

On March 13, 1894, females were found with eggs, which are pink in colour. The number of eggs laid by one female is very great; I estimated them at a thousand. From the Mesilla Valley specimens I bred some numbers of a Chalcidid parasite, the *Aphycus ceroplastis* of Howard.

Looking over the above list of Chihuahua State insects, it will be seen that the Nearctic types largely preponderate, and that some few are even boreal. But it is proper to state that several of the species taken have not yet been identified; and as the specimens were mostly submitted to specialists who are much more familiar with the Nearctic than the Neotropical fauna, it may be assumed that the unnamed species were probably largely Neotropical. Consequently, had everything found been named, the percentage of Neotropical types might have been larger.

The localities cited are all over 3000 feet above sea-level; Juarez is about 3700 feet, Montezuma about 4500 feet, Damalayuca about 4200 feet, Ojo Caliente about 4200 feet, Ortiz about 3800 feet.

Las Cruces, New Mexico, U.S.A.,
Nov. 13, 1894.

On the Nutrition of Two Commensals (Nereilepas and Pinnotheres).
By M. HENRI COUPIN.

It is a well-known fact that in the whelk-shells inhabited by hermit-crabs the annelid *Nereilepas fucata* is very frequently found. This worm takes up its abode in the first whorls of the spire—that is to say, in a chamber which is almost completely closed by the posterior portion of the crab. It is, however, very well developed, in no way foul, and is, so to speak, resplendent with health. Herein there is nothing that need astonish us, as it is admirably protected against injuries and enemies from without. But the question arises, as to how it is able to obtain food. It is generally supposed that it is contented with consuming the excrement of the hermit-crab, which is voided in the very spot in which it is found. With a view to ascertaining if this is really the case I made various observations and experiments, which show that this hypothesis has no foundation in fact.

Let us actually examine a hermit-crab having a *Nereilepas* as its co-tenant. The crab has two principal modes of feeding. Under ordinary circumstances it is content to devour the particles which are brought into contact with its mouth by the rapid movements of its appendages: the refuse of these matters after digestion passes to the exterior in the shape of a cylindrical roll, more or less elongated, about 1 millim. in diameter, and easily to be distinguished from the fæces of the worm, which are filiform. If the worm devoured these evacuations, it is very evident that they would not be seen to pass out of the shell. During the whole of the time that

this feeding lasts the annelid gives no external sign of life: it awaits the favourable moment.

But the procedure is different when we give the crab a morsel of large size, as, for instance, a half or a quarter of a cockle (*Cardium*). Well pleased with this prize, the crab is seen to masticate it forthwith with animation; it even protrudes a portion of its body, and feeds, if I may be permitted to use the expression, like a glutton. But almost immediately, between the cephalothorax and the bases of the limbs on the right side, the anterior portion of the worm is seen to make a slow forward movement. The creature, without hesitation, proceeds to explore its comrade's mouth; on encountering the morsel of cockle there, it nips it forcibly with its powerful mandibles and thenceforth does not relax its hold. Retracting its body, it draws the booty to itself. Then one of two things happens: either the hermit-crab also clings to the prey, without noticing, moreover, the cause of its impending loss, and the annelid redoubles its efforts so effectually that the fragment is finally torn in two; whereupon the worm drags its portion into the interior of the shell, to devour it unmolested. Or else the crab lets go its prey, and the annelid carries it off bodily; in this manner I have seen the worm take away a *Cardium* almost whole, so that it could not even make it pass through the narrow orifice left between the crustacean and the shell. By dragging very hard, however, the annelid almost always succeeded in accomplishing its purpose.

There is no need to believe that the worm perceives the near presence of prey by smell, for, as I have been able to determine by withdrawing it from the shell, its organs of sense are greatly dulled. It is curious to find that it is the hermit-crab itself that, unconsciously of course, informs its comrade of the presence of prey of considerable size; the irregular movements in which the crustacean indulges indicate to the annelid that it is time to show itself; the worm is never seen to emerge at any other time. Another fact of interest to be noted is the indifference of the crustacean with regard to the robber with which it lives and which, to use a popular expression, comes to "snatch the morsel out of its mouth." I have often seen the annelid, after the hermit-crab had inadvertently let its prey fall, introduce its head and the foremost annuli of its body between the maxillipeds and right into the mouth of the crustacean. Apparently nothing would have been easier for the latter than to ingest the worm and to rid itself of it once for all; but it left it absolutely alone. The *Nereilepas* profits by the opportunity to devour the fragments of food that still remain in the mouth of the crab, and to carry them off into its retreat.

The above observations were made in aquaria. There is no doubt, considering their frequency, that the phenomena take place in the same way in a state of nature at the bottom of the sea. The annelid feeds upon the large substances that the hermit-crab intends to devour. But perhaps it will be asked whether, in addition, the worm does not eat, if not the whole, at least a portion of the fæces

of the crustacean. The following experiment proves that this is not the case.

To a hermit-crab that has been starved by fasting for some days there is given a *Cardium* impregnated with carmine. Immediately the annelid, which is likewise starving, shows itself, it is made to withdraw by being touched with a brush: it is driven away in this manner each time it returns. During this time the crab devours the *Cardium* and the carmine. After a few hours there is seen in the basin the excrement of the crustacean stained a vivid red. To ascertain whether the annelid has eaten a portion of the faeces, we break the shell and dissect the worm: I have never discovered carmine in its alimentary canal.

Nereilepas, therefore, does not devour the excrement of the hermit-crab. This discovery, it seems to me, is interesting from the point of view of the nature of the association between the crab and the annelid. In the opinion of P.-J. van Beneden this is a case of commensalism. Now, according to the definition of the celebrated zoologist, "the commensal does not live at the expense of its host: all that it desires is a home or its host's leavings; the parasite instals itself with its neighbour temporarily or permanently; with or without the latter's consent, it extorts from it board and, very often, lodging." This last definition applies admirably to the case of *Nereilepas*. The creature evidently injures the hermit-crab, since it abstracts a considerable portion of the latter's food: it is a veritable parasite, in the sense in which the word is understood in ordinary language.

Pinnotheres, another commensal, which is equally well known, leads us to identically the same conclusion. On dissecting the stomachs of specimens of *Pinnotheres* and those of the *Acephala* with which they live I have discovered the presence of the same substances, composed for the most part of lower forms of plant-life. There is not, as certain rash hypotheses would endeavour to make us believe, a division of the particles into two groups: the animal particles for the *Pinnotheres* and the vegetable ones for the mollusk. On the contrary, the *Pinnotheres* diverts for its own benefit a portion of the food-matter intended by the mollusk for itself. Although the injury may be very slight, it exists none the less. It matters little whether the food-matter be abstracted in the alimentary canal itself, as is done by *Tania*, *Echinorhynchus*, and many Nematodes, or at the entrance of the mouth; on the same grounds that the Helminthes, which do not attack the tissues, are parasites of their host, *Pinnotheres* is a veritable parasite of its mollusk, as is *Nereilepas* of the hermit-crab. This is the conclusion at which it was my desire to arrive; by the study of other commensals it will doubtless be strangely extended.—*Comptes Rendus*, t. cxix. no. 13 (September 24, 1894), pp. 540-543.



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