Kansas Insect Newsletter

For Agribusinesses, Applicators, Consultants and Extension Personnel

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How Does "Drought or Heat Stress" Influence Plant-Insect Interactions

The recent hot and dry weather conditions and lack of substantial rainfall throughout most of the state may result in extensive problems with plant-feeding insects and mites. First of all, the excessive heat accelerates insect and mite development so that it takes less time to complete their life cycles or generation times. In addition, a major control for caterpillars, aphids, beetle larvae, and many other insects are natural fungi present in the environment. These fungi are more prevalent and "aggressive" when the weather conditions are cool and moist. However, when dry conditions are prevalent, more insects survive.

Drought or heat stress, which is usually a temporary state, is the lack of sufficient moisture to maintain plant turgor and reduces the plant's ability to conduct biochemical processes thus allowing cells to function. This primarily occurs when the rate of transpiration from plant leaves and evaporation from the soil exceeds the capacity of roots to absorb water, due to a lack of sufficient rainfall, leading to decreased plant water potential.

The effect of drought or heat stress may vary depending on the feeding behaviors of insect and mite pests. For example, insects with piercing-sucking mouthparts including aphids, scales, plant bugs typically benefit more from dry conditions than insects with chewing mouthparts such as beetles, caterpillars, and sawflies. Plant stress, due to lack of soil moisture, often increases susceptibility to wood-boring insects and bark beetles. Plants experiencing extreme drought or heat stress decrease production of compounds such as oleoresin, which act to deter feeding by wood-boring insects, thus increasing susceptibility. In addition, water-deficient plants emit volatile chemicals such as ethanol and alpha-pinene, which attract wood-boring insects and bark beetles. Wood-boring insects use these chemical cues to locate plants whose natural defenses have been compromised by a lack of sufficient moisture. For example, a lack of moisture in the upper tree canopy may result in localized areas of cambial and phloem tissue degradation that are very attractive to wood-boring insect females for egg-laying. Also, the colonization success of bark beetles increases when trees are stressed due to lack of moisture. Bark beetles depend on moisture stress to weaken the defenses of trees and shrubs.

Inadequate soil moisture can also lead to enhanced populations of the twospotted spider mite (*Tetranychus urticae*) because there is less moisture in the air from evaporation. These lower relative humidity levels and drier conditions tend to favor twospotted spider mite development. Twospotted spider mites also tend to feed more under dry conditions because the dry air or low relative humidity allows them to easily acquire excess water in plant leaves.

Insects are impacted by drought conditions or heat stress through a number of mechanisms. First, dry conditions provide a favorable thermal environment for growth and development of plant-feeding insects and mites. Second, drought- or heat-stressed plants are more attractive and acceptable to insects. As plants lose

moisture through transpiration, the water columns in the xylem cavitate or break-apart, producing ultra-sonic acoustical emissions that are detected/sensed by many bark beetles, thus attracting them to drought-stressed plants. Third, drought- or heat-stressed plants are more suitable for certain insects. Water-deficient plants are more favorable for insect growth (e.g., increased larval weight), survival, and reproduction because plant nutrients are more concentrated. However, the primary reason why water-deficient plants are more susceptible to insects is due to the decline in the production of secondary metabolites or defense compounds, which increases susceptibility to attack. Fourth, drought conditions increase insect detoxification systems. It is possible that insects feeding on drought- or heat-stressed plants are more efficient in breaking down certain plant allelochemicals or defense compounds that would normally negatively affect insects. Overall, drought or heat stress induces changes the quality of plants, which may improve the performance of plant-feeding insects and mites.

Figure 1

Figure 2

Figure 3

Raymond Cloyd

I'll Take The Walnut Caterpillars!

For the past several years, I have followed walnut caterpillar activities in the Manhattan area. This has been, in part, to all fears that when people discover that their walnut trees have been defoliated, they need not have angst for the health and survival of their trees. Invariably (as with other instances of defoliation by any caterpillar species), broad leaved trees fare well, issuing forth a new flush of foliage is early enough in the season, or the following spring as is the situation with late-season defoliations.

A good example is the trees featured in Issue #14 of this year's Kansas Insect Newsletter (Figure #1).

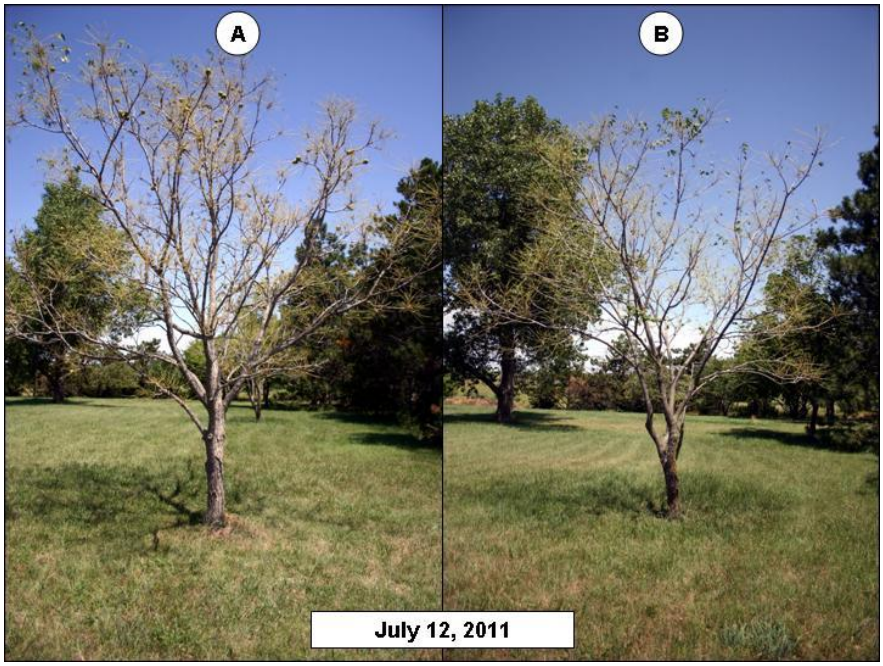

Figure 1

As seen in Figure 2B, branches have been completely stripped of foliage. However, by August 3, new growth is issuing forth (Figure 2C),

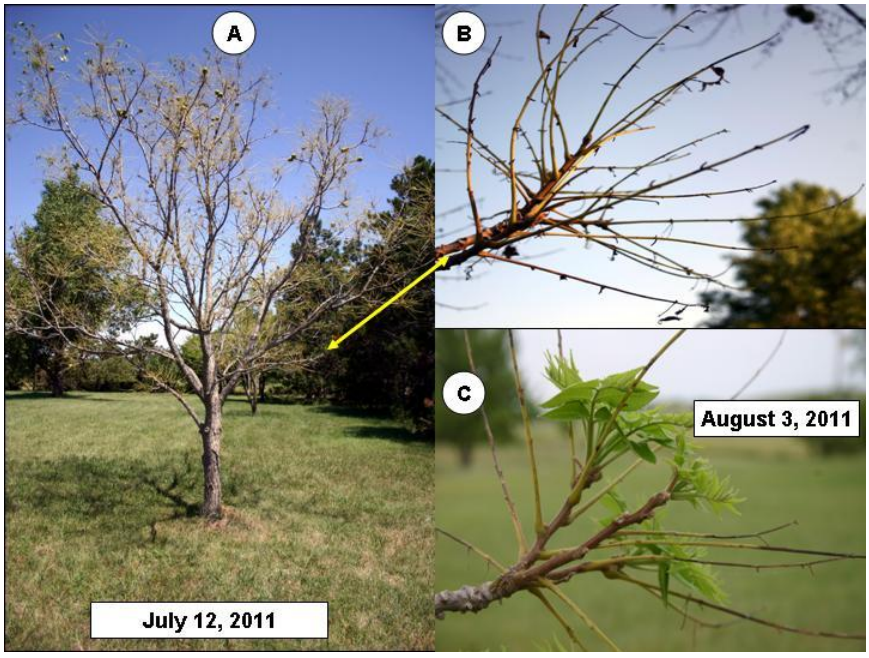

Figure 2

and trees are beginning to "green-up" (Figure 3B and C).

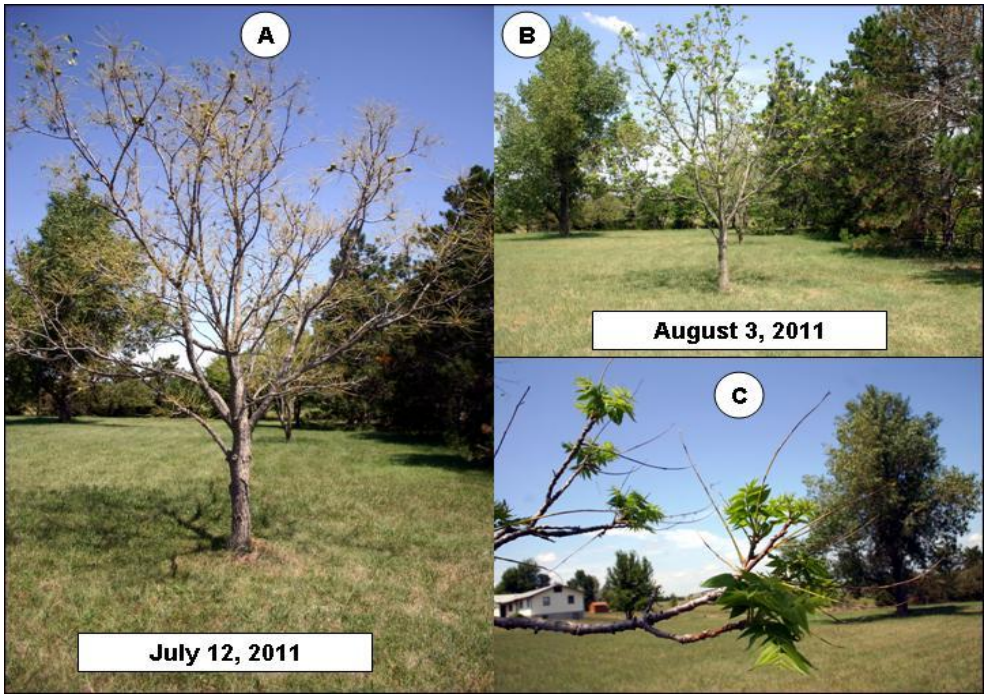

Figure 3

Back to the premise of this piece: "I'll Take The Walnut Caterpillars!" In reference to what? MAN!

A tree which has provided many photo opportunities has done it again ---- but this time in a negative sense. There has been coexistence between the caterpillars and that tree over the years, during which time the tree has received numerous defoliations (Figure 4A). There always followed a restoration of its "full appearance" (Figure 4B).

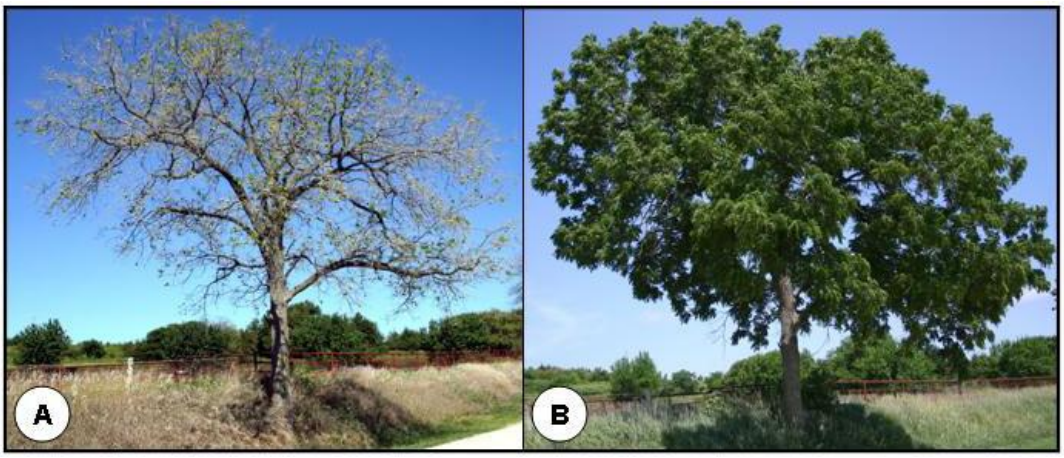

Figure 4

However, some time during the past 2 weeks, the tree has received unkind cuts which have caused more damage in a few minutes than any damage attributable to walnut caterpillars over the years of their presence (Figure 5).

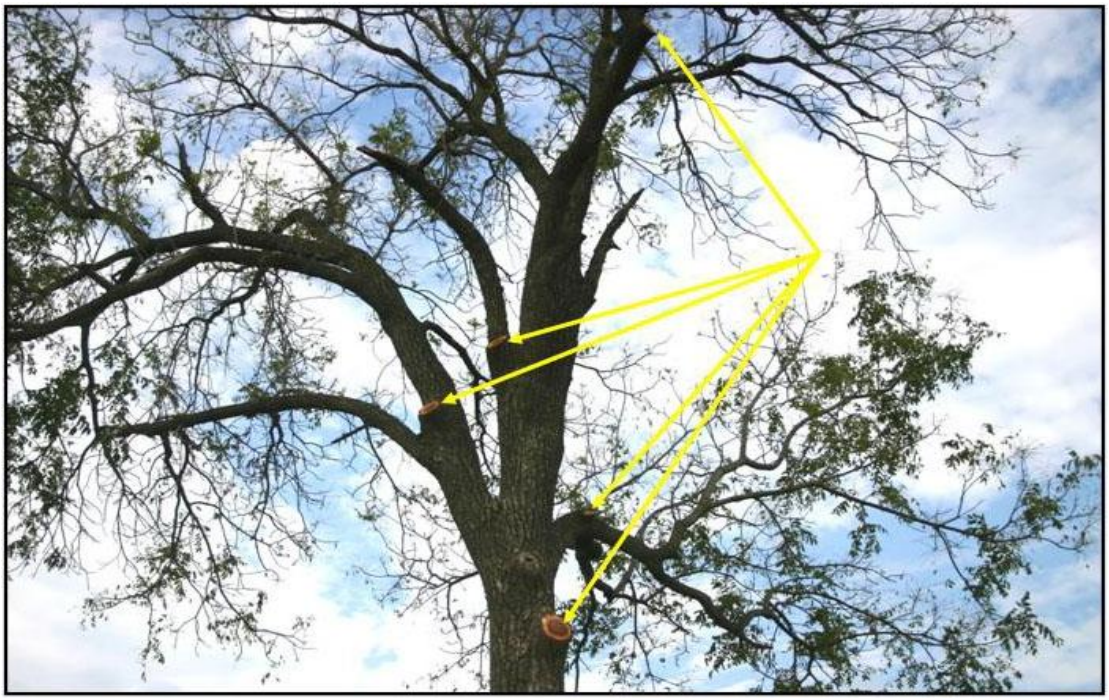

Figure 5

The comparative damage between walnut caterpillars (Figure 6a) and MAN (Figure 6B):

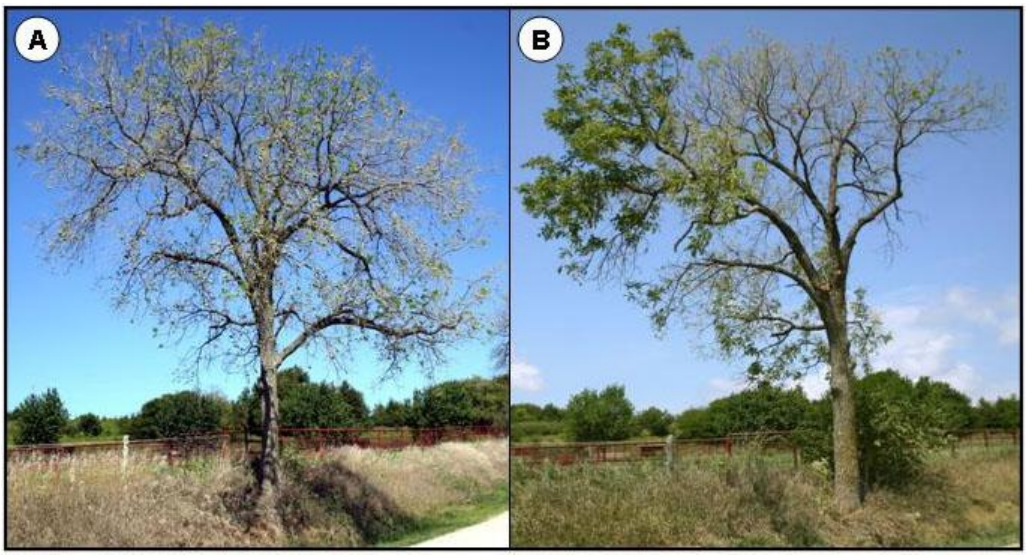

Figure 6

should favor the walnut caterpillars (as we have seen in Figure 4 repeated).

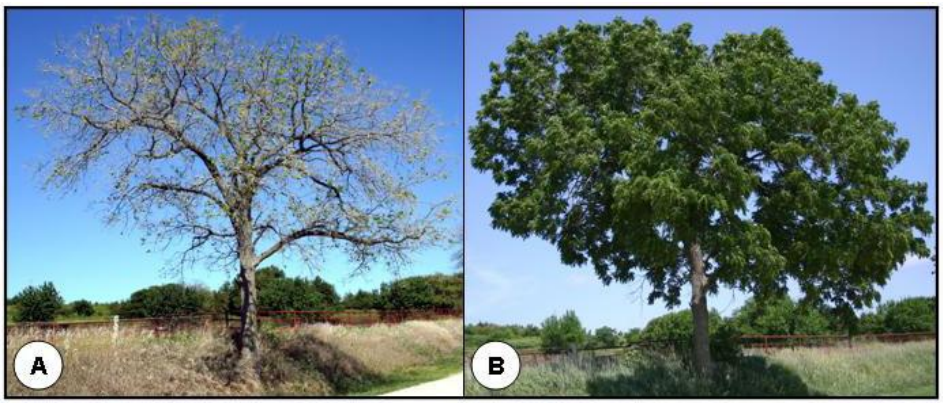

Figure 4 – repeated

The appearance of the tree in 2012 given its current "trimming? Time will tell?

(Figure 7)

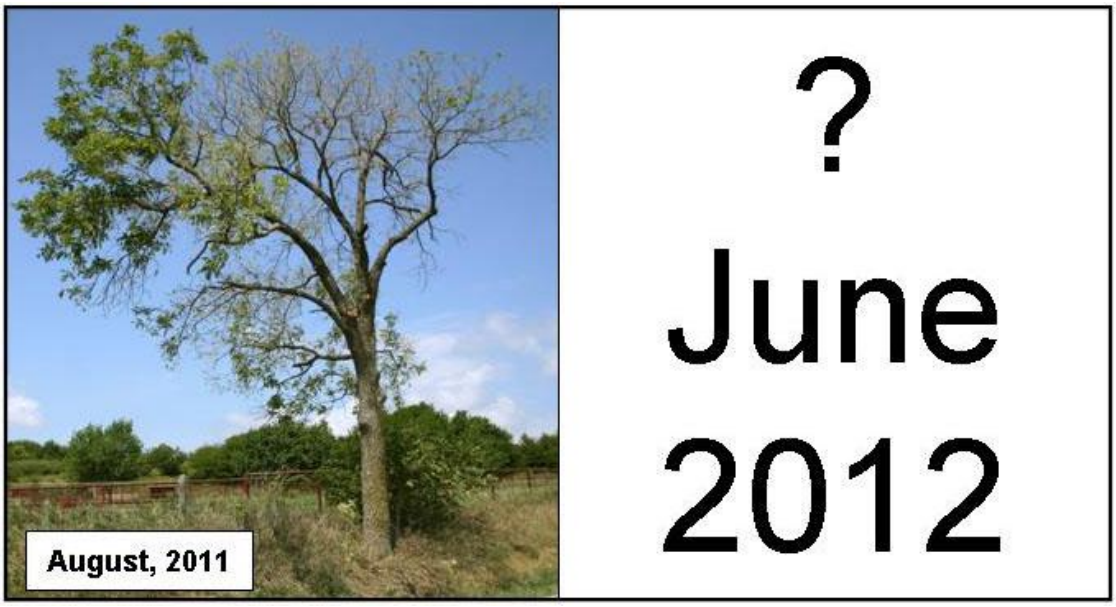

Figure 7

In the offing ……. Fall webworms

Actually, the above introduction might have been more appropriate had it appeared in an earlier issue of this year's Kansas Insect Newsletter. I first began recovering fall webworm moths (from blacklight traps) on June 14. Despite the continued presence of moths through June, I noted but a single webmass (Figure 6) as I drove routes where webworm masses common in the past.

Figure 6

During the past two weeks, the presence of fall webworms has revealed itself as the larvae have increasingly sized up and expanded their web masses to enclose new foliage upon which they feed. The predominant fall webworms are of the redheaded race (red head capsules and orangish tubercles) (Figure 7A) whose "nests" are comprised of rather loosely woven silk (Figure 7B).

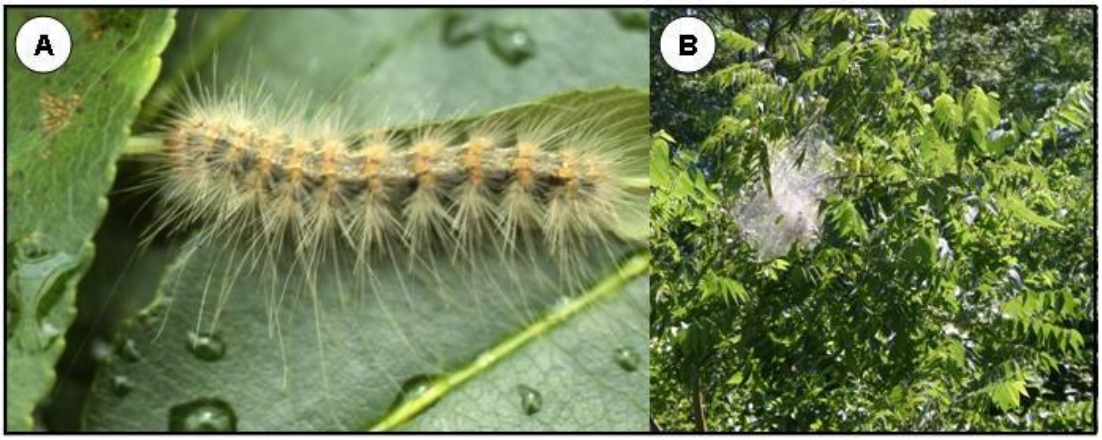

Figure 7

While the caterpillars of the redheaded race feed on many tree species, their preferred favorites are walnut, flowering crab and pecan and pecan (Figure 8).

Figure 8

Web masses within arms reached can easily be raked out with fingers. The proverbial pole with either a bent nail or a toilet bowl brush affixed to the end of the pole can be also be used to remove a web mass. Far too often, webbing is beyond "pole distance" in which instances they must remain untouched. The consolation, though, is like that of other defoliating caterpillars: merely aesthetically objectionable.

A more detailed account of fall webworms is contained in the electronically available Extension Publication MF-2395, Web-Producing Caterpillars in Kansas. Go to: http://www.entomology.ksu.edu. Click into the Department of Entomology; click Extension; click Publications; click Lawn, Garden, Tree and Shrubs; and click Trees and Shrubs.

A Perennial Tomato Pest ……. Hornworms

Year after year, the tomato pest which most often captures the attention of home gardeners are the large "hornworms" which (during their last developmental stage) ravenously consume tomato foliage leaving behind stripped plants .This leads people to ask, "Where did they come from?", and, "How long have they been in my garden?"

Hornworms are the larvae/caterpillars of two closely-related moths: tomato hornworm moths and tobacco hornworm moths. If viewed side-by-side, a person can compare the number of yellow splotches along the abdomen and the wing markings, thus easily distinguishing differences between the two moth species (Figure 9).

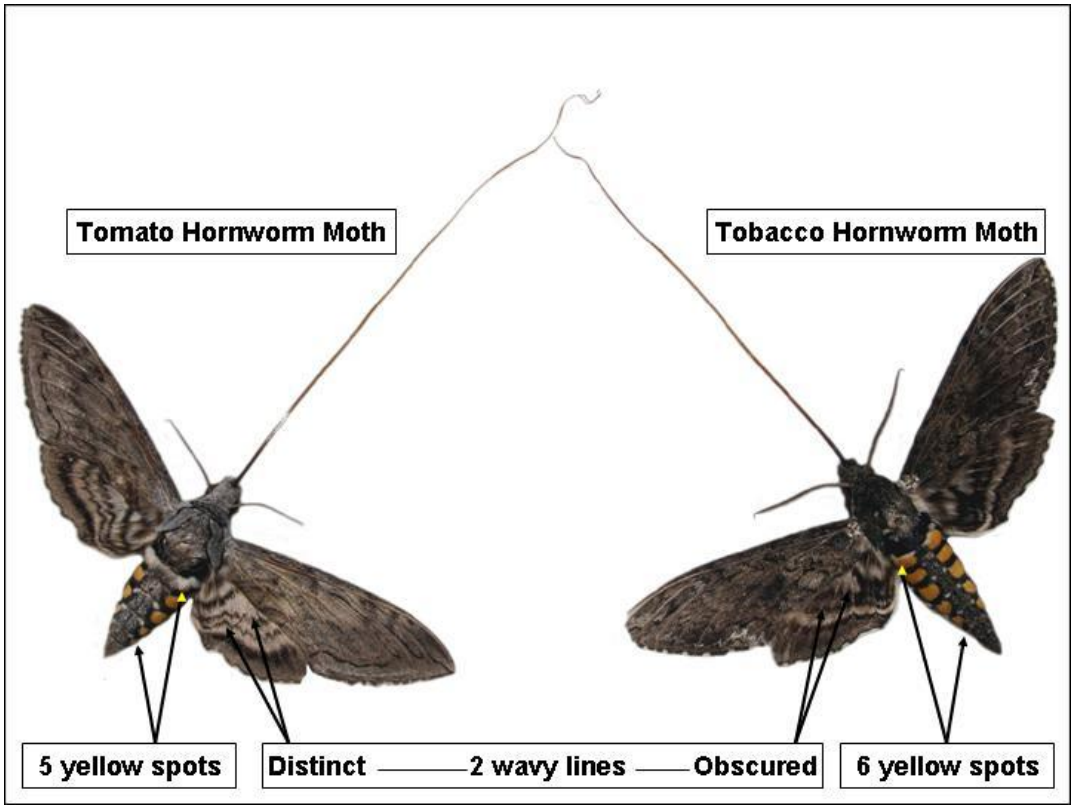

Figure 9

These large moths are commonly referred to as "hummingbird moths" due to their habit of hovering over plants (like actual hummingbirds) and inserting their long proboscis deep into flowers to extract nectars (akin to hummingbirds inserting their long beaks into flowers to extract nectars).

In Kansas, tomato hornworms and tobacco hornworms produce two generations per year.

Both overwinter as pupae within earthen cocoons (Figure 10A) buried in the soil to depths of 4-6 inches. Often times when working the garden soil early in the spring, people accidentally break the earthen cocoons thus exposing the spindle-shaped mahogany-colored pupae within (Figure 10B). A curious feature of a pupa is its slender tongue case described as a "pitcher handle" (Figure 10C). If held, a person may notice that the tail/abdominal end of the pupa wiggles.

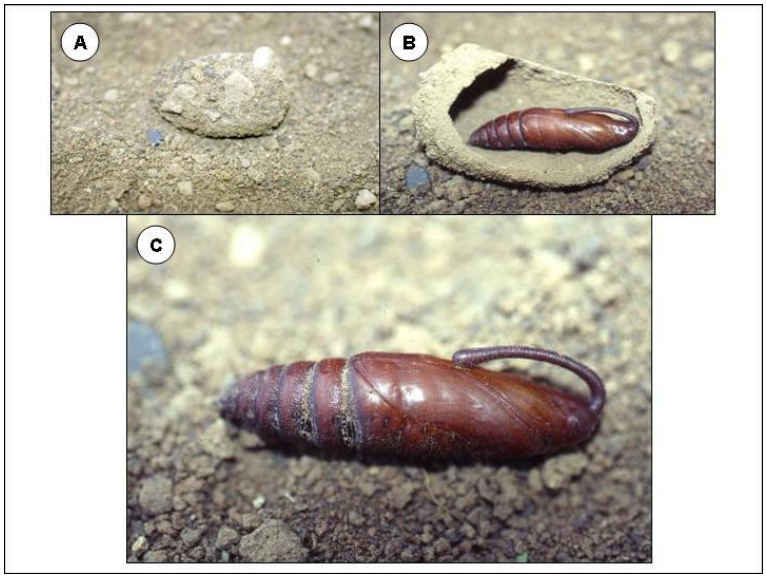

Figure 10

Moths deposit greenish-colored eggs on tomato foliage (Figure 11).

Figure 11

Larvae (tail and all) hatch in a week to 10 days and begin feeding. Due to their small size as well as a plentitude of lush tomato foliage, their presence goes unnoticed until they reach their aforementioned final growth stage. The first sign of their presence are tomato plants that "suddenly" (seemingly overnight) have been stripped of their leaves (Figure 12).

Figure 12

Also, on the ground beneath the stripped vines, fresh green fecal pellets (Figure 13) are another sign that the hornworms are in close proximity.

Figure 13

However, the worms are so well camouflaged (Figure 14) that close inspections are required to actually detect them.

Figure 14

So are your worms tomato hornworms or tobacco hornworms? While overall shades of green may vary, there are other constant "landmarks". Tomato hornworms have 8 chevrons and a black "horn" whereas tobacco hornworms have 7 diagonal stripes and a red "horn" (Figure 15).

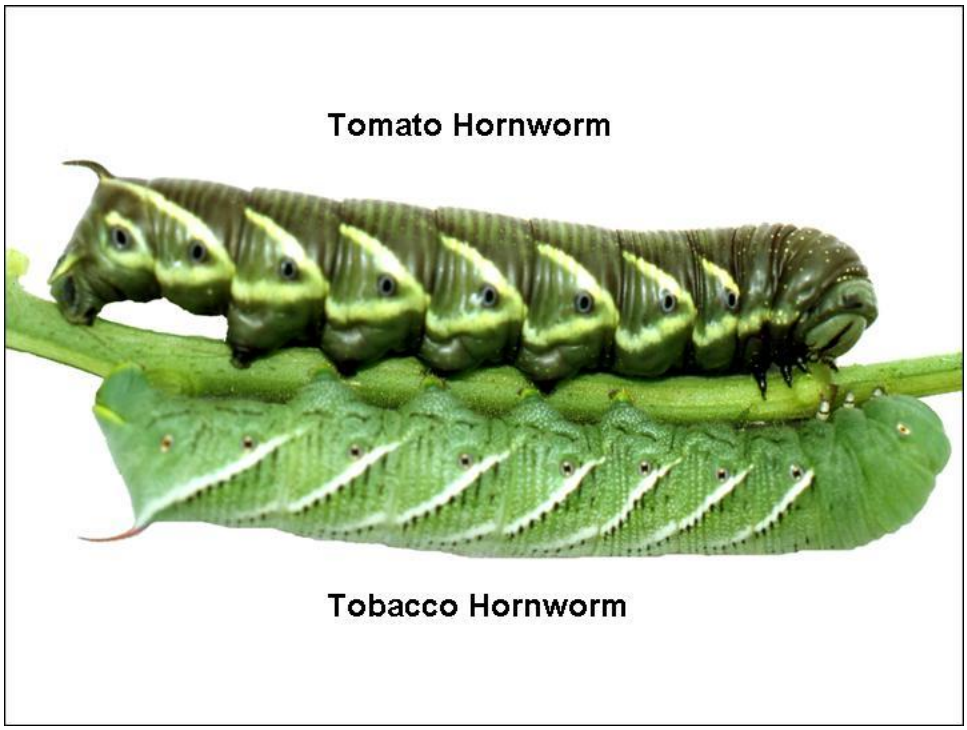

Figure 15

What can be done to detect hornworms and eliminate them before they become large and destructive? **Little!** While moths occur on a yearly basis, generally their presence in gardens is erratic. Moths are active at night and so their egglaying activities go unnoticed. Given the amount of lush tomato foliage in addition to the green coloration of the eggs themselves, inspecting plants for eggs is futile. Due to the small size of larvae plus their camouflage coloration, their detection is improbable. Automatically applying frequent synthetic insecticides may be environmentally unsound. Frequent applications of "environmentally friendly" insecticides are wasteful. The bottom line is that if hornworms occur, they will expose themselves as previously discussed.

When hornworms are detected, they are at the end of their feeding cycle. A person may decide to apply an insecticide directly to them. Or handpick them and dispose of them. OR SIMPLY, LET THEM BE!

Bob Bauernfeind

Report from the Kansas State University Insect Diagnostic Laboratory:

The following samples were submitted to the Insect Diagnostic Laboratory from July 29th to August 4th.

July 29 2011 – Wyandotte County – Rattailed maggots (drone fly larvae) in lawn
July 29 2011 – Gray County – Leafrolling caterpillars in locust
July 29 2011 – Coffey County – Oak cynipid gall wasp
July 30 2011 – Hamilton County – Chinch bugs in buffalo grass
August 1 2011 – Sherman County – Possible ash rust on ash tree
August 1 2011 – Jefferson County – Brown dog tick nymphs
August 1 2011 – Jefferson County – *Lasius* sp. ants in home
August 1 2011 – Morris County – Ground beetles entering cabin
August 1 2011 – Sedgwick County – Springtails in home
August 2 2011 – Anderson County – Pine sawyer beetle
August 2 2011 – Dickinson County – Shothole borer damage (Scolytidae) in peach tree
August 3 2011 – Sedgwick County – Drugstore beetle and checkered beetle in home
August 4 2011 – Pratt County – Aphids on cucumber

If there are any questions regarding these samples or about the identification of any arthropod please contact the Insect Diagnostician at (785) 532-4739 or GotBugs@ksu.edu.

Holly Davis

Sincerely,

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