

Palomena prasina (Hemiptera: Pentatomidae) vibratory signals and their tuning with plant substrates

Research Article

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Received 31 January 2013; Accepted 19 March 2013

Abstract: *Palomena prasina* is interesting for the study of vibrational communication within the Pentatomid subfamily Pentatominae, because its host range is limited to woody plants, unlike the better known *Nezara viridula*, whose vibrational communication is commonly used as a model for the whole family. The vibrational repertoire of *P. prasina* was described several decades ago and is redescribed in this paper using modern methods for non-contact vibration recording. Additionally, we hypothesized that this species has retained the capacity for signal frequency variation necessary for tuning to resonance properties of various host plants of Pentatominae, but if the signals are emitted in the absence of mechanical feedback, they are tuned more specifically to their native acoustic environment – woody plants. By recording live bugs signalling on different substrates and comparing spectral properties of their signals among substrates, we found that there is a match between the signals emitted on a woody branch and those emitted on a non-resonant surface, while spectral properties of signals emitted on herbaceous plants differ. Our findings provide evidence in support of the signal tuning hypothesis and shed further light on the crucial role of substrate in vibrational communication of insects.

Keywords: *Pentatominae* • *Vibrational communication* • *Signal propagation* • *Frequency characteristics*

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1. Introduction

Palomena prasina (Linnaeus, 1761) (Heteroptera: Pentatomidae) is a univoltine herbivorous species of the subfamily Pentatominae, the stink bugs, that feed on various deciduous trees and shrubs. It has a Palearctic distribution and is common in Europe where it has status as a minor pest of apple, pear, raspberry and hazelnut, particularly in those orchards that are situated in the vicinity of broadleaved woodlands [1]. One notable exception to this minority status is in Turkey, where the species is the dominant insect pest in hazelnut production [2]. Vibrational repertoire of *P. prasina* was first described several decades ago by its air-borne sound component, which was registered with a conventional microphone and amplified [3]. The authors described the female and male calling songs, and two types of male courtship songs, assuming that the “calling

song” is a type of song used for long-range detection and localization of mates, while “courtship song” consisting of more elaborate signals is used for precise species recognition analogous with *Nezara viridula* [3]. The airborne components' spectral composition was similar to all described vibratory signals in the subfamily Pentatominae to date [4,5], but no correlation with properties of the substrate was made at the time.

In recent years, the importance of substrate for vibrational communication has come into focus. Physical features of the substrate determine various signal transmission properties, such as propagation velocity, frequency filtering, and resonance [6]. Plant tissues are generally considered low-pass filters [5-9], imposing the upper frequency limit of signals used for efficient long-range communication in Pentatomine stink bugs. The dominant frequencies of all described songs produced in Pentatomine stink bugs by abdomen

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