Survey of Twospotted Spider Mite (Acari: Tetranychidae) Host Plants in the Mississippi Delta[1]

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Abstract A survey of twospotted spider mite, *Tetranychus urticae* Koch, hosts was conducted during the spring months of 2007, 2008, and 2009 in Mississippi. Uncultivated field borders that supported a diverse flora of herbaceous plants and adjacent in-field weeds were sampled from late-March through May for the presence of twospotted spider mite. Twospotted spider mite preference for each plant species was determined and ranked in a 0 - 3 scale. Henbit, *Lamium amplexicaule* L., was the most consistent and preferred host of twospotted spider mite in Mississippi. Carolina geranium, *Geranium carolinianum* L., cutleaf geranium, *Geranium dissectum* L., vetch, *Vicia* spp., volunteer soybean, *Glycine max* L., purple deadnettle, *Lamium purpureum* L., and spiny sowthistle, *Sonchus asper* (L.) Hill, were other frequently infested dicotyledonous species. Of the monocotyledonous species sampled, only rescuegrass, *Bromus catharticus* Vahl, johnsongrass, *Sorghum halepense* (L.) Pers., and volunteer corn, *Zea mays* L., appeared to be major hosts of twospotted spider mite during spring months. Italian ryegrass, *Lolium perenne* (L.) spp. multiflorum (Lam.), did not appear to be an important host of twospotted spider mite at any location, which is a benefit considering glyphosate resistant biotypes are very common in many Mississippi fields. Equally important, twospotted spider mite was not found on annual bluegrass, *Poa annua* L., which occurs in all Mississippi fields during winter and spring. The host list generated from this study can be directly used to refine early-season twospotted spider mite management, and also help support future research.

Key Words: *Tetranychus urticae*, twospotted spider mites, alternate hosts

The twospotted spider mite, *Tetranychus urticae* Koch, is a polyphagous plant feeder and pest of many crops. In cotton, *Gossypium hirsutum* L., twospotted spider mite has traditionally been considered an occasional pest of cotton in the southern United States. However, from 2005 through 2008, the number of cotton acres treated for mites in Mississippi increased by 2-fold above historic levels (Williams 2009). Other southern states also experienced increases in mite densities, compared with previous years. Twospotted spider mite management will likely continue to be an annual economic problem for cotton production in southern United States, so effective management of the pest will continue to be important.

One strategy used to control polyphagous pests is to disrupt host plant synchrony by eliminating alternate hosts that are used before crops become suitable. Snodgrass et al. (2006) was able to reduce populations of tarnished plant bug, *Lygus lineolaris*

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(Palisot de Beauvois), and insecticide applications in cotton by minimizing host plants around field borders during early-spring. Removal of hosts with a selective herbicide in February and March limited the ability of tarnished plant bugs to increase population densities around field perimeters. Similar reductions in twospotted spider mite populations may be possible using similar procedures. However, before such projects are initiated, host plants of twospotted spider mite in the southern cotton belt need to be identified. Previous literature has documented many hosts of twospotted spider mite (Cagle 1949, Brandenburg and Kennedy 1981, Brandenburg and Kennedy 1982, Takafuji and Kamibayashi 1984, Margolies and Kennedy 1985, Flexner et al. 1991, Wilson 1995, Steinkraus et al. 1999, Hardman et al. 2005). However, these studies were either not conducted in the southern U. S. cotton belt or did not extensively sample weeds during the early-spring critical time period. Steinkraus et al. (1999) conducted a host survey in Arkansas but sampled during June and July. Brandenburg and Kennedy (1981 and 1982) identified several primary hosts in North Carolina, but did not conduct an exhaustive host survey. Flexner et al. (1991) and Wilson (1995) observed mite preference for many plants, but conducted the studies in Oregon and Australia, respectively.

The following manuscript describes a 3-year host survey that was conducted across the Mississippi River alluvial plain 'Delta' in Mississippi. The current results were compared with previous reports and an extensive host list is included.

Materials and Methods

A twospotted spider mite host survey was conducted during the spring months of 2007, 2008, and 2009. Uncultivated field borders that supported a diverse flora of herbaceous plants and adjacent in-field weeds were sampled from late-March through May for the presence of twospotted spider mites. Extensive sampling was used to collect data from multiple sites and all weed species present. Sample sites were located across the Mississippi Delta in areas with a history of spider mite infestations in cotton. Sites were chosen both at random and, when possible, near fields of seedling cotton experiencing twospotted spider mite outbreaks. Sampling was conducted by examining entire plants using a 10X hand lens for the presence or absence of mites. Spider mites were categorized by species and life stage (egg, immature, or adult) and recorded as present or absent on each weed species. Densities on each host were determined by counting the number of mites on 10 leaves or shoots.

During 2007, 16 locations adjacent to fields that had been planted to cotton the previous year were sampled from March through May. During 2008, 14 fields and adjacent weedy areas were sampled for mites from 28 March to 9 May. Sample sites were near locations where populations had existed the previous season. Thirteen locations were sampled in 2009, adjacent to current cotton fields or fields planted to cotton the previous year.

Twospotted spider mite preference for each plant species was determined and ranked in a 0 - 3 scale (Flexner et al. 1991), where: 0 = No mites were observed on the plant species, 1 = very few mites were found on the plant and no reproduction was evident, 2 = mites and reproduction was commonly found, but densities were generally low [≤10 mites/plant (small plants like henbit, *Lamium amplexicaule* L.) or leaf (larger plants like Carolina geranium, *Geranium carolinianium* L.)], and 3 = when mite populations were located, the species was always infested and supported high (> 10

mites/plant or leaf) populations relative to other plant species present. Classification of plant preference was based primarily on spider mite densities. However, not all plant species were present at all sample sites, so some subjectivity exists in the ranking of spider mite preference for certain species. There were also a couple of instances where high populations were found on a plant species in one location, but in other areas the species did not host mites. Common plant species were identified in the field. Field identification was confirmed by comparing plant specimens to published descriptions. Specimens of less common plant species were transported to the laboratory for identification and confirmed by a weed scientist at Mississippi State University. The same rating scale also was applied to hosts plants documented in previous reports. Classification of plant preference was based on previous preference ranking or descriptions in published reports.

Results

Mites were detected at 8 locations sampled in 2007. Population densities were variable among those locations. On 7 May, two areas in Sunflower Co. and one field in Leflore Co. were sampled for mites. Two sites in Sunflower Co. contained mites. At the first site, a weedy area around a shop yard, twospotted spider mites were found on henbit, hairy vetch, *Vicia villosa* Roth, Carolina geranium, Brazilian vervain, *Verbena brasiliensis* Vell, and white clover, *Trifolium repens* L (Table 1). Average density on henbit was 3.4 twospotted spider mites per stem. Carolina geranium and Brazilian vervain had 3.0, and 3.1 twospotted spider mites per leaf, respectively. Eggs and immature twospotted spider mites were present on all 3 species. No twospotted spider mites were found on johnsongrass, *Sorghum halepense* (L.) Pers., spotted spurge, *Chamaesyce maculata* (L.) Small, curly dock, *Rumex crispus* L., pigweeds, *Amaranthus* spp., bermudagrass, *Cynodon dactylon* (L.) Pers., rescuegrass, *Bronus catharticus* Vahl, field corn, *Zea mays* L., cutleaf eveningprimrose, *Oenothera laciniata* Hill, and several unidentified grass species. At the second location in Sunflower Co., twospotted spider mites were found on ivyleaf morningglory, *Ipomoea hederacea* (L.) Jacq., (1.7 mites/leaf), honeyvine milkweed, *Cynanchum laeve* (Michx.) Pers., (0.57 mites/leaf), and dewberry, *Rubus* spp., (0.4 mites/leaf). No mites were found on yellow woodsorrell, *Oxalis stricta* L., horsenettle, *Solanum carolinense* L., giant ragweed, *Ambrosia trifida* L., buttercup, *Ranunculus* spp., Virginia creeper, *Parthenocissus quinquefolia* (L.) Planch., or Pennsylvania smartweed, *Polygonum pensylvanicum* L. Three fields, with varying twospotted spider mite populations, were sampled on 16 May. Among the species sampled, Brazilian vervain, johnsongrass, *Sorghum halepense* (L.) Pers., coneflower, *Dracopis amplexicaulis* (Vahl) Class, henbit, entireleaf morningglory, redvine, *Brunnichia ovata* (Walt.) Shinners, honeyvine milkweed, and cotton were hosting twospotted spider mite. At one location, 66% of henbit stems within a cotton field were infested and damaging twospotted spider mite populations had developed in adjacent cotton. Three cotton fields (2 - 4 leaf stage) containing twospotted spider mite infestations were sampled on 21 May. No mites were found in fallow areas around the fields, but henbit that persisted within each field after herbicide applications was infested. Volunteer field corn within one of the fields also was infested. Infestations were scattered in an aggregated distribution across the fields and recently killed or living henbit was found within each infestation. The cotton closest to the infested henbit had been killed by extensive mite feeding injury. Areas of the field that did not have henbit were not infested. On June 29, johnsongrass growing

Table 1. List of plant species sampled during host survey. Twospotted spider mite host preference is estimated using a 0 - 3 scale.

Common Name of Weed	Scientific Name	Family	TSSM Host Preference *
Carolina geranium	*Geranium carolinianum*	Geraniaceae	3
coneflower	*Dracopis amplexicaulis*	Asteraceae	3
cotton	*Gossypium hirsutum*	Malvaceae	3
cutleaf evening-primrose	*Oenothera laciniata*	Onagraceae	3
cutleaf geranium	*Geranium dissectum*	Geraniaceae	3
field corn	*Zea mays*	Poaceae	3
hairy vetch	*Vicia villosa*	Fabaceae	3
henbit	*Lamium amplexicaule*	Lamiaceae	3
ivyleaf morningglory	*Ipomoea hederacea*	Convolvulaceae	3
Palmer amaranth	*Amaranthus palmeri*	Amaranthaceae	3
purple deadnettle	*Lamium purpureum*	Lamiaceae	3
soybean	*Glycine max*	Fabaceae	3
spiny sowthistle	*Sonchus asper*	Asteraceae	3
spotted burclover	*Medicago arabica*	Fabaceae	3
vetch	*Vicia* spp.	Fabaceae	3
Brazilian Vervain	*Verbena brasiliensis*	Verbenaceae	2
crimson clover	*Trifolium incarnatum*	Fabaceae	2
dewberry	*Rubus* spp.	Rosaceae	2
giant ragweed	*Ambrosia trifida*	Asteraceae	2
green pigweed	*Amaranthus viridis*	Amaranthaceae	2
honeyvine milkweed	*Ampelamus albidus*	Asclepiadaceae	2
johnsongrass	*Sorghum halepense*	Poaceae	2
Pennsylvania smartweed	*Polygonum pensylvanicum*	Polygonaceae	2
pigweeds	*Amaranthus* spp.	Amaranthaceae	2
pitted morningglory	*Ipomoea lacunusa*	Convolvulaceae	2
rabbit tobacco	*Pseudognaphalium obtusifolium*	Asteraceae	2
rescuegrass	*Bromus catharticus*	Poaceae	2
hemp sesbania	*Sesbania herbacea*	Fabaceae	2**
barnyardgrass	*Echinochloa crus-galli*	Poaceae	1
broadleaf signalgrass	*Urochloa platyphylla*	Poaceae	1
common chickweed	*Stellaria media*	Caryophyllaceae	1
common pokeweed	*Phytolacco americana*	Phytolaccaceae	1

Table 1. Continued.

Common Name of Weed	Scientific Name	Family	TSSM Host Preference *
horseweed	*Conyza canadensis*	Asteraceae	1
Italian ryegrass	*Lolium perenne*	Poaceae	1
mouseear chickweed	*Cerastium fontanun*	Caryophyllaceae	1
purple cudweed	*Gnaphalium purpureum*	Asteraceae	1
redvine	*Brunnichia ovata*	Polygonaceae	1
shepherd's purse	*Capsella bursa-pastoris*	Brassicaceae	1
tall goldenrod	*Solidago canadensis*	Asteraceae	1
white clover	*Trifolium repens*	Fabaceae	1
wild carrot	*Daucus carota*	Apiaceae	1
briars	*Rubus* spp.	Rosaceae	1**
daisy fleabane	*Erigeron annuus*	Asteraceae	1**
goldenrod	*Solidago*	Asteraceae	1**
kudzu	*Pueraria montana*	Fabaceae	1**
Virginia pepperweed	*Lepidium virginicum*	Brassicaceae	1**
annual bluegrass	*Poa annua*	Poaceae	0
bermudagrass	*Cynodon dactylon*	Poaceae	0
common purslane	*Portulaca oleracea*	Portulacaceae	0
curly dock	*Rumex crispus*	Polygonaceae	0
prostate spurge	*Chamaesyce humistrata*	Euphorbiaceae	0
purple nutsedge	*Cyperus rotundus*	Cyperaceae	0
spotted spurge	*Chamaesyce maculata*	Euphorbiaceae	0
wild garlic	*Allium vineale*	Liliaceae	0
yellow nutsedge	*Cyperus esculentus*	Cyperaceae	0
yellow woodsorrel	*Oxalis stricta*	Oxalidaceae	0
buttercup	*Ranunculus* spp.	Ranunculaceae	0**
Virginia creeper	*Parthenocissus quinquefolia*	Vitaceae	0**
crabgrass	*Digitaria* spp.	Poaceae	0**
horse purslane	*Trianthema portulacastrum*	Aizoaceae	0**
horsenettle	*Solanum carolinense*	Solanaceae	0**

* Spider mite preference for each plant species was determined and ranked in a 0 - 3 scale. Rankings were as follows: 0 – No mites were observed on the plant species, 1- Very few mites were found on the plant and no reproduction was evident, 2- mites and reproduction was commonly found, but densities were generally low, 3- when mite populations were located, the species was always infested and supported high populations relative to other species present.

** Indicates that rating is based on limited data.

around a utility pole within a cotton field in Washington Co. supported high twospotted spider mite densities. Cotton adjacent to the area was infested also.

In 2008, mite densities were low throughout the spring, and mites were found in only 2 locations. At the 2 locations, twospotted spider mites (1 - 2 mites/plant) were found on crimson clover, *Trifolium incarnatum* L., and honeyvine milkweed. On 28 July, twospotted spider mites were found on Palmer amaranth, *Amaranthus palmeri* S. Wats, and cotton at one site. This corroborates with findings of Steinkraus et al. (1999) that Palmer amaranth is a major host for twospotted spider mite during summer months.

Twospotted spider mites were found at 5 locations in 2009 and 2 were heavily infested (50 - 100 mites/plant of preferred hosts). On 30 March, a large population of twospotted spider mite were found in a producer's equipment yard in Leflore Co., MS, with a diverse flora of plants. Twospotted spider mites were found on cutleaf evening primrose, hairy vetch, rescue grass, *Bronus catharticus* Vahl, spotted bur clover, *Medicago arabica* (L.) Huds., henbit, rabbit tobacco, *Pseudognaphalium obtusifolium* (L.) Hilliard & B.L. Burtt ssp. *Obtusifolium,* shepherd's purse, *Capsella bursa-pastoris* (L.) Medik., Carolina geranium, Brazilian vervain, horseweed, *Conyza canadensis* (L.) Cronq., American black elderberry, *Sambucus nigra* L. ssp. *canadensis* (L.) R. Bolli, purple deadnettle, *Lamium purpureum* L., and common pokeweed, *Phytolacco americana* L. Twospotted spider mite adults were found at low levels on Italian ryegrass, *Lolium perenne* (L.) spp. multiflorum (Lam.), wild carrot, *Daucus carota* L., and common pokeweed, *Phytolacco americana* L. Henbit, purple deadnettle, and hairy vetch supported the highest densities of twospotted spider mite (>100 mites/leaf or stem) and 100% of these plants were infested. Carolina geranium and American black elderberry also supported high densities of twospotted spider mite. Cutleaf evening primrose (4.8 mites/leaf), rescue grass (7 mites/leaf), spotted bur clover (7.9 mites/leaf), Brazilian vervain (0.25 mites/leaf), Shepherd's purse (0.25 mites/leaf), wild carrot (0.5 mites/leaf), and horseweed (21 mites/leaf) supported moderate twospotted spider mite densities. No mites were found on daisy fleabane, *Erigeron annuus* (L.) Pers., curly dock, or mouseear chickweed, *Cerastium fontanun* Baumg. ssp. Vulgare. The area was sampled again on 4 May to determine mite host preference on later emerging species. Spiny sowthistle, *Sonchus asper* (L.) Hill, henbit, vetch, Carolina geranium, cutleaf evening primrose, and cutleaf geranium were all heavily infested with twospotted spider mite. Horseweed, broadleaf signalgrass, *Urochloa platyphylla* (Munro ex C. Wright) R.D. Webster, Brazilian vervain, daisy fleabane, and spotted bur clover supported low densities of twospotted spider mite. No mites were found on curly dock, yellow woodsorrell, Italian ryegrass, or Virginia pepperweed, *Lepidium virginicum* L.

On 4 May, a ditch bank adjacent to a soybean field was sampled in Humphreys Co. Mites were found on hairy vetch, spiny sowthistle, Carolina geranium, johnsongrass, henbit, honeyvine milkweed, green pigweed, *Amaranthus viridis* L., goldenrod, *Solidago* L. spp., common chickweed, *Stellaria media* (L.) Vill, white clover, soybean, *Glycine max* (L.) Merr. in the adjacent field, and cutleaf geranium, *Geranium dissectum* L. Henbit (numerous mites present), cutleaf geranium (10 mites/ leaf), and prickly sowthistle (~75 mites/leaf) supported the highest densities of twospotted spider mite at the location. Hairy vetch (3.5 mites/leaflet), soybean (3.5 mites/leaf), Carolina geranium (1.5 mites/leaf), johnsongrass (1mite/seedling plant, one plant with ~50 mites), common chickweed (1 mite/stem), honeyvine milkweed (2 - 4 mites/seedling), pigweeds

(1.5 mites/leaf), goldenrod (1mite/seedling), and white clover (0.25 mite/leaf) supported moderate twospotted spider mite densities. No mites were found on yellow woodsorrell, crabgrass, *Digitaria* spp., nutsedges, *Cyperus* spp., common pokeweed, prostrate spurge, *Chamaesyce humistrata* (Engelm. ex A. Gray) Small, briar, *Rubus* spp., and several unidentified grass spp.

On 13 May, twospotted spider mite colonies were identified on ~10% of Pennsylvania smartweed leaves in fallow areas adjacent to a cotton field in Humphreys Co. No other plant species were infested around the field. Low densities (< 10% leaves infested) of twospotted spider mite also were identified on kudzu in Washington Co. on 28 May. On 16 July, twospotted spider mites were found on field corn and volunteer soybean in Tallahatchie Co. Pitted morningglory, *Ipomoea lacunusa* L., Johnsongrass, hemp sesbania, *Sesbania herbacea* (Mill.) McVaugh, and spiny pigweed also were infested (5 - 10/leaf). Densities of twospotted spider mite on horseweed were ~1 per plant. No mites were found on barnyardgrass, *Echinochloa crus-galli* (L.) Beauv., broadleaf signalgrass, horse purslane, *Trianthema portulacastrum* L., and Palmer amaranth.

Discussion

Henbit appears to be the most consistent and preferred spring host of twospotted spider mite in Mississippi. Previous research has noted twospotted spider mite preference for henbit and the plant's suitability as a host from fall through spring (Brandenburg and Kennedy 1981, Margolies and Kennedy 1985, Wilson 1995). Henbit was infested at nearly every location where twospotted spider mites were found from March through May in the current study. Furthermore, nearly all twospotted spider mite infestations sampled in seedling cotton were linked to nearby henbit. Purple deadnettle was present at only one location where mites were found, but appeared to support twospotted spider mite populations similar to those on henbit. Henbit is a common winter annual weed across Mississippi and, in the absence of herbicides or tillage, can be found within and around most fields.

Many other dicotyledonous plant species were found to be hosts for twospotted spider mite. Carolina and cutleaf geranium, vetch, volunteer soybean, and spiny sowthistle were frequently infested and often supported higher densities of twospotted spider mite than other nearby dicotyledonous plant species at given locations. Brazilian vervain, honeyvine milkweed, 'hairy' (entireleaf and ivyleaf) morningglory, cutleaf evening primrose, pigweeds, and clover spp. were generally infested with lower densities (1 - 5 mites/leaf) of twospotted spider mite than the more preferred hosts. Horseweed was heavily infested (22 mites/leaf) at one site, but overall was only occasionally infested with low densities (<1 mites/leaf) of twospotted spider mite relative to other nearby hosts. Curly dock was not found to be a host of two spotted spider mite at any sample sites. Mouseear and common chickweed, common pokeweed, and daisy fleabane were minor hosts of twospotted spider mite.

Of the monocotyledonous species sampled, only rescuegrass, johnsongrass, and volunteer corn appeared to be major hosts during spring months. Few, if any mites, were found on other grass or sedge species. Italian ryegrass was not a major host of mites at any location. This is important because glyphosate resistant Italian ryegrass is common in many Mississippi fields (Robinson 2008). Equally important, twospotted spider mite was not found on annual bluegrass, *Poa annua* L., which occurs frequently in all Mississippi fields during winter and spring.

Early-season populations of twospotted spider mites were variable from year to year, likely due to several factors including environmental conditions and population densities entering overwintering. Recent, heavy-rainfall events lowered population densities and increased the difficulty of locating populations. After rain, webbing was sometimes present, but no mites were observed. It is likely mites were present at some locations at densities below those we were able to detect. For example, no mites were found after inspecting over 100 plants in a cotton field just after being planted. The field was untilled, covered with winter annual weeds and no herbicides had been applied. However, 3 wk later twospotted spider mite populations exceeded threshold across the field of seedling cotton and required treatment. This situation exemplifies the difficulty of detecting low mite populations on weeds, and that populations can increase quickly.

Previous workers have documented many host plants of twospotted spider mite (Table 2). In many cases, our observations corroborate those reports. As in this survey, henbit served as an important host of twospotted spider mite host in many areas from fall through spring months (Brandenburg and Kennedy 1981, Margolies and Kennedy 1985, Wilson 1995). Purple deadnettle is a preferred cool weather host in Japan (Takafuji and Kamibayashi 1984). Margolies and Kennedy (1985) reported that vetch, henbit, and Carolina geranium were the primary winter and early-spring hosts of twospotted spider mite in North Carolina. Flexner et al. (1991) determined that vetch, cutleaf geranium, and bur clover were suitable hosts of twospotted spider mite in Oregon. Our results support previous findings that these plant species are also highly preferred host plants in Mississippi. However, other reported host plants contradict observations made in Mississippi. Brandenburg and Kennedy (1982) and Flexner et al. (1991) reported that red and white clover, respectively, can support high populations of twospotted spider mite. Although twospotted spider mite was found on white and crimson clover in this survey, only spotted bur clover appeared to be a preferred host relative to henbit, geranium, and vetch. Flexner et al. (1991) concluded that ryegrass was a suitable host in Oregon, but in Mississippi, Italian ryegrass did not seem to be a preferred host. Steinkraus et al. (1999) did not observe twospotted spider mite on geranium during early-summer. However it was found to be a primary host during spring months in Mississippi. The differences in host suitability and preference of twospotted spider mite observed in this study and other reports demonstrate that the pest may use many different host plants under different climatic or temporal conditions, or in different geographical regions (Flexner et al. 1991).

The host list generated from this study can be used to refine early-season twospotted spider mite management. If cotton is to be planted into or adjacent to weedy areas, it would be prudent to determine if spider mites are present before planting. It appears that henbit, geranium, vetch, cutleaf evening-primrose, and most likely purple deadnettle are primary spring hosts of twospotted spider mite in Mississippi and can be used as indicator species to determine if twospotted spider mite is present. The presence or absence of twospotted spider mites on these primary hosts can be used to determine whether additional management strategies should be applied before planting. This host survey should also help support future research focused on early-season management of twospotted spider mite. Twospotted spider mites often migrate from alternate hosts to cultivated crops (Brandenburg and Kennedy 1982, Wilson 1995, Steinkraus et al. 1999). By eliminating specific weeds that were identified as primary hosts, it may be possible to delay or reduce seasonal population

Table 2. List of published twospotted spider mite host plants found within the United States.

Hosts	Sci. name	Family	Publication *	Location**	TSSM Host Preference***
burclover	*Medicago polymorpha*	Fabaceae	4	OR	3
bush vetch	*Vicia sativa*	Fabaceae	8	Japan	3
Carolina geranium	*Geranium carolinianum*	Geraniaceae	1, 6	NC	3
commom chickweed	*Stellaria media*	Caryophyllaceae	8	Japan	3
common mallow	*Malva neglecta*	Malvaceae	3, 4	VA , OR	3
crabgrass	*Digitaria sanguinalis*	Poaceae	4	OR	3
cutleaf geranium	*Geranium dissectum*	Geraniaceae	4	OR	3
dead-nettle	*Lamium purpureum*	Lamiaceae	8	Japan +	3
henbit	*Lamium amplexicaule*	Lamiaceae	1, 6, 9	NC, AU	3
nightshade	*Solanum nodiflorum*	Solanaceae	4	OR	3
Palmer Amaranth	*Amaranthus palmeri*	Amaranthaceae	7	AR	3
pitted morniingglory	*Ipomoea lacunosa*	Convulvulaceae	7	AR	3
red clover	*Trifolium pratense*	Fabaceae	1, 2, 3	NC, VA	3
showy milkweed	*Asclepias speciosa*	Asclepiadaceae	4	OR	3
switchgrass	*Panicum virgatum*	Poaceae	1	NC	3
vetch	*Vicia* spp.	Leguminosae	6,4	NC, OR	3
white clover	*Trifolium repens*	Fabaceae	3, 4, 5	VA, OR, NS	3
wild rose	*Rosa* spp.	Rosaceae	4	OR	3
blackberry	*Rubus* spp.	Rosaceae	1, 2, 4, 6	NC , OR	2-3

Table 2. Continued.

Hosts	Sci. name	Family	Publication *	Location**	TSSM Host Preference***
violet	*Viola* spp.	Violaceae	1	NC	2-3
trumpet creeper	*Campsis radicans*	Bignoniaceae	6	NC	1-3
common dandelion	*Taraxacum officinale*	Asteraceae	4	OR	2
false dandelion	*Hypochaeris radicata*	Asteraceae	4	OR	2
Japanese honeysuckle	*Lonicera japonica*	Caprifoliaceae	6	NC	2
lambsquarters	*Chenopodium album*	Chenopodiaceae	3, 7	VA, AR	2
minerslettuce	*Montia perfoliata*	Polygonaceae	4	OR	2
orchard grass	*Dactylis glomerata*	Poaceae	4	OR	2
red root pigweed	*Amaranthus retroflexes*	Amaranthaceae	4	OR	2
ryegrass	*Lolium multiflorum*	Poaceae	4	OR	2
smartweed	*Polygonum persicaria*	Polygonaceae	4	OR	2
thymeleaf speedwell	*Veronica serpyllifolia*	Scrophulariceae	4	OR	2
trefoil	*Lotus corniculatus*	Fabaceae	4	OR	2
velvetgrass	*Holcus lanatus*	Poaceae	4	OR	2
barnyardgrass	*Echinocloa crus-galli*	Poaceae	4, 7	OR, AR	1-2
cocklebur	*Xanthium stumarium*	Compositae	7	AR	1-2
curled dock	*Rumex crispus*	Polygonaceae	7	AR	1-2
entireleaf morningglory	*Ipomoea hederacea*	Convulvulaceae	7	AR	1-2

Table 2. Continued.

Hosts	Sci. name	Family	Publication *	Location**	TSSM Host Preference***
goosegrass	*Elusine indica*	Poaceae	7	AR	1-2
hedge bindweed	*Convolvulus arvensis*	Convulvulaceae	4, 7	OR, AR	1-2
horsenettle	*Solanum carolinense*	Solanaceae	7	AR	1-2
purple vetch	*Vicia american*	Leguminosae	7	AR	1-2
smartweed	*Polygonum pensylvanicum*	Polygonaceae	7	AR	1-2
spotted spurge	*Euphorbia maculata*	Euphorbiaceae	7	AR	1-2

* Publications 1 - Brandenburg, R. L., and G. G. Kennedy. 1981. 2 - Brandenburg, R. L., and G. G. Kennedy. 1982. 3 - Cagle, L. R. 1949. 4 - Flexner, J. L., P. H. Westigard, P. Gonzalves, and R. Hilton. 1991. 5 - Hardman, J. M., K. I. N. Jensen, J. L. Franklin, and D. L. Moreau. 2005. 6 - Margolies, D. C. and G. C. Kennedy. 1985. 7 - Steinkraus, D., J.Zawislak, G. Lorenz, and J. Welch. 1999. 8 - Takafuji, A. and M. Kamibayashi. 1984. 9 - Wilson, L. J. 1995.

** Locations: AR-Arkansas, AU-Australia, NC-North Carolina, OR-Oregon, NS-Nova Scotia, VA-Virginia

+ Data from Japan, but plant species also found in United States

*** Spider mite preference for each plant species was determined and ranked in a 0 - 3 scale similar to that used by Flexner et al. (1991). Rankings were as follows: 0 – No mites were observed on the plant species, 1- Very few mites were found on the plant and no reproduction was evident, 2- mites and reproduction was commonly found, but densities were generally low, 3- when mite populations were located, the species was always infested and supported high populations relative to other plant species present. Classification of plant preference was based on previous preference ranking or descriptions in published reports, but also remained somewhat subjective.

growth of twospotted spider mite with methods similar to those Snodgrass et al. (2006) used to control tarnished plant bug.

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