

Egg Parasitism in Membracids by Chalcidoid Parasitoids and its Interspecific Association

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Abstract

The interspecific association of egg parasitism between membracids and chalcidoid parasitoids was studied. *Gonatocerus brevifuniculata* and *Gonatocerus narayani* (Mymaridae), *Mirufens afrangiata* and *Brachygrammatella indica* (Trichogrammatidae), *Centrodora azizi* and *Centrodora mumtazi* (Aphelinidae) parasitized the eggs of membracids, viz., *Leptocentrus taurus*, *Otinotus oneratus* and *Oxyrhachis taranda*. The parasitisation by each parasitoid species was calculated. The emergence hole formed by each parasitoid species was specific on the host eggs parasitized by each chalcidoid species, from which percentage of parasitisation was calculated. The respective percentage of egg parasitism in *Leptocentrus taurus* by *Gonatocerus brevifuniculata*, *Brachygrammatella indica*, *Mirufens afrangiata* and *Centrodora azizi* was 6.80, 2.49, 5.77 and 3.19; in *Otinotus oneratus* by *Gonatocerus brevifuniculata*, *Gonatocerus narayani*, *Brachygrammatella indica*, *Mirufens afrangiata* and *Centrodora mumtazi*, was 9.90, 11.80, 7.15, 6.99 and 10.36; and in *Oxyrhachis taranda* by *Gonatocerus brevifuniculata*, *Gonatocerus narayani*, *Mirufens afrangiata* and *Centrodora azizi* was 7.47, 6.68, 4.18 and 3.80.

Key words: Egg parasitism, *Leptocentrus taurus*, *Otinotus oneratus*, *Oxyrhachis taranda*, *Gonatocerus brevifuniculata*, *Gonatocerus narayani*, *Mirufens afrangiata*, *Brachygrammatella indica*, *Centrodora azizi*, *Centrodora mumtazi*

Membracids, the Membracidae (Hemiptera: Auchenorrhyncha), a tropical group [1] of exclusively phytophagous insects that depend entirely on their host plant for reproduction [2] eat phloem, mainly from the soft parts of sun-exposed plants [3], and they inhabit forested to opened areas. They exhibit awesome and diverse natural history traits; some species are solitary, while others are gregarious and have subsocial behaviour [1,4,5]. Membracids (treehoppers) eggs experience parasitism from many species of wasps, which are smaller than the membracid eggs [2]. As early as 1886, Jack [6] noted egg parasitism in *Ceresa bubalus*, and Ashmead [7] found *Trichogramma seresarum* attacking the eggs of *Ceresa bubalus*. The parasite host interactions involving the membracids offer a wide field of investigation since very little progress has been made so far in this direction. Hence, in the present study, the interspecific relationship between the membracids and the chalcidoid egg parasites were studied with reference to the percentage of parasitisation of the membracids eggs by the parasitoids.

MATERIALS AND METHODS

To study egg parasitism in membracids, chalcidoid hymenopterous parasites, viz. *Gonatocerus brevifuniculata* and *Gonatocerus narayani* (Mymaridae), *Mirufens afrangiata* and *Brachygrammatella indica* (Trichogrammatidae), *Centrodora azizi* and *Centrodora mumtazi* (Aphelinidae), found attacking the eggs of membracids, viz., *Leptocentrus taurus*, *Otinotus oneratus* and *Oxyrhachis taranda* were collected from their natural habitat, in an open field in Thiruvallur district of Tamil Nadu, India, and maintained in glass tubes plugged with cotton wool for the emergence of adult parasitoids. The parasitisation by each parasitoid species was calculated by counting the number of adult parasitoids emerged and adding the number to the emergence holes of the parasitoids found in the egg masses at the time of collection. The emergence hole formed by each parasitoid species was specific on the host eggs parasitized by each chalcidoid species, from which percentage of parasitisation was calculated.

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RESULTS AND DISCUSSION

Egg parasitism varied among the three membracids. *Leptocentrus taurus* eggs were parasitized by *Gonatocerus brevifuniculata*, *Brachygrammatella indica*, *Mirufens afrangiata* and *Centrodora azizi*, and their percentage of egg parasitism was 6.80, 2.49, 5.77 and 3.19 respectively. In *Otinotus oneratus*, its eggs were parasitized by *Gonatocerus brevifuniculata*, *Gonatocerus narayani*, *Brachygrammatella indica*, *Mirufens afrangiata* and *Centrodora muntazi*, and their percentage of egg parasitism was 9.90, 11.80, 7.15, 6.99 and

10.36 respectively. While, *Oxyrhachis taranda* eggs were parasitized by *Gonatocerus brevifuniculata*, *Gonatocerus narayani*, *Mirufens afrangiata* and *Centrodora azizi* and their percentage of egg parasitism was 7.47, 6.68, 4.18 and 3.80 respectively (Table 1). Amongst the parasitoids *Gonatocerus brevifuniculata* and *Mirufens afrangiata* parasitized the eggs of all three membracids, and egg parasitism was found to be more in *Otinotus oneratus* for both the parasitoids, followed by *Oxyrhachis taranda* and *Leptocentrus taurus* for *Gonatocerus brevifuniculata*, and by *Leptocentrus taurus* and *Oxyrhachis taranda* for *Mirufens afrangiata* (Fig 1).

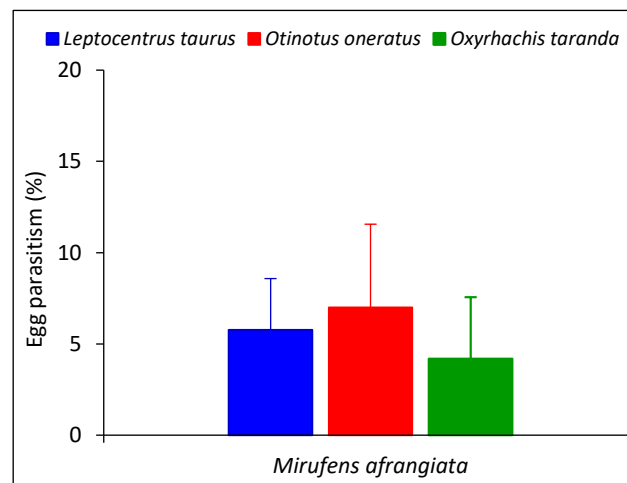
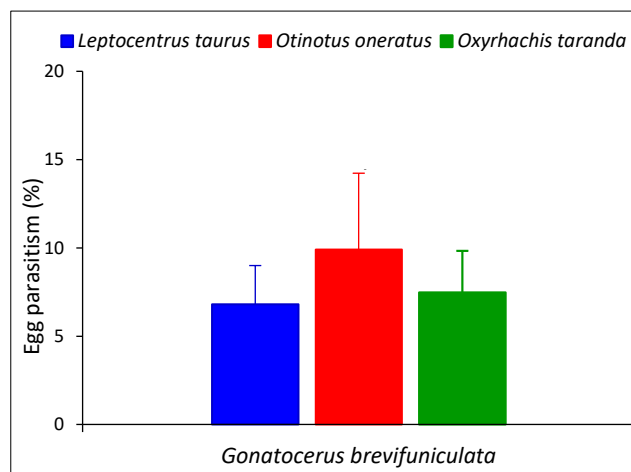


Fig 1 Egg parasitism by *Gonatocerus brevifuniculata* and *Mirufens afrangiata* in all three membracids

Table 1 Egg parasitism in membracids by chalcidoid parasitoids

| Membracid species | Parasitoid species | Eggs parasitized | Egg parasitism (%) |
|----------------------------|------------------------------------|------------------|--------------------|
| <i>Leptocentrus taurus</i> | <i>Gonatocerus brevifuniculata</i> | 13.37 ±8.53 | 6.80 ±2.20 |
| | <i>Brachygrammatella indica</i> | 4.33 ±3.07 | 2.49 ±1.37 |
| | <i>Mirufens afrangiata</i> | 10.75 ±6.58 | 5.77 ±2.81 |
| | <i>Centrodora azizi</i> | 5.70 ±3.62 | 3.19 ±1.51 |
| <i>Otinotus oneratus</i> | <i>Gonatocerus brevifuniculata</i> | 15.87 ±9.08 | 9.90 ±4.33 |
| | <i>Gonatocerus narayani</i> | 20.25 ±12.15 | 11.80 ±3.75 |
| | <i>Brachygrammatella indica</i> | 11.25 ±6.54 | 7.15 ±4.20 |
| | <i>Mirufens afrangiata</i> | 10.20 ±4.99 | 6.99 ±4.57 |
| | <i>Centrodora muntazi</i> | 16.62 ±6.82 | 10.36 ±3.50 |
| <i>Oxyrhachis taranda</i> | <i>Gonatocerus brevifuniculata</i> | 14.29 ±6.64 | 7.47 ±2.36 |
| | <i>Gonatocerus narayani</i> | 11.87 ±7.57 | 6.68 ±3.12 |
| | <i>Mirufens afrangiata</i> | 6.91 ±5.10 | 4.18 ±3.38 |
| | <i>Centrodora azizi</i> | 7.79 ±4.80 | 3.80 ±3.02 |

Membracid eggs are susceptible to parasitism by several species of insects belonging to Hymenoptera, particularly to Mymaridae, Trichogrammatidae and Aphelinidae. Hayat [8] brought to light the occurrence of two species of aphelinoid egg parasites, *Centrodora azizi* and *Centrodora muntazi* from the eggs of *Otinotus oneratus*, and a *Trichogramma* species from the eggs of *Oxyrhachis taranda*. Hubner [9] listed the mymarid parasitoids of membracidae, viz., *Schizophragma* and *Stethynium* from the eggs of membracid species. *Trichogramma* parasitoids, viz., *Mirufens afrangiata* and *Brachygrammatella indica* parasitized the eggs of *Oxyrhachis taranda* [10]. Ramachandran [11] reported *Centrodora azizi* to

parasitize the eggs of *Otinotus oneratus* and *Oxyrhachis taranda*. Ananthasubramanian and Ananthakrishnan [12-13] reported on species of *Gonatocerus*, *Aphelinoidae* and *Centrodora* attacking the eggs of various species of Indian membracids.

A notable feature in many of the parasites is the lack of absolute host specificity; for instance, the eggs of *Oxyrhachis rufescens* are parasitized by species of *Gonatocerus*, *Aphelinoidae* and *Centrodora*, all of which are also capable of attacking the eggs of *Otinotus oneratus* [13]. The eggs of a particular membracid species are susceptible to the attack of more than one species of chalcidoid parasite. In the present

study, the eggs of *Oxyrhachis taranda* was parasitized by four species of parasitoids, viz., *Gonatocerus brevifuniculata*, *Gonatocerus narayani*, *Centrodora azizi* and *Mirufens afrangiata*, and amongst them *Gonatocerus brevifuniculata* infestation percentage was the highest. In *Otinotus oneratus*, among the five parasites, viz., *Gonatocerus brevifuniculata*, *Gonatocerus narayani*, *Brachygrammatella indica*, *Mirufens afrangiata* and *Centrodora mumtazi*, it was *Mirufens afrangiata* which showed the highest percentage of egg parasitism. In the case of *Leptocentrus taurus*, among the four species of parasites, viz., *Gonatocerus brevifuniculata*, *Brachygrammatella indica*, *Mirufens afrangiata* and *Centrodora mumtazi*, the parasite *Gonatocerus brevifuniculata* exhibited the highest percentage of egg parasitism. The parasitized membracid eggs were recognisable by colour change, and are associated with the developmental phases of the immature stages (eggs turning yellow, and black colour becomes more pronounced as the pupal stage is reached) as reported by Ananthasubramanian and Ananthakrishnan [13]. Despite this, membracids did not suffer any significant depletion, due to their high reproductive potential, and lack of absolute host specificity, however, in no way reduced the efficiency of parasitoids.

Parasitoids are important enemies of the Membracidae. Wasps in the families, Mymaridae, Trichogrammatidae and Aphelinidae parasitize treehopper eggs [2]. Clumped membracids on their host plants attract parasitoids, and increase the risk of egg parasitism. As membracids are phytophagous insects, parasitoids react to either treehopper or its host plant odours to search for and find their prey [14]. Parasitoids search for potential hosts using several signals, of which chemical cues seem to be the most important, as they have been reported to be those of the host's host plant, host plant emissions induced by feeding activity of the host, and host insect itself [15-17].

CONCLUSION

The biological foundation underlying parasitoid host relationships stems from an innate struggle for survival characterized by adaptive evolution, natural selection, and specialization over time. The host insects are under constant pressure to avoid parasitoid detection and parasitoids, as this interaction results in the death of the host.

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