RELATIONSHIP BETWEEN OLFACTORY AND VISUAL STIMULI DURING HOST PLANT RECOGNITION IN IMMATURE AND ADULT GLASSY-WINGED SHARPSHOOTERS

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ABSTRACT
The interactive effects between visual and olfactory stimuli in host plant recognition and location by glassy-winged sharpshooter (GWSS) may be subtle. Thus, observation and evaluation of these interactions will require the development of behavioral assays that take into account host searching behaviors specific to GWSS. A prototype behavioral assay in which adult and immature GWSS are presented with combinations of visual and olfactory stimuli has been developed. Protocols for the presentation of various combinations of stimuli have been evaluated and standardized. Information generated from this approach may provide insight into processes (such as host plant selection and interplant movement by GWSS) that may be otherwise difficult to detect because of the complexity inherent at larger spatial scales.

INTRODUCTION
Although visual cues are of primary importance in host location and selection behavior in leafhoppers (Todd, et al. 1990a; Mizell 2001; Mizell and Andersen 2001; Hix et al. 2003; Tipping, et al. 2004), very little is known about possible interactions between visual and olfactory stimuli in this regard. That plant volatiles can strongly influence host searching and recognition behavior in cicadellids was demonstrated by Todd et al. (1990b) who examined the maize specialist *Dalbulus maidus*. However, the high degree of polyphagy observed in GWSS will challenge efforts to determine the role of volatile stimuli in this insect's searching behavior (Leal 2001). Preliminary results have been reported on volatiles emitted by GWSS host plants (Leal et al. 2001), but the relative importance of plant volatiles in host plant location and recognition in GWSS has not been demonstrated with certainty (Leal et al. 2001; Mizell 2001; Mizell and Andersen 2001). Since other highly polyphagous insects utilize plant volatiles in concert with visual cues to locate host plants (Metcalf and Metcalf 1992) it is not inconceivable that plant volatiles play some role in GWSS host location behavior (Leal et al. 2001).

The interactive effects between visual and olfactory stimuli may be subtle and their observation and evaluation will require the development of behavioral assays that take into account host searching behaviors specific to GWSS (as was done by Todd et al. (1990b) for *D. maidus*). Information generated from this approach may provide insight into processes (such as interplant movement by GWSS) that may be otherwise very difficult to detect because of the complexity inherent in larger scale phenomena. Since nymphs can easily move between plants it is important to understand the nature of the stimuli they use to locate host plants (Tipping et al. 2004). As well, information derived from studies of nymphs can help inform the design of experiments for adults.

OBJECTIVES
1. Develop a behavioral assay that permits observation and evaluation of responses of adult and immature GWSS to combinations of olfactory and visual stimuli.
2. Determine the relative importance and possible synergistic effects of combinations of olfactory and visual cues in host plant recognition in adult and immature GWSS.

RESULTS
Preliminary results showed a positive interactive effect between visual and olfactory stimuli in host plant recognition and selection by both immature and adult GWSS. A manuscript describing the design of the behavioral chamber and the results of ongoing experiments will be submitted for publication in the near future.

CONCLUSIONS
We have developed a laboratory assay designed to accommodate the behavioral attributes of immature and adult GWSS. This approach will prove useful in determining the relative importance and interactive effects of olfactory and visual cues in GWSS searching behavior. This information will, in turn, provide insights into the complex set of cues utilized by GWSS during movements between plants and habitats.

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