REV. G. D. HULST.

We deeply regret to announce the death of the Rev. George Duryea Hulst, Ph. D., which took place suddenly on Monday, Nov. 5th, at his residence, 15 Himrod street, Brooklyn, N. Y. Mr. Hulst was in his fifty-fourth year, and had been pastor of the South Bushwick Reformed Church for over thirty years. In the entomological world he was widely known from his researches in the Lepidoptera, and especially for his work in the Geometridæ, in which family he was recognized as an authority. He was a frequent contributor to the pages of this magazine, and also published elsewhere many elaborate papers on his special department of study. His removal from among us, when in the prime of life, and with apparently many years of useful work before him, will be keenly regretted by systematic entomologists everywhere.

THE LIFE-HISTORY OF *ARCTIA PHALERATA*, HARR.

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On the 18th June, 1900, Mr. C. T. Hills, of Chicago, was kind enough to send me a batch of about 79 eggs of *Arctia phalerata*, Harr. The parent moth was captured on the 12th June, and enclosed in a box over night; on the next day, the 13th, the eggs were laid.

Egg.—75 mm. in width, semi-ovoid, about as high as wide, shiny, smooth, creamy-white, concave at base.

The eggs hatched on the 20th and 21st of June. Duration of egg stage 7 or 8 days.

Stage I.—Length 2 mm. General colour dirty cream. Head .3 mm. wide, bilobed, shiny, brownish-black, and bearing sparse slender hairs. On each segment is a transverse row of black tubercles, which appear to occur almost in a line in the middle of the segments. These tubercles bear long black and silvery hairs, and are situated in a light brownish field, which encircles each tubercle. On segments 5 to 12, inclusive, slightly nearer to centre of dorsum, and anterior to larger dorsal tubercles, are two smaller tubercles, which also bear one or two hairs. Thoracic feet and prolegs concolorous.

On the 23rd June the larvæ were swollen, and on the 24th they passed the first moult.

Stage II.—Length 3.5 mm. General colour, some blackish-brown with a light stripe on dorsum, others light brownish with a creamy stripe on dorsum. Head .5 to .6 mm. wide, sparsely covered with short light hairs and long slender dark hairs, bilobed, black at apex and on cheeks; frontal triangle whitish, with a slight tinge of brown. In the darker specimens almost the whole of the head is black. Dorsal tubercles large, with exception of the two anterior tubercles on segments 5 to 12, inclusive, which appear smaller, and are like minute dots. The large dorsal tubercles are now situated in a distinct light brown band. Lateral, stigmatal and ventral tubercles smaller than dorsal series, varying in size from lateral down. Between lateral and stigmatal series of tubercles are brownish blotches, which give the appearance of stripes, or bands. These markings are not so plain on the darker specimens. The bristles from dorsal tubercles are black, with the exception of the small tubercles on segments 5 to 12, inclusive, which bear one or two whitish hairs. Remaining tubercles bear blackish and whitish bristles. Stigmata brown. Thoracic feet and prolegs concolorous, darkened at tips.

On the 27th June most of the larvæ passed the second moult.

Stage III.—Length 5 mm. General appearance blackish hairy larvæ, with a pale yellowish stripe on dorsum, which is almost imperceptible in some specimens. In the majority of the specimens, however, this stripe was plainly distinguishable. Head .8 to 1.0 mm. wide, bilobed, shiny, brownish black, sparsely covered with long blackish hairs; frontal triangle lighter in colour, with dark centre, in some specimens all black. Dorsal tubercles large and shiny black, and bearing black bristles, varying in length, some long and some short. Medio-dorsal tubercles on segments 5 to 12, inclusive, are very small, and bear two or more short white hairs. This series of tubercles almost touches the pale yellowish dorsal stripe. Lateral, stigmatal and remaining tubercles smaller than dorsal tubercles, and bearing black and white bristles. In some specimens the skin of the body is a deep black, with the exception of the dorsal stripe; others are lighter in colour of skin, and have the appearance of two stripes on the sides, but this is due to the black shiny tubercles being more plainly noticeable than the skin. Stigmata dark brown. Thoracic feet concolorous, splashed with shiny black; prolegs concolorous.

On the 1st July a number of larvæ passed the third moult, and by the 3rd all had moulted.

Stage IV.—Length 7.5 mm. General appearance, black hairy larvæ, tubercles very prominent, some specimens having a yellowish dorsal stripe. Of the whole batch of 71 larvæ, the dorsal stripe was only present in seven specimens. In the majority of the other specimens just the faintest sign of this stripe was to be seen, while the remainder were perfectly black. Head 1.2 to 1.4 mm. wide, bilobed, shiny, brownish-black, sparsely covered with long blackish hairs. Bristles from dorsal tubercles black, with a few white hairs intermingled. The bristles from the stigmatal and ventral tubercles in this moult are of a light rusty hue, in some specimens much brighter than in others; there are also a few black bristles from these tubercles. The medio-dorsal tubercles on segments 5 to 12, inclusive, are very small and black in colour, bearing two or three bristles each. The dorsal tubercles are very large, and bear numerous black bristles. Stigmata black. Thoracic feet shiny, jet black, covered with short reddish and blackish hairs. Prolegs concolorous, rather translucent, light at tips.

On the 7th July three larvæ passed the fourth moult, and on the 8th the majority of the remainder moulted.

Stage V.—Length 11.5 mm. General appearance, black larvæ with black tubercles, bearing short and long black bristles, with rust-red bristles from tubercles on lower half of sides. Head 1.5 to 1.8 mm. wide, depressed at apex, shiny, black, sparsely covered with short whitish and long blackish hairs. The reddish bristles on dorsum of second segment turn down abruptly over the face, and give it a brownish appearance. The dorsal stripe has disappeared, and is not present in any of the specimens. Bristles from dorsal tubercles black, with a few grayish ones intermingled. On the 12th and 13th segments the dorsal tubercles bear one or two long hairs, black in colour, tipped with gray. The bristles from upper half of stigmatal tubercles are black, those from lower half, as well as all bristles below stigmata, rust-red. Spiracles black, with a light orange centre, with exception of those on 2nd and 12th segments, which are wholly bright orange. Thoracic feet shiny, jet black, covered sparsely with short rust-red bristles; prolegs concolorous, lighter at tips, also bearing short rust-red bristles.

On the 14th July three larvæ passed the fifth moult, and by the 17th nearly all had moulted.

Stage VI.—Length 15 mm. General appearance the same as after the fourth moult; the rust-red bristles on sides and dorsum of second segment appear brighter. Head 2.0 to 2.4 mm. wide, of about the same

size as the body, shiny, jet black, slightly depressed at apex, sparsely covered with slender blackish and silvery hairs, with a number of short light rust-red hairs around the mouth-parts. Bristles from the black tubercles on the dorsum, black. Dorsal tubercles on 12th and 13th segments bear three or four long hairs. Upper half of stigmatal tubercles bear black bristles, lower half rust-red bristles. Bristles from all tubercles beneath spiracles bright rust-red. On dorsum of segment 2 the bristles from front half of tubercles are bright rust-red. These turn down over the face, and give front portion of larvæ a reddish appearance. Spiracles orange, in some specimens faint. Skin of body deep velvety black. Thoracic feet shiny, jet black, sparsely covered with short rust-red bristles. Prolegs, upper two-thirds shiny, jet black; lower third and claspers dull reddish; the whole bearing short rust-red bristles.

On the 23rd July three larvæ passed the sixth moult, and by the 31st all but a few had moulted.

Stage VII.—Length 24 mm. General appearance, velvety black larvæ with black tubercles, bearing short stiff black bristles on dorsum, and bright rust-red bristles from the tubercles below stigmata. In some specimens there is a distinct clear ochre-yellow dorsal stripe, expanded somewhat in the middle of each segment. In others, instead of the dorsal stripe there is a series of elongated spots of the same colour, one on each segment; the number of spots constituting this series varies, some specimens having as many as nine, others only one or two. Head 2.5 to 2.8 mm. wide, slightly smaller than second segment; shiny, jet black, depressed at apex, and sparsely covered with short reddish hairs, and some long slender blackish hairs, the reddish hairs being mostly around the mouth-parts. Base of antennæ and mentum pale. Bristles from dorsal tubercles black. On dorsum of segment 2 the anterior half of tubercles bear rust-red bristles, which turn down over the face. In some specimens the bristles from tubercles on segment 2 are all reddish, with only a few black bristles. Dorsal tubercles on segment 3 also bear some rust-red bristles in some specimens. Medio-dorsal tubercles on segments 5 to 12, inclusive, bear a small bunch of short black bristles. Tubercles on dorsum of segments 12 and 13 bear a few longer black bristles. In some specimens all the dorsal tubercles bear a very few bristles of a dark rusty colour. Lower halves of the stigmatal tubercles bear bright rust-red bristles. All bristles below spiracles, including those from ventral tubercles, are bright rust-red. Tubercle i. small, about one-fifth size of tubercle ii.; tubercles

without shining base. Bristles smooth, not barbed. Stigmata bright orange. Thoracic feet shiny, jet black, dull brownish at tips, and sparsely covered with rust-red bristles, some short and some long. Prolegs, upper two-thirds shiny, jet black; lower third and claspers light rust-red, covered sparsely with short, reddish bristles.

Length of mature larva before spinning cocoon 30 mm., width at widest part 8.5 mm.

On the 26th July one larva passed the sixth moult, and showed the clear ochre-yellow dorsal stripe (rather faint on segments 2, 3 and 13). Another moulted the same day, and in this specimen, instead of the dorsal stripe, occurred a series of elongated ochre-yellow spots, one on each segment, from segment 4 to 12, inclusive. On the 26th July, also, seven more specimens passed the sixth moult, the ochre-yellow varying in these specimens from very faint elongated spots only on one or two segments, to a distinct dorsal stripe, faint on segments 2, 3 and 13. On the 28th one larva moulted, and in this instance the dorsal stripe was distinct, but only present on segments 8 to 12, inclusive. In this, the sixth and last moult, out of the whole batch of 64 larvæ, only 17 specimens showed the ochre-yellow on dorsum; the remaining 47 were perfectly black, and no dorsal stripe or spots whatever were present.

On the 1st August eight specimens began to spin their slight cocoons between the leaves, and on the following day changed to pupæ. In some later specimens it was two days before the pupa was formed, but in the majority of the specimens the change took place the following day.

The cocoon is very thin, and is simply a slight network or web of reddish-brown silk, covering the pupa. The larva draws the leaves of the food-plant together by means of threads of silk, or folds up a leaf, fastening the edges together, and spins its slight cocoon inside.

Pupa.—Length 19 mm., width at widest part 6 mm.; black slightly pruinose, abdomen minutely pitted, thorax and wing-cases slightly wrinkled, dull reddish-brown in folds of abdomen. Cremaster rough and short, rounded above and hollowed below, terminating in a bunch of about 20 capitate bright rust-red bristles of varying lengths.

On the morning of the 13th August four female moths emerged, and by the following morning five more females had appeared. During the afternoon of the 14th the first male moth emerged. The moths continued to emerge every day for about a week and a half.

Length of pupal stage about 12 days.

On the 23rd August two live females and one male, all of which had just emerged, were placed out of doors in a cage made of wire cloth, and two days later the females laid a large number of eggs.

On the 2nd September, 80 larvæ hatched, and by the 4th September 35 more had emerged. The description already made of this stage agreed with these specimens.

The larvæ which hatched on the 4th September passed the first moult on the morning of the 9th, and showed no difference from those described in former brood.

On the 12th September one larva passed the second moult, and many others on the following day. These also were the same as the specimens described previously.

On the 17th September a number passed the third moult, the remaining specimens moulting on the 18th and 19th. At this time the number of larvæ living was 85, and in this moult, out of the whole batch, 22 specimens showed the dorsal stripe; in three or four of these specimens the stripe was present on segments 3 to 11, inclusive, but in most of the specimens it was only observable on a few of the middle segments.

On the 25th September a number passed the fourth moult, and by the 28th nearly all had moulted. The larvæ in this moult showed no sign whatever of the dorsal stripe, and the description already given above of this stage answers well for this batch.

On the 4th October some passed the fifth moult, and by the 7th nearly all had moulted. These also corresponded with the description already made. In many of the specimens, however, the rust-red bristles on sides were not so bright or numerous as in the first lot of larvæ.

On the 16th October eight specimens passed the sixth moult. At this time—in fact, a few days earlier—the larvæ were very quiet, and had almost stopped feeding, only a very little frass being found each day in the breeding jars.

On the 18th October four more specimens passed the sixth moult. Of these 12 larvæ, only one specimen showed any sign of a dorsal stripe, and in this case the colour of the stripe was just a little lighter than the velvety black of the skin. The rust-red bristles from sides of these specimens were also not so bright or numerous as those already described. The hairs on the face were mostly blackish, and in some specimens none of the dorsal tubercles bore rust-red bristles.

From the 16th to the 26th October the larvæ had practically stopped feeding, and at this latter date they were put down in a cool cellar, to be left there throughout the winter.

Food-plant.—The larvæ of the first brood were fed on dandelion and plantain, those of the second on dandelion only.

In the Journal of the New York Entomological Society for March, 1900, Dr. Dyar publishes an article entitled "Preliminary Notes on the Larvæ of the Genus *Arctia*." In this paper some remarks are made regarding the mature larvæ of *Arctia phalerata* and *Arctia vittata*, and it is stated that "the matter is not decided beyond question as to whether *phalerata* or *vittata* has the larva with the dorsal stripe, or whether this is a specific character at all." The notes on the mature larvæ of *phalerata*, as given in the present paper, throw some light upon the matter, and it will be readily seen that the dorsal stripe is not a specific character, as it is present in some mature larvæ, and totally absent in others. This will agree with both Professor French's description and also with the notes of the Department of Agriculture at Washington.

With regard to *vittata*, I might say that on the 26th May last I found a specimen of the mature larva at Ottawa, which spun a very slight cocoon two days later, and produced the moth on the 1st June. This larva was a reddish, hairy caterpillar, with no sign whatever of a dorsal stripe, and not at all like those mentioned above.

The following description was taken from the cast skin and head of larva: Head 3.3 mm. wide, jet black, bearing sparse long slender blackish and reddish hairs, and some short rust-red hairs. Skin of body velvety black, tubercles rough, not polished, bearing bright rust-red bristles, those on dorsum slightly darker. Bristles smooth, not barbed. Tubercle i. about one-fifth size of tubercle ii. Thoracic feet blackish brown, covered sparsely with rust-red bristles.

Pupa.—Length 24 mm., width at widest part 8 mm.; black, pruinose, covered with a bloom similar to that on a ripe unrubbed plum; folds of abdominal segments with slight reddish tinge. Abdomen minutely pitted, wing-cases and thorax slightly wrinkled. Cremaster rough, short, rounded above, slightly hollowed beneath, and terminating in a bunch of about 18 capitate rust-red bristles of varying lengths.

From the first brood of *phalerata* 55 moths were bred. In over half of these specimens the costal edge of the primaries is narrowly black, that of the others being yellow. Dr. Dyar, in the above paper, says that the

costal edge of *phalerata* is yellow, and remarks that this may possibly be a distinguishing character between *phalerata* and *nais*, as the costal edge of all his specimens of the latter is black. This, of course, agrees with many of our specimens of *phalerata*, but on account of the black edging being present in the majority of those bred at Ottawa, it would appear that this character is not of specific importance. In about ten female specimens all the yellow markings on the primaries are suffused with the ruddy colour of the secondaries, but there is a remarkable lack of variation in the whole series, both with regard to colour and markings.

I beg gratefully to acknowledge assistance from Dr. Fletcher in confirming my notes in the above investigation, and also to Dr. Dyar for the determination of this species and of the specimen of *A. vittata* referred to above.

ENTOMOLOGICAL SOCIETY OF ONTARIO.

The thirty-seventh annual meeting of the Society was held in London on the 13th, 14th and 15th of November. On the first evening a joint meeting with the London Horticultural Society took place in the Normal School, and was very largely attended. Prof. James, Deputy Minister of Agriculture, presided, and gave an interesting address on the beneficial effects of the pursuit of horticulture. Mr. W. E. Saunders read a paper on "The planting, care and pruning of the trees in the parks and streets of the city," and was followed by Dr. James Fletcher, who gave an address, illustrated by lantern pictures, on the growth of trees, and the insect enemies of the flower and fruit garden.

The morning of the 14th was taken up with a business meeting of the Council. In the afternoon the various reports of the Directors, Officers, Branches and Sections were read, and then followed an important discussion on the San José scale in Ontario. Mr. Fisher, the Provincial Inspector, gave an account of the work that had been performed during the year for the repression of the scale, and the results that had been obtained from the use of various remedies. Dr. Fletcher, Prof. Webster (of Ohio), Prof. Lochhead, Mr. Dearness, Dr. Fyles, and others, took part in the discussion. The speakers insisted strongly upon the very dangerous character of this insect, its wide dissemination in several parts of the Province, and the destruction that would be surely wrought among the orchards and fruit plantations if stringent measures were not taken for its subjugation.

In the evening the Rev. Dr. Fyles read his presidential address on "Insects as agents in the cross-fertilization of blossoms," and papers were read by Prof. Webster on the Codling moth, Prof. Lochhead on Forest Insects, and Mr. Gibson on the life-history of *Arctia phalerata*. The points brought forward by the speakers were discussed with much interest and animation at the close of each paper.