Oxycarenus hyalinipennis

Scientific Name
Oxycarenus hyalinipennis (Costa)

Synonyms:
Aphanus hyalinipennis Costa
Aphanus tardus var. *hyalipennis* Costa

Common Name
Cotton seed bug

Other Common Names
Dusty cotton stainer

Type of Pest
Hemipteran

Taxonomic Position
Class: Insecta, **Order**: Hemiptera, **Family**: Lygaeidae

Figure 1. *Oxycarenus hyalinipennis* adult, dorsal and side view (Image courtesy of Natasha Wright, Florida Department of Agriculture and Consumer Services, Bugwood.org)

Reason for Inclusion
CAPS Target: AHP Prioritized Pest List for FY 2012

This datasheet was prepared for CAPS surveys; however, it is also appropriate for use by cotton industry scouts and extension agents for early detection surveys of the cotton seed bug.

Pest Description
Eggs: "Oval 0.28 x 0.95 mm, longitudinally striated, pale yellow becoming pink" (Henry, 1983).

Nymphs: "Head and thorax brownish-olivaceous, abdomen pinkish. Fifth instar darker brown on head and thorax, wingpads distinct, extending to at least third abdominal segment" (Henry, 1983).

Adults: "Newly emerged individuals pale pink but rapidly turn black. Length of male about 3.8 mm; female 4.3 mm. Male abdomen terminates in round lobe, while female is truncate. The insects have three tarsal joints and a pair of ocelli. Second antennal segment usually in part pale yellow. Hemelytra hyaline and usually whitish; clavus, base of corium, and costal vein more opaque than rest. Setae of 3 different types: [1)] More or less erect stiff setae, blunt at tip terminating in 4-7 small teeth; [2)] normal, straight, tapering setae; and [3)] very thin, curved, flat-lying setae" (Henry, 1983).

Biology and Ecology:
Once host plant seeds open, *O. hyalinipennis* begins to feed, mate, and lay eggs (Henry, 1983). *O. hyalinipennis* cannot pierce unopened bolls to feed (Henry, 1983). Copulation occurs within one day of adult emergence during hot months, while mating occurs within 2-3 days in cooler months. Oviposition occurs during the evening or night (Hammad et al., 1972). After mating, females lay approximately 20 eggs on the lint of the opened bolls (Henry, 1983). Ananthakrishnan et al. (1982) found that females prefer immature capsules and bolls when ovipositing, usually laying eggs between the calyx and fruit wall. The total amount of eggs laid per female is dependent on both temperature and host material (Holtz, 2006). Eggs are laid singly or in groups of 2-4 eggs; rarely are more laid at the same time (Hammad et al., 1972).

Eggs hatch around 4 days later when temperature is optimum (around 35°C) (Henry, 1983). After nymphs hatch, they will cluster together for approximately half an hour before they begin searching for food (Hammad et al., 1972). The nymphs go through five nymphal instars in as little as two weeks, depending on temperature (Henry, 1983).

Both adults and nymphs of *O. hyalinipennis* feed on seeds (Henry, 1983). *O. hyalinipennis* may also feed on the leaves and young stems of host plants to obtain moisture (Ananthakrishan et al., 1982).

An entire generation can be completed in 20 days with 3-4 generations occurring annually (Henry, 1983). Some sources have reported that *O. hyalinipennis* can complete as many as seven generations per year (Hammad et al., 1972). Hammad et al. (1972) found that temperature affects the duration of the life stages, especially when relative humidity is constant. *O. hyalinipennis* displays local migratory behavior in which it moves between host plants throughout the year (Holtz, 2006).

The last generation hibernates on “branches or leaves of grass and weeds or other such shelters” and does not feed or mate until host food is available again (Henry, 1983). The last generation flies to resting places (not necessarily host plants) and clusters together until host material is available again (Schaefer and Panizzi, 2000).

Schaefer and Panizzi, (2000) suggest that *O. hyalinipennis* intentionally tries to avoid feeding on the vegetative parts of the host plant [cotton] in order to avoid harming hosts with their toxic saliva. This would allow the plant to produce more valuable food seeds at a later time (Schaefer and Panizzi, 2000). This may be why *O. hyalinipennis* undergoes facultative diapause when seeds are shed versus feeding on plant material (Schaefer and Panizzi, 2000).

A detailed description of biology can be found in Kirkpatrick (1923), including life history information for different host plants.

Symptoms/Signs

Lint of cotton will be stained pinkish from the crushed insects (Henry, 1983). Although cotton seeds appear normal from the outside, the embryos are shriveled and discolored (Kirkpatrick, 1923) and weight loss can occur up to 15% (Schaefer and Panizzi, 2000). Seed germination can be severely reduced (Hill, 1983; Schaefer and Panizzi, 2000).

O. hyalinipennis has been described feeding on several types of fruit trees; the damage due to feeding appears like greasy spots that exude light-colored gum (Henry, 1983). When crushed, nymphs and adults of *O. hyalinipennis* emit a characteristic foul smell (Hill, 1983).

A detailed description of damage on cotton can be found in Kirkpatrick (1923).

Pest Importance

O. hyalinipennis is considered a serious cotton pest in Egypt that causes weight loss in cottonseed, decreased germination, and decreased oil quality of the seed (Henry, 1983). It is also considered a major pest in Southeast Asia, India, and Africa on both cotton and okra (Hill, 1983). Both adults and nymphs can cause damage by sucking oil from mature seeds (Ananthakrishan et al., 1982; Rajashekhargouda et al., 1983). Stored, un-ginned cotton may also be attacked by *O. hyalinipennis* (Henry, 1983).

O. hyalinipennis has also been recorded causing tree fruit damage in Israel; damage included greasy spots caused by adults sucking on fruits and disfigurement of the fruits caused by feces of the bug (Avidov and Harpaz, 1969). Fruit damage may be due to the toxic saliva of *O. hyalinipennis* (Schaefer and Panizzi, 2000).

Known Hosts

O. hyalinipennis primarily feeds on seeds of plants in the Malvaceae family, particularly *Gossypium* spp. (cotton). In addition to cotton, this pest has also been intercepted on certain fruits and vegetables including apple, avocado, corn, dates, figs, grapes, peach, okra, pineapple, and pomegranate, as well as hibiscus (USDA, 2009).

Holtz (2006) classified the following as ‘true hosts’ of *O. hyalinipennis* within the Malvales order:

Abelmoschus spp. (*A. esculentus* (okra)*, A. moschatus* (musk okra)), *Abutilon* spp. (*A. crisper* (bladdermallow), *A. guineese*, *A. indicum* (monkeybush), *A. mauritianum*), *Althaea* spp. (*A. rosea* (hollyhock)), *Cola* spp. (cola), *Corchorus* spp. (*C. olitorius* (nalta jute)), *Dombeya* spp., *Gossypium* spp. (*G. barbadense*

(Gallini cotton), *G. hirsutum* (Bourbon cotton)), *Hibiscus* spp. (*H. cannabinus* (kenaf), *H. mutabilis* (Dixie rosemallow), *H. sabdariffa* (roselle), *H. titiaceus* (sea hibiscus), *H. trionum* (Venice mallow)), *Malva* spp. (*M. rotundifolia* (low mallow)), *Malvastrum* spp. (false mallow), *Pavonia* spp. (swampmallow), *Phymosia umbellata*, *Sida* spp. (*S. acuta*, *S. cordifolia* (llima), *S. mollis*, *S. rhombifolia* (Cuban jute), *S. rhomboidea*), *Sphaeralcea* spp. (globemallow), *Sterculia* spp., *Triumfetta* spp., *Urena lobata* (Caesarweed), *Wissedula amplissima*,

Holtz (2006) also listed reported hosts outside of the Malvales order: *Asclepias* spp., *Cydonia* spp., *Diospyros* spp. (Malabar ebony) *Eriodendron* spp., *Ficus carica* (fig), *Malus* spp. (apple), *Persea americana* (avocado), *Phoenix dactylifera* (date-palm), *Prosopis juliflora* (mesquite), *Prunus* spp. (stonefruit), *Pyrus* spp. (pear), *Ricinus communis* (castor beans), *Spondias mangifera*, *Vigna sinensis* (blackeyed pear), *V. unguiculata* (cowpea), *Vitis* spp. (grape), *Zea mays* (corn)

Pathogens Vectored

This pest is not currently known to vector any pathogens or other associated organisms.

Known Distribution

Algeria, Angola, Argentina, Austria, Bahamas, Bangladesh, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Brazil, Bulgaria, Burkina Faso, Burma, Burundi, Cambodia, Canary Islands, Cayman Islands, China, Congo, Cote d'Ivoire, Croatia, Cuba, Cyprus, Dominican Republic, Egypt, Ethiopia, France, Germany, Ghana, Greece, Guinea, Hungary, India, Iran, Iraq, Israel, Italy, Kenya, Laos, Libya, Madagascar, Malawi, Mali, Mauritania, Morocco, Mozambique, Namibia, Niger, Nigeria, Pakistan, Paraguay, Philippines, Portugal, Russia, Rwanda, Sao Tome & Principe, Saudi Arabia, Senegal, Serbia, Slovakia, Spain, Somalia, South Africa, Sri Lanka, Sudan, Swaziland, Syria, Tanzania, Thailand, Togo, Tunisia, Turkey, Turks and Caicos Islands, Uganda, Vietnam, Yemen, Zaire, and Zimbabwe (EPPO, 2007; Baranowski and Slater, 2005; Fauna Europaea, 2005; Grillo Ravelo, 1993).

Potential Distribution within the United States

Henry (1989) suggests that *O. hyalinipennis* could survive in southern California, as well as other southern states where cotton is grown with similar climatic conditions to where the pest is found in Africa, Asia, and Europe. The model by Holtz and Borchert (2006) predict that *O. hyalinipennis* could potentially complete four to seven generations a year in all areas of in the United States where cotton is grown. Using lifecycle data, it was predicted that *O. hyalinipennis* could potentially complete a maximum of seven generations in four states: California, Arizona, Texas and Florida (Holtz and Borchert, 2006). According to Holtz (2006), a potential Malvales host of *O. hyalinipennis* can be found in every U.S. state.

This pest was recently found in 2010 in Monroe County, Florida (FDACS, 2010) and also in Puerto Rico and the U.S. Virgin Islands (USDA, 2010).

Pathway

"The cotton seed bug may be introduced into the continental United States through natural movement. In recent years, it has been observed steadily extending its distribution northward through the Caribbean (Smith and Brambila, 2008), though there have been no definitive studies conducted on the specific mode of spread. The cotton seed bug has been documented flying short distances, but may also be aided by wind. The occurrence of hurricanes or tropical storms may aid the spread of the cotton seed bug from Caribbean islands to the continental United States" (USDA-APHIS, 2010).

"The cotton seed bug moves easily in trade, even with commodities that are not known as hosts (CAPS, 2007; Henry, 1983). The cotton seed bug has been intercepted 570 times at U.S. ports-of-entry since 1984, primarily on cut flowers or fruit for consumption. A few interceptions have also been recorded on plants for propagation. Seventy percent of those interceptions have occurred since 2000. The cotton seed bug has been found to move in both baggage and commercial cargo shipments. Sixty-six percent of the interceptions were recorded in permit cargo, and 26 percent were recorded in baggage. Eighty-four percent of the interceptions occurred on plants not known as hosts (PestID, 2010)" (USDA-APHIS, 2010).

Survey

CAPS-Approved Method*:

Visual inspection.

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at http://caps.ceris.purdue.edu/.

Survey site selection

Surveys should be conducted in high risk areas where the introduction of cotton seed bug is most likely. This includes cultivated and wild cotton stands in states near the Caribbean islands, where the pest is known to be established. In addition, cotton fields near transit sites or distribution centers that receive items from countries with known infestations should also be targeted for regular surveys, as these items may carry hitchhiker bugs (USDA-APHIS, 2010).

Time of year to survey

Surveys should be carried out when the host plants are in seed. Surveyors for cotton should examine crops when host plants have newly matured bolls and dry seeds (Derksen et al., 2009). For early detection surveys, surveying during "the quiescent period [of the host] is not recommended, due to the cryptic nature of the cotton seed bug" (USDA-APHIS, 2010).

Sampling protocol
All samples should be processed at the field location.

1. Sample size
Choose the appropriate sample size based on the type of cotton to be surveyed.

a. Wild cotton stands
In isolated, wild cotton stands, sample from as close to twenty plants as possible. Inspect five bolls per plant or as many as possible.

Or

b. Large commercial cotton fields
Determine the acreage of the field and ask for permission to survey the field. Ask the grower if it is possible to cut bolls (destructive sampling). Ideally, plants from 10% of the field should be visually inspected; however, if resources are not available to survey at this level, survey as close to it as possible. Insect samples can be taken where necessary (not necessarily from every plant or boll) and bolls do not have to be removed to collect insect specimens.

Figure 2. Adult cotton seed bug in a mature cotton boll.
(Image courtesy of Julio A. Navarro, USDA-APHIS)

2. Survey design
This species occurs in a clumped distribution so it is important to walk into the field and visually inspect portions of the entire field. The highest risk zone in the field is the entrance edge (where the vehicles enter the field from the highways or roads).

3. Visual inspection
Walk through the field and visually inspect bolls on cotton plants. The entire cotton plant should be inspected. The insects may be in other places than just the bolls; the insects may rest in hiding places outside the boll, on the leaves, etc. Be especially attentive and inspect the bolls and plants thoroughly.

If there are no signs of the insect in either the field edges or the areas visually examined, it is not necessary to take samples. Infestations are very obvious; the bolls look like they have fleas. If small, black insects are observed (preferably Lygaeidae if they can be distinguished, or just Heteroptera), prepare to collect the insect specimens by one of the following methods and follow the instructions in the **Collect insect specimens** section below:

a. Cut the boll from the plant. This is the preferred method as it allows the surveyor to closely examine the boll.

Or

b. Leave the boll on the plant, but open the boll with your fingers. This method is appropriate if permission cannot be obtained to remove bolls.

4. Insect specimen collection
At the collection location, collect insects that are hiding within the bolls by one of the following methods:

a. Open a gallon-sized plastic bag (does not need to be re-sealable) and tap the bolls into the bag, dislodging the insects into the bag. **Important: Remove the bolls.** Squirt 70% isopropyl alcohol into the bag to kill the insects and make it easier to transfer them to a vial (Brambila and Smith, personal communication, 2011).

Or

b. Beat the bolls over a tray or paper sheet and use an aspirator to collect the insects (Brambila and Smith, personal communication, 2011).

Use either method and then transfer the insects to a vial and cover with 70% isopropyl alcohol. **DO NOT transport live insects, cut bolls, or cotton seeds.** Leave all plant material in the field.

<u>Literature-Based Method:</u>
Visual observation
“The cotton seed bug has been observed on tree trunks, on the undersides of both living and dead leaves, pods of leguminous plants, cracks in telephone

poles or wooden posts and fences, under bark, in old nests of *Polistes,* in crevices between strands of barbed wire, on dried flower heads, among roots of grasses, underneath sheath-leaves of maize and sugarcane, in stored cotton, or in artificial traps such as old sacks on poles or in hedges near cotton fields (Kirkpatrick, 1923). It could also be found in leaf litter beneath cotton plants, or occasionally on the leaves (Smith and Brambila, 2008), in dry fruit pods, under tree bark, between planks of wooden structures, or in dry grass and leaf litter (Adu-Mensah and Kumar, 1977)" (USDA-APHIS, 2010).

"Trees appear to be a preferred resting location of the cotton seed bug. Rough barked trees are more attractive than smooth barked trees. The cotton seed bug was rarely observed on willows or poplars. Very few bugs were observed on date-palms and mulberries. The more common trees included various species of *Ficus*, *Acacia*, and some *Eucalyptus*. Colonies on the trees may be detected near the ground, up to a height of 6–7 meters (Kirkpatrick, 1923).
Sweep-netting of weeds between cotton rows, or along field edges is not recommended except in cases where there is a high likelihood that the pest is present. It may be useful to sweep remaining vegetation after removing infested host material. Kirkpatrick (1923) found significant numbers of the cotton seed bug when old sacking was tied to bushes during the winter quiescent period" (USDA-APHIS, 2010).

UV-lights
"UV-light traps are not recommended for surveying for the cotton seed bug except in cases where there is a need to confirm eradication or enhance detection of a known population. UV-light traps are not pest specific, and consequently are cumbersome and time-consuming for sampling and identification purposes. In addition, it is unclear whether or not UV-light traps would be an effective monitoring tool for the cotton seed bug. Kirkpatrick (1923) demonstrated positive phototropism in laboratory experiments; however, when Kirkpatrick placed light traps at night in the direct path that the cotton seed bug was known to use between a tree and nearby field where they were coming from, no individuals were captured. It was concluded that the cotton seed bug did not migrate at night, and was not attracted to light at night" (USDA-APHIS, 2010).

"Conversely, Nakache and Klein (1992) noted that the cotton seed bug was strongly attracted to light at night in Israel. Additional research regarding the efficacy of UV-light traps is needed" (USDA-APHIS, 2010).

UV-light traps were used as part of a sentinel site survey in Florida. "Sentinel sites were located in areas where the pests' preferred host plants (cotton, okra and kenaf) could be found and UV-light traps were placed in areas related to a potential pathway for *O. hyalinipennis* to enter Florida. Typically, sentinel sites were chosen in pathways that were easily accessible (parks with open admission, roadsides, etc.) and had several host plants for inspection. Traps

were placed in or around a point of entry and were checked at least once a month" (Derksen et al., 2009).

Identification

CAPS-Approved Method*:

Morphological examination of adults is needed to confirm identification. A field screening aid is available for *O. hyalinipennis* on the CAPS website at http://caps.ceris.purdue.edu/webfm_send/529. Final identification should be confirmed by dissecting and examining adult male internal structures (Brambila, 2010).

*For the most up-to-date methods for survey and identification, see Approved Methods on the CAPS Resource and Collaboration Site, at http://caps.ceris.purdue.edu/.

Easily Confused Pests

This pest can be mistaken for *Oxycarenus bokalae* which is not currently present in the United States. *O. hyalinipennis* can be differentiated by examining the clavus which will be either completely or mostly pale, brick-red to white, whereas in *O. bokalae* the clavus will be almost uniformly dark brown or black (Slater and Baranowski., 1994). Also, the pygophore opening in *O. hyalinipennis* tapers evenly to a triangular point, whereas in *O. bokalae*, the opening "is broad with the side margins arcuate and triangularly tapering to a sharply or bluntly pointed distal end" (Slater and Baranowski., 1994). *O. hyalinipennis* may also be mistaken for *O. albidipennis*, *O. pallidipennis* and *O. congoensis*, but these species can be differentiated due to their "orange-red coloration of the first five abdominal segments" (Slater and Baranowski., 1994).

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