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### Title

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# A Field Key to the Most Common *Lygus* Species Found in Agronomic Crops of the Central San Joaquin Valley of California

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## Introduction

This key can be used to distinguish between three species of *Lygus* reportedly found in agronomic crops in the Central San Joaquin Valley of California. *Lygus hesperus* Knight (western tarnished plant bug) is the predominant species found, while *Lygus elisus* Van Duzee (pale legume bug) is observed less frequently. *Lygus lineolaris* Palisot de Beauvois (tarnished plant bug) has been reported from the Central San Joaquin Valley, but is rarely found in field crops. Being able to correctly identify the various *Lygus* species may improve interpretation of research results or enhance research progress in areas such as biological control and assessment of economic damage. Studies of overwintering habitat and intercrop movement will also be facilitated.

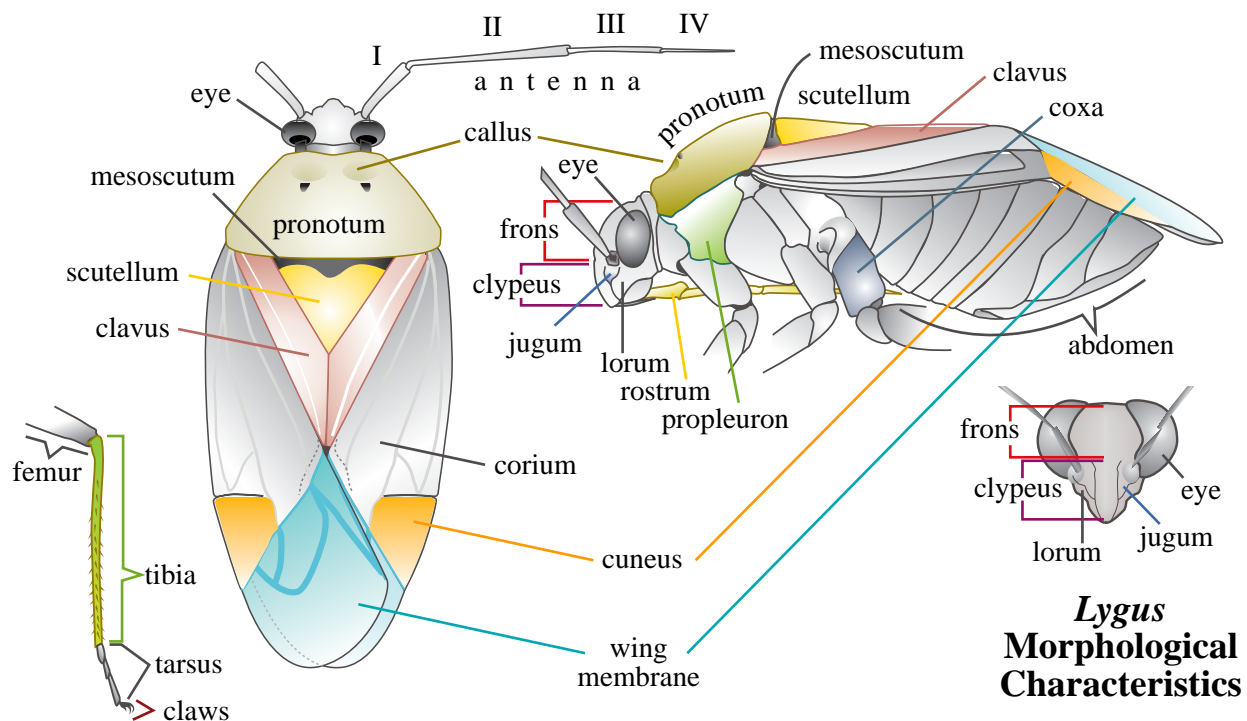
## Collection Methods

Collect lygus bugs using a sweep net or other sampling device. Prior to beginning the identification process, place specimens in the freezer for at least 24 hours to kill them. Alternatively, they may be placed in ethyl alcohol to kill and preserve them, but specimens tend to become brittle if stored in alcohol for more than 3-5 days prior to examination.

## General Instructions

It is important to work through the field key step by step. Completing Step 8 of the key is extremely important to confirm the identity of the species in question, especially if the specimen could be an overwintered adult. Terms and morphological characters are defined in the glossary at the end of this key.

**Use a minimum of 10x magnification and the best lighting available.**

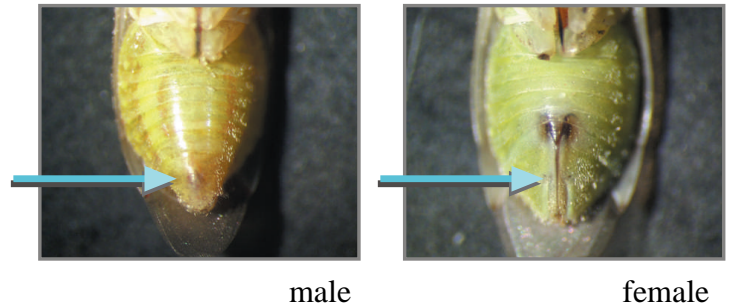


## Step 1

**Separate males from females. Continue the identification process using males only.**

This key best describes males of each species. Female lygus bugs of some species exhibit greater variability in coloration, markings, and size and are therefore not always reliably identified using existing keys.

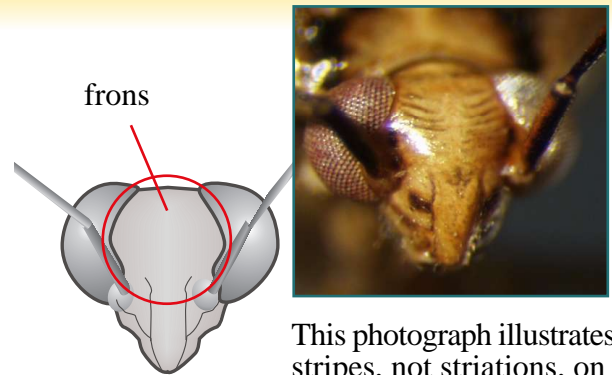
Male specimens can be separated from female specimens by observing differences apparent on the lower ventral surface of the abdomen. Females have an obvious slit on the rounded abdomen where the ovipositor rests. The abdomen of the male is less round, tapers nears the end, and does not have a slit.



## Step 2

**Examine the frons (face).**

Look directly at the insect's face, as if it is flying toward you. All of the species of *Lygus* distinguished in this key have a smooth frons, not striate (grooved). The color patterns observed on the frons, often oblique stripes, are *not* considered striations. Move the specimen so light travels across the "forehead" area of the face. You should see a smooth surface, not a "wrinkled" surface.



This photograph illustrates stripes, not striations, on a smooth frons.

## Step 3

**Examine the hind tibiae (long segment of the back legs).**

The hind tibiae in these species are green or yellow, not red or black. There may be some red shading near the ends of the tibia, but on the whole, the tibia will be green or yellow.

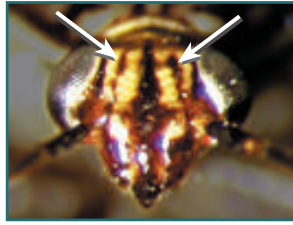


**Check to make sure these characteristics are confirmed prior to proceeding with the key. If you observe grooves, or corrugations, on the frons, or if the hind tibia is red or black, this key will not properly identify the species. You will need to take the specimen to your local farm advisor or refer to Kelton's key (1975) to properly identify the species.**

## Step 4

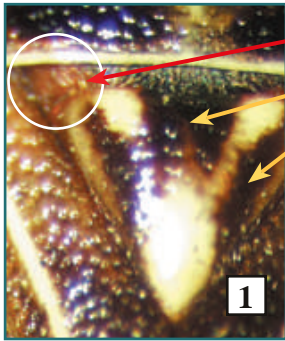
Examine the frons (face) by looking at the specimen as if it is flying toward you.

If the frons has submedian vittae (distinct dark brown or black vertical stripes), the species is most likely *L. lineolaris*.



If the frons does not have submedian vittae, proceed to Step 5.

To confirm the identification as *Lygus lineolaris*, look for the presence of:



- (1a) yellow or reddish lateral margins on the mesoscutum
- (1b) median and lateral lines on the scutellum
- (2) pale cuneus with a very large black apex
- (3) reddish or black markings on the clypeus, lorum, and jugum
- (4) black spots, rays and areas near the callus and base of the pronotum
- (5) dark lines on the propleura



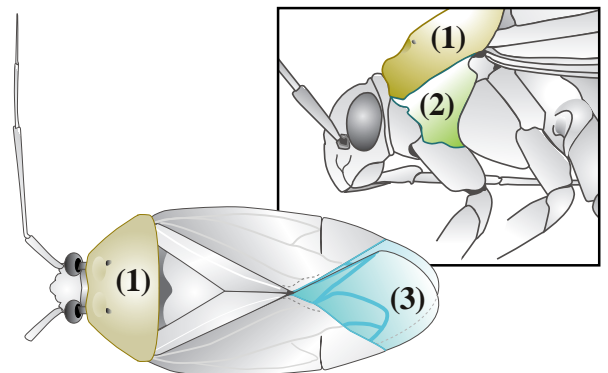
## Step 5

Examination of three characteristics will usually allow you to determine whether a specimen is *Lygus elisus* or *Lygus hesperus*.

The characteristics are observed by examining

- (1) **B** the pronotum,
- (2) **B** the propleura (side of the pronotum), and
- (3) **B** the wing membrane.

Individually, these characteristics have shown a 94% or higher probability of correctly identifying the species.

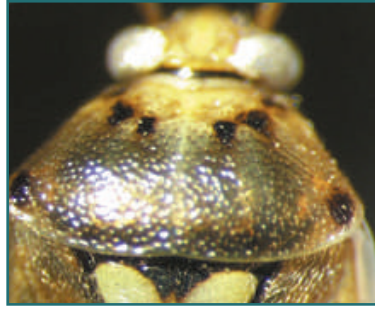


## Step 5 (continued)

### B Pronotum



If the pronotum has a single black spot above each callus, or the callus is outlined in black, then the species is most likely *L. elisus*.



If marks on the pronotum include several pairs of spots, often extending into rays, and dark areas around the callus, then the species is most likely *L. hesperus*. Often the corners of the pronotum are also dark.



### B Propleura

No spot



If there are no marks on the propleura (check both sides), then the species is most likely *L. elisus*.

1 spot



2 spots



2 lines

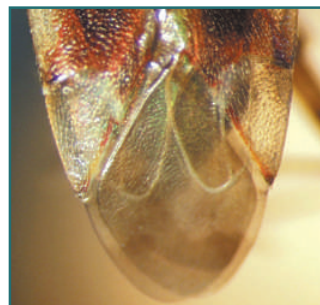


If a spot, line, or multiple dark spots or lines are observed on the propleura (check both sides), then the species is most likely *L. hesperus*.

### B Wing Membrane



If the wing membrane is clear, then the species is most likely *L. elisus*.

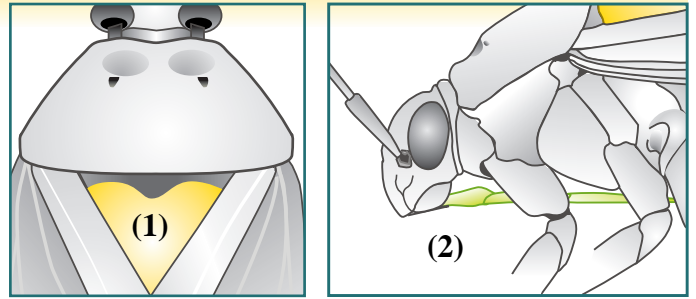


If the wing membrane is tinted black, then the species is most likely *L. hesperus*.

## Step 6

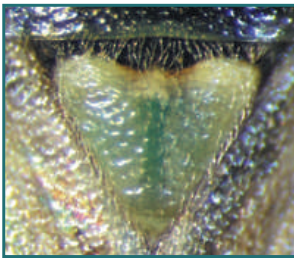
To confirm the initial identification based upon the three most reliable characteristics, continue the process by examining two additional characteristics:

- (1) **B** the shape of the scutellum, and
- (2) **B** the relative length of the rostrum.

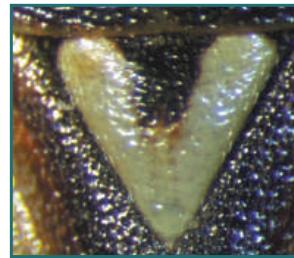


These characteristics are somewhat less robust in identifying a specimen as compared to the first three.

### **B** Shape of the Scutellum



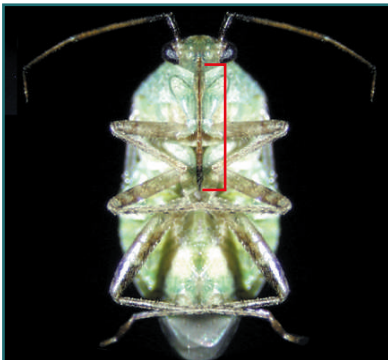
If the median lines on the scutellum do not extend to form a deep heart shape, then the species is most likely *L. elisus*.



If the median lines on the scutellum extend to form a deep heart shape, then the species is most likely *L. hesperus*.

### **B** Relative Length of the Rostrum

Because of the variable position of the head in relation to the body, and the common interference with legs or the mounting apparatus, rostrum length is often not clearly discernible.



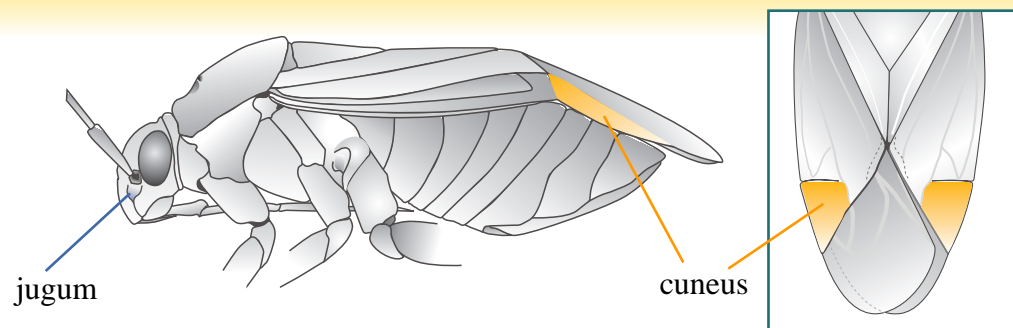
If the rostrum does not extend below the point of attachment of the last pair of legs (the metacoxae), then the species is most likely *L. elisus*.



If the rostrum extends below the point of attachment of the last pair of legs (the metacoxae), then the species is most likely *L. hesperus*.

## Step 7

Examine the **juga**, **cuneus**, and **body and wing coloration**.



## Step 7 (continued)

- **Juga**

No juga marks

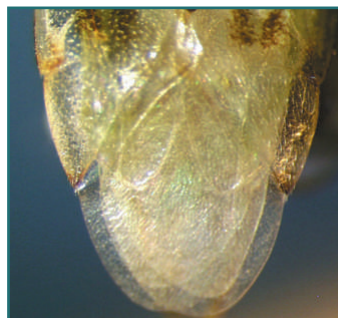


Juga marks



About half of the time, *Lygus hesperus* will exhibit stripes on the juga. Stripes are not usually observed on the juga of *L. elisus*. Observation of this characteristic can be used to confirm the identification of *L. hesperus*, but the absence of juga marks does not confirm the identification of *L. elisus*.

- **Cuneus**



In *L. elisus*, the cuneus is transparent green with a small dark apex.



The inner margin and the tip of the cuneus in *L. hesperus* is often dark or reddish.

- **Body and Wing Color**



In *Lygus elisus*, the body is uniformly green or yellow-green. Wings are pale green and translucent, with brown markings. There are no strong black/dark brown marks on the body or wings.



In *Lygus hesperus*, the body color is yellow green with the abdomen often, but not always, marked with brown/black/red/orange coloration for a variegated appearance. Wings are green marked with dark brown/black/red combinations. The overall appearance of the body and wings is often dark brown/black/red.

## Step 8

Use the detailed descriptions of morphological characteristics presented on the following pages to confirm the identity of the species. All descriptions are taken directly from Kelton (1975).

### *Lygus hesperus* (Knight)

**Male:** length 5.32-6.5 mm, width 2.38-2.68 mm

**Head:** length 0.98 mm, width 1.22 mm. Yellowish green, bar on jugum and line about antennal socket often black; frons smooth.

**Antennae:** I – 0.65 mm, yellowish, brown beneath; II – 1.82-2.17 mm, reddish brown, base and apex black; III – 1.0 mm, brown; IV – 0.63 mm, brown.

**Rostrum:** 2.45-2.66 mm long

**Pronotum:** 1.96-2.38 mm wide at base; green, outer half of callus, spot behind callus, and spot at basal angle, black; in darker forms entire pronotum darkened; anterior angles rounded; shallowly and closely punctate.

**Mesoscutum:** black

**Scutellum:** yellow, two median dashes at base, black.

**Hemelytron:** yellowish green, apical half of corium often reddish; in darker forms clavus and corium strongly marked with black, veins and sutures reddish, cuneus pale green, inner margin and tip often reddish; wing membrane lightly fuscous (dark brown, approaching black), veins clear; pubescence long and dense, pale.

**Ventral surface:** greenish yellow, sternum often black; abdomen often marked with black or reddish; legs yellowish, femora with usual markings reddish brown.

**Female:** length 5.6-6.3 mm, width 2.52-2.8 mm. Rostrum: 2.52-2.73 mm long. Much like male in pubescence but more robust and color yellowish green, and hemelytra seldom reddish or brown.

The description above is based on summer adults. Overwintered adults are similar in size and appearance except that the males are somewhat darker brown on the pronotum and hemelytra, while the corresponding areas in the females are pinkish. The scutellum in the females is contrastingly green. Overwintered adults often persist to the end of July while summer adults appear about the middle of June or earlier and continue through July and August.

**Host Plants:** This species is a known pest of alfalfa seed, cotton, fruit and vegetable crops. It is also commonly found in alfalfa hay but is not a pest of that crop. It is fairly well confined to the areas where agriculture is carried on and probably attacks other agricultural crops similar to those attacked by *L. elisus*. It also feeds on a great variety of weeds and other herbaceous plants.

**Distribution:** This species is widely distributed in the western United States, extends into British Columbia, and is likely to be found in Mexico. This species ranks with *L. elisus* and *L. lineolaris* in abundance in agricultural areas and is confined to relatively low altitude of the Rocky Mountains region.

### *Lygus elisus* (Van Duzee)

**Male:** length 4.8-5.8 mm, width 2.24-2.8 mm

**Head:** length 0.91 mm, width 1.19 mm. Pale yellowish green, often line above antennal socket, black; frons smooth, often marked with black or reddish.

**Antennae:** I – 0.52 mm, yellowish brown, black beneath; II – 1.40-1.82 mm, yellowish brown, base and apex often black; III – 0.77 mm, brownish; IV – 0.56 mm, brown.

**Rostrum:** 2.10-2.38 mm long

**Pronotum:** 2.10-2.35 mm wide at base; pale green, spot behind each callus black; anterior angles rounded; deeply and closely punctate.

**Mesoscutum:** black

**Scutellum:** green, two median dashes at base, and often lateral lines, black.

**Hemelytron:** pale green; middle of clavus often fuscous; apex of corium usually with two fuscous patches; tip of cuneus black; wing membrane mostly clear, veins yellow; pubescence moderately long and dense, silvery.

**Ventral surface:** yellowish green, sternum black; legs pale green, usual markings on femora brown.

**Female:** length 4.4-5.3 mm, width 2.31-3.01 mm. Rostrum: 2.10-2.52 mm long. Much like male in color and pubescence but more robust and rostrum slightly longer.

The description above is based on summer adults. Overwintered adults are similar in size and appearance but are more extensively marked with fuscous or black, and as a result, a synonym exists. *Lygus nigrosignatus* Knight is a synonym of *L. elisus*. The former was described from overwintered adults. *Lygus desertinus* Knight is also a synonym of *L. elisus* (Wheeler, 2001). The lateral margins of the mesoscutum will be yellowish in these insects.

The frons in the overwintered adult is often marked with an inverted black “V.” The callus on the pronotum is margined with black, and behind are two black dashes that often extend posteriorly to join the black subbasal margin. The scutellum often has lateral lines in addition to the usual median lines, thus forming a “V” on each side of the middle. The dark markings on the clavus and corium are often extensive, and the cuneus is usually fuscous along the basal margin. The ventral surface is mostly black with the pleura and the side of abdomen greenish.

These extensive dark markings are quite obvious when the adults emerge from hibernation or later in the summer and fall. The dark markings are also more pronounced at higher altitude and latitude.

Overwintered adults may be collected in late July, while the summer adults appear about the middle of June. Further south the hibernating adults may be active in April and later at higher altitudes and as the season progresses.

**Host Plants:** This species is an important pest of alfalfa seed, rape, vegetable crops, cotton, and fruit trees. It is commonly found in alfalfa hay but is not a pest of that crop. It also feeds on a great variety of weeds and other plants that are normally associated with agriculture.

**Distribution:** This species is widely distributed throughout the prairie-parkland and Rocky Mountain regions of North America, and extends into Alaska, and probably occurs in Mexico. It was originally described from California.



## Step 8 (continued)

### *Lygus lineolaris* (Palisot de Beauvois)

**Male:** length 4.9-5.74 mm, width 2.38-2.8 mm

**Head:** length 0.91 mm, width 1.12 mm. Yellowish brown, middle of clypeus, lorum, and jugum marked with reddish or black; line above antennal socket red or black; frons smooth, median line and submedian diagonal line red or black.

**Antennae:** I – 0.56 mm, reddish brown, black beneath; II – 1.40-1.82 mm, brown, base and apical third black; III – 0.88 mm, black; IV – 0.74 mm, black.

**Rostrum:** 2.24-2.52 mm long

**Pronotum:** 1.96-2.31 mm wide at base; yellowish brown to reddish brown; outer callus, two dots or rays behind, black; basal angle and often subbasal margin at base, black; anterior angles rounded; shallowly and widely punctate.

**Mesoscutum:** black, lateral margins reddish.

**Scutellum:** yellowish, two median and lateral lines, black or reddish.

**Hemelytron:** reddish brown; darker at apex of corium; cuneus pale green, basal and inner margins reddish, tip black; wing membrane fuscous, veins reddish; pubescence moderately long and dense, yellowish.

**Ventral surface:** reddish brown, sternum and middle of abdomen black; legs yellowish, usual markings on femora reddish brown.

**Female:** length 5.25-5.95 mm, width 2.52-3.01 mm. Rostrum: 2.17-2.52 mm long. Much like male in color, markings, and appearance, but more robust.

The description above is based on overwintered adults. Summer adults are quite similar in size but may vary in color from pale yellow with few black markings to reddish brown, and to almost completely black with few pale yellow markings. However, the characteristic pattern on the head, and the reddish or pale lateral markings of the mesoscutum, and the rather long and dense pubescence on the hemelytra readily distinguish this species from its close relatives.

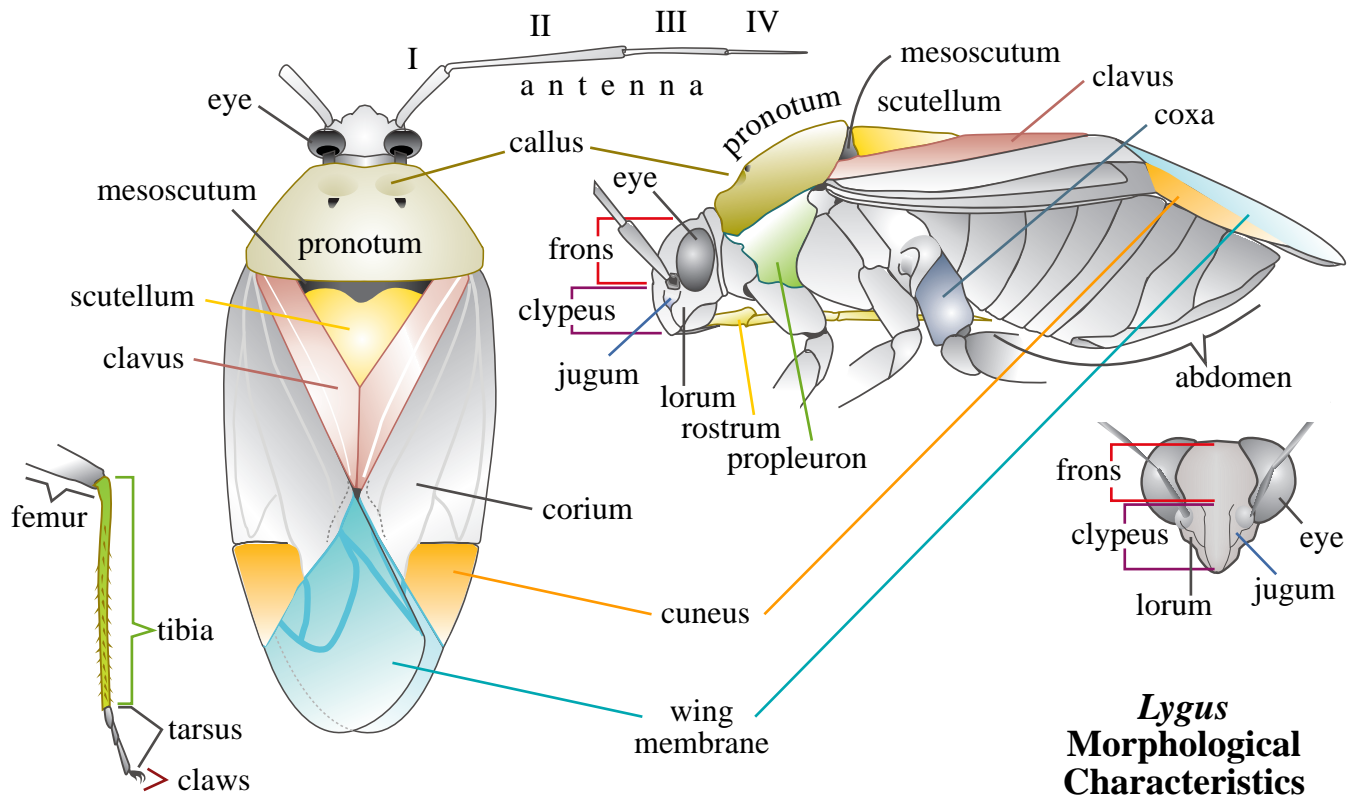
Summer adults may appear as early as the end of April and later at higher altitudes and as the season progresses northward.

**Host Plants:** This species feeds and breeds on a great variety of plants. It has been reported causing damage or injury to the following crops: fruit trees: apple, apricot, cherry, grape, peach, pear, plum, quince; commercially grown flowers: asters, carnations, chrysanthemums, dahlias, marigolds, peonies, roses; garden crops: beans, beets, cabbage, celery, carrots, cucumbers, peas, potatoes, lettuce, turnips; other crops: alfalfa, clover, tobacco, cotton, blackberries, raspberries, currants, strawberries.

**Distribution:** The species was described originally from the eastern United States but is now known to be the most widely distributed and common species in North America. It is found in all agricultural regions at low and relatively high altitudes.

## Glossary

These definitions are taken largely from Torre-Bueno (1950) and Gordh and Headrick (2001). Refer to the original sources for any terms not defined in this glossary or additional information as needed.



### *Lygus* Morphological Characteristics

**Abdomen** - the third or posterior division of the insect body; consists normally of nine or ten apparent segments; bears no functional legs in the adult stage.

**Antenna** (pl. antennae) - the paired, segmented, flexible, sensory organs, borne one on each side of the head, commonly termed horns or feelers.

**Anterior** - in front; before.

**Apex** - that part of any appendage, joint, or segment opposite the base by which it is attached; that point of a wing furthest removed from the base or at the end of the costal area.

**Basal** - at or near the base or point of attachment to or nearest the main body.

**Callus** (pl. calli) - a hard lump or swelling of the cuticle; in particular, such a swelling at the base of the wing articulating with the thorax by means of an axillary (Tillyard); in Heteroptera, the thickened or raised spots on the thorax, especially of Pentatomidae.

**Clavus** - the club of an antenna; clava, clavola; the sharply pointed anal area of the hemelytra in Heteroptera, next to the scutellum when folded.

**Clypeus** - that part of the head of the insect below the front, to which the labrum is attached anteriorly; in Heteroptera, the cephalic end is called the tylus (MacGillivray).

**Corium** - in Heteroptera, the elongate middle section of the hemelytra which extends from the base to the membrane below the embolium.

**Coxa** (pl. coxae) - the basal segment of the leg, by means of which it is articulated to the body.

**Cuneus** - in Heteroptera, the small triangular area along the anteroapical margin of the corium on the hemelytron.

**Femur** (pl. femora) - the third segment of the insect leg, the thigh, usually the stoutest segment of the leg.

**Frons, front** - the unpaired sclerite of the head lying between the arms of the epicranial suture; it bears the median ocellus (Imms). The upper anterior portion of the head capsule, usually a distinct sclerite between the epicranium and clypeus (Tillyard).

**Fuscous, fuscus** - dark brown, approaching black; a plain mixture of black and red.

**Hemelytron** (pl. hemelytra) - the anterior wing in the Heteroptera, the basal half of which is thickened and the apical membranous.

**Heteroptera** - considered by some taxonomists to be a suborder (which contains the true bugs, including *Lygus*) of the order Hemiptera, the other suborder of Hemiptera being Homoptera (which contains the aphids, scale insects, leafhoppers etc.). Others consider Hemiptera and Homoptera to be separate orders.

## Glossary

**Jugum** (pl. juga) - in Heteroptera, the two lateral lobes of the head, one on each side of the tylus.

**Lateral** - pertaining to the side.

**Lorum** (pl. lora) - in Heteroptera, the plate or sclerite on the outer sides of the juga and in front of the eyes.

**Median** - in or at the middle.

**Membrane** - any thin, transparent, flexible body tissue; in Heteroptera, the thin transparent or translucent tip of the hemelytra, as distinguished from the thickened basal part, the corium.

**Mesoscutum** - in Heteroptera, the anterior part of the mesothorax, lying under the edge of the prothorax, ordinarily not visible.

**Meta** - Greek prefix; used to designate any posterior part of a structure.

**Oblique** - slanting; any direction between perpendicular and horizontal.

**Overwintered** - surviving through the winter months.

**Ovipositor** - an egg-laying tube of a female insect's abdomen; the tubular or valved structure by means of which the eggs are placed.

**Pleuron** (pl. pleura) - the lateral region of any segment of the insect body, commonly of the thoracic segments.

**Posterior** - a term of position pertaining to a structure or color located behind the midline; toward the rear end of the insect; opposed to anterior.

**Pronotum** - the upper or dorsal surface of the first thoracic segment (prothorax) of an insect's body.

**Propleuron** (pl. propleura) - the lateral portion of the prothorax.

**Pubescence** - short, fine, soft, erect hair.

**Punctate** - descriptive of surface sculpture that is microscopically pitted; pertaining to a surface with impressed points, microscopic pits or punctures.

**Rostrum** - in Hemiptera, the beak; a jointed sheath formed by the labium to enclose the stylets or trophi; in general, a snout-like prolongation of the head.

**Scutellum** - in Heteroptera, the triangular part of the mesothorax, generally placed between the bases of the hemelytra, but in some groups overlapping them.

**Sternum** (pl. sterna) - the entire ventral division of any ring-like body segment; specifically, and in general usage, the underside of the insect thorax, between the coxal cavities.

**Striate, striated, striatus** - marked with numerous parallel, fine, impressed lines.

**Suture** - a seam or impressed line indicating the division of the distinct parts of the body wall; the line of juncture of the hemelytra of Heteroptera.

**Synonym** - two or more different names for one and the same thing; a different name given to a species or genus previously named and described (Smith).

**Tarsus** (pl. tarsi) - the foot; the jointed appendage attached at the apex of the tibia, bearing the claws and pulvilli; the distal part of the insect leg, consisting of from one to five segments or joints.

**Tibia** (pl. tibiae) - the fourth division of the leg, articulated at the proximal end to the femur and bearing on the distal end the tarsi; generally slender and frequently equalling or exceeding the former in length.

**Veins** - the chitinous, rod-like structures supporting and stiffening the wings in insects.

**Ventral** - pertaining to the undersurface of the abdomen.

**Vitta** (pl. vittae) - a broad, longitudinal stripe (Kirby and Spence).

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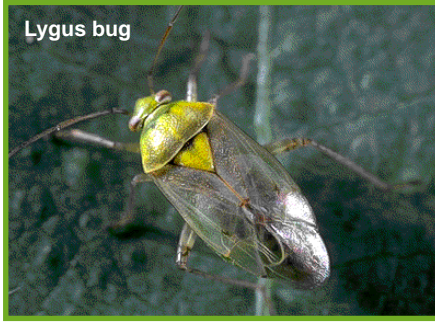
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## Lygus and Insects That Appear Similar

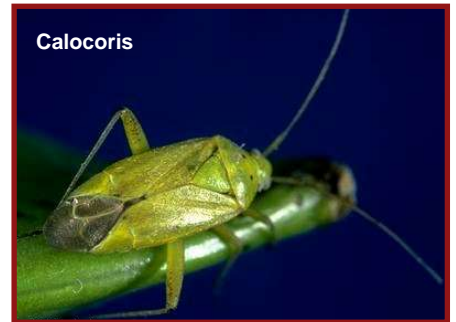


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Lygus bugs are in the order Heteroptera, family Miridae. They are about 5-6 mm long and 2.5 mm wide with soft, elongate bodies. The antennae are long and slender, consisting of 4 segments. Color and markings are variable, ranging from dull brown to greenish or dirty yellowish brown. A yellow or greenish triangular scutellum is a prominent feature in the dorsal view.



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The basal portion of the front wing is thickened and leathery, while the apical portion is membranous. Most lygus bugs have two closed cells at the base of the membrane. The wings at rest are held flat over the abdomen with the membranous tips of the front wings overlapping. A cuneus (see drawings) is present as part of the wing structure of bugs in the family Miridae. The presence of a cuneus does not mean the specimen is a *Lygus* species, but the absence of a cuneus means the specimen is not a *Lygus* species. The mouthparts are of the piercing-sucking type and in the form of a slender 4-segmented beak.



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RE Rice