PHEROMONE TRAPPING AND FIELD SCOUTING FOR TOMATO FRUITWORM IN TOMATOES AND SWEET CORN

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SUMMARY

Monitoring of tomato fruitworm (TFW) adults using pheromone traps was initiated in Gisborne to augment existing egg and larval scouting programmes in tomatoes and larval scouting in sweet corn. Increases in pheromone trap catches in tomatoes in late-January, mid-February, and in March coincided with increases in egg counts. Moth catches in sweet corn crops were low compared to catches in tomatoes. However, the peak flights into tomato fields in mid-February and early-March coincided with flights into sweet corn crops. These preliminary results indicate that monitoring the fluctuations of adult populations may considerably reduce crop inspection time and lead to reduced and more accurately timed insecticide spraying of these crops.

INTRODUCTION

The tomato fruitworm (TFW), *Helicoverpa armigera*, also known as corn earworm, is the major insect pest of tomatoes and sweet corn in New Zealand. It feeds mainly on fruit and flowers and causes significant damage at low population levels. However, as some damage can be tolerated in process crops (10% in tomatoes and 3% in sweet corn), a reduction in insecticide use would be possible if spray application decisions were based on the presence of TFW as determined by monitoring. This approach required the identification of thresholds above which TFW causes unacceptable damage, and the development of monitoring systems to detect these thresholds in the field.

To monitor egg and larval populations in tomatoes we are developing a rapid sampling or scouting technique. This technique is being used to test various spray decision thresholds and has been calibrated against absolute counts obtained by destructive sampling.

A second monitoring technique which is used overseas for *Helicoverpa* and *Heliothis* spp. is the use of pheromone traps to monitor increases in adult population density and thus to forecast the timing of potential egg and larval infestations (Rothschild *et al* 1982). Some studies suggest that the levels of larval infestation cannot be accurately predicted using pheromone traps (Kehat *et al* 1982). However, pheromone trapping may be used to decide when and if scouting is necessary and thus reduce the time entailed in continuous checking of individual crops.

This paper reports on the first use of pheromone traps for TFW in Gisborne tomato and sweet corn crops. It records catches in early and late-season crops, and relates these to egg and larval infestations in tomatoes, and larvae in corn.

METHODS

A hollow cone trap similar to that described by Hartstack *et al* (1979), was baited with a rubber septum impregnated with 500 µg of the pheromone blend described by Rothschild *et al* (1982) to attract male TFW moths. In tomatoes a trap was placed in each of four early-season and four late-season crops at the pre-flowering or early-flowering stage. The traps were positioned in a part of the crop which was maintained free of insecticide to monitor the development of unsprayed TFW egg and larval infestations. Traps were emptied and TFW moths counted twice weekly in all but two late crops, which were monitored daily after 11 February. To allow comparison of trap catches made over periods of different duration, results were expressed as number of

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TFW per day. Scouting consisted of a 1 minute search of each plant for eggs and larvae on upper leaves, flowers, and all fruit, and provided an index of the numbers of eggs and larvae per plant. Ten randomly selected plants were sampled in each of four 40 x 10 m areas of a crop, one site being the unsprayed area.

In sweet corn, pheromone traps were placed into four early sweet corn crops at silking. The traps were monitored twice weekly until the crop was sampled for TFW larval infestations at 10-14 days before harvest. Larval monitoring involved randomly sampling 50 cobs on a transect across a crop. These cobs were examined for the presence of TFW larvae to estimate the percentage infested. Traps were then moved to later planted crops which had started silking. A total of 20 crops were examined.

RESULTS

In tomato crops TFW moth catches were low until late-January (Fig. 1A) when at all four sites catches exceeded 8 per day. On 12-13 February there was a large moth catch and in late-February catches increased again, with peak catches in early-March. The number of moths caught declined again from mid-March. In sweet corn crops TFW moth catches were very low until mid-February (Fig. 1B). There were two distinct peaks in numbers caught, on 12-13 February and in early-March and these coincided with some of the peak catches in tomato crops.

Fig. 2: Mean number of TFW moths caught in pheromone traps, and eggs and larvae per plant in unsprayed areas of a) one early, and b) one late tomato crop.

Twice weekly monitoring of traps was adequate early in the season, but increasing catches in tomatoes indicated that traps may reach saturation levels and require more frequent emptying to retain their catching efficiency. Traps which were monitored daily tended to catch more moths than those monitored twice weekly (Fig. 1A), but specific trials will be required to determine if trap saturation is a problem.

Scouting in tomatoes showed that egg and larval infestations were generally related to moth catches (Table 1A). The comparison of early and late crops shows a lower mean number of moths/day in early crops, fewer peak moth catches, fewer eggs and larvae, and also less fruit damage. Until moth catches exceeded 10/day in early crops few eggs were found (Fig. 2A). The first major moth catch on 15 January was followed by egg counts reaching a maximum of 0.3/plant and larval counts peaking at 0.9/plant in unsprayed areas. In unsprayed areas of the four early crops percent fruit damage at harvest ranged from 3.6 to 10.4% (Table 1A). Egg and larval counts from the sprayed areas of these crops were also generally low, reaching a maximum of 1.3 eggs and 0.2 larvae per plant.

In all late tomato crops egg counts increased after the two large moth catches on 12-13 February and early March (Fig. 1A). Moths commonly exceeded 15/day, maximum larval counts exceeded 1/plant and damage exceeded 15% at all four sites (Table 1A). Differences in infestation or damage between individual late-season tomato crops were not clearly related to trap catches. Scouting was initiated too late to monitor the increase in early infestations in unsprayed areas (Fig. 2b). However, within each late crop, increased trap catches were frequently associated with increased egg counts (Fig. 2b). Fruit damage in unsprayed areas of late crops ranged from 15 to 33%, and was minimal in sprayed areas.

TABLE 1: Mean number of tomato fruitworm moths caught in pheromone traps compared with (A) egg and larval counts and fruit damage in early and late unsprayed tomato crops, (B) larval infestation of sweet corn in March.

A. Tomatoes		Early crops				Late crops			
Site		1	2	3	4	5	6	7	8
Moths/day		4.7	2.8	3.8	4.4	7.3	9.8	14.3	9.9
Mean catch >10		1	0	1	2	4	4	7	7
Mean catch >15		1	0	0	0	3	3	7	4
Max. eggs/plant		0.2	0.5	0.4	0.3	0.5	2.9	1.7	0.5
Max. larvae/plant		0	0.1	0.2	0.9	1.2	1.9	1.8	1.4
Damage (%)		4.0	3.6	10.4	6.7	32.6	21.1	19.6	15.0
B. Sweet corn									
Site		1	2	3	4	5	6	7	8
Moths/day		0.8	7.0	13.4	0	5.0	9.3	2.4	0.2
Cobs infested (%)		0	28	38	0	14	16	0	0

Fig. 1: Mean number of tomato fruitworm moths caught in pheromone traps in, A) four early and four late tomato crops, B) sweet corn crops.

In sweet corn, TFW larval infestation was clearly related to moth catches. Early crops monitored in December and January produced few moths (Fig. 1B) and no larvae. Increased catches in February were not accompanied by larval infestation, but in March larger catches were associated with the occurrence of larval populations. In this period, catches >5 per day were associated with larval infestations of 14-38%, whereas crops with catches of <5 per day had no infestations (Table 1B).

DISCUSSION

The preliminary results reported here indicate that the use of data from pheromone traps may reduce the need for scouting. The implementation of the technique requires refinements of trap design and use, but problems such as trap saturation can be overcome by using less efficient traps. The potential for usefully interpreting the trap data was shown by the strong relationships between adult flights and infestation in both tomato and corn crops. Small flights of adult TFW into early crops and damage levels below the acceptable level of 10% in these crops suggests that scouting is necessary only after moth catches exceed approximately 10/day. In late tomatoes regular scouting of most crops may be necessary, but pheromone trap catches should allow forecasting of danger periods.

In sweet corn the seasonal variation in trap catches between early and later crops provides greater potential for predicting the timing of significant TFW infestations. The relationship between trap catch and crop infestation also suggests that pheromone traps will assist in determining which crops should be scouted to make spray decisions.

The synchrony of peak catches between tomato and sweet corn crops suggests that factors such as the timing of spring moth emergence and subsequent generation time are similar throughout the Gisborne area. This uniformity may allow the development of models utilizing temperature accumulations, which could forecast the occurrence of damaging populations.

These results suggest that pheromone trapping will be a useful addition to IPM of tomato fruitworm in tomatoes and sweet corn. Prior to implementation, both the trapping and scouting thresholds need much further definition over a range of seasons in the Gisborne area to ensure that the techniques will reliably assist spray decisions and enable reductions in insecticide use.

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