The invertebrate fauna in a research block of manuka (*Leptospermum scoparium*, Myrtaceae) and its crosses

Kees (C.W.) van Epenhuijsen

New Zealand Institute for Crop & Food Research Limited, Private Bag 11600 Palmerston North, New Zealand (vanepenhuijsenk@crop.cri.nz)

Introduction

Manuka (*Leptospermum scoparium* J.R. Forst. & G. Forst., Myrtaceae), commonly known as tea tree, has been widely regarded as a major native weed (Sewell 1949, Gardiner 1953). At the same time, its colonising role as one of New Zealand's pioneer plants in the natural succession from cleared land to climax forest is also well recognised. Since the early days of European settlement, the number of manuka plants in the country has reduced dramatically. Today, manuka is the only *Leptospermum* species extensively bred as a garden plant. Breeding is underway in California (Lammerts 1945) and New Zealand (Dawson 1997). In 2004, 149 wholesale nurseries propagated manuka plants in New Zealand (Anon. 2004). Breeding new cultivars that are suitable for use as garden plants or for export as potted plants or cut flowers has been the aim of research for many years (Bicknell 1995).

The approach taken in Crop & Food Research's breeding programme at Levin was to use controlled crosses. This technology was applied to extend the short vase life of manuka flowers, which ranged from 1 to 6 days (Bicknell 1995), and to breed for resistance to sooty mould. Mould-resistant lines have not been found so far (Anon. 2004), but some selections are more resistant than others (Garry Burge, *personal communication*).

This paper describes the major fauna found on manuka plants in Crop & Food Research's breeding programme. It lists potential pests of commercially grown manuka.

Observation sites

Pests at Crop & Food Research's Levin Research Centre were observed in blocks containing young, 900 – 1200 mm high, F2 manuka hybrids obtained from crosses of cultivars Crimson Glory and Jervis Bay planted in 1985. Many manuka varieties and other *Leptospermum* species (including *Leptospermum rotundifolium* and *L. macrocarpum)* were growing in the block. During the observation period, manuka plants were also planted at Aokoutere to establish a new collection in 1998.

Plants in both places were grown in weed-free rows, in grass separated by tall (evergreen) shelter belts (deciduous willows at Aokoutere). The plants were not sprayed with any agricultural chemicals, so as not to kill or deter visiting insects. Plants observed were 600 – 1200 mm high and 4 years old.

Sampling methods

Over a period of two seasons (1997 and 1998) plants were sampled by removing 50 – 100 mm tips, and beating branches with a piece of alkathene hose. Sweep netting was also carried out fortnightly. Tips were placed in 180 x 330 mm organza bags. Attention was paid to insects and mites that might cause visual damage to the plants or jeopardise the export of manuka plant material.

Results

Different insects were present in the samples collected when bushes were beaten. The fauna collected on manuka at the Levin Research Centre yielded very high numbers of beetles, spiders, psocids, springtails and smaller numbers of ants, thrips, oribatid mites and other harmless mites such as tydeids. Spiller & Wise (1982) give a long list of insects found on *Leptospermum* spp. The wide range of fauna is probably due to the frequent presence of honeydew excreted by scale insects, which results in black mould where psocids and oribatids are known to feed on associated lichens and algae. Algae and mosses are a good food source for some oribatids.

Occasionally the brownheaded leafroller, *Ctenopseustis obliquana* Walker (Tortricidae), and a green looper, *Poecilasthena pulcharia* Doubleday (Geometridae) (Fig. 1) occurred. They are usually difficult to find as they remain closely concealed amongst the foliage, only to be dislodged by vigorous beating (Hudson 1928). Numerous small, dark-coloured beetles, *Melanophthalma gibbosa* Herbst (Lathridiidae), were found. This species also occurs in hay where it feeds on the spores of moulds.

Anzora unicolor Walker (Flatidae), the grey plant hopper (Fig. 2a), is a pale grey-blue insect with iridescent wings that was found sucking on branches, causing die-back of up to 600 mm long branches in autumn. In New Zealand it is also known to occur on citrus, New Zealand flax and ornamentals. After the first adults had visited, branches were left with a white fluffy tissue from moulting (Fig. 2b). The plant hopper over-winters as eggs. Many eggs are laid in longitudinal rows under the bark of thin branches (Fig. 2c) in the middle of March. The ovipositor of the female is adapted for lacerating plant tissues. Plant hoppers can produce large quantities of honeydew. However, the numbers found were rather low, suggesting that this insect was not a major producer of honeydew in the plants studied (Pam Dale, *personal communication*).

Ctenarytaina clavata Ferris & Klyver (Psyllidae - jumping plant lice), is a minute (1.3-1.5 mm) yellow insect that is difficult to catch because it jumps when disturbed. Psyllids

Figure 1. *Poecilasthena* larva.

Figure 2. Grey plant hopper: a. adult, b. exuviae, c. eggs.

were caught by sweep netting the plants (Tuthill 1952). Eggs are shiny, yellow-orange, irregular, apically spined, and mainly found in very young tips (Fig. 3). Most eggs and young nymphs were found in the middle of November (20 eggs per 20 tips). The larvae feed on young shoots of plants and are very mobile. This species has also occasionally been found on grass. It is thought that *C. clavata* in low numbers does not add to the amount of honeydew excreted on manuka (Ferris & Klyver 1932). No real plant damage was caused by the nymphs. However, young branches were damaged by adults laying eggs in the tips of the branches.

Figure 3. Psyllid eggs.

Figure 4. *Eriococcus* female (left), nymphs in crack (right).

The occurrence of the felted manuka scale, *Eriococcus leptospermi* Maskell (Fig. 4), was described by van Epenhuijsen *et al.* (2000). Previously the death of manuka plants was attributed to the manuka blight scale *Eriococcus orariensis* (Hoy) (Hemiptera: Eriococcidae), but in this study the felted manuka scale was the most common scale found in Levin and in samples from the North and South Islands. Many more species of scale insects are found on *Leptospermum* spp. (Spiller & Wise 1982, Miller 1971) but do not cause appreciable damage.

Heliothrips haemorrhoidalis Bouché (Thripidae), the black greenhouse thrips, an important pest in citrus, caused serious damage to the manuka foliage at Aokoutere in April. The block was adjacent to an *Acacia floribunda* shelterbelt that had been trimmed just before the attack and the thrips were obviously looking for another food source.

The eriophyoid mite, *Parulops heatherae* Manson (Eriophyoidae), was found in young manuka tips. It looks like a very small, whitish, thick 'carrot'. It causes galls (although usually only minor deformations) in the tips of branches and blisters on manuka. This species also causes galls on tawaki, *Syzygium maire* (Myrtaceae) (Manson 1984).

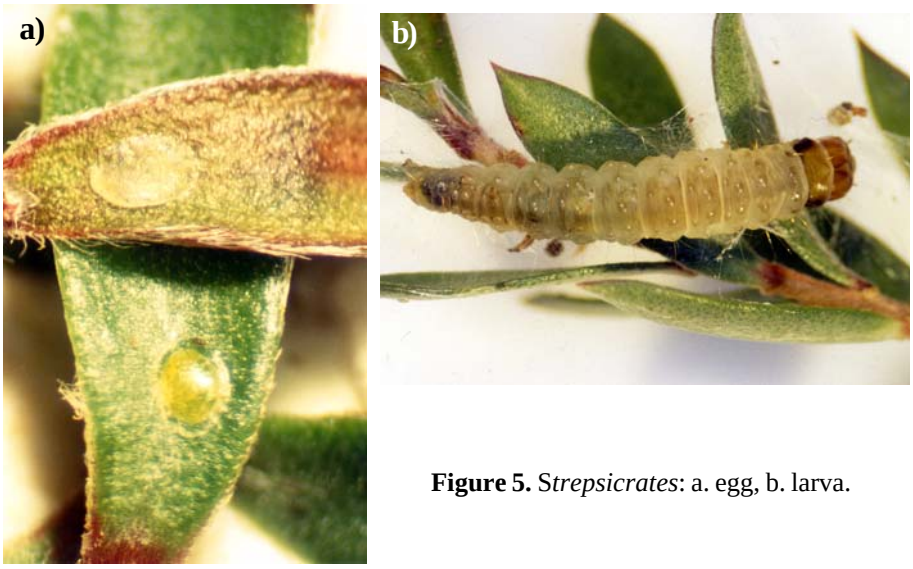

Figure 5. S*trepsicrates*: a. egg, b. larva.

Parulops heatherae are very difficult to find without magnification; they only measure up to 194 µm in length. The fast-moving, light-coloured eriophyoid mite occurs in large numbers in the young tips of manuka when new growth is present. Nymphs can be seen with a hand lens on young buds where they soon cover the outer leaves of buds with dark red spots. At the end of January the older specimens are greyish. In the weekly samples taken between December and February, up to 25 % of the tips were infested. Hybrid plants with high manuka *Leptospermum scoparium* parentage and softer purple tops showed most symptoms. Later, heavily affected leaves became deformed (with galls), did not expand any more, and became blackened and hard. When the buds dried up or no new growth was formed, the mites disappeared or moved to other buds.

The leafroller, *Strepsicrates ejectana* Walker (Tortricidae) found on manuka is a defoliator of some Myrtaceae, including some species in New Zealand (Spiller & Wise 1982), and of heather *Calluna vulgaris* (John Dugdale, *personal communication*). At Levin, all young tips of manuka plants were affected by leafrollers at the end of the season, resulting in browning and drying up of the plants late in spring. Removing the young tips is advised as a treatment (Anon. 2004).

Clouds of adult *S. ejectana* were found flying from the webbed dead leaves in the tops of completely dead plants at the end of the season. The flight of adult moths at the end of the season resulted in considerably more damage than flights early in the season. Pest control is warranted in these situations.

Most eggs were found in December. From the end of February until early March there were up to 16 eggs per 20 tips of 50 mm long branches. Eggs were mainly deposited on the upper side of the young leaves (Fig. 5a) and the larvae (Fig. 5b) tunnel first into the leaf, then destroy the bud, before webbing the remaining leaves together. In many cases all growing tips were affected by April, with very high numbers of larvae found in May. Leaves dropped in autumn and by the following spring the plants were left without leaves. High numbers of larvae then remain in the webbed shelter (15 larvae per 20 tips in early September).

At the Levin site 85 % of the original plantings died over a 10-year period. The sudden collapse of young plants in the collection at the Levin Research Centre and later at Aokoutere raises several questions about the causes of this decline, which was definitely not caused by scale insects. Pot-bound transplant could be blamed in some cases when contorted roots did not spread out much beyond a small area. Although the symptoms might point to a root disorder or soil-borne disease, no root disease symptoms were found. Mycorrhizal fungi may be the cause of plant death, but some losses may be due to sensitivity to herbicides used near the plants (Garry Burge, *personal communication*). Plants that were severely defoliated by leafrollers at the end of the growing season did not always die in the following season. Low infestations of sooty mould also did not seem to cause plant death.

Plants that suddenly collapsed had many dead roots, causing them to be blown over by strong winds.

Summary

Manuka plants in the collection and breeding garden at Levin hosted a large number of invertebrates, including scale insects, leafrollers and eriophyoid mites, that could pose a threat to commercial manuka growers. Only a few of the insects and mites found on manuka cause damage to the plants or pose a biosecurity threat when manuka plants or plant material, such as flowering stems, are exported. Access to an unsprayed research block provided information on insects that might be damaging the crop. By taking regular samples from the manuka plants, the time for pesticide treatment can be established for leafrollers and mites. Many other kinds of insects and mites were occasionally found on manuka plants in other parts of the country (Spiller & Wise 1982), and their relative abundance depended on the location in New Zealand.

Large numbers of spiders did not significantly affect the great variety of insects and mites on the manuka plants.

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References

Anon. 2004. Marvellous manuka under-valued super species. *Commercial Horticulture* May issue: 31-36.

Bicknell R. 1995. Breeding cutflower cultivars of *Leptospermum* using interspecific hybridisation. *New Zealand Journal of Crop and Horticultural Science* 23: 415-421.

Braza RD. 1991. Important pests of Bagras trees and their control. *The PCARRD Monitor* 19: 8-9.

Dawson M. 1997. A history of *Leptospermum scoparium* in cultivation - discoveries from the wild. *The New Plantsman* 4(1): 51-59.

Ferris GF, Klyver FD.1932. Report upon a collection of Chermidae (Homoptera) from New Zealand. Transactions of the Royal Society of New Zealand. 63: 34 -61.

Gardiner LC. 1953. Manuka blight - farmer's view. *Proceedings 6th New Zealand Weed Control Conference*, Massey Agricultural College, Palmerston North, pp.43-45.

Hudson GV. 1928. *The Butterflies of New Zealand*. Ferguson & Osborne Ltd, Wellington.

Lammerts WE. 1945. New double flowering *Leptospermum* hybrids. *The Journal of the California Horticultural Society* VI: 250-257.

Manson DCM. 1984. Eriphyoidea except Eriophyinae (Arachnida: Acari). *Fauna of New Zealand* 4: 58-59.

Miller D. 1971. *Common Insects in New Zealand*. AH & AW. Reed, Wellington, pp.116-117.

Sewell TG. 1949. Manuka blight survey. *New Zealand Journal of Agriculture* 79: 101-104.

Spiller DM, Wise KAJ. 1982. A catalogue (1860-1960) of New Zealand insects and their host plants. *DSIR Bulletin 231*. (Revised and edited by PS Dale & PA Maddison.)

Tuthill LD. 1952. On the Psyllidae of New Zealand (Homoptera). *Pacific Science* 6: 83-125.

van Epenhuijsen CW, Henderson RC, Carpenter A, Burge GK. 2000. The rise and fall of manuka blight scale: a review of the distribution of *Eriococcus orariensis* (Hemiptera: Eriococcidae). *New Zealand Entomologist* 23: 67-70.