Frequently Asked Questions: Brown Stink Bugs

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Which species of brown-colored stink bugs are present?

We have many species of stink bugs in Arizona, some of which are brown. We have confirmed that the brown-colored stink bug afflicting cotton in 2012 was THE Brown Stink Bug (BSB), *Euschistus servus* (Fig. A). While this is likely the most common species of stink bug in area cotton fields, we believe that there may also be another brown-colored stink bug found in Arizona crops: *E. biformis*. The two can be separated by the color of the membrane at the tip of the forewing (Fig. B) — *E. biformis* has a darker, uniformly brown membranous tip that is best seen by sliding a piece of white paper beneath it (Figs. C, D). *E. servus* is very well studied in agricultural settings throughout the cottonbelt, though not in Arizona or California. The other, *E. biformis* is practically unknown. So far, we do not know if it behaves differently from *E. servus*. Other brown-colored stink bugs have appearances distinct from these *Euschistus* species.

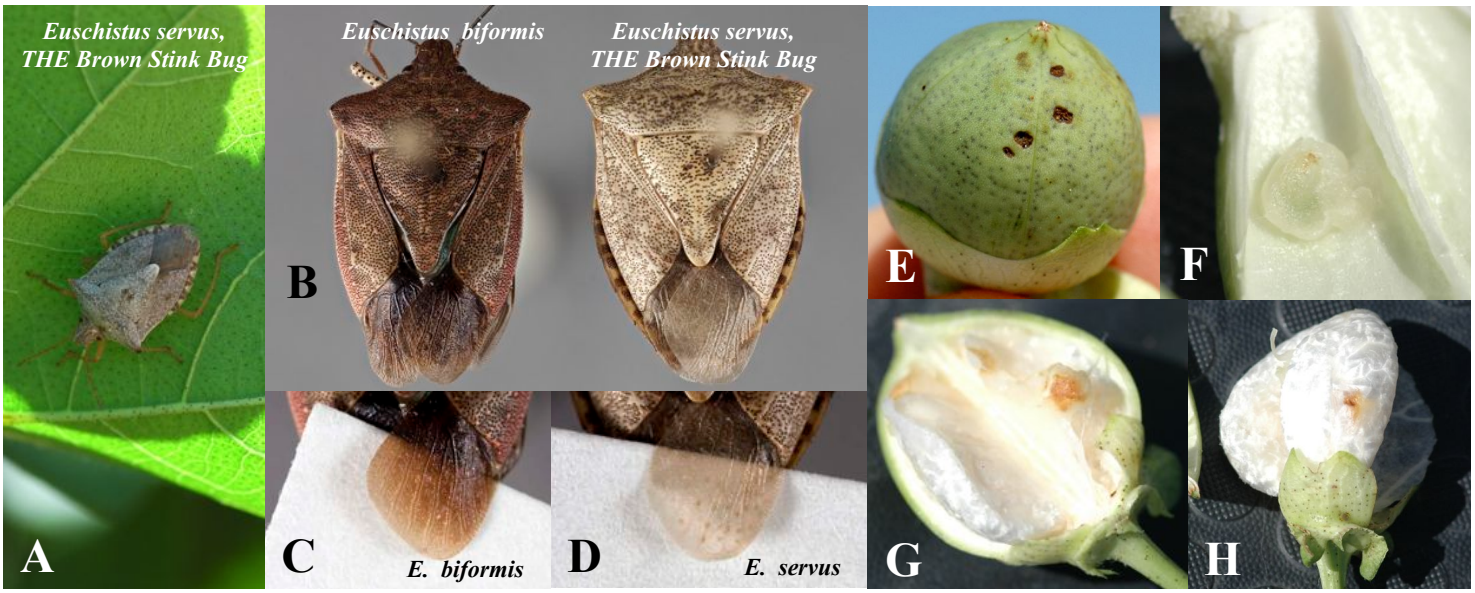
Why is BSB suddenly a damaging pest in Arizona cotton?

We do not know why BSB has reappeared as a damaging pest. BSB, *E. servus*, is an occasional pest in Arizona cotton. They are present most years, but not in significant numbers, and until recently, they did not cause noticeable injury in cotton. The last recorded outbreak of the Brown Stink Bug in Arizona was in 1963. In 2010 and 2011, they caused damage in a few scattered fields, but in 2012 BSB became a significant issue for many growers in Arizona. In May and June 2013, many PCAs from western Arizona reported high populations and injury to cotton bolls.

We have very limited Arizona-specific data for surveying, thresholds, economics, or chemical efficacy. We are relying on information from our counterparts in the Southeast, where stink bugs are primary pests.

What does BSB injury look like?

Stink bugs use their piercing-sucking mouthparts to pierce the boll and feed on the seeds. Feeding can cause external punctures and brown, circular, usually symmetrical spots (Fig. E), but external injury is **not** predictive of internal injury or damage; even unscarred bolls may have internal injury. Bolls may be "parrot beaked" due to direct feeding on seeds and stunting seed development. However, this is also a sign of incomplete fertilization that can be caused by heat stress and Lygus feeding on floral structures or squares. Check other, internal symptoms to verify that stink bugs are the culprit. Internal injury includes warts inside the carpel wall (Fig. F), discoloration or brown staining of seeds and lint (G, H), evacuated seeds, and sometimes hard lock. BSB feeding can also introduce pathogens such as boll rot organisms.



Do BSB attack squares?

Square feeding is not a normal stink bug behavior. Under normal circumstances and in general, stink bugs do not feed on squares. Stink bugs are seed-feeding insects. Bolls are what they like, and they prefer larger bolls with developing seed. When a field is first flowering and BSB have nothing else to feed on, they can and will feed on the smaller, 1–3 day old bolls beneath the flowers and can cause young boll shed (Fig. I, J, K, L).

Do Lygus attack / feed on bolls?

Lygus can attack bolls, but rarely and only under specific conditions of depleted square populations. In caged experiments and in drought-induced cut-out in Texas or hard cut-out in Arizona, Lygus have been reported feeding on bolls. Under normal conditions, they will not routinely attack bolls. Unlike stink bugs, Lygus prefer flower and pre-flowering structures (i.e., squares).

Under intense Lygus pressure that has caused shed of most of the squares at early bloom, Lygus, especially adults, can and will move to the smaller bolls that are available. In one case in 2013, fruit retention was lower than 30% because of persistent Lygus from migrating sources, and under these conditions some small boll feeding was apparent. But these are unusual situations. In general, Lygus prefer and will concentrate on squares; stink bugs prefer and concentrate on bolls.

Do Lygus cause boll rot or transmit boll rot/hard lock organisms?

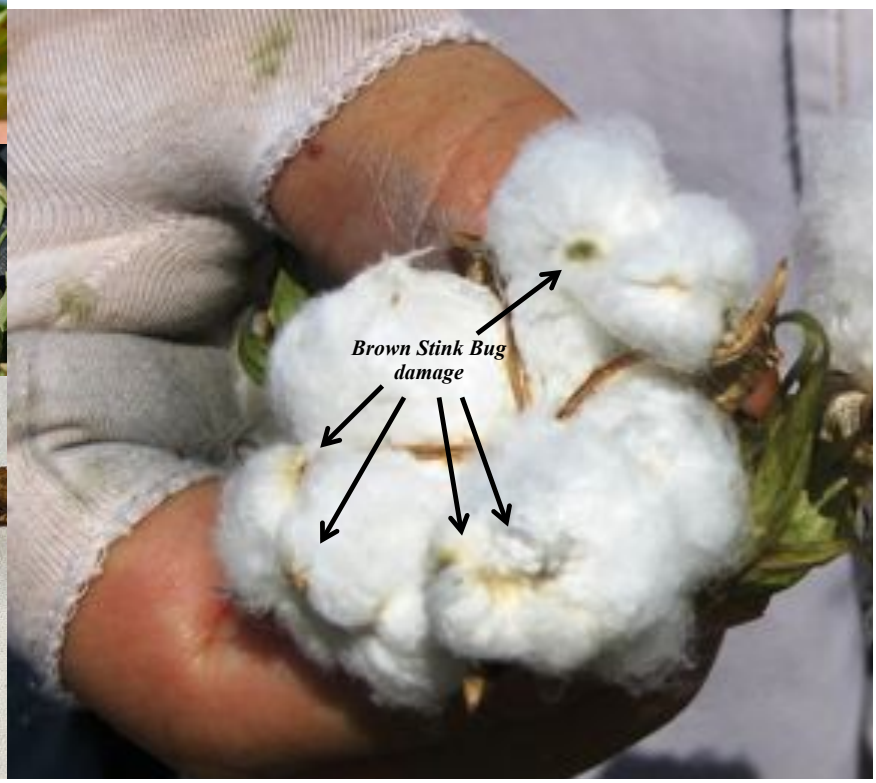
Generally no. First, they prefer squares and flowers; they do not feed on bolls unless they have few or no other choices. These organisms are most often associated with stink bugs.

Does boll injury by Lygus and stink bugs look the same?

Warts are plant wound responses to injury. Anything that penetrates the boll in a piercing manner is capable of causing a boll to raise a wart at the site of attack (e.g., stink bug, Lygus bug, and cotton stainer feeding; or 1st instar pink bollworm boring). Thus, when Lygus are forced to feed on bolls, they can cause some warting.

To distinguish between the activities of stink bugs versus Lygus, one should consider a number of factors. Stink bugs can damage much larger bolls than Lygus. Warting is much more common in association with stink bugs; Lygus feeding on small bolls does not as often result in warts and sometimes results in a jelly-like mess inside the boll. Warts from stink bugs are often larger and more numerous, forming patterns that look like mountain ranges on the interior of the carpel. Staining of lint is much more common with stink bugs. Some stink bug species may spend more time near the tips of bolls, though they can feed anywhere on the boll. Where they are present, external wounds on the boll exterior are larger for stink bugs.

In the end, a scout should be trying to link observations of populations in the field with the boll injury that they are measuring. In general, under normal conditions, blasted or shed squares are associated with Lygus bugs and injured, warty, and/or stained boll interiors are associated with stink bug feeding.



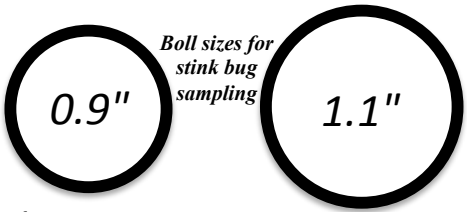
How do I sample accurately for BSB?

The only way to accurately survey for BSB is to break open bolls and examine for internal injury. Pull a random sample of at least 25 (or 1 boll/A) 1-inch diameter squeezable bolls. Do not sample hardened bolls. Crack bolls and inspect for internal injury. A boll with any level of injury (for example, a single wart or any staining) counts as an injured boll. If 1-inch bolls are not yet present, smaller bolls may be sampled. Once 1-inch bolls are present, sample from that size class only. **It is important to sample from the same size class throughout the season in order to track changes in injury levels through the season.** This is the only way to know if treatments have been effective and if BSB is causing more or less injury.

Please see the IPM Short covering this topic by visiting *http://ag.arizona.edu/crops/cotton/files/BrownStinkBugShortvF.pdf*

A Pocket Scouting Decision Aid is available: *http://ipm.ncsu.edu/cotton/insectcorner/pdf/AG_730_WPrint-NC.pdf*

Contact Lydia Brown at *lbrown@cals.arizona.edu* to request a boll sizer & pocket guide.

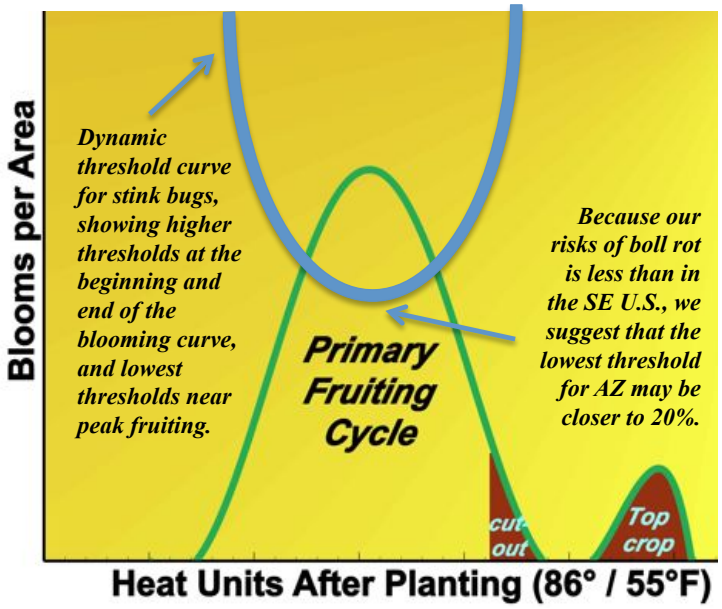


Week of Bloom	Threshold (% with internal boll injury)
1	50
2	20–30
3	10–15
4	10–15
5	10–15
6	20–30
7	30+
8	50

This information is from the southeastern states GA, NC, and SC. Thresholds are unknown for AZ.

What is the treatment threshold?

A threshold for BSB injury has not been established in Arizona. For now, we have to rely on information from the Southeast. In the Southeast, they have established dynamic thresholds, which means that different levels of injury can be tolerated depending on where you are in the bloom curve (see Table below). In the Southeast, there are 3 damaging species: the Green Stink Bug, the Southern Green Stink Bug, and the Brown Stink Bug. Due to the climate and the fact that their species are more effective vectors, southeastern cotton is more at risk to disease organisms and rot transmitted by stink bugs. As a result, 10% is likely too low for Arizona's dry climate, where we expect rates of boll loss to rot to be much lower. We can most likely tolerate more injury before incurring economic loss. Therefore, we suggest thresholds should extend no lower than 20%, depending on where we are in the bloom curve and fruiting cycle (see graphic below).



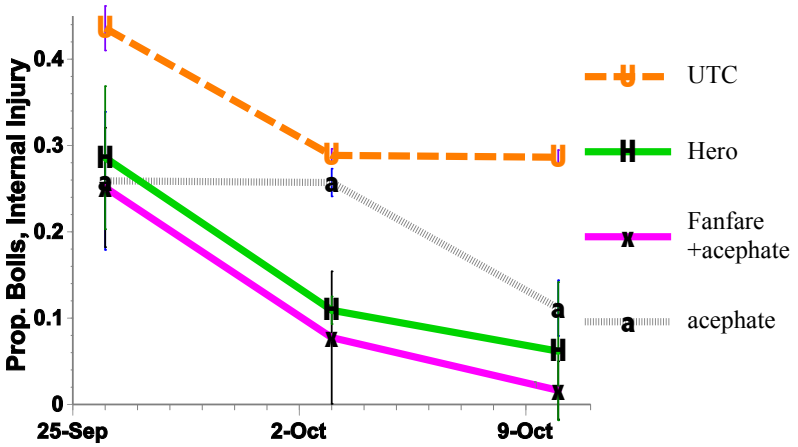


Figure 1. *Brown Stink Bug internal green boll injury, 7, 14, and 21 days after treatment (DAT). At 7DAT, bolls that were already injured at the time of spraying still show up in the survey. By 14DAT, the full effect of the sprays become more apparent.* ***External*** *boll injury is* ***not*** *predictive of ultimate boll damage. Scouts must examine 1 inch squeezable green bolls for signs of internal injury. Only the mixture, Fanfare (bifenthrin) + acephate, was significantly lower than the untreated check.*

What works? What can we try to kill BSB?

Here, again, we do not have much Arizona-specific information. In the Southeast, the preferred chemical for BSB is Bidrin (dicrotophos), which has been relabeled for Arizona this year. We did a grower-cooperator trial late in the 2012 season to look at the efficacy of available chemicals (see Figure 1). The grower generously allowed a replicated trial, in which we looked at Hero (bifenthrin+cypermethrin premix), bifenthrin + acephate, and acephate alone. It appears bifenthrin and acephate at maximum label rates, alone or together, will provide significant control (see Summary Table below). In the trial, bifenthrin was always in a combination, but we think that bifenthrin may work on its own based on our results and its popularity in Georgia. It may fit as a first use against BSB as it is less likely to flare mites or other secondary problems. All chemicals should be used at maximum rates.

Acephate with or without bifenthrin may be a good hedge if you have both Lygus and BSB. If you have whitefly and BSB, Bidrin or acephate (both OPs) should synergize a pyrethroid to get some knockdown of whiteflies while controlling BSB.

We do not have selective options for treating Brown Stink Bug.

What about Bidrin as a tool against BSB?

It is still untested for BSB efficacy in Arizona, but Bidrin now has an Arizona label. Along with bifenthrin, Bidrin has historically been a popular BSB control chemical in Georgia and other areas of the Southeast. It is an old organophosphate (OP) that has not been registered or used in AZ for over 25 years. It is very hazardous to handle, and broadly toxic and injurious to beneficials. Research in the last 15 years confirmed that it is very damaging to natural enemies. It is very toxic to birds, mammals, and bees. Do not spray the border areas of a field, and do not spray where bees or birds are present. Bird kill is possible. That said, if it does work, it might be an important tool to consider.

The maximum Bidrin rate is 8 oz (0.5 lbs ai/ A) and should be used no more than twice. Bidrin requires engineering controls (i.e., in closed systems) for mixing and loading. It is a highly toxic OP with a "danger" signal word. It has a 6 d REI period and a 30 d PHI.

Does Transform (sulfoxaflor) provide effective control of BSB?

No, not in any practical sense. In 2012, we sprayed Transform 4 times at the Lygus rate (1.5 oz) at as close an interval as 5 days, but we saw no commercial level control of BSB as indicated by boll injury or lint damage. We have not explored the higher labeled Transform rates to see if any suppression can be achieved (up to 2.25 oz / A).

Is Carbine or Belay effective against BSB?

We have found very minor yet statistically significant impact on lint injury of all 3 compounds (Transform, Carbine, Belay). The use of these compounds (sprayed 4 times) only reduced rates of significantly injured locks to 40%, down from 60%. Bottom line, these new compounds do NOT show commercial level promise for the control of BSB. We were confronted only by BSB in 2012. We do not have any data on the impact of these compounds on other stink bug species (including *E. biformis*), but we do not expect these compounds to control stink bugs.

Product	Active Ingredient	Effective against BSB?
Bidrin	dicrotophos	Georgia
Bifenthrin	bifenthrin	Georgia
Orthene97	acephate	AZ (2012)
Hero	bifenthrin + zeta-cypermethrin	AZ (2012)
Fanfare + Orthene97	bifenthrin + acephate	AZ (2012)
Transform	sulfoxaflor	No
Carbine	flonicamid	No
Belay	clothianidin	No