Introduction

The diamondback moth, Plutella xylostella L. (Lepidoptera: Plutellidae) is the most important pest of cultivated Brassicaceae worldwide, including several greenhouse plants like cauliflower, cabbage, or canola. The success of invertebrate biological control programs involving the use of the egg parasitoid Trichogramma wasps (Hymenoptera: Chalcidoidea) to control lepidopteran pests, depended among others, on insect capacity to disperse from introduction points (Smith, 1986).

Objectives

To control the diamondback moth in cauliflower greenhouses, the dispersal capacity of eight Trichogrammatidae strains (Hymenoptera: Chalcidoidea) was studied with sticky traps in simplified structure of cauliflower crop and in greenhouse. This study permitted to select the Trichogrammatidae the better adapted to cabbage crop environment in greenhouse.

<table>
<thead>
<tr>
<th>Species</th>
<th>Strain</th>
<th>Host</th>
<th>Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>T. bourouzie</td>
<td>Bou-1</td>
<td>Vanessa carina</td>
<td>Morocco</td>
</tr>
<tr>
<td>T. chilonis</td>
<td>Cho-1</td>
<td>Plutella xylostella</td>
<td>Japan</td>
</tr>
<tr>
<td>T. chilonis</td>
<td>Cho-2</td>
<td>Chilo sacchariphaga</td>
<td>Reunion Island</td>
</tr>
<tr>
<td>T. chilonis</td>
<td>Cho-3</td>
<td>Euphasia kuehniella</td>
<td>Taiwan</td>
</tr>
<tr>
<td>T. evanesceae</td>
<td>Eva-1</td>
<td>Euphasia kuehniella</td>
<td>Egypt</td>
</tr>
<tr>
<td>T. evanesceae</td>
<td>Eva-2</td>
<td>Plutella xylostella</td>
<td>France</td>
</tr>
<tr>
<td>T. striata</td>
<td>Str-1</td>
<td>Plutella xylostella</td>
<td>France</td>
</tr>
</tbody>
</table>

Table 1: Host and country of origin of the Trichogramma strains studied.

- Sticky traps were green, paper (7.5 x 7.5 cm) glued with Tanglefoot®.
- Cauliflower Brassica oleracea Botrytis L. (Brassicaceae) was used for the experiments as it is the main brassicaceae cultivated by French seed-bearers. Cabbages were grown in pots in glass insect-proof growth chamber (21±1°C, 60±5% RH).
- Experiments were effected in three parallel glass greenhouses (4x20m).

Experiment 1: Dispersal in simplified structure of cabbage crop.

Mature cauliflowers in pots were used, placed in cross and 30 cm spaced (Figure 1 left). Sticky traps were placed at canopy level with wood posts at 1m, 3m and 5m of the release point. Black (i.e. preserved) Ephesia kuehniella eggs stuck on a yellow card were counted, just before Trichogrammatidae emergence, to have thousand females. When more than 50% of the parasitoids emerged, the tube containing them was placed in a falcated sleeve placed on a cabbage at canopy level (release point).

Number of female trapped was counted at 1, 3 and 5 days after the release. Seven replications were made for each strain.

Figure 2: Percentage of females trapped (mean ± SE) (same letter means no significant difference, p<0.05).
- Most important dispersal for: T. chilonis-2, T. chilonis-1, T. striata-1 and T. semibliss-1

Figure 3: Weighted mean distance (WMD±SD) (same letter means no significant difference, p<0.05).
- T. striata-1, T. semibliss-1, T. chilonis-2
- and T. ochromatoides-1 had the best dispersal index upper 2 meters

Figure 4: Percentage of females trapped (mean ± SE) (same letter means no significant difference between strains, p<0.05).
- Trichogrammatidae flow was the most important for T. chilonis-2
- Weighted mean distance did not differ significantly between strains.

Conclusion

T. chilonis-1, T. chilonis-2, T. evanesceae-1, T. ochromatoides-1 and T. semibliss-1 seemed to be the better adapted to cabbage crop conditions in greenhouse.

Vegetable seem to decrease Trichogrammatidae dispersal by providing increased host searching area, however no eggs were present in our study. These results demonstrate also the importance of working at the strain level rather than at the species level.

Parasitic efficiency of these five strains must to be tested on P. xylostella eggs in real conditions of cabbage crop to refine Trichogrammatidae selection for biological control of the diamondback moth.