

# PARASITES AND PREDATORS

Glenn Fisher, Extension Entomologist, Oregon State University

Jaime Undurraga, former Research Associate in Entomology, Oregon State University

Many parasites and predators of insect pests occur naturally; others have been introduced to aid in biological control. Seed producers are concerned principally with beneficial insects that control three primary pests of the seed crop—lygus bugs, aphids, and the alfalfa weevil. All three pests—and particularly aphids—must be maintained at levels that are not damaging, yet provide a food supply for predators.

## CONTENTS

Parasites .....	1
Aphid Parasites .....	1
Alfalfa Weevil Parasites .....	3
Parasites of Moth Larvae—Cutworms, Armyworms, Loopers .....	3
Predators .....	3
Lady Beetles .....	3
Minute Pirate Bug .....	5
Bigeyed Bugs .....	5
Damsel Bugs .....	5
Green Lacewings .....	7
Hover Flies or Flower Flies .....	8
Spiders and Harvestmen .....	9
Numbers Required .....	9

**PEST MANAGEMENT** in alfalfa grown for seed relies on integrated control. Integrated control is the synchronization of biological and chemical control to reduce damage from pests. To use integrated control, three conditions must be met: population thresholds and injury levels must be established for the pest in question, reliable sampling techniques must be available, and selective pesticides must be used to achieve pest control with a minimum of disruption to predators and parasites.

Over 500 insect, mite, and spider species have been collected and identified from alfalfa fields, but the vast majority do not directly influence seed production. Many may be transients, or feed on

other plant life, or on decaying organic matter present in the field. In Idaho, Nevada, Oregon, and Washington, the primary pests of seed alfalfa are lygus bugs, aphids, the alfalfa weevil, the twospotted mite, and the alfalfa seed chalcid. Lygus bugs and aphids are usually the most important pests.

Major naturally occurring predators and parasites of the primary pests have been identified and the life cycles for many have been researched. Additionally, parasitic insects have been imported and released for control of the alfalfa weevil, the pea aphid, and the spotted alfalfa aphid.

Predatory and parasitic insects play a major role in pest management of three of the five primary pests of alfalfa grown for seed: lygus bugs, aphids, and the alfalfa weevil. Predator populations in particular are instrumental in helping growers decide if insecticide applications are justified.

The following discussion focuses on those beneficial insects and spiders whose role is clear. Special emphasis will be given to predators that have the most direct effect on pest populations during the critical prebloom, bloom, and postbloom periods.

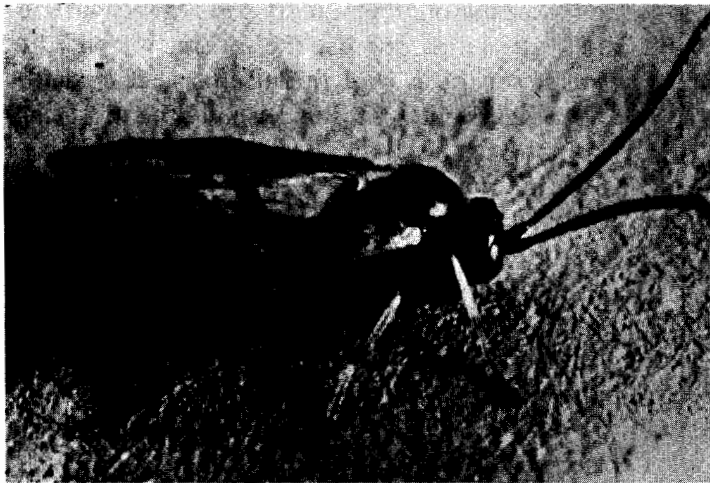
## PARASITES

### Aphid Parasites

There are three important aphid pests of seed



The larvae of tiny parasitic wasps feed inside aphids. *Aphidius* species, top, leave a naked brown shell, while *Praon* species mummies are covered with a filmy cocoon.



This small, slender ichneumon wasp is a parasite of the alfalfa weevil.



Tachina flies are beneficial parasites of caterpillar pests. They are quite bristly compared to other flies.

alfalfa in Idaho, Nevada, Oregon and Washington: the pea aphid, *Acyrtosiphon pisum*, the alfalfa aphid, *Macrosiphum creelii*, and the spotted alfalfa aphid, *Therioaphis maculata*. The alfalfa aphid is only a major pest sporadically, mainly in Washington. The spotted aphid was seldom important in Idaho, Oregon, and Washington until 1979, but reached damaging levels in Nevada and Utah much earlier. A fourth aphid, the blue alfalfa aphid, *Acyrtosiphon kondoi*, is a new pest first observed in Nevada in 1975 and in the other states in 1977 or 1978.

The most common aphid parasites are very small wasps. The female wasps insert single eggs into live aphids. The hatching larvae subsequently feed within and eventually consume the internal tissues of the host aphids, leaving only bronzed, hardened mummies. The larvae pupate within the aphid cadavers and emerge as adults through holes in the top. Several generations occur each year. These parasites overwinter primarily as mature larvae, or prepupae.

The most successful wasp parasite of the pea aphid in this region is *Aphidius smithi*. It was introduced into California from India in the late 1950s; within two years it had dispersed through the alfalfa-producing areas. It continues to be one of the most important factors in suppressing pea aphid outbreaks in California.

From 1959 to 1964, this parasite was introduced into the Northwest along with a European parasite, *Aphidius ervi ervi*. Additionally, two native parasites, *A. ervi pulcher* and *Praon pequodorum*, were also propagated and released. By 1970, all of these parasites had become established and have contributed to the biological control of pea aphid in the Northwest. *Aphidius smithi* probably is most important in pea aphid control in warm, arid regions. However, it does not attack the alfalfa aphid. *A. ervi pulcher* and *Praon pequodorum* parasitize both the pea aphid and the alfalfa aphid and *A. ervi ervi* is more effective in cooler climates.

Like the pea aphid, the spotted alfalfa aphid is an introduced pest from Europe. Its most effective parasites in North America have been imported from the Old World. Three European

species of parasites were introduced into California in 1955-56: *Aphelinus asychis*, *Praon exosoletum*, and *Trioxys complanatus*. They were subsequently released in southern Nevada during 1956-57 and had spread up to central Nevada by 1959.

### Alfalfa Weevil Parasites

Both the alfalfa weevil, *Hypera postica*, and a closely related species, the Egyptian alfalfa weevil (a southwest United States pest) have been targets of efforts to release and establish exotic parasites. The first and most successful parasite introduction for the alfalfa weevil in the West occurred between 1911 and 1914. The small ichneumon wasp, *Bathyplectis curculionis*, was introduced into Utah from Italy and Switzerland. Subsequent re-introductions and natural dispersal have helped distribute this parasite throughout the United States. It is an internal parasite of the weevil larva. After the prepupa overwinters in a cocoon, the adult becomes active in late spring and early summer, synchronized with the appearance of weevil larvae.

Activity of the adult parasite is restricted by high summer temperatures. It is primarily important in coastal areas or regions with cool summer temperatures.

### Parasites of Moth Larvae—Cutworms, Armyworms, and Loopers

In addition to the braconid wasps and the ichneumon wasps, parasitic flies contribute to the overall seasonal regulation of caterpillar pests. The two most common parasitic fly groups are the flesh flies and the tachinas. Tachinas resemble large, bristly house flies. They deposit eggs on or near the pest larvae (caterpillars). Usually only one parasitic larva feeds and develops within a single host, resulting in its eventual death.

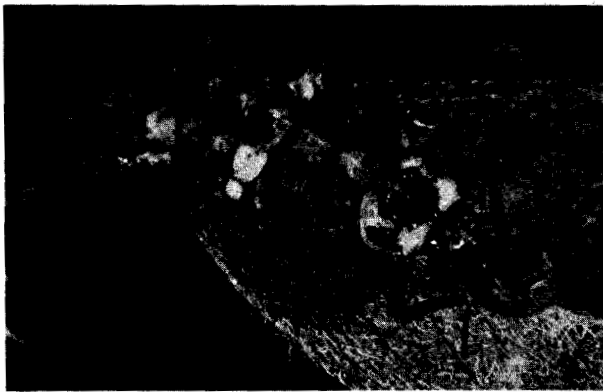
## PREDATORS

### Lady Beetles

Lady beetles are the most familiar insect pred-

ators in agricultural systems. They are easily identified; the adults have wing covers that are usually red, orange, or yellow marked with different arrangements of black spots. The front part of the body (thorax) is usually black with white spots. Larvae resemble tiny alligators, are nearly ½ inch long when full grown, and are marked in blues, blacks, grays, and oranges. Spindle-shaped, orange eggs are deposited in groups of 3-15 on the underside of vegetation during the alfalfa growing season.

About a dozen native North American species of lady beetles occur in alfalfa fields of the Northwest and Nevada. Less common are small black lady beetles belonging to the genus *Scymnus*, which are predators of spider mites. Common



The larvae of lady beetles also feed on aphids.



Convergent lady beetle eggs.

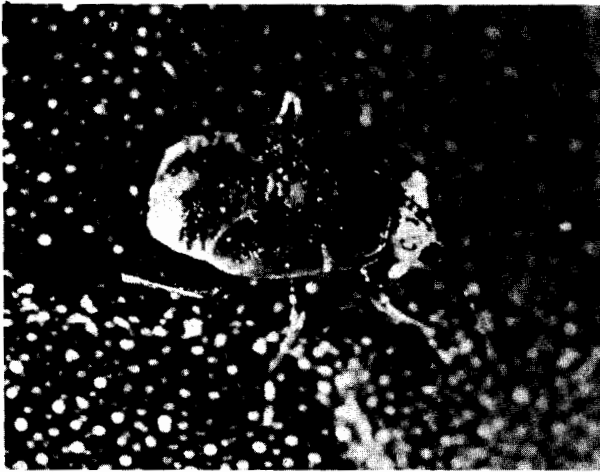
species in alfalfa seed fields are the convergent lady beetle, *Hippodamia convergens*; transverse lady beetle, *Coccinella transversoguttata*; and sinuate lady beetle, *H. sinuata*. The adult stage overwinters and colonizes alfalfa fields in the spring. For some species, such as the convergent lady beetle, distinct migrations of the adults from alfalfa fields occur in summer and fall. But, adults of some other species remain in or near alfalfa fields during the winter.

Lady beetles can be highly significant in keeping populations of aphids below injurious levels. They achieve this when large, early spring populations of adults migrate to alfalfa fields as the aphid populations increase. Both adults and larvae are fairly host specific to aphids and possess a tenacious searching capacity. Studies show adult females of *Hippodamia* species consume about 120 pea aphids or 400 spotted aphids before laying eggs and then eat an average of three aphids for each egg that is deposited thereafter. One female has the potential for laying up to 1,700 eggs over a lifetime that extends several months. Pupae occur as orange and black tear-drop shaped objects on vertical surfaces such as leaves, stems, and fence posts.

In several major species, overwintering lady beetles migrate long distances in the springtime to search for aphids. This search for food makes



Transverse lady beetle feeding on aphid.



Even the young stage or nymph of a bigeyed bug has prominent eyes. It feeds on aphids and small lygus bug nymphs, but cannot handle adult lygus bugs.

the release of lady beetle adults from cold storage or collected from overwintering sites of limited value. Adults usually fly long distances from their initial release point.

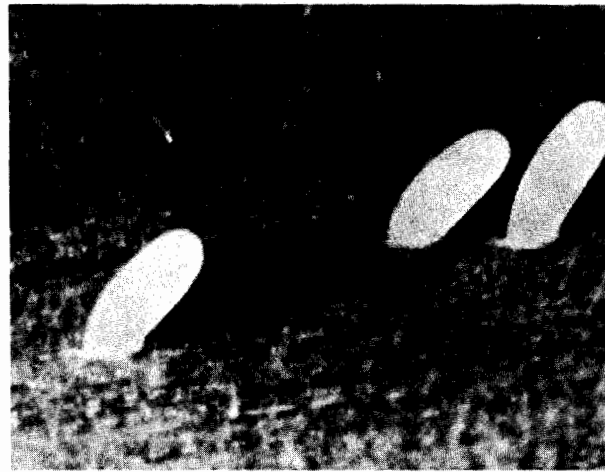
### Minute Pirate Bug

As the name implies, minute pirate bugs, *Orius tristicolor*, are very small ( $\frac{1}{16}$  inch long) true bugs. They are important predators of mites and thrips. The minute pirate bug is the smallest of the predatory insects in seed alfalfa. It is flat and checkered black and white. Both the adults and nymphs are predators. Pirate bugs overwinter as adults in sheltered areas in or near the field in tree bark, boards in and around buildings, and plant litter on the soil. The eggs are small, white or clear, and are inserted into plant tissues. The nymphs resemble the adults, but are smaller and red to orange. There may be as many as four generations each season in an alfalfa seed field.

Very small aphids, mites, thrips, and the immature stages of almost any insect are attacked and eaten by minute pirate bugs, but they are primarily predators of thrips.

### Bigeyed Bugs

At least two species of these true bugs are found

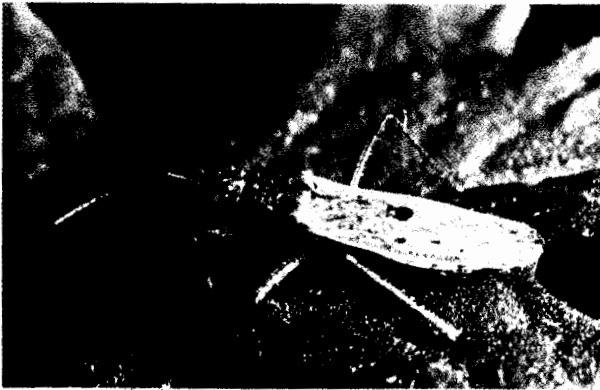


Eggs of the predaceous damsel bug are inserted into plant tissues. Damsels are more effective than bigeyed bugs because they feed on all stages of lygus.

in alfalfa seed fields in the Northwest and Nevada: the western bigeyed bug, *Geocoris pallens*, and the large bigeyed bug, *G. bullatus*. They are easily distinguished from other true bugs because of their large bulbous eyes, present even in the nymphal stages. They are commonly confused with lygus bugs and false chinch bugs. Adults are  $\frac{1}{8}$ – $\frac{1}{16}$  inch long and are dull brown or grayish. The western bigeyed bug overwinters as an adult in areas similar to that of the minute pirate bug. The large bigeyed bug overwinters as an egg. The former usually has two complete generations a year, while the latter has three. Bigeyed bugs appear in the field when other insects such as lygus bugs begin to increase to economically damaging levels. They are very important predators of aphids, immature bugs, and leafhoppers, and can be important in the regulation of lygus bugs. Both adult and nymphal bigeyed bugs consume lygus bugs, but the smaller nymphs of these predators prefer to feed on aphids. When large populations of aphids persist in a field, both nymphs and adults feed on aphids, diluting their effectiveness on lygus bugs, the primary pests.

### Damsel Bugs

Damsel bugs, slender true bugs, are important predators of lygus bugs and aphids. The adults



Damsel bug.



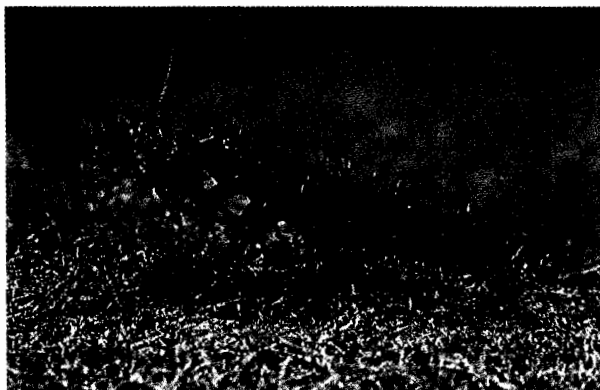
Introduced Indian aphid parasite.



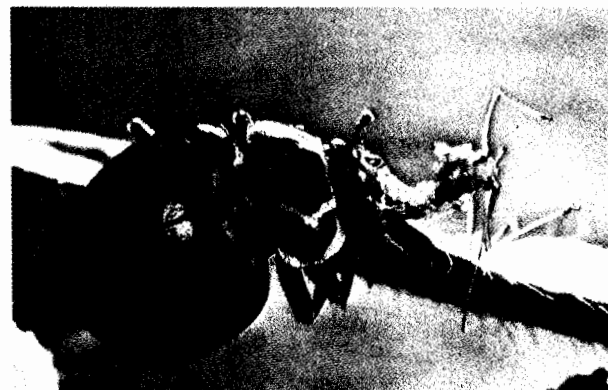
Bigeyed bug feeding on lygus bug nymph.



Lacewing larva feeding on aphid.



Lady beetle larva feeding on aphid.

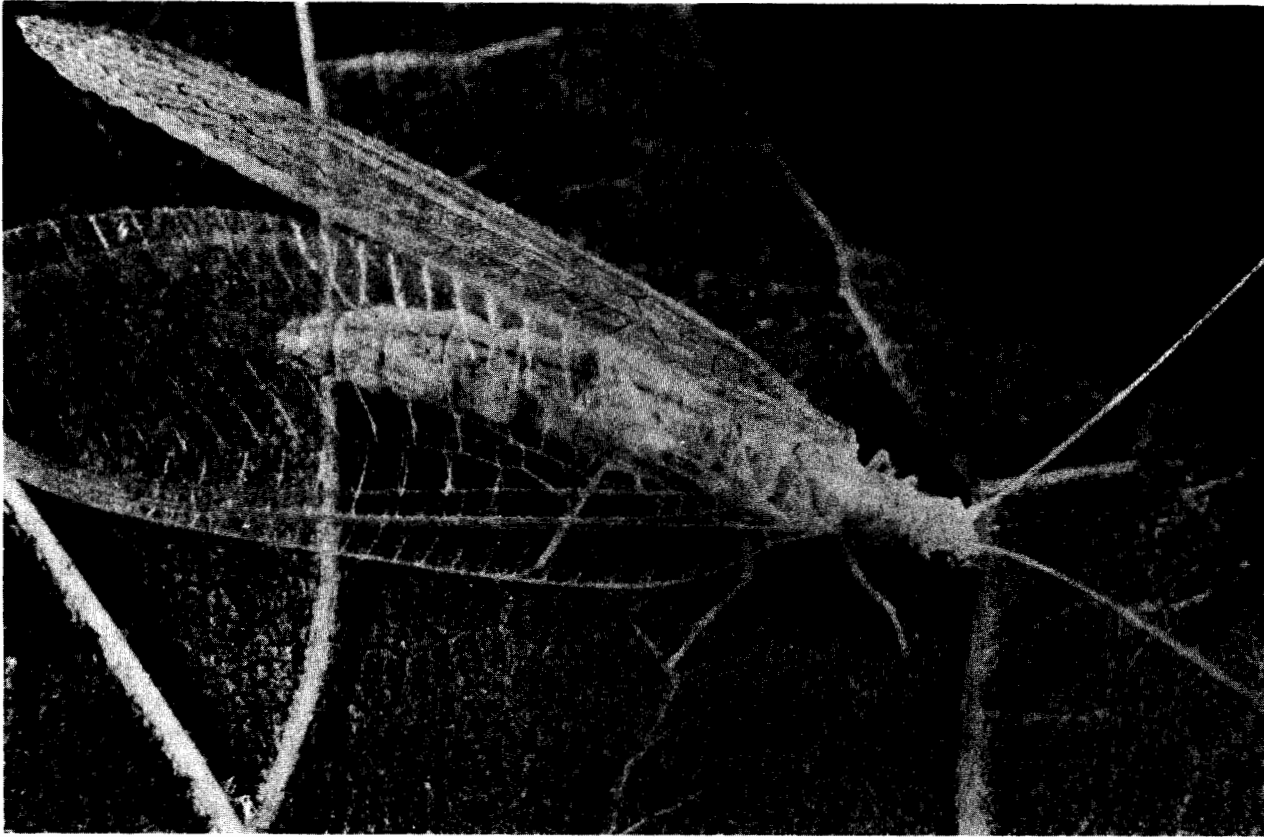


Lady beetle adult feeding on aphid.

are about  $\frac{1}{2}$  inch long and grayish brown. Both nymphs and adults are general predators. The common damsel bug, *Nabis americanoferus*, and the western damsel bug, *N. alternatus*, are the two most common species in alfalfa, with the latter being most prevalent in the Northwest. Adults overwinter in established alfalfa fields or near field

margins. They usually do not become numerous until after late June. Early instars are often found on the soil surface beneath the plants and under litter or duff near the stems. Aphids, leafhoppers, small larvae of the alfalfa weevil, and lygus bugs are preferred foods. Damsel bugs also feed upon spring-tails, grasshoppers, caterpillars, flies, and wasps.





The green lacewing is well named. Its larvae prefer to feed on aphids rather than alfalfa weevil larvae.

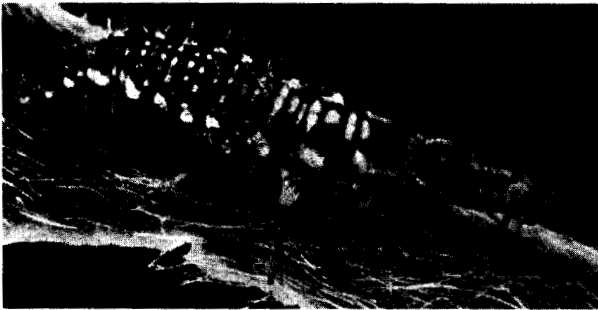
Bigeyed bugs and damsel bugs are key predator insects in the summer sampling program in alfalfa seed fields. When chemical sprays must be applied, insecticides are chosen that have the least disruptive effect on these insects as well as other predators and the pollinating bees. Low level aphid populations before bloom (below 100 per sweep) are actually beneficial and should not be treated, because they serve as food for these important insect predators. Bigeyed and damsel bugs feed and reproduce on the aphids and thereby build up a large predatory force for upcoming lygus bug generations. However, when aphid populations are large, over 300 aphids per sweep, bigeyed bugs and damsel bugs prefer to feed on aphids rather than lygus bugs.

After July or after the alfalfa seed has been set, a ratio of one or two bigeyed bugs or damsel bugs (in any stage) to one lygus bug in an alfalfa seed field will result in adequate lygus bug control, so

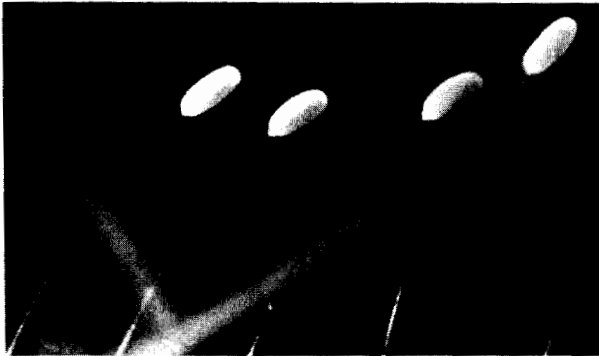
that a chemical application is not necessary. Cool, moist springs may allow aphids to build up and surpass the ability of these predators to control them. Warm to hot weather early in the year encourages these predators to multiply.

### Green Lacewings

There are two common species of green lacewings in the alfalfa seed-producing fields in this region: the goldeneye lacewing, *Chrysopa oculata*, and the common green lacewing, *C. carnea*, with the latter most prevalent in the Northwest. Adult lacewings reach a size of about  $\frac{3}{4}$  inch, are light green, and have two large wings with a series of net-like veins. Both species have two generations a year in the Northwest. Larvae of both species become most abundant after late June. Adults do not feed on insects but rather take nourishment from pollen and nectar produced by plants or



Green lacewing larvae have hollow, sickle-shaped jaws for sucking the juices from aphids or other prey.



Green lacewing eggs are laid on slender stalks so the first larvae which emerge will not eat the others.

honeydew excreted by aphids. Larvae are general predators and feed on a wide variety of insects. The lacewing prefers aphids over alfalfa weevil larvae. Studies show as many as 75 aphids may be consumed by lacewing larvae before pupation.

A couple of hundred eggs are usually deposited by each female during her lifetime. These eggs are deposited singly, in groups of up to 10, on the undersides of leaves on slender stalks. Up to 30 eggs may be deposited per day by each female. Upon hatching, the larvae immediately seek food. In shape and size they somewhat resemble lady beetle larvae but are flatter, smaller, and usually light yellow, brown, or white. They also possess hollow, sickle-shaped mandibles to suck fluids from their prey. This is in contrast to lady beetle larvae which consume the prey.

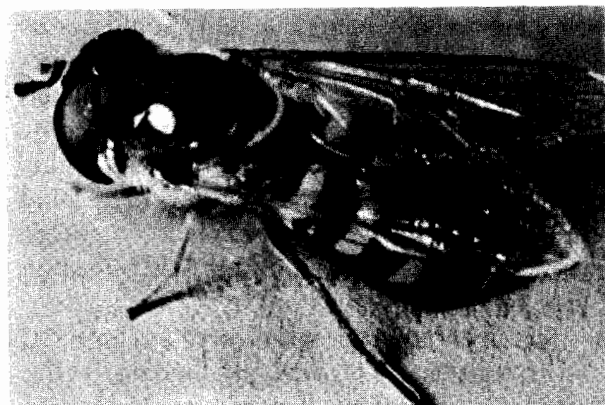
In California, where lady beetle larvae are scarce in the summer, green lacewing larvae play an important role in the regulation of aphid populations. They are less of a factor in the control of aphids in the Pacific Northwest and

Nevada, since they are generally quite scarce compared to other predators.

### Hover Flies or Flower Flies

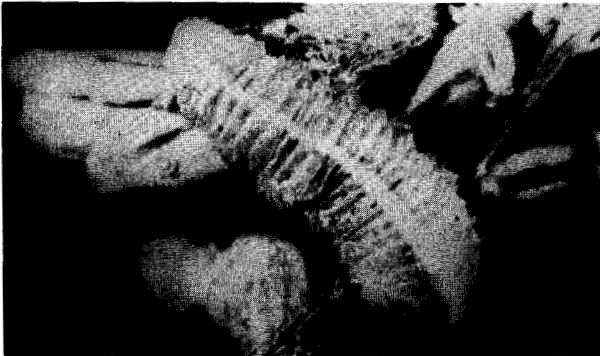
There are many species of hover flies in the Pacific Northwest. The most common species are *Scaeva pyrastris* and *Eupeodes volucris*. Like the lacewings, adults of these flies feed on honeydew, plant nectar, and pollen, while the larval stages are active predators of aphids. Adults are easily recognized in the field, since they resemble wasps with black-and-yellow or black-and-white striped abdomens. They hover and dart just above the alfalfa. Oval, white eggs with a pebbled surface (as seen under a hand lens) are deposited singly among aphid colonies. Eggs hatch in 3-4 days into a fleshy maggot tapered at the front end. Larvae vary from yellowish to green with white areas. They occasionally resemble alfalfa weevil larvae, but lack the black head capsule. Larvae pupate in the fall and overwinter on foliage or in the soil. In late spring or early summer, the adults become active. From three to seven generations per year are possible.

Hover fly larvae feed primarily on aphids. One larva may consume from 150-400 aphids in the course of its development from egg to pupal stage. *Scaeva* hibernates as an adult, while the other syrphids probably hibernate as pupae.



The adult syrphid or hover fly has a striped abdomen resembling a wasp or yellowjacket.





Hover fly larvae are fleshy maggots that feed on aphids. This species resembles the alfalfa weevil, but doesn't have a dark head capsule.



Crab spiders are the most common type found in alfalfa seed fields.

### Spiders and Harvestmen

Spiders, particularly crab spiders and harvestmen (daddy longlegs), are generalized predators in alfalfa seed fields. Recent studies show that these creatures can be an important component of the predator group which attacks the pests.

### Numbers Required

It is difficult to generalize "per sweep" figures of predator insects necessary for control of alfalfa seed pests because of the many variables involved. In general, one half of a bigeyed bug per sweep during early season and up to seven per sweep by mid-season are high counts that definitely enhance biological control. Damsel bugs at one half the numbers of the bigeyed bugs also aid biological control.

When broad spectrum insecticides are used, not only pests are killed but also predatory and parasitic insects. When lygus bugs reinvade a field from its margins, weeds, or drying vegetation, predators will also migrate into the field, but only *after* the lygus bugs have moved in. This is why large populations of lygus bugs develop during early and mid-season and predator counts remain low after the use of broad spectrum insecticide sprays.

Low numbers of aphids and small lygus bug nymphs are beneficial because they sustain populations of bigeyed bugs and damsel bugs important in the control of lygus bug populations.

