

# The role of signals of different modalities in initiating vibratory communication in *Nezara viridula*

## Research Article

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**Abstract:** Signals of different modalities are involved in the behaviour of the green stink bug, *Nezara viridula* (L.) (Pentatomidae, Heteroptera). Long range attraction is mediated by male pheromones, resulting in aggregation of bugs on the same plant where vibratory signals, vision and various chemical signals become important. Both males and females sing spontaneously. When both are on the plant, males start vibratory communication as often as females. Females induce the exchange of vibratory signals spontaneously or triggered by the male pheromone while males initiate the duet either spontaneously or after seeing the female. Males and females sing spontaneously and respond to signals of different modalities more often in the daylight than in the dark. Long lasting autonomous emission of the female calling song is present when triggered by the male pheromone and males respond to female calling predominantly by the emission of the courtship song.

**Keywords:** *Vibrational communication* • *Pheromones* • *Mating behaviour* • *Vibrations* • *Nezara* • *Spontaneous singing* • *Green stink bug* • *Pentatomidae* • *Heteroptera* • *Trigger*

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## 1. Introduction

The green stink bug *Nezara viridula* L. is a cosmopolitan, highly polyphagous pest of economic importance for soybean and cotton, and other agriculture crops like tomatoes, potatoes, many legumes and cereals [1]. Its biology has been described in detail by Todd [1] and Panizzi [2].

This species' mating behaviour has been studied in several geographically isolated populations [3-7] and consists of two phases: long range calling and short range courtship behaviour. At long range, male pheromones act as an attractant that brings adults and last stage nymphs together [4,5,8-10]. The composition of the male pheromone has been identified in several populations and the main pheromone components have been synthesized [5,8,9]. Differences between populations are reflected in the different *trans* to *cis* ratios of Z- $\alpha$ -bisabolene epoxide (BAE), the main compound in the pheromone blend [11].

At close range, signals of other modalities become important. While pheromone extracts alone do not

elicit short-range courtship behaviour (defined as "butting" and "pivoting") in females [5], pheromones do elicit vibrational communication [12], which enables mate location on the plant [13] and recognition [14]. In *N. viridula* Čokl and co-workers [15] described species specific female and male calling songs, FCS and MCS, and courtship songs, FCrS and MCrS, together with the female repellent (FRS) and male rival (MRS) songs. Temporal characteristics of calling songs differ between geographically isolated populations [7].

Although mating behaviour and communication in *N. viridula* have been described in numerous studies, the question as to which signals trigger vibrational communication remains open. To reveal the role of each modality in triggering communication with vibratory signals we examined the effects of chemical, mechanical (vibrational) and optical (visual) signals. Our hypothesis was that male singing is triggered by females' vibratory and visual stimuli and female singing by males' pheromones. Three different tests were assembled: to reveal the role of visual cues, a dead body of a green stink bug was used as a visual stimulus. Vibrational stimuli were tested

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