

Simultaneous Control of *Diaphorina citri* Kuwayama, Other Citrus Pests and Some Diseases with Petroleum Spray Oils

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Key pests of citrus in Asia include citrus psylla, citrus leafminer, armoured and soft scales, mealybugs, aphids, whiteflies, thrips and mites. Synthetic pesticides are widely used for their control. In recent decades use of these chemicals has reached excessive levels. The number of annual sprays can exceed 40. They significantly affect production costs and marketing. The mixing of several pesticides in a single spray exacerbates inappropriate use. These practices are not sustainable; resistance is common and widespread, natural enemies are rendered ineffective, and there are significant effects on the environment and human health. Greening, tristeza and canker are also serious throughout most of the region. These diseases cause devastating economic losses. They also threaten citrus germplasm diversity. Each is linked to a pest; greening to citrus psylla, tristeza to aphids, and canker to citrus leafminer. Are synthetic pesticides necessary for their control, and control of other pests that occur on leaves, fruit and branches? The answer is no or infrequently.

Recent research funded by the Australian Centre for International Agricultural Research (ACIAR), the Horticultural Research and Development Corporation (HRDC), Ampol Rural, and Caltex Oil (Australia) Pty Ltd has shown that petroleum spray oils can be used to control most pests simultaneously by drowning them and/or affecting their behaviour.

The success of the research stems from highly significant behavioural effects of oils on citrus psylla (Fig. 1) and citrus leafminer (Beattie *et al.*, 1995; Rae *et al.*, 1996 a and b, 1997), and the effects of strategically timed multiple (2-4) low-concentration (0.25-0.5% v/v) high-volume sprays required to control these two key pests during susceptible periods of flush growth, on other pests such as scales, mites, thrips and whiteflies (Beattie, Rae, Huang *et al.*, unpublished). High volumes are required for wet deposits that leave effective films of oil on sprayed surfaces and enhance capillary movement of oil into the tracheae of susceptible insects and mites (Beattie and Smith, 1997; Smith *et al.*, 1997).

Mixing the oils with copper fungicides should also allow, and possibly enhance, simultaneous control of citrus canker, and oil alone can be used to control greasy spot (Whiteside, 1989). Recent research on rose, apple, tomato and cucurbit powdery mildews (Kallianpur *et al.*, unpublished; Thwaite *et al.*, unpublished) infers that citrus powdery mildew (*Acrosporium tingitaninum* (Carter) Subram) should be susceptible to low concentration petroleum oil sprays.

Petroleum spray oils are organic biorational products. Generally, they do not need to be mixed with synthetic insecticides and acaricides. The risk of detrimental environmental and health effects from their use is very low. There has been no empirically demonstrated case of resistance in over a century of use of refined products. However, oil induced phytotoxicity must be avoided.

High quality products must be used. Oxidation of unstable molecules can be reduced by UV filters. Sprays must not be applied at ambient temperatures above 35°C (sprays should be applied early in the morning or in the evening). Clean water and thorough agitation are required. Use at high volumes and low-concentrations reduces the risk of phytotoxicity, while maintaining or improving efficacy. Incompatibilities with other chemicals must be avoided. Fortunately, oil accumulation on leaves can be avoided through low pest and disease pressure in temperate regions and rapid natural senescence and abscission of leaves in the tropics.

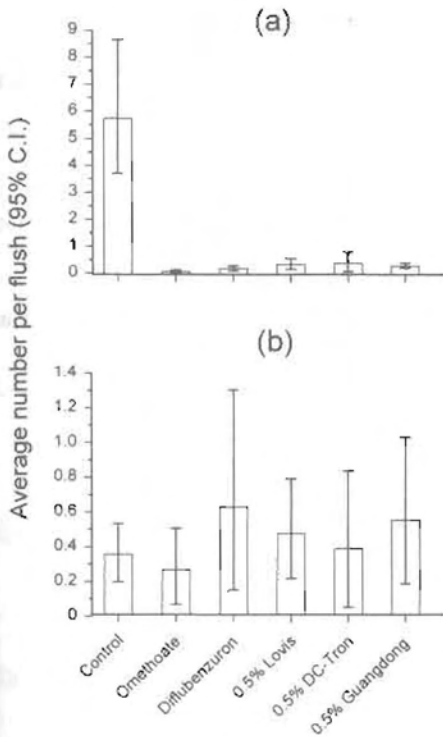


Figure 1. Effects of petroleum spray oils (Caltex Lovis, Ampol D-C-Tron NR and Guangdong Oil), omethoate and diflubenzuron on citrus psylla (based on Rae *et al.*, 1997).

- Two sprays were applied to flushing potted calamondin trees; the second spray was applied five days after the first.
- Larvae and eggs were sampling 14 days after the first spray.
- Numbers of larvae (a) were significantly lower in sprayed treatments than in unsprayed control due to larval mortality and reduced oviposition.
- The oils were as effective as omethoate & diflubenzuron.
- Differences in eggs (b) per treatment, and therefore effects on oviposition behaviour, were not significant because the interval between second spray and sampling was too long.

Properly implemented petroleum spray oil/natural enemy based IPDM programs for citrus psylla, greening (including disease-free propagation) and other pests and diseases should lead to dramatically reduced pesticide use on citrus in Asia. In China it should be possible to reduce 10->20 annual synthetic pesticide sprays to zero. In Thailand, where pesticide use is perhaps most extreme, it should be possible to reduce use by 50-75%. Costs can be reduced by >\$1,000 ha⁻¹. Investment is required in education, refineries and marketing.

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