

A REVIEW OF WILD HOST PLANTS AND THEIR MANAGEMENT FOR CONTROL
OF THE TARNISHED PLANT BUG IN COTTON IN THE SOUTHERN U.S.

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ABSTRACT

A review of the literature available on wild host plants of the tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), in the Southern United States found that most research on these hosts was done in Alabama, Arkansas, Louisiana, Mississippi, and Texas. The most important hosts, which could influence numbers of plant bugs found in cotton, *Gossypium hirsutum* L., listed by most authors, were species of fleabane, *Erigeron* spp., since fleabane can support high TPB numbers during the time cotton begins to produce fruit, in June and July. Nonselective management (mowing or use of a herbicide that kill broad leaf weeds) of wild hosts to reduce TPB numbers was tested in one small study. Selective management (control targeting only a few selected wild host plants) was proposed in one study but has never been tested. The effect of selective or nonselective management of wild hosts on subsequent populations of beneficial arthropods and TPB in cotton is unknown. Early season hosts, on which the F1 generation is produced in February and March, are only partly known. However, management of these early hosts could be the most effective way of reducing TPB numbers in cotton.

INTRODUCTION

The tarnished plant bug (TPB), *Lygus lineolaris* (Palisot de Beauvois), is found in all agricultural regions of the United States and Canada, and in most states of Mexico (Kelton 1975). TPB probably has the broadest documented feeding niche of any known arthropod, having been reported on 328 host plant species, and it will prey on or scavenge other arthropods (Young 1986). The most extensive review of the host plants of the TPB in North America was done by Young (1986). He reviewed the ecology and economic entomology literature prior to 1986. In his review, he tabulated the numbers of plant species recorded as hosts in each state of the United States and the provinces of Canada. Arkansas, Louisiana, and Mississippi had 97, 81, and 159 host plants, respectively. Most of the records from these three southern states came from a study done by Snodgrass et al. (1984). Alabama, Georgia, Florida, and Texas had only 9, 2, 3 and 13 host plants listed, respectively.

TPB can be a serious pest of cotton, *Gossypium hirsutum* L, in many areas of the Southern United States. Damage to cotton can occur at any time prior to fruit maturity; however, cotton appears to be most susceptible to TPB damage early in the season, before the

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opening of the flower buds (Scales and Furr 1968; Hanny et al. 1977). Control of TPB in cotton is almost exclusively by use of nonselective insecticides, and use of these insecticides reduces beneficial arthropod populations that could otherwise aid in suppressing populations of the bollworm, *Helicoverpa zea* (Boddie), and tobacco budworm, *Heliothis virescens* (F.). In addition, TPB with high levels of resistance to pyrethroid insecticides are now present in the Mississippi River Delta of Arkansas, Louisiana, and Mississippi (Snodgrass 1996). Pyrethroid resistant TPB also have multiple resistance to several other classes of insecticides. Control methods for TPB in cotton not based solely on insecticides are needed. One alternative control method could be the reduction of wild host plant populations (by mowing or herbicides) available to TPB for population increases in the early season. This method could work in intensively farmed areas which have relatively small areas in which wild host plants can grow. One such large agricultural area is the Mississippi River Delta. Most of the land in the Delta is cultivated and wild hosts are found mainly in margins of roads, ditches, and fields. These marginal areas comprise only 2.4% of the land in a 6.4 km square area of Washington County, MS, which is located on the west side of the state about equidistant from the northern and southern boundaries (Snodgrass et al. 1991). In addition, many growers in the Delta have, over the past 4 to 5 years, practiced "burndown," in which weeds in their fields are treated with paraquat or glyphosate in February or March, greatly reducing the early season wild host plants available to TPB. Literature on TPB wild host plants in the Southern United States was reviewed. The information is related to potential management of these hosts for reduction of TPB populations in cotton.

MATERIALS AND METHODS

The literature search utilized the review by Young (1986) who searched the literature for TPB host plants in North America reported prior to 1986. A search of entomological literature from 1986 through 1999 by the authors completed the review. The review focused on determining host plants used by TPB from January through June which could be managed for control of TPB in cotton. Information on management of wild host plants as a method of reducing TPB populations in cotton was also a goal of the search.

RESULTS AND DISCUSSION

The literature search found several references, mainly for research done in Alabama, Arkansas, Louisiana, Mississippi, and Texas. Most authors rated the importance of a wild host plant by its abundance, TPB density on it, and its occurrence in relation to cotton phenology. Those wild hosts that supported large TPB populations when cotton begins to fruit during June and July were considered to have the greatest potential influence on TPB infestations in cotton. Most TPB infestations of cotton begin after squares are formed (since TPB prefer hosts with flower buds formed or open), and the adults that infest cotton migrate from weed hosts. The distance over which adults can migrate is unknown, and the importance of not having wild hosts near the cotton crop is incompletely known. Tugwell et al. (1976) found that during the last week in June cotton fields in Arkansas with the lowest TPB infestations were those bordered by the highest infestations of TPB on annual fleabane, *Erigeron annuus* (L.) Persoon. They speculated that the fleabane served to keep TPB out of the fields during that week. However, farms with the largest areas of TPB habitat near cotton had a small but significant increase in TPB infestations in cotton during the second week in July.

Snodgrass et al. (1984) found that in the Mississippi River Delta of Arkansas, Louisiana, and Mississippi, many wild hosts matured during June. This resulted in a large decline in the

number of wild plant species available to TPB in July, as compared to the April-June period. The decline in numbers of wild hosts can result in the dispersal of adults into cotton. Cleveland (1982) thought that annual fleabane was the most important spring host influencing TPB in cotton in the delta of Mississippi. Fleischer and Gaylor (1987) identified *E. annuus* and *E. strigosus* Muhlenberg ex Willenow in Alabama as having the densest TPB populations when cotton was in the early square growth stage. Anderson and Schuster (1983) stated that *E. strigosus*, *E. philadelphicus* L., and *Gaura suffulta* Engelman were key wild hosts of TPB in the northern blacklands region of Texas. They speculated that TPB populations on these hosts were good indicators of possible infestations in cotton. All of the above species of *Erigeron* and *G. suffulata* often grow in dense stands, can support large TPB populations, and are often found growing in ditch and road margins. They are attractive to TPB from May through July.

Weather may play an important role in determining when TPB move into cotton. Fleischer and Gaylor (1987) found that TPB populations declined on several important hosts during June and July of one year and produced populations that probably moved into cotton. In the following year, these hosts remained attractive (because of a large amount of rain) and held TPB out of cotton during its most susceptible growth period (early square growth). Thus, the hosts may have been a nurse crop in one year and a trap crop in the following year.

Management of TPB hosts plants will also affect beneficial insects, since beneficial insects also occur on the wild hosts. Fleischer and Gaylor (1987) found that total predator counts (adults and immatures of coccinelids, *Orius*, and *Geocoris*) were much lower on *E. strigosus* and *E. annuus* as compared to numbers of TPB on the two host plant species. This suggested to them that these two plant species could be selectively managed with little effect on predator populations. Both plant species are frequently found along road right-of-ways, and these areas are already managed with mowing or herbicides. Selective management of wild hosts for TPB has never been tested. Nonselective management in which broad leaf weeds are killed with a herbicide, or mowed, has been tested on a small scale. Snodgrass and Stadelbacher (1994) tested mowing and (2,4-dichlorophenoxy) acetic acid (2,4-D) treatments for their effectiveness against TPB on dense stands of *Geranium dissectum* L. The mowing and 2,4-D treatments significantly reduced TPB numbers, but also reduced beneficial arthropod numbers by an average 56.5 and 45.6%, respectively, as compared to an untreated check. The question that arises is whether or not nonselective management of wild hosts with its accompanying reduction in beneficial populations is better than other control options for TPB in cotton. Presently, the only other control option is the use of broadspectrum insecticides for TPB control. These insecticides have little selectivity and destroy beneficial arthropods along with TPB. If nonselective management of wild hosts reduced TPB numbers and eliminated one or more of these insecticide treatments in cotton, it may be the better control option. Environmentally, use of a herbicide or mowing of wild hosts would typically be on 10% or less of the land in an intensively farmed area, and only one herbicide application is needed. This compares favorably to the large cotton acreage that would be treated with insecticides in terms of chemical usage and its associated problems. Selective and nonselective management of wild hosts needs research to better determine if they can be used in cotton insect pest management.

Reproductive diapause in TPB is a research area that also needs more study. Knowledge of the time at which reproductive diapause is broken and eggs are laid, and the wild hosts utilized, is critical in determining the optimum time for wild host management. Management of wild hosts on which the F_1 generation is produced in February and March could be much more important than management of hosts in May or June, since the population increases from one or two generations may be greatly reduced by earlier management. The early season hosts on which the F_1 generation of TPB is produced have been studied in Texas (Anderson and Schuster 1983) and in the Mississippi River Delta (Snodgrass et al. 1984). In Texas, henbit, *Lamium*

amplexicaule L., daisy fleabane, *E. philadelphicus* L., ragwort, *Senecio imparipinnatus* Klatt., and *Rapistrum rugosum* (L.) were all listed as hosts during February and March. The main host utilized by tarnished plant bugs in January in the Mississippi River Delta is henbit. This weed is very abundant and blooms from November through April. Part of the TPB population in winter is also found in ground trash. TPB averaged 81 to 138 adults per acre in ground trash samples taken in February and March in the Delta of Mississippi (Cleveland 1982). In February, henbit, sour dock, *Rumex crispus* L., and vetch, *Vicia angustifolia* Reichard, are good hosts. In March, additional good hosts include spotted burclover, *Medicago arabica* (L.) Hudson, and shepherd's-purse, *Capsella bursa-pastoris* (L.) Medicus. Although infrequent in occurrence, crimson clover, *Trifolium incarnatum* L., is also an excellent host from January through April (Snodgrass et al. 1984).

In summary, the wild host plants of the TPB have been fairly well identified in some areas of the Southern United States. Management of these hosts as a method for controlling TPB in cotton has not been studied. Research on selective and nonselective management is needed.

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