The western tarnished plant bug or lygus bug, Lygus hesperus (Knight), can be one of the most difficult pest problems in pistachio. The severity of this insect as a pest in orchards is dependent upon the development of the insect on host plants on which it lives and feeds. Unlike Phytocoris, Lygus does not develop on pistachio. Instead, Lygus moves into the orchard from surrounding crops or weeds and into the tree when understory vegetation becomes unsuitable. Environmental conditions such as rainfall and temperature, which favor the emergence and establishment of many broadleaf weeds, will favor Lygus population development in the general west side area of the San Joaquin Valley.

DESCRIPTION AND DEVELOPMENT
Lygus hesperus is predominantly brown with a gold straw-like mottling also present throughout the body. It is about 1/4 of an inch in length. Another species, Lygus elisus Van Duzee, is a light green color, the same size, but less common (Mueller et al., 2003). Both these species have yellowish triangular markings on the back between the wings. Lygus could be confused with Calocoris (Chapter 21) but Calocoris has two distinct spots on the pronotum just behind the head and usually has a green (compared to yellow for Lygus) triangular scutellum (Plate 22A). Lygus can be distinguished from Neurocolpus (Chapter 21) by their short first antennal segment and uniform leg coloration compared to a long first antennal segment and alternating white and brown bands on the legs and antennae of Neurocolpus (Plate 21A).

The immature or nymphal stages of Lygus are light green, hump-shaped and appear like aphids. As the nymphs mature, they develop wing pads. As the nymphs reach maturity, the presence of five black dots can be seen on the back of the insect. Two dots are located on the prothorax, two on the mesothorax, and one on the abdomen. Neurocolpus nymphs also have black dots and mottling, but also have black and white stripes on the legs and antennae (Plate 21B). Calocoris nymphs do not have black dots (Plate 22A). This stage is seldom found on pistachios because little egg-laying occurs on the crop. It is important to recognize the nymphs as they reach maturity, as this indicates when migration from host weeds to pistachios may occur. Just prior to migration small wing pads will be noted on the back of the nymphs (Plate 22A). While older nymphs can cause substantial damage in many crops, it is the adults that are key in population movements. Adults can fly away from unsuitable conditions, nymphs cannot.

Lygus overwinter as adults and move from ground cover protection to a variety of host plants in spring. In alfalfa, five to seven generations per year will occur but only three can develop in cotton (Leigh et al., 1996). The number of generations occurring in spring on non-crop hosts is determined by the amount of heat available for development. Developmental thresholds for L. hesperus range from 46.4°F (Champlain and Butler, 1967) to 53.6°F. As day length decreases to less than 9 hours, immature L. hesperus adults enter into an arrested development or sexual diapause (Beards and Strong, 1966).

DAMAGE
Like Neurocolpus, Calocoris and Phytocoris, Lygus damage is caused by feeding and occurs prior to hardening of the shell. These insects only cause epicarp lesion because they are incapable of piercing a hardened pistachio shell and do not cause internal nut (kernel) necrosis as do the larger stinkbugs and leaffooted bugs. Research conducted with Calocoris indicated
that shell hardening was sufficient to prevent
damage when 1,197 dd_{50} F had occurred after
75% bloom (Purcell and Welter, 1991).

HOST PLANTS AND MOVEMENT
To understand Lygus management it is
important to understand its biology in the agro-
ecosystem in which pistachios are found. Lygus
is a native insect in the San Joaquin Valley that
feeds on developing reproductive or growth
tissues. L. hesperus has a reported host range of
110 plant species, with two plant families
(Asteraceae and Fabaceae) constituting 39% of
its recorded hosts (Scott, 1977). Lygus bugs are
pests on cotton, seed alfalfa, strawberries, dry
beans, apples, pears, celery, broccoli, cauliflower, and vegetable seed crops. Lygus bugs
generally do not use grasses as
reproductive hosts.

Lygus intensity in any given year depends
on 1) the abundance of hosts (determined by
rainfall patterns), 2) warm temperatures in the
early season that allow Lygus to complete
multiple generations and 3) early summer hosts
(Plate 22B).

In California’s Mediterranean climate, few
non-cultivated hosts survive beyond June and
most Lygus movement from wild areas occurs
between April and May. Winter rainfall
patterns set the stage for the abundance,
diversity, and longevity of hosts that are
suitable for the colonization. Early winter rains
tend to produce grass years in the surrounding
hills while late winter rains favor broad leaf
hosts suitable for Lygus such as London rocket,
fiIaree and clovers (George et al., 1988).
Abundant rainfall in spring provides deep
moisture for Russian thistle and tarweed. In
years when moisture is adequate to extend
these host plants into June or July, additional
generations can build and create severe Lygus
migrations. Many crops such as sugar beets,
seed alfalfa, tomatoes, and weeds within
orchards, vineyards, and row crops provide
areas of refuge during the winter and spring,
regardless of weather conditions (Stern, 1969).

Summer hosts consist almost entirely of
cultivated plants or their associated weed
complexes, which in the San Joaquin Valley
includes over 200 crops. As these crops are
readied for harvest, Lygus will be forced to
migrate in neighboring fields. Alfalfa hay
represents a substantial portion of cropland that
Lygus inhabit and is preferred over many other
plants.

Thus, it is the proximity of a pistachio
orchard to these sources that determines the
intensity of the migration. Since the majority of
the production occurs on the western edge of
the San Joaquin Valley, the native plant growth
in the west side hills would be more important
as a source of Lygus then cultivated crops
bordering the orchard. For example, in years
when late winter or early spring rainfall
(Febraury through April) plants such as
Hemizonia (tarweed) or Russian thistle can
cover hundreds or even thousands of acres. The
population density can build to high levels if
the plant can draw sufficient moisture to
remain a suitable host to Lygus for multiple
generations.

Once the insects move into the orchard, the
understory vegetation can become an important
source of Lygus that can move into the tree
when the vegetation becomes unsuitable. Cover
crops that serve as good Lygus hosts include
vetch, bur medic, crimson, rose, and berseem
clover and these should be avoided. For seeded
cover crops the use of subterranean clover has
been suggested (Thomas et al., 1998) as a non-
Lygus host.

The timing of Lygus movement into a
pistachio orchard determines the severity of the
problem. Lygus can penetrate the shell only
before it hardens so migration into an orchard
between bloom and shell hardening is critical.
For example, both birdsfoot trefoil and bur
clover naturally decline prior to the growth of
nut clusters in pistachio. However, other weed
hosts that overlap with developing nut clusters
include lupine, London rocket, various
mustards, stinging nettle, and tarweed and the
development of Lygus on these weeds is
important. During dry years these weed species
usually become unattractive at the same time
when pistachio nut clusters are susceptible to
Lygus.

Plants that can act as hosts should be
sampled to detect of Lygus and estimate the
threat of movement. A standard 38” sweep net
is useful in striking the tops or sides of plants
and counting the insects caught in the net. As
an aid in predicting possible *Lygus* movements, it is valuable to identify the host, note its condition (i.e. vigorously growing, flowering, drying), and the age structure of *Lygus* collected from the host (nymphs or adults, instar of nymphs). Grasses are not a host for *Lygus* and sampling for *Lygus* in grasses will result in a misleading estimation of population abundance.

Following *Lygus* populations in these hosts over several years will help in describing their relationship to movement into pistachio orchards. The cotton industry has supported regional *Lygus* surveys in the San Joaquin Valley for many years. The annual reports are published in local papers, newsletters, and other media during late May or early June.

**MONITORING AND CONTROL**

Monitoring of *Lygus* should be done with a sweep net on host weeds at the appropriate time. Numerous sweeps should be made to detect the presence of *Lygus* and the stage of their development. As the wing pads become visible on the captured insects there is potential for migration if the weeds dry. If weeds can be sprayed within pistachio, the insects are easily killed. The material proven most effective is permethrin (Pounce® or Ambush®).

Within the pistachio tree, *Lygus* is difficult to detect. The most common method of sampling is the use of a beating tray whereby the catch tray is held under a nut cluster and the limb holding the cluster is struck with a club to dislodge bugs. This technique is not very efficient and even two or three insects found is an indication of a damaging population. If epicarp lesion is increasing within the orchard and adult *Lygus* can be found, it may be necessary to spray the crop. The amount of lesion present is also a determinant in deciding upon the need for treatment. There are no current thresholds for treating *Lygus* in pistachio. If the decision to spray is made, timing should be based on the development of adults in the weed hosts nearby. It is important not to disturb weeds within the orchard during the period from bloom through shell hardening. If weeds are disturbed, *Lygus* may be driven into the trees where bug feeding results in epicarp lesion.

Due to the migratory nature of this pest, future work should address regional management of *Lygus*. Research has already documented that alfalfa is a preferred host of *Lygus*, and practices such as strip cropping can help keep *Lygus* in the alfalfa (Goodell et al., 2000). Future research could potentially develop better ways to utilize host weeds or plants as trap crops which would keep the insect from migrating to the less preferred pistachios.

**Literature Cited**


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