

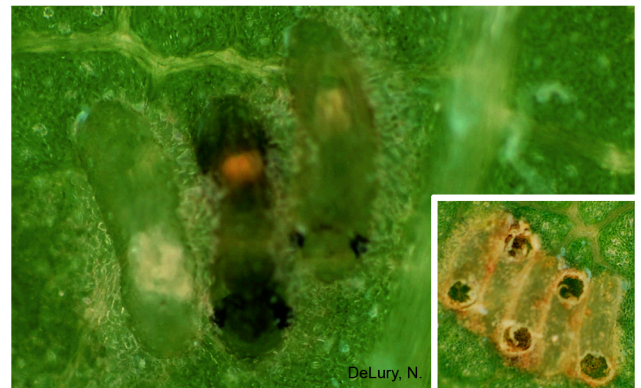
Beneficial Insects and Mites of Grape in British Columbia

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Plate 1



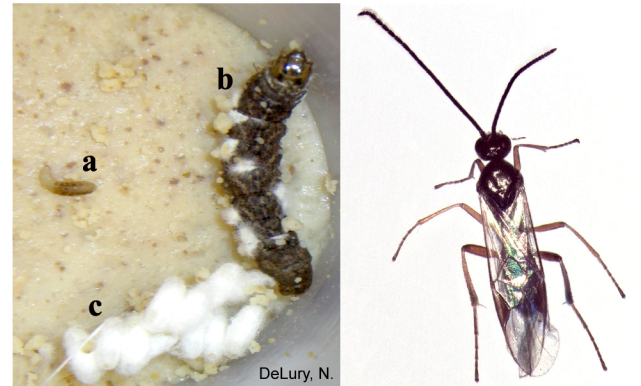
1a) Parasitic *Anagrus* wasps, an adult shown here emerging from a leafhopper egg (inset), are the most effective natural control agents of leafhoppers on grapes. Barely visible to the naked eye, two species of *Anagrus* wasps overwinter in alternate hosts before moving into the vineyard in the spring.



1b) *Anagrus* wasps developing within leafhopper eggs cause them to darken a few days before the adult wasps emerge. Wasps chew their way out of the egg (inset), leaving a nearly round hole.



1c) Cross section of a cutworm larva (right) containing large numbers of *Copidosoma* larvae (arrows) and pupae that will emerge into the small adult wasp shown on the left.



1d) Larvae (a) of *Glyptapanteles* wasps (right) exit the parasitized cutworm larvae (b) to pupate in cottony cocoons (c).



1e) This *Diphyus* wasp is one of 12 species of parasites we have reared from climbing cutworm larvae collected from grapevines at night. Larger in size, a single adult emerges from each parasitized cutworm larva.



1f) This tachinid fly, *Tachina brevirostris*, was reared only rarely from parasitized cutworm larvae feeding on grapevines. The large larva (inset) exits the cutworm to pupate in the soil.

This publication is a companion to the *Best Practices Guide for Grapes for British Columbia Growers*, BC Wine Grape Council, Peachland, BC (www.bcwgcc.org). Please refer to that publication for information relating to the biology and management of insect and mite pests of grapes in BC.

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Plate 2



2a) Eggs of the greater yellow underwing moth, *Noctua pronuba*, a close relative of the lesser yellow underwing, *N. comes*, eventually turn black (inset) when parasitized by these minute *Trichogramma* wasps (arrow).



2b) Parasites of soft scale can alter the appearance of scale nymphs; in this case a parasitic wasp (right) caused the scale exoskeleton to darken as it developed inside the scale nymph (left) and left a distinct round exit hole (arrow) when it emerged.



2c) Parasites of soft scale are effective natural control agents. This tiny wasp lays multiple eggs in a single scale, as seen by the multiple exit holes (arrows). Chemical sprays and guardian ants can interfere with parasitism of scale.



2d) Multicolored Asian ladybeetle, *Harmonia axyridis*, and several other ladybeetle species feed on various pests of grapes. Contamination and tainting of wine by *H. axyridis* has not been a problem here in BC as it has in eastern N.A. Ladybeetle pupa shown on right.



2e) As for most other ladybeetle species, this convergent ladybeetle larva, *Hippodamia convergens*, is marked with red or orange and has the typical 'knobby alligator-like' appearance.



2f) Related to their small size, larvae (top right) and adults of this *Stethorus* sp. ladybeetle feed on mites and other small prey species. Adults of related species can be all black or black with dark brown.

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Plate 3



3a) Feeding on powdery mildew and other fungus, adults and larvae (left) of this small twenty spotted ladybeetle, *Psyllobora vigintimaculata*, have an unusual diet for this group of predators.



3b) This predacious carabid ground beetle (Carabidae) is one of many species of soil-dwelling beetles likely to feed on eggs and larvae of climbing cutworms.



3c) Several species of rove beetles (Staphylinidae) actively feed on the ground or under the bark of grapevines and other plants. Prey would include eggs and small larvae of cutworms.



3d) This fierce looking green lacewing larva (Neuroptera) feeds on soft bodied insects. Unfortunately, releases of larvae or eggs have not proven to be very effective. Inset shows a green lacewing egg on its characteristic long stalk.



3e) Green and brown lacewing (top) adults emerge from pupae that are formed within a loosely constructed net-like pupal case (bottom).



3f) This long-legged field assassin bug (Heteroptera) is one of many similar species that use their piecing and sucking mouthparts to ingest the juices from their prey, which includes leafhoppers and small caterpillars.

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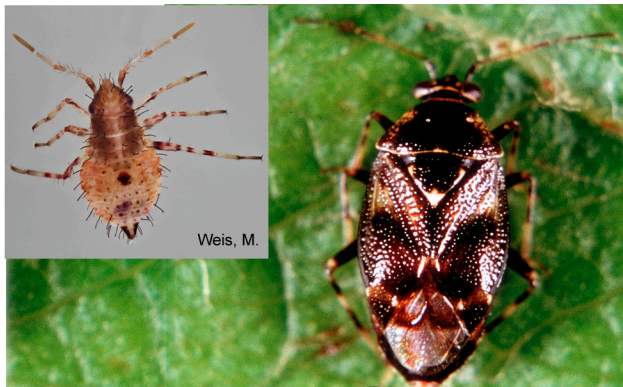
Plate 4



4a) Field damsel or nabid bugs (Heteroptera) (late instar nymph shown here) are generalist predators that are most often found on the groundcover vegetation where they feed on aphids, leafhoppers and other small insects.



4b) The young minute pirate bug, *Orius* sp., nymph (inset) has an orange abdomen from feeding on European red mites. Adults also include small insects such as leafhopper nymphs in their diet.



4c) Similar to the minute or insidious flower bugs, this *Deraeocoris* adult and the somewhat spiny looking nymph (inset) suck the body fluids from a range of small insects and mites.



4d) The largest number of species of generalist predators found on grapevines belong to the 'true bugs' (Heteroptera). Named for its protruding eyes, this big-eyed bug is another member of this important group.



4e) Predacious thrips, such as this banded-wing thrips, *Aeolothrips* sp., are some of the most important predators on grapes in BC where they help control mites and plant feeding thrips such as the western flower thrips.



4f) Largest of our predatory thrips, adults and nymphs (inset) of the black hunter, *Leptothrips* sp., also include larger prey such as immature leafhoppers in their diet.

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Plate 5



5a) This black predatory thrips adult, *Haplothrips* sp., and colourful striped nymph (inset) are among about half a dozen species of predatory thrips commonly found on grapevines in BC. Even the damaging western flower thrips has been reported to feed occasionally on mites or their eggs.



5b) The diet of the European earwig includes decaying matter and soft, wet plant tissue. They feed on soft bodied insects such as aphids and scrape leafhopper eggs from the undersides of grape leaves. 'Damage' to table grapes is only due to the 'yuck factor' when they scurry from the clusters.



5c) Although showy and easily recognized, the Chinese praying mantis or mantid, *Tenodera sinensis*, is not a very effective predator of grape pests due to its small numbers and preference for larger prey species.



5d) The large predacious whirligig mite, *Anystis agilis*, that feeds on small leafhopper nymphs, thrips, scale crawlers and mites is noticeable for its bright orange colour and rapid, whirling motion.



5e) Smaller than adult spider mites (left), this oblong shiny opaque western predatory mite, *Galendromus occidentalis* (bottom right), consumes all strages of spider mites. Moving rapidly and erratically it is more active than the plant feeding mites. Permission was granted for use of this image, originally from ANR publication #21496, "Natural Enemies Are Your Allies!" copyrighted by the Regents of the Univ. of California.



5f) Microscopic Stigmaeid mites and *Amblyseius* sp. (inset) are important predators on grape leaf rust mite and grape erineum mite. Pest mite numbers often increase when pesticides harm these beneficial mite species.

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Plate 6



6a) Hunting spiders such as this yellow sac spider, *Cheiracanthium* sp., are active throughout much of the year and are often the first predators to recolonize vineyards after sprays of broad-spectrum pesticides. Many different species of these active hunters feed on a range of small and medium sized insect pests.



6b) Rather than building webs, jumping spiders are another group of active spiders that hunt down small prey species such as leafhopper nymphs or cutworm larvae (inset). Over 750 spider species have been recorded in BC.



6c) Many species of spiders prefer to remain on the ground or on low-lying vegetation, such as this rarely seen trapdoor spider, *Antrodiaetus* sp., a close relative of the tarantula. Larger spiders are able to capture small cutworm larvae overwintering on the ground.



6d) Fungal conidia or spore bodies emerging from a climbing cutworm pupa infected with a *Beauveria bassiana* fungus. Climbing cutworm larvae are infected by fungi, bacteria, and nematodes.



6e) Vertebrate predators of cutworm larvae include this spadefoot toad that hunts mostly at night to avoid the hot, dry conditions of the southern interior of BC. Coyotes, snakes and raptors help control rodent populations in vineyards.



6f) Many species of birds contribute to pest control in vineyards. Kestrels and other raptors feed on mice and gophers, while this house sparrow and other small birds feed on leafhoppers, soft scale and mealybug.

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