THE LIFE-HISTORIES OF THE NEW YORK SLUG-CATERPILLARS.—XVIII.

PLATE I, FIGS. 1–10.

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Natada nasoni *Grote.*

1876—*Sisyrosea nasoni* GROTE, Can. Ent. VIII, 112.
1882—*Limacodes rude* HY. EDWARDS, Papilio, II, 12.
1887—*Perola daona* DRUCE, Biol. Cent.-Am., Lep. Het. I, 219; pl. 23, f. 11.
1892—*Sicyrosea nasoni* and *rude*, KIRBY, Cat. Lep. Het. I, 554.
1892—*Perola daona* KIRBY, Cat. Lep. Het. I, 532.
1894—*Sisyrosea nasoni* NEUMOEGEN & DYAR, JOURN. N. Y. ENT. SOC. II, 70.

LARVA.

1878—GLOVER, Ill. N. Am. Ent. pl. 11, fig. 9.
1898—DYAR, Psyche, VIII, 173.
1898—BEUTENMÜLLER, Bull. Am. Mus. N. H. X, 395.

SPECIAL STRUCTURAL CHARACTERS.

Dorsal space broad, even, a very little narrowed at either end, widest centrally, though almost perfectly uniform, flat; lateral space broad, steep, almost perpendicular, straight, not concave nor flared at base, of uniform width, rounded, narrowed to the terminal joints 3 and 13; subventral space strongly retracted and so short that the lateral horns almost touch the leaf. Outline a parallelogram, slightly rounded, scarcely elliptical. Ridges slight, indicated by the horns. These are flexible in the subdorsal row, bent outward at will, normal in arrangement for the spined Eucleids, short, thick and rounded. The subdorsal horns extend at an angle of 45° when erected, those of joints 3 to 5 being larger than the rest except that of joint 13 which is longer and more slender. Lateral horns horizontal, those of joints 5 and 12 slender and longer than the subdorsals of the same segments, markedly shortened at the last moult. The spines on the horns are of the normal stinging type after stage I, but not very numerous, while the marginal ones are club-shaped and setiferous. Those on the large horns are stained with black pigment, some even banded black and white. In stage I the horns are surmounted by a central swollen-tipped seta and a series in a circle as in *Sisyrosea textula* on the anterior and posterior segments, but centrally reduced to three setæ of

equal length, with the others rudimentary at the base, or absent. Depressed spaces represented by whitish spots, distinct but unmodified at the surface of the skin; (1) paired and alternating with (2) in the dorsal space; (4) and (6) on the posterior half of the segment in the lateral space in an unpigmented area; (5) indistinguishable. The spiracle of joint 5 is above the line of the lateral horns. No caltropes or detachable spines are present. Skin at first wrinkled shagreened, later finely granular. This larva neatly connects *Sisyrosea textula* with the other spined Eucleids. The horns are of nearly equal length as in *S. textula*, but the three anterior ones are a little lengthened, while the subdorsal of joint 8 is not, thus foreshadowing the structure of *Sibine*. The general shape is that of the spined Euclids, not specially flattened as in *S. textula*, though the lateral horns are longer than the subdorsals at one stage, indicating an affinity with *Sisyrosea* that is shown also in the wrinkled skin, the depressed spaces situated in posterior pigmentless areas separated by raised bars, the absence of caltropes, etc. The similarity is by far greatest in the early stages and the two larvæ continually diverge during ontogeny. Stage I is almost the same as in *S. textula*. Examples of the latter occur with the central horns partly degenerated as in *N. nasoni*. This condition is an evident approach to the three-spined horns of the higher member of the groups such as *Sibine*, *Euclea*, *Parasa*, etc.

AFFINITIES, HABITS, ETC.

This larva represents the oldest type of spined Eucleid, possessing true stinging spines, that is found in North America. The moth belongs to a wide-spread type. Species with exactly the same pattern of coloration occur in both India and Africa and one at least of them is congeneric with our species. I am not certain that it may not prove conspecific. *N. nasoni* occurs throughout the Southern States to Mexico. Mr. H. Druce has redescribed it from the latter country as *Perola daona* from Jalapa and Costa Rica. In New York State it finds its northern limit and has only a precarious foothold in the State. The occurrence is in a limited area through the hilly central portion of Long Island, including the towns of Ronkonkoma and Yaphank, where I have collected it. Southward it reappears at Plainfield, N. J., and further south is doubtless more wide-spread, although not often reported by collectors. It is not rare in the District of Columbia.

The moths emerge at the end of June and early in July. The emer-

gence takes place late in the afternoon or early evening, flight occurs early, pairing the same night and the eggs begin to be laid the following night. They are placed singly or in small groups on the under sides of the leaves. The larvæ are found usually several on the same plant on low shrubs or the lower limbs of trees of their food plants. The first stage may be found rarely as late as the first of August, and the first mature larvæ early in September. There is but a single brood in the year. The larvæ rest on the under sides of the leaves, colored green, without conspicious marks. The stinging power of the spines is not great, and the subdorsal ones are bent down outwardly at maturity when not in use. There are eight larval stages, occasionally but seven by the omission of the normal stage III.

The sexes have different attitudes of rest. The ♀ moth sits with the body bent over the back, the wings closed beneath it and parallel to the twig, as is usual. The ♂ sits in the reverse position, the head hanging down, the body enclosed by the wings of which only the tips touch the twig. It holds loosely by the middle legs, which are partly extended, the other pairs being folded up. In this position the white dots at the bases of the forelegs and bases of antennæ are quite conspicuous. The ♀ does not exhibit the white dots, though possessing them.

CRITICISM OF PREVIOUS DESCRIPTIONS.

Glover gives a recognizable figure of the larva, life-size, but without identification. I have myself briefly referred to some of the characters in comparison with certain Australian forms.

DESCRIPTION OF THE SEVERAL STAGES IN DETAIL.

Egg. Elliptical, flat, very large, translucent whitish, shining; reticulations distinct, linear, irregularly quadrangular. Size, 2 x 1.6 x .1 mm.

Stage I. (Plate I, fig. 1.) Head whitish, eye black; body elliptical, dorsal space broadest anteriorly, not narrower centrally; segments fairly well marked; skin smooth. A subdorsal and a lateral row of thick, horn-like prominences, eleven in the subdorsal row (joints 3 to 13), nine in the lateral row (joints 3, 4, 6 to 12); the subdorsals of joints 3, 4 and 13 large, well developed, of the structure of *Sisyrosea textula*, an apical seta and radiating crown around it, all with enlarged tips (Plate I, fig. 3). The central subdorsals, as well

as the laterals (except on joints 3 and 4) have essentially the same structure, but are smaller and the setæ are partly reduced or degenerate, three setæ of equal length, with very rudimentary ones around the bases of these. The subdorsal row stand nearly erect, the lateral ones are horizontal. Color whitish, a faint, more opaque yellowish tint centrally on joints 6 to 9. Length 1.1 mm. The larva does not feed.

Stage II. As in stage II of *Sisyrosea textula*; dorsal space not rounded at joint 3, even, subdorsal horns nearly erect. There are 7 to 10 spines on a horn, the apical one not setiferous. Segmental incisures rather well marked. No depressed spaces, the skin pitted-shagreened, finely reticulate, the lines catching the light under a high power. Color greenish white, immaculate. Length, 1.1 to 1.8 mm.

Stage III. As in the next stage, but without color. Horns subequal, the subdorsals a little longer than the laterals, the subdorsal of joint 13 rather large and directed backward; lower spines of lateral horns bulbous and setiferous, the rest stinging spines, black tipped. Skin finely reticulate, granular, irregular, without definite form to the sculpturing. All pale green, a square, yellowish patch centrally, seen by transparency. Length, 1.8–2.8 mm. In seven-stage larvæ the length reaches 3.9 mm.

Stage IV. Elliptical, rather square before and behind; dorsal space moderate, lateral space a little broader, subventral space retracted, small. Horns normal in number (subdorsals on 3 to 13, laterals 3, 4, 6 to 12) short, rather thick, all alike, forming a regular ellipse from side view, the subdorsals of joints 3, 4, 5 and 13 and laterals of 3 and 4 a trifle stouter than the others. Each horn has about 15 black-tipped spines arising from conical bases. Color green, a faint yellow subdorsal line on joints 3 to 13, the pair parallel, a narrow broken yellow dorsal line; addorsal spaces appear as white dots and a larger yellow dot on joint 9 anteriorly. Horns concolorous except the subdorsals of joints 3 to 5, which are bright red, especially 4 and 5 (Plate I, fig. 4). Skin densely flat or concave-granular, shagreened, the joining of the obscure granules appearing like a fine reticulum. Depressed spaces (1) and (2) represented by pale dots, (4) as slight hollows without differentiation of the surface. At end of stage a yellow bridge joins spaces (1) on joint 9. Length, 2.8 to 3.9 mm.

Stage V. Essentially as before. The subdorsal horns of 3, 4, 5

and 13 are a little larger than the others, those of joints 4 and 5 bright red, that of 3 as well as the laterals of 3 and 4, pale red; all the rest green. An obscure yellow line along the subdorsal ridge on joints 3 to 12 connects the horns in a series of lunate dashes; a dorsal row of segmental pale dots, largest on joint 11. Segmental incisures well marked in paler lines. Body green from the blood, brighter anteriorly. The addorsal depressed dots and the large lateral ones (4) are whitish. Horns short, rounded, not much tapering, well spined. Skin very finely densely clear granular, the granules much like those in the bottom of the depressed spaces of *H. flexuosa*.* Length, 3.7 to 6.0 mm.

Stage VI. Dorsal space moderately broad, even, flat or a little concave, only turning down at the ends; sides folded in above the lateral horns, concave, nearly perpendicular above; subventral space much contracted, the lateral horns touching the leaf. Subdorsal horns small, conical, projecting at an angle of 45° except those of joint 13, which project obliquely backward; 3 to 5 and 13 are a little the largest. Lateral horns distinctly longer than the subdorsals, bearing several swollen-tipped setiferous spines among the others. Clear leaf green, horns of joints 3 and 4 and the subdorsals of 5 and 13 red, 13 the palest; a narrow yellow subdorsal line; a geminate dorsal yellow line composed of a double series of lunate marks, which enclose the addorsal dots in the concavities and touch the paired dorsal dots with their apices (Plate I, fig. 5). This marking is faint on joints 3 and 13. On the sides, the reniform (4) and round (6) spots are whitish in a single large depressed area, cutting off the front of the segment as a dark green bar. The paired dorsal dot on joint 9 is now scarcely defined from the regular dorsal marking. Skin uniformly granular shagreened, the sides of the low granules radially corrugated to the base. Horns granular; spines of the red horns blacker than the others. No caltropes. Length, 6 to 9.3 mm.

Stage VII. Elongate, dorsum flat, sides not narrowed till the ends, the lateral horns almost touching the leaf. Bright green, the narrow, pale yellow subdorsal lines of joints 4 to 13, joined by a straight line

* The skin structure is practically the same in stages II to IV, showing under the microscope shining lines in small, dense, irregularly hexagonal reticulations, not revealing a very definite structure (Plate I, fig. 8). It is the same as in *S. textula*, but the reticulations are more regular, distinctly round, not elongate. In *S. textula* they are elongate, somewhat sinuate and more confused. After stage IV the larvæ diverge, *nasoni* becoming granular.

between the horns of joint 4 enclosing a double pale waved line of nine loops around the paired dorsal dots, much as in the next stage (Plate I, fig. 6); a tiny single dot between the pairs of (1). Between the horns of joints 3 and 4 are six dots; a bar before the last pair. On the sides the white dots (4) and (6) are in large reniform pigmentless areas with a whitish bordering line. Horns all red tipped, the former red ones the brightest. Spines black and white, some banded, darkest on the largest horns. Skin very finely subconic, or pointed granular, not shagreened except slightly at the bases of the subdorsal horns above. No caltropes, but the spines of the latera horns are short and dense at base. Length, 9.3–13.5 mm.

Stage VIII. Shape as described, the side horns suddenly shortened to less than half their former length. They are now shorter than the subdorsals which become contractile on joints 4 to 12 and are bent outward, appressed to the sides. Subdorsal horns of 3 and lateral of 3 and 4 are small and short, the laterals of 6 to 12 green, broad and low, not as long as wide, with only a few short spines and some clubbed ones on the lower outer side. Subdorsals of joints 5 to 12 red, forming round cushions not as long as wide, bearing a tuft of banded or black-tipped spines at the apex; on joint 13 longer and tapering, pinkish red. Body green, well pigmented, apparently uniformly in both bars and spaces down to and surrounding the lateral horns. Depressed spaces (1), (2), (4) and (6) and the pattern of lines more distinct than before, pale whitish, the subdorsal line narrow, concolorous and uniform with the other lines (Plate I, fig. 6).

Depressed space (1) forms a long curved slit instead of paired dots as before, and there is a pale dot behind it. Skin nearly continuously conic, clear granular, horns, depressed spaces and all, the green pigment situated in the bases of the granules just as the red is in *Euclea indetermina*, absent in the light markings which are colored only by the blood. Spines with sharp black tip, shaft white, often banded, the degenerated ones clubbed (Plate I, fig. 9); some at the bases of the horns are very small. (Plate I, fig. 2.) Length, 13.5 to 18.3 mm. The color for pupation is only a slight paling. The larva still rests on the leaf for twenty-one hours, the horns dull red, erected. Finally it voids a little clear fluid and enters the ground to spin.

Cocoon. With the characters of the group, but thin, less firm in texture than usual and more blackish in color.

Food plants. Black oak, hickory, chestnut, beech and ironwood.

EXPLANATION OF PLATE I.

Fig. 1. Larva, stage I, enlarged.
" 2. Horns of last stage, enlarged; lateral horn above, subdorsal below.
" 3. A single horn of stage I, enlarged (joint 3).
" 4. Larva, stage IV, dorsal view.
" 5. Pattern of dorsal marking, stage V.
" 6. Mature larva, three-quarters view, enlarged.
" 7. The same, front view.
" 8. Skin sculpture, stage IV.
" 9. Some of the spines enlarged.
" 10. Moth of *Natada nasoni*.

LIFE-HISTORY OF DIPHTHERA FALLAX *H.-S.*

BY HARRISON G. DYAR.

This larva possesses the characters of the Apatelæ, having many-haired warts. The warts degenerate during ontogeny, becoming functionless. The nearest allies seem to be *Polygrammate hebraicum* and *Harrisimemna trisignata*.

Egg.—Circular, much flattened, domed, about 48 ribs, diminishing by confluence toward vertex, which is irregularly reticularly ribbed; ribs slightly fluted, the space smooth, finely punctate shagreened; no cross striæ; micropyle smooth. Waxy white, scarcely shiny, no marks; diameter, 1 mm.; height, 2 mm.

Stage I.—Head rounded, eye black, mouth brown, otherwise translucent, colorless; width, .25 mm. Body translucent, slightly whitish; segments convex; hairs white, spinulose, single, i to v present, i slightly blackish except on joint 11 which looks paler; hairs equal, quite distinct, iv above v; no subprimaries; feet normal.

Stage II.—Head slightly bilobed, colorless; width. 4 mm., warts almost in line transversely, iv nearly imperceptible; all with central hair and distinct crown of long hairs. Hairs pale, except the central one of warts i and ii which are black. Translucent green from the foot with faint traces of a white subdorsal line.

Stage III.—Head whitish green; width .75 mm. Body somewhat flattened, especially behind; head retracted at apex. Body clear green with narrow white subdorsal line and a broken dorsal one. Warts moderate, i and ii on joint 12 in a square; iv behind the upper edge of the spiracle, v just below, iv and v about equal, vi large. Hairs quite numerous, short, pale and black mixed, spinulose. Later all the warts are narrowly pale brown. Body narrowed behind.