MATING BEHAVIOR OF THE GLASSY-WINGED SHARPSHOOTER, *HOMALODISCA COAGULATA*

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INTRODUCTION

Mating behavior in leafhoppers is mediated by vibrational signals transmitted through plants (Claridge and de Vrijer 1994). Leafhopper calls are species-specific and have proven useful in resolving taxonomic problems. Furthermore, analysis of intra- and interspecific variation in male calls has provided clues about speciation processes. However, little is known about mate-finding tactics at the habitat level or the specific cues used by males to locate females after mate recognition. Theoretical and some experimental research on leafhoppers and planthoppers clearly indicates that seasonal patterns of abundance and dispersal are intimately linked to a species mating system (Ott 1993). Thus, determining rules that govern mating behavior may ultimately contribute an understanding of population and community level processes. Also, the application of basic knowledge of leafhopper mating behavior to an applied problem such as developing a novel monitoring device for the glassy-winged sharpshooter is virtually unexplored.

OBJECTIVES

1. Determine the role of vibrational signals in mate recognition, attraction, courtship, and copulation. This objective will be accomplished by describing variation in vibrational signals associated with mate recognition, attraction, courtship, and copulation and by quantifying behavioral transitions that lead to mating. Playback experiments will be done to confirm the involvement of observed signals in mediating the above behaviors.
2. Assess the feasibility of developing improved monitoring traps by using vibrational signals to attract adults. This objective will be accomplished by determining the effect of sticky traps augmented with vibrational signals on the capture of glassy-winged sharpshooters.

RESULTS AND CONCLUSIONS

Laboratory observations and experiments are being conducted in an arena that provides a uniform background and both reduced airborne noise and observer interference. The arena is a 1.1 m x 0.7 m x 0.9 m box that is positioned on a vibration isolation table. The laser and vibrator (see below) are located inside the box.

We recorded vibrational signals using a laser Doppler vibrometer (LDV) (Polytec: model OFV 353 sensor; model OFV 2602 controller, 1.0 mm/s/volt setting) connected to a Macintosh computer equipped with a 16-bit Audiomedia III (Digidesign) sound card. The card was controlled using Peak 3.0 (BIAS) software. Signals were digitized at a sample rate of 44,100 s^{-1} and stored on the hard drive of the computer. Temporal and frequency features were measured using Canary 1.2.4 (Cornell Laboratory of Ornithology) software. The filter bandwidth for all frequency measurements was set at 43.71 Hz. Calls emitted by males have been recorded and characterized (Figure 1 and Table 1). The male call consists of a long duration whine that rises in frequency followed by a series of pulses. Current efforts on male calling behavior focus on determining daily patterns of calling activity.

At present I am investigating male/female interactions and male search behavior. Females respond to calls emitted by males or to recordings of these signals by emitting a whine-like call that is similar in structure to the male call. Males search in response to female calls in a manner typical of other leafhoppers. Results of this ongoing work will be used to plan specific studies under objective 2.

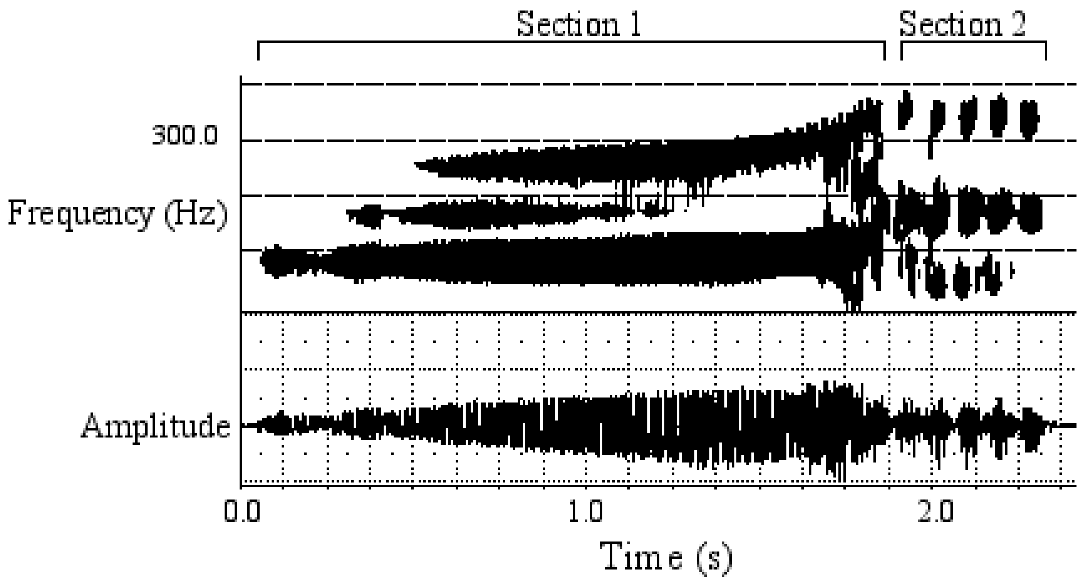

Figure 1. Sonogram (upper panel) and oscillogram (lower panel) of a typical call emitted by a male *Homalodisca coagulata.* Male calls have two distinct sections. Section one consists of a whine that increases in frequency. Section 2 consists of a series of pulses. Refer to Table 1.

Table 1. Analysis of calls emitted by first generation males (N = 15) reared from adults collected on the UC Riverside campus.

Call Features	Mean	± SD
Section 1 duration (s)	1.71	± 0.167
Section 2 duration (s)	0.68	± 0.164
Section 1 initial frequency	75.20	± 9.871
Section 1 end frequency	115.60	± 19.036
Section 2 initial frequency	65.60	± 14.136
Section 2 end frequency	66.20	± 8.446
Number of pulses in section 2	6.4	± 1.789

All frequency (Hz) measurements are based on the fundamental frequency (i.e. the lowest high energy band). Refer to Figure 1.

REFERENCES

Claridge, M.F. and P.W.F. de Vrijer. 1994. Reproductive behavior: the role of acoustic signals in species recognition and speciation. In: The Planthoppers: Their Ecology and Management R.F. Denno and T.J. Perfect, (eds.), pp. 216-233. Chapman and Hall, New York.

Ott, J.R. 1994. An ecological framework for the study of planthopper mating systems. In The Planthoppers: Their Ecology and Management R.F. Denno and T.J. Perfect, (eds.), pp. 234-254. Chapman and Hall, New York.

Thornhill, R. and J. Alcock,. 1983. The Evolution of Insect Mating Systems. Harvard University.

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