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Oviposition behaviour in two species of dryinid parasites (Dryinidae, Hymenoptera)

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Abstract. The oviposition behaviour of two species of dryinids (Dryinidae, Hymenoptera), parasitic on the nymphs of the planthoppers, *Dichoptera hyalinata* (Dictyopharidae) and *Eurybrachys tomentosa* (Eurybrachidae), influenced by such factors as host specificity, mobility, and size of the host is discussed with the aid of a flow chart indicating the behavioural sequences involved in oviposition.

Keywords. *Dryinus* spp. ; Dryinidae ; planthoppers ; ovipositional behaviour.

1. Introduction

Dryinids are well-known as potential ectoparasites of many homopteran insects, particularly those of planthoppers and leafhoppers (Clausen 1940; Sweetman 1958). In many dryinids sexual dimorphism is well pronounced in terms of body size and shape of forelegs, which are modified in females for the capture of hosts for oviposition (Clausen 1940). Female dryinids exhibit interesting behavioural sequences during oviposition and available information is restricted to *Lestodryinus pyrillae* Kieffer and *Pseudogonatopus hospes* Perk., ectoparasitic on *Pyrilla perpusilla* Walker (Subba Rao 1957) and *Delphacodes furcifera* Horvath (Pagden 1934) respectively. The ovipositional behaviour of two species, *Dryinus* spp. (A)* and (B)*, the former parasitic on the nymphs of *Dichoptera hyalinata* F. (Dictyopharidae, Fulgoroidea) and the latter on the nymphs of *Eurybrachys tomentosa* F, (Eurybrachidae, Fulgoroidea) is discussed here.

2. Materials and methods

Parasitized nymphs of *D. hyalinata* and *E. tomentosa* were collected from their natural habitat and reared in the laboratory to obtain adult parasites. Small glass

* The two *Dryinus* species have been designated as (A) and (B) as they have been identified to be two new species (Dr Z Boucek, Commonwealth Institute of Entomology, London—Personal communication). Being very host specific the identity of the species (A) and (B) would not be confusing.

chimneys (110 ml) or plastic vials (10 ml, 15 ml) were used as cages and *Dryinus* spp. were fed with a dilute sucrose solution or honey soaked in cotton swabs fixed to a wire projecting from the inside of the lid of the containers. Fresh nymphs of the specific as well as non-specific hosts and those already parasitized/dead nymphs of the specific hosts were introduced in the cages containing the gravid females of dryinids.

3. Observations

The behavioural sequences of these dryinids were observed to involve three distinct phases, viz. host location and recognition, host seizure and immobilization and oviposition.

Highly active gravid females with their vibrating antennae search suitable hosts for egg-laying. In the laboratory cages if the host nymphs occurred at a distance of 2–3 cm, the parasite became passive, stopping the movements of the body and antennae. When the sighted host was stationary, the parasite never attacked, and dead hosts placed in the vicinity of the parasite never attracted the parasite. On the contrary, with the evidence of movements of the host the parasite resumed oviposition behaviour. Both the dryinids showed a high degree of discrimination in selecting their specific host in a group of heterogeneous hosts allowed in the parasite chamber. *Dryinus* sp. (A) never parasitised *E. tomentosa* nymphs, and similarly *Dryinus* sp. (B) never preferred *D. hyalinata* nymphs. Both the parasites avoided the nymphs of membracids, cercopids, and other fulgorids for oviposition. Even among the specific hosts the size of the nymphs was a factor for selection and usually the earlier, smaller developmental stages were more frequently parasitised than the later, larger stages. Parasitised hosts were generally avoided and only under prolonged non-availability of fresh unparasitised hosts, did the dryinids attempt to oviposit on them.

After recognising the proper host, the dryinids slowly followed the movement of the hosts with their antennae held back over the head. When the parasites approached the hosts, the latter exhibited a threatening response to the parasites by their body oscillation and vibration of the caudal filaments. Under the circumstances the parasites avoided the caudal filaments and moved towards the head end of the host and finally pounced on it. Large-sized hosts (4th and 5th nymphs) pushed away the parasites with ease and escaped by sudden leaping. After an unsuccessful attack the parasite resumed the search of a suitable host. Fifth instar fulgorids always escaped from the attacks of both dryinids, while fourth instar fulgorids were successfully captured by the parasites in two or three successive attempts. Smaller hosts (first, second, and third stage nymphs) were easily captured by both the parasites. Immediately after pouncing, the host was firmly held with the specially adapted forelegs and immobilization and paralysing of the captured host was brought about by the immediate injection of venom. While the effect of the venom was prolonged only in smaller, earlier nymphs, the later, larger ones recovered quickly from paralysis. Occasionally the venom proved lethal, particularly for the first stage nymphs. After paralysing, the parasite firmly grasped the ventral side of the thorax of the host with forelegs, lifting the body

of the latter from the substratum. Then the body of the host was so manipulated as to bring it perpendicular to the long axis of the parasite body.

Seizure and immobilization of the host was followed by oviposition, the parasite bending its abdomen over the dorsal side of the host with its tip elevating the wing pads or tergal plate, inserting its ovipositor to deposit an egg. After successful oviposition the host was released, the parasite moving away from it. The egg-laying sites over the body of the host varied with the two dryinids. *Dryinus* sp. (B) always laid under wing pads while *Dryinus* sp. (A) not only laid eggs beneath the wing pads, but also in the mid-dorsal intersegmental region of the thorax and on the sides of the dorsal abdominal segments. In the latter species the preference for mid-dorsal thoracic region was greater than for the other regions. In all the first instar host nymphs of *E. tomentosa*, the parasite deposited its eggs only under the hindwing pads, while in the second, third, and fourth instar hosts oviposition took place frequently under all the wing pads.

The time taken for the entire ovipositional sequence (figure 1), involving host location and recognition, host seizure and immobilization, and egg-laying, ranged from 80 to 300 sec with the maximum time taken for egg-laying alone. If more than one host was given for egg-laying, the subsequent oviposition was attempted by the parasites after an interval of 8–10 min.

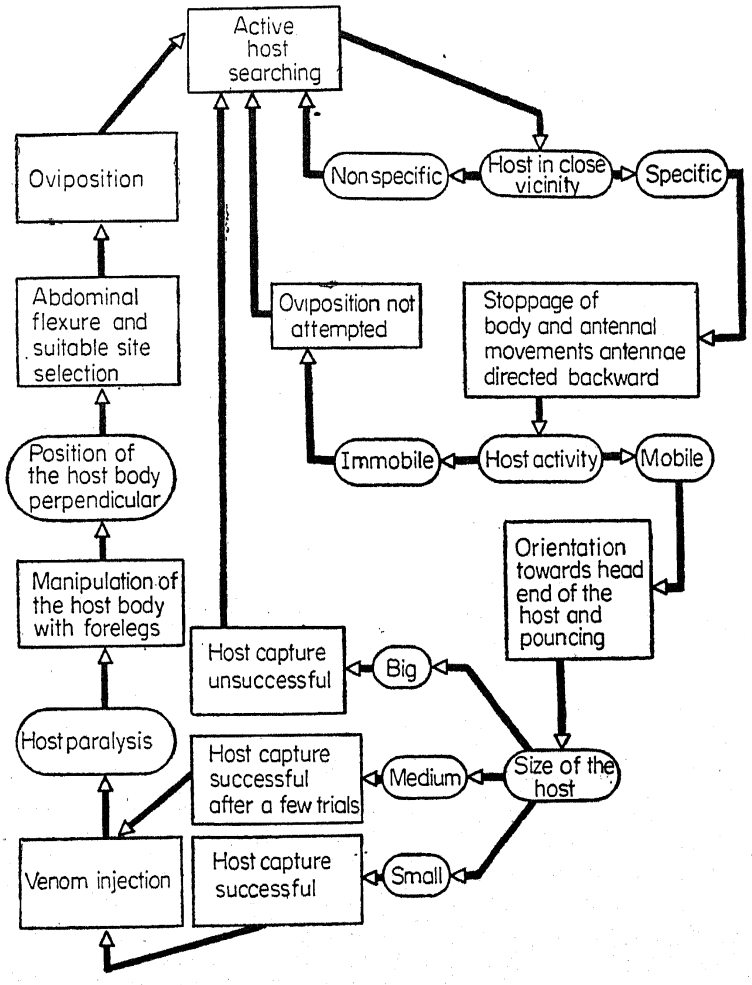

Figure 1. A flow chart indicating the oviposition behaviour sequences of dryinids.

4. Discussion

Dryinus spp. (A) and (B) show a high degree of host specificity, like the other known dryinids (Clausen 1940; Sweetman 1958; Subba Rao 1957; Pagden 1934). The reported ovipositional behaviour of *Lestodryinus pyrillae* on *Pyrilla perpusilla* (Subba Rao 1957) is similar to that of the dryinids studied here, where both the species showed more or less identical behavioural patterns in egg-laying, while only the oviposition sites on their respective hosts varied. While laying eggs, the obvious preference for a specific site, for example the underside of the wing pads, laterals of the abdomen, and dorsal middle region of the thorax in *Dryinus* sp. (A), and the underside of the wing pads in *Dryinus* sp. (B) appears strange. Such a preference was also earlier known in the case of *Pseudogonatopus stenocrani* Perk. and *Neochelogynus* spp. always laying eggs beneath the wing pads of *Stenocranus dorsalis* Fitch, and the posterior coxa as well as the sides of the neck of various fulgorid species respectively (Clausen 1940). This suggests that the dryinids show a characteristic site selection. It is more interesting to observe that the underside of the wing pads is a favourite site of dryinids particularly those attacking the fulgorids. The antennal vibration of the host-searching females stops if the host is sighted within 2–3 cm and this indicates the possible olfactory perception in prey discrimination. DeBach (1964) pointed out host movement to be a necessary stimulus for the initial acceptance of the host. *Dryinus* spp. (A) and (B) appear to be attracted only by moving hosts, and the size of the host is one of the main factors which affect the host capturing capacity of dryinids. If the host is too small (e.g. first stage nymph) the effect of paralysis is drastic, sometimes leading to the death of the host, parasites failing to capture and parasitise the larger nymphs. This appears interesting since in the present investigation it was observed that the parasite normally attacked the smaller, earlier instars. On the other hand, Pagden (1934) reported *Pseudogonatopus hospes* Perk. an ectoparasitic dryinid attacking the small *Delphacodes furcifera*, a delphacid, particularly the later instars, so that the size of the host appeared more important than the stage of development. By violently vibrating the caudal filaments against the approaching dryinid, the hosts protected themselves from the attack of the parasite, and this accounts for the behaviour of the parasite attempting to capture the host from the anterior end.

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