

reflected that 0.31 days would be gained by the average individual if every first death were averted while the entropy value for *M.patnalis* was 0.45 and the expectation of life of a newly hatched larva was 49.26 days. The growth index was higher (2.29) for *C.medinalis* than *M.patnalis* (2.24).

This study indicated that more than 10 per cent egg and larval mortality in both species and 10 per cent egg mortality was perceived earlier in *C.medinalis* and *M.patnalis* (Waldbauer and Marciano, 1979 and Joshi, 1985). More than 60 per cent of both the species reached adult hood which is lower than that reported by Waldbauer and Marciano (1979) for *C.medinalis* (87.00%). In both, larval mortality before pupation was observed and this explains lower adult emergence. Among the two species, *C.medinalis* has better survival capabilities than *M.patnalis* which may be the reason for its dominance in the field. Barrion *et al.* (1991) confirmed the dominance of *C.medinalis* in the field conditions of rice ecosystem.

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Research Notes

Distribution of natural enemies of rice leaf folders

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Large scale outbreaks of rice leaf folders have been reported from all rice growing countries of Asia including India (Khan *et al.* 1988) from 1960's onwards. These outbreaks are attributed mostly to reduced abundance of natural enemies; as a consequence of extreme weather

conditions or the indiscriminate use of insecticides (Rajapakse and Kulasekare, 1982).

The natural enemies are essential for maintaining the pest population at low level. A vast multitude of natural enemies associated

Table 1. Natural enemies of rice leaf folders in different situations

Insect	Nursery	Transplanted field	Field bund	Irrigation channel	Grassy patches	Harvested field with stubbles
Coleoptera						
<i>Brumus</i> spp.	+	*	+	+	+	-
<i>Coccinella repanda</i>	*	*	+	+	*	-
<i>Harmonia octomaculata</i>	+	*	+	+	*	-
<i>Micraspis</i> spp.	+	*	+	+	**	-
<i>Menochilus sexmaculatus</i>	+	*	+	+	+	-
<i>Ophionea nigrofasciata</i>	+	***	*	+	+	-
<i>Paederus fuscipes</i>	+	***	*	+	+	-
Dermaptera						
<i>Proreus simulans</i>	-	+	-	-	-	-
Hymenoptera						
<i>Brachymia</i> spp.	-	*	*	-	-	-
<i>Cardiochiles philippinensis</i>	-	***	*	-	-	-
<i>Macrocentrus</i> spp.	-	***	*	-	-	-
<i>Stenobracon</i> spp.	-	*	+	-	-	-
<i>Temelucha</i> spp.	-	*	+	-	-	-
<i>Xanthopimpla flavolineata</i>	-	*	+	-	-	-
Odonata						
<i>Agriocnemis femina femina</i>	+	**	+	-	+	-
<i>Diplacodes trivialis</i>	+	**	+	-	+	**
<i>Crocothemis servillia</i>	-	+	+	-	+	+
<i>Ischnura</i> spp.	+	*	+	-	+	-
<i>Orthetrum sabina</i>	+	***	+	-	+	**
<i>Pantala flavescens</i>	+	**	+	-	+	***
Orthoptera						
<i>Anaxipha longipennis</i>	***	***	**	**	***	-
<i>Conocephalus indicus</i>	-	+	+	+	+	-
<i>C. maculatus</i>	-	**	+	***	**	-
<i>C. longipennis</i>	-	***	**	-	*	-
<i>Metioche bicolor</i>	-	+	+	+	+	-
<i>M. vittaticollis</i>	-	**	***	*	**	-
Aranae						
<i>Damoledes</i> spp.	-	+	-	-	-	-
<i>Lycosa pseudoannulata</i>	+	**	+	-	+	**
<i>Oxyopes</i> spp.	+	**	+	-	**	+
<i>Tetragnatha</i> spp.	+	***	+	+	***	+

+ Species present

- Species absent

Intensity of abundance : * < 10 numbers, ** 10 to 20 numbers, *** > 30 numbers

with leaf folder has been enlisted by Khan *et al.* (1988). Most of natural enemies are crop stage specific. Survey on occurrence of natural enemies at various packets of rice field will document the data on their distribution pattern. Studies were taken on the distribution of natural enemies of the rice leaf folder under different situations of the paddy fields viz. nursery, transplanted rice fields, field bunds, irrigation channels, grassy patches around the rice fields and harvested rice fields with the stubbles. The observations were recorded in different situations mentioned using a sweepnet with 25 sweeps per situation at weekly intervals between 0600 and 1100 hours throughout the study period at Paddy Breeding Station, Tamil Nadu Agricultural University, Coimbatore during August 1998 - April, 2000.

Thirty different group of natural enemies (Table 1) viz. Coleoptera (7), Dermaptera (1), Hymenoptera (6), Odonata (6), Orthoptera (6) and Araneae (4) were recorded in the different situations. Among the group except hymenoptera, others are predators on various stages of leaf folder. Most of hymenopteran species reported in the study are larval pupal parasitoids of leaf folder. Predators that belong to Coleoptera and Dermaptera feed on eggs and young larva of leaf folder. Shepard and Ooi (1992) recorded coccinellid (*Micraspis* spp.) and Luo *et al.* (1990) reported staphylinid beetle *Paederus fuscipes* Curtis as predators of leaf folder (Barrion and Litsinger, 1985). The adult predation by Odonata group insects was earlier reported by Barrion *et al.* (1979). The effective predation of leaf folder eggs by the orthopteran insect *Anaxipha longipennis* (Serville) (Canapi *et al.* 1988) and *Metioche vittaticollis* (Stal) (Rubia *et al.* 1990) was reported earlier. Nosato (1983) and Ando (1993) mentioned that *Conocephalus maculatus* Guilan feeds on dead adult moths of leaf folder and Yasumatsu *et al.* (1976) reported that *C. maculatus* accepted leaf folder eggs in its diet. In the present study, nursery harboured the maximum of *Anaxipha longipennis* Serv. (Gryllidae: Orthoptera) and the transplanted fields harboured *Ophionea nigrofasciata* Schimdt-Goebel (Carabidae: Coleoptera), *Paederus fuscipes* Curtis (Staphylinidae: Coleoptera), *Cardiochiles philippinensis* Ashmead, *Macrocentrus* spp., (Braconidae: Hymenoptera), *Orthetrum sabina* Fab. (Coeno-

agrionidae: Odonata), *Anaxipha longipennis*, *Conocephalus longipennis* de Haan (Tettigoniidae: Orthoptera) and *Tetragnatha* spp. (Tetragnatha: Araneae). The highest population of the black crickets *Metioche vittaticollis* Stal. (Gryllidae: Orthoptera) was found in the field bunds while *Conocephalus maculatus* Le Guillou (Tettigoniidae: Orthoptera) was predominantly present in the irrigation channels and in the grassy patches around the fields. The harvested fields with the stubbles had a thin film of water and the dragonfly *Panatala flavescens* Fab. (Coenoagrionidae: Odonata) was observed frequenting the fields. The abundance of predatory natural enemies recorded at various situations of rice field revealed that the areas adjacent to the crop also harbour a high level of natural enemy population. Moreover leaf folder is found to attack several weed grasses in the rice field. Several weed hosts of rice leaf folder were reported earlier by Barrion *et al.* (1991). The natural enemies may be able to sustain on these weed hosts in the absence of main crop. But overall natural enemy population was abundant in transplanted field. The hymenopteran parasitoids were restricted in this situation only. Their absence in other areas indicated that they prefer the rice crop ecosystem. Abundance of natural enemies at uncropped areas ensured their diverse distribution in the rice ecosystem as evident from the present study.

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Research Notes

Ovicidal action and ovipositional deterrence of certain neem product against bhendi fruit borer (*Earias vittella* Fabricius)

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The fruit borer *Earias vittella* Fabricius (Lepidoptera : Noctuidae) causes extensive damage to bhendi (*Abelmoschus esculentus* L.) fruits, resulting in 69 per cent reduction in yield (Rawat and Sahu, 1973). Farmers rely solely on chemical insecticides for the management of bhendi fruit borer due to their perceived efficiency. As bhendi fruits are harvested in frequent intervals, the dependence on the chemical pesticides may lead to accumulation of residues in the fruits and pose problems to the consumers

Realizing the gaining importance of botanicals an investigation was made at Department of Entomology, Tamil Nadu Agricultural University Coimbatore during the year 2000 to evaluate certain neem products for their ovicidal and ovipositional deterrent effect against *E. vittella*. The experiments were conducted in a Completely Randomized Design (CRD) under laboratory condition. The transformed data were analysed and the means compared by Duncan's Multiple Range Test (DMRT) (Gomez and Gomez, 1976).