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Record of Parasitoids and Pathogens on *Leucinodes orbonalis*

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Twelve parasitoids belonging to two super families viz., Ichneumonoidea and Chalcidoidea emerged from field collected *L. orbonalis* larvae during survey. The parasitoids identified were; *Trathala flavo-orbitalis* Cameroon, *Phaneratoma* sp. *Chelonus* sp., *Vaepellinae* sp. *Bracon hebetor* Say, *Antrocephalus mitys* Walker, *Brachymeria lasus* Walker, *Spalangia irregularis* Walker, *Spalangia endius* Walker, *Endius* sp. *Spalangia* sp. and *Trichogramma* sp. *Trichogramma* sp. was found to parasitize the field exposed eggs of *L. orbonalis* for six days. Of the three entomopathogens identified, two were bacteria viz., *Serratia marcescens* (Bizio) and *Enterobacter* sp. and the other one was a fungus *Aspergillus ochraceous* (Kent).

Key words: entomophages, entomopathogens, *Leucinodes orbonalis,* brinjal.

Brinjal, a versatile vegetable is one of the most popular and economically important vegetables among small-scale farmers and consumers. Outside India, eggplant is especially important in South Asia (Bangladesh, Nepal and Sri Lanka) and this region accounts for almost 50 per cent of world's area under brinjal cultivation. This commercial crop is reported to be infested by more than 36 pests (Regupathy *et al*., 1997) from the time of planting to harvest. Rizvi (1996) highlighted nine major pests, mites and nematodes causing economic losses in brinjal. Among them, the internationally, known eggplant fruit and shoot borer, (EFSB) *Leucinodes orbonalis* (Guenee) (Pyraustidae: Lepidoptera) is considered to be the most serious pest of brinjal in all parts of India (Isahaque and Chaudhuri, 1984).

Materials and Methods

Surveys were taken up in the eggplant fields from Coimbatore, Cuddalore, Thiruchirappalli and Pudukkottai districts of Tamil Nadu, India to identify and catalogue natural enemies by collecting the larvae and pupae of *L. orbonalis*. At every site of survey, at fortnightly intervals 100 infested fruits were collected and collected the larvae were reared on brinjal fruits / semisynthetic diet to record emerging parasitoids at different insect stages. Observation on the number of natural enemies from field collected *L. orbonalis* larvae were made following the methods described by Sandanayake and Eridisinghe (1992). Since the eggs of *L. orbonalis* were laid sparsely on the plants under the field condition, it was very difficult to locate the parasitised eggs. Hence the eggs of *L. orbonalis* laid on a filter paper under laboratory condition were randomly placed periodically in the field to assess the incidence of egg parasitoids and the same were maintained in the laboratory for enumerating egg parasitoids.

Similarly, diseased cadavers collected in natural condition during survey were transferred to sterile petriplates and glass vials, brought to laboratory and preserved with details on host insect, stage of the host, place and date of collection. Later the specimens on isolation were examined with specific microbial infections by pathogenicity test. Fungal pathogen was isolated on potato dextose agar following standard

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mycological techniques of CM1 (1983) and the bacterial were isolated by nutrient agar medium (Martin, 2000).

Results and Discussion

Totally 12 different parasitoids emerged from field collected *L. orbonalis.* They were grouped under two superfamilies *viz*., Ichneumonoidea, and Chalcidoidea (Fig. 1). The identified parasitoids were *Trathala flavo-orbitalis* Cameroon, *Phanerotoma* sp. *Chelonus* sp*., Vaepellinae* sp., *Bracon hebetor* Say, *Antrocephalus mitys* Walker, *Brachymeria lasus* Walker, *Spalangia irregularis* Walker, *Spalangia endius* Walker*, Endius* sp*., Spalangia* sp., and *Trichogramma* sp. Parasitoids other than *Trathala flavo-orbitalis* and *Phenerotoma* sp. were reported for the first time on *Leucinodes orbonalis* (Table 1). Samples collected from Coimbatore viz., TNAU farms, Madhukkarai and Karadimadai had a maximum six species of parasitoids. Vamban sample from Pudukkottai district had only one parasitoid (*T. flavo-orbitalis)*.

Sixteen parasitoids, three predators and entomopathogens were reported as natural enemies of *L. orbonalis* all over the world (Khorsheduzzaman *et al.,* 1998), with only least significant role in keeping *L. orbonalis* damage under reasonable control (Srivastava and Butani, 1998), especially in South Asia. Among Ichneumonoidea, *Trathala flavo-orbitalis* (Ichneumonidae), *Phanerotoma* sp. (Braconidae),

Fig. 1 Newly recorded parasitoids of *L. orbonalis*

Chelonus sp. (Braconidae), *Vaepellinae* sp. (Braconidae) and *Bracon hebetor* (Braconidae) were recorded in brinjal growing tracts. However, *Bracon hebetor* and *Vaepellinae* sp. are reported for the first time in India. High level of parasitism on *L. orbonalis* by *T. flavo-orbitalis* was reported by Alam *et al.* (2003).

T. flavo-orbitalis was found in all the surveyed locations. *B. hebetor* was not observed at Thiruchirappalli and Pudukkottai while *C. blackburnii* and *Endius* sp. were recorded at Coimbatore and Thiruchirappalli. *Phanerotoma* sp., *S. irregularis* and *Trichogramma* sp. were recorded only in Coimbatore. *A. mitys* occurred only in Pudukkottai and Thiruchirappalli. *S. endius* was recorded in all the districts except Pudukkottai.

Along with *T. flavo-orbitalis,* few other ichneumonids, *Pristomerus testaceous* Morl. (Ayyar, 1927), *Eriborus argentiopilosus* (Tewari and Sandana, 1987), *Xanthopimpla punctata* (Navasero and Calilung, 1990), *Eriborus sinicus* (Talekar, 1995) and *Diadegma apostate* (Tewari and Sandana, 1987) were also reported earlier. However, they were not found to occur in Tamil Nadu. Occurrence of braconids, *viz., Chelonus* sp. (Navasero and Calilung, 1990), *Bracon* sp. (Tewari and Sandana, 1987), *Bracon greeni* (Venkatraman *et al.,* 1948), *Bracon chinensis* (Nair, 1967) and *Phanerotoma* (Tewari and Moorthy, 1984) was recorded on *L. orbonalis* by previous workers.

Under Chalcidoidea, seven species viz., *Brachymeria lasus* (Chalcididae), *Antrocephalus mitys* (Chalcididae), *Spalangia irregularis* (Pteromalidae), *Spalangia endius* (Pteromalidae), *Endius* sp. (Pteromalidae) and *Spalangia* sp. (Pteromalidae) and *Trichogramma* sp. (Trichogrammatidae) were identified. *Brachymeria obscurata* and *Brachymeria* sp. were earlier reported by Navasero and Calilung (1990) on the larvae and pupae of *L. orbonalis*. Except *Brachymeria,* all others were reported for the first time on *L. orbonalis* while, *S. irregularis* and *Spalangia* sp. have been reported for the first time in India.

Of the three pathogens identified, the two bacteria were *Serratia marcescens* (Bizio) and

Table 1. Some parasitoids of *L. orbonalis* in Tamil Nadu

S. No.	Name	Taxonomic position	Status	General characters	Taxonomic characters
1.	*Antrocephalus mitys* (Walker)	Chalcidoidea Chalcididae Chalcininae Chalcinini	Most difficult genus to study taxonomically	First report in India as pupal parasitoid on *L. orbonalis*	Hind femur with inner basal tooth; Pre orbital carinae unite with carinae on outerside of antennal sclerite; leg rufous; gaster rufous; propordeum with lateral teeth.
2a.	*Spalangia endius* (Walker	Chalcidoidea Pteromalidae Spalanginae Spalangininii	First report in India as a pupal parasitoid on lepidopterans. Earlier, reported on dipteran hosts.	Taxonomic boundaries are not still clearly defined.	Antennae inserted just above the mandibles; notangular lines complete; body black to testaceous with course piliferous puncture; gaster petiolate; Break in the marginal vein.
2b.	*Spalangia irregularis* (Walker)	Chalcidoidea Pteromalidae Spalanginae Spalangininii	First report in India as pupal parasitoid.		
2c.	*Spalangia* sp.(Walker)	Chalcidoidea Pteromalidae Spalanginae Spalanginini	First report in India on *L. orbonalis.*		
2d.	*Endius* sp.	Chalcidoidea Pteromalidae Pteromalyinae Pteromalinini	First report in India on *L. orbonalis.*	Pupal parasitoid	
3.	*Vaepellinae* sp.	Ichneumonoidea Braconidae Braconinae Braconini	First report in India on *L. orbonalis.*	Larval parasitoid	Fore wing with only one mediocubital vein; second m-cv absent

Continued

S. No.	Name	Taxonomic position	Status	General characters	Taxonomic characters
5.	*Brachymeria lasus* (Walker)	Chalcidoidea Chalcididae Chalcininae Chalcinini	Reported genus, but species *lasus* is a new report, on *L. orbonalis*	Pupal parasitoid.	Anterior margin (upper margin) of clypeus not fused with frons, sparsely pubscent on post clypeus; hind coxa without a trichoid zone; Hind femur without a distinct tooth at inner basal side; Hind coxa with a distinct ventromesal tooth; Hind tibia yellow with baseblack; Hind coxa black; hind femur black with apex yellow; first tergite of gaster smooth.
6.	*T. flavo-orbitalis* (Cameroon)	IchneumonidaeI chneumonidaeI chneumoninaeI chneumonini	Reported on *L. orbonalis*	Larval pupal parasitoid on lepidopteran host.	Main genital clasper with a single lobe; occipital carina usually complete; thorax usually shagreened.
7.	*Phaneratoma* sp.	Ichneumonoidea Braconidae Braconinae Braconini	Reported on *L. orbonalis*	Larval parasitoid on lepidopteran host.	Fore wing with only one medio-cubital vein; second m-cv absent.
8.	*Chelonus* sp.	Ichneumonoidea Braconidae Braconinae Braconini	Reported on *L. orbonalis*	Egg larval parasitoid	Forewings with central started hyaline strip bordered with black large spots on either side.
9.	*Bracon hebetor* Say.	Ichneumonoidea Braconidae Braconinae Braconini	Reported on *L. orbonalis*	Larval parasitoid	Second medio-cubital vein absent; brightly coloured.
10	*Trichogramma sp.*	Trichogrammatidae Trichogrammatinae Trichogrammanini	Reported on *L. orbonalis*	Egg parasitoid	Pubescence setae arranged in definite rows on forewing; leaflike reduced hindwing; forewings broader than longer; tarsi three segmented.

Enterobacter sp. while the fungus was *Aspergillus ochraceus* (Kent) (Table 2). A diseased larva collected from Cuddalore location showed yellow hyphal growth on the body surface. This fungus as culture on the media was light yellowish with definite concentric layers bordered with cement coloured edges. Another diseased third instar larvae of *L. orbonalis* was collected from plant leaf surface at Coimbatore during survey. The larva completely turned red within 24 hours. When the insect cadaver was subjected to isolation using potato dextrose and nutrient agar media, two bacterial cultures were found on nutrient agar medium. The two mixed bacterial cultures after purification were microscopically examined for the sporulating characters. Since, no spores were found it was confirmed as non-sporulating bacteria. The characteristic feature of red culture was white at the vegetative stage, which turned red at the reproductive stage and found insoluble in water. Pale white coloured culture was soluble in water. In infectivity tests, both cultures were pathogenic to *L. orbonalis.* The morphological, physiological and biochemical tests confirmed the identity of isolated pathogens as *Serratia marcescens* and *Enterobacter* sp.

Table 2. Some entomopathogens of *L. orbonalis* in Tamil Nadu

S.No	Pathogens	Characteristics
1.	*Serratia marcescens* Bizio (Bacteria)	White coloured at the vegetative stage and turned red at the reproductive stage. It is insoluble in water
2.	*Enterobacter* sp. (Bacteria)	Pale white coloured and found soluble in water
3.	*Aspergillus ochraceus* Kent (Fungus)	Light yellowish coloured with definite concentric layers bordered with cement coloured edges

Third instar *L. orbonalis* larva infested with yellow hyphal growth on the body surface was found at Cuddalore location. The pathogen was identified as *Aspergillus ochraceous* Kent*.* The culture of *S. marcescens* is cherry red in colour with white vegetative cells. Effectiveness of *S. marcescens* was against *L. orbonalis* was reported earlier by Rangarajan *et al*., (1971). In general, the action of pathogens on *L. orbonalis* was limited compard to parasitoids.

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