

Vibrational Mating Disruption of *Scaphoideus titanus*: the current state after two years of field experience and benchmark analysis with Pheromonal Mating Disruption

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Abstract

Biotremology is a new discipline that studies the vibrational communication in animals (Hill & Wessel, 2016). Vibrational mating disruption (VMD) is an innovative technique that is based on the transmission of vibrational signals into plant tissues to disrupt the mating behavior of insect pests (Eriksson et al. 2012). After the first laboratory experiments conducted in the second half of the 2000s (Mazzoni et al. 2009; Polajnar et al. 2016), the method has now been applied in commercial vineyards. In 2017, the world's first vibrational vineyard was established in San Michele all'Adige (Northern Italy) for the control of the leafhopper *Scaphoideus titanus*. As a whole, we installed 110 emitters of disruptive noise on a surface of 1.5 ha of organic cabernet-franc. Each emitter was 50m distant from the next one. As a control, we used a nearby vineyard of the same variety and approximately the same size. Manual samplings were conducted throughout summers 2017 and 2018 at week periodicity from May to September. At each sampling, 20 randomly chosen leaves, from the median-basal part of 26 grapevines/plot were inspected to check the presence of leafhopper nymphs or other arthropods (namely, spiders or other no-target insects). The first results, at the second year of application, indicate a significant reduction from 2017 to 2018 of the number of *S. titanus* (<50%) and *Empoasca vitis* (<25%) nymphs in the vibrational vineyard as compared to the control. No effects on spiders and no-target insects were detected.

To outline possible advantages and disadvantages of applying VMD to commercial crops, and for indicating weaknesses, strengths, similarities and differences, we made a benchmark analysis using the pheromone mating disruption (PMD) as reference. Both behavioral and physiological characteristics of the different target species and peculiarities of the two methods were included in this analysis: (1) sensorial modality and signal specificity; (2) searching behavior; (3) signal active space; (4) male rivalry behavior; (5) spatial dispersion; (6) insect phenology; (7) mechanisms of action; (8) efficacy assessment.

We concluded that VMD is a promising method for control of pest species that rely on substrate borne vibrations for mating and that thanks to the constant and fast development of technologies (i.e. electronics, informatics, and energetics) it is quickly filling the gap to become applicable to commercial vineyards. In addition, we propose the use of the term “semiphysicals” as analogue of “semiochemicals” to indicate vibrational signals used for intra and interspecific communication in insects.

Key words: Biotremology, grapevine, leafhoppers, IPM

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