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CONSERVATION BIOLOGICAL CONTROL OF THE MULBERRY SCALE, *Pseudaulacaspis pentagona* (Targioni), BY IPM WITH COMMUNICATION DISRUPTION USING SEX PHEROMONE TO TEA TORTRIXS

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Summary

Integrated pest management (IPM) by the method of communication disruption by dispensing sex pheromones of tea tortrixs (*Homona magnanima* and *Adoxophyes honmai*) was practiced in commercial tea fields covering an area of 13 hectares in Shizuoka Prefecture in 2004 and 2005. Further, the frequency of pesticide spraying was reduced in tested tea fields. The shutdown rate of the traps of tea tortrixs that were being monitored was higher than 95% in the tested fields, and the densities of tea tortrix larvae were almost the same as those in the tea fields where pesticides were conventionally applied.

At the beginning of the experiment in 2004, the densities of mulberry scale's in the tested fields were higher than in the control tea field. However, the densities in the tested fields gradually decreased and became lower than that in the control tea field after the third generation of the scale in 2004. Three species of parasitoids that were natural enemies of the scale were found, and *Arrhenophagus albitibiae* was the primary dominant parasitoid. At the beginning of this experiment, the percentage parasitism of the parasitoids in the tested fields was lower than that in the control field. However, the percentages increased with the alternation of generations of the scale and eventually reached more than 80%. In addition, the frequency of pesticide spraying in the tested fields reduced by approximately 30% as compared with in the control field. Thus, the effects of pesticides on natural enemies of the scale were evidently lower in the tested fields than in the control field.

These results suggested that IPM with communication disruption by using pheromone dispensers proved successful in the biological control of mulberry scale in tea fields since it conserved the natural enemies of the scale.

Keywords

Pseudaulacaspis pentagona, mulberry scale, tea totrix, natural enemy, parasitoid, biological control, communication disruption, pheromone, IPM, tea

Introduction

The mulberry scale *Pseudaulacaspis pentagona* (Targioni) is the most important pest on tea trees in Shizuoka prefecture, Japan. It is suggested that various pesticides sprayed in tea fields adversely affect the natural enemies of the scale. Biological control by natural enemies is effective in controlling the scale, and it is necessary to reduce the use of pesticides in tea fields. Therefore, we practiced integrated pest management (IPM) by using dispensers that released sex pheromones of tea tortrixs for communication disruption in commercial tea fields and evaluated the effectiveness of IPM against mulberry scale.

Materials and Methods

1. Tested tea fields and treatment

We conducted experiments on 13 hectares of commercial tea fields in Shizuoka prefecture in 2004 and 2005, and 250 dispensers (Hamakikon-N) that released sex pheromones of tea tortrixs were uniformly attached to tea bushes per 10 ares in March. Control without pheromone dispensers was attempted at a conventional tea field

(control field) near the tested fields.

2. Investigation of tea tortrixs, the mulberry scale, and natural enemies of the scale

The pheromone traps were monitored, and the number of tea tortrix adults captured was counted weekly to check the communication disruption effect. The scale density was examined by observing the male cocoons at every generation, the percentage parasitism, and the species of mulberry scale parasitoids in our laboratory.

3. Evaluation of the effects of pesticides sprayed in tea fields on natural enemies

The mortality of the scale's parasitoid *A. albitibiae* with various pesticides was clarified in advance by laboratory tests. We calculated the mortalities of the parasitoid for each pesticide sprayed by the farmers during a year and calculated the effect indices based on the IOBC standards for sprayed pesticides. Next, we compared the effects between the treated and control fields.

Results and Discussion

1. Control effects of the pheromone of tea tortrixs

Shutdown rates of the monitor traps were more than 95% in the tested fields, and the densities of tea tortrix larvae were almost the same as in conventional tea fields. However, for the second generation, the shutdown rates occasionally decreased in summer.

2. Changes in the densities of mulberry scale

The scale's densities were higher in the tested fields than in the control field in early 2004. However, the densities gradually decreased and became lower than that in the control field after the third generation of the scale in 2004; the lower densities were maintained even during 2005 (Fig.1).

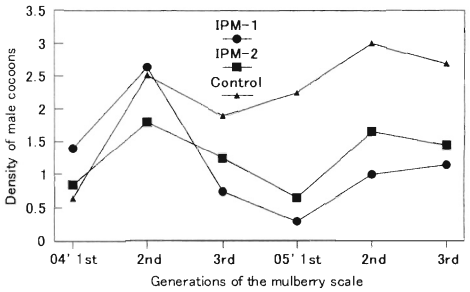

Fig. 1 Changes of densities of the mulberry scale in tea fields

3. Parasitism of natural enemies of the scale

Three species of parasitoids, namely, *A. albitibiae*, *Pteroptrix orientalis*, and *Thomsonisca amathus*, were found as natural enemies, and *A. albitibiae* was the primary dominant parasitoid. At the beginning of this experiment, the percentage parasitism of the parasitoids in the tested fields was lower than that in the control field. Further, the percentages increased with the alternation of generations of the scale and eventually reached more than 80%. On the other hand, the percentage parasitism in the control field was suppressed to lower than 40% (Fig. 2). This result showed that the activity of the parasitoids against mulberry scale was enhanced in the tested fields.

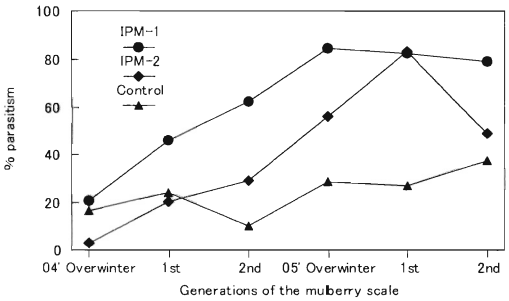

Fig.2 Percentage of parasitism of the parasitoids on the mulberry scale

4. Frequency of pesticide spraying and the effects of sprayed pesticides on natural enemies

The frequency of pesticide spraying in the tested fields was suppressed to three-fourths or two-thirds that in the control field. The effect indices of pesticides on the parasitoid A. albitibiae in the tested fields were lower than those in the control field (Table 2). This suggested that the natural enemies of the scale in the tested fields were actively conserved.

5. Conclusion

IPM by using the tea tortrix's pheromone dispenser Hamakikon-N was successfully conducted for conserving biological control of mulberry scale and reducing the use of pesticides.