SNAKEFLIES (CAMELNECK-FLIES)

ORDER: NEUROPTERA (neuron=nerve, pteryx=wing, refers to complex venation of wings, resembling nerve webs)
Suborder: Raphidiodea (raphid=needle-like)

IMPORTANCE Both adults and larvae are predaceous. Economically important at high densities. European species released for biological control in New Zealand.

DISTRIBUTION Worldwide (mainly northern hemisphere): 855 spp.
North America: 21 spp. Canada: 7 spp. (36,87)

BIOLOGY Diurnal. Female uses long ovipositor to lay cluster of up to 100 eggs, stuck together, under loose bark or in bark cracks of conifers and deciduous trees. Up to 800 eggs per female lifetime. 10-15 larval instars. Overwinter as larvae or pupae. Generation time: 2-3 years. Holometabolous development (complete metamorphosis: larvae do not resemble adults, 4 life stages include egg, larva, pupa and adult).

FOOD SOURCE Adults: mature budworm (Choristoneura sp.) larvae and pupae, aphids, small insects. Larvae: aphids, caterpillars, small arthropods.

SEASONAL OCCURRENCE (Adults):

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MONITORING
Methods - Branch beatings, malaise trap, sweep net.
Habitats - Woodlands. Adults: on foliage, branches, trunks of pines, firs, other trees. Larvae: near insect prey on, under bark, rotten wood, in debris.

CONSERVATION
Pesticide Toxicities -
High: azinphos-methyl, carbaryl, carbofuran, dicrotophos, fenitrothion, malathion, methylparathion, mevinphos, monocrotophos, mexitcrobate (Zectran™), parathion, phosmet.
Variable (environment-dependent): carbophenothion, dimethoate, endosulfan, phosphamidon, rotenone.
Safe: aldicarb, demeton, methidathion, methoxychlor, naled, ryania, tetradifon, trichlorfon.

RECOMMENDED READINGS: 13, 50, 92
SN A K E F L I E S (CAMELNECK-FLIES)

DESCRIPTION

Adults 12-25 mm. Resemble tiny winged serpents, shiny, dark-grey or dark reddish-brown, elongate, long neck able to raise head above body like snake ready to strike. Large compound eyes, long antennae, flat, elongate head with flexible biting mouthparts, elongate, mobile thorax, 2 pairs of clear wings with complex venation held roof-like at rest (Figs. 20 and 21), female with long flexible ovipositor (Fig. 22). Poor fliers.

Eggs 1.5 mm x 0.4 mm. Elongate to oval, yellowish-white with knob.

Larvae Similar to beetle larvae. Black, elongate, flattened, land-dwelling larva with biting mouthparts (Fig. 23). Agile, move quickly forward or backward when disturbed.

Pupae Active, very mobile, with flexible mouthparts.

Figure 20 - Snakefly female.

Figure 21 - Snakefly female.

Figure 22 - Snakefly male (bottom) and female (top).

Figure 23 - Snakefly larva.
DUSTY-WINGS

ORDER: NEUROPTERA (neuron=nerve, pteryx=wing, refers to complex venation of wings resembling nerve webs)
Family: Coniopterygidae

IMPORTANCE: Both adults and larvae are predaceous. Important in fruit orchard pest control. Some occasional pollen or honeydew feeders.

DISTRIBUTION: Canada: 7 spp. (36)

BIOLOGY: Eggs laid singly on foliage or bark, hatch in 1-3 weeks. Larva development (3 or 4 instars): few weeks - few months, pupate in foliage or bark crevices. Overwinter as prepupae, generation time: few weeks - few years. Holometabolous development (complete metamorphosis: larvae do not resemble adults, 4 life stages include egg, larva, pupa and adult).

FOOD SOURCE: Moth larvae, aphids, spider mites, scales, insect eggs and other small arthropods. Mandibles used to catch prey, inject enzymes into prey to dissolve body contents and suck fluids through narrow tube formed with maxillae.

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MONITORING
Methods - Branch beatings, light trap.
Habitats - Trees infested with insect pests.

CONSERVATION
Pesticide Toxicities -
High: azinphos-methyl, carbaryl, carbosulfan, dicrotophos, fenitrothion, malathion, methylparathion, mevinphos, monocrotophos, mexacarbate (Zectran™), parathion, phosmet.
Variable (environment-dependent): carbophenothion, dimethoate, endosulfan, phosphamidon, rotenone.
Safe: aldicarb, demeton, methidathion, methoxychlor, naled, ryania, tetrachlorfuron, trichlorfon.

RECOMMENDED READINGS: 13, 92
DUSTY-WINGS

DESCRIPTION

Adults  2.5-5 mm. Minute, soft-bodied, covered with white waxy powder, two pairs of membranous wings (longer than the body) held roof-like at rest, chewing mouthparts, long thread-like antennae (Fig. 24). Weak fliers.

Eggs  Oval to elongate, with micropyle.

Immatures  Free-living larvae, with long sucking, sickle-like jaws, short head (Fig. 25), 5 pairs of simple eyes.

Pupae  Inside flat cocoon within 2 distinct envelopes spun of silk from anal glands (Fig. 26).

Figure 24 - Dusty-wing.

Figure 25 - Dusty-wing larva.

Figure 26 - Dusty-wing cocoons.
BROWN LACEWINGS

ORDER: NEUROPTERA (neuron=nerve, pteryx=wing, refers to complex venation of wings, resembling nerve webs)
Family: Hemerobiidae

IMPORTANCE Predaceous adults and larvae common in seed orchards. Active even in early spring. Considered for biological control around world. Generalist feeders, may disrupt other biological control programs.


BIOLOGY Nocturnal, hide in vegetation during day. Eggs (not stalked like green lacewings) laid singly or in groups, attached by their sides to plants. Up to 2500 eggs laid per lifetime. Life span: several months. Egg hatch: few days (unless overwintering), egg to adult: 24-30 days, larval development (3 instars): several weeks. Overwinter as eggs, prepupa or pupae in cocoons, or as adults. Generation time: few weeks to few years, up to 4 generations per year. Holometabolous development (complete metamorphosis: larvae do not resemble adults, 4 life stages include egg, larva, pupa and adult). May feign death when disturbed.

FOOD SOURCE Aphids (many thousands of aphids per lifetime) including balsam woolly adelgid (Hemerobius neadelphus), spider mites (all life stages), scales, moth eggs, moth larvae (larger than themselves), thrips and other soft-bodied arthropods. Emit enzymes for digestion outside body. Suck up body fluids with tube formed by maxilla and mandible. Cannibalistic tendencies.

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MONITORING Methods - Branch beatings, light trap, sweep net.
Habitats - Adult: hiding in vegetation during day in forests, fields, orchards, gardens, lighted buildings on summer nights. Larva: wherever prey occur, or in soil. Pupa: under protection, beneath loose bark, in soil, on vegetation.

CONSERVATION Attractants - Spray artificial diet (simulated aphid honeydew made from 1:1:10 Wheat™ or Formula 57™, sugar, and water) onto trees or posts (also increases egg production). Encourage pollen and nectar flowers such as dill and buckwheat. Other attractant plants include angelica, California coffeeberry, camphor weed, carrot, oleander, soapbark tree, tree-of-heaven, wild lettuce. Provide water sources during drought conditions.
Mowing - Leave some flowering weeds such as dandelion and goldenrod between rows.
Pesticide Toxicities - High: azinphos-methyl, carbaryl, carbofuran, dicrotophos, fenitrothion, malathion, methylparathion, mevinphos, monocrotophos, mexitacarbate (Zectran™), parathion, phosmet. Variable (environment-dependent): carboxenothion, dimethoate, endosulfan, phosphamidon, rotenone. Safe: aldicarb, demeton, insecticidal soap (Safer’s™ soap, adults: when able to fly away), methidathion, methoxychlor, naled, ryania, tetracifon, trichlorfon.

(42,77,97)

RECOMMENDED READINGS: 88, 92, 97
BROWN LACEWINGS

DESCRIPTION

Adults  4 - 12 mm. Small to moderate, similar to green lacewings but smaller, brown. Soft-bodied, prominent brown compound eyes, long thread-like antennae, chewing mouthparts, two pairs large, clear wings with complex venation, held roof-like over body at rest (Figs. 27 and 28). Weak, erratic fliers.

Eggs  White, turning orange, pink, and dark brown before hatching, elongate, lightly sculptured, not stalked like green lacewing.

Immatures  "Aphid wolf" larvae resemble minute alligators with prominent sickle-like jaws, short antennae. Similar to green lacewings, but swing head side to side when moving, also shorter, stout mouthparts (Fig. 29).

Pupae  Prepupae and pupae in loosely woven elliptical silk cocoons, spun from anus (Fig. 30). Equipped with mandibles to chew exit hole.

Figure 27 - Brown lacewing.

Figure 28 - Brown lacewing.

Figure 29 - Brown lacewing larva with prey.

Figure 30 - Brown lacewing pupa inside cocoon.
GREEN LACEWINGS

ORDER: NEUROPTERA (neuron=nerve, pteryx=wing, refers to complex venation of wings, resembling nerve webs)
Family: Chrysopidae

IMPORTANCE: Both adults and larvae are predaceous, larvae most effective. Commercially available across North America for biological control of agricultural pests. Able to suppress aphid numbers early in cool spring.


BIOLOGY: Nocturnal. Lay 10-30 eggs per day in spring on hair-like stalks, under foliage, singly, in rows, or in close groups. Egg stalks protect against cannibalistic siblings and predators. Egg to adult: 30-40 days, egg hatch: 5 days, larvae: 12 days, pupae: 10 days, adults: 20-40 days. Overwinter as adults or pupae. 3-4 generations/year. Holometabolous development (complete metamorphosis: larvae do not resemble adults, 4 life stages include egg, larva, pupa and adult). May emit offensive odour when disturbed.

FOOD SOURCE: Larvae: balsam woolly adelgid (Chrysopa quadripunctata) and other aphids, spider mites, mite eggs, small moth larvae, moth eggs, thrips, leafhoppers, and mealybugs. Use pincer-like jaws to pierce and suck body fluids from prey. Cannibalistic when prey is scarce. Adults prefer plant nectar and aphid honeydew.

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MONITORING: Methods - Branch beatings, light trap, sweep net.
Habitats - Adults: orchards, gardens, meadows, forest edges: in grass, weeds, trees, shrubs.
Larvae: aphid-infested foliage.

CONSERVATION: Attractants - (see brown lacewings).
Mowing - (see brown lacewings).

Pesticide Toxicities - High: azinphos-methyl, carbaryl, carbofuran, dicrotophos, disulfubenzuron, triflumuron (BAY SIR 8514, insect growth regulator) fenitrothion, malathion, methylparathion, mevinphos, monocrotophos, mexitcarbate (Zectran™), oxydemeton-methyl (Metasystox-R™), parathion, phosmet, tetrachlorvinphos, thiometon.
Variable (environment-dependent): carbophenothion, dimethoate, endosulfan, phoshamidon, rotenone.
Low: Bacillus thuringiensis (B.t.) (Dipel 4L™, for larvae), bioresemethrin (Isathrine™), cypermethrin (Ripcord™), deltamethrin (Decis™), fenvalarate (Sumicidin™), permethrin (Ambush™).
Safe: aldicarb, B.t. (Dipel 4L™, for adults), demeton, insecticidal soap (Safer's™, for adults, when able to fly away), methidathion, methoxychlor, naled, pirimicarb (Pirimor™), rynia, tetradifon, trichlorfon. (19,57,58,62,64,77,96,97)

RECOMMENDED READINGS: 42, 63, 88
GREEN LACEWINGS

DESCRIPTION

Adults  14-20 mm. Pale yellow to green body, 2 pairs of clear, delicate, lace-like wings with complex green venation, small head with large, shiny, golden, brass or red eyes, long antennae, prominent, strong, sickle-shaped chewing mouthparts used as sucking tubes (Figs. 31 and 32).

Eggs  White, elongate, on long slender stalk (Fig. 33).

Immatures  6-10 mm, "aphid lion" larvae active, flattened, alligator-shaped body, large sickle-like jaws, short antennae, pale yellow, white or greenish with brown or black marks (Fig. 34). More stout than brown lacewings, mandibles are more slender and curved, do not swing head side to side when moving, some carry debris such as sucked out prey bodies on hooked dorsal spines for concealment.

Pupae  Inside hard, round, white, cocoon which may have debris woven within it. Attached under foliage.