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The Canadian Entomologist.

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ON THE HISTORY AND THE PREPARATORY STAGES OF FENESICA TARQUINIUS, FABR.

BY W. H. EDWARDS, COALBURGH, W. VA.

Nothing has been known of the history or earlier stages of this butterfly till quite recently, except what Boisduval and LeConte (1833) gave, both plate and text having been copied from Abbot (about 1800). On the plate the mature larva is represented as lying on a leaf of Hawthorn, and the chrysalis is attached to a stem of same. The larva is green and white-striped, and neither in coloration nor shape resembles the real larva, and the description in the text is made up from the figure. The chrysalis is a little better. The larva (according to Abbot) "lives upon Cratægus, and the species is very scarce." We also read that "this butterfly is plainly quite unlike the true Polyommati in its caterpillar and the shape of its chrysalis. Godart, who knew this species only by the description of Fabricius, wrongly believed that it was an Erycina." Boisduval puts it in Polyommatus with *Phleas*.

The late Professor Glover figured the mature larva and the chrysalis on plate xxii of his Lepidoptera, but the larva is surprisingly ill-done, being studded with round knobs that have no place in nature. The chrysalis is fairly done, and both dorsal and side views are given. On another plate is copied Boisduval's figures with no alteration (B., fig. 5). Mr. Glover told me that the larva fed on Hawthorn, and I believe that plant alone is written in his original work.

Many authors have spoken of the butterfly, and according to Prof. Riley, Mr. Scudder has given quite a list of food plants in different papers, as Alnus, Ribesia, Vaccinium, Viburnum, and conjecturally, Arrow-wood, Elder, Hawthorn.

At a meeting of the Ent. Soc. of Washington, 6th Jan., 1886, "a letter was read from Mr. C. L. Johnson, stating that he had observed a lepidopterous larva feeding on a species of Aphid, and had bred the insect to maturity. Mr. Lugger stated that the larva was that of *F. Tarquinius*,

and that he had also made the same observation several years in succession; though he had never actually seen them feeding on the Aphids, they were always found among them." At a subsequent meeting, Feb. 11, 1886, "Mr. Howard read a note from Prof. Riley in relation to the food habits of *F. Tarquinius*, in which it was stated that he had had for some time in his notes the records of observations by Mr. Pergande, who had found the larvæ actually feeding on the following species of Aphididae: Pemphigus Fraxinifolii, Schizoneura tessellata, and Pemphigus imbricator. The last named species is the one referred to by Messrs. Johnson and Lugger, at the last meeting." Ent. Amer., vol. 2.

Prof. Riley gave an abstract of the accounts by different authors of *Tarquinius*, in "Science," Vol. 7, No. 169, April 30, 1886, and of what was known as to its food, and stated four reasons why it was "more than probable" that different species of plant-lice "are the normal food of this larva." The essential reasons are the first and fourth. That attempts to feed the larvae on leaves had proved futile. That both Mr. Lugger and Mr. Johnson had found the larvae, but never dissociated from the plant-lice. But, concludes this paper, "neither of these observers were able to get positive proof of the fact." That is, I suppose, "proof of the fact" that aphides were the sole food, because all the gentlemen named had seen the larvae eating aphides.

That is all, so far as I know, which has been published on this matter to the present date. I am pleased to be able to say now that the full history of *Tarquinius* from egg to chrysalis has been followed out the past season, by Miss Emily L. Morton, of New Windsor, Orange Co., New York, well known as an enthusiastic lepidopterist. It has cost much patient labor, the observations having to be made mostly at a distance from home, in difficult ground, and running through several weeks. But the object has been attained, and I think little can remain to be discovered about the habits of *Tarquinius*.

Miss Morton kindly wrote me her notes from day to day, and sent eggs and larvae repeatedly, as well as supplies of aphides. Also sent the same to Mrs. Peart, at Philadelphia, so that drawings could be made at every stage. I propose to publish these drawings soon in But. N. A., Vol. 3.

Miss Morton wrote 11th Aug., 1886: "I saw a *Tarquinius* laying an egg on the twig enclosed (alder). She flew about and finally settled on the branch, depositing the egg right in the middle of the aphides. From

the care with which she settled in the midst of these creatures, I thought the larvae might possibly live on them. So I cut off the twig and send it to you. This female is in a bag in the woods where I found her." (I should say here that Miss Morton knew nothing of observations on *Tarquinius* by other persons. It was all new ground to her.)

On 13th Aug.: "The female laid but a few eggs, and those on the side of the bag, but I saw two more butterflies this morning, and both acted just as did the first one, carefully selecting a place in the midst of the plant-lice, in spite of a large black and red ant, which in great numbers was guarding the aphides. I watched closely, though I had to stand in the brook, and after some time I saw them lay 3 or 4 eggs, all among the aphides. I then cut off the limbs and brought them home, first bagging the females on the spot. After brushing off the lice, I found a dozen eggs, all on under side of the twigs. There were a few queer looking other eggs *on the leaves*" (perhaps of the grubs afterwards spoken of,) "also one small hairy larva, which I do not think can be *Tarquinius*, but as it possibly may be, I send it."

Leaving the letters for a little while, I will give my observations on the eggs and larva spoken of. One egg had not hatched, two or three had, and the shells remained, each with a hole eaten out of the top. They did not look to me like Lycaenid eggs, and I thought there must be some mistake about it, and that they were of some moth, or possibly Hemipterous. They were button-shaped, flat at base, lying nearly full breadth on the bark and firmly set, not quite circular; the curve at top like that of Lemonias *Nais*, not like Lyc. *Pseudargiolus*, the central depression broad and shallow, the surface somewhat rough, with no appearance under a Coddington lens of network; color pale yellow. Now all Lycaenid eggs known to me are covered with an elaborate and conspicuous lace-work, or are much sculptured. And the little larvae did not look like Lycaenid larvae. Rather like Tortrices, and their movements suggested that. The same thing struck Miss Morton. They were slender, of even thickness, each segment rounded, the body itself rounded, the feet, legs and head not in the least retractile; the hairs long and short, disposed very much as in some of the Nymphalidae, say Grapta or Phyciodes, the head as broad as body, and obovoid, but prolonged at the mandibles; on segment 2 a chitinous bar; color whitish-green.

I wrote Miss Morton forthwith that I could see no probable *Tarquin* eggs or larvae. However, I went in search of aphides, first visiting a

Hawthorn bush which I had set in my garden years ago expressly that I might some day have food for larva of *Tarquin*, and on which there had been myriads of aphides a few weeks before. But I now found none. The elms were visited with same result. At last I found a few on weeping willow, and put them in a glass tube with the larvae. I watched some time, but there was no haste on part of the larvae. I saw one of them go to an aphis, nose at it, push it and bite at it, lifting it partly off the leaf (the aphis being the larger of the two) and shaking it as a dog would shake a rat. But the victim escaped and retreated to the reverse side of the leaf, and the larva rested. Next morning, not an aphis was to be found. I got another small supply of willow aphides and presently saw a larva bite an aphis near the head and eat into the body so that its own head was buried, the aphis not resisting, nor even removing its sucker from the leaf. After a moment the larva let go and went its way.

Not finding more aphides on willow, I searched many trees and shrubs in vain, but at last found a young wild plum somewhat infested with them, and thereafter had a moderate supply. But there soon began to arrive boxes of twigs of alder covered with large woolly aphides, and eggs and larvae in all stages, sent by Miss Morton. The young larva (and the habit continues through the two earlier stages) pushes its way under the large aphides, or in case of such as are found on plum and willow, among them, and forthwith begins to spin for itself a loose web, not close enough to conceal it from view were the aphides away, but sufficient to keep the aphides from walking over the body, and to protect it when the moult is approaching and the skin sensitive. The web seems to be just about the length of the larval hairs from the body. The aphides may be seen running over it, and often get their legs fast in the meshes, and are very apt to be devoured as a consequence. Receiving these other eggs and larvae, I had pretty soon become satisfied that these hairy larvae were of *Tarquin*. The first stage was about two days in duration.

At first moult, the body was not so round, but a little flattened, and a little broadest in middle, the dorsum not raised, the legs and feet not retractile; the head a little within 2, but not more than with a Papilio larva; body clothed with many long hairs disposed in six rows, two sub-dorsal, one on mid-side, one along base; the hairs not in tufts but in groups, which spring from low tuberculous swellings; the hairs from base falling down and fringing the body; on 2 a chitinous band and in front of it 3 or 4 rows of long hairs which fall over head.

Miss Morton wrote 18th: "I have often found on the alder a hairy red and gray larva which produces an Apatela, and I thought the small larva I first wrote you about might be that. But if you saw it and the others were all like it, of course it can't be that." On 19th: "This morning I found what I think is a full-grown larva. It was resting in a fork of the bush close to a large colony of the aphides, but while I was wondering how I should get it in my box, so high on the limb was it, the way was suddenly made plain by a large ant rushing at and biting it furiously, and the larva curled up and fell to the ground. I thought I had lost it, but it fell on a bare spot, and here it is in a tube for your investigation, together with two other smaller larvae found feeding on the aphides. These were in a very thin web directly under a mass of aphides, and both were in the act of eating, each with an unlucky aphis kicking on its back, the head of the larva buried in its body. I have two more now before me, and both are devouring from underneath as fast as they can the swarms of aphides collected around them. There was a curious creature walking up and down the aphides, pulling the wool off them and sticking it on its own back. I removed it, fearing it might injure the young *Tarquins*, such formidable jaws had he." *

On 21st: The ants do not let the larvæ alone, but bite at them furiously whenever they see them; but until nearly grown the larvae lie concealed under the aphides with a web covering them, and cannot be got at by the ants without disturbing their cows. I went to the swamp again to-day to watch these most interesting creatures, and under nearly every pile of aphides found either eggs or larvae. But the larvae are so covered with the wool of the aphides and their webs conceal them so effectually that it is most difficult to detect them even with a powerful glass. The day was cool and cloudy and I did not see a single butterfly, but found about a dozen eggs and small larvæ, besides two nearly as large as the one I send you. There were places on the limbs of the alder where evidently full-grown larvae had cleaned off the aphides. At one place, the ants, a very large species, with black head and abdomen, and red thorax, were in a state of great excitement, running and biting in every direction, and had probably just discovered and routed a full-grown larva, as a large brown spot with all the aphides cleared off showed itself on the limb."

* This creature was a larva of a Chrysopa or Lace-Fly. See Harris' Ins., plate 3, page 247, for habits.

On 26th: "I went to-day to another swamp where I found quite a number of aphides, all on the stems of alder, some so low down as to be under the grass. There was also one butterfly flying, but I could not catch it. I got, however, one egg, which I mail to Mrs. Peart. There is a small Syrphus fly grub which devours the aphides far faster than does *Tarquinius*. I took 6 from the twigs of aphides which I send you to-day. These grubs stick the wool from the aphides upon their own backs, and are often difficult to detect.*

"After second moult, I find the larvae crawling naked on the limb seeking for fresh supplies of food; then they again spin a web, which they leave after the aphides are consumed. I do not think they spin after third (the last) moult. They then go about very quickly. There are four species of ants guarding the aphides on the alder, and I find fewest *Tarquinius* larvae among those guarded by the black and red ones I before told you of, though the butterflies do not seem to fear them in the least. The female lays her eggs generally close to or among a bunch of aphides, but occasionally on the leaf, if it rests on the aphides. The latter do not feed upon leaves unless just at the junction of them. On putting in a fresh supply for the larvae they at once burrow under and devour the aphides from the under side, unless after third moult, when the larvae eat roads through, but still from the under side, their backs covered with wool from the unlucky aphides. I think the wool prevents eating from above, for I noticed the larvae eat the red aphides from cherry from the back, or wherever they seized them."

Aug. 30th: "Each stem has to be cleared of ants, some species of which not only bite sharply enough to draw blood, but also sting, and cut off with a knife, the slightest jar often knocking off the aphides and such larvae as are not in webs. Then there is what I take to be a Syrphus larva which has to be removed, as it devours twice as many aphides as do the *Tarquins*. These lie under the aphides, often in a web of the *Tarquins*, and are very difficult to find."

Sept. 3rd: "Last night I saw a *Tarquin* just out of egg and watched it for over an hour spinning a web close to and almost under a large Syrphus grub. So I do not suppose these grubs injure the *Tarquins*. It crawled under the mouth of the grub and over its back, without the least

* Syrphus-fly grubs. See Harris, p. 248.

notice being taken by the grub." In another letter a farther observation is made going to show that the relations of larva and grub are not unfriendly.

Sept. 4th: "Have you noticed the ape's face which the chrysalis shows, when looked at upside down?"

At the second moult, the body was higher, and was broader in middle, and was more the shape of maturity, the hairs more abundant; the feet and legs not retractile; the head more covered by next segment than before, but very little, and that only along forehead.

The growth of these larvae is remarkable for rapidity, scarcely more than two days between moults, and there are but three moults in all. Such haste to reach chrysalis is what might be expected when one considers the nature of the food, its precariousness, and the activity of the enemies the larva is constantly exposed to. There is no long interval preceding a moult when the larva lies helpless, and this is particularly so at the third moult, when the larva is fully exposed to view. I watched several most carefully when I anticipated the third moult, but never was able to see it, or to know precisely when it occurred. I could see that a moult must have taken place by the fresh and differently colored skin of body, and the enlarged head. Miss Morton at first experienced the same difficulty, and wrote 30th Aug.: "Thursday morning the larvae had devoured every aphis in the box, and I remembered seeing some red aphides on wild cherry near the house. These I put in until I could go to the swamp, a mile away. When I returned, 3 hours after, three of the five larvae had moulted, after eating nearly the whole of the two square inches of aphides, though there was no appearance of a moult when I went away. These three had changed from the whitish and gray to the mature orange (on dorsum) and pupated Sunday morning (i. e., 3 days after 3rd moult.)" But Sept. 21st: "Since writing on the moults, I have seen the three, and have now eight larvae in all stages from first to last." Mrs. Peart also detected the third moult, and sent me four tables of the length of the several stages of as many larvae.

At third moult, the larva is .44 inch long, and .14 inch broad in middle, the sides tapering about equally either way; the dorsum is flattened broadly, and is highest at 6; the under side flattened; the feet are not retractile and the pro-legs cannot properly be called so; the head is covered more than before. As the stage proceeds, the head is more and more concealed by the growth of segment 2, but there is no extensile neck as in Lyc.

Pseudargiolus or Thecla *Henrici*, both which species I have described in their early stages; the low swellings before spoken of form three rows on either side, and on these are the clusters of hairs as before, but more numerous; and the lower hairs make a fringe as before; the color of dorsal area is pale gray, the outer edges white, and the side is white, with a pale brown macular stripe running through it, and above this is an oblique brown bar on each segment, except at the extremities; on mid-dorsum a macular brown stripe, and on 7 to 11 four brown rounded spots, two in front, two on rear; the sub-dorsal swellings are red-orange, or Indian red, or pinkish; there is much variation in individuals in all the markings; and I suspect the species of aphis fed on may cause variations, as one larva raised by me wholly upon plum aphides was at all stages whiter than those on alder, and the darker markings pale. The chrysalis of this larva was also lighter than any I have seen.

The chrysalis is .31 to .39 inch long, .12 to .15 inch broad at mesonotum, .18 to .22 at abdomen; extreme height of abdomen .2; the ventral side flattened and rounded laterally; the head case is prominent on ventral side, and nearly shape of larval face; behind it, and projecting somewhat over it, is the second segment, broad and incurved; the front of both 2 and 3 are turned up a little, so as to increase the excavation of 2; mesonotum prominent and nose-like, but flattened, and with a decided carina; followed by a considerable dorsal depression, and a deeper one on side, in which is an oval eye spot, as if set in; next, the abdomen rises abruptly, overhanging the depression like a brow on face; the abdomen is very high for width of three segments, then diminishes rapidly, and on dorsum rounds down to 13, but the sides of 11, 12 are greatly compressed; 13 is rounded and widened at the edges, and lies flat on the object to which it is attached like the hoof of a horse; the under side shows a flat rim, and a rounded interior depression, on which last is a broad circle of minute points; under a high power these look like so many walking sticks, with their straight handles bent at an angle of about 40°; color of ventral side whitish, glossy, more or less dotted with dark brown; the second segment white; mesonotum whitish and black; the eye-spot spoken of glossy black; the abdomen brown, grading on the sides into yellowish; dark patches on sides of 6, 7, 11, 12; the whole upper surface indented and roughened, but has a glossy appearance.

In all, the monkey's face is a conspicuous feature, the overhanging

brow, the deep-set eyes, the flattened nose, the curled and open lips (the white second segment.)

The chrysalis is closely pressed to the object by the shape of its last segment, but is also held by a girdle which passes over dorsum between 4 and 5, and is free at the upper lids of the eye-spots.

On 22nd Sept., I found that one imago had come from chrysalis, and was dead and dry. I suppose the period in this case was about 10 days. The other chrysalids will hibernate.

From laying of egg to hatching 3 and 4 days; in one instance in which Miss Morton saw the egg laid, the larva came forth at 3 days, and had reached 3rd moult at 9 days, date of the letter. One egg sent me hatched 29th Aug., 1st moult 31st Aug., 2nd moult 3rd Sept., 3rd not observed; pupation 8 Sept. Allowing 3 days for egg period, that would make 13 days from laying of egg to chrysalis, a pace unequalled in my experience. In the case of Agraulis *Vanillæ*, C. Ent., 12, 125, from egg to pupation was 16 days, the shortest period I think recorded by me.

The larvae, at Coalburgh, have several times been without food for many hours, or two or three days, and pupation has taken place when they were dwarfed from starvation. They always had plum leaves in the tubes, but never eat of them. I asked Miss Morton about this, and the reply 21st Sept., says: "I can answer as positively as you could wish. I left in the swamp, where I saw the first butterfly, four eggs in a bag, on a limb with leaves and a small cluster of aphides. Being prevented from going again for several days, I found the larvae hatched and three of them gone; not a trace of them in the bag, which I emptied on a sheet. The fourth larva was still alive, but stunted and weak. Being put in with fresh aphides, it eat ravenously, and finally changed to a very small pupa. It certainly had not eaten of the leaves. Besides this, I have always had a few leaves in the tin box with larvae and aphides, but even when the latter are entirely gone, the *Tarquins* have never touched leaves except to make their chrysalids on them. I have found that the larvae prefer leaves for pupating on."

On 24th Sept., I received from Miss Morton three larvae in 2nd, 3rd, 4th stages, and experimented with them amongst aphides on willow and plum, all small and naked species. The ants on willow are of a small species, honey-colored, those on plum of same size, but black. I laid the smallest larva on willow leaf directly by a small cluster of aphides, at which few ants were engaged. The larva paid no heed to the aphides,

but walked past and back and forth and was on both sides of the leaf The ants were somewhat inquisitive but did not trouble the larva, nor were they disturbed by it. This went on for about 15 minutes, when I removed the larva.

I put the next sized larva (2nd moult) on same leaves, and the ants were agitated, ran about gesticulating, but paid more attention to their cows than to the larva. I put this larva on a plum leaf by a large colony of aphides, at which were a dozen of the black ants. The ants sprang at it, bit at it everywhere, especially trying to get a hold under the edge of the body, where the surface is naked, or at the joints of the segments, or at 2, which being bent over the head is more exposed than any other segment. One determined fellow seized on 2 and was hardly to be dislodged, was at last by violent jerking of the head, but wounded the larva so that blood flowed. When the attack was at the joints the larva squirmed so as to tighten the joints just there. These attacks were simultaneous and by at least six ants at a time. The larva crawled away and the assailants mostly dropped off. I though it best to come to the rescue, else I should lose the larva.

I then put the largest larva (3rd moult) amongst the same excited ants, and they attacked it in same manner, but seemed unable to make impression on it. The hairs protected the whole upper side more sufficiently. The larva crawled up and down and over the leaf, followed by some of the ants, who attempted to seize it at every vulnerable part. But no harm was done. I repeated the experiments the next day, and came to the conclusion that the willow ants were mild-tempered, and seemed unlikely to hurt a larva; but that the black ones were fierce and would attack wherever they saw their enemy.

Now it may be that the butterfly avoids the fiercer ants and the aphides they guard, and therefore that the larvae are not to be looked for on certain plants. There is room for farther observation on this point.

I had noticed that whenever one of these larvae was removed by forceps a thread held it to the object, and I watched when making the experiments related to see if the ants would force the larvæ to drop from the leaf. But they did not drop. I shook the largest larva out of the box till it let out a thread a length of four inches. Then held the box to see if the larva would climb the thread, which it did, in about 20 minutes. It twisted its body into a spiral and whirled about so fast that I could not bring the lens to bear, but I could see that jaws and feet were active.

Now, all young lepidopterous larvae spin threads, and in falling guard themselves by this means, but I certainly never saw or knew of this habit in an adult butterfly larva. Adult or middle-sized Lycaenid larvae double up and fall on least provocation, but use no cord. Here would seem to be a means of defence in a larva always liable to sudden attacks.

Miss Morton calls my attention to the fact that ants do not disturb the larvae of the Syrphus flies, which with either woolly larvae, or naked species, as on cherry, devour far more aphides than do the *Tarquins*. "One would suppose the ants would at least expostulate in some way at the wholesale destruction going on, but though I have watched until the aphides were nearly devoured, the ants did nothing but pet their cows." Perhaps the wise ants have learned to submit to the inevitable.

I watched these larvae at every stage to see in what degree the legs and feet were retractile, and they certainly are not at all in the earlier stages, that is, up to second moult. Nor in the remaining stages any more than is the case with a Papilio larva. Mrs. Peart, who from drawing figures of feet and legs of many species and genera of butterflies, is accustomed to notice such points, writes me: "Through all the stages they seem to be the same as in Papilio larvae, but the fleshy legs are very short." I found a mature larva of Lyc. *Pseudargiolus* and placed it on glass slide by side of a mature *Tarquin*, and the difference in the appearance of and the handling of the legs and feet, was decided. If at the last stage *Tarquin* may be held to have the pro-legs at all retractile, as that word is used in describing onisciform larvae, it is but imperfectly, and not after the manner of the Lycaenidæ.

I should have said before that on looking at a stem of alder, which may be completely covered by the aphides, there will appear inequalities on surface, little hillocks as it were; and on pulling these apart, small larvae of *Tarquinius* will probably be found, in their webs. None at all will be visible, unless they are nearly mature.

Miss Morton writes, 23rd Sept.: "*Tarquin* gets itself stuck over with the wool of the aphides, and the Chrysopa larva, running over the *Tarquins* as well as the aphides, pulls the wool off the former also. I have watched, but never saw one of these formidable creatures bite or annoy a *Tarquin*. When the *Tarquins* moult, they come out bright and clean, but by the time they crawl their own length, they are again stuck over with wool, and this is the case till pupation. They are naturally so exactly the

color of the aphides on alder that I should not suppose the wool would be necessary to their preservation."

Also: "I have never found a chrysalis. though I have looked for them whenever I have been in the swamps. My larvae generally seek a leaf, but I think it probable the wild ones crawl down the stems and pupate among sticks or grass." The larva of Lyc. *Pseudargiolus* when ready to pupate drops to the ground.

The observations settle these points: that the eggs are laid directly among the aphides, and in case of stem-aphides, on the bark; that the ants do not destroy the eggs (though usually ants destroy every egg they find); that the larvae from egg to past second moult conceal themselves under the aphides, and under spun webs of loose texture, through the meshes of which they devour their prey, and which webs also serve to protect them from injury, especially at moulting time; that the larger larvae, that is, from before third moult on, are in full view, but besides being coated with wool from the aphides, have ways of protecting themselves from enemies, as by falling off the stem, throwing out a thread, or by falling to the ground; that there is no period, at any moult, of much length when the larva is helpless, and apparently none at all at third moult, when it is most exposed; that there are but three moults, and the whole larval period is exceptionally short; that the larvae will eat many species of aphides (possibly any, unless deterred by certain species of ants), but prefer the large, woolly ones.

I have repeatedly had letters from different parts of the U. S. and Canada, asking if I knew on what the larva of *Tarquinius* fed, and in nearly all cases the writers stated that the butterfly had been taken on or near alders.

Prof. Riley, in the Science paper quoted, notes that this is the only butterfly known whose larva is carnivorous. But next to nothing is known of the early stages of tropical butterflies, especially in the great family of Erycinidae. Both there and among the Lycaenidae there may be species which have this same peculiarity.

Godart conjectured that *Tarquinius* should be classed with Erycina. His instinct was right; Fenesica belongs to the Erycinidae. The present classification of butterflies, based as it is solely upon one stage of the four, is imperfect and at best but temporary, and is sure to give way to a better as the early stages of species become known.

At Coalburgh there would appear to be at least three broods of the

imago of *Tarquinius*. I have taken it in several years, in April, from 17th to end of the month and 5th May. Again in June, from 14th to 4th July; on this latter date I took 24, in 1868, and saw large numbers more; and again last of July, in several years. And I have repeatedly bagged the females on hawthorn, led thereto by what Prof. Glover told me, but always have failed of getting eggs. I have taken these examples generally up the branches of the creeks, flying about the stones in the nearly dry beds thereof. I remember that on the occasion spoken of when I took so many, the butterflies persisted in visiting a large stone, and I caught most of my examples by a bottle, so tame were they. So far as I know there were no alders or hawthorn within a mile of the points where the butterflies have been abundant. There were plenty of beeches, but the probability is that many trees or shrubs on which there was a good supply of aphides would attract the females.

I know nothing about the broods of this species at the north. As we have seen, eggs and larvae were found at New Windsor from middle of August to last of September.

NOTE.—After the above lines had been sent to printer, on 4th Oct., I received three nearly mature larvæ of *Tarquinius* from Mr. Henry F. Schönborn, at Washington, D. C., on alder. No information was received respecting these larvæ.

ON THE PREVIOUS STAGES OF PTINIDÆ AND ALLIED GROUPS.

BY DR. H. A. HAGEN, CAMBRIDGE, MASS.

A small round box of bamboo (8 by 6 inches) was bought nine years ago in Hong Kong, China, and brought home to Boston. It was placed on a little shelf on the wall, and used for Turkish tobacco. The box was lined inside with a perfectly closing box made of East Indian block-tin, about a millimetre thick. I examined the box January, 1885, and found it hollowed throughout like a sieve, and containing between the tin box and the bamboo cover a large number of dead and living beetles and two living larvæ. The tin box had four small round holes apparently cut through by the insects. The beetles represented two species, one, a little

larger, only two specimens, all the others belonging to the second species. I submitted the beetles to Dr. G. H. Horn, and received the following kind answer:

"The beetles are not specifically known to me. The *Lyctus* (the numerously represented species) is different from any we have. The other is a Bostrichid, and is allied to *Sinoxylon*. There is just enough to show that the last three joints of the antennæ form a loose club as in *Sinoxylon*."

Therefore as the beetles are not yet known living in the U. S., they must have been imported from China, and lived and propagated in the bamboo box. I remembered directly a similar fact represented in the biological collection here. In 1870 was presented by Mr. J. H. Hubbard from Detroit, Mich., a piece of Supple-tack, a vine of Jamaica, imported nine years ago. Only during the last two years was observed fine mealy dust dropping out of numerous small round holes. By splitting the stick many living beetles and larvæ of a species of *Lyctus* were discovered.

I tried to make out the Chinese species, but Harold's Catalogue has no species of *Lyctus* or *Sinoxylon* from China. Lewis's Catalogue of Japan has *Lyctus brunneus* Steph. By comparing the description and figure in Steph. Illust. iii., p. 117, pl. 18, f. 4 (Wollaston Ins. Mad. were not at hand), and Kiesenwetter, Insect. Deutschl., v., p. 17, I suppose that the Jamaica species may be *L. brunneus*. This insect is given as imported by trade into Germany, and has been raised by Mr. Fuss out of walking sticks made from the so-called Cuba vine.

I compared the Jamaica and the China specimens, and find the latter ones identical with the smaller specimens of the lot from Jamaica, as I was not able to find any difference. But some of the larger specimens from Jamaica have a decidedly stronger sculpture on the thorax. Being well aware of the difficulty of determining species of *Lyctus*, and not having to compare a specimen of *L. brunneus*, I may only draw the attention of American entomologists to this species. It would be surprising if a species so widely spread and imported into Germany to the Baltic shores, and living in the Antilles Islands, should not be found in the United States. Considering the species near *Sinoxylon*, I am not able to give a determination. The larvæ in the bamboo box belong very probably to *Lyctus*.

In my Bibliotheca, ii., p. 499, are related all cases of insects boring through metals, mostly lead. I do not know if block-tin is known as in-

jured by insects as in the bamboo box from China. I believe that the boring was done by the species allied to *Sinoxylon*, because only very few holes were made, and because a related species, *B. capucinus*, has bored lead.

As it is of general interest to know the history and the habits of the insects belonging to this obnoxious and dangerous group, I have tried to make out the species of which the previous stages have been described. Therefore I have given a catalogue of the 32 species represented to-day in the biological collection of the Museum in Cambridge.

Besides these, Harold's Catalogue mentions 28 species more, of which the previous stages are described; Rupertsberger mentions 29 species more, and Riley 2 from the U. S.

The species of Ptinidæ and allied forms represented in the earlier stages in the biological collection in the Museum, are in alcohol, and besides, dry inflated larvæ; also parts of wood or other things in which they have made borings. For want of time and space, a very large lot of later additions have not been classified and arranged. There may be among them more species from North America.

PTINIDÆ.

Hedobia imperialis L. Europe. Im., larv., nymph, and bark with the craddle.

Ptinus fur L. Europe. Im., larv.

rufipes F. Eur. Im., larv., wood bored.

Anobium tessellatum F. Eur. Im., larv.

pertinax L. Eur. Im, larv. *Betula alba* injured.

striatum Oliv. Eur. Im., larv., nymph., wood of *Aesculus Hippocastani* injured.

emarginatum Duft. Eur. Im., larv., nymph, wood of *Pinus picea* injured.

nigrinum Er. Eur. Im. larv., wood of *Pinus sylvestris* injured.

paniceum L. Eur. Im., larv., boring in candy; the same species from U. S., boring in the pith, larv.; also destroying insects—Mr. Austin.

Ernobius abietis F. Eur. Im., larv., boring in cones of *Pinus picea.*

mollis L. Eur. Im., larv.; the same from U. S., boring in pine sap-wood; boring in corks.

Ptilinus costatus Gyll. Eur. Im., larv., boring in *Salix alba.*

Lasioderma serricorne F. Eur. Im., larv., boring in *Cacuma longa* from East India.

Mesocoelopus niger Muell. Eur. Im., larv.

Dorcatoma chrysomelina Strm. Eur. Im., larv.

Dresdensis Hlst. Eur. Im., larv., and cells in *Polyparus frumentarius.*

Caenocara bovistæ Hoffg. Eur. Im., larv.

Anitys rubens Hoffm. Im., larv., boring in *Quercus pedunculata.*

BOSTRYCHIDÆ.

Apate (Bostr.) capucina L. Eur. Im., larv., and a larva type from Ratzeburg.

Dinapate Wrightii Horn. Cala. Im., larv., from Horn's types.

Xylopertha sinuata Fr. Eur. Im., larv., nymph, boring in *Quercus pedunculata.*

LYMEXYLONIDÆ.

Hylecoetus dermestoides L. Eur. Im., larv., nymph; borings in *Fagus sylvatica;* also types from Prof. Ratzeburg. Larva, borings in *Fagus sylvatica* and borings in oak, a fact not known before (c. f. Ratzb. Waldverderbniss, ii., p. 151), from Stolberg in Harz.

lugubris Say. U. S. Im., larv., nymph; borings in elm, from Trenton Falls, N. Y., by Mr. H. J. Hubbard, May 20, 1874.

CIOIDÆ.

Lyctus canaliculatus F. Eur. Im., larv., nymph; borings in *Quercus pedunculata.*

opaculus LeConte. Philadelphia. Im., larv., nymph; types sent by Dr. LeConte.

planicollis LeConte. California. Im., larv.; raised by Dr. Horn from borings in Mesquit wood, from San Diego, Cal, 1884.

striatus Say. U. S. Raised from hickory, the types of the borings figured in the Hub. 1879, presented by Dr. Horn.

brunneus Steph.? Jamaica. Im., larv.; raised from borings in a vine.

sp., perhaps the same. China. Im., larv.; raised from the bamboo box from China.

Rhopalodontus perforatus Gyll. Eur. Im., larv., nymph. In *Polyporus frumentarius.*

Ennearthron affine Gyll. Eur. Im., larv.; in *Polyporus squamosns.*

Octotemnus sp. Detroit, Mich. Im., larv.; in old sponges, by Mr. H. J. Hubbard, Aug., 1874.

Of the 668 species given in Harold's Catalogue, the previous stages of 100 species are published. They belong to 34 genera of the 81 enumerated by Harold. Only of 28 genera of the 53 enumerated in Mr. Henshaw's Catalogue of the Insects of the U. S., the previous stages are known. Only of 13 species of the 176 mentioned by Mr. Henshaw have the previous stages been described.

THE NORTH AMERICAN GENERA OF ANTHRACINA.

BY D. W. COQUILLETT, LOS ANGELES, CAL.

The sub-family Anthracina differs from any other of the Bombylidæ, as well as from any other group of Diptera known to me, in that the second vein issues from the third at a point opposite or nearly opposite the small cross-vein, the distance being never greater than the length of that cross-vein; the course of the third vein at the place where the second vein issues from it, is perfectly straight, while in the other Diptera the third vein bends obliquely downward at the same angle that the second vein extends upward at its base.

The genus *Dipalta* O. S. must be united to *Anthrax* Scop. It was founded upon a species *(serpentina* O. S., West. Dipt., 237) which differs from a typical *Anthrax* only in having three submarginal cells in each wing instead of two, and also in that the second vein is strongly bent S-shaped before its tip. I have two undescribed species which agree in every particular with *D. serpentina* O. S., except the course of the second vein; in one of these species this vein is nearly as strongly bent S-shaped before its tip as in *serpentina,* but in the other species it is not more strongly curved than in an ordinary *Anthrax.* The number of submarginal cells in each wing—three in *Dipalta* and normally only two in *Anthrax*—will not serve to separate these two genera, since specimens occur in several different species of *Anthrax* in which there are three

submarginal cells in each wing, and occasionally there are three of these cells in one wing and only two in the other wing of the same specimen. Thus every gradation between these two genera occurs, making it necessary to unite them under the older name.

From *Exoprosopa* proper I have separated those species in which there are four submarginal cells in each wing, the third being divided into two cells of nearly an equal size. I have examined numerous specimens of this group from all parts of the world, and in every specimen of any given species the number of submarginal cells in each wing is very constant. For the genus which shall contain these species I propose the name *Velocia* (from *velox*, swift); the *Anthrax cerberus* Fabr. may be regarded as the type of this new genus.

My new genus, *Mancia* (from *mancus*, defective), although most closely related to *Anthrax*, is sufficiently distinct; its separation from *Anthrax* is the more desirable as the latter genus already contains a great many species.

The following table contains all the genera of the Anthracina known to occur in North America:

1—Pulvilli pad-like, distinct; wings usually with only two submarginal cells.....2

Pulvilli spine-like or wanting.....3

2—Tip of antennæ bearing a pencil of hairs.....*Argyramoeba*

Tip of antennæ destitute of a pencil of hairs.....*Hemipenthes*

3—Style at tip of third antennal joint at least one-fourth as long as that joint; wings with three or four submarginal cells.....4

Style at tip of third antennal joint minute or wanting; wings usually with only two submarginal cells.....5

4—Wings with only three submarginal cells.....*Exoprosopa*

Wings with four submarginal cells, the third being divided by a cross-vein into two cells of nearly an equal size.....*Velocia*

5—Axillary cell not longer than twice the distance between tips of last two veins; third basal cell widest at its apex.....*Mancia*

Axillary cell much longer than twice the distance between tips of last two veins; third basal cell not widest at its apex.....*Anthrax*

Genus MANCIA, n. gen.

Same as *Anthrax* except that the axillary cell is not longer than twice the distance between the tips of the last two veins, and the third basal cell is wider at its apex than at any other part. Wings tapering considerably toward the bases, axillary cell very narrow. (Name from *mancus*, defective).

Mancia nana n. sp.—Front black, reddish tomentose and black pilose; face yellowish, much produced below, middle part white, the sides reddish tomentose; antennæ black, first joint sometimes yellowish, base of third joint subglobular, the styliform portion slender and linear; proboscis projects from one fourth to one half its length beyond the hyperstoma. Occiput reddish tomentose. Thorax black, mixed white and reddish tomentose; pleura reddish tomentose. Scutellum black, reddish tomentose. Abdomen black, reddish tomentose, a cross-band of white tomentum on the second segment. Venter black, white tomentose. Legs reddish, yellowish tomentose; front tibiæ sometimes provided with bristles; tarsi black, claws of front tarsi well developed. Wings hyaline, a brown cloud in middle of first basal cell, faint brown clouds on veins at bases of first submarginal, first and fourth posterior cells, and of the discal cell. Length 3½–4½ m. m. Cal.; 20 specimens, in April.

ON CECIDOMYIA LIRIODENDRI.

BY DR. H. A. HAGEN, CAMBRIDGE, MASS.

The two galls of the Tulip tree described by Osten Sacken, Monogr., Vol. I., p. 202, No. 26, *C. liriodendri* n. sp., and No. 27, *C. tulipifera* n sp., were wanting in the collection of his types presented by the Baron to the collection of the Museum in Cambridge. I am glad to state that I collected one of them in considerable numbers on leaves from a young Tulip tree on Quincy Street, Cambridge, in October, 1885. But all those galls were burst open along a part of the margin, and were empty. Prof. G. W. Farlow presented some collected in Newton, Mass., Oct. 12, 1886, and I found the living, full grown larva in one gall. I remembered then the tree in Cambridge, and found the same galls numerous, but again all empty. Apparently the larva has to be collected in the beginning of

October, or somewhat earlier. It is possible that the brown or reddish halo around the galls appears only later, after the larva has left the gall; at least the only gall containing a larva had no halo. The larva and its breast-bone agree with the Baron's description. But I was very much interested to find in the body of the larva two large eggs, with an embryo similar to those described for Miastor. We may conclude therefore that *C. liriodendri* also can be propagated by the larva. Perhaps the very numerous galls found often on the same leaf, of different sizes, may be the results of this kind of propagation.

In comparing the galls in the collection, I found very similar ones on *Fraxinus americana* (*C. pellex* O. S.), on *Quercus tinctoria* (*C. symmetrica* O. S.), on *Carya* (*C. caryæ-lamina* Walsh, and *C. glutinosæ* O. S.), and on *Tilia americana* (*C. verruricola* O. S., CAN. ENT., 1875, p. 201). Osten Sacken, l. c. p. 202, speaks of similar spots on the leaves of the Tulip-tree produced by a Lepidopterous larva. I presume they are made by Nepticula or by Phylocnistis.

Of the 32 species of Cecidomyia galls described in Monograph, Vol. I., p. 190–205, besides the two from the Tulip-tree, 4 are not in his collection, *C. cynipsea* from hickory, *C. erubescens* from oak, *C. impatientis* from *Impatiens fulva*, and *C. agrostis* from Agrostis.

CORRESPONDENCE.

A CORRECTION.

Dear Sir: I wish to correct the statement made by me on p. 13 of the present volume of this journal, in regard to a pupa of *Elaphidion parallelum* Newm. being found inclosed in a silken cocoon. The cocoon in question was undoubtedly that of a parasite.

C. H. T. TOWNSEND, Constantine, Mich.

Dear Sir: In the article on explosive emissions from Carabidae, June No. CAN. ENT., I notice that the genus *Harpalus* is not included. While collecting in Conn. about a year ago, I took *H. caliginosus* in large numbers on the flowers of the rag-weed. Several filled my cyanide bottle with a dense white smoke. I noticed no explosions outside of the bottle.

GEO. F. CURTISS, Lynn, Mass.