INSECTICIDAL SOAPS FOR POST HARVEST CONTROL OF THRIPS IN ASPARAGUS

J.B. WALLER

Entomology Department, Lincoln University, Canterbury

SUMMARY

Asparagus infested with thrips is not accepted into Japan or the U.S.A. Conventional insecticides leave unacceptable residues so insecticidal soaps were compared with maldison for thrips control. One percent soap was as effective as two percent soap. One percent soap gave 97 percent reduction in thrip numbers whereas maldison gave 100 percent reduction. Both treatments caused most of the thrips to migrate from the spears. An expert taste panel detected no significant difference between the taste of soap-treated and control asparagus.

INTRODUCTION

Asparagus is an important horticultural crop with an export value for 1988-89 of about $10 million. The main importing countries, Japan and U.S.A., have strict tolerance levels for both insect pests (Japan zero, U.S.A. zero) and insecticide residues (Japan: maldison 3 ppm, dichlorvos 0.1 ppm; U.S.A.: maldison 8 ppm, dichlorvos zero). Currently there are no recommendations for the post harvest control of thrips in export asparagus. Maldison has been used in the past by some export packers.

Thrips are the main pest problem in fresh asparagus because of their small size which enables them to hide under bracts. In Canterbury, aphids and plant bugs are also found on asparagus but because of their larger size are readily removed in the washing process. Asparagus bed management over winter does not reduce spear contamination sufficiently to reduce the need for post harvest decontamination of export spears (Townsend and Watson 1984).

Several methods for post harvest disinfestation of asparagus have been reported (Carpenter 1987; Lill and Van der Mespel 1986; Anon. 1983). Carpenter (1987) showed that dichlorvos and carbon dioxide formulations were not totally effective against insects in asparagus. He concluded that dichlorvos could not be used for treating asparagus for fresh export.

With the recent public concern over the use of pesticides, the need for research into alternative strategies for control of pests and diseases has increased. While insecticidal properties of soaps and fatty acids have been known for a long time (Siegler and Popenoe 1925; Dills and Menusan 1935), interest in these insecticidal soaps for control of soft-bodied organisms such as mites, aphids, mealy bugs and thrips has been renewed in recent years (Puritch *et al* 1982; Osborne and Petitt 1985; Blank *et al* 1986).

The objective of this study was to determine the feasibility of using insecticidal soaps as an alternative to organophosphorus insecticides for post harvest control of thrips in fresh export asparagus.

MATERIAL AND METHODS

Asparagus, either cv. 'Limbras' or 'Larac' was purchased from growers in West Melton, Canterbury district from October through December 1989. The 10 kg quantities were collected from the grower after overnight storage in a coolroom (0-2 °C). Ten replicates of each of ten spears were selected at random from the 10 kg bulk, and submerged in the test solutions for 30 minutes without agitation. The temperature of the solutions varied between 17 °C and 20 °C over the experimental period. Treatments consisted of 1% soap, 2% soap, 0.5% soap plus 0.5% oil (soap, Yates YR299; oil, Yates YR100), 0.8 g/litre maldison (Coopers 50%EC) and a water only control. The

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formulations of the Yates products are confidential but the insecticidal soap contains potassium salts of C_{12} to C_{18} fatty acids and the oil is a blend of vegetable oils and emulsifiers. Maldison was used as a standard for comparison with soap treatments because until recently it was the only chemical used for water-bath treatment of export asparagus (Anon. 1983). Onion thrips (*Thrips tabaci*) was identified as the only species infesting both varieties of asparagus.

Preliminary experiments using carbon dioxide, bract removal and tapping indicated that tapping was the most satisfactory method for removing thrips. It is the method used by MAFQUAL staff when inspecting asparagus prior to export. Thrips were removed from all spears by vigorously tapping each spear about 20 times over a white plastic tray. After the thrips had been counted, sub samples of five spear tips (6-8 cm) from four replicates in each treatment were heat extracted. The heat extraction procedure allowed an assessment of the effectiveness of tapping as a method of removing thrips.

A taste panel of ten panellists trained in the quantitative descriptive analysis (Stone *et al* 1974) of fresh, steamed asparagus from breeding programmes at CRD, DSIR, Lincoln, New Zealand, was used to assess the flavour of treated and untreated asparagus.

RESULTS AND DISCUSSION

The heat extraction experiments showed that 10% of the thrips remained in the untreated control spears after vigorous tapping (Table 1). A comparison of the mean number of live thrips from the untreated control with that from the treated showed that the treatments had a "flushing" effect, i.e. the thrips left the asparagus and died in the soap or maldison solution rather than dying in the spear. The large numbers of dead thrips found in the treatment baths supported the idea of a flushing effect.

TABLE 1: Effect of insecticidal soap and maldison on the recovery of live thrips from asparagus after a 30 minute dip.

Harvest date	Untreated			1% soap (2% soap)			0.8g ai/litre maldison		
	Reps	Total live thrips		Reps	Total live thrips		Reps	Total live thrips	
		Tapping	Heat*		Tapping	Heat*		Tapping	Heat*
1.11.89	5	107	52	6	1	6	—	—	—
3.11.89	6	62	37	6	2	15	—	—	—
6.11.89	10	114	17	12	7(6)	10(1)	—	—	—
13.11.89	10	162	30	10	15(2)	3(2)	—	—	—
4.12.89	10	502	39	10	8(23)	14(3)	—	—	—
6.12.89	10	168	23	10	10	10	10	0	3
11.12.89	10	187	23	10	4	6	10	0	0
12.12.89	10	450	27	10	8	3	10	0	0
13.12.89	10	690	14	10	19	3	10	0	1
±95% C.L		271 ± 168	29 ± 7.8		8.2 ± 6.2 (10.3 ± 12.5)	7.8 ± 3 (2 ± 1.1)			2.8 ± 1.4

— No experiments
* Estimated from sub-sample of four replicates of five spear tips

A comparison of the mean of all soap treatments with that of the controls showed a 97% reduction in thrips numbers (Table 1). Even if the values for tapped out and heat extracted thrips are added, the reduction effected was still 95%. A comparison of the results of 1% and 2% soap treatments after three experiments showed a large variation in thrip numbers but no difference between treatments. Therefore, 2% soap treatments were discontinued. The maldison treatment gave 100% control of thrips.

Some live thrips ca. 3% were left in the treated spears as shown by either vigorous tapping or heat treatment. It is assumed these live thrips move deep into the asparagus head and survive in bubbles of trapped air. Agitation of the spears during treatment may help overcome this problem. Obviously 100% control was not achieved and it remains to be seen whether asparagus tested on a commercial scale would be passed by MAFQUAL for export or by the importing countries.

The variation in thrip counts from spears harvested on different dates is quite high as indicated by the large confidence limits for pooled data (Table 1). This is not

surprising, however, because of the large temperature fluctuations during the harvest season which influence thrips activity.

Only two experiments were carried out with a soap and oil mixture but the results showed the same level of control as soap alone. Asparagus treated with oil and insecticidal soap had a distinct shiny, oily appearance quite different from spears treated only with soap. It was assumed that oil-treated asparagus would meet with customer resistance so experiments with insecticidal oils were discontinued. The maldison-treated spears had a characteristic organophosphate smell even after washing and in this state probably would not have been acceptable to the end user who buys the asparagus in the raw state.

Soaps offer the advantage of being easy to use, of low hazard to workers and not subject to residue regulations. Because of their solubility in water any traces of soap which may be found on the asparagus after treatment can easily be removed by washing.

Asparagus was evaluated for sweetness, bitterness, amount of asparagus flavour and level of off-flavours using a quantitative scale. Analysis of variance for the mean scores for each attribute showed no significant differences between treated (soap or maldison) and untreated spears. There was also no significant difference between mean scores for the asparagus in this test and other asparagus assessed throughout the season by the panel.

Although maldison reduced the thrip numbers more than did the insecticidal soap the risk of residues is such that exporters do not use maldison baths for treating fresh export asparagus. Therefore dipping in insecticidal soap (Yates YR299) may offer a reasonably effective (95% control) method for the post harvest disinfestation of export asparagus. Commercial scale trials would therefore be warranted.

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REFERENCES

Anon., 1983. Insect contamination in export asparagus. *Fruit & Produce, July-August:* 18-20.

Blank, R.H., Balgrove, M.J. and Waller, J.E., 1986. Screening chemicals to control greenhouse whitefly on tamarillo. *Proc. 39th N.Z. Weed and Pest Control Conf.:* 148-152.

Carpenter, A., 1987. Post-harvest fumigation of fresh asparagus with dichlorvos. *Proc. 40th N.Z. Weed and Pest Control Conf.:* 71-74.

Dills, L.E. and Menusan, H., 1985. A study of some fatty acids and their soaps as contact insecticides. Contrib. Boyce Thompson Inst. 7: 63-82.

Lill, R.E. and Van der Mespel, G.J., 1986. The effect of controlled atmosphere storage of asparagus on survival of insect passengers. *Proc. 39th N.Z. Weed and Pest Control Conf.:* 211-214.

Osborne, L.S. and Petitt, F.L., 1985. Insecticidal soap and the predatory mite, *Phytoseiulus persimilis* (Acari: Phytoseiidae), used in management of the twospotted spider mite Acari: Tetranychidae) on greenhouse grown foliage plants. *J. Econ. Entomol. 78:* 687-691.

Puritch, C.S., Tonks, N. and Downey, P., 1982. Effect of a commercial insecticidal soap on greenhouse whitefly (Hom: Aleyrod.) and its parasitoid, *Encarsia formosa* (Hym: Euloph.). *J. Entomol. Soc. Brit. Columbia 79:* 25-28.

Siegler, E.H. and Popenoe, C.H., 1925. The fatty acids as contact insecticides. *J. Econ. Entomol. 18:* 292-299.

Stone, H., Oliver, J., Woolsey, A. and Singleton, R.C., 1974. Sensory evaluation by quantitative descriptive analysis. *Food Technol. 28:* 24, 26, 28, 29, 32, 34.

Townsend, R.J. and Watson, R.N., 1984. Stand management of asparagus for control of thrips. *Proc. 37th N.Z. Weed and Pest Conf.:* 151-155.