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The Canadian Entomologist.

VOL. IX. LONDON, ONT., MARCH, 1877. No. 3

METAMORPHIC CHANGES OF PLATYSAMIA CECROPIA.

BY THOMAS G. GENTRY, PHILADELPHIA, PA.

In the early part of May, 1876, I secured a newly-developed female moth of the above species to a branch of the common red currant (*Ribes rubrum*). It was about seven o'clock in the evening of May 6th, to be more precise in regard to time. On the next morning, I visited the spot, and a lusty male was discovered in coition. This condition of things continued until the close of the day, when her amorous partner, lured by the presence of dusky night and midnight revels, gradually loosened his embrace, and hied him away to other scenes. During the night some fifty eggs had been laid, which continued to be deposited at intervals during the succeeding day, until the number had reached about seventy. These eggs were not arranged with any view to order, but were agglutinated in masses to the reposing surfaces, or appeared in small isolated patches.

They were beautifully elliptical in contour, and measured one-eighth of an inch in length, and one-twelfth in width. The thickness was about one half the width. They were yellowish-white in color, and thickly coated with a brown viscid secretion.

These eggs did not hatch until June 3rd. Another batch was laid by a second female on the night of May 9th, which hatched on the same day as the first. A third lot by another female was deposited on the 22nd of the same month, which hatched on the 6th of June, just three days after the first and second lots. During favorable weather I have known the eggs of *cecropia* to develop in six days. This being the case, it is evident that the necessary conditions were wanting in the above-cited instances. A temperature ranging from 80 to 90 degrees of Fahrenheit thermometer, and a comparative freedom from undue atmospheric moisture, are essential conditions.

At the time when the above deposits were made, the weather was more or less cloudy, and both light and heavy rains were of frequent occurrence. Such was its unfavorableness, that fears were entertained of the complete failure of my experiments. On many occasions, eggs were broken, and their contents examined with very strong magnifying glasses, to ascertain whether putridity had taken place. Within a week of the time of hatching, numerous eggs were examined, and the only evidence of change apparent, was a slight turbidity of their contents. The weather for a day or two previous had been exceedingly fine, and the heat rather powerful. This happy state of things continued with slight, unimportant changes, until the hatching process was over. Eggs, as well as chrysalids, can endure a strong degree of cold without injurious effects, provided transformation has not already commenced, when vitality receives a check from which it never recovers. An alternation of wet and dry, or of extremely cold and very warm weather, is exceedingly detrimental. May it not be that the extreme paucity of certain kinds of insects during some years is due to the causes which have just been noticed?

The caterpillar of this species (when hatched) is nearly three-sixteenths of an inch in length, and scarcely thicker than an ordinary darning-needle. Its general color is a jet black. It is armed with two dorsal rows of glossy black spiniferous tubercles, those on the second and third somites being the largest; and also two lateral rows on each side, making six in all. The antennæ are short, black, triple-jointed, and moderately tapering. The true legs are black, three-jointed, and armed with short, in-curved claws; the pro-legs occupy the 6th, 7th, 8th, 9th, 10th and anal segments, and are furnished with a double row of black ciliæ.

June 10th—First moulting takes place. The caterpillar now measures nearly one-half of an inch. At first, it is greenish-yellow, but gradually changes to a yellowish-brown, with a slight tinge of green when perfectly dry. The caput and star-crowned protuberances still remain a beautiful glossy black. Each somite, between the different rows of tubercles, is diversified with a pair of black spots which ultimately become conjoined, forming longitudinal lines throughout their entire length. Between the segments, they are continued as obscure bands.

With age, the color becomes a dark yellowish-brown. At this stage, the caterpillar ceases to feed, and becomes considerably shortened. It is now perfectly inactive, and behaves as if dangerously ill. This state of things lasts for a couple of days, during which time the larva has completely changed its skin, and gathered strength for future labor.

On thrifty plants of the red currant growing in the sunlight, development is very rapid; whereas, caterpillars feeding upon plants growing in the shade, exhibit the most remarkable contrasts, even in the same brood. The latter are more slender, being one-eighth of an inch shorter, darker, and have olive-green constrictions. The head and tubercles are an obscure black; the body bands much darker. From careful watching I am satisfied that they pass into their next stage without the necessity of moulting.

June 18th—The caterpillar has changed its skin again. It now measures from seven-eighths to one inch in length. The time of changing apparently varies from five to eight days, depending upon individual vigor.

The general color, at first, is a light yellowish-green. The tubercles of the first somite have each a dark basal annulus, and a pale blue summit which is surmounted by seven black spines, six in a circle and the remaining one occupying an apical position, from which it projects either vertically or obliquely; the remaining tubercles upon the first segment are jet black, and furnished with six spines. The second and third series of dorsal tubercles are a deep flesh color, with spines similar in number and position to the foregoing. The 4th, 5th, 6th, 7th, 8th, 9th and 10th somites have lemon-colored tubercles, with black, longitudinal dashes, facing laterally; and the 11th segment is armed with one large tubercle, occupying a median dorsal position, which is surrounded by a circle of seven spines near the middle, and overlooked by two divergent terminal ones.

The lateral tubercles of the 2nd, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th and 11th segments, are glistening and bluish. The 2nd and 3rd are armed with six encircling spines, and one apical; while the others, with five, and, sometimes, six encircling spines. Each tubercle is marked with longitudinal dashes on both sides, or merely on the dorsal side. The 12th segment has four light blue tubercles, armed with six spines. Above the anal pro-legs, two light blue tubercles are visible, which are furnished with six black glossy spines in a circle, and two broad lateral dashes.

The four abdominal pro-legs have each a broad, irregular, quadrangular black patch, near the distal extremity, and a small semi-elliptical one near the proximal end. The anal pro-leg on each side has two long, broad, oblique bands, inclining anteriorly.

The median dorsal line is marked with black dots which are arranged as follows: 3rd segment, posteriorly, a small dot; 4th, two very small dots; 5th, 6th, 7th, 8th, 9th and 10th segments, both fore and aft, two large jet black dots.

Between the dorsal and lateral tubercles, the arrangement is as follows: 1st segment, one linear, transverse dash, posteriorly; 2nd to 10th inclusive, both fore and aft, each two nearly circular dashes; 11th, one posterior dash.

Above the sub-lateral tubercles, exists another row. The 2nd and 3rd segments have each one in front; 4th to 11th inclusive, each one small dot in front of a larger one. Below this row, between the pro-legs, there is also a small dot on each of the several segments.

Each of the 1st, 2nd, 3rd, 4th and 5th segments, below the sub-lateral row of tubercles, bears a single jet black tubercle, which is armed with a single spine, or a pair of divergent, similarly colored spines.

The true legs are black, conical, 3-jointed, and armed with a single black incurved claw. The pro-legs, with a semi-circular row of black ciliæ, inwardly.

The head is lemon-colored, with two black, irregularly elliptical spots anteriorly, resembling eyes, which have a small triangular shield between them. There are also two smaller spots near the proximal end of the 3-jointed, conical antennæ. The basal joint of the latter organ is subtruncate and lemon-colored; middle, small, cylindrical, and concolorous; and apical, setiform, hairy, and blackish. Upper lip, bi-labiate, greenish, and black on margin. Jaws and lower lip similarly colored with the upper lip; palpi, 3-jointed, each joint being dark brown, with a greenish annulus near their lines of union.

Before moulting, the caterpillar assumes a bluish-green color. The dots of the dorsal row become smaller, the posterior dots, partially or entirely, disappearing. The tubercles upon the first segment become a jet black; dorsal tubercles upon the 2nd and 3rd segments, a reddish purple; lateral pair, a glossy black with bluish tinge at apex; and the others, a beautiful black. The remaining dorsal tubercles are deep yellow, and have broad black patches on the sides, which are confluent posteriorly in certain cases. Lateral tubercles, black on the inferior two-thirds, and bluish above. Sub-lateral, jet black, with pale blue apices. The dots between the dorsal and lateral rows of tubercles are much smaller than formerly, and have actually disappeare in several instances. Between the lateral and sub-lateral rows they are nearly gone in front, and entirely so behind. Upon the abdominal pro-legs they are broader below, and rapidly diminishing above. On the anal pro-legs, the two confluent spots have separated and grown elliptical in shape. That upon the head is somewhat longer and broader.

The jaws, lips and palpi have become more conspicuously colored, approaching the color of these parts in the mature caterpillar.

The spiracles, which all along occupied a middle lateral position on the 1st, 3rd, 4th, 5th, 6th, 7th, 8th, 9th, 10th and 11th somites, but, without being easily recognized from resemblance in color to surrounding parts, are now quite conspicuous. They are narrowly elliptical in contour, with the longest diameter arranged transversely, and have cream-colored centres with black borders.

The general color of the caterpillar upon the inferior surface, is a bluish green, with obscure patches of black between the segments. Along the middle of the dorsum, extends an obscure bluish band from the head almost to the last segment.

The caterpillars, at this stage, vary considerably in the time of moulting. Some reach this period much sooner than others, at least two days earlier, even in the same brood. It is the thrifty-looking caterpillars that are thus favored. The ill-favored ones contrast quite remarkably with the latter, in size, color and markings. A number of caterpillars was purposely confined to a bush of the red currant, whose leaves were small and sickly-looking. They throve poorly, increasing but slowly in size, while their more fortunate companions of the same brood fairly outstripped them in size and vigor, and actually passed through an entire transformation in advance of them. At the start, they had no advantage over their brethren; all were favored alike. What could have wrought the difference? From the foregoing facts, the conclusion is irresistible that nutrition had been the force at work; the vigorous larvæ, being amply supplied with food of the very best quality, had rapidly added to their size; while their stunted companions, being supplied with plenty of innutritious diet, had remained almost stationary.

June 26th—The caterpillar has moulted for the third time. Its length is one and three-fourth inches, and thickness nearly one-half an inch. The color of the middle dorsal line is bluish-green, and of the lateral walls, a beautiful pea-green. The dorsal and lateral dots and blotches have entirely disappeared, as well as those upon the pro-legs and spine-bearing tubercles.

The tubercles upon the 1st segment are a light blue, bordering upon pearl; concolorous with those upon the lateral and sub-lateral abdominal rows. Their spines still retain the primary black. The 2nd and 3rd segments have dark purple tubercles above, while the 4th, 5th, 6th, 7th, 8th, 9th and 10th pairs of dorsal tubercles, are a deep lemon. The 11th segment has one large central tubercle, equal in size to those upon the 2nd and 3rd segments, which are larger than the others. The 12th and 13th dorsals are a pale blue.

The pro-legs and true legs are yellowish green, except the lower part of the distal joints of the latter, which are similarly colored with the claws.

Upon each side of the caput, near the base of antennæ, are two dark spots. General color of head, pea-green; mouth appendages, light blue.

The under surface of the caterpillar is a light green.

July 4th—The last moulting occurs. The length is two and one-half inches, and the thickness one-half an inch. As soon as the skin is changed, the dorsal tubercles of the 2nd and 3rd segments, are yellowish brown, with a lower circle of eight black papillæ without spines, and a circle of six spines above, surrounding a central one. Fourth pair of dorsal tubercles yellow, with eight black warts near the base, and a circle of six black spinules above, surrounding a central terminal one; 6th, 7th, 8th, 9th and 10th each with two horizontal spines; 5th, with five spines arranged in the form of a pentagon; 11th, yellow, with a circle of six spines, near the base of which, anteriorly, are several irregular black blotches.

On the anterior margin of the 1st segment, in line with the dorsal tubercles, exist four blue wart-like prominences.

The 2nd and 3rd lateral tubercles are light blue, each furnished with a circle of six spines, surmounted by a central spine; 4th, a circle of four and one central; 5th, 6th, 7th, 8th, 9th and 10th, blue, with one central spine.

Sub-lateral tubercles, below spiracles, same size as the laterals, hairy, 2-spined, with rudiments of a second pair in some cases. Below these, on the 2nd, 3rd, 4th and 5th segments, exist small blue tubercles tipped with double spines. On the 12th segment, alternating with dorsal and lateral rows, there are four blue tubercles, with a circle of six black spots near their base, and a circle of four spines and one central on the dorsal tubercles, and a circle of four spines on the laterals. In line with the dorsals, two blue tubercles with five black spines, two of which in some cases have nearly disappeared.

True legs, greenish yellow, with black incurved claws; pro-legs, greenish-yellow.

Spiracles narrowly elliptical, with pearly centres and black margins.

Antennæ, cream-colored, tipped with brownish, and having two dark kidney-shaped spots near their base. Upper lip, pearl-colored and deeply cleft; lower lip, similarly colored; palpi, short, hairy, and marked with dark brown blotches; jaws, pearly at base, and dark brown for the anterior two-thirds.

General color above, greenish blue; on the sides, pea-green, and of the same color below.

In many cases, the lateral and sub-lateral tubercles are a beautiful pearl color, which appears to be due to the character of the food, for it is a noticeable fact that the majority of the caterpillars which exhibit this color-change, are found feeding upon the leaves of the common plum (*Prunus domestica*).

July 21st—The larvæ commence to spin their cocoons. This requires a period ranging from three to four days. While the operation is in progress, a slight incision is made through a cocoon, which is instantly repaired. Three times is the experiment performed, and as many times is the cocoon mended. But the fourth time the caterpillar seems to take no notice of the rent, or, even if it does, it is unable to make good the damage by reason of the lack of necessary material. The cocoon being completed, the remaining efforts of the larva are spent in the rupture and separation of the epidermis, which is eventually thrust into the lower part of the cocoon. This is effected in about six days. The process is precisely similar to that which takes place in moulting.

Caterpillars in confinement, particularly in empty boxes, become exceedingly restless, and wander about for several days, as if in quest of something. This is especially noticeable in larvæ which utilize the leaves of the plants upon which they feed for cocoon purposes. Where the box is small, and both the upper and lower surfaces are perfectly accessible, the absence of leaves is but little missed. But, on the other hand, where these substitutes do not exist, the chrysalis has been known to appear without the customary covering.

This fact seems to point to the conclusion that the cocoon is only a subsequent acquirement, which did not primarily exist. In climates where rains are of common occurrence, as protecting envelopes, they are indispensable. A chrysalis will endure a very low temperature while comparatively passive, with perfect impunity; but cannot endure excessive moisture without destruction.

Of the exact time which the chrysalis requires to develop into the imago, I can only say that it depends upon thermometric conditions; were the several larval transformations undergone in early summer, while the mercury is standing at 92 degrees, and were the chrysalis stage then assumed, it is probable that the moth would appear in about two weeks. We reason from analogy. *Actias luna* requires but a single day less than a fortnight to pass from the condition of pupa to that of imago, and surely *cecropia* could scarcely surpass this period. Cocoons that have been taken into the house in August, and kept close to a hot stove, have developed in January; while those which have been left out doors, seldom change before the middle of May. As far as I have been able to ascertain, this species is single-brooded.

Before bringing this sketch to a close, there are a few particulars which I shall touch upon, that came under my immediate notice during the season that has passed. It is a mistaken impression that caterpillars of particular species confine their feeding to certain plant-species, exclusively. During several years past, I have closely looked into this subject, and my experience has been otherwise. My observations upon *cecropia* have been both interesting and remarkable. In the neighborhood of Germantown, the leaves of the common red currant, constitute its favorite food. During the first and second stages, by which I mean the intervals before and after the first moulting, it entirely restricts its feeding thereto. But after the second moulting, it readily accustoms itself to *Ribes nigrum*, *R. grossularia*, *Prunus cerasus*, *P. vulgaris*, *Rosa blanda* and *Spiræa corymbosa*. A little later, I have tried numerous larvæ upon *Wistaria sinensis*, *Philadelphus inodorus*, *Syringa vulgaris* and *Prunus serotina*, with remarkable success. Subsequent to the last moulting, several caterpillars were induced to feed upon *Symphoricarpus racemosus*. Some cocoons which were produced by larvæ reared upon the leaves of *Sambucus Canadensis*, are the largest that I have ever seen. They measure fully four and a half inches in length, and have a diameter of nearly three inches. They are less compact than those found upon any of the foregoing plants, being very light and considerably inflated. The chrysalis within is proportionally large. In some parts of the country, along the borders of thickets and waste fields, they are found in abundance, and thrive handsomely upon the elder. The moulting periods are shorter, and the chrysalis stage is attained at least a fortnight sooner than is usual. At first, where plants more congenial to the taste, are in close proximity, a disposition to stray thereto was discernible. To obviate this difficulty, perfectly isolated plants were selected, which proved highly successful. Frequent attempts to rear caterpillars before the first moulting was over, upon foreign plants, proved in every case an utter failure. It is doubtless true that instinct has much to do in the matter, but may it not be that the jaws and legs are so constructed at first as to be only adapted to cutting and holding on to the leaves of particular plant-species? This being so, with the further development of these organs, would certainly come the power of adaptability to take advantage of the changes thus introduced into their *environment*.

The food has certainly much to do with the color of the cocoon. Caterpillars feeding upon the leaves of the common red currant, produce silk of a deep reddish-brown color; while the leaves of the cherry, plum, and the several species of *Rosa*, give a light brown color, bordering on gray. Cocoons taken from *Spiræa*, *Symphoricarpus* and *Prunus serotina*, are invariably a grayish-brown. There is also plainly noticeable in caterpillars feeding upon these plants, with the exception of those feeding upon *Ribes rubrum*, a tendency to lighter colors, which in some cases is decidedly marked, as in the case of those feeding upon the leaves of *Prunus domestica*, where the lateral tubercles often display a beautiful pearl color.

That food has certainly much to do in determining the sexes among Lepidoptera, I think has been clearly shown in the writings of Mrs. Treat, and in those of the author, although leading authorities are disposed to think differently. But, notwithstanding their opinions to the contrary, I cannot be deterred from placing upon record my experience of the past summer with *Platysamia cecropia*. As before remarked, quite a number of caterpillars were constrained to feed upon the leaves of plants that betrayed anything but a healthy appearance. It has been already shown that these larvæ were readily distinguished from their vigorous brethren in many particulars, such as size, color and markings. And, further, that in some cases growth was delayed, and even the time of moulting more than doubled; while, in others, either the first or second moulting was entirely dispensed with. An examination of their chrysalids reveals the startling fact that out of some twenty in my possession, all, with two exceptions, are masculine in character.

The question is often asked—Are there any checks to the undue multiplication of *cecropia* in the shape of natural enemies? I answer in the affirmative. Certain species of *aves* prey upon them. But no enemies are more destructive than two of our commonest species of spiders, *Tegenaria medicinalis* and *Agelena nævia*, the former of which constructs its web upon bushes of the red currant, using a curled leaf for a tube. I have noticed the above species on numerous occasions engaged in dragging caterpillars into its dens. It is only while the caterpillars are young, before the first moulting has taken place, that these attacks are ventured upon. *Dermestes lardarius*, in the larval state, frequently attacks the living chrysalis when divested of its cocoon, and does not cease from its ravages until it has reduced it to a mere hull. Even the chitinous covering shares the fate of the softer parts within. In a few instances, these larvæ had penetrated the only door of entrance, by gnawing their way through the comparatively loose fibres of silk which occupy the centre of the basal extremity. Their presence was only detected by the removal of the cocoon. Several cocoons which I have in a warm room have recently yielded fine specimens of the following parasites: *Ophion macrurum* Linn., *Exorista militaris* Walsh, *Chalcis maria* Riley, and *Cryptus nuncius* Say—the *extrematis* of Cresson. At least one out of every three which I raised during the past season, and the number was not short of two hundred specimens, has been infested.

THE NATURALISTS' DIRECTORY.—This pamphlet, recently issued, will prove a great convenience to all those interested in science. It contains the names of Naturalists, Chemists, Physicists, and Meteorologists, arranged alphabetically, the several departments separately indexed. It is well printed and interleaved with blank paper, on which additional names may be written. It is published by the Naturalists' Agency, Salem, Mass.

HISTORY OF PHYCIODES THAROS, A POLYMORPHIC BUTTERFLY.

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

(Continued from Page 10.)

I have had upwards of 500 examples of the species before me in making these comparisons, most of them bred, but many taken in the field during several years past, since my attention has been attracted to the variation manifested. Many others I have brought together from localities as far apart as those mentioned. And I can well corroborate the words of Drury, applied to *tharos*, now more than an hundred years ago: "In short, Nature forms such a variety of this species that it is difficult to set bounds, or to know all that belongs to it."

In most of the comparisons above made I have used the under side of the hind wings only, for the reason that here the markings are most decided and colors most varied; but there are differences in the fore wings also corresponding much with the others. On the upper side there is more uniformity throughout the species; but, as a rule, the winter form has the fulvous portions deep red, while in the summer generations the fulvous is usually paler, and often partly replaced by yellow, as before mentioned. The 1st summer generation at Coalburgh had much less of this change in the fulvous portions than the 2nd, and the 2nd corresponded in this respect with the 1st Catskill summer generation. But the upper side of var. A forms an exception, the black being paler, almost gray, and the hind margin of fore wing edged by a narrow band which is distinctly separated from the blacker submarginal patches. Usually these are confluent and concolored with the band, making in effect a very broad black margin. The blackish net work about the base is very open, the lines fine. A appears to be an offset of B in the direction most remote from the summer form, just as in *Papilio ajax*, the var. *Walshii* is on the farther side of *telamonides*, remote from the summer form *marcellus*. On the contrary, var. C leads from B through D directly to the summer form. A is farther from this last in all respects than are several species of this genus, and were it not for the intermediate grades, I do not think it would be suspected of any close relationship to the summer form. Variety B I conceive to be nearest the primitive type. Besides that this has appeared constantly in the butterflies changed by cold, as related, it is common in this region, predominating over the other varieties. It is also found more or less as far north as New York, though there it is not common. And moreover its distinctive peculiarity of color is seen in the allied species *phaon*, inhabiting the Gulf States, and in *vesta*, Texas, which in some degree replace *tharos* in those regions. Both these are seasonally dimorphic, and both are restricted in the winter form, so far as I can learn, to the single phase denoted by B in *tharos*. And in their summer generations, both have a close resemblance to the summer *tharos*, though owing to the increased number of summer generations in the extreme south, permitted by the length of the season, there are phases of the summer form in these species not observable in higher latitudes. It is noteworthy that these two species, the only ones, excepting *Batesii*, on the Atlantic slope especially near to *tharos* (and what *Batesii* is, whether it is not another variety of the winter form of *tharos*, is not yet settled), should be seasonally dimorphic, while of the many other species of the genus belonging to our fauna, not one, so far as is known, shows any marked difference between its winter and summer generation.

The significance of these phenomena I take to be this: when *phaon* and *vesta* and *tharos* were as yet only varieties of one species, the sole coloration was similar to that now common to the three. As they gradually became permanent, or in other words, as these varieties became species, *tharos* was giving rise to several sub-varieties, some of them in time to become distinct and well marked, while the other two, *phaon* and *vesta*, remained constant. As the climate moderated and the summer became longer, each species came to have a summer generation; and in these the resemblance of blood-relationship is still manifest. As the winter generations of each species had been much alike, so the summer generations sprung from them were much alike.

And if we consider the metropolis of the species *tharos*, or perhaps the parent species back of that, at the time when it had but one annual generation, to have been somewhere between 37° and 40° on the Atlantic slope, and within which limits all the varieties and sub-varieties of both winter and summer forms of *tharos* are now found in amazing luxuriance, we can see how it is possible, as the glacial cold receded, that only part of the varieties of the winter form might spread to the northward, and but one of them at last reach the sub boreal regions, and hold possession to this day as the sole representative of the species. And at a very early period the primary form, together with *phaon* and *vesta*, had made its way southward, where all three are found now, and neither of them, so far as appears, having developed any marked varieties of the winter form.

[After this paper was written, and the first part of it in type, I received from Mr. Boll a fine series of *tharos*, *phaon* and *vesta*, from Texas, with the dates of capture accompanying each example. It appears that *tharos* there flies from February to November, and there must be in all six or seven generations during this period. Five of these are represented in the series sent. All the examples of *tharos* are of small size, resembling in this respect those from the far north. All, except the February examples, which are var. B winter form, are very dark above, the black intense and the fulvous deep red, and some of the males have the under side of the hind wings almost deprived of markings of any sort, and to a considerably greater degree than I have observed in more northern examples. But certain males labeled Sept., Oct., resemble surprisingly var. C of the winter form. I find the first of these phases, that of the plain wing, also in *phaon*, and among the examples of this species is a female labeled November, that is undoubtedly the winter form, var. B, and which would be expected to appear in February, after the winter. And this has led me to suspect, considering the effect produced on the Coalburgh larvæ fed in the Catskills, as before related, that a cool season during the time the fall brood is feeding, or a few cool days after the chrysalis is formed, may tend to change the form of such of the butterflies as will emerge before winter, so that they shall not differ from those which pass the winter in chrysalis and appear in February. That may happen naturally which was brought about artificially with the Coalburgh brood spoken of.

I have also received a letter from Dr. Weismann of 16th Nov., 1876, which by his permission I may give in this connection: "Naturally your experiments with *tharos* have greatly interested me. The case seems to me perfectly intelligible; *marcia* is the old, primary form of the species, in the glacial period the only one. *Tharos* is the secondary form, having arisen in the course of many generations through the gradually working influence of summer heat. In your experiments cold has caused the summer generation to revert to the primary form. The reverting which occurred was complete in the females, but not in all the males! This proves, as it appears to me, that the males are changed or affected more strongly by the heat of summer than the females. The secondary form has a stronger constitution in the males than in the females. As I read your letter; it at once occurred to me whether in the spring there would not appear some males which were not pure *marcia*, but were of the summer form, or nearly resembling it; but when I reached the conclusion of your letter I found that you especially mentioned that this was so! And I was reminded that the same thing is observable in *V. levana*, though in a less striking degree. If we treated the summer brood of *levana* with ice many more females than males would revert to the winter form. This sex is more conservative than the male—slower to change."]

I am at a disadvantage with this paper not to be able to give colored illustrations of the different forms of *tharos*, with the variations, as well as figures of the allied species mentioned, but I propose to do so fully in the Butterflies of North America.

It is the female of the summer form, and that variety of it which displays the brown discal patch on the under side of the hind wings, that Drury figured as *tharos*, in 1770, and exceedingly well. In some notes when the description of *marcia* was given, Trans. Am. Ent. Soc., vol. 2, p. 207, I discredited *tharos* of Drury, but wrongly, and for the reason that I had not seen the peculiar phase figured. It pleases me now to make correction. My description of *marcia* was based on the first three of the varieties designated in this paper. The 4th, D, I then knew nothing of, nor indeed should I ever have noticed it but for having bred it from the egg.

Cramer's *tharos* is stated to have come from New York, and reference is made in the text to Drury. The figures are coarsely drawn and rudely colored. Bois.-Lec. state this *tharos* to be identical with Drury's, but in his Lep. de la Californie, Dr. Boisduval says it is another insect, and he considers Drury's *tharos* not to be our Atlantic species, but a Californian which he calls *pulchella*. I received the type of *pulchella* from Dr. Boisduval, and it proved to be *mylitta* Edw., a species by no means so near *tharos* as is *pratensis* Behr, of California. *Cocyta* Cramer, ♂, fig. A, B, pl. 101, is *tharos* ♂ of the summer form, and fig. C probably is intended for female of same, but the text refers it to Surinam, and it is given with a doubt as to whether it belongs to the male figured or not. Mr. Scudder regards these as var. of *tharos* Drury. But Dr. Boisduval makes it synonymous with *morpheus* Fab., and locates it in So. California. And Mr. Butler, Cat. Fab. Lep., makes *morpheus* Fab. a syn. of *liriope* Cramer, and refers it to Florida. And Mr. Scudder rejects *liriope* as N.

Am. So that the synonymy is rather mixed, and I give the above as a sample of the difficulties caused by attempts at utilizing the illy-executed figures and indifferent descriptions of some of these old books.

However, Fabricius (Ent. Syst. 3, No. 479) describes *morpheus* as a N. Am. insect, and in language, which though brief, is applicable to the summer form of what for many years has been known as *tharos*. Parvus. Alae omnes integerrimae, fulvae, maculis margineque nigris. Posticae punctis sex nigris in strigam dispositis versus marginem posticum. Subtus anticae fulvae, nigro maculatae, posticae pallascentes strigis undatis, margine punctisque sex fuscis. And accordingly, as it is best to designate by name the dimorphic forms of any species, I call the entire species *tharos*, the summer form var. *morpheus* Fab., the winter form var. *marcia*, and take no heed of Cramer's figures.

The figures of the male *tharos* in Bois. and Lec., are not very exact either, but may be taken to represent the var. *morpheus*. But the female must have been drawn from *Batesii*, and evidently Dr. Boisduval had this insect before him when he wrote these words: "We possess individuals which we consider as varieties, of which the primaries are black, with some fulvous spots and a transverse macular band of the same color. The hind wings do not differ, *except that the lines on the basal area run together*. Beneath, *the hind wings are wholly deprived of a brown border; the fore wings have likewise a part of the border effaced, but that which remains is blacker than in ordinary individuals.*" An excellent description of *Batesii*.

My experiments have thrown no light on the position or history of *Batesii*, and inasmuch as this is certainly a winter form (though I am not yet able to say that it may not be a summer form also), and the only larvæ of *tharos* so far carried through the winter having been from the Catskills, where *Batesii* is never taken, I could not expect this last to appear among the resulting butterflies, even if it were only a variety of *tharos*. If I succeed in saving the hybernating larvae which I now have, most of which originated at Coalburgh, the point as to relationship of these species, or forms, may be settled this coming spring. *Batesii* is not common here, and I have taken perhaps a dozen examples in course of several years; all these were flying with *marcia*.

* DESCRIPTION OF PREPARATORY STAGES OF THAROS.

EGG.—Conoidal, truncated, depressed at summit, rounded at base the lower half indented like a thimble, the excavations being shallow and arranged in close and regular rows; the upper half smooth, with about 15 slightly raised vertical ribs, terminating at the rim above; color pale green. Laid in clusters on the leaves of any species of Aster. Duration of this stage 4 to 7 days.

YOUNG LARVA.—Length .06 inch.; cylindrical, largest anteriorly, the segments each well rounded; sparsely pilose, the hairs black, and on the anterior segments directed forward; color yellow-green clouded with brown; head ob-ovate, deeply cleft; pilose; color dark brown. Duration of this stage 5 to 6 days.

AFTER FIRST MOULT.—Length .1 inch.; cylindrical, stoutest in the middle segments; armed with 7 rows of short, fleshy, brown spines, each thickly set with short, concolored bristles; there is also at the base of body a row of small spines, similar to the others, one on each segment from the 3rd, and over the pro-legs two on each; the 2nd segment with a collar of minute spines; body striped longitudinally with light and dark brown and sordid white; the dorsum light brown edged with white, and on this brown area are two interrupted white streaks; on the side a dark brown stripe on light ground; and in line with the lower lateral spines a white ridge; under side, feet and legs brown; head sub-cordate, the vertices rounded, and across each a gray band; another band on front lower face; color shining black. Duration of this stage 5 to 6 days.

AFTER SECOND MOULT.—Length .22 inch.; same shape; the stripes almost the same, the white dull, the brown darker; head sub-cordate, dark brown or black; on each vertex a white spot and one on front lower face. To 3rd summer moult 3 days. Where the larva passed 3rd moult in the fall, the interval was from 7 to 14 days.

* NOTE.—As the publication of this paper has been delayed, I am able to say now (March 24th), that the hybernating larvæ spoken of have gone through their larval changes and are now in chrysalis, 11 of them. These all had passed 3 moults last fall, and have passed 2 since hybernation ended. As will be seen below, the coloration at both these moults differed in several respects from the summer coloration. I did not succeed in bringing alive through the winter any of those larvæ which hybernated after 2nd fall moult, but of those which passed 3rd in the fall, the larger part were living when I placed them in the greenhouse, 7th Feb'y.

AFTER THIRD FALL MOULT.—Length .3 inch.; the dorsum light brown, edged with faint white at the 1st lateral row of spines, the brown area showing two macular white streaks; below 1st laterals, a black stripe, the remainder of the side brown; a white ridge with 3rd laterals; spines generally brown, the bristles same, black-tipped; head sub-cordate, shining black; with a gray, illy-defined spot on each vertex, and another on each side of face; some gray points also back of the last.

AFTER FOURTH MOULT, IN SPRING.—Length .44 inch. Body yellow-brown, dotted with yellow-white; the spines short, stout at base blunt at top, yellowish at base, brown above; the bristles short, divergent, brown, black-tipped; along the dorsal row a black stripe; a yellow stripe runs with 1st laterals, usually broken and somewhat irregular, most continuous on either side of each spine; a yellow band in line with 3rd laterals; head small, cordate, bronze or black, shining, with a few black hairs; across each vertex a narrow yellowish bar; a yellow triangular spot on front lower face, at the lower angles connecting with a curved yellow bar which runs to the back of the head.

AFTER FIFTH AND LAST MOULT, IN SPRING.—Length .6 inch. Color blackish-brown, dotted, especially on dorsum, with yellow; the spines more tapering, stout at base, blunt at tip, mostly yellowish at base; the bristles brown, black-tipped; on dorsum a black stripe, but often wanting; a yellow stripe in line with 1st laterals, and a yellow band below 3rd laterals; in some examples there is a black stripe between 1st and 2nd laterals; head bronze, shining, with black hairs; across each vertex a narrow whitish bar, thickened at the front and bluntly barbed on outer side; in front a triangular spot, connecting at the lower angles with a sickle-shaped bar on side, both yellowish. In other respects like 4th summer moult. Length at maturity .85 inch.

AFTER THIRD SUMMER MOULT.—Length .45 inch. Color olive brown; the dorsum much specked and dotted with dull white; a dull white stripe in line with 1st laterals, and a band of same color below spiracles, above which is another band, rather indistinct, whitish, macular; under side dark brown; the spines brown, light tipped, many with yellow, sometimes orange bases; the bristles black; head cordate, bronze; a straight silvery bar across each vertex; a triangular white spot in front, connected with a curved white line on either side, and white on the mandibles. To next moult 3 to 5 days.

AFTER FOURTH AND LAST MOULT, IN SUMMER.—Length .80 to .85 inch.; when mature, .90 to .95 inch. Cylindrical; color dark brown, dotted with yellow, and striped with yellow and black, the yellow always dull; armed with 7 rows of spines, 1 dorsal, and 3 on either side, besides smaller spines, arranged as after 1st moult; the spines stout, tapering, dark brown, in part white-tipped, those of 1st and 3rd lateral rows more or less orange tinted at base; each spine beset with many stout, straight, black bristles; next below 1st laterals a blackish stripe, edged on the dorsal side by yellow; in line with the lower laterals a yellow ridge; head cordate, either black or bronze; on each vertex a transverse white band; in front a cordate yellow spot, and on each side a sickle-shaped yellow stripe. Duration 4 to 6 days.

CHRYSALIS.—Length .50 inch.; cylindrical, thickest at 9th and 10th segments; head case narrow, excavated at the sides, nearly square at top; the mesonotum moderately prominent, compressed at summit, and followed by a slight depression; the anterior edges of the last four segments of the abdomen prominent, especially of the foremost, which is developed into a ridge; on the abdomen several rows of fine tubercles; the color varies, being light cinereous, covered with fine abbreviated streaks; or it may be cinereous on dorsum, the rest yellow brown; or a dull white mottled dorsally with brown; or wholly dark brown finely mottled with gray. Duration from 6 to 13 days, unless retarded by cold.

DESCRIPTION OF A NEW SPECIES OF HESPERIAN FROM TEXAS.

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

Pamphila Meskei.

Female—Expands 1.4 inch.

Upper side blackish-brown; primaries have the costal margin to cell and nearly to apex densely covered with fulvous; the basal area and the inner margin sprinkled with fulvous scales; and the cell wholly deep fulvous except towards the outer end, where through the middle runs an oar-shaped blackish stripe; midway between cell and apex an elongated yellow-white spot, cut into three by the sub-costal nervules, the one of these spots nearest costa nearly lost in the fulvous ground; across the disk an oblique band of yellow-white spots, the upper one small and in the upper discoidal interspace, placed a little outside the costal spot, the lower one in the submedian interspace, the spots widening as they proceed towards inner margin, and the 3rd and 4th deeply excavated on the outer side. Secondaries have the costal margin blackish like the hind margin, but the rest of the wing is sprinkled with fulvous, and the inner half covered by long dull greenish hairs; between the cell and margin an extra discal bright fulvous bar crossing three interspaces; fringes whitish.

Under side uniform bright orange, only the inner margin of primaries and a narrow space below the cell to base being fuscous; the spots on primaries faintly reappear in paler color than the ground, reduced in size, and at the end of the cell are two faint, yellow, horizontal bars, one at either side of cell. Secondaries immaculate except for two or three yellowish points corresponding to the spots of the extra discal bar.

Body above covered with dull green hairs, the collar orange, and the hairs at base of antennæ partly orange-fulvous; thorax below yellow-white, the abdomen yellow, on the sides and at the end orange; legs ochrey and yellow-white; palpi orange, as are the hairs of the collar; antennæ blackish above, yellow below; club fuscous.

From a single example in the collection of Mr. Otto Meske. The species is allied to *attalus* Edw. and *seminole* Scud., but is larger, more brightly ornamented on upper side, and beneath is not to be mistaken for any other species, owing to its bright orange surface. The male yet unknown. Taken in Bastrop Co., Texas.

CORRESPONDENCE.

I think it would be beneficial if a portion of the journal-space were devoted each month to a notice of the localities, habitats, food and habits of some of our rarer species, the best methods and apparatus for their capture, and the most approved way of putting them to death without damage, as also of pinning, setting and preserving them. These matters may seem of but slight consequence to the practised collector, but they assume an aspect of the greatest importance in the eyes of a beginner. In this connection, if Entomologists throughout the province would relate their experience in successfully collecting certain families of insects, and describe any method, implement or apparatus which they have found advantageous, and at the same time record the date, time of day, locality and habitat of their captures, a judicious selection of the same would, I think, add much to the popularity, and not a little to the utility of the journal.

The question of the localities I consider as of very great importance, especially when united with the season at which certain insects may be expected to appear. Entomologists visiting remote sections of the country would, if such observations were duly registered, be directed whither to go in order to obtain specimens of species which might be rare or wanting entirely in their own neighborhoods. For instance, I have never captured any of the Lycænidæ, nor ever known one to be captured in the immediate vicinity of Belleville, though in Madoc, about 30 miles north, I saw them in great profusion in the middle of May, 1868. Again, *P. asterias* is very common in this town, while only a few stragglers of *P. turnus* are ever seen. In the township of Lake, about 25 miles north-west from Madoc, and a very wild district, *P. turnus* is abundant, while I did not observe a single specimen of *asterias* in three weeks of the heighth of the season.

I think it would also be desirable to give from time to time notices of works on the science, especially such as refer to the discrimination of insects, and to give a list of such books as are likely to be of service to young collectors. You will see that I am an advocate of the *propaganda*. Every collector is certain to meet with rare, and is not unlikely to capture hitherto undescribed species, and if "in the multitude of counsellors there is wisdom," so in the multitude of collections there is knowledge.

JAMES H. BELL, Belleville, Ont.

I found in opening some *cecropia* cocoons lately, *two* pupæ in one cocoon. These were of different sex, and in opposite position as regarded the loose end of cocoon ; neither was perfectly formed, apparently owing to their being crowded out of shape in the limited space. The cocoon was one of the "loose" kind ; both inner and outer cocoons and floss were uniform in texture, showing no line by which the work of two larvæ could be distinguished. There was, however, a rudimentary division on the inside of the inner cocoon at its close end, partly enclosing the abdominal end of the ♂ pupa. In writing of *Ophion macrurum*, p. 220, v. 8, I omitted the word "imago." *Ophion* pupæ would hardly be a rarity, since over 20 per cent. of *polyphemus* are thus affected, but *Ophion* imago in October and November are new to me. The cocoons were kept in a cold room.

C. E. WORTHINGTON, Chicago.