

Article XIX.—TRANSFORMATIONS OF SOME NORTH AMERICAN HAWK-MOTHS.

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The following notes on transformation of some Sphingidæ were made during the past summer, and nearly all the eggs were received through the kindness of Mr. Jacob Doll.

Sphinx drupiferarum A. & S.

Egg.—Oval, longer than broad, pale whitish green, smooth. Length, 1.5 mm.; width, 1.25 mm.; height, 1 mm. Laid June 11; emerged June 16. Length of young larva, 2 mm.

Stage I.—Head globular, smooth. Wholly pale whitish with a faint trace of a greenish tinge and no traces of the characteristic oblique bands on each side. Caudal horn rather long, black. Under the lens the larva is regularly transversely wrinkled, and as it grows older, faint traces of a whitish subdorsal stripe appears. Length, 8 mm.; caudal horn, 2 mm. Moulded June 22.

Stage II.—Head finely granulated. Body pale green along the sides and whitish along the dorsal region. Along each side is a fine whitish subdorsal line and oblique stripes along the sides. Caudal horn reddish. Legs green, with black tips; thoracic feet pinkish. The subdorsal line, as the larva grows older, becomes broken and is quite indistinct. Length, 18 mm. Moulded June 27.

Stage III.—The body is now apple green, the caudal horn redder, and the oblique stripes more distinct—whitish in the middle, greenish at each end and carmine red in front. Body and head rather strongly granulated. In some individuals the red on the oblique stripe is absent. Length, 30 mm. Moulded July 2.

Stage IV.—Body green, granulated, with the oblique stripes on each side pure white, with violet in front. Thoracic feet pink, yellow at their bases. Length, 43 mm. Moulded July 6.

Stage V.—Head large, rugose, green, with a broad russian leather red stripe on each side. Body smooth, without granulations, pale pea green, darker at the extreme sides and beneath; the oblique stripes are broad, bright violet-

purple in front and narrowly white behind. Caudal horn russian leather red. Thoracic feet russian leather red, with their basal halves yellow. Spiracles pale orange. Abdominal legs green, extremities black and preceded by a narrow yellow ring. Mouth parts black. Length, 80–85 mm. Fully grown, July 14–17. Formed pupæ July 18 and 21.

Pupa.—Rather large and stout, pitchy brown, segments rugosely punctured, junctions of segments dull, exceedingly finely and regularly wrinkled. Thorax and head rugose, wing-cases slightly rugose. Tongue-case closely applied to the chest. Length, 50–52 mm.; width, 13 mm.; tongue-case, 10 mm.

The eggs were received from Mr. J. Doll, who found them on Long Island on wild cherry (*Prunus serotina*). The young larvæ, however, would not eat the leaves of this tree, and they all died. Another lot of eggs were sent me by Mr. Doll, and they were fed and raised to maturity on a species of cultivated Japanese cherry, on which they thrived very well. Mr. Doll informs me that he was likewise unable to raise his larvæ of *drupiferarum* on *Prunus serotina*. They also feed on beach plum (*Prunus maritima*), cultivated plum and cherry, and are said to also feed on hackberry (*Celtis occidentalis*). I have found the eggs on *Prunus pennsylvanicus*. My larvæ also refused to eat the leaves of cultivated apple.

Sphinx lucitiosa Clem.

Egg.—Globular, smooth, shining, pale green, slightly longer than broad. Length, 1.25 mm.; width, 1 mm.; height, 1 mm. Laid June 4; emerged June 9. Length of young larva, 1.5 mm.

Stage I.—Wholly pale yellowish white, without any marking whatever. Caudal horn black. As the larva grows older it is regularly covered with transverse rows of minute white dots, and on each side is a very narrow white subdorsal stripe. Length, 7 mm. Moulded June 15.

Stage II.—Head globular, with numerous fine granulations. Body granulated, pale green along the sides, whitish green along the dorsal region, and a subdorsal stripe on each side. Abdominal and thoracic feet green. Along each side are faint traces of oblique bands composed of granulations. Caudal horn black. Length, 14 mm. Moulded June 20.

Stage III.—Head as in the previous stage, but with a yellow stripe on each side. Body with numerous yellow granulations and a yellow subdorsal stripe running from the head to the end of the third segment. The oblique lateral

bands are yellow and very distinct. Dorsal region paler green than the sides of the body. Caudal horn brownish on top, yellowish at sides and beneath. Length, 18 mm. Moulded June 23.

Stage IV.—Similar to the last stage, but the caudal horn is much stouter and pale greenish with a pinkish tinge or is wholly green. The oblique lateral bands are yellow behind, whitish in the middle and pink in front. Head with a broad, bright yellow stripe on each side, and on the body is a short, yellow, subdorsal stripe on the anterior segments. Thoracic feet yellowish at base, claret red at tip. Body bright yellowish green, paler along the back. Length, 33 mm. Moulded June 29.

Stage V.—Head smooth, with a broad yellow stripe on each side in front. Thoracic feet yellow and tipped with red. Body bright yellowish green, entirely smooth, the granulations being reduced to yellowish dots. On the second and third segments there are many white dots encircled with black. The oblique lateral bands are finely black in front, carmine red in the middle and white behind. The white on the last band reaches to the base of the caudal horn, which is green, with a broad black stripe on each side. When fully grown the larva becomes apple green, smooth and darker on the first, second and third segments. The oblique bands lose the black on the anterior part, and they are bright carmine red in front and clear white behind. The head is somewhat rugose, apple green, with the yellow stripe on each side pale green. The thoracic feet are pale yellow at base and cherry red at their tips. Anal and abdominal legs wholly green. Spiracles pale orange. In some individuals the carmine of the lateral bands is inclined to be purplish. Length, 60 mm. Fully fed July 9, 11 and 13. Head, 5.5 mm. wide; 5.75 mm. high.

Pupa.—Rather small, pitchy brown, rugosely punctured and wrinkled. Tongue-case very short, slightly curved or straight. Projection on last segment rather long and stout at base, sharply pointed at tip with two very small spines. Length, 34 mm.; width, 10 mm.; tongue-case, 3 mm.; anal projection, 4 mm.

The eggs were received from Mr. J. Doll. They were found on the leaves of willow (*Salix discolor?*), and it is possible that they will also feed on other species of willow. My larvæ were raised on Lombardy poplar.

***Sphinx kalmiæ* A. & S.**

Egg.—Oval, smooth, pale semitranslucent whitish green. Laid June 22. Emerged June 28, 1896. Length of young larva, 1.5 mm.

Stage I.—Wholly pale whitish. Caudal horn black. As it grows older the body becomes greenish and there appear faint traces of a whitish subdorsal line on each side. Length, 12 mm.

Stage II.—Greener than in the last stage, with a fine white subdorsal stripe and fine white oblique lateral bands. Head and body finely granulated. Caudal horn black, with short black bristles, like spines at the tip. Body along the back whitish green, somewhat darker green along the sides. Legs and feet wholly green. Length, 18 mm. Moulded July 5 and 6.

Stage III.—The head is now bright apple green, with a yellow stripe on each side. The body is also bright apple green at the sides and beneath; along the dorsal region, pale whitish green. Caudal horn bluish, with short black spines. The oblique bands are now blue black in front, white in the middle and yellow behind. The granulations on the anterior segments are more numerous than on the sides. Length, 22–25 mm. Moulded July 7 and 8.

Stage IV.—Head with a yellow or yellow and black stripe on each side. The body is now much smoother than in the preceding stage, and the oblique bands are sky blue in front, white in the middle and yellow behind, the yellow of the last band running to the base of the caudal horn, which is blue at the basal half on top, yellowish green beneath, and outer half jet black, with black spines. Thoracic feet black, white at their bases, with a narrow black ring. Abdominal and anal legs green. Anal plates with black granulations. Length, 36 mm. Moulded July 10, 11, 12 and 13.

Stage V.—Body now entirely smooth and without granulations, bright green, and much paler along the back than along the sides. Head rather small, with a broad jet black stripe on each side and a light yellowish green one before the black one. The oblique lateral bands are now broadly jet black, finely white along the middle and broadly canary yellow behind. Caudal horn blue, with jet black granulations. Spiracles pale orange. Thoracic feet black, with a bluish ring at their bases. Abdominal legs green inside, with a jet black band outside at the base and at the extremities, and yellowish green between. Anal plates with black granulations; extremities black. Length, when fully grown, 65 mm. Stopped feeding July 14–18. Formed pupæ July 16, 18, 19, 20 and 21. Moths emerged August 1, 3, 4, 5, 6 and 7.

Pupa.—Deep chestnut brown, wing-cases and thorax pitchy brown, as are also the leg-cases, which are streaked at their junction with light chestnut color. Tongue-case slightly curved, stout, about one-third the length of the wing-cases. Anal projection rather short. Length, 42 mm.; width, 11 mm.; tongue-case, 8 mm.; anal projection, 2 mm.

The eggs were obtained from a female collected at light at Greenwood Lake, New Jersey, and the larvæ were raised on lilac. They also feed on laurel, ash, privet and *Chionanthus*.

Sphinx plebeius Fabr.

Egg.—Pale green, smooth, shining, very slightly longer than broad. Length, 1.2 mm.; width, 1 mm.; height, .75 mm. Emerged July 15. Length of young larva, 1.5 mm.

Stage I.—Wholly pale shining green, with a subdorsal stripe of a whitish color along each side, and a finer one along the extreme sides. Head minutely granulate. Length, 12 mm. Moulded July 19.

Stage II.—Head and body regularly granulated; body apple green above, bluish green at the extreme sides and underneath. The oblique lateral bands are yellowish white, and the subdorsal stripe yellow and composed of granulations from the anterior edge of the first segment to the end of the third segment. Caudal horn rather long, bluish above, greenish at the sides and beneath, and with a few blackish points. Length, 22 mm. Moulded July 21.

Stage III.—Body above apple green laterally, and beneath blue green, finely granulated, with the short granulated subdorsal stripe as in the last stage. The oblique lateral bands are yellowish green and whitish green as they enter the paler color on the dorsal region, and whitish in the bluish green lateral portion of the body. First three segments above and below apple green, as also are the thoracic feet. Abdominal and anal legs blue green. Caudal horn bluish with the tip green. Spiracles orange. Length, 35 mm. Moulded July 24 and 25.

Stage IV.—The dorsal region of the body is now bright yellowish green and the sides and underneath bluish green, standing in strong contrast to the color along the dorsal region. The oblique bands are yellow as they enter into the yellowish green color on the back, and whitish green at the sides. Caudal horn bluish lead color. Body dotted with yellow granular dots at the sides and beneath with whitish. First three segments wholly green, with a subdorsal line composed of yellow granular dots. Head globose, with greenish white granules. Spiracles cream color, black at each side. At the sides of the body behind each oblique band on the bluish green lateral parts is a triangular bluish flush. In mature larvæ the caudal horn is decidedly blue, yellowish green on top, with yellow granules. Length, 68 mm. Entered the ground to pupate July 28 and 30. Formed pupæ July 31 and Aug. 2.

Pupa.—Bright shining chestnut brown, finely punctured. Tongue-case long, slender, straight and closely applied to the chest. Anal projection sharp, rather short, with two minute spines at tip. Length, 40 mm.; width, 11 mm.; tongue-case, 13 mm.; anal projection, 1.5 mm.

The eggs were received from Mr. J. Doll. The larvæ were fed on trumpet vine (*Tacoma radicans*), which seems to be, as far

as we know at present, its only food-plant. They passed through only three moults, instead of four or five, as is usually the case with other Sphingid larvæ. They fed very rapidly, it taking but sixteen days to reach maturity.

***Ceratomia undulosa* (Walker).**

Egg.—Pale green, smooth, shining, longer than broad. Length, 1.5 mm. ; width, 1.25 mm. ; height, 1 mm. Laid June 8. Emerged June 13.

Stage I.—Head subtriangular. Wholly pale green, with a narrow, pale yellow subdorsal stripe along each side of the body. Caudal horn pale brown. Length, 10 mm. Moulded June 18 and 19.

Stage II.—Pale green ; body transversely wrinkled, with the subdorsal yellow stripe broader and more distinct than in the previous stage. Caudal horn reddish black. Head granulated, with an indistinct yellow stripe on each side. Length, 15 mm. ; caudal horn, 3 mm. Moulded June 20 and 21.

Stage III.—In this stage the subdorsal stripe is very conspicuous, being clear yellow and quite broad. The stripe on each side of the head is also broad and clear yellow. Along each side of the body are seven yellow, oblique bands, which become white as they reach the subdorsal stripe. In some individuals there is a row of red spots along each side, one spot on each segment, situated on the subdorsal stripe from the fourth to the tenth segment inclusive. On the stripe of the head is also a red spot. Spiracles orange. Caudal horn long and stout, reddish, with very short spines. The body color is yellowish green above and brighter green beneath. As the larvæ grow older the subdorsal stripe becomes broken by the oblique lateral bands, which are then very distinct and conspicuous. Length, 23 mm. ; caudal horn, 4 mm. Moulded June 25 and 26.

Stage IV.—Head subtriangular, almost smooth, with the stripe on each side broad. Anterior segments of the body with a few granulations ; sides of body pale green ; dorsal region yellowish green, with regular transverse wrinkles which are yellowish. The oblique bands are very distinct and quite broad, white at the middle, yellow at each end, and with a claret red streak on the anterior part of each ; in some specimens the red is absent, and in others there is a large carmine blotch before each oblique band, and one on the head on the yellow stripe. The last oblique stripe is very broad and does not run to the end of the caudal horn, as is the case with some species of Sphingid larvæ. Caudal horn is either rose red or pale violet with fine black granules. Length, 35 mm. Moulded June 29 and 30.

Stage V.—The larva is now entirely smooth, except the anal plates, which are finely granulated with black. The stripes on the head are now white instead of yellow. Body at the sides uniformly blue green, dorsal region yellowish green and transversely wrinkled. Spiracles large and conspicuous, white centrally and orange red outside. The oblique bands are conspicuously white and broad, and in some individuals reddish in front. Caudal horn pinkish. Thoracic feet pink, paler at the base. When fully grown the larvæ become grayish green along the sides and beneath, and remain yellowish green along the back. The stripes on the head become whitish flesh-color. The oblique lateral bands are whitish and yellow as they run into the reddish green color on the back. Caudal horn pinkish at the sides. Some individuals of the brood have the back very bright yellowish green; the head lilac with the stripes decidedly flesh-color, and before each oblique band is a large ferrugineous patch. Abdominal legs outside pinkish. Fully grown July 5-6. Length, 65 mm. Entered the ground for pupation July 6-7, and formed pupa July 9-11. Moths emerged July 22-23.

Pupa.—Dark chestnut brown, shining, without a tongue-case; anal projection rather short; segments punctured; wing-cases smooth. Length, 45 mm.

The eggs were obtained from a female collected in Hoboken, New Jersey, by Mr. W. Sachs, and the larvæ were raised on lilac. They also feed on ash and privet (*Ligustrum*), and are double brooded. Mr. Sachs informs me that one larva of the brood he raised was entirely ferrugineous.

***Smerinthus myops* (A. & S.).**

Egg.—Pale green, smooth, shining, longer than broad. Length, 1 mm.; width, .75 mm. Laid June 3. Emerged June 10.

Stage I.—Pale green, covered with short, pale sordid white hairs. Caudal horn green. Head globular and granulated. Length, 7 mm. Moulded June 15.

Stage II.—Head triangular with the granules larger, and along each side of the body is a short yellowish green subdorsal stripe running from the head to the end of the fourth segment; along the sides are also oblique yellowish green bands. Legs green; thoracic feet pink; caudal horn red. Length, 14 mm. Moulded June 20.

Stage III.—Body yellowish green, head decidedly triangular and forming a tubercular process at the apex, granulations canary yellow, as are also those on the body. The short subdorsal stripe is composed of granular serrations; lateral

oblique yellow bands distinct. Thoracic feet red. Caudal horn red with indications of the last oblique band at the sides. One specimen has a red spot on each side of the second and fifth segments. Length, 18 mm. Moulded June 24.

Stage IV.—Very much like the last stage, but the last oblique lateral band is clear yellow and runs to the end of the caudal horn, which is now entirely yellow. Length, 27 mm. Moulded June 28.

Stage V.—The body is now bright yellowish green above and below, covered with fine yellow granulations; the last oblique band is much brighter yellow and broader than the rest, and runs to the end of the caudal horn. Head triangular with the tubercles on the vertex much reduced. Spiracles white in the centre and red outside. Length, 40 mm. Fully grown July 5.

Pupa.—Similar to that of *S. excæcatus* and *S. geminatus*, but much smaller and more glossy. Segments rugosely punctured and shining, junctions of segment opaque. Wing-cases smooth and very shining. Tongue-case absent. Anal projections short. Length, 25–30 mm; width, 8–9 mm.

The eggs were received from Mr. J. Doll, and the larvæ were raised on wild cherry (*Prunus serotina*). As compared with *S. geminatus* and *excæcatus* the larva of *S. myops* differ from these by having the granulations on the body much finer, and the short subdorsal stripe on the anterior segments quite indistinct, while in *geminatus* and *excæcatus* this stripe is composed of prominent serrations. The lateral oblique bands of *myops* are also fainter.