13. THE INCREASING PROBLEM OF PESTS AND DISEASES

Pinus radiata—Minor Concerns

Long before anyone thought of the word biosecurity, tree growers were aware of pests and diseases, with the constant theme over the Association's 50 years that we should not depend on single species forestry or monocultures. The continued success of research into improving *Pinus radiata*, together with its short rotation, has persuaded the large forestry enterprises and most farm foresters to stay with this species although there have been occasional frights.

In the 1950s, large numbers of mature pines died suddenly in shelterbelts and woodlots in different parts of the North Island, particularly Auckland and Northland. Dr Frank Newhook, Mycologist with Plant Diseases Division of DSIR, isolated *Phytophthora cinnamomi* and other species from the soil of most affected sites, which was quite a concern for a while, as this fungus is very difficult to control. It occurs mainly in poorly drained soils, and is responsible for restricting such crops as avocados to only the best-drained soils.

Phytophthora cinnamomi can badly affect *P. radiata* nurseries in the wrong soil type, but is not a problem if the nursery is well sited. *Pinus radiata* has not been successful on very wet soils (few trees are), but *Ph. cinnamomi* has not been referred to in the more recent years of extensive forestry expansion. It is likely that other fungal diseases caused ill thrift in trees, with *Ph. cinnamomi* being present in the soil as a secondary problem.

The wood wasp *Sirex noctilio* was a concern in the 1940s and 1950s, with larvae tunnelling into trees or ringbarking them. It occurred mainly in dense stands which had been planted at about 1.8 × 1.8 m spacing and left unthinned and unpruned, with weaker trees generally affected. As spacing became wider and pruning opened up the stand, *S. noctilio* has caused little further trouble.

Armillaria spp. was another fungus to worry foresters, but occurred in cutover native bush areas, particularly tawa. The Forest Health Advisory Committee reported in *TG 16/1* February 1995 that *Armillaria* spp. was showing up in some areas of second-rotation pines. There was no known control, but a slightly higher initial stocking might be an insurance.

Dothistroma Required Major Control Effort

The disease to cause most problems for *P. radiata* and several other pine species was *Dothistroma pini* which arrived in the Rotorua/Taupo area in 1964. This was a needle-cast fungal disease which spread upwards from lower to higher foliage, particularly in dense stands.

Members were warned of restrictions on the movement of nursery stock from North Island to South Island, and in May 1968 this restriction still existed, together with movement of any stock outside certain areas of the North Island. By then infection had reached Nelson in the South Island.

It was fortunately discovered quickly that aerial spraying with copper controlled the disease, with a large-scale operation being mounted each year on badly infected areas. Farm foresters were invited to join the spraying programme by applying to the Forest Service, so that infected farm woodlots could be sprayed when planes were being used for large forests.

V.Jancarik published early reports of the control of Dothistroma in nurseries, in *FRI Research Leaflet No.24*. This report showed that nursery stock could be infected without showing symptoms as incubation was slow. It was recommended that copper sprays be applied at fortnightly to monthly intervals while trees remained in the nursery. Where a nursery was close to a large infected forest, frequent spraying was necessary. Nurseries were targeted because obviously they could be responsible for spreading the disease to new locations.

Dr Colin Bassett of FRI reported in *FF 14/2* June 1972 that the disease was then almost everywhere except

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FF = the journal *Farm Forestry*, *TG* = *Tree Grower*

Canterbury and Southland. By this time it was known that some species of pine such as *P. ponderosa* were severely infected and since then they have been rarely planted.

Pinus radiata showed increased resistance with age so that 15-year or older trees appeared at little risk. It was also shown that growth of trees was not reduced until some 25% of the green crown was diseased, and so one spray per year of affected trees gave sufficient control.

The Dothistroma Action Committee which controlled the spray programme for the whole industry was able to keep costs low by bulk buying of copper sprays and good utilisation of aircraft.

The transfer of seedlings from one part of New Zealand to another continued to be expanded as new areas of infection were discovered. This movement came under the Forest Disease Control Regulations 1967, and applied to Douglas-fir, larch, and spruce as well as pines.

In 1984, Director-General Andy Kirkland reconstituted the Forest Disease Committee because of a recent discovery that a chemical, dothistromin, which was produced in trees with Dothistroma, could be a possible health hazard, and so efforts were to be made to reduce the disease to the lowest possible level.

In a report published in *TG 7/1* February 1986 the Forest Service described the low level of risk of exposure to dothistromin, but recommended that workers refrain from working in areas of high infection in wet weather.

On 25 March 1988 the regulations controlling movement of trees were revoked as, although they had been successful in slowing the spread of Dothistroma, the disease could now be found to some extent in almost all New Zealand exotic forests. Neil Cooper, Chief Protection Officer with the Ministry of Forestry, said that the development of "Micronair" spray applications had reduced the price of spraying. Propagation of Dothistroma-resistant *P. radiata* was also being studied.

The wider spacing of trees, early pruning, and thinning also contributed to better air movement through a plantation,

reducing the risk of disease spread which was largely by splash.

The Dothistroma Action Committee reminded members in *TG 13/2* May 1992 and subsequent years to remain vigilant against the disease, and advised about bulk rates of copper together with flying contracts negotiated by the Committee.

Other Pests and Diseases on Pine

A nursery disease, terminal crook caused by the fungus *Colletotrichum acutatum* f. sp. *pineum*, became a severe problem in some areas from the mid 1960s. The Auckland area was most affected, with the disease causing seedlings to remain stunted and bend at the tip with a reddish discoloration. Control was achieved with phenyl mercuric chloride and Captan; later, when mercury was environmentally unacceptable, other more expensive fungicides were used. Some nurseries still spray as a safety measure, but the disease appears to have almost disappeared today.

Cyclaneusma minus is a fungus responsible for completely defoliating pines in some northern forests in recent years. It occurs during wet warm winters, which are becoming more frequent in Northland. The trees recover after about 6 months, but two or more successive years of attack may be very serious.

Weakened trees could also become susceptible to other pests such as *S. noctilio*.

Bruce Treeby has represented the Association on the Forest Health Advisory Committee since 1988, reporting first in *TG 9/2* May 1988 on a visit the Committee paid to FRI health laboratories to examine the way research treated pests and diseases. The system depended on a number of Forest Biology Observers appointed by the Forest Service and strategically placed throughout the country, together with Timber Inspectors at ports.

The FBOs were constantly on the move through forests, woodlots, and trees of any kind, looking for new pests and diseases, with any forester or member of the public able to report possible outbreaks to them to follow up.

In 1999, 42 years after the appointment of FBOs, they are still 12 in number. Their name changed to Forest Health Officers under the Ministry of Agriculture and Forestry, and now Forest Protection Officers under FRI control. There is growing importance placed on their knowledge and an increasing need to monitor trees for new and unwanted arrivals through ports of entry.

Heliothis armigera conferta or tomato fruit worm is an insect pest feeding mainly on lotus in some central North Island forests, but if the lotus runs out, caterpillars can climb and defoliate young pines. *TG 18/3* August 1997 discussed the control of this moth by parasites used in the tomato industry.

The Risk of Pine Pitch Canker

Bruce Treeby drew attention in *TG 19/1* February 1998 to the most recent threat to *P. radiata*, and potentially the most serious. Pine pitch canker is caused by a fungus endemic to the south-eastern United States, *Fusarium subglutinans* f. sp. *pini*. The disease is now present on the three mainland sites of the natural range of *P. radiata* in California.

Vectors transmitting the disease are local insect species not present in New Zealand, but we do have a range of insect pests which could act as vectors.

The canker causes the pines to exude resin which Americans call pitch, hence the name. The canker causes death of trees, reduced timber quality because of stem deformation, reduced growth, seed contamination, and extensive seedling mortality in nurseries. Douglas-fir is also affected and so it is fortunate that seed imports of both species are controlled.

The disease appears limited by cold temperatures, either high latitudes or high altitudes, but would be very dangerous if established in most areas of New Zealand. No fungicidal or insecticidal treatments are effective in controlling pine pitch canker. In California, many large trees have been removed and people are recommended not to plant *P. radiata*.

A number of New Zealanders were accompanied by Professor Bill Libby on a trip through the region in 1998, and

Ian Brown of Hamilton recalls being so shocked at the impact of the disease that he threw his shoes away rather than risk importing canker material.

It is most important to control the import of seed, any living plant material or insects, or such material as shavings on imported sawmilling machinery.

Such a disease reinforces the wisdom of planting a range of tree species.

Douglas-fir in the North Island

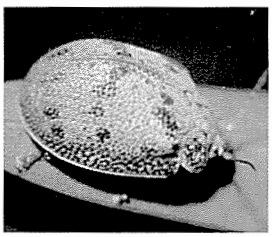
Douglas-fir (*Pseudotsuga menziesii*) suffered from severe defoliation due to looper caterpillars, mainly *Pseudocoremia suavis*, in the years 1970, 1972, and 1978 in Kaingaroa Forest.

The fungal disease, Swiss needle blight (*Phaeocryptopus gaeumannii*), also had an impact on forest health and productivity in the North Island from the mid 1960s. When the establishment of Douglas-fir was restricted to cooler South Island areas, these problems became of little consequence.

Damaging Insects on Eucalypts

The range of *Eucalyptus* species grown in New Zealand has gradually attracted a number of insect pests from Australia. There, the insects and the parasites that control them are in a natural balance, and although trees are affected they are able to maintain sufficient leaf area to grow well.

In New Zealand a newly arrived insect will have no natural control, and so can increase in numbers very rapidly to the point where trees can be defoliated. The trees may recover once or twice, but if insect populations remain high, the trees can die.



Adult tortoise beetle, *Paropsis charybdis*.

The first insect pest to have an important detrimental effect on some eucalypt species in New Zealand was the tortoise beetle, *Paropsis dilatata* (subsequently reclassified as *P. charybdis*), first recorded at Lyttleton in 1916 but reaching the North Island in the 1950s where it rapidly became a problem. The beetle and its larva appeared on the cover of *FF 4/1* February 1962. An article in this journal by

R.T.Baker and R.B.de Lautour of FRI described the control of tortoise beetle by aerial spraying with DDT.

The species most affected were *E. viminalis*, *E. macarthurii*, *E. punctata*, and *E. maidenii* (subsequently reclassified as *E. globulus* subsp. *maidenii*) on Puketutu Island in the Manukau Harbour, but other species such as *E. nitens* which was to become important in later years were badly defoliated in other parts of the country.

The spraying was effective in controlling the insects, and allowing new growth to come away, but the logistics of such an operation on farm woodlots together with the growing public unease at the use of DDT ruled out further operations.

An article by K.Klitscher of FRI in *TG 4/4* November 1983 included a picture of eucalypts at Atiamuri severely damaged by tortoise beetle, and gave a wide-ranging account of the problems of introduced pests and the methods being used to prevent further outbreaks.

TG 9/4 November 1988 announced the release of two promising egg parasites for the biological control of tortoise beetle. This control was sufficient to allow normal growth and encourage further plantings, particularly of *E. nitens*.

Brendan Murphy of FRI became concerned that the parasites were suffering overwintering mortality in some areas, and in *TG 18/3* August 1997 requested farm foresters to advise him of any increase in the number of beetles and larvae, with species, age, and distribution. The parasite usually came back naturally and control was resumed.

Another beetle in the *Paropsis* family, *Trachymela catenata*, was discovered near the port of Gisborne in 1992.

The Australian leaf-mining sawfly appeared to spread out from Auckland Airport in 1985. The larva "mines" between the two leaf surfaces of susceptible eucalypts, and can severely damage trees. The sawfly is *Phylacteophaga froggatti*, and it was quite quickly brought under control with a species of *Bracon* introduced for the purpose.

The Eucalyptus gall insect, *Ophelimus eucalypti*, appeared in the Wellington area in 1988, and has spread throughout areas where *E. botryoides* and *E. saligna* grow.

Eucalyptus gall wasp damage on eucalypts in the Hutt Valley.

Bruce Treeby and Patrick Walsh inspecting galls of *Ophelimus* sp. at Cumberland State Forest in New South Wales to see if any parasites were present.

It is also a very small wasp, with the larvae living between the two leaf surfaces, each one producing a reddish brown gall. Very large numbers mean that the leaf can be covered in galls and fall prematurely, causing severe defoliation on trees of any age. Such weakened trees can be further attacked by psyllids.

The Association in 1994 funded a visit to Australia by Bruce Treeby to assist Dr Patrick Walsh of FRI in looking for parasites to control *O. eucalypti*. They looked mainly at *E. botryoides* on coastal New South Wales sites and found few galls occurring, and so were sure some biological control was in progress.

Three possible biocontrol insects were isolated, with Patrick Walsh stating in *TG 17/2* May 1996 that one of these was favoured and expected to give good control in New Zealand conditions. Quarantine regulations were being worked out and it was hoped to release the parasite in 1997.

In an article in *TG 19/5* February 1999, Patrick Walsh wondered if it was too late for *O. eucalypti* control. In a recent trip through Northland he had found six undescribed insects inhabiting galls on *E. botryoides*, with the relationship between them not understood.

Eucalyptus regnans was planted widely by NZ Forest Products Ltd and, to a small extent, by farm foresters. In 1991 an unknown disease caused crown thinning and dieback in this species near Tokoroa, and was named the Barron Road Syndrome.

Cardiaspina fiscella, the brown lacy lerp, was discovered at Auckland International Airport in May 1996. By 1998 the pest range extended from Orewa to Huntly and Matamata. Possible biocontrols had been identified in Australia and steps were being taken to introduce them to New Zealand.

The Foundation provided seeding finance which helped with the funding of initial research into finding the best parasite to control *C. fiscella* which, unfortunately, like the sawfly and *O. eucalypti*, attacks mainly *E. botryoides* and *E. saligna*, the two species best able to supply high-quality reddish timber for furniture, panelling, and flooring, and a good substitute for imported mahogany.

The committee allocating public funding for forest health turned down an application for funds to continue with this work to control *C. fiscella*, and it is worth noting they were industry representatives growing mainly *P. radiata* and Douglas-fir.

The continual under-resourcing of research into all aspects of growing species other than *P. radiata* and Douglas-fir may well come back to haunt New Zealand if a disease such as pine pitch canker should seriously affect our main crop.

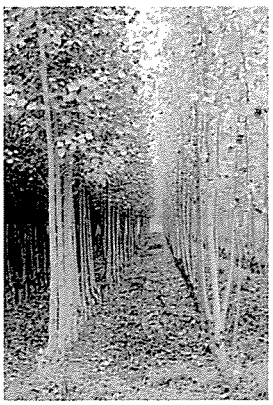
Other pests arriving in recent years to attack eucalypts include *Uraba lugens*, the gum leaf skeletoniser, which attacks *E. nitens*, *E. pilularis*, *E. saligna*, and others and was first discovered at Mt Maunganui in 1997, and *Eucalyptolyma maideni*, the spotted gum psyllid which attacks *E. maculata* and was discovered in the Auckland Domain in 1996.

The *New Zealand Herald* carried reports of the finding of the blackbutt leafminer, *Acrocercops laciniella*, in Auckland on 1 June 1999. It had been in the country for some time, and was too widely spread to eradicate. It has been found on *E. viminalis*, *E. macarthurii*, and *E. leucoxylon*, but is known to attack *E. nitens* and *E. pilularis*, its main host. This insect had probably been imported on eucalypt foliage for use by florists, and presents another case in which finding a biocontrol has to be funded by eucalypt growers. As these people are often small growers not united in any sort of industry, such funding is unlikely to be arranged. One cannot but suggest that in the national interest to maintain our diversity of timber trees, it is a national responsibility to attempt to protect them.

Clearly our proximity to Australia, with prevailing winds coming our way, and ever-increasing movement of people and goods between the two countries, means that calls need to be made for increased vigilance and more funding, some of which the Association must be expected to provide.

Poplar Rusts

The poplar rusts were forecast to arrive in New Zealand after having been discovered in New South Wales in 1972.



Poplar clones at the Plant Materials Centre at Aokautere. The clone on the left shows superior growth and disease resistance compared with the rows on the right.

Chris van Kraayenoord had already disseminated information on the cultivars affected and the signs to look for.

In March 1973, the North American poplar leaf rust, *Melampsora medusae*, was discovered in Northland, and shortly afterwards the European rust, *M. larici-populina*, was found in the south-west of the North Island.

FF 16/2 June 1974 described the life cycles of these two rusts, and how they had spread rapidly to both Islands. With a complicated life cycle including five different sorts of spores, control was not an option. Highly susceptible varieties could be so badly affected that leaf fall occurred within 3 weeks.

A further disease on poplars was discovered in 1976 when the poplar leafspot disease *Marssonina brunnea* was found in the Palmerston North area.

Bruce Treeby published a photograph of a disc of clone I 78 in *TG 3/4* November 1982 showing growth increasing again after several years of suppression due to rust, and wondered if some immunity was developing.

The loss of Lombardy poplar in some areas was a particular blow, as its tall narrow form and good autumn colour made it a very successful shelter and landscape tree. The disease was most damaging in warm wet summers, with successive leaf drop causing dieback or death of the tree. In the far south there has been little problem, and so the spectacular autumn colour at places such as Lake Hayes has continued.

With the Plant Materials Centre producing new rust-resistant clones, New Zealand is fortunate to be still able to grow poplars for erosion control, timber production, and landscape values. In today's political climate, the lack of resources going into research makes it unlikely that a similar effort would now be made.

Cypress Canker

Cypress canker seriously affects most cypresses in some areas of New Zealand, while being little problem elsewhere. The disease was described by Dudley Franklin in

TG 16/4 November 1995, with good coloured photographs showing symptoms and after-effects.

Canker can be caused by a number of fungi, but in New Zealand *Seiridium unicorne* and *S. cardinale* appear to be the main culprits. Spores lodge in branch axils or small cracks in the bark, and grow into the cambium, probably producing toxins which kill the branch further up the tree. Spores are spread by rain splash but do not necessarily spread to neighbouring trees, and so by thinning out affected trees, the problem can be prevented from becoming serious.

The cankers cause a cracking and sinking of the bark, with resin bleeding common, and fluting of the stem often starts from these points.

Cupressus macrocarpa and *Cupressocyparis leylandii* are the two worst-affected species in New Zealand, but *Cupressus lusitanica* and *Chamaecyparis lawsoniana* are also attacked. *Cupressus arizonica* and *C. torulosa* are less susceptible.

A typical canker on young macrocarpa. Cracks, dark patches, sunken bark, and resin bleed are all symptoms.

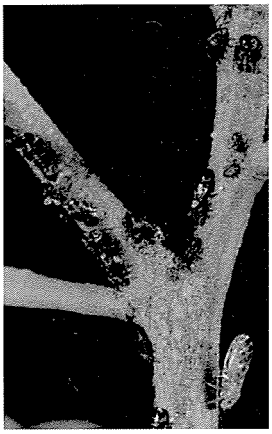
Trees growing in warm regions in soils with high nitrogen content seem particularly susceptible. Shelterbelts of Leyland cypress can be badly affected, and the practice of annual or bi-annual hard trimming of these belts in orchard areas may well spread the disease. Pruning in woodlots does not seem to cause disease entry, and pruning of affected branches back at the stem can control disease spread.

There is some evidence that older trees of *C. macrocarpa* become less susceptible to canker.

Dudley Franklin suggests that the best method of minimising the disease is to plant *C. lusitanica* rather than *C. macrocarpa* in areas where the disease is present, to avoid nitrogen-rich soils, and to maintain a healthy vigorous plantation by pruning and thinning any infected trees.

Blackwood Insects

Acacia melanoxylon (Australian blackwood) suffers in most areas from attack by psyllids and leaf miners, with young trees and saplings most likely to be affected. Clive



Adults and nymphs of *Psylla acaciae* on a blackwood shoot.

Appleton and Patrick Walsh of FRI summarised the current state of knowledge on these pests in *TG 18/1* February 1997.

The psyllids are very small sap-sucking insects infesting the growing tips of the trees, sucking from the phloem, and excreting a form of honey dew which becomes utilised by fungi. This gives the typical black mouldy appearance of infested shoots.

Two species of psyllids, *Psylla acaciae* and *P. uncatoides*, can rapidly increase populations, with eggs followed by five instars of larvae followed by adults with wings.

The effect of serious infestation is to stunt the shoot growth, tending to form a short bushy tree and aggravating the problem of good leader extension that blackwood growers find hard enough to achieve.

The other pest attacking blackwoods is the leaf miner, *Acrocercops alysidota*, a tiny moth which lays eggs on developing phyllodes. The larva mines between the two leaf surfaces and can mine through the leaf base into the stem, causing tip dieback.

Spraying with insecticides can be effective during the first 2 or 3 years, but becomes impractical as the trees grow past 3 or 4 m. Long-lasting systemic insecticides are necessary, with perhaps several applications per year, and so this is not likely to be an option for most growers.

An acacia tortoise beetle, *Dicranosterna semipunctata*, was discovered on the Remuera Golf Course in 1996. It attacks blackwood but is uncommon in Australia, and so probably has a biocontrol.

The death of large numbers of cabbage trees (*Cordyline australis*) in the North Island from the 1980s upset many farmers and New Zealand tree lovers. The condition was called Sudden Decline, and researchers attributed it to obscure bacteria that live in the vascular system of the plant.

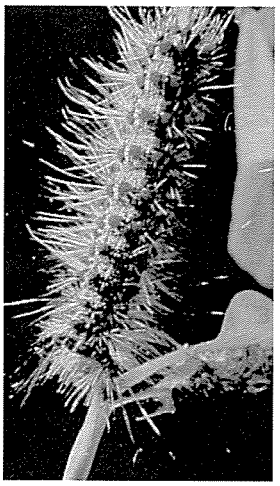
New Insects Hard to Control

The potential size of the problem of dealing with introduced insects was highlighted by the efforts to control

the white-spotted tussock moth in 1996–98, when large areas of Auckland were sprayed by air or from the ground, and large numbers of pheromone traps were set to find evidence of the moth's presence. This big operation appears to have ended successfully, but was not appreciated by Auckland residents.

The Dutch Elm disease has required a big effort in the removal of infected trees and the trapping of beetles responsible for spreading the causative fungus.

The Asian Gypsy moth has not become established in New Zealand, but is potentially very dangerous to forestry, and 14 ports are being constantly monitored as eggs can come in via containers or goods.



Fully grown Asian Gypsy moth caterpillar.

Four-legged Pests

Rabbits, hares, possums, goats, and deer are all potential pests in New Zealand forests, the last three mainly a risk to indigenous forests. The Department of Conservation and Regional Councils spend millions of dollars each year on holding the line with possums (aerial drops of 1080 poison, ground crews trapping and shooting), while farmers and gardeners wage their own battle in many areas to keep populations under control.

Although possums are known mostly for the damage they cause to indigenous forest, exotic forests are also badly affected at times. As well as eating foliage, they often break the leader on pines and eucalypts. Bill Gimblett suggested in *TG 5/4* November 1984 that they concentrated on eating male pine flowers in July and August, shown up by yellow droppings, and so poisoning or trapping at this time of year was effective.

Seedlings in particular were often damaged by possums, rabbits, and hares, usually soon after planting where the sprayed bare ground encouraged the critters to scratch holes, probably to work up an appetite to eat the tree.

Liza Crozier of FRI Rotorua considered animal repellents in an article in *TG 8/2* May 1997. She reported on tests carried out on pine seedlings by FRI in both Rotorua and

Christchurch on seven repellents over a 2-year period. The tests were carried out in the field and also in pens with captive rabbits and possums. Such materials as mutton fat and kerosene, thiropel (a thiram fungicide product), eggs either fresh or powdered, and fish were trialled with an adhesive as required.

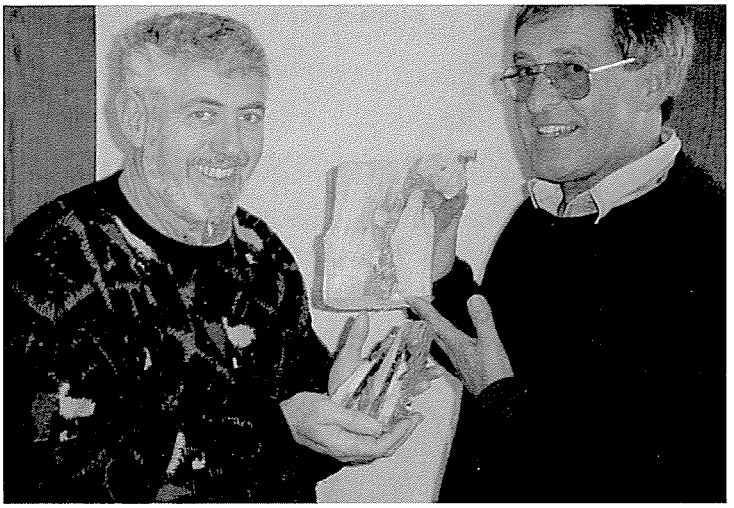
Both fish fertiliser and kerosene mixtures were inclined to burn *P. radiata*, and would have been worse on broadleaved ornamentals. Egg repellents were found to be safe and effective. A recipe of 80 g whole egg powder plus 800 ml water, mixed with 150 ml white acrylic paint, was suggested, with spray application of 20 ml of the mixture on the tree and ground immediately after planting. A follow-up spray in spring might be necessary.

Allan Laurie, a forestry consultant at Waimate, wrote in *TG 9/4* November 1988 of his success using the above mixture. He reported outstanding survival, with *P. radiata* treatment effectively staving off the attention of hares, rabbits, possums, and wallabies. Prior to using the repellent, hares alone had accounted for up to 20% of seedlings in the first week after planting. Success had been achieved even in the rabbit-infested land of the Mackenzie Country.

Tom MacBride reported similar success in *TG 13/4* November 1992; the Mid North branch had committee member Lloyd Gravatt making up pots of the mix and distributing it at cost through a local nursery.

Wellington Regional Council Pest Management Field Officer Ken Wright described the Timms possum kill trap in *TG 15/1* February 1994. These traps were lightweight and easy to use, set, and maintain. They were humane and unlikely to attract household pets.

Another clever trap used successfully and safely consisted of a letterbox construction, with half the floor on a hinge. The possum was attracted into this part of the floor which swung down with the weight, dropping the possum into, an empty drum or into one half-full of water. The floor swung up to horizontal again with weights, ready for the next victim.



Author Rob Lucas and Bruce Treeby with some paulownia infested by puriri moth. The caterpillar of this moth makes a "7"-shaped burrow.

Need for Association Involvement

The work Bruce Treeby has done on the Forest Health Advisory Committee, now called the Forest Biosecurity Advisory Committee, and in keeping Association members aware of new pests and diseases, has been of great value. There is clearly a need for representatives of tree growers outside the main forestry companies to argue for control of pests and diseases affecting special-purpose and important ornamental species.

We just do not know what tree species will be important in 50 years, and so every effort needs to be made to maintain the diversity we have.