fifth abdominal segment bluntly conical, whitish, with deep brown lateral patch crossed by three velvety black stripes and preceded by some palish shading extending to tubercle II of fourth abdominal segment; a similar pale area laterally on the first abdominal segment; traces of pale lateral stripes due largely to the accentuating lines of dark dots; a black oblique stripe posterior to tubercle II on the eighth abdominal segment; lateral fringe sparse; beneath greenish white with deep brown patches. Length, 30 to 40 mm.

FOOD-PLANT.—Oak.

Ova received from Mr. Reiff of Boston labelled *jacquenetta* were the source of the above notes, but all the larvæ perished in the pupal stage so we were unable to verify the identification, although we presume it to be correct.

