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Responses of Asian Citrus Psyllids to Substrate-borne Vibrational Communication Signals

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The Asian Citrus Psyllid (ACP), *Diaphorina citri* Kuwayama, vectors a harmful bacterium, Candidatus Liberibacter asiaticus, which causes huanglongbing, an economically devastating disease of citrus. Improved methods for detection and trapping of ACP could significantly reduce the damage associated with the spread of this disease. One previously unexploited method of detection involves the vibratory, substrate-borne signals by which adult male and female ACP communicate over 10-50-cm distances within their citrus tree hosts. Mate-seeking males begin calling while moving along the tree branches, searching for females. A receptive female replies to these signals within about 0.5-s, which helps the male to find her position (Wenninger et al. 2009, Rohde et al. 2013). A series of studies was conducted in a noise- and vibration-shielded anechoic chamber (Fig. 1) to manipulate these communications in a way that could be used to attract and trap ACP males in field environments. Male recorded calls were played back to females through the vibration exciter and the replies were monitored with the accelerometer. The frequencies, durations, and loudness of calls that elicited the greatest female response were analyzed for further study. In addition, recorded replies from females were played back to males, attracting them to the signal source. Based on the successful results with the laboratory accelerometer and vibration exciter systems (Rohde et al. 2013), we began development of a portable, automated system with a piezoelectric vibratory element that replies to male calls immediately after they are detected by a microphone attached to a small, inexpensive microcomputer. Searching males move towards the source of such calls (Fig. 2) and can thereby be trapped. To facilitate trap development we have begun testing the relative attractiveness of carefully constructed synthetic calls, some of which are described in (Rohde et al. 2013). In addition, we are beginning to conduct field studies under conditions of moderate background noise.

References

Wenninger, E. J., Hall, D. G., and Mankin, R. W. 2009. Vibrational communication between the sexes in *Diaphorina citri* (Hemiptera: Psyllidae). Annals of the Entomological Society of America 102: 547-555.

Rohde, B., Paris, T. M. Heatherington, E. M., Hall, D. G., and Mankin, R. W. 2013. Responses of *Diaphorina citri* (Hemiptera: Psyllidae) to conspecific vibrational signals and synthetic mimics. Annals of the Entomological Society of America 106: 392-399.

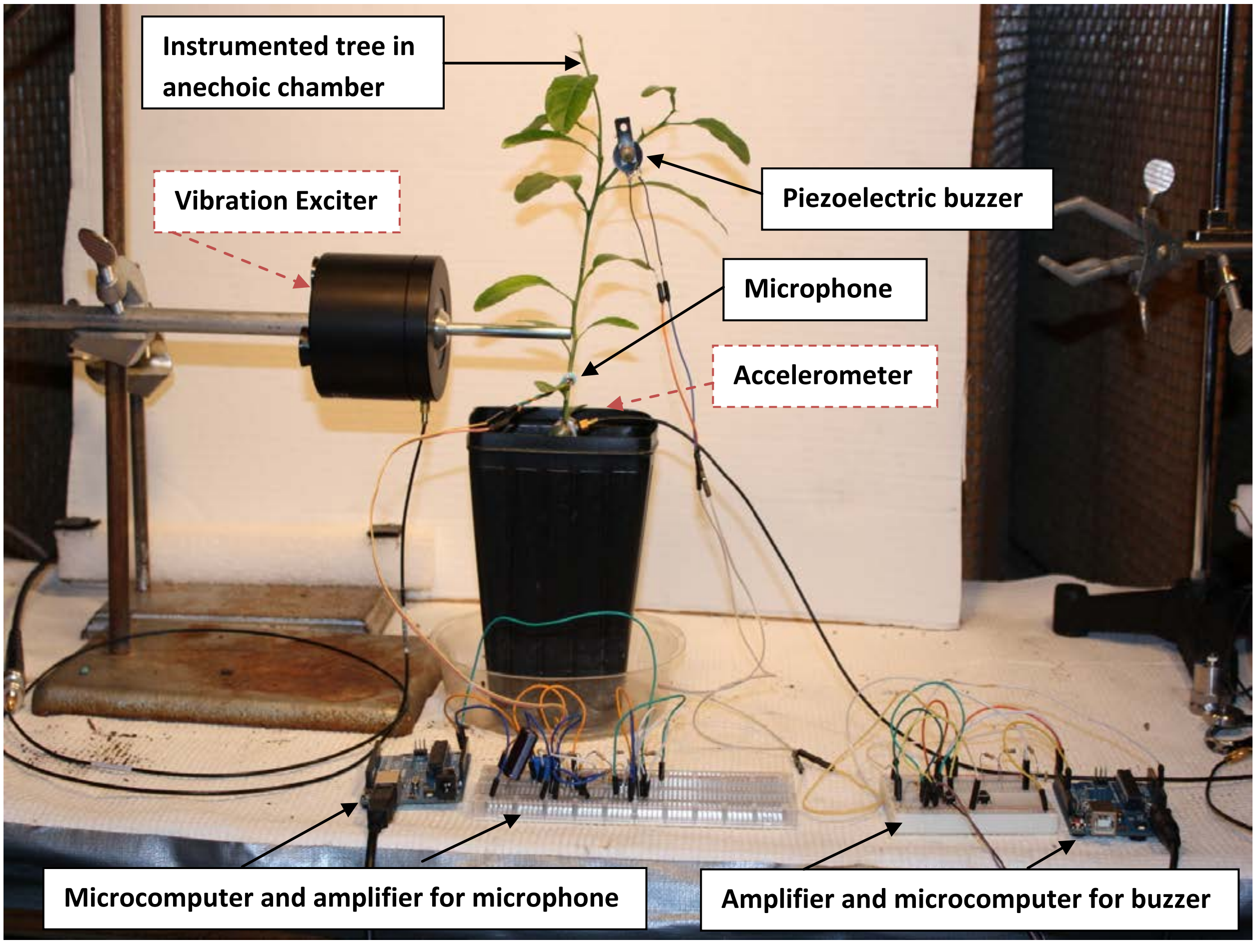

Figure 1. Setup of equipment used for monitoring and producing ACP vibrational signals in a sound- and vibration-shielded anechoic chamber. Dashed lines indicate the standard laboratory accelerometer for monitoring vibrations and an exciter for producing vibrations. An inexpensive Arduino microcomputer, amplifier, and microphone system was attached to the tree as an alternative method of monitoring vibrations and a microcomputer, amplifier, and piezoelectric buzzer was attached as an alternative method of producing vibrations. The laboratory system and the two Arduino systems could be operated simultaneously for monitoring and detection of real and synthetic signals.

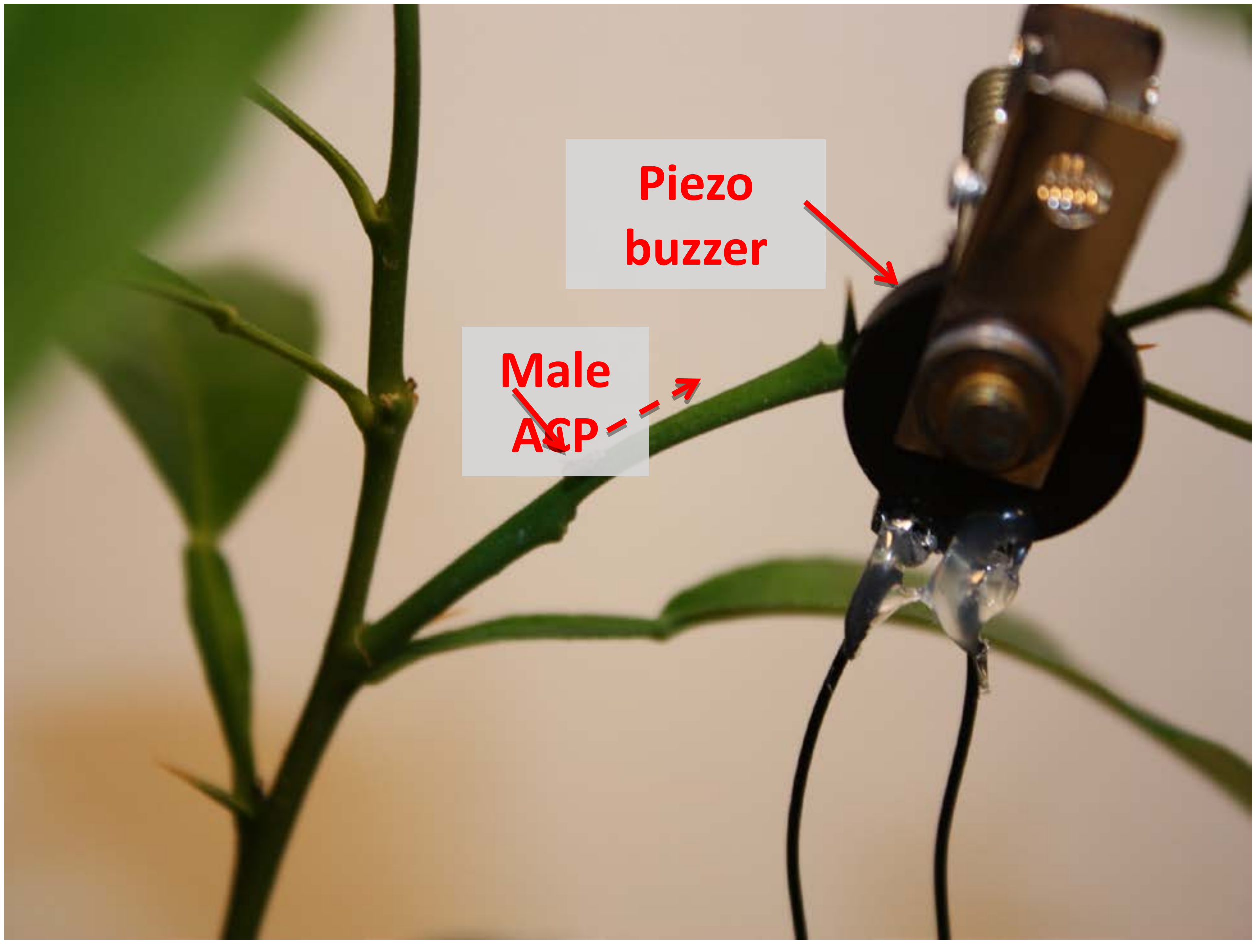

Figure 2. Example of male ACP searching for source of synthetic signal played from the piezoelectric buzzer. The signal is supplied by an Arduino microprocessor-amplifier system that costs ~ $50.