Summary report of soil arthropods sampled from Australian lettuce fields, 2005-06, using Berlese Funnel extraction.

Greg Baker (SARDI) and Dr Peter Crisp (Univ. Adelaide)

As part of a search for biological control agents of lettuce pests and reduced reliance on pesticides, a survey of arthropods in soils collected from lettuce fields is being conducted in three States (SA, VIC and NSW).

Populations of the sampled soil arthropods, such as collembolans (springtails), Tyrophagous and oribatid mites (all detrivores and fungivores) and predatory mites, were generally low in most of the soil samples received from lettuce fields in VIC (Werribee), NSW (Hay and Sydney Basin) and SA (Northern Adelaide Plains and Murray Bridge) in 2005-06. We speculate that the low populations of arthropods in these field samples is likely due to the combined pressures of regular disturbance, multiple pesticide applications and low soil organic carbon levels.

The arthropod populations sampled from these five regions appear more specific to individual growers than particular regions. The SA sites appeared to have higher population densities than the other sites, but whether this is due to the greater delay between collecting the VIC and NSW samples from the field and commencing their Berlese extraction in Adelaide, or other factors (such as site selection, soil type, soil management, soil carbon level, pesticide history) is unclear.

The populations of predatory mites in the 150 ml soil samples ranged from 0 to 11 (mean of 4.4). The majority (>95%) of these predators are mesostigmatid mites, including *Hypoaspis* spp., Machrochelidae, *Pachylaelaps* sp. (*P. australicus*?), *Pergamasus* sp., *Protogamasellus mica*, *Dendrolealaps* sp., *Athasiella relata* and several unidentified Parasitidae species.

All of these soil-inhabiting predatory mites may be able to contribute to the control of western flower thrips pupae in soils of lettuce fields.

These species, genera and families have all been found in Riverland citrus soils, and the orchards where they are most abundant have high mortality of the soil-dwelling pupae of Kelly's citrus thrips (the citrus industry's main pest in the Riverland-Sunraysia), and minimal crop damage from this pest. Based on the citrus studies *Pachylaelaps* sp. and *A. relata* are of specific interest as predators of thrips pupae.

Hypoaspis sp. is a large (2mm) aggressive hunter predator that has been shown to feed on a range of small arthropods, and is available commercially as a biological control agent.

Pergamasus sp. (Acarina: Parasitidae) and an unidentified Parasitid mite, both of a similar size to *Hypoaspis*, have been found in soil samples and within lettuce heads at Murray Bridge and Werribee. These mites are fast-moving hunters that are known to feed on a wide range of small arthropods, and potentially could feed on early instar thrips and aphids. The Murray Bridge site is managed with a conventional pesticide spray program, whereas the Werribee site is managed with a reduced frequency, 'soft' pesticide spray (IPM) program. While further evaluation of these mites is needed, the apparent tolerance to pesticides at the Murray Bridge site, and their presence in the outer leaves of lettuce plants, suggests that these mites are potential biological control agents of pests such as thrips, currant-lettuce aphid, small caterpillars and pest mites. It is likely that these beneficial mites are able to persist in the soil between crops feeding on small arthropods such as other soil mites and springtails.

The Machrochelidae are robust, slow-moving predatory mites, and while potentially useful in an IPM system have so far been difficult to rear in laboratory conditions.

The densities of these predatory mite species in Australian citrus soils is strongly positively correlated with soil organic carbon levels (Baker *et al.* 2005), and a similar association between other soil dwelling mite predators and soil carbon levels has been reported previously.

There are a numerous studies that report negative effects on soil-dwelling predatory mite populations and the use of synthetic insecticides such as organophosphates and synthetic pyrethroids. Populations of these beneficial mites are highest where there is the combination of high organic carbon content in the soil and no pesticide application, and lowest where there is a combination of low organic carbon and high pesticide use.

In summary, a range of soil-dwelling predatory mite species are present in most lettuce fields sampled across VIC, NSW and SA in this 2005-06 study. Although the densities of these predators are generally low, some changes to current soil management practices and pesticide programming may create conditions suitable for these predators to flourish, and thereby help control difficult pests such as western flower thrips. In particular, the soil and foliage hunter *Pergamasus* sp., with potential as both a thrips and aphid predator, and possibly possessing some pesticide tolerance, warrants further attention.

July 2006