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EVALUATION OF SEAWEED EXTRACT AND TWO RESISTANT PEACH VARIETIES FOR CONTROL OF PEACH LEAF CURL DISEASE *(TAPHRINA DEFORMANS)*

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ABSTRACT

The effectiveness of seaweed extracts for the control of peach leaf curl (*Taphrina deformans)* on Red Diamond nectarines was compared with a copper fungicide and with two varieties of peach claimed resistant to peach leaf curl. Field and laboratory tests were undertaken.

The peach varieties Winiata Gold and Gordon's Glory were tolerant to peach leaf curl under conditions of severe disease pressure. They were more effective than seaweed extracts in the control of the fungus.

The seaweed extract, Seagro, did not control peach leaf curl disease on Red Diamond nectarines planted in a randomised complete block design in Palmerston North in 1987. No evidence of fungicidal properties was found in the second year of the study when there were eleven infection periods suitable for the leaf curl fungus. In this season both seaweed extract and copper oxychloride fungicide were ineffective. In laboratory experiments, the seaweed extracts Response, Ecklonia and Carpophyllum had no effect on *T. deformans* growth.

In vitro, *T. deformans* grew well on a media of potato dextrose agar and 1% peptone. Satisfactory growth was also obtained on whole potato extract but the ease of preparation of the commercial agar mix made it the best option for this study. *T. deformans* grew more slowly on malt agar and peptone and did not grow at all on Czapek media. Acidifying the PDA media to a pH of 3.5 did not significantly affect *T. deformans* growth.

Quick laboratory tests for comparison of fungal growth on different fungicide/seaweed extract amended PDA plates were compared. The measurement of light absorbance of cell suspensions with a spectrophotometer was quicker than counting cells using a haemacytometer. The petri dish zonal inhibition technique was useful for quantifying the effectiveness of some fungicides against *T. deformans.*

Streptomycin, Benlate, and Rovral had little or no effect on the growth of *Taphrina deformans in vitro* but Saprol inhibited growth.

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1.0 INTRODUCTION

Peach leaf curl disease has been a problem of peach growing since the early nineteenth century (Atkinson 1968) and occurs throughout New Zealand wherever peaches and nectarines are grown. It is common on peach and nectarine cultivars and has also been found on almonds. On the latter host however it is reportedly of no economic significance (Heyns, 1965).

On unsprayed trees leaf curl can become a serious disease. It may destroy the first leaves and much of the crop year after year, gradually weakening the tree until it dies or is invaded by other organisms (Atkinson 1968). However, for nearly a century leaf curl has been fairly easily controlled with fungicidal sprays such as copper-containing Bordeaux mixture and copper oxychloride.

In 1987 growers in Hawke's Bay New Zealand found that despite a regular spray programme leaf curl had become more of a problem each season. It was suggested that the cause of the problem was either fungicide resistance or the development of a strain of the leaf curl pathogen which causes infections later in the growing season. Tate *et al.* (1987) did not find any evidence of fungicide resistance or of an unusual strain of the leaf curl pathogen. They concluded that the infection period for Fantasia nectarines occurred later than was usual for stonefruit (at the end of August in 1987 and mid-September in 1986), compared with the traditional timing of spray application in July/early August. These were respectively four and six weeks too early. However, in 1989 a strain of *Taphrina deformans* was isolated by Cheah and Tate that had low sensitivity to copper fungicide in laboratory tests. In controlled greenhouse experiments this strain of *Taphrina deformans* caused leaf curl on copper sprayed nectarine trees. Further tests are underway to confirm that this represents true resistance to copper fungicides.

There is thus a need for an alternative to copper sprays for the control of peach leaf curl.

In addition to the problems encountered by New Zealand stonefruit growers research into an alternative to copper fungicides is relevant for two other reasons: (i) the need for organic growers to decrease the use of such fungicides if their products are to be certified as organically grown, and (ii) the potential problem of copper reaching toxic levels in orchard soils as a result of long term use.

(i) Organic growing

To obtain certification of organic produce organic growers in New Zealand follow the guidelines set by the Biological Producers Council (BPC). These state, with respect to pest and disease control, that the

routine use of any pesticide is not allowed. Plant protection treatments based on natural plant extracts and/or simple salts may be used. Prohibited pesticides include all organochlorine, organophosphate and carbamate insecticides, dithiocarbamate fungicides and other synthetic pesticides.

To prevent peach leaf curl organic growers may use copper fungicides approved by the BPC, provided they are not used 'routinely'. The only copper fungicide specifically approved in the 1988 BPC standards is cupric hydroxide but it is known that organic growers in New Zealand may also use copper oxychloride. For growers to retain organic certification of their crops their use of fungicides must decrease over a period.

(ii) Copper toxicity

Potential copper toxicity problems have been documented by Merry *et al.* (1983). They found the level of copper, lead and arsenic was up to 25-35 times higher in soils from orchards and former orchards in South Australia and Tasmania than in uncontaminated agricultural soils. The high affinity of copper for oxide minerals and organic matter resulted in the retention of copper in the surface 20-30 cm of soil with no evidence of leaching to greater depth, even in the acid, sandy soils of Tasmania.

However, they also found that the concentration of copper in pasture plants (ryegrass and white clover) growing on former orchard soils in Tasmania was generally unrelated to total soil concentration of copper. In South Australia other pasture plants (from former orchard soils) had concentrations much higher than that recommended for sheep grazing - up to 20 ppm. The warmer soil temperatures of South Australia account in some way for this as plants accumulate more copper at higher temperatures (Merry *et al.* 1983).

Pasture plants in both studies had no obvious symptoms of toxicity, even where copper levels were up to 50 ppm. This is significant given the large number of former orchards in Australia which support pastures, and the high number of existing orchards with high concentrations of copper in the soil which support good stands of grasses (usually with legumes) as ground cover.

Despite these Tasmanian and South Australian results of Merry *et al.* earlier work by Merry (in Merry *et al.* 1983) found a relationship between soil concentrations of lead and copper and those in pasture, crop, and vegetable plants grown in contaminated soils in field and glasshouse experimental plots. The lack of a simple correlation between plant and soil levels of copper in the latter experiment may be due to the effects of other toxic elements, fertilisers and different acidities of contaminated soils. Plant uptake of copper increases with increased acidity (Merry *et al.* 1983).

Merry 's glasshouse experiments indicated that the copper, lead and arsenic contents of vegetables grown on former orchard soils would not exceed established standards for human consumption (in Merry *et al.* 1983). He cited two potentially dangerous circumstances for humans: people growing, and largely consuming, their own vegetables on highly contaminated former orchard soils and children in such areas ingesting dirt. To the author's knowledge, no study has been done in New Zealand on the concentration of copper in orchard soils. However, in general, much of New Zealand's soils are copper deficient.

Two techniques which would be acceptable to organic growers for the control of leaf curl disease are the use of resistant varieties and the use of plant or seaweed based products. There has been interest in the use of seaweed extracts for the control of leaf curl of peaches by organic growers (Chase 1986) but there is limited research in this area. No detailed observations have been made on the relative resistance to leaf curl of locally grown stonefruit varieties, but it is known that most of the varieties grown for export are susceptible in some degree (Atkinson 1968).

This work was undertaken to evaluate the effectiveness of seaweed extracts for the control of peach leaf curl and to assess the resistance of some "leaf curl resistant" stonefruit. A review of literature on the fungus *Taphrina deformans* was made and its classification, biology and lifecycle, culture ***in vitro*** and control is documented in section 2. Laboratory experiments were used to develop a technique for the growth of *T. deformans* in culture and for a method to evaluate the effectiveness of products in the control or inhibition of the fungus. These are described in section 3. A field trial was set up to compare the effect of a seaweed extract with a copper fungicide for the control of peach leaf curl on Red Diamond nectarines. Two peach varieties, Gordon's Glory and Winiata Gold claimed to be resistant to leaf curl were assessed. A discussion of results is given in section 5.