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

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ABSTRACT

Surveys in the native range of *Homalodisca vitripennis* (*H. vitripennis*) are continuing to discover nymphal parasitoids and to determine the ecology and phenology of glassy-winged sharpshooter in undisturbed natural areas. Fifteen sites with stands of native *Vitis* spp. in southeastern Texas have been surveyed monthly from October 2005 to present. The focus is on big-headed flies (Pipunculidae), which are known to be nymphal parasitoids of sharpshooters. Several methods have been used to survey for the parasitic flies, including yellow sticky cards, malaise traps, sweeping, hand collection, and tethered nymphal sentinels. Pipunculid adults have been recovered from hand collected *Oncometopia orbona* feeding on mustang grapes which have been identified as *Eudorylas* nr. *vierecki*. Populations of *H. vitripennis* began to increase in March and peaked in July. While populations peaked in July, a small proportion of these insects tested positive for the presence of *Xylella fastidiosa* (*Xf*) compared to the insects collected in later months (i.e. August, September, etc.). Only 7% of *H. vitripennis* tested positive in July, whereas 59% of *H. vitripennis* tested positive in September.

INTRODUCTION

The glassy-winged sharpshooter (GWSS), *H. vitripennis,* 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 is derived from its status as a vector of Pierce's disease, *Xf,* 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 have focused on egg parasitoids of GWSS (Mizell and Andersen 2003, Hoddle and Triapitsyn 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 unpublished data).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, and released in California where several species are now established (CDFA 2004). Nymphal parasitoids of *H. vitripennis,* including Pipunculidae, have not been evaluated as biological control agents. Skevington and Marshall (1997) review the natural history and rearing of Pipunculidae. They indicate that many pipunculids are oligophagous and show specificity at the genus level. Five new pipunculid-sharpshooter host associations have been documented by Skevington (unpublished). The focus of our research is to discover, identify and evaluate the pipunculid parasitoids of GWSS and other sympatric sharpshooters. We will also use this survey of sharpshooters to determine the seasonal percentage of adults infected *Xf* in native habitats for comparison to agricultural settings in California where GWSS is invasive.

OBJECTIVES

1. Conduct monthly surveys in the native range of GWSS.
2. Determine the phenology and ecology of GWSS and other sharpshooters.
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 (Goolsby & Setamou 2005). 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. Five yellow sticky cards were placed monthly at each location starting in October 2005.

The pooled mean number of *H. vitripennis* and *Oncometopia* spp. adults from yellow sticky card traps for all locations are shown in Figure 1. Populations of sharpshooters were lower in 2007, even though all sites experienced above average rainfall. *Oncometopia orbona* populations peak in early spring followed by *H. vitripennis*. This phenology results in nymphal sharpshooter populations throughout the spring and summer which may be exploited by pipunculid parasitoids.

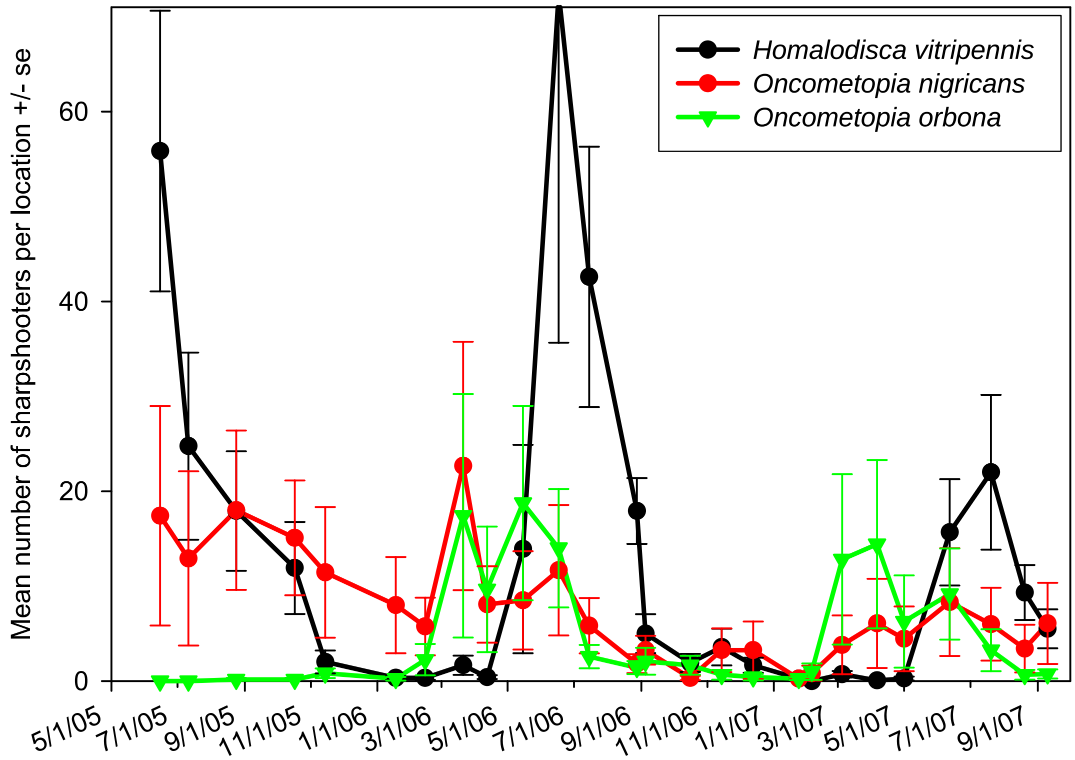

Figure 1. Yellow sticky trap catches of sharpshooter adults collected from mustang grape stands in southeastern, TX (Oct. 05- Sept 07).

Pipunculidae have been collected in yellow sticky traps and from hand collected sharpshooters from several survey locations in Southeast Texas. Many *Eudorylas* nr. *vierecki* have been recovered from *Oncometopia* spp., and possibly *H. vitripennis*, but the latter host association has not been confirmed with host remains.

Several methods have been investigated for recovery of Pipunculidae in addition to yellow sticky traps, including Malaise traps, hand collecting of adults for dissection and to hold for emergence of parasitic flies, sweeping, and tethering of nymphs. Hand collecting of sharpshooter adults and nymphs has proven to be the most effective method for recovery of Pipunculidae. Despite our success at collecting *E.* nr. *vierecki* from hand collected *Oncometopia* spp., the apparent failure to rear pipunculids from *H. vitripennis* remains unclear. Pipunculids could be parasitizing small, early instars of *H. vitripennis* and then dropping them away from their feeding location, as per the published accounts by Jervis (1980) describing the life history a *Chalarus* species on a typhlocybine leafhopper in the UK. In this scenario, recovering parasitized *H. vitripennis* could be difficult. An alternative scenario could be that percent parasitism of *H. vitripennis* is very low and despite collecting thousands of nymphs from many different locations over time we have not collected the unique pipunculid parasitoid. Lastly, pipunculid parasitoids of *H. vitripennis* may be more common in other parts of its range, i.e. Florida where proconiine sharpshooter diversity is higher. To this end, Dr. Jesusa Legaspi is surveying for pipunculid parasitoids near Tallahassee, FL.

Sharpshooters collected from the traps were assayed for the presence of *Xf* using molecular techniques developed by Bextine et al. (2005). Analysis of these samples is not complete, so this data set will grow in the coming months. At this point, 95/345 (27%) *H. vitripennis* have tested positive from July to November. This figure is consistent with the other common sharpshooter species; *Oncometopia nigricans* (21%) and *Oncometopia orbona* (14%). Although there was little discrepancy in the percentage of insects testing positive, *H. vitripennis* was the most populous insect resulting on nearly four times the number of positive insects. Also, in July 2006, the percentages of *Xylella*-positive insects was low (*H. vitripennis* (7%), *O. nigricans* (0%) and *O. orbona* (10%)) in comparison to later months. For example, in September high numbers of *Xylella*-positive insects were found (*H. vitripennis* (59%), *O. nigricans* (57%) and *O. orbona* (71%)).

CONCLUSIONS

A pipunculid parasitoid, *Eudorylas* nr. *viereckii* has been recovered in fair numbers from the sharpshooter, *Oncometopia orbona* and *O. nigricans*. Despite intensive efforts spanning two years and multiple field sites a pipunculid parasitoid of *H. vitripennis* has not been positively recovered and identified. Further collecting will take place in the eastern range of *H. vitripennis* in northern Florida, where nymphal parasitoids of *H. vitripennis* may be more abundant. As potential vector species, all three sharpshooters have similar ratios of *Xylella*-positive insects and acquire greater amounts of *Xylella* as the season progresses. However, *H. vitripennis* occurs in higher numbers resulting in greater vectoral potential.

REFERENCES

Bextine, B., Blua, M., Harshman, D., and Miller, T.A. 2005. A SYBR green-based real-time polymerase chain reaction protocol and novel NDA extraction technique to detect *Xylella fastidiosa* in *Homalodisca coagulata*. J. Econ. Entomol. 98: 667-672.

CDFA 2004. Pierce's Disease Control Report to the Legislature: p. 20-24.

de León, J.E., W.A. Jones, and D.J.W. Morgan. 2004. Population genetic structure of *Homalodisca vitripennis* (Homoptera: Cicadellidae), the vector of the bacterium *Xylella fastidiosa* causing Pierce's disease in grapevines. Annals Entomological Society America. 97: 809-818.

Goolsby, J.A. and M. Setamou. 2005. Exploration for biological control agents in the native range of the glassy-winged sharpshooter, pp. 318-320. *In* Proceeding, Pierce's Disease Research Symposium, 5-7 December 2005, San Diego, CA. Complied by M. Athar Tariq, Stacie Oswalt, Peggy Blincoe, Amadou Ba, Terrance Lorick, and Tom Esser, Sacramento, CA

Hoddle, M.S. and S.V. Triapitsyn. 2004. Searching for and collecting egg parasitoids of the glassy-winged sharpshooter in the Central and Eastern USA. In: Pierce's Disease Program: Symposium Proceeding, Coronado, CA.

Irvin, N.A. and M.S. Hoddle. 2005. Determination of *Homalodisca vitripennis* (Hemiptera: Cicadellidae) egg ages suitable for oviposition by *Gonatocerus ashmeadi*, *Gonatocerus triguttatus,* and *Gonatocerus fasciatus* (Hymenoptera: Mymaridae). Biological Control 32: 391-400.

Luck, R.F., C.E. Coviella, and D. Morgan. 2004. Evaluation of olfactory responses by *Gonatocerus ashmeadi*, a parasitoid of glassy-winged sharpshooter egg masses on various host plants. In: Pierce's Disease Program: Symposium Proceeding, Coronado, CA.

Mizell, R.F. and P.C. Andersen. 2003. Keys to management of the glassy-winged sharpshooter: interactions between host plants, malnutrition, and natural enemies. In: Pierce's Disease Program: Symposium Proceeding, Coronado, CA.

Skevington, J.H. and S.A. Marshall. 1997. First record of a big-headed fly, *Eudorylas alternatus* (Cresson) (Diptera: Pipunculidae), reared from the subfamily Cicadellinae (Homoptera: Cicadellidae), with an overview of pipunculid-host associations in the Nearctic region. Canadian Entomologist 129: 387-398.

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