THE PEA AND BLUE ALFALFA APHID ON ALFALFA

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Abstract: The pea and blue alfalfa aphid are commonly found on alfalfa in California. The two aphids are sufficiently similar in appearance to create possible problems in identification. The blue alfalfa aphid can cause greater damage with fewer aphids than the pea aphid. Control can be employed using various methods: cultural, biological, chemical, planting resistant varieties, or a combination thereof.

Keywords Pea Aphid, Blue Alfalfa Aphid, Alfalfa

INTRODUCTION

Aphids can literally suck the life out of an alfalfa field. Aphids are still the primary insect pests of alfalfa. In particular, the blue alfalfa aphid, Acyrthosiphon kondoi and the pea aphid, A. pisum are the most damaging pests in California's central valley.

LIFE HISTORY, APPEARANCE AND HABITS

The pea and blue alfalfa aphid are cool season pests. Most damage occurs in early spring and again in mid-to-late fall. The blue alfalfa aphid appears earlier in the spring while the pea aphid continues its development later into the spring and early summer. The pea aphid predominates in the fall.

The blue alfalfa aphid is an introduced pest of alfalfa, and made its first appearance near Bakersfield, CA in the spring of 1974. The insect is native to the Far East (Manchuria, Mongolia and Japan) where it has been reported as a minor pest on alfalfa and some other small-seeded legumes. The blue alfalfa aphid damages alfalfa by stunting plants, causing leaf curl, shortened internodes, chlorosis, and eventual leaf drop. Seedling year stands can suffer widespread mortality from blue alfalfa aphid infestations. Aphid survival and reproduction rates are greater at lower (10-15^{o}C) than at higher (20-25^{o}C) temperatures. This may explain why the greatest level of activity and damage from this insect occurs in the early spring. Laboratory temperature treatments have failed to produce sexual forms of the aphid. Thus, the inability of eggs for overwintering may limit the northern distribution of the insect.

The blue alfalfa aphid tends to congregate on terminal growth or at the base of the plant on regrowth. The blue alfalfa aphid prefers to feed on the tender succulent parts of the alfalfa plant. The pea aphid tends to distribute itself more evenly over the entire plant. This behavior trait can be useful as a tentative identification characteristic.

The two aphids are similar in appearance and often occur together in the same field, on the same plant. The blue alfalfa aphid is somewhat smaller in size than the pea aphid The blue alfalfa aphid appears darker in color having a waxy bluish-green or light green color. The most consistant characteristic separating the two species are the dark bands found only on the pea aphid's antennal segments. The blue alfalfa aphid antenna is uniformly dark its entire length.

The pea aphid is the most common aphid found on alfalfa and it is widely distributed over the world. The pea aphid was probably introduced into the USA from Europe in the late 1800's. The pea aphid's first reported outbreak on alfalfa occurred in Kansas in 1921. Pea aphid color can vary from light to dark green, but a red form, known to occur in Europe, has been found in the USA. The red form differs from the green form in its reaction to resistant alfalfa varieties. Pea aphid feeding can cause stunting, yellowing, prevention of flowering, and reduced seed yield. Researchers have found that pea aphid feeding can reduce caroteen levels and cold-hardiness. In northern areas, true sexual forms develop in the fall and overwintering eggs are produced. Where the winter is mild

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the pea aphid continues to reproduce. Adult females give birth to active young nymphs which will molt four times before reaching the adult stage in approximately 12 days. Each female produces an average of six to seven young a day until 50 to 100 nymphs have been born. There are 7 to 20 generations of pea aphid per year.

CONTROL

If left unchecked by any control measures, these aphids can increase to phenomenal numbers. Control measures against insects can be grouped into four general categories:

Cultural control involving the use of regular or slightly altered farm practices to adversely affect insect pests.
2 Biological control based upon the major role predators, parasites and fungi play in controlling aphid pests.
3 Chemical control.
4 Use of resistant varieties.

Cultural Control.

The manipulation of farming practices is one of the oldest forms of insect control. Changed timing of alfalfa harvests can be of great value in regulating population numbers of potato leafhopper and alfalfa weevil. Manipulation of harvest timing has a limited impact on aphids. The actual cutting of the forage results in some aphid mortality, but not enough to sufficiently reduce aphid numbers. Rain is an effective destroyer of aphids, and can easily reduce populations by 80%. Sprinkler irrigation can have a similar effect, but is seldom used in alfalfa fields. Negative cultural practices can include the use of nurse crops that are more attractive to aphids. Broad beans (Vicia faba) are a preferred host plant of the pea aphid, and can produce staggeringly high numbers of pea aphid.

Biological Control.

A large number of insect species and birds are predators of aphids in alfalfa fields. An important predator of aphids is the convergent lady beetle, Hippodamia convergens, but aphids can seriously damage alfalfa before the beetles can bring the aphids under control. Attempts to artificially place lady beetles in the field have not produced acceptable control. Green lacewings, Chrysopa carnea, are also important regulators of aphid populations. Insect predators found in alfalfa fields occasionally feed on other insect pests, but their preferred diet appears to be aphids. Two parasitic wasps, Aphidus smithi, which attacks the pea aphid, and Aphidus ervi, which attacks both can provide effective control. Parasite activity can be detected by the presence of large golden brown "mummified" aphids on the upper leaf surfaces. A developing parasite is inside each mummy. Entomophthora fungi can be effective control agents especially under conditions of high humidity and cool temperatures. Certain disadvantages are characteristic of many approaches to biological control. Pathogens are very dependent upon temperature and humidity. Parasites and predators tend to build up in numbers and control the pest after the crop has been damaged. The individual grower can do little to initiate or enhance most instances of biological control.

Chemical Control

Chemicals were not used extensively on alfalfa until after World War II. Newly developed insecticides were discovered to provide excellent control of some insects and produce increased yields of alfalfa forage and seed. Their use on alfalfa became widespread. In time, concern arose over residues left on the harvested forage, and many products, especially the chlorinated hydrocarbons, have been phased out of use. The correct insecticide must be applied properly at the right time and in accordance with its registered label. Timing of the application is crucial. Treatment thresholds are different for the two aphids and are related to plant growth. Damage is more severe on short plants than on taller alfalfa for both the blue alfalfa aphid and the pea aphid. In the absence of predators and parasites the control thresholds presented in the accompanying table should be

used to prevent yield reduction. If you have a mixed population of pea and blue alfalfa aphids, use the control threshold for the blue alfalfa aphid. To sample for aphids, cut individual alfalfa stems at ground level. As you cut each stem, shake it onto a white sheet of paper into a pan. Examine the cut stem for small nymphs that often remain between new leaves and bud areas. Record the total number of aphids gathered in the pan and on each stem. Five or six stem samples should be taken at five widely-separated locations in the field.

Treatment Levels for Pea Aphid and Blue Alfalfa Aphid

Plant Height (Inches)	Pea Aphid	Blue Alfalfa Aphid
under 10"	40-50/stem	10-12/stem
over 10"	70-80/stem	40-50/stem
over 20"	100/stem	

In general, spraying with an approved insecticide is recommended when populations reach these indicated levels. Growers should check with local Extension Service personnel for materials and rates recommended for their areas.

Use of Resistant Varieties.

One of the best ways to reduce plant damage and yield losses caused by aphids is to plant an improved aphid resistant alfalfa variety. The development of insect resistant alfalfa varieties has had unprecedented success in the USA during the past 30 years. Ironically, much of the success can be attributed to the spotted alfalfa aphid, Therioaphis maculata. The research initiated by the introduction of this pest into the USA in 1954 was carried over into work done on other pests of alfalfa. The first varieties developed for resistance to the pea aphid were 'Washoe,' 'Apex,' 'Dawson,' and 'Mesilla.' These varieties were released in 1966 and 67. Sources of resistance to the blue alfalfa aphid were found in 'UC Cargo,' a cultivar resistant to the spotted alfalfa aphid and pea aphid. From this material the variety 'CUF 101' was developed and released. Multiple aphid resistance provides protection to several insect species throughout the growing season and allows for parasites and predators to feed on aphids that are usually present in subeconomic levels. Development and use of alfalfa plants resistant to insect attack is the most economical and effective method to control insect pests. A resistant variety will produce higher yields of better quality forage than susceptible varieties under the same level of insect infestation. Furthermore, use of a resistant variety can eliminate the added cost of applying a chemical insecticide.

In general, the resistance of all plants to insect attack is defined as the influence of heritable characteristics of the plant on the degree of damage done by the insect. Major mechanisms of resistance in plants are as follows:

ANTIBIOSIS: The plant has an adverse effect on the insect. The response in the insect may be measured in reduced fecundity (reduction in reproduction success), decreased size, reduction in life span and higher mortality. Various combinations in response are observed when the insect feeds on different resistant varieties.

ANTIXENOSIS: The plant is not a desirable or preferred host for the insect. The insect will tend to avoid the plant for oviposition (laying eggs), food, shelter, or a combination of these supporting activities.

TOLERANCE The plant is capable of growth, reproduction and injury repair, while supporting an insect population that would damage a nontolerant host.

Psuedoresistance is a serious problem in the selection of resistant plants. Psuedoresistance refers to apparent resistance in a potentially susceptible host plant, and results from evasion, conditioning and escape. In evasion, the host plant passes through its most susceptible stage at a time when insect numbers are low. Conditioning refers to

changes either in the plant or environment, or both, that makes the host unattractive to the pest insect. Blue alfalfa aphids are very sensitive to conditioning responses. They usually will not feed where other aphids have been. Escape is simply the chance absence of infestation that results from any one or a combination of variables. The degree of resistance between alfalfa and the aphids can be classified as follows:

Immunity:	An immune variety is one which a specific pest will never consume or injure under any known conditions. An immune plant can never be a host plant. Immunity is absolute. There are NO immune alfalfas.
High Resistance:	51% or greater of the plant's population survives a specific insect's attack.
Resistance:	31 to 50% of the plants survive.
Moderate Resistance:	15 to 30%.
Low Resistance:	6 to 14%.
Susceptible:	less than 5%.

Many varieties are currently available with good levels of resistance to both of these pests.