

ABSTRACT

Leucinodes orbonalis (Lepidoptera ; Pyralidae) is a pest of Solanum melongena L. (Solanaceae) where the larva bores and feeds on the shoots and fruits of the plant. It is known to attack all three varieties of S.melongena grown in Sri Lanka, as well as other related economic species of Solanum such as Solanum indicum, Solanum tuberosum and Solanum xanthocarpum. S.melongena is cultivated widely in Sri Lanka and it's fruits are a popular vegetable. L.orbonalis is known to cause economic damage to S.melongena fruits and use of chemicals remain as the only means of control of this pest.

A survey carried out in 12 of the 24 districts in Sri Lanka gave a mean damage level of 52.5% for fruits of S.melongena by larvae of L.orbonalis. Three species of larval parasites of L.orbonalis were recorded during this survey. They are Trathala flavoorbitalis (Hymenoptera ; Ichneumonidae), Phenerotoma sp.(Hymenoptera ; Braconidae) and Chelonus sp.(Hymenoptera;; Braconidae). Of the three parasites, T.flavoorbitalis was the most common and abundant parasite with an average parasitism level of 30.2%.

Investigations carried out during this study was restricted to studies on the biology and life cycle of L.orbonalis (reared on S.melongena) and to it's major larval parasite; Trathala flavoorbitalis.

L.orbonalis larvae obtained from field collected infested fruits were reared in the laboratory at  $29\pm 2^{\circ}\text{C}$  and  $69\pm 5\%$  RH on S.melongena fruits. This laboratory culture provided the necessary stages of L.orbonalis for the study.

Females of L.orbonalis is larger than the male which has a characteristic ~~the~~ upwardly curved thin abdomen. The longevity of the female was 3 - 4 days while that of the male was slightly less, 2 - 3 days. Adult moths were not observed to feed in the laboratory on 10% sucrose solution provided. A mortality of 64% was recorded for L.orbonalis reared in the laboratory from the egg stage to the adult stage.

Female L.orbonalis lays whitish, elliptical eggs (0.56 X 0.35 mm) singly or in batches of 2 - 3 eggs on the underside of the leaves and on tender parts of the S.melongena plant. The mean fecundity of L.orbonalis reared in the laboratory was  $291.8\pm 59$ . Eggs laid in the laboratory hatched in 2 - 3 days. L.orbonalis has five larval instars whose head capsule widths range from 0.18 - 1.8 mm and the body length from 1.14 - 15.5 mm. The larval period lasts for 11 - 16 days. Pupae are reddish brown in colour and about 8 - 15 mm in length. Pupal period lasts 7 - 15 days.

Although the Department of Agriculture recommends soil application of 3% G carbofuran at 3 week intervals for the control of L.orbonalis, none of the

farmers were found to adhere to this recommendation. Farmers use less expensive and more toxic insecticides to control L.orbonalis as well as other pests, associated with S.melongena. A study was done over a period of two years to assess the level of fruit damage and parasitism using the below given insecticidal application procedure adopted by farmers.

- (a) Soil application of carbofuran and spraying of tamaron over a period of 12 months, at irregular intervals ie when there was evidence of pest attack.
- (b) Suspension of insecticidal application during the proceeding six months.
- (c) Soil application of carbofuran regularly once in every three weeks during the next six months.

Although the damage to fruits was significantly less during the irregular application of tamaron and carbofuran, the level of parasitism was reduced drastically to 3.33%. When the application of insecticides was suspended for 6 months; level of damage to fruits increased to 23% and the level of parasitism to 7.7 - 28.04%. The lowest damage and the highest parasitism level were recorded when the application of carbofuran was resumed at 3 - 4 week intervals.

Laboratory and field investigations were carried out to compare the systemic efficacy of L.C. 60% tamaron (methamidophos) used by the farmers and 3% G carbofuran

recommended by the Dept. of Agriculture. 10% - 15% dilutions of tamaron as recommended by the manufacturer affects certain of the larval instar stages of L.orbonalis but is much more harmful to the parasite T.flavoorbitalis. Carbofuran is able to prevent damage to specially the fruits of S.melongena by I<sup>st</sup> instar larvae of L.orbonalis upto the 13<sup>th</sup> day of application. Carbofuran has no direct effect on the parasite as it is a soil applied systemic insecticide.

The parasite, T.flavoorbitalis was cultured in the laboratory on L.orbonalis larvae.

Of the host larvae parasitized and reared through in the laboratory, from 7% of the pupae neither parasite nor the host emerged due to mite and fungal attacks.

Female parasites, prefer to oviposit into III<sup>rd</sup> - V<sup>th</sup> instar larvae of L.orbonalis. T.flavoorbitalis eggs are oval in shape and measures 0.125 - 0.15 mm in length and 0.03 - 0.04 mm in breadth. These hatch in 4 - 5 days at 30°C. The newly hatched larva has a head capsule and a tail, while the later larvae lack both. Only three distinct larval stages of T.flavoorbitalis were recognized and they have been referred to as instar I, II, & III. Pupae of T.flavoorbitalis are offwhite in colour with a pair of red eyes and mouth appendages. The late pupa bear rudiments of legs and wing buds. Adult T.flavoorbitalis has a brown body and two pairs of transparent wings. The female has a

prominent ovipositor. The fecundity of T.flavoorbitalis is ca. 100 but only 61% of the eggs laid in the laboratory in IV<sup>th</sup> instar host larvae developed into adults. Under experimental conditions, T.flavoorbitalis females were able to lay upto 12 eggs in the same host larva but of them, only one developed into the adult. Superparasitism of the host occurs even in the presence of adequate number of unparasitized host larvae. Female T.flavoorbitalis appears to be attracted to the fresh frass of L.orbonalis larvae and prefers III<sup>rd</sup> - V<sup>th</sup> instar larvae for oviposition. Younger I<sup>st</sup> - II<sup>nd</sup> larvae when oviposited was subjected to mutilation and died as a result.

The time taken by T.flavoorbitalis to complete it's development from egg to adult within the host body is ca. 21 days, which is slightly less than the period of development of it's host which is 22 - 27 days at ambient temperatures of 27.5 - 31.5°C.

T.flavoorbitalis is parthogenetically thalyotokus; where fertilized eggs give rise only to male progeny and unfertilized eggs to females. T.flavoorbitalis with a fecundity of ca. 100, is the most common parasite of L.orbonalis in Sri Lanka, with a natural parasitism level of 30.2%. Studies done so far indicate that T.flavoorbitalis has a potential as a biological control agent of L.orbonalis in Sri Lanka.