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ON CERTAIN HABITS OF HELICONIA CHARITONIA, LINN., A SPECIES OF BUTTERFLY FOUND IN FLORIDA.

By W. H. EDWARDS.

In part read before the Ent. Sub-Section of the Am. Assn., at Cinn., August 18, 1881.

In Wallace's Contributions to the Theory of Natural Selection, London, 1870, page 77, we read: "There is in South America an extensive family of these insects, the Heliconidæ, which are in many respects remarkable. They are so abundant and characteristic in all the woody portions of the American tropics, that in almost every locality they will be seen more frequently than other butterflies. They are exceedingly beautiful and varied in their colors, spots and patches of yellow, red, or pure white, upon a black, blue or brown ground being most general.

They frequent the forests chiefly, and all fly slowly and weakly. Yet, although they are all so conspicuous and could certainly be caught by insectivorous birds more easily than almost any other insect, their great abundance all over the wide region they inhabit shows that they are not persecuted.

It is to be especially remarked also that they possess no adaptive coloring to protect them during repose, for the under side of their wings presents the same, or at least, an equally conspicuous coloring as the upper side, and they may be observed after sunset suspended at the ends of twigs and leaves, where they have taken up their station for the night, fully exposed to the attacks of enemies, if they have any.

These beautiful insects possess, however, a strong, pungent, semi-aromatic or medicinal odor, which seems to pervade all the

juices of their system. When the entomologist squeezes the breast of one of them between his fingers to kill it, a yellow liquid exudes, which stains the skin, and the smell of which can only be got rid of by time and repeated washings. Here we have, probably, the cause of their immunity from attack, since there is a great deal of evidence to show that certain insects are so disgusting to birds that they will under no circumstances touch them."

Mr. Belt, in "Naturalist in Nicaragua," p. 316, relates, that when in Brazil he watched a pair of birds catching butterflies and dragon flies, which they brought to their nest to feed their young, and in no case did they catch one of the Heliconidæ, which were in great numbers about, and could have been caught with less trouble than any others. Also, that a tame monkey, who was extremely fond of insects, and would greedily munch up any beetle or butterfly given to him, never would eat a Heliconian. There was no doubt from his actions that they were distasteful to him.

H. Charitonias is common in parts of southern Florida, and I am in possession of facts as to its habits through a correspondent, Dr. Wm. Wittfeld, a physician, resident at Georgiana, Indian River.

The eggs are laid on the tenderest terminal leaves of passion-vine. The caterpillars are conspicuous in color, being in the middle stages greenish white, and in the last stage dead white, like porcelain. They are furnished with long black spines, on the verticles of head as well as on body.

The chrysalis is a singular and remarkably pretty object. From the top of the head case proceed two long foliaceous divergent processes, and on the dorsal side of abdomen are broad and thin processes tipped with sharp thorns. The color is brown in shades, with some yellowish, and with burnished gold spots.

The butterflies live in the forest and fly along the paths, but they come into the open in the heat of the morning and return towards night, finding roosting places on Spanish moss and on dead twigs or branches, especially such as have dry leaves still hanging. Here they collect up to the number of seventy or even more.

The caterpillars, after third moult, at which time they become quite conspicuous in color, conceal themselves during the day.

Nothing appears to have been published of the preparatory stages of *Charitonias*, although it is a common species in Mexico, Central America, and some of the West India Islands. I deem myself fortunate, therefore, in having secured drawings of every stage for a plate in the "Butterflies of N. A." I have received young caterpillars, at Coalburgh, sent through the mails by my friend, and have raised them to chrysalis and imago.

Dr. Wittfeld, some time ago, called my attention to a strange habit of these butterflies, as follows: "On May 28th, I observed

three *Charitonias* on a chrysalis of same species in the woods. They were firmly attached, and on trying to drive them off they would not go. I tried repeatedly, and finally used force. But after flying around a few times they took up their former position, heads down.

The next day the same thing occurred, only I noticed that one butterfly at a time would leave to feed; force was again used, with the same result as before. The following day, shortly after dawn, only a trifle of empty shell remained.

This observation prompted me to raise another chrysalis, which I suspended in a flowering shrub, which *Charitonias* frequented, June 27. Soon some butterflies came and touched the chrysalis, but its wriggling seemed to cause them to move off. Two days before the imago was due, they attached themselves again, two or three at a time, and would only yield to force, always returning. On the third day, at daybreak, only a trifling bit of the empty shell was left, and the butterflies were all gone." Dr. Wittfeld adds, "Did they come to protect the chrysalis or to assist the butterfly to come forth, or was there anything of sexual desire?"

I replied to this, asking how the butterflies attached themselves. Did they actually rest on the chrysalis, holding on by the legs? Also, was I to understand by bits of empty shells remaining that the imagos had come from the two chrysalids? I suggested, if this last was not what he meant, that, perhaps, the butterflies had discovered that the chrysalids were dead and decaying and came to seek the fluids as they come to carrion.

On this Dr. Wittfeld again writes: "In each case the butterfly emerged from the chrysalis. The chrysalis looked natural but was growing darker, and the day before the emerging, the coming live insect could, to some extent, be distinguished. There was nothing dead or decayed or partly eaten about it. All the legs of the guarding butterflies had firm hold of the chrysalis, and it required a little effort to remove them with the fingers. They sat firmly, not lightly upon it. To frighten them off did no good, it required force to remove them. After having been picked off they did not stay long away, but flying around a few times, (I having removed to some distance), returned to the chrysalis and attached themselves to it just as they had done before."

This is explicit. May there not be here a case of intelligent protection of the unborn butterfly by other individuals of its species? The butterflies themselves are protected, as we read, by their obnoxious smell and taste, or both, from birds, lizards and other animals, and the chrysalis might be just as obnoxious after it was seized. But, its color or appearance would not be sufficiently well known for its protection, and at the time when it was least able to take care of itself. To be sure, the chrysalis may, in a measure, protect itself by wriggling about, and by the

squeaking noise which we read in books the chrysalids of the Heliconidæ make when alarmed, and which Dr. Wittfeld informs me he had noticed in the case of *Charitonias*. But when the pupa-case was softening, and the immature imago was in condition to receive injury by any rough attack, apparently the friendly neighbors gather about it and cover it unceasingly till the danger is past, and the butterfly emerges.

The foregoing recital led to some discussion by members of the sub-section, and it seemed to be rather the prevailing opinion that the immediate cause of the gathering of the butterflies about and on the chrysalis must be sexual. Much was said about the attraction of males of the Saturnidæ by the females, but this is excited by the females at large, not encased in pupa. It was doubted by some members if any odor could emanate from the imago of a moth in pupa, or of a butterfly in chrysalis, hermetically sealed up, as it were. Further observations were desirable.

After returning home from Cincinnati, I wrote Dr. Wittfeld, urging him to try again, and especially to ascertain whether the free butterflies and the imago in the chrysalis were always of opposite sexes or not, and whether females were attracted to a chrysalis in any case. I have his further report, as follows:

"With regard to the chrysalis found May 28, of which I wrote you, I add, that there was found by me on the ground, on the morning the butterfly emerged, a female with wings but partly expanded, yet paired with a perfect male. Also, when I discovered that the butterfly had come from the second chrysalis, that of June 27, I found a similarly undeveloped female on the ground near by, paired with a free male. I lifted both and placed them on a twig. The male flew off in course of two hours, but the female remained, though a cripple and unable to move.*

"After receiving your letter, for a long time I could obtain neither eggs nor caterpillars of *Charitonias*, but at last, near the end of September, I hung out a chrysalis. A heavy rain storm setting in, no butterflies were flying that evening, and next day, six A. M., I found the empty shell of the chrysalis and imago. On Oct 1, I suspended another chrysalis. Soon a number of butterflies appeared, flying around and touching it. None however attached themselves to it as in previous observations. I caught one after another of these butterflies, as they came, and put them in a bag. About eleven o'clock, the imago came from the chrysalis, and as it clung to the empty shell, an occasional free butterfly would alight by it or fly about it. On examination this imago proved to be a male, and so did the captured butterflies.

At the same time another chrysalis was suspended, and began to change color, October 4, early in [the afternoon. Soon

* As Dr. Wittfeld had not mentioned these facts in his first accounts, I conclude that he did not then understand the relation between these crippled females and the imagos in the chrysalids, as he afterward learned to.

male butterflies appeared, took hold of the chrysalis, as before, but were easily frightened away.

By six o'clock, same afternoon, the color had changed, and males came freely, attached themselves firmly, and would not let go, in fact, were utterly regardless of their safety. When picked off they would fly around and return at once. Two males remained all night. Before daybreak next morning, I was at my post, and there found the two males, opposite one another, head down, abdomen curved toward the abdominal end of the chrysalis, both apparently exercising a pressure. Lighted matches held near them would not drive them off, shaking the twig did not loosen their hold, only picking them off bodily separated them from the chrysalis. The latter was now almost black, and momentarily I expected the shell to burst. This happened, but the break was not at the usual place. Owing probably to the pressure or weight of the butterflies the shell burst at the abdominal end, and *instantly one of the males made connection with the female imago, while the head and thorax of the latter were still enclosed in the shell.* After about ten minutes, I determined to free the new insect, which was accomplished by a slight pressure on the shell, and I then removed the pair and suspended them to a leaf-stem. The wings of the female immediately began to expand, but they did not fully develop. Without my aid, the imago would not have been able to extricate itself from the shell, although copulation had been affected.

I suspended another chrysalis, well discolored, under same conditions, October 7, in the morning. Males flocked around the chrysalis, circled about a few times, approached closely and then flew off again, none having alighted or actually touched the chrysalis. This went on for an hour, when a male emerged. The butterflies were mostly caught and all proved to be males.

October 17, another chrysalis was suspended under same conditions as the last mentioned. Males appeared, etc. Behavior just as before; none touching. The imago proved to be a male.

It seems to me that the sexual odor is but faintly developed when first discoloration takes place, and hence the chrysalis draws the males but little, but as the color changes the odor develops rapidly, so that males flock to the chrysalis from different directions."

On November 1, Dr. Wittfeld again writes, "To-day I made another corroborative observation on *Heliconia* chrysalis. At eight A. M., 2 ♂♂ attached themselves to female chrysalis, and acted as before reported. Four more males had appeared by nine o'clock, took hold as best they could, and the six made quite a bunch. Soon after others came, but had to be content with flying in close proximity, as there was no more holding room. At ten o'clock, I freed the female from the crowd, and found the abdomen exposed, but head and thorax still in the shell. I observed

that the abdomen was torn so that the contents were somewhat protruding.* I carried her to the house, allowed her to suspend from a branch, and being now out of the shell, the wings soon grew, and in another hour or so, the wound was healed or dried, and the insect flew off.

Though I have seen many *Agraulis Vanillæ* copulating, I don't remember of ever having seen *H. Charitonias* do the same at large. This prompts me to propose the following question; does this species ever pair in the ordinary way, after both sexes are fully developed, or do the males hunt the females while still in chrysalis? My late observations have brought me into all sorts of places, chiefly where passion-vine runs over dense bushes. There I have made frequent captures and have found all taken to be males. I believe the males were in search of a chrysalis. The females are mostly flying where the leafy parts of the vine are, while the males are where the chrysalis would be likely to be found, some distance off or below."

Dr. Wittfeld's admirable observations settle this; that in *H. Charitonias* the males are able, by some means, to distinguish the presence of a female in chrysalis, from the time when discoloration of the shell commences, that the attraction becomes stronger as the imago nears its emergence, that the females show no such attraction toward a male in chrysalis, and that males do not attract males. Incidentally, the female chrysalids would seem to be thoroughly protected against birds and other animals, but the protection, apparently, is purchased at a dear rate, if the female insect is liable to bodily injury or to be left crippled in wing. The last question propounded by Dr. Wittfeld, no doubt, he will in time be able to answer.

As I have elsewhere stated (Can. Ent. xiii, p. 208) it is not unusual to find female butterflies so lately out of chrysalis that the wings are at least limp, coupled with perfectly developed males, but I have not myself observed a case where the connection took place the instant the female broke from its shell, or before the wings were expanded. Certainly I have never known of male butterflies watching the advent of a female one moment, much more, for hours and days, and do not remember ever to have read of such an occurrence.†

November 11, 1881, discovered two chrysalids of *Charitonias* on the same plant, about two inches apart, but as much as two feet from the nearest passion vine. No. 1 was not discolored, No. 2 was a little discolored. To each chrysalis two males were attached. They would let go when touched, those on No. 2 hesitating a little; however, they all would return at once. On both chrysalids I noticed that the bodies of the males were bent

* I take it that copulation had been effected and that the torn appearance was caused by the forcible removal of the male. W. H. E.

† NOTE—After the foregoing pages were sent to the printer, I received from Dr. Wittfeld a statement of further observation, as follows:

up, that is, off from the chrysalis, and the pressure excited in former observations was not yet applied by the males. Apparently the males simply kept hold so as to be on hand when things developed.

Nov. 12, No. 1 is forsaken. To No. 2 four or five males cling, head down, bodies still bent up. They leave only to feed.

Nov. 13, No. 1 still forsaken, but in course of the day males flocked to it, their bodies still bent up. Were frightened away readily.

Nov. 14, No. 1 had all the attention of the males, while No. 2 remained forsaken, the bodies now touching the chrysalis, but almost midway of the abdomen of the pupa, not at the extremity.

Later. Two males had taken firm hold, as in previous observations, touching at the end of abdomen of pupa; would not let go, but had to be picked off.

Later. I found a pair in copulation on the ground. Now I examined No. 2 and found the imago nearly developed, but dead, and this explains why the chrysalis was forsaken.

During this observation I noticed that the males would alight on the chrysalis as they do on flowers, then wheel around quickly, head down, body up.

Nov. 14. My attention was attracted by a flock of six or eight *Charitonias* butterflies on the edge of woods, flying around an object which, on inspection, I found to be a chrysalis.

SOME REMARKS UPON THE CATOCALÆ, IN REPLY TO MR. A. R. GROTE.

BY GEO. D. HULST.

I notice in No. 9, Vol. I. of "PAPILIO," some strictures by Mr. A. R. Grote upon myself and an article written by me upon the Catocalæ of the U. S., and published by me in the Bulletin of the Brooklyn Ento. Soc., Nos. 1 and 2, Vol. III.

Following Mr. Grote in his remarks upon the article, I reply as follows:

It is substantially charged that in the article I was but the mouthpiece of Mr. Strecker; that he was the author or inspiration of the determinations made. I am able to prove by Mr. Strecker's letters to me at the time that he was not the suggester or inspirer of the article, nor the author of its ideas; and, moreover, that in one way or another he did not agree with me in my determination concerning the following Catocalæ: *Belfragiana*, *Alabama*, *praeclarata*, *Atarah*, *abbreviatella*, *Whitneyi*, *illecta*, *Bunkerii*, *Snowiana*, *perplexa*, *Meskei*, *vidua*, *Sappho*, *residua*, *Angusi* and *Mariana*—16 in all. He consequently did not so nearly agree with me as did Mr. Grote.

In giving my judgment upon the names in dispute between Messrs. Strecker and Grote, I decided upon the following evi-