EXPLORATION FOR BIOLOGICAL CONTROL AGENTS IN THE NATIVE RANGE OF THE GLASSY-WINGED SHARPSHOOTER

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ABSTRACT
A new initiative to study the ecology of GWSS in its native non-crop habitat is underway. Several sites in southeastern Texas have been selected each with stands of native *Vitis* spp. Monthly trapping will be used to determine the phenology of GWSS and other proconine sharpshooters. Several methods including hand collection, egg and nymphal sentinels, sweeping, and baits will be used to assess the diversity of natural enemies at each location. Since previous biological control efforts have focused on egg parasitoids of GWSS, these exploration efforts will be emphasize discovery of nymphal parasitoids.

INTRODUCTION
The glassy-winged sharpshooter (GWSS), *Homalodisca coagulata* is native to Northeastern Mexico and the Southeastern U.S., and the origin of the invasive California populations is reported by de León et al. (2004) to be Texas. Most of the entomological and epidemiological information regarding this pest are derived from its status as a vector of Pierce's Disease, *Xyllela fastidosa* in cultivated hosts. Much less is known about the field ecology and phenology of GWSS and its natural enemies in its native habitat in the Southeastern U.S. Recent surveys in the native range and research on biological control agents has focused on egg parasitoids of GWSS (Mizzell and Andersen 2003, Hoddle and Tripitsyn 2004, Luck et al. 2004, Irwin and Hoddle 2005, Jones et al. unpublished data). *Gonatocerus* spp. egg parasitoids have been collected from the native range of Texas, Florida and Northeastern Mexico, released in California where several species are now established (CDFA 2004). Nymphal parasitoids of *H. coagulata* are thought to exist, but have not been documented from the native range.

Based on what we know about other leafhopper species, *H. coagulata* should have a suite of nymphal parasitoids including chalcid wasps in the family Hymenoptera: Dryinidae, the big-headed flies, Diptera: Pipunculidae, and possibly the twisted-winged wasps, Strepsiptera. For the apple leafhopper, *Edwardsiana froggatti* (Homoptera, Cicadellidae), Clausen (1978) reported that this pest was attacked by the nymphal-adult parasitoid, *Apheloopus typholcybae* (Dryinidae) and that they often attained high rates of parasitism in North America. Jervis (1980) described the life history of an *Aphelopus* species (Dryinidae) and *Chalarus* species (Pipinculidae), primary parasites of typhlocybine leafhoppers in mixed oak woodlands of Wales. Gandolfo and Richman (1996) found several species dryinid and strepsipteran nymphal parasitoids of leafhoppers feeding on invasive broom snake weed in the rangelands of New Mexico. Moya-Rayagoza et al. (2004) found three nymphal parasitoids (Dryinidae, Pipunculidae, and Strepsiptera) of the corn leaf hopper, *Dalbulus maidis* in cultivated corn in Mexico and noted increased levels of parasitism at higher, cooler altitudes. The pipunculid parasitoid had the broadest geographic and temporal distribution. Skevington and Marshall (1997) review the natural history and rearing of Pipinculidae. They indicate that many pipunculids are oligophagous and show specificity at the genus level. They also document of the first pipunculid-host association for a Cicadellinae leaf hopper, *Cuerna striata* in the Nearctic region. This is significant because *Cuerna* is in the same tribe Proconini, with *Homalodisca*. In summary, nymphal parasitoids in the groups Pipunculidae, Dryinidae, and Strepsiptera are the most common parasitoids of leafhoppers and in some cases they are known to cause high levels of parasitism in both natural and agricultural settings.

Our studies are aimed at finding nymphal parasitoids of GWSS in native range that can be used as biological control agents in California. Parasitoids in the families Dryinidae and Pipunculidae may be the most suitable candidates if they have a sufficiently narrow host range to warrant release in California. In addition, the nymphal parasitoids must be able to cope with the lack of immature hosts during the winter when only adults are available. Many species of Pipunculidae are known to over winter as pupae which may make them pre-adapted to California agroecosystem.

OBJECTIVES
1. Establish field sites in the native range of GWSS for intensive monthly surveys and evaluation of natural enemies, in particular nymphal parasitoids.
2. Determine the phenology of GWSS.
3. Determine the species composition of GWSS natural enemies in their native habitat.
4. Develop methods for collection of parasitized GWSS nymphs and adult parasitoids.
5. Investigate the biology and biological control potential of GWSS nymphal parasitoid species.

RESULTS

Fifteen field sites have been established in southeastern Texas (Figure 1). The sites are located in eight different biogeographic zones. The transect starts at the southern tip of Texas in the Lower Rio Grande Valley in Weslaco, extending northwest to the Texas Hill Country near New Braunfels, northeast to the Piney Woods near Houston and south along the coastal plain. Each site has natural stands of native *Vitis* spp. Four to five yellow sticky cards were placed monthly at each location starting in June 2005.

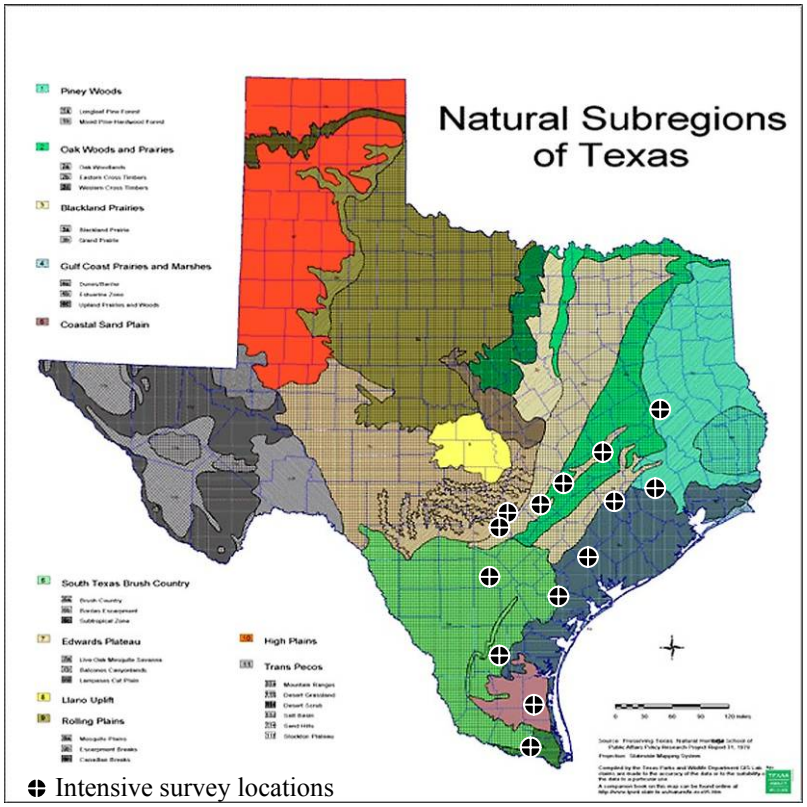

Figure 1. Biogeographic zones and survey sites in southeastern Texas.

Map compiled by Texas Parks and Wildlife, GIS Division
http://www.tpwd.state.tx.us/landwater/land/maps/gis/map_downloads/

During the surveys five *Vitis* species have found in southeastern Texas, but *V. mustangensis* was the most common one found in all the sites except one (Table 1). *Vitis rotundifolia* and *V. cinerea* were restricted in their distribution, and were only present in the pine forests of east Texas.

Table 1. Presence of major sharpshooters on various *Vitis* species collected in southeastern Texas

Host plant	Presence per site	*H. coagulata*	*H. insolita*	*O. nigricans*	*O. orbona*
V. aestivalis	3/15	×			×
V. berlandieri	3/15	×			×
V. cineriae	1/15	×			
V. mustangensis	14/15	×		×	×
V. rotundifolia	2/15	×	×	×	

Data from the first three collections indicate the presence of four major sharpshooter species; GWSS being the most abundant and widely distributed throughout the survey area. In trap catches, GWSS represented approximately 74% of the sharpshooters. *Oncometopia nigricans* and *O. orbona* constituted 19% and 6% respectively, of the sharpshooter populations but their distribution were restricted to 2 to 4 sites, where they were the most common species. *Homolodisca insolita* was the least abundant in yellow sticky cards with approximately 1% of sharpshooter populations and only present at two sites. Other sharpshooter species i.e., *Graphocephala atropunctata*, *G. coccinea*, *Ferrariana trivittata* and *Draeculacephala* sp. were found in few occasions, but their numbers represented less than 0.1% of all sharpshooters trapped.

Yellow sticky cards were efficient in trapping adult sharpshooters. For each of the 4 major species, the proportion of adults collected was > 90% of the total population suggesting that either yellow traps attracted more adults and/or nymphs are less

frequent on *Vitis* plants compared to adults. In fact, adults sharpshooters are known to be highly polyphagous while nymphs are relative immobile and restricted to a narrower host range (Turner & Pollard 1959). The sex ratio of adults trapped was also male biased.

GWSS was collected from all *Vitis* species but *V. mustangensis* was the most common host from which adult GWSS and *O. nigricans* were captured. Direct observations and hand collections revealed that nymphs were less frequent on *Vitis* spp, corroborating trap catches data. Most adult sharpshooters were found in pairs (>95%) aggregated on young growing vines.

Out of >500 nymphs collected no parasitoids have been collected, but two specimens of Pipunculidae were recovered from yellow sticky cards at one of the survey sites. Studies are underway to collect and dissect more nymphs as well deploy sentinel nymphs for intensive studies at specific sites.

CONCLUSIONS

GWSS adults are common in their natural habitat on native *Vitis* spp. Because of the low relative abundance of nymphs on native *Vitis*, surveys will be expanded to find host plants which are preferred by GWSS nymphs. Intensive surveys on host plants that harbor higher densities of GWSS nymphs will be conducted. This should maximize the likelihood that the full complement of nymphal parasitoids will be discovered. The recovery of two pipunculid specimens from habitats where GWSS is common suggests that further efforts to recover this parasitoid are warranted. Plans are to continue the surveys and exploration for new natural enemies for the next two years until June of 2007.

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