

## Evaluation of the social behavior based on vibrational signals of *Philaenus spumarius* in semi-field conditions

Imane Akassou<sup>1,2</sup>, Sabina Avosani<sup>1,2</sup>, Vincenzo Verraastro<sup>3</sup>, Valerio Mazzoni<sup>2</sup>

<sup>1</sup>DICAM Department of Civil, Environmental and Mechanical Engineering, University of Trento, Trento, Italy; <sup>2</sup>Research and Innovation Centre, Fondazione Edmund Mach, San Michele all'Adige (TN), Italy; <sup>3</sup>CIHEAM-IAMB - International Centre for Advanced Mediterranean Agronomic Studies, Bari, Italy

### Abstract

Substrate-borne vibrations are probably the most common means of communication in insects; they underlie insect social and ecological interactions in a complex vibrational environment, containing interferences from other species and sources of noise. In leafhoppers (Hemiptera: Cicadomorpha), the mating behavior is mediated by vibrational signals that are emitted in different social contexts: individuals, pairs, and groups (Tishechkin, 2003).

The meadow spittlebug *Philaenus spumarius* (Hemiptera: Aphrophoridae) is the main vector of the quarantine bacterium *Xylella fastidiosa*, that is the causal agent of the Olive Quick Decline Syndrome, a severe vascular disease that appeared suddenly few years ago in the province of Lecce (Salento peninsula, southeastern Italy) (Saponari et al. 2014).

Since the nymphal stage of *P. spumarius* commonly lives in spittles, grouped on the same plant or on nearby plants; sharing the same feeding site. It is relevant to assess if this aggregation behavior is maintained also in the adult stage and, if it is based on the exchange of vibrational signals. Furthermore, the control of the insect relies on chemicals; it would be interesting to evaluate the potential development of a sustainable management strategy, based on vibrational signals, as physical disruption (Polajnar et al. 2016). Thus, it is fundamental to understand the temporal and the seasonal pattern of the emitted vibrational signals.

The aim of our study was to investigate the social behavior, based on vibrational communication signals, between individuals of the same sex of *P. spumarius* and to evaluate the insect vibrational signaling activity throughout the day but also during the adults development stages.

To minimize the communication associated to the mating behavior, the studied groups consisted on 6 to 10 individuals, of only males and only females. They were placed on grapevine plants, separately in two net-cages. Recordings were carried out outdoor, in semi-field conditions, simultaneously via two laser Doppler vibrometers.

Trials took place from the middle of June until the end of September, in terms of periods of 20 to 30 days each, in order to evaluate the seasonal pattern of the insect vibrational signaling activity. To study the temporal pattern, three slots of the day were chosen to record: from 06:30 am to 11:00 am, from 11:30 am to 16:00 pm and from 16:30 pm to 21: 00 pm, each slot was repeated 3 times during each period.

Our preliminary results indicate that males were calling throughout the full season of recording; calls were usually followed by jumping of the males from the plants (call & fly behavior), while females started calling only later, from the middle of July. During the day; females were emitting more calling signals in the evening, whereas males were emitting calling signals during the three slots of the day, with a lower activity in the middle of the day.

The acquired knowledge is important to better understand the signaling behavior and the phenology of *P. spumarius* in natural conditions. The next steps will consist on the characterization of the recorded signals and their association to their behavioral meanings.

Further experiments applying playbacks, in different social contexts (males & females) will be performed, to achieve these goals.

**Key words:** *Philaenus spumarius*, vibrational communication, social behavior, substrate-borne signal

### References

- Polajnar, J., Eriksson, A., Virant-Doberlet, M., & Mazzoni, V. 2016: Mating disruption of a grapevine pest using mechanical vibrations: from laboratory to the field. *Journal of pest science* 89(4): 909-921.
- Saponari, M., Loconsole, G., Cornara, D., Yokomi, R. K., De Stradis, A., Boscia, D. & Porcelli, F. 2014: Infectivity and transmission of *Xylella fastidiosa* by *Philaenus spumarius* (Hemiptera: Aphrophoridae) in Apulia, Italy. *Journal of economic entomology* 107(4): 1316-1319.
- Tishechkin, D. Y. 2003: Vibrational communication in Cercopoidea and Fulgoroidea (Homoptera: Cicadina) with notes on classification of higher taxa. *Russian Entomological Journal* 12(2): 127-181.