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Mating Disruption of Insect Pests with Vibrational Signals: from Theory to Practice

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Mating communication in many insect species is mediated by substrate-borne vibrational signals that play a main role compared to other sensory cues. This is the case, for example, in leafhoppers (Hemiptera, Cicadellidae) in which are included many important crop insect pests. In these species mating signals are characterized by species-specific features (spectral and temporal) that allow the receiver to estimate identity, and to perform location and courtship, after establishing a vibrational duet with the partner.

As model species we used *Scaphoideus titanus* a grapevine leafhopper which is a vector of a phytoplasma disease Flavescence dorée. In this species rival males show complex rivalry behaviour which includes specific signals to interrupt a mating duet of another male with a female. Thus we hypothesized that playing back the male rivalry signals to grapevine plants we would be able to disrupt the mating behaviour of *S. titanus*, thus preventing the copulation.

First, we conducted laboratory tests on pairs placed on a grapevine leaf to demonstrate that mating disruption with vibrational signals is feasible.

As a second step we tested a system of potted plants inside plastic cages interconnected by iron wires, to simulate a typical vineyard trellis. Pairs of *S. titanus* were released into the cages for 18 hrs (4 pm to 10 am) and a prototype of a vibrational shaker with best transmission performances was used to vibrate the wire. As a result more than 90% of pairs remained unmated (in control treatment only 20% of pairs did not mate).

Later we applied vibrational mating disruption to mature plants in open vineyard. Pairs of males and females were released inside net sleeves including 3-4 grapevine shoots with fully developed leaves. Again the disruption signal was continuously applied to plants through the supporting trellis wire for 18 hrs. Results showed that even 10 m away from the shaker more than 90% of pairs were remained unmated, compared to 20% of non-mated pair in controls.

Finally, we applied the method to test new prototypes of shaker that may be effective at longer distances and with different disruption time regimes in order to spare energy consumption. We found that 65% of mating disruption is still achieved at 45m and that at least 18 hrs of disruption are necessary to have 80% of success. Now our aim is to further optimize the system in order to make the device an economically sustainable tool for agricultural use.