Pests Can Be Unintentionally Spread in New Zealand Through Commercial Transport of Nursery Plants©

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This study assessed the potential for pests to be transported within New Zealand in association with deliveries of plants between commercial nurseries. Soil and litter were sampled from three deliveries of nursery plants to Christchurch, and searched for associated organisms. A diversity of nematodes, seeds, and arthropods was recovered, including trichodorid and *Xiphinema* nematodes, which can vector some plant viruses and currently have limited distributions in New Zealand. This small survey showed that transport of nursery plants must be an important pathway for the dispersal of a wide range of organisms within New Zealand, including across Cook Strait. The nursery plant industry could stand to directly suffer from the activity of some pest species and perhaps one of the challenges is to come up with a strategy to reduce movements of pests in association with transportation of nursery plants

INTRODUCTION

Ministry of Agriculture and Forestry (MAF) Biosecurity aims to prevent foreign, unwanted organisms from becoming established in New Zealand. About 40 unwanted, new organisms were detected in New Zealand in 2003 and this number has been steadily increasing since 1990 (Wilson et. al., 2004). MAF may attempt to eradicate newly discovered, unwanted organisms in cases where the potential risk from the organism is high, a successful outcome is plausible, and the intended actions are acceptable to stakeholders (Stephenson et al., 2003; Wilson et al.. 2004). Containing the spread of the targeted pest throughout the campaign is fundamental to eradication success (Stephenson et al., 2003). In cases where eradication is not possible, "slow to spread" measures may be implemented to delay distribution of the pest to uninfested regions (e.g., varroa bee mite). Although it is generally difficult to limit pests' natural dispersal (i.e., insect flight, windborne seeds), it is possible to influence the extent to which humans unintentionally assist them to spread. Transportation of plants has obvious potential to assist pests to spread, thus the small survey described here assessed movements of insects, nematodes, and seeds in association with the commercial carriage of nursery plants within New Zealand.

METHODS AND MATERIALS

In three separate occasions in June 2004, September 2004, and April 2005, a truck and trailer unit delivering plant material to nurseries in Christchurch was sampled for invertebrates and weeds. Plants had been collected from several nurseries in the North Island including Hamilton, Te Awamutu, New Plymouth, and Palmerston

North. The trucks were also delivering plants to a range of other locations between Blenheim and Invercargill. The consignment included flowering shrubs and bagged and bare-rooted trees. Litter was sampled from the top of plant containers along with litter and soil samples taken from the decks of the truck and trailer unit. Sampling was carried out by hand or by using a blower-vac with a net fitted to the inlet to catch the debris.

Nematodes. Thirteen kilograms of soil was collected from the June 2004 consignment, and 11 subsamples, each weighing 75 g, were processed to extract nematodes using the tray method of Bell and Watson (2001). Nematodes were observed at 20-80 X magnification and identified to genus where possible. As the June 2004 sample indicated the presence of economically important nematodes, additional sampling was conducted at one nursery to assess the possibility these had become established in Christchurch. At this nursery, bare-rooted trees trucked from the North Island had been dug into rotted sawdust pending their delivery to customers elsewhere in Canterbury. In April 2005, a 25-mm-diameter by 100-mm-deep corer was used to take six samples from each of the following situations: sawdust into which the trees were temporarily placed; soil from an adjacent waste area; soil from under native shrubs; and potting mix from around *Betula pendula* (European white birch). In the latter case the trees had been placed in the sawdust prior to transfer to containers. Samples were transferred to plastic bags and sent to AgResearch Ruakura for extraction.

Seeds. From the June 2004 consignment, approximately 2.5 kg of soil was dried for 16 h at 60 "C. The sample was coarse sieved to remove leaf litter and three lots of 500 g of soil were placed in plastic bags. The samples were forwarded to the National Seed Laboratory (AgriQuality Limited, Palmerston North) where any seeds found in the soil were identified.

Arthropods. For all three sampling occasions, arthropods were extracted from litter and soil using the Berlesse-Tullgren funnel technique, which relies on heat from a light bulb to drive living organisms from the litter into a collecting vial containing 70% ethanol. Arthropods were categorised into order, family, and life stage (e.g., larvae, adult).

RESULTS AND DISCUSSION

Nematodes. Table 1 shows that species from the family Trichodoridae (probably of the genus *Paratrichodorus)* and *Pratylenchus* species were most abundant in the samples. The trichodorid nematodes can vector some plant viruses (Karanastasi et. al., 2000) and in many cases still have limited distributions in the South Island. *Xiphinema* species nematodes were relatively rare in the samples (Table 1), but can be very damaging pests, particularly of woody plants. They cause direct feeding damage to roots, including root swelling, and can also vector plant viruses (Jones et al., 1995). There are currently at least seven species of *Xiphinerna* in New Zealand, with the only endemic species being *X. wairnungui* (Yeates et al., 1997). *Xiphinerna* nematodes have very limited distributions in the South Island: X. *krugi* and *X. radicicola* occur in the Nelson area, and only X. *diversicaudatum* has been reported from south of Nelson. The remaining nematode genera shown in Table 1 are distributed throughout New Zealand, with *Pratylenchus* species having the most pest potential, followed by *Helicotylenchus* species, then *Paratylenchus* spe-

cies. The additional samples taken from the Christchurch nursery did not reveal any trichodorid or *Xiphinema* species, and only a small number of *Pratylenchus, Paratylenchus,* and *Heterodera* species. The *Helicotylenchus* nematodes were not recovered. This suggests that the while nematodes occurred in the soil at the point of origin, either the remaining soil adhering to the roots of the bare-rooted stock was free of nematodes or they did not survive the transfer into the sawdust at the nursery. Nevertheless, these results clearly indicate that transport of nursery stock has the potential to introduce nematode pests to previously uninfested regions of New Zealand.

Table 1. Plant parasitic nematodes observed from soil removed from truck transport and an indication of their abundance and frequency of occurrence in the 11 subsamples.

Nematode group	Likelihood of establishment	Risk factor	Abundance per subsample
Trichodorids	Low	High	Common to abundant
Pratylenchus	High	Moderate	Rare to abundant
Helicotylenchus	High	Low	Rare
Xiphinema	Medium	High	Rare
Paratylenchus	High	Low	Rare

Seeds Testing. Seeds from 30 different plant species were found, with *Amaranthus, Cardamine,* and *Poe* being the most common species, but 43% of the species were represented by a single seed (Table 2). While none represent significant new weed threats to the South Island, the results demonstrated the potential for inadvertent transfer of economically important weed species (e.g., kikuyu grass), to be unintentionally spread around New Zealand.

Arthropod Species. On all three sampling occasions, large numbers of a wide range of arthropods were recovered, with Collembola and Acari being the most abundant (Table 3). Arthropods were found in their nymphal, larval, pupal, and adult stages. The diversity of arthropods shown in Table 3 is probably an underestimate of that associated with the consignments of nursery stock because plant foliage was not directly sampled. Many of the families represented in the samples contain species, which are well known as pests (e.g., springtails, aphids, mites, scales, thrips, and weevils). It seems possible that. some very important pests, which still have restricted distributions in New Zealand, might frequently be associated with nursery stock. For example, clover root weevil, which has not been recorded from the South Island, could occur in clovers growing as weeds in nursery plant containers. Similarly, varroa bee mite, which is currently also restricted to the North Island, could be transported to the South Island with bees on flowering plants.

Table 2. Plant species and number of seeds recovered from 1.5 kg soil removed on 25 July 2004 from trailer unit transporting plant material from North to South Island nurseries.

Common name	Scientific name	Total seeds
amaranth	*Amaranthus* species	103
annual mouse-ear chickweed	*Cerastium glomeratum*	1
bittercress	*Cardamine* species	22
black nightshade	*Solanum nigrum*	6
catsear	*Hypochaeris radicata*	1
clovers	*Trifolium* (two species)	15
fathen	*Chenopodium album*	2
grass species	Nine species	38
hairy birdsfoot trefoil	*Lotus suaveolens*	1
hawksbeard	*Crepis capillaris*	1
hedge mustard	*Sisymbrium officinale*	1
hydrocotyle	*Hydrocotyle* species	1
oxalis	*Oxalis* species	8
plantain	*Plantago* (two species)	7
purslane	*Portulaca oleracea*	1
wireweed	*Polygonum aviculare*	2
scarlet pimpernel	*Anagallis arvensis*	1
twin cress	*Coronopus didymus*	11
violet	*Viola* species	1
vulpia hair grass	*Vulpia bromoides*	3

SUMMARY

Transportation of plants almost certainly provides a significant, unintentional, human-assisted means of spread of many pests within New Zealand. While none of the insects, acarids, or weeds found in these samples appears to be unique to the South Island, the trichodorid and *Xtiphinerna* nematodes are more restricted in their distribution and are known vectors of plant viruses. The movement of potential pests is clearly not restricted to commercial nurseries and numerous other plant-based industries, as well as amateur gardeners, must also contribute to this issue. The range and volume of plant material being transported around New Zealand, along with the diversity of often-cryptic organisms associated with it, makes it difficult to envisage practical management solutions. Nevertheless, the nursery plant industry obviously stands to suffer directly from the spread of some pests species in New Zealand. Perhaps one of the challenges for the industry is to come up with strategies to reduce movements of pests in association with transportation of nursery plants.

Table 3. The order, family, and stage of arthropods extracted from litter and soil collected on three occasions from a trailer unit transporting plant material from North to South Island nurseries.

Order	Family	Stage
Acari (mites)	Orbatidae, Phytoseiidae, others	Adults
Araneae (spiders)	Salticidae, others	Adults
Collembola (springtails)	Isotomidae, Sminthuridae, Entomobryidae	Larvae, adults
Diplopoda	Millipedes	Adults
Coleoptera	Staphylinidae (rove beetles), Curculionidae (weevils), others	Adults, larvae
Diptera	Sciaridae (fungus gnats), Psychodidae (sand flies), Empididae, others	Adults, pupae larvae
Hemiptera (sucking bugs)	Aphididae (aphids), Coccidae (scales)	Adults, larvae
Hymenoptera	Braconidae, Ichneumonidae (parasitoid wasps), Formicidae (ants)	Adults
Lepidoptera	Moths	Larvae, adults
Pscoptera	barklice	Larvae, adults
Thysanoptera	Thripidae (thrips)	Larvae

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