AUGMENTATIVE BIOLOGICAL CONTROL OF SUGARCANE MOTH BORER CHILO TUMIDICOSTALIS IN THAILAND

By

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Abstract

Augmentative releases of Cotesia flavipes (500 per hectare) for biological control of Chilo tumidicostalis were investigated. Cotesia flavipes were mass-reared at NBCRC-CRC Kamphaeng Saen, Nakhon Pathom, and field releases were made during 1999 and 2000 in Buri Ram and Sa Kaew Provinces. We showed that percent parasitisation of C. tumidicostalis was higher in plots of cane where parasitoids were released than in plots of cane where parasitoids were not released. Over all sample dates, parasitism averaged 17.4 ± 5.9% in release plots and 13.5 ± 3.6% in control pots, indicating that repetitive releases of C. flavipes at 500 per hectare boosted levels of biological control of C. tumidicostalis. While the releases boosted biological control, the levels achieved were insufficient for reducing infestation densities of and damage by the borer. Higher levels of control might be possible using higher augmentative release rates, and these might reduce economic losses to the borer.

Introduction

Sugarcane moth borers are the most important pests of sugarcane in Thailand (Suasa-ard, 1982). Chilo tumidicostalis (Hampson) is the most important species and has risen to outbreak status in northeastern and eastern Thailand. In some areas of Buri Ram Province in northeastern Thailand and in Sa Kaew Province in eastern Thailand, 100% of stalks are sometimes infested. The biology and ecology of C. tumidicostalis and of its natural enemies have been investigated in Thailand (Suasa-ard, 2000). Trichogramma chilotraeae Nagaraja and Nagarkatti and Cotesia flavipes (Cameron) are the most important egg and larval parasites of C. tumidicostalis, respectively. Cotesia flavipes is considered the most effective and plays an important role in the biological control of sugarcane moth borers, not only in Thailand, but in many countries, such as Brazil, India, Indonesia Mauritius, Pakistan and Taiwan (Mohyuddin, 1992; Pan and Lim, 1979). The objective of this investigation was to determine the usefulness of augmentative releases of C. flavipes for biological control of C. tumidicostalis in Thailand.

Materials and methods

Mass-rearing of C. flavipes

Cotesia flavipes were reared at NBCRC-CRC, Kamphaeng Saen. Initial stocks for mass-rearing were obtained from field collections. Adults of C. flavipes were reared in cylindrical-shaped plastic boxes (12 cm in diameter, 13 cm high) with a few drops of honey on wax paper as food. An 8 cm diameter hole was cut in the top and covered with organza screen for ventilation. To transfer larvae for parasitisation, a smaller hole (about 0.5 cm in diameter) was made in the cover of the box and plugged with a cork. The second, or third, instar larvae of sugarcane moth borers from a stock culture were used as host and were exposed individually to adult parasites through the small hole. After parasitisation, the larvae were taken out and reared in new plastic boxes until the parasites had spun their cocoons; these were then transferred to and kept in new plastic boxes until the adults emerged.

Field release and assessment of C. flavipes

Adult C. flavipes were field-released over a 2-year period (1999–2000) in sugarcane plantations where C. tumidicostalis was considered a serious pest. Assessments of the releases were carried out beginning in June 1999. Two test plots (each 10 ha and 10 km apart) were established at each of two locations, one within Buri Ram Province and one within Sa Kaew Province. At each location, parasites were released in one plot and the other acted as a control (no parasite releases). About 5000 adults of C. flavipes were released at monthly intervals (about 500 parasitoids per hectare, 50:50 female: male ratio) for the first 3 months of plant growth. Subsequent releases were made every 2 months.

Assessment of the releases was made by determining the percent parasitisation of C. tumidicostalis by C. flavipes in release and control plots. We took 100 one-stool samples at random from each field at monthly intervals for 2 years. The number of C. tumidicostalis larvae and the number of parasitised larvae per sample were recorded. Data were used to determine the percent parasitisation by C. flavipes.

Results and discussion

Parasitisation in the release plots was higher than in control plots at both locations during 1999 and 2000 (Table 1). Parasitisation showed similar trends at both locations. In 1999, the parasitisation increased...
sharply in August and September and then decreased until December (Figures 1 and 2). In 2000, parasitisa-
tion increased slowly in May and June, and then increased sharply. The highest percent parasitisation
in release and control plots at Buri Ram were 18.3
and 16.1% in 1999 and 30.0 and 15.2% in 2000,
respectively, while at Sa Kaew they were 20.0 and
17.5% in 1999 and 26.4 and 17.3% in 2000, respect-
ively. Although the highest percent parasitisation in
release plots was higher than those in control plots at
both locations, the average percent parasitisation was
not significantly different between the release and
control plots in Buri Ram in 1999 and 2000 and in
Sa Kaew in 1999. Only at Sa Kaew in 2000 was the
average percent parasitisation in release and control
plots significantly different.

Overall, our investigation showed that releases of
C. flavipes boosted biological control of C. tumidi-
castalis in Sa Kaew in 2000. However, at Buri Ram
in both years and at Sa Kaew in 1999 more parasites
needed to be released to have a significant impact on
borer parasitisation rates.

<table>
<thead>
<tr>
<th>Location</th>
<th>Average parasitism (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1999</td>
</tr>
<tr>
<td></td>
<td>Mean ± SD</td>
</tr>
<tr>
<td>Buri Ram</td>
<td></td>
</tr>
<tr>
<td>Release plot</td>
<td>13.27 ± 6.57 a</td>
</tr>
<tr>
<td>Sa Kaew</td>
<td></td>
</tr>
<tr>
<td>Control plot</td>
<td>13.08 ± 1.89 a</td>
</tr>
</tbody>
</table>

*Means of pairs of release and control plots followed by the different letters are significantly different (P = 0.05).
Fig. 2—Percent parasitisation of *Chilo tumidicostalis* by *Cotesia flavipes* in release and control plots at Buri Ram and Sa Kaew in 2000.

**REFERENCES**


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**LA LUTTE BIOLOGIQUE AUGMENTATIVE DU FOREUR DES TIGES DE LA CANNE À SUCRE CHIOLO TUMIDICOSTALIS EN THAILANDE**

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**Résumé**

Des lâchers augmentatifs de *Cotesia flavipes* (500 à l'hectare) pour la lutte biologique de *Chilo tumidicostalis* furent étudiés. *Cotesia flavipes* fut élevé en masse au NBCRC-CRC Kamphaeng Saen, Nakhon Pathom, et des lâchers aux champs furent entrepris dans les provinces Buri Ram et Sa Kaew en 1999 et 2000. Nous démontrons que le taux de parasitisme de *C. tumidicostalis* était plus élevé dans les parcelles où des lâchers furent effectués. Le taux de parasitisme fût 17.4 ± 5.9% en moyenne dans les parcelles où des lâchers furent effectués comparé à 13.5 ± 3.6% dans les parcelles témoin, indiquant que des lâchers répétitifs de *C. flavipes* à 500 à l'hectare augmentèrent les niveaux de contrôle biologique de *C. tumidicostalis*. Même si le contrôle biologique fût amélioré, les taux étaient insuffisants pour réduire les infestations et les dégâts causés par le foreur. Des taux plus élevés de contrôle pourraient être obtenus avec des lâchers plus importants et pourraient ainsi réduire les pertes économiques causées par le foreur.

*Mots clés:* lutte biologique augmentative, foreur des tiges, Thaïlande.
INCREMENTO DEL CONTROL BIOLÓGICO DEL PERFORADOR DE LA CAÑA DE AZÚCAR CHILO TUMIDICOSTALIS EN TAILANDIA

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Resumen
Se investigó el incremento en las liberaciones de Cotesia flavipes (500 por hectárea) en el control biológico de Chilo tumidicostalis. La cría masiva de Cotesia flavipes se realizó en NBCRC-CRC Kamphaeng Saen, Nakhon Pathom, y las liberaciones en el campo se efectuaron durante 1999 y 2000 en las provincias de Buri Ram y Sa Kaew. Se encontró que el porcentaje de parasitismo de C. tumidicostalis fue mayor en parcelas de caña donde se habían hecho las liberaciones que en las parcelas donde no se habían hecho. Considerando todas las muestras, el promedio de parasitismo fue 17.4 ± 5.9% en las parcelas donde se hizo la liberación y 13.5 ± 3.6% en los testigos. Las liberaciones de 500 especímenes de C. flavipes por hectárea incrementaron el control biológico de C. Tumidicostalis, sin embargo, los niveles alcanzados fueron insuficientes para reducir la infestación y el daño del barrenador. Es posible que se obtengan mayores niveles de control empleando mayores tasas de liberación, para poder reducir las pérdidas económicas causadas por el barrenador.

Palabras claves: Control biológico, barrenador del tallo, Chilo tumidicostalis, Tailandia