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The Abundance and Parasitism on the Egg Masses of the Asiatic Corn Borer *Ostrinia furnacalis* Guenee in Weedy and Weed-Free Cornfields in Malaysia

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ABSTRACT

The presence of weeds has an effect on the insect abundance in the crop ecosystem, which affects the pest management practices. This paper reports the abundance of Asiatic corn borer, *Ostrinia furnacalis* Guenee, egg masses and parasitism by its native egg parasitoid, *Trichogramma papilionis* Nagarkatti, in two vegetational regimes namely weedy (plot with natural weed) and weed-free (plot without weed). The results showed that there was no significant difference in the total number of egg masses laid in weedy and weed-free plot, however, the number of parasitized egg masses was significantly higher in the weedy plot than the weed-free plot (72 and 50%, respectively). The higher number of parasitized egg masses in weedy plot reduced the number of holes bored by *O. furnacalis* on corn stalks and that the number of corn borer present inside the stalks as compared to those in the weed-free plots. Results of this study suggest that an establishment of weeds in corn ecosystem could be an important strategy in enhancing the effectiveness of *T. papilionis* in controlling the Asiatic corn borer.

Key Words: *Ostrinia furnacalis*; Egg masses; *Trichogramma papilionis*; Parasitism; Weeds

INTRODUCTION

The Asiatic corn borer, *Ostrinia furnacalis* Guenee (Lepidoptera: Pyralidae) is the most destructive insect of corn in Malaysia (Hussein & Ibrahim, 1992). Although there are many methods that can be employed in managing the corn borer, spraying with insecticides is the most commonly practiced in the country. In order to minimize the use of insecticides, both for ecological and commercial reasons, there is a need to develop an alternative approach such as using biological control agents. Among biological control agents found attacking the corn borer, a native egg parasitoid identified as *Trichogramma papilionis* Nagarkatti (Hymenoptera: Trichogrammatidae) is believed to play an important role in reducing damage in Selangor, Malaysia (Hussein *et al.,* 1996). However, there is a tendency of less performance of *T. papilionis* in some fields, especially in those with intensive weed control practiced (Sulaiman *et al.,* 2003a).

Increase in vegetation diversity and density (crops or weeds) has an effect on the insect abundance in the crop ecosystem. For example, crops fields with a dense weed cover and high diversity usually have more beneficial insects than do weed-free fields and outbreaks of some insect pests are more likely to occur in weed-free than in weed-diversified crop systems (Altieri, 1981; Landis *et al.,* 2000). However, in certain cases the presence of weeds does not reduce the pest population but increase the population of the herbivorous insects (Tonhasca & Stinner, 1991; Zhao *et al.,* 1992).

In this paper we report the abundance of *O. furnacalis* egg masses and their parasitism by *T. papilionis* in weedy and weed-free cornfields. The report could be used as a first step towards the utilization of weeds as a component of insect pest management in cornfield.

MATERIALS AND METHODS

The studies were carried out at the farm of the Universiti Putra Malaysia at Serdang, Selangor, Malaysia from April to July 2003. Weed-free plot (weeds were manually controlled) and weedy plot (weeds were uncontrolled) were arranged, following a randomised complete block design with three replicates.

Each corn plot (7.5 x 10 m) was separated from another by a 10 m bare soil. Based on quadratic sampling assessment, the percentage of weeds in the weedy plot was: (*Amaranthus viridis* = 25%, *Asystasia intrusa* = 10%, *Ageratum conyzoides* = 5%, *Cleome rutidospermae* = 5%, *Euphorbia heterophylla* = 30%, *Mimosa invisa* = 15%, others = 10%). All plots were planted with local sweet corn BC1-10 with a planting distance of 75 x 25 cm. Normal cultural practices such as fertilization and watering were done as recommended. No pesticides were used in the study.

Numbers of egg masses and parasitized egg masses. Twenty-five plants were selected at random in each plot every five days from 25 to 70 DAP (days after planting).

The numbers of egg masses and parasitized egg masses per plants were recorded on every observation day.

Numbers of holes on the stalks and *O. furnacalis* inside the stalks. At the end of the experimental period (70 DAP) forty plants were sampled randomly in each plot. Holes bored by *O. furnacalis* on the corn stalks were recorded. The number of *O. furnacalis* inside the corn stalks was counted by cutting open the stalks. All living and dead larvae and pupae found inside the corn stalks were observed and considered as number of *O. furnacalis.*

Data analysis. Data collected from each parameter were pooled and analysed using one-way analysis of variance (ANOVA). To detect the significant differences between treatments, means of each parameter were compared by using Tukey's test at P < 0.05.

RESULTS AND DISCUSSION

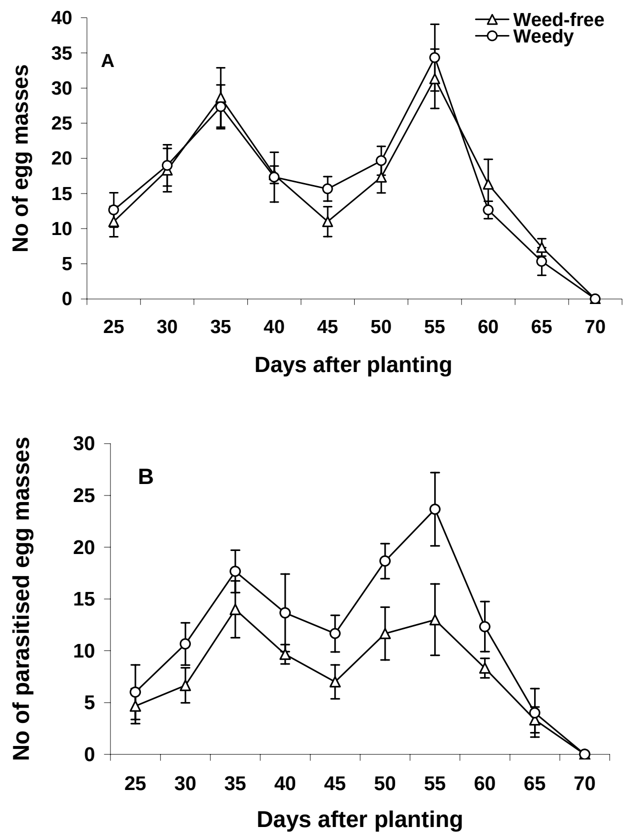
Fig. 1A and 1B show the occurrence and abundance of *O. furnacalis* egg masses and parasitized egg masses in weed-free and weedy plot at various days after planting (DAP), respectively. The first and second major peaks of egg masses abundance were observed at 35 and 55 DAP indicating that there are two generations of *O. furnacalis* as typical infestation of the corn borer (Hussein & Kameldeer, 1988). Similar trend of infestations between the weedy and weed-free plots was observed suggesting that weeds did not affect the time of occurrence and typical infestation of *O. furnacalis.*

In general, there was no significant difference (P > 0.05) in the means of egg masses laid in weed-free plot (varying from 7 to 31 egg masses) as compared to the weedy plot (varying from 5 to 34 egg masses) at all observations periods (Fig. 1A). However, the means of parasitized egg masses in weedy plot (from 4 to 23 egg masses) was significantly higher than the weed-free plot (from 3 to 14 egg masses) especially at 45 to 60 DAP (Fig. 1B).

From 10 times of observation in weed-free plot, a total of 477 egg masses were found and 235 of the egg masses had been parasitized. While in weedy plot, 354 of 492 egg masses were found to be parasitized. These findings suggest that there was no significant difference in the number of egg masses laid in weedy as compared to the weed-free plot, but the percentage of parasitized egg masses in weedy plot was 22% higher as compared to the weed-free plot (Table I). The in-significant number of egg masses laid between the two plots reveals that increasing vegetational diversity does not affect the behaviour and capability of *O. furnacalis* females to oviposit their eggs on the corn plants. This phenomenon is also found in other common corn stem borers, *Chilo partellus* and *C. orichalcociliellus* (Pats *et al.,* 1997).

Table II shows the number of holes bored by *O. furnacalis* and number of the corn borer inside the corn stalks in weedy and weed-free plots. In general the numbers of holes and *O. furnacalis* in weedy plot were approximately two times lower than the weed-free plot. The lower damage level and lower number of *O. furnacalis* in weedy plot were likely caused by the higher number of parasitized egg masses in weedy plot as shown in Table I.

Fig. 1. Means (± SE) of egg masses (A) and parasitised egg masses (B) in weedy and weed-free plots at various days after planting (n = 25 corn plants per observation)



It is well known that certain flowering weeds act as food sources to adult of many parasitoids (Idris & Grafius, 1997; Lewis *et al.,* 1998; Colley & Luna, 2000). The presence of several flowering weeds in weedy plot like *A. intrusa* and *C. rutidospermae* might act as food sources to *T. papilionis.* Those parasitoids fed on nectar of the wild plants were found to have increment in their performance of parasitism and longevity (Sulaiman *et al.,* 2003b). Besides acting as food sources, the weeds in the weedy plot also contribute as shelter and maintaining a suitable microclimate to the egg parasitoid (Altieri & Whitcomb, 1980; Orr *et al.,* 1997; Tooker & Hanks, 2000). Therefore, we suspect that the higher parasitism in the weedy plot was caused by the richness of food sources and suitable ecosystem that could support the parasiotid's life. While in the weed-free plot, the environment was unfavourable and food sources were less and thus caused less parasitism.

Table I. Means (± SE) of *O. furnacalis* egg masses, parasitised egg masses and percent parasitism of T. papilionis in weed-free and weedy cornfields (data derived from ten times of observations)

Plots	Egg masses per 250 plants	Parasitised egg masses per 250 plants	% parasitism egg masses
Weed-free	158.97 ± 18.83a	78.30 ± 10.07a	50a
Weedy	163.96 ± 19.59a	118.29 ± 12.19 b	72b

Means followed by the same letter in each column are not significantly different at P = 0.05 as determined by T test

Table II. Means (± SE) of number of holes on the corn stalks and number of *O. furnacalis* inside the stalks in weed-free and weedy cornfields

Plots	No. of holes per 40 plants	No. of *O. furnacalis* per 40 plants
Weed-free	34.33 ± 6.12 a	27.66 ± 6.64 a
Weedy	16.00 ± 4.32 b	14.66 ± 4.18 b

Means followed by the same letter in each column are not significantly different at P < 0.05 as determined by T test

The present studies inferred that the establishment of weeds as beneficial insectary plants in corn-ecosystem could be an important strategy in enhancing the effectiveness of *T. papilionis* in controlling *O. furnacalis.* However, due to some adverse effects of weeds in reducing corn production, entomologists and weed scientists should work together in minimizing the adverse effects of the wild plants. Perhaps providing the right weeds that really could act as beneficial insectary plants, maintaining the weeds population at tolerable level and designing a proper interplanting system between corn and selected weeds like row spacing pattern, cover crops, selective weeding, etc. are recommended (Altieri, 1981; Landis *et al.,* 2000).

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