

HOST-PARASITOID INTERACTION AND BEHAVIOR OF *GONIOIZUS LEGNERI* (GORDH), AN EXTERNAL PARASITE OF THE MANGO LEAF WEBBER, *ORTHAGA EXVINACEA* (HAMPSON)

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ABSTRACT

Goniozus legneri (Gordh), a Hymenopteran parasitoid, is an ectoparasite on the caterpillars of *Orthaga exvinacea* (Hampson), the leaf webber of the mango tree, *Mangifera indica*. The tree is attacked by many insect pests in all stages of its development. The leaf webbers of *O. exvinacea* make nests by joining leaves by means of webs constructed by the caterpillars and causes destruction to young shoots and inflorescence. *Goniozus* species are effective biological control agents against the caterpillars of *O. exvinacea*. Bethylids are exclusively entomophagous insects, parasitizing various Lepidopteran and Coleopteran species of economic importance. A brief study on host-parasitoid interactions and behavior of *G.legneri* was undertaken in this study. A laboratory culture of the parasitoid was maintained for undertaking the work. These were reared on the larvae of *O. Exvinacea* collected from mango trees. *Goniozus* sps. has been used as an effective bio-control agent against *O. exvinacea* and other leaf webbers of the oriental region.

KEYWORDS: Hampson, Webber, Entomophagous insects

The Hymenopteran parasitoid *Goniozus legneri* is ectoparasitic on the caterpillars of *Orthaga exvinacea* (Hampson), the leaf webber of the mango tree, *Mangifera indica*. The tree is attacked by many insect pests like hoppers, borers, fruit flies, weevils and leaf and blossom webbers, in all stages of its development. *O. exvinacea* make nests by joining leaves by means of webs constructed by the caterpillars and causes destruction to young shoots and inflorescence. Biological control is the most important and cheapest element in avoiding pest outbreaks. In integrated pest management strategy; every effort is made to increase natural mortality. Entomophagous insects are primary mortality agents. Bethylids are exclusively entomophagous insects. *Goniozus* species are effective biological control agents against the caterpillars of *O. exvinacea*.

The genus *Goniozus* belongs to the family Bethylidae, super family Bethyloidea and order Hymenoptera. The genus is erected by Foester (1986). Earlier *Parasierola* and *Goniozus* were

considered as different genera; but Evans in 1978 synonymised *Parasierola* with *Goniozus*. Family Bethylidae is potentially important from the point of comparative structure and behavior (Evans, 1964). The family consists of about 40 valid genera and about 2000 nominal species (Gordh *et al.*, 1983).

Bethylidae are evolved from Aculeata to exploit small larvae occurring in cryptic situations. They exhibit various adaptations for entering the habitat of hosts. Some are adapted to attack larger hosts, subduing them by repeated stinging and laying several eggs on them. Clausen (1940) has pointed out that they show an exceptional uniformity in host preferences. The larvae of Coleopteran form the major hosts. Bethylids attack the larvae of Lepidoptera, chiefly borers, seed feeders case bearers and leaf rollers. Usually the host is paralyzed permanently and the larvae develop externally. Adults feed on the body fluids of the host. The study by Voukassovitch (1924) on *G. claripens* shows that the attack caterpillars, feeding at the oviposition

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punctures and laying from 1-8 eggs on host. Unfertilized eggs produce males. The work of Kurian (1954,1955) on many oriental species record Microlepidoptera as host, most of them are of economic importance.

MATERIALS AND METHODS

The parasitoid was reared in the laboratory for the purpose of carrying out observations on its biology and behavior. The adult parasitoids were collected along with host from infected mango trees. The insects were reared in clean specimen tubes (4inch x1inch and 6inch x 1inch) which were closed with cotton plugs. The host larva was provided in each tube for parasitisation. 50% honey solution provided as droplets on polythene or wax paper as food for adult parasitoids. The culture tubes were arranged horizontally on wooden racks having transverse racks. The racks were kept on rearing stands, the legs of which were kept on ant wells. The stands were kept in place where sufficient ventilation and light were available.

A stock of culture was maintained. The parasitized larvae were taken out and kept in separate specimen tubes till emergence. After emergence and mating, each pair of male and female were taken out and caged in individual tubes; the host larvae were provided from the next day onwards, one per day. The strips with honey were changed every day. The host culture was maintained in the laboratory in order to make the proper stage of larvae available throughout.

RESULTS AND DISCUSSION

Host-Parasitoid Interaction

Goniozus legneri is one important larval parasitoid of *Orthaga exvinacea*, the mango leaf

webber. Studies show that this species is host specific in natural conditions. Laboratory observations show that this species highly host specific. In none of the alternate hosts provided, the parasite was found to complete the life cycle successfully. Observations of different aspects of host parasitoid interaction namely host selection, effect of parasitism on host, effect of host on parasite and host regulation was carried out in the laboratory.

Goniozus species are prevalent in almost all seasons when the host insect is present. As the host larvae are concealed within the galleries of silk made by the caterpillar, the location of the host is possible probably due to the olfactory attractant from the host of the plant. Once in the host habitat, the host move in and out through the host galleries with spread antennae. The streamlined body helps in burrowing rapidly through the tunnels made by the host larvae. Apart from olfactory stimuli, texture and shape of the host larvae, perceived through visual and tactile stimuli may help in host location. The parasite was seen to attack only early stage of the larva. Once the host is located, it is attacked and paralysed. The female attaches its mandibles to the host's integument immediately posterior to the head capsule and inserts its sting into the venter, near the prothoracic gland. After paralysis the host body is inspected for oviposition.

Once a female locates a suitable host, it examines the whole surface of the caterpillar by the tip of the abdomen as well as its antennae, for the presence of eggs already deposited by another female. Previously deposited eggs are usually eaten by the female and the surface is cleaned for laying her own eggs. Host of late larval stages are not preferred for oviposition due to stronger resistance offered by the larger host. The number of eggs

deposited on a particular host is regulated by its size. More eggs are laid on larger larvae. Once the host is paralysed, the female walks over the surface of the body of the host with vibrating antennae to detect the size, suitability and viability of the host. The inter segmental grooves are chosen for oviposition. On each inter segmental groove, a pair of eggs are deposited, one on each side, laterally.

On hatching the larva pierces the skin of the host in order to draw nourishment. The failure of the larva to pierce the host's skin obviously leads to its death. By the time the larva completes its growth, the larva of the host *O. exvinacea* starts drying up and shrinking. Meanwhile, the larvae of parasite complete their growth and get detached from the host and start to pupate. When the numbers of developing parasitoid larvae are very few, they may not cause total damage to the host. Nevertheless, the host larvae never complete their life cycle successfully.

The reproductive success of the parasitoids is dependent on the abundance of hosts, the fecundity of the parasitoids and the mortality of the host during larval stage of the parasitoid. The growth, development and survival of the parasitized directly influence the parasitoid. If the host dies before the parasite emerges, the parasitoid also dies. The venom injected into the host body is neurotoxic. Paralysis reduces the mortality of the parasitoid by reducing the ability of the host to remove the egg and larvae. Paralysis may also reduce competition with other parasitoids, since only active hosts are attacked. The paralysed larvae do not feed and stops other activities, but maintains the basal metabolic activities.

Effect of Parasitism on Host

The activity of the parasitoid is detrimental to the host, and if not, alters the morphological and physiological aspects of the host. Vinson (1975) reported that the parasitoid influences the development of their larval host so that the parasitoids may complete their development. In the case of *Goniozus*, the host is permanently paralysed and hence there is no further growth of the host and it just remains alive till the larval development is completed.

The effect of parasitism by many bethylids on their host has been studied. Stinging and paralysis are shown to occur in all cases, but the degree of paralysis varies. Permanent paralysis has been reported in many bethylids like *G. gallicola* (Gordh, 1976). Many are only temporarily paralysed, their activity being resumed later on (Voukassovitch, 1925; Taylor, 1933).

Effect of Host on Parasitoid

Evidences indicate that the host has profound influence on the size, form, rate of development and behavior of its parasite. The effect of the size of the host on the sex ratio of its Hymenopteran parasite is summarized by Clausen (1939). He cites a number of examples in which mostly females emerge from large host and mostly males from small hosts. In the case of *Goniozus* also the sex-ratio as well as number of eggs deposited depends on the size of the host. Holdaway and Smith (1932) observed that large hosts produce a high proportion of female parasite, and small ones, an excess of males.



Adult *Orthaga exvinacea*



The webs formed by the leaf webber



A bunch of leaf infested with the webber



An adult wasp parasitizing the larva of *O. exvinacea*



Eggs layed on the caterpillar



Pupation on the caterpillar

The influence of host on the longevity and fecundity of the parasitoid has been studied by many workers (Flanders, 1935 and Salt, 1941). An increase in the number of larvae of the parasitoid within the host, result in a reduction in developmental time and the size of the parasitoid is reduced.

CONCLUSION

Goniozus legneri is an important natural enemy of the mango leaf webber, *Orthaga exvinacea* Hampson. *Goniozus* belongs to the family Bethylidae of primitive Aculeata of order Hymenoptera. It is potentially very important from the standpoint of the comparative structure and BEHAVIOR adaptations. The parasitoid shows high specificity in host selection and regulation. The presence of parasitoid affect the biology of the host and the presence of the host influence the biology and BEHAVIOR of the parasitoid. *Goniozus* is a potential biological control agent of the mango leaf webber *Orthaga exvinacea*.

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