PARASITISM AND PREDATION OF RICE LEAFFOLDERS, MARASMIA PATNALIS (BRADLEY) AND CNAPHALOCROCIS MEDINALIS (GUENEE) (LEPIDOPTERA: PYRALIDAE) IN LAGUNA PROVINCE, PHILIPPINES

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ABSTRACT

There were no significant differences in rates of parasitism and predation on eggs of leaffolders (primarily Marasmia patnalis [Bradley] and Cnaphalocrocis medinalis [Guenee]) in transplanted and direct seeded rice. Egg parasitism reached a peak of about 80% in August in both transplanted and direct seeded rice but averaged about 40%. Highest levels of parasitism occurred when predation was lowest. Trichogramma sp. was the most abundant egg parasitoid. At least twelve species of parasitoids emerged from leaffolder larvae. A hyperparasitoid, Eurytoma braconis (Ferriere), also was collected. Predation on leaffolder eggs reached a maximum of about 85%.

Key Words: Rice, leaffolders, Marasmia patnalis, Cnaphalocrocis medinalis, parasitoids, predators, biocontrol, Lepidoptera, Pyralidae.

J. Agric. Entomol. 7(2): 113-118 (April 1990)

Rice leaffolders (LF) were previously considered minor or sporadic pests (Capco 1957, Lim 1962), but in recent years their importance has increased (Kalode 1974, Soejardjan and Iman 1980). Severe outbreaks were reported in Vietnam in 1981 (Heinrichs, personal communication), in India (personal observation) and Southwestern Japan (Hirao 1981).

A recent survey of LF species collected from irrigated lowland fields in Laguna province, Philippines revealed that of more than 3,500 larvae collected, over 90% were Marasmia patnalis (Bradley). Cnaphalocrocis medinalis (Guenee) was next most abundant. M. ruralis (Walker) and M. exigua (Butler) were found in sparse population densities (Arida and Shepard 1986).

Modern high-yielding rice varieties have no resistance to LF, and chemical insecticides are used frequently for their control. The impact of natural enemies is not considered in farmers’ decision-making about whether or not chemical applications are needed. However, it is clear that predators and parasitoids play a major role in maintaining several species of insect pests of rice below economically important levels (Ooi and Shepard in press) and the impact of predators and parasitoids on LF populations is likely to be significant.

Many species of parasitoids and predators of LF have been identified from different parts of Asia. Rao et al. (1969) reported 32 species of larval and pupal parasitoids of C. medinalis in India. In the Philippines, Barrion et al. (1979) listed nine species of parasitoids which attacked LF larvae and pupae but did not report parasitoids of eggs.

1 Received for publication 16 November 1988; accepted 13 December 1989.
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The incidence of parasitism and predation was monitored from the yellow stem borer, *Scirpophaga incertulas* (Walker), eggs in the Philippines by Shepard and Arida (1986) in transplanted and direct-seeded rice. They found parasitism higher in transplanted than in direct-seeded rice.

LF eggs also are vulnerable to natural enemy attack. Predators were reported to cause 70% mortality while egg parasitism was 20% (Kamal 1981).

The objectives of our study were to identify major parasitoids and predators of LF eggs and parasitoids of LF larvae in rice in Laguna Province, Philippines. Also, the seasonal abundance of major parasitoids of LF was determined.

**MATERIALS AND METHODS**

This study was conducted on the International Rice Research Institute (IRRI) experimental farm from November 1985 - October 1986. Fields were established each month of the year by direct-seeding or transplanting with rice selection IR1917-3-17. Experimental fields were divided into five 300-m² plots. Means were compared using the Student's t-test at $P < 0.05$.

**Egg parasitism and predation:**

*C. medinalis* were allowed to oviposit on plants by caging field-collected moths overnight in the laboratory on potted plants of the same age and variety as those in the field. Five pots, each bearing 25 LF eggs, were placed in transplanted and direct-seeded fields 55 d after seeding. Missing eggs were recorded after 48 h and plants were brought to the laboratory where remaining eggs were held individually in test tubes until LF hatched or parasitoids emerged. Parasitoids were counted and identified.

**Larval parasitism:**

An average of 100 LF larvae were collected every 2 w from December 1984 to November 1985 from the same fields from which egg parasitism was determined and from private fields. Larvae were reared individually in glass tubes (16 by 150 cm) on cut rice leaves which were changed as needed until parasitoids or LF emerged. LF larvae were not identified to species because of high mortality caused by unfolding the leaves to examine larvae. Parasitoids were identified by the Commonwealth Institute of Entomology (CIE), London, England.

**RESULTS AND DISCUSSION**

**Egg parasitism and predation:**

*Trichogramma* sp. and *Copidosomopsis nacoleiae* (Eady) were the only parasitoids which emerged from LF eggs. Their seasonal incidence, as detected by the prey enrichment method, is shown in Fig. 1. More than 95% of the parasitized eggs were attacked by *Trichogramma* sp. Parasitism reached two smaller peaks (about 20 - 40%) in January and March and began increasing in June, reached the highest peak of about 80% in August and declined to near undetectable levels by October (Fig. 1). The seasonal mean parasitism levels were the same ($P < 0.05$) irrespective of whether the crop was transplanted or direct-seeded (Figs. 1, 2A).
Fig. 1. Parasitism of rice leafrollers, *Cnaphalocrocis medinalis* eggs by *Trichogramma* sp. and *Copidosomopsis nacoleiae* in transplanted and direct seeded rice. IRRI Farm, Los Banos, Philippines.

The seasonal incidence of predation on LF eggs is shown in Fig. 2B. Egg predation was highest in October-November and in February-April. As with parasitism, no significant differences in mean levels of predation could be detected between the two crop establishment methods (transplanted vs. direct-seeded). In general, when egg predation was high, parasitism was low and vice versa (Fig. 2).

Density of eggs on sentinel plants may have influenced our estimates of parasitism and predation. These “resource patches” of egg-laden plants in the field could have altered parasitoid and predator behavior, thereby increasing attacks by these natural enemies over that which may ordinarily occur without artificial manipulation of host numbers. Also, removal of parasitized eggs by predators could bias estimates of parasitism.
Fig. 2. Percent parasitism (A) and predation (B) of eggs of rice leaffolders in transplanted and direct seeded rice. IRRI Farm, Philippines, 1985-86.

Larval parasitism:

The seasonal activity of larval parasitoids from the IRRI farm and from farmers' fields is shown in Figure 3. In general, parasitism rates were highest in April, May, November and December. Parasitism reached peak of over 65% in private fields in April, but overall mean larval parasitism was 30%. Twelve species of larval parasitoids emerged from LF larvae. In addition, one egg-larval parasitoid, *C. nacoleiae* was found (Table 1). Five species collected on larvae made up 83% of the total number of species from IRRI farm and 72% from private fields. *Goniozus triangulifer* Kieffer was one of the most common parasitoids found in both locations but it was not abundant during the months of May and June at the IRRI farm. Other abundant parasitoid groups included *Cardiochiles philippinensis* Ashmead, *Macrocentrus nr. trimaculatus* (Cameron) *Trichoma*, sp. and *Temelucha* sp.
Fig. 3. Seasonal incidence of leaffolder larval parasitoids from IRRI Farm and nearby farmers’ fields. Los Banos, Philippines.

Table 1. Parasitoids from rice leaffolders, *Marasmia palpalis* and *Cnaphalocrocis medinalis*, Laguna Province, Philippines. 1985-86.

<table>
<thead>
<tr>
<th>Family</th>
<th>Species</th>
<th>Stage parasitized</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bethylidae</td>
<td><em>Goniozus triangulifer</em> Kieffer</td>
<td>Larva</td>
</tr>
<tr>
<td>Braconidae</td>
<td><em>Apanteles augustibasis</em> Gahan</td>
<td>Larva</td>
</tr>
<tr>
<td></td>
<td><em>A. schoenobii</em> Wilkinson</td>
<td>Larva</td>
</tr>
<tr>
<td></td>
<td><em>Cardiochiles philippinensis</em> Ashmead</td>
<td>Larva</td>
</tr>
<tr>
<td></td>
<td><em>Macrocentrus</em> nr. trimaculatus</td>
<td>(Cameron)</td>
</tr>
<tr>
<td>Ceraphonidae</td>
<td><em>Aphenogmus</em> fijiensis* (Ferriere)</td>
<td>Larva</td>
</tr>
<tr>
<td>Elasmidae</td>
<td><em>Elasmus claripennis</em> Cameron</td>
<td>Larva</td>
</tr>
<tr>
<td></td>
<td><em>Elasmus</em> sp.</td>
<td>Larva</td>
</tr>
<tr>
<td>Encyrtidae</td>
<td><em>Copidosomopsis</em> nacoleiae* (Eady)</td>
<td>Egg-larva</td>
</tr>
<tr>
<td>Trichogrammatidae</td>
<td><em>Trichogramma</em> sp.</td>
<td>Egg</td>
</tr>
<tr>
<td>Pteromalidae</td>
<td><em>Trichomalopsis</em> nr. <em>shirakii</em> Crawford</td>
<td>Larva</td>
</tr>
<tr>
<td>Ichneumonidae</td>
<td><em>Trichoma</em> sp.</td>
<td>Larva</td>
</tr>
<tr>
<td></td>
<td><em>Temelucha</em> sp.</td>
<td>Larva</td>
</tr>
<tr>
<td></td>
<td><em>Tratula</em> sp.</td>
<td>Larva</td>
</tr>
<tr>
<td>Eulophidae</td>
<td><em>Tetrastichus</em> ayyari* Rohwer</td>
<td>Pupa</td>
</tr>
<tr>
<td>Eurytomidae</td>
<td><em>Eurytoma brachonidis</em> Ferriere</td>
<td>hyperparasite</td>
</tr>
</tbody>
</table>

It is clear from these results that parasites and predators are an important source of LF mortality. Efforts to conserve these indigenous natural enemies should include development of workable action thresholds, a practical monitoring program and selective chemical or microbial insecticides applied only when LF population density reaches threshold levels.
REFERENCES CITED


