XIII. *Further observations on the last stage of the larva of* Lycaena arion. By F. W. Frohawk, M.B.O.U., F.E.S.

[Read October 6th, 1915.]

Plates L, LI.

The following notes on the observations I have been enabled to carry out under natural conditions, are entirely due to the unlimited assistance which my friend Capt. Purefoy has most kindly accorded me, by his very elaborate and successful experiments carried out in the establishment of a large collection of ants' nests, most carefully transplanted in his garden at East Farleigh, Kent. I may here state that the bulk of the nests comprise chiefly a common garden ant (*Myrmica laevinodis*) and the small yellow species *Donisthorpea flava*. All the nests were transplanted last April, so that when the experiments with *L. arion* were started last August, both the nests and the whole of the growth (consisting of wild thyme, *Lotus corniculatus*, etc.) covering and surrounding the nests were thoroughly established. These ant nurseries, as I may term them, are absolutely in a natural condition for observation purposes, which adds vastly to the interest of such research. Before recording our observations, I should here wish to express my sincere thanks to Capt. Purefoy for his kindness, and also to Miss Ley, who has rendered invaluable help by her untiring patience as an observer, as well as for her expert management with the earlier stages of this remarkable butterfly.

The first important and very interesting news respecting *L. arion* I received from Capt. Purefoy in a letter written on August 9, stating he had seen at 5 p.m. the day before, a *laevinodis*, who had milked the larva several times, suddenly seize it bodily and rush off with it. After this good news I arrived at East Farleigh on August 13 when Capt. Purefoy, Miss Ley and myself made some very interesting observations that evening and again the following morning, during which time we turned down four *arion* larvae,

which had just passed through their third and last moult ready for entering their new and remarkable mode of existence.

At 4.45 p.m. (August 13) we placed No. 1 larva on the ground, which was partly cleared of growth, near the ants' nest; it wandered slowly about and was found by one of the ants (*laevinodis*) at 5.50. The ant at once milked the larva and remained with it until 6.30, when it seized the larva and carried it off to one of the main entrances of its nest, where three other larvae had been previously taken during the past few days by *laevinodis*, which Capt. Purefoy had seen.

No. 2 larva was put down near the spot where No. 1 was placed. No. 2 was found by a *laevinodis* just after 6.30, and was carried off at 7.30 to the same main entrance; it was at first taken down the mouth of a small passage adjoining, but the ant reappeared, backing out with the larva, and continued its backward career down the main entrance carrying the larva, while two other ants at the entrance saluted them as they passed by, immediately before disappearing down the tunnel.

No. 3 larva we turned down at 11 a.m., August 14. This was placed on another bed of nests; it was shortly afterwards found by a *laevinodis*, in full sunshine, and carried off to one of the nest entrances at 11.30. This particular larva hunched itself four times before being seized by the ant.

No. 4 larva was put down (close to the spot where No. 3 was found by the ant) at 12.35, a *laevinodis* found it in eight minutes and carried it off to the centre of its nest, covered with thyme, etc., at 1.3 p.m.

In each case all four larvae and ants behaved precisely similar, except No. 3 larva, which signalled four times. The individual ant which first finds the larva is always the one to seize and carry it off. Although during its attendance several other ants may find the larva and stay by it a short time, and even milk it, they soon leave it to its original attendant, who apparently informs them that their services are not needed.

Whether the ant signals to the larva for it to prepare itself for transit, or the larva gives the ant the signal that it is ready to be taken, seems doubtful; but from what we have seen both Capt. Purefoy and I are inclined to think that the larva gives the signal. No. 3 larva alluded to

hunched itself both the second and third time while the ant was about an inch away and facing an opposite direction, and at the fourth hunching up the ant was standing over the larva ready for the signal, and when this was given it was quickly seized and carried.

Capt. Purefoy tells me that in every case—numbering as many as eighty-two—the ant which first finds the larva is the one that carries it away, as witnessed by either Miss Ley or himself.

Only yesterday, October 5, I again visited the ants' nurseries at East Farleigh, when we carried out further very interesting observations, by so doing bringing them up to date.

Upon removing part of the side of a large nest of *laevinodis* in which we had previously seen larvae taken, we found no fewer than six very healthy *arion* larvae, varying in size from about 6 mm. to 8 mm. These were fairly equally distributed over a space of about eight inches on the same level, and about five inches below the surface. Five were quietly resting in the larger galleries of the nest, each apparently in its selected chamber, as we found the surface upon which they rested to be finely carpeted with a slight layer of silk. The sixth larva was amongst a brood of *laevinodis* larvae and had several ants in attendance; it was then apparently in its dining-room. It is probable that they rest in certain selected parts of the more spacious galleries to which they return after each meal, but this of course remains to be ascertained.

From observations we have made it appears highly probable that the little yellow ant (*Donisthorpea flava*) is an unsuitable host, and that it is incapable of carrying off such a comparatively bulky burden as the larva of *L. arion*.

During August last I placed as many as seven *arion* larvae just after moulting, on a natural nest of *D. flava* established in a large flower-pot; these all entered the nest by themselves, they were not carried by the ants, although they were milked by them. A month after the last had entered, I very carefully searched every particle of the nest without finding any trace of the larvae. The nest contained broods of *flava* larvae, and it was impossible for the *arion* to have escaped from the nest.

If *D. flava* proves to be, as I firmly believe it will, an unsuitable host for *L. arion*, it explains the cause of failure

in finding *arion* larvae in the great number of *flava* nests I have from time to time searched in the Cornish habitat of this butterfly, although *L. arion* in a wild state freely deposits on the thyme growing on the nest mounds of this small yellow ant.

Explanation of Plates L, LI.

Plate L. *Myrmica laevinodis* and larva of *Lycaena arion.*

A. Larva in normal attitude.
B. Larva hunched ready to be carried.
Myrmica laevinodis about to seize larva.
(After rough sketches from life, 6.30 p.m. August 13, 1915.)

Plate LI.

Myrmica laevinodis carrying larva to its nest.
(After rough sketch from life, 11.30 a.m., August 14, 1915.)