

Exploration for leafhoppers yields a broad array of parasitoid species in Central Texas

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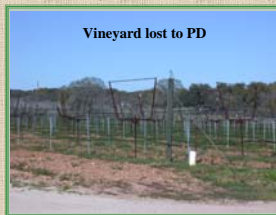
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Abstract

Pierce's disease is a serious disorder of grapevines (*Vitis vinifera* L.) caused by a bacterium carried and transmitted by xylem sap feeding insects. This disease inflicted severe economical losses to the California and Texas grape industry. Intensive research has taken place in several states since 2000 to combat Pierce's disease. The glassy-winged sharpshooter is one of three dominant vector species in Central Texas. Observations were carried out during the summer of 2005 on the dynamics of host plant utilization by different leafhoppers and spittlebugs. This study is part of a continuing research effort to assess vector biology, as well as biotic and abiotic factors involved in regulation of vector populations. Leafhopper eggs that were collected then yielded more natural enemies than leafhoppers. Many different parasitoid species were identified: a known species, *Gonatocerus ashmeadi*, was the most common species, some of the other species collected were unexpected. There is great interest in resuming more intensive monitoring at the onset of vector oviposition next spring. Program data is meant to be integrated into the development of a management strategy for Pierce's disease.

Introduction

Among the leafhoppers (Hemiptera: Membracidae), spittlebugs (Hemiptera: Cercopoidea) and cicadas (Hemiptera: Cicadoidea) are found several potential and known vectors of *Xylella fastidiosa*, the causal agent of several plant diseases, including Pierce's disease of grapevine. These insects feed on xylem fluid where they pick up the bacterium from infected host plants and have the ability to transmit it to healthy hosts. Susceptible hosts develop the disease and die relatively slowly from restriction of sap movement in the conductive tissue (Purcell and Hopkins 1996). The glassy-winged sharpshooter (GWSS), *Homalodisca coagulata* (Cicadellidae) is a leafhopper vector with which most people are familiar. It is native to Southeastern United States (Tripiatsyn and Phillips 2000), is common in Texas vineyards (Lauzière et al. in preparation) and invaded California vineyards in the early 1990s (Phillips 1999) where the disease has been responsible for severe economical losses (Purcell 1980, Wrinkler 1949). In several Texas vineyards surveyed during 2004-2005, we also captured *Graphocephala versuta* (Cicadellidae) and *Clastoptera xanthocephala* (Clastopteridae) very frequently (Lauzière et al. in preparation). These 3 insect species comprised 90% of the xylem fluid feeding insects captured on traps. Little is known about the ecology of these vectors and the factors involved in the regulation of their populations in their native range. In an ongoing research program, initial steps were taken during 2005 to identify natural enemies responsible for reductions in populations of *H. coagulata* in Central Texas. Preliminary observations are presented herein.



Vineyard lost to PD

Methods



Homalodisca coagulata

A preliminary survey was conducted in Gillespie County, Texas, between June and September 2005 for leafhopper vectors of Pierce's disease and their parasitoids. Leaves bearing egg masses were removed from the plant and brought back to the laboratory.



Nymph emergence

Each egg mass was then placed individually in a Petri dish lined with filter paper moistened with a flower preserving solution to prevent excessive leaf desiccation. The eggs were incubated at 25 ± 1°C, 60 % RH under 10L:14D photoperiod.



Mymarid emergence holes

All egg masses were checked daily for insect emergence. Leafhopper nymphs or adult parasitoids were recorded. Unknown species were sent for identification by a taxonomist. Twenty one days following insect emergence, the eggs were dissected under a stereomicroscope at 20-32X to determine the total number of eggs in the egg mass and the number of leafhopper embryo or parasitoid pupae that did not complete development. Death of parasitoids at earlier developmental stages could not be assessed.



Leafhopper egg mass



Parasitoid emergence



Trichogrammatid emergence holes

Results and Discussion

Common host plants for oviposition by leafhoppers

About 950 GWSS egg masses of various sizes (12.32 ± 5.68 eggs/egg mass; range: 1 - 41) were collected during the summer months from various plant species and locations in Gillespie County, Texas. During those months, eggs were most commonly found on: Vitex (*Vitex agnus*, Verbenaceae, n = 450), Crepe myrtle (*Lagerstroemia indica*, Lythraceae, n = 313), Button tree (*Cephalanthus occidentalis*, Rubiaceae, n = 80), Canna lily (*Canna* spp., Cannaceae, n = 14) Green briar (*Smilax* spp., Smilacaceae, n = 5), Mountain laurel (*Sophora secundiflora*, Fabaceae, n = 3), Indian hawthorn (*Rhaphiolepis indica*, Rosaceae, n = 2), Lily (*Hemerocallis*, Liliaceae, n = 2), Texas sage (*Leucophyllum frutescens*, Scrophulariaceae, n = 2) and Chinese photinia (*Photinia serrulata*, Rosaceae, n = 1).



Crepe myrtle



Vitex



Button tree

Mymarids and trichogrammatids

Of near 11,000 individual eggs collected, 79% were parasitized. Another 17% of the leafhopper eggs did not complete development: some of this additional embryonic mortality could be attributed to parasitism with parasitoid development being arrested at earlier stages, embryonic or larval mortality, which are difficult to assess. Overall, only 4% leafhopper nymphal emergence was observed.

Seven different parasitoid species were observed. 87% of the eggs were parasitized by species in the Mymaridae (*Gonatocerus ashmeadi*, *G. incomptus*, *G. novifasciatus* and *Anagrus stethynioides*). The remaining 13% of the eggs were parasitized by species in the Trichogrammatidae (*Zagella spirita* and *Ufens ceratus*). A single specimen of Tetrastichinae (Eulophidae) was collected but not identified to genus (specimen of poor quality).



Gonatocerus ashmeadi



Gonatocerus incomptus



Anagrus stethynioides



Ufens ceratus



Zagella spirita

Host plant	No. eggs collected	Percent parasitism		
		Total	Mymaridae	Trichogrammatidae
Vitex	5415	77	80	20
Crepe myrtle	3946	74	85	15
Button tree	912	79	96	4
Canna lily	261	89	100	0
Green briar	57	91	8	92
Mountain laurel	27	78	100	0
Indian hawthorn	22	36	100	0
Lily	26	100	100	0
Texas sage	27	89	100	0
Chinese photinia	25	40	100	0

Unlike the trichogrammatids, the mymarids successfully parasitized eggs deposited by leafhopper females on a broad array of host plants. In 10% of cases, egg masses were parasitized by both mymarids and trichogrammatids. This year, additional observations have been carried out since January. So far, data indicate that Mountain laurel (evergreen) is a popular host for leafhopper oviposition and is also one of the first host plants used for oviposition early in the season (February). However, it is likely that as other host plants such as Vitex or Crepe myrtle become available in the spring and summer, that insect preference quickly switches to other preferred plants. Leafhopper eggs somewhat escaped parasitism on Indian hawthorn and Chinese photinia with less than 40% parasitism. In 2005, this survey was initiated in June which did not allow for the full range of observations. More complete data will be acquired throughout 2006. However, these initial results enhance our understanding of xylem sap fluid feeding insects and their natural enemies. Studies of the reproductive biology, seasonal response to host plants and overwintering of select vectors are underway to better understand population dynamics in different habitats. Little is known about the biology of these insects in their native habitat and the factors involved in natural regulation of their populations.

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