INSECT PESTS OF CANOLA

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SUMMARY

- Canola crops are most susceptible to damage by earth mites, lucerne flea and false wireworms during crop establishment, and to a lesser extent by aphids, native budworm and Rutherglen bug during flowering and podding.
- Current management strategies for insects depend largely on chemical control, but alternatives are being actively pursued.
- A complex of earth mite species represents the most serious threat to crops; effective management requires strategic use of insecticides, cultural control measures and resistant plants.

INTRODUCTION

The pests discussed in this chapter are common to all major canola-growing regions of Australia, although the severity of infestation can differ greatly between regions. The key invertebrate pests attack the crop during establishment in autumn (earth mites, lucerne flea, false wireworm species) and flowering-pod set in spring (aphids, native budworm and Rutherglen bug). Generally, the former cause most concern because, while they are relatively inexpensive to control ($5 to $15/ha), they are also responsible for more than 10% of crop failures. Pests not dealt with in this chapter (cutworm, scarabs, cabbage moth, cabbage white butterfly, cabbage centre grub, weevils) are more sporadic, and rarely or only locally significant.

The regular pests such as earth mites, lucerne flea and false wireworms persist in the cropping environment between seasons using mechanisms that enable them to survive the long, dry, temperate summers. The more sporadic pests such as native budworm and aphids are migratory, and thus outbreaks are more influenced by seasonal conditions than cropping practice. In a cropping-grazing system, canola is frequently the first crop following pasture. This regime exposes canola to high pest pressure from species that commonly inhabit pastures including earth mites and lucerne fleas, as well as some minor pests such as pasture scarabs and weevil species.

CROPS ESTABLISHMENT PESTS

Earth mites (*Halotydeus destructor*, *Penthaleus* spp.)

Biology and taxonomy

The earth mites, redlegged earth mite (*Halotydeus destructor,* RLEM) and blue oat mite (*Penthaleus* spp., BOM) (Figure 13), are the most regular and damaging pests of canola across southern Australia. The different species often co-exist. Adult mites rupture the surface of cotyledons and leaves, removing cell contents. Damaged plants may wilt and die if damage is severe, particularly if growing conditions are poor. The source of most major outbreaks of mites is leguminous pastures where spring densities of up to 30,000 mites /m^2 are common.

Recent research by Hoffmann on BOM has revealed that there are at least three parthenogenetic species (*P. major*, *P. falcatus* and *P.*sp.x) which have distinctive but overlapping distributions in south eastern Australia. The discovery of multiple species of BOM has significant implications for the interpretation of previous research that did not distinguish species, and for future management regimes for all earth mites.

Mites emerge from over-summering eggs (physiologically arrested or diapause), which survive through summer, in response to autumn rains and falling temperatures. Juvenile mites feed on soil microflora (algae, mosses, bryophytes). RLEM have three to four generations during autumn-spring; BOM possibly have fewer.

Management
Standard industry practice is to minimise the risk of earth mite damage by the prophylactic use of insecticide applied post-sowing, pre-emergence ('bare earth'). In regions where damage is sporadic or less severe, an application of a systemic, post-emergence insecticide is used when mite activity is detected. A more strategic approach may be to control mites in the previous spring, before they enter diapause. Currently, a model is being developed by Ridsdill-Smith to predict critical dates in spring to spray populations before diapause eggs are produced. His research should be valuable in preparing paddocks for a highly susceptible crop such as canola.

Partial resistance in RLEM to some insecticides has been reported although full resistance has not been detected. The repeated use of insecticides from the same chemical group carries the risk of further inducing resistance, so the recent introduction of new insecticides (eg. bifenthrin, imidacloprid) has widened control options. Recent work by Hoffmann on apparent insecticide tolerance of BOM and RLEM indicates that there are significant differences in the response of the four species to a range of common insecticides. *P. falcatus* is significantly more tolerant of the most commonly used insecticides than the other species. This work highlights the importance of determining species composition when considering control options.

Non-chemical control options also exist. The use of "non-host" crops (eg. lentil, chickpea, wheat, barley, lupins and linseed) prior to canola in the rotation dramatically reduces the build up and carry-over of earth mites to densities below economically damaging levels in autumn. The use of non-host crops relies on these being kept largely weed-free so mites do not have alternative hosts for multiplication. Similarly, intensive grazing of pastures in the previous spring also reduces mite carry-over. The cultivation of paddocks in early autumn kills diapausing eggs and newly emerged nymphs.

Laboratory and field screening of a large collection of *B. napus* lines by McDonald, Dunse and Rowles has demonstrated that some lines were partially resistant (or tolerant) to RLEM, although none were completely resistant. Four lines were identified with seedling resistance (survival) at least twice that of the highly susceptible *B. napus* cultivar Oscar. One of these, when crossed with cv. Oscar, resulted in some F_2 progeny with resistance levels comparable to that of the resistant parent. The mechanisms involved in resistance are unclear. The link between resistance and glucosinolates in the *B. napus* F_2 plants is currently being evaluated. In *B. juncea*, high levels of allyl glucosinolate did not confer resistance. Glucosinolates are often associated with a plant defence role but concentrations above 40 μmole are unacceptable in canola. Preliminary work suggests that larger seeds, which produce more vigorous seedlings, are less susceptible, but further work is required.

Lucerne flea (*Sminthurus viridis*)

Lucerne fleas are plant-feeding spring tails (collembola), and are found across the higher rainfall parts of southern Australia where they multiply on broad-leafed pasture plants and leguminous crops. In some areas lucerne fleas are considered as damaging as earth mites.

These pests feed on cotyledons and seedling leaves, consuming epidermal cells and leaving small round holes in the leaves, similar to symptoms caused by flea beetle in North America. Severe infestations can stunt or kill seedlings. Lucerne fleas have a similar seasonal biology to RLEM: three to four autumn-spring generations; the final spring-laid eggs entering a summer diapause and hatching the following autumn when favourable temperatures and rainfall occur.

Management
Lucerne fleas are commonly controlled post-emergence when damage is detected, generally using an organophosphate insecticide (eg. omethoate). In areas where damage may be common, either a seed dressing or the use of a border spray, post-emergence, may be sufficient to stop invasion of the crop from neighbouring pasture or crops.

As with earth mites, there are opportunities for minimising the pressure on canola by controlling lucerne flea in preceding pasture or broadleaf crops. Anecdotal evidence suggests that the incidence of lucerne flea is increasing even in areas of continuous cropping. The increased adoption of conservation cropping may be contributing to the pest's increased survival.

There have been successful releases in Tasmania and south-eastern Victoria of an introduced predatory mite (*Neomolgous capilatus*).

False wireworms (*Isopteron punctatissimus*, *Adelium* spp.)

False wireworms are soil-dwelling larvae of beetles (tenebrionids) which attack crops both pre- and post-emergent. Both *I. punctatissimus* and *Adelium* spp. are native species that normally inhabit grasslands or pastures and prefer light, dry soils with high organic content such as cracking grey clay soils. The incidence of false wireworm damage appears to have grown with the trend towards conservation farming and shorter periods of fallow.

These false wireworm species have one generation per year. The larvae feed predominantly on organic matter, encouraged by crop residues and weedy fallows. The larvae are active from autumn through to early spring, adults emerging in spring to early summer.

Larvae eat germinating seed, underground parts of seedlings and the stems and leaves of young plants. Some species will feed on leaves at the soil surface. The larvae of the bronzed field beetle *(Adelium brevicorne*) represent the most damaging false wireworm species in South Australia and Western Australia. In Victoria, the grey false wireworm (*I. punctatissimus*) causes most damage by 'ringbarking' and eventually severing the hypocotyl of young seedlings or leaving them severely weakened and susceptible to dehydration and disease. Damage is most severe where crop growth is slowed by dry or cool conditions. Vigorous crops can often outgrow false wireworm damage.

Other tenebrionid species such as *Pterohelaeus* and *Gonocephalum* spp. are relatively common in soils with high organic content, but are relatively minor pests. *Gonocephalum* sp. adults have caused damage to spring-sown crops in South Australia in late spring.

Management
Current management tactics for false wireworm in canola are, at best, rudimentary. The incorporation of an organophosphate insecticide (eg. chlorpyrifos) into the seed bed prior to sowing provides good seedling protection, and has been widely adopted as a prophylactic treatment. Post emergence applications of insecticide (eg. pyrethroid) and seed dressings are also used in some areas. Research by the senior author, and more recently by Rohitha (Victoria) and Michaels (Western Australia), aims to develop integrated management strategies for these pests.

CROP FLOWERING AND PODDING PESTS

Aphids: Turnip aphid (*Lipaphis erysimi*), Cabbage aphid (*Brevicoryne brassicae*), Green peach aphid (*Myzus persicae*)

Aphids are principally pests of flowering and podding crops across Australia, except WA where heavy infestations can occur in both seedling and flowering crops. The turnip aphid is the most abundant species in canola at flowering and podding. The cabbage and green peach aphids occur less frequently and rarely persist in large numbers on flowering plants.

Aphids that invade canola in autumn and spring overwinter on cruciferous weeds in and around cropping areas. Mild and dry autumn and spring conditions encourage outbreaks. Although withering of flowers/buds and distortion of pods is often evident where there is uncontrolled aphid feeding, recent research by Berlandier has demonstrated that even large infestations of aphids (up to 160 per raceme) produce no reduction in yield. Plants may compensate for damage by producing more flowering stems although the capacity for compensation depends on the availability of moisture during the growing season. As a result of this finding, a range of economic thresholds has been derived that are more conservative in lower rainfall zones than in higher rainfall zones. Oil quantity and quality in aphid-infested canola appears not to be affected, even after large and prolonged infestations.

Management
Current practice is to control aphids by a single application of insecticide (chlorpyrifos, dimethoate, pirimicarb) when aphid densities reach a nominal threshold level. The use of pirimicarb, an aphid-selective product, is advocated to preserve the important beneficial insects (ladybirds, wasp parasitoids, lacewings, and hoverflies)

thus potentially reducing the need for follow-up applications. Insecticide resistance has been recorded in green peach aphid, but not in turnip or cabbage aphid.

Native budworm (*Helicoverpa punctigera*)

Native budworm is a major insect pest of all broadleaf crops in Australia and can be a severe pest of canola. In spring, the moths migrate from inland breeding sites to cropping areas in southern Australia. The magnitude of the migration and subsequent outbreak depends on the seasonal conditions inland and the nature of wind systems, which transport the moths. Each female moth can lay a large number of eggs on vegetative plants, flowers and pods. Young larvae mostly graze on the leaves and pod surfaces, while older larvae feed on flowers and burrow into pods, consuming developing seed. Damage to the integrity of the seed pod makes the pod susceptible to shattering, and allows the entry of moisture and potentially diseases. Infestations inflicting economic losses are not common, especially in eastern Australia. However, economic damage occurs occasionally in both standing and swathed (windrowed) crops prior to the complete desiccation of the plants.

Management
Current management practice is to control native budworm with a single application of insecticide, often a synthetic pyrethroid, when pod damage is visible. There are a number of natural enemies of native budworm, but none is known to exert effective control in canola. As for other post-flowering pests, damage is likely to be reduced by crop swathing.

Rutherglen bug (*Nysius vinitor*)

Rutherglen bug is a common native insect that breeds in a wide range of weed and crop hosts. In some seasons it can reach plague proportions, typically when the senescence of weed hosts in spring and early summer forces adults and nymphs into nearby crops. Large infestations of Rutherglen bug at harvest have caused difficulties in achieving acceptably low moisture levels in harvested grain.

Although Rutherglen bug is usually a pest in spring, in rare instances large infestations have occurred in autumn with seedling crops decimated by the feeding of adults and nymphs. The insect feeds on vegetative growth and developing pods, penetrating the pod wall to the developing seed. Rutherglen bug has a detrimental impact on the quantity and quality of sunflower oil, and probably has a similar impact in canola.

FUTURE DIRECTIONS

The future battle with pests of canola will rely increasingly on the development of integrated pest management packages (IPM) and is likely to access more opportunities through biotechnology.

Future management strategies for earth mites will continue to be a priority for the industry. The integration of chemical control with alternative strategies will provide the most robust and enduring solution to the overwhelming mite problem. The major thrust is likely to be two pronged: firstly through the development of canola lines with complete resistance, either using gene technology, or by selection for increased tolerance to earth mites. Secondly, strategies to decrease mite pressure by using cultural methods to lessen survival and reproduction will be a vital element in an integrated pest management strategy. Nonetheless, strategic chemical usage will remain a key element of earth mite management.

A reliable management strategy for false wireworms will depend upon our capacity to predict occurrence in "at-risk" paddocks, to develop farmer-friendly economic thresholds, to have access to more selective tools for chemical control, and to develop methods for cultural control. Many of these elements require a sound knowledge of biology and ecology of the pest species. Plant resistance is also possible given recent work showing tolerance to nematodes in *B. napus* expressing aliphatic glucosinolates in seedling roots.

FURTHER READING

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