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Pupation of the Nymphalidae.

ABSTRACT.

There is no more interesting phenomenon in insect transformation than the withdrawal of the chrysalis from the shrunken larval skin, and its firm attachment to the button of silk previously spun by the larva, in those Rhopalocera which suspend themselves perpendicularly during pupation. For a century and a half Reaumur's account, namely, that the soft segments of the forming chrysalis acted the part of legs by grasping the larval skin between the sutures, has been accepted and generally copied. Dr. J. A. Osborne, of Milford, England, first drew attention, some two years ago (*Nature*, v. 16, p. 502-503), to the fact that there was a membrane concerned in the act, and Mr. W. H. Edwards, of Coalburgh, West Virginia, corroborates Dr. Osborne's statement by observations on some of our American species, recorded in the *Canadian Entomologist* of last December.

In a paper recently presented to the Washington Philosophical Society, at its meeting of June 7th, Prof. C. V. Riley records the results of a number of observations on this subject, and thus explains the philosophy of the act which has so long misled observers. His studies have been principally made with the larvae of *Vanessa antiopa*, and we give the results as we have gathered them from correspondence with him.

The principal means by which the chrysalis holds on, and rises at the critical moment, is a stout ligament, which is, virtually, the shed intestinal canal; not alone the lining, but the

whole organ, which, as we know, becomes sub-obsolete in the imago state of so many Lepidoptera. The ilium and colon are more particularly serviceable, and the ligament holds with such force around the anus of the cast larval skin that it cannot well be severed. The rectum of the nascent chrysalis draws this in or lets it go by peristaltic action of the sphincter muscles, the whole ligament being drawn out as soon as the hooks of the cremaster reach the silk. In addition to this rectal ligament, which is of a reddish color, and which Prof. Riley considers the principal suspensor, there are two lateral ligaments, also quite long and strong, and of the color of the skin, which serve as auxiliaries. These are the shed linings of the tracheae issuing from the last or ninth pair of spiracles, which in the chrysalis become closed or blind. These ligaments may be called the tracheal ligaments, and seem to be somewhat specialized to aid in this important act. Lastly, there is the membrane proper referred to by Dr. Osborne, which is, virtually, but the anal portion of the inner lining of the skin itself, or corium, caught upon the knobs at the end of the ridges which usually form the ventral part of the cremaster. It consists chiefly of the skin that lines the region of the rectum and the anal prolegs, and takes on a more or less bifurcated form from the pulling power of the knobs during the act of withdrawal from the larval skin. The ligaments Prof. Riley considers constant physiological factors in the problem, most necessary in those species which have the knobs imperfectly developed; acting even during the larval molts, and so holding the shed skin of lepidopterous larvae that it is worked to the anus in a shriveled mass, as a stocking is pushed to the toes; whereas most other insects, especially those in which the metamorphosis is incomplete and the change in the intestinal canal but slight, crawl out of the exuviae rather than work them off, the anal parts not being held within the end of the casting skin, but really being the first parts detached. The membrane is a purely mechanical factor, and may not always be properly caught and drawn out. It may also be severed without necessarily causing the chrysalis to drop. Yet that it is an important aid to the rising of the chrysalis, there cannot be much doubt; and Prof. Riley finds, in the chrysalis of

Paphia glycerium, for instance, a totally different mechanical provision for clutching the membrane, namely, a notch between the ridges around the rectum and the base of the cremaster proper, in which the skin may be caught, the ridges being, in this species, very narrow, smooth, and shallow, and the ordinary ventral knobs obsolete.

Is this *Euchaetes collaris* (Fitch.) ?

The earliest mention of an *Euchaetes* larva distinct from that of *E. egle* (Drury), is in Mr. J. A. Lintner's Entomological Contributions, iii, p. 147, where it is stated that Prof. C. V. Riley had recently bred the larva of *E. collaris*, and found it very distinct from that of *E. egle*. But Prof. Riley has omitted to publish the differences, and the first account of the larva is given by Mr. G. H. Van Wageningen, in the *Canadian Entomologist*, Sept. 1877, v. 9, p. 170. As Mr. Lintner's description of the larva and pupa (given in Mr. Van Wageningen's article) differs, in many respects, from one I had previously drawn up from a living specimen, I am led to present this description in full. My observations agree with Mr. Van Wageningen's as to the solitary habits of the larva, but differ as to the food plant; yet his observations may prove that *Apocynum* is the proper food of the insect. As the existing descriptions of the moth appear to be at variance with one another, a description of the moth reared from the larva is added.

Mature larva. Testaceous, clothed with tufts of tawny plumose bristles; head a little paler. The eight ventral prolegs with a black spot at their external base. Each of the first three segments of the body with two black tubercles on each side bearing a few bristles; first segment with a dorsal fringe of bristles inclining forwards, second segment with two pairs of approximated dorsal tubercles which bear slender tufts of bristles extending 3 mm. beyond the head when the larva is at rest, third segment with two pairs of approximated dorsal tubercles which bear dense tufts of bristles, the bristles curving forwards slightly, and one third longer than those on the abdominal



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