GREENLOOPER CATERPILLAR CONTROL ON GREENHOUSE TOMATOES WITH *BACILLUS THURINGIENSIS*

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When *Encarsia formosa*, the whitefly parasite, and *Phytoseiulus persimilis*, the two-spotted mite predator, are used in glasshouses overseas, *Bacillus thuringiensis* (B.t) is recommended for control of lepidopteran larvae. In New Zealand an important caterpillar pest of tomatoes and many other greenhouse crops is the greenlooper, *Chrysodeixis eriosoma*. The greenhouse trial described here tested the ability of three available formulations of B.t to control artificially established greenlooper caterpillar infestations.

Tomatoes, cv. 'Virosa' were planted in January 1985 in two glasshouses at the DSIR Pukekohe Research Station. In each glasshouse 64 plants were arranged in two double rows with each plot containing eight plants. Each treatment was present in each double row. Buprofezin, (125 mg ai/litre) was sprayed every 2 weeks to control whitefly.

Three products (Bactospeine, Dipel and Thuricide), of the same strain (HD1) of B.t were applied every 3 weeks from 19 Feb-14 May at 0.5 g product (16,000 international units of potency per mg) per litre. The spray was directed onto the underside of the leaves and plants sprayed to point of run off. To reduce drift, plastic sheets were hung between plants of adjacent plots but not in the central pathway.

Preliminary experiments showed that artificial infestations were more easily established by placing egg batches rather than larvae onto plants. Eggs were obtained from field collected larvae, pupae and moths. Known numbers of eggs laid on filter paper were stapled onto tomato leaves in each treatment. On each occasion eggs were placed on only one plant per plot. The filter papers with the eggs were collected later and the number of unhatched eggs counted.

The numbers of larvae on the plants and the degree of leaf damage were recorded each week. Larvae from artificial infestations could be distinguished from natural infestations because larvae stay on leaves close to the egg batch. Larvae from natural infestations of greenlooper and tomato fruit worm (*Heliothis armigera*) were also recorded.

TABLE 1: Effect of *Bacillus thuringiensis* formulations on greenlooper survival.

Treatment	Weeks after egg release on					
	16 April				30 April	
	1	2	3	4	1	2
Mean larval survival* (percentage)						
Dipel	46.2 (52)	21.1 (13)	7.0 (1.5)	1.5 (0.1)	31.6 (28)	11.4 (4)
Thuricide	17.6 (9.2)	5.2 (0.8)	3.4 (0.4)	0.0 (0)	2.2 (0.1)	0.0 (0)
Bactospeine	39.4 (40)	15.3 (7)	7.7 (1.8)	1.5 (0.1)	32.8 (29)	10.5 (3.3)
untreated	55.5 (68)	49.8 (58)	41.3 (44)	37.2 (37)	46.2 (52)	43.0 (47)
LSD (within week)	9.8	9.8	9.8	9.8	11.2	11.2

*arcsine transformation

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Fig. 1: Effect of *Bacillus thuringiensis* products on natural infestations of; *a*, greenlooper; *b* tomato fruitworm.

Analysis of variance was carried out on transformed data: arcsine of square root of the proportion of surviving larvae (no. larvae/no. hatched).

The proportion of greenlooper eggs that hatched was greater than 70% in all treatments except for two, Dipel and Thuricide of the 30 April release, in which the proportion hatched was 36 and 40% respectively. On this occasion some of these egg batches were in exposed sunny positions and eggs appeared to be desiccated.

Mortality of greenlooper larvae was higher on the sprayed plants than on the unsprayed plants (Table 1) and all B.t formulations prevented larvae reaching the late instars that damage fruit. Thuricide was the most effective formulation.

Application every three weeks of the three products also substantially reduced a natural infestation of greenlooper (Fig. 1a) and tomato fruit worm (Fig. 1b). On the treated plants no greenlooper larvae of fruit damaging size developed but there was some fruit damage by tomato fruit worm larvae. More frequent applications of B.t products, such as every two weeks, may prevent fruit damage by tomato fruit worm which attack fruit when the larvae are still small.

The high natural infestation of greenlooper and tomato fruit worm in the trial probably developed because the side vents were permanently open whereas in the past they have been closed from dusk to dawn. Closing the vents early in the evening may reduce the chance of greenlooper and tomato fruit worm attack.

This trial has shown that three B.t products, Bactospeine, Dipel and Thuricide, sprayed onto tomato plants every three weeks, prevent fruit damage by greenlooper caterpillars but not tomato fruit worm. These safe pesticides will provide caterpillar control in greenhouse tomatoes and other crops where integrated pest control is practiced.