STAND MANAGEMENT OF ASPARAGUS FOR CONTROL OF THRIPS

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SUMMARY

A survey of grower management systems in asparagus (*Asparagus officinalis*) over winter and early spring showed a link between degree of weed/litter control and subsequent resident thrips populations. The proximity of over-wintering sites of certain thrips species to asparagus stands increased the chances of infestation of asparagus spears by these species. There was no indication that over-wintering management would reduce spear contamination by the aerial thrips population sufficiently to alleviate the requirement for post-harvest decontamination of export asparagus.

INTRODUCTION

Contamination of fresh export asparagus is the most important pest problem facing asparagus growers (Watson 1983). Small insects conceal themselves beneath bracts in the spears and resist normal washing procedures. Thrips are a major concern as they are a most difficult pest to remove. Overseas quarantine requirements are that the product must carry very few insects, of which none are alive. A post-harvest washing system has been developed to minimise numbers of live insects on asparagus (Batchelor and Harris 1983). However, pre-harvest measures can also make an important contribution to meeting this objective.

A programme to monitor grower management and subsequent thrips incidence on spears was initiated in 1983. This was to determine the thrips species involved, their sources of infestation and practices which reduced their incidence.

METHODS

Eight properties from throughout the Waikato region were chosen to represent the widest possible range of stand management. Weed control from both over-winter cultivation and pre-harvest herbicide use, and management of the fern trash were recorded. Observations of crop and weed residues still present at harvest and of weeds present before, during and at the end of the harvest period were made for each property.

Incidence of thrips was measured by sampling spears weekly from each site throughout the harvest period. Five sets of ten spears of export quality were taken from designated areas, centred on sticky traps sited within the stands. Spears were harvested with minimum disturbance into plastic bags, which were sealed and stored at 4°C until processed within a few days. Samples were then washed in water at 40°C for a minimum of 15 minutes with continuous agitation by compressed air bubbling vigorously up through the container. Detergent was added to reduce surface tension, sufficient to produce bubbles on the surface of the bath. Spears were then rinsed individually in running water, and all washings were passed through fine organdie which was then scrutinised for insects under a stereomicroscope (x5).

Aerial thrip populations were recorded from each site using five cylindrical, yellow painted sticky traps (site 4, 10 traps) set at 250-500 mm above ground. Acetate sheets (255 x 314 mm) coated in "Stikem Special" were wrapped around these cylinders and changed weekly. Thrip numbers were recorded by species, and by trap sector to determine directional movement into the asparagus.

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RESULTS AND DISCUSSION

Site comparisons

In Table 1 the eight sites are ranked with respect to weed and litter presence before, during and at the end of the harvest period. This was a visual ranking, supported by quadrat samples of weed counts/m² on each site. Sites 1-3 constituted one group which was considered to have substandard weed and litter control for an export property. Sites 4-8 were consistent with well managed properties suitable for asparagus exporting.

TABLE 1: Visual ranking of asparagus sites for weeds and litter with subsequent proportion of "immigrant" thrips.

Site	Weed/litter ranking ¹			No. thrips /100 spears ²	% Immigrant thrips	
	Pre-harvest	During	After		Ex spears	Sticky traps
1	8	8	8	18.2	55	96
2	7	7	6	27.1	40	84
3	5	6	7	20.6	51	92
4	6	5	5	11.8	89	99
5	4	4	4	6.8	94	100
6	3	3	3	4.0	82	99
7	2	2	2	1.5	100	94
8	1	1	1	7.0	85	99

1 Weed/litter ranking, 1 best → 8 worst sites

2 Washing removed 50% of thrips from spears

TABLE 2: Percentage species composition of thrips from asparagus sites with poor (1-3) and good (4-8) weed/litter management.

	Spear samples		Sticky traps	
	Sites 1-3	4-8	Sites 1-3	4-8
Immigrant				
<i>Thrips tabaci</i>	35	65	26	22
<i>T. obscuratus</i>	2	8	14	46
<i>T. australis</i>	0	1	2	5
<i>Chirothrips manicatus</i>	5	8	22	11
<i>Haplothrips niger</i>	4	1	19	4
<i>Anaphothrips obscurus</i>	0	1	2	4
<i>Ceratothrips frici</i>	0	0	4	3
<i>Aeolothrips fasciatus</i>	1	2	2	3
Resident				
<i>Apterothrips secticornis</i>	34	5	6	0
<i>Nesothrips</i> sp.	4	0	2	1
Tubuliferan juveniles	0	2	0	1
Terebrantian juveniles	12	1	1	0
Unidentifiable	3	5	0	0

Others < 1% *T. nigropilosus*, *Limothrips cerealium*, *Desmidothrips walkerae*, *Aptinothrips rufus*.

Total thrips from 3784 spears = 411, from 45 sticky traps = 3033

Site 1 had both weeds (50% cover before harvest) and fern litter from the previous season present throughout the harvest. Site 2 had only a sparse scattering of weeds before harvest, but a lot of undecomposed litter on the surface. This site also had a bad infestation of Californian thistle (*Cirsium arvense*) by the end of harvest. Site 3 had a good break-down of litter and few weeds evident before harvest, but this rapidly deteriorated as a large variety of weed species established during spring. This was the only site where no pre-emergence herbicide was applied.

Sites 4-8 had negligible litter present, and few weeds at the beginning of harvest. Weeds increased on most of the sites by the end of harvest, mainly Californian thistle or *Paspalum dilatatum*. The best four of this group had either ensilerated or burned fern from the previous season to reduce both litter, and carryover of fungal spores, in particular *Stemphylium vesicarium*. All five sites had at least four cultivations between fern removal and harvest.

Table 1 gives the percentage of "immigrant" thrips from spear and sticky trap samples for each sites. The immigrant population was defined as the numbers of all winged species sampled on spears and in the air above asparagus stands from late September until early December. The "resident" thrips population was designated as the numbers of all apterous species and any juveniles sampled over the same period. These species may over-winter on weeds and litter in the stands.

There were large differences in the proportion of immigrant : resident thrips recorded from spear samples. Sites 1-3 had a 1:1 ratio and sites 4-8 a 9:1 ratio of immigrant to resident thrips. Fewer thrips contaminated spears from the smaller resident populations on well managed sites (4-8). There was also a significant difference in numbers of thrips per 100 spears between the poorly managed (22.0 + 4.6) and well managed (6.2 + 3.8) sites. This indicates that a reduction in the resident thrip population can substantially reduce field infestations on spears and thereby reduce the onus on or uncertainty of post-harvest decontamination.

Thrips species and ecology

Fourteen thrips species were recorded from sticky traps during the 1983 harvest (Table 2). Of these, four species contributed less than one percent of the total insects and another, *Ceratothrips frici*, was probably recorded in misleading numbers. Lewis (1973) stated that no thrips were known to be markedly attracted to yellow. In New Zealand, however, *C. frici* has been recorded largely from yellow flowered Compositae (Mound and Walker 1982) and could presumably have been attracted to our yellow sticky traps. None were recorded on spears.

The "resident" portion of the thrips fauna on sticky traps was low. *Apterorthrips secticornis*, a common apterous species which appears to subsist in "tufted grasses" (Mound and Walker 1982), provided the majority of "resident" thrips on spears. It was the commonest species found on weeds sampled from asparagus stands over the winter. The other resident species, *Nesothrips* sp. (*propinquis*?) is a fungal spore feeder existing in litter (Annette Walker pers comm). Juveniles of both thrips sub-orders were recorded on spears, with plant feeding Terebrantia generally predominating. Although it is impossible to identify species from juveniles, the Terebrantia were probably *T. tabaci* that had over-wintered on some of the weeds or litter, while the Tubulifera were either *Haplothrips niger* or *Nesothrips* sp.

Banded thrips (*Aeolothrips fasciatus*), a predaceous species, was caught in low numbers during the early harvest period and occasionally thereafter. American grass thrips (*Anaphothrips obscurus*) occurred at very low numbers until mid November, but catches increased towards the end of harvest. Red clover thrips (*Haplothrips niger*) also occurred at low levels on well managed sites. Its increased incidence on sticky traps from sites 1-3 is attributed to large catches recorded from site 1, which had clover weeds present through the winter harvest. The site had only one light cultivation so that good over-wintering survival of the diapausing juveniles probably contributed to the subsequent aerial population above the stand.

Timothy thrips (*Chirothrips manicatus*) over-winter in the dead inflorescences of their host grasses and disperse in early spring (Lewis 1973). Differences in sticky trap catches between the two groups of sites (Table 2) arose because of the proximity of

infestation sources on unmown grass verges and roadsides at sites 1-3. Similarly site 5, which had the greatest percentage of timothy thrips on good sites, had internal verges of standing grass seedheads unmown through the winter and harvest periods.

The gum tree thrips (*T. australis*) is a species of minor overall significance which would be reduced in numbers further by not using its major hosts, gum and other Myrtaceae, as shelter around asparagus.

New Zealand flower thrips (*T. obscuratus*) is the dominant flower feeding species recorded in New Zealand. It is polyphagous and occupies a wide range of habitats, probably over-wintering as an adult. This species made up the largest percentage of thrips (27%) from the combined catches of all sticky traps. Despite being a large component of the aerial population it contributed a minor proportion of thrips on spears, possibly because asparagus is unattractive to a flower feeding species.

Onion thrips (*T. tabaci*) made up 24% of the total thrips caught in sticky traps and 48% of all thrips recovered from spears (65% from the well managed sites). By contrast, all but one thrips found by dissection of autumn asparagus, harvested from 26 February - 30 March 1984 at Rukuhia, were *T. tabaci* (310 spears, 1906 thrips).

Onion thrips is a cosmopolitan pest of many cultivated plants. Dimitrov (1977) listed 131 host plants from 29 different families including many common pasture and arable weed species. This extremely wide host range, combined with the fact that onion thrips over-winter as juvenile and adult stages (Lewis 1973) enables the species to provide a continuous supply of adults into the aerial population during spring. Accumulated data from all sites showed that onion thrips was the only species to have a continuous increase in its aerial population throughout the harvest, from late September until early December. With such a wide range of possible infestation sources outside asparagus stands the chance of spear infestation by onion thrips can never be dismissed.

CONCLUSIONS

Thrips contaminate asparagus spears from sources within and outside the field. A resident population exists on weeds and litter within the stand through the winter. The resident population was greatly reduced by the stand management practices which are normally adopted for good weed and litter control, and which are consistent with reducing carry-over of fungal pathogens. Care of verges and roadsides is included in normal stand management.

The aerial population monitored above stands during the harvest contained at least 14 species of thrips. The incidence of some of these may be reduced by attention to specific over-wintering sites. Stands with good management practices still averaged six thrips recovered per 100 spears, of which the majority (90%) were from the aerial population.

A post-harvest decontamination procedure for export spears is therefore necessary even with the best possible field management, but such management will greatly reduce the chances of thrips surviving preparation for export by ensuring the least possible field infestation.

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