

- Background -

- *Drosophila suzukii* (Matsumura) (Diptera: Drosophilidae), the spotted wing drosophila (SWD), is a major pest which is spreading as an invasive species across Europe and North America. Females are able to lay eggs in ripening fruits seriously affecting the production [1].
- In several species of the genus *Drosophila* a specie-specific courtship song has been described. Instead, to date, the mating behaviour of SWD was believed to rely only on visual signals [2].
- The knowledge of mating behaviour is crucial to develop long-term and sustainable solutions to control the pest spread and damages, such as mating disruption [3]

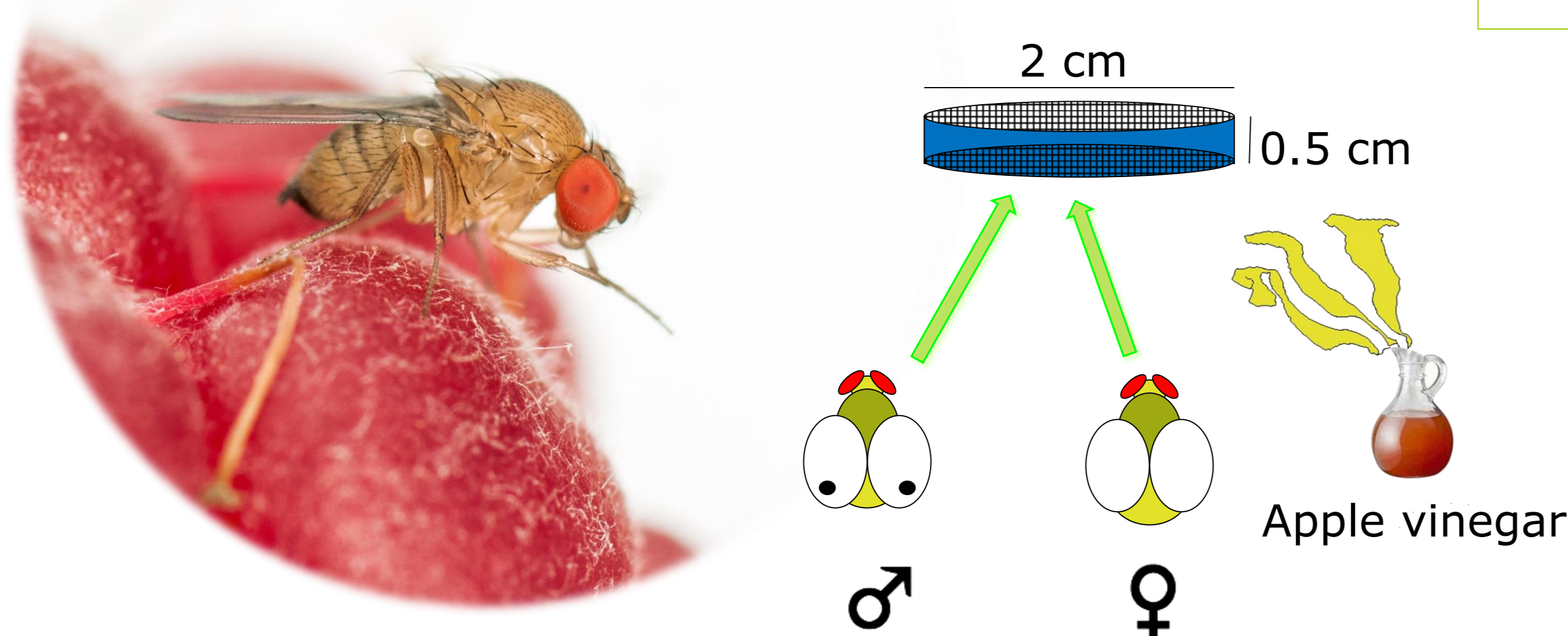
- Aim of the study -

Are acoustic signals present in the courtship behaviour of *D. suzukii*?



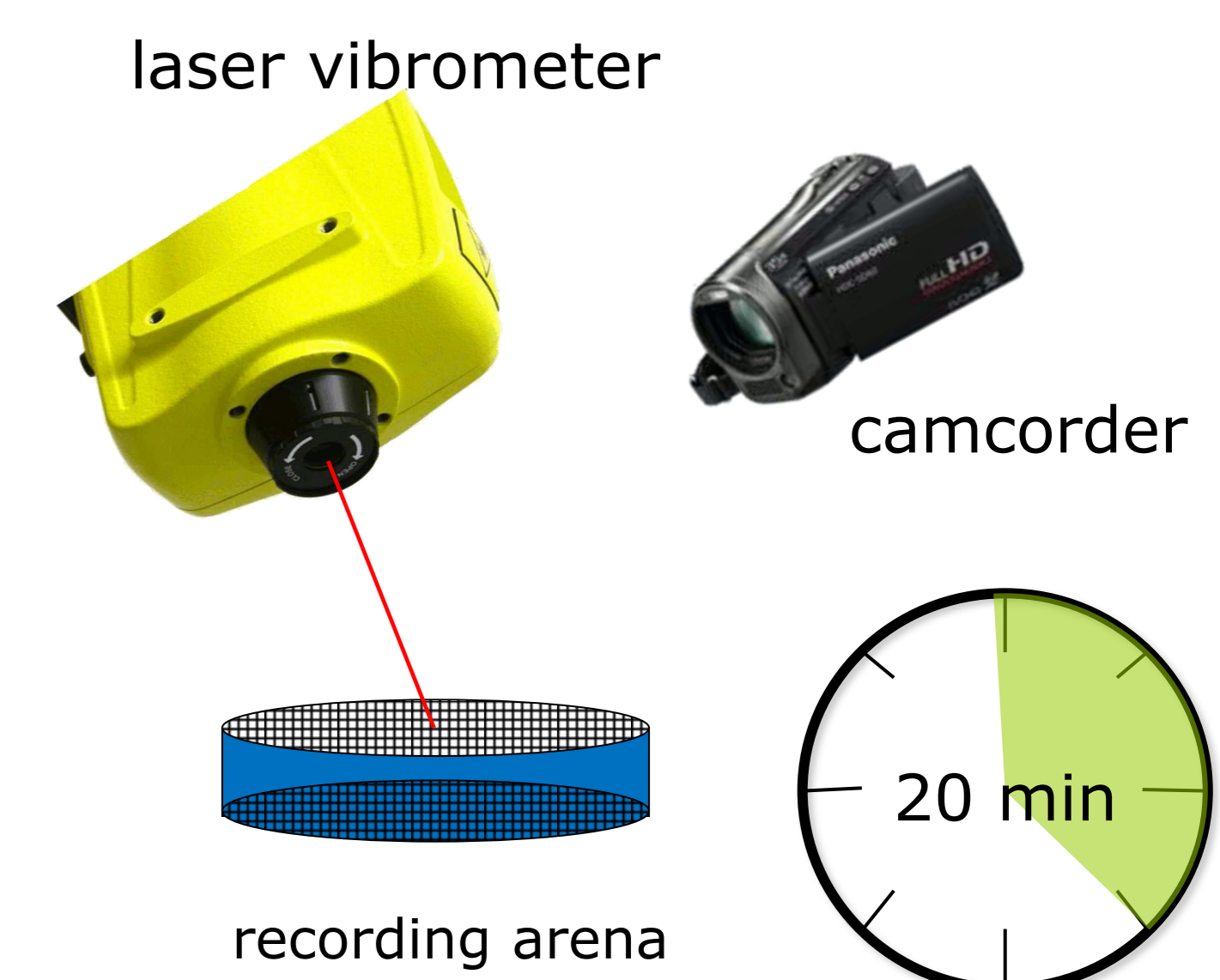
Especially focusing on **substrate-borne vibrations** → Mating disruption by vibrational signals is currently developed by the Chemical Ecology group for applications to grapevine leafhoppers[4]. Can it be applicable also to SWD?

- Materials & Methods -



- Pairs of SWD were placed in a recording arena and the behaviour was recorded together with vibrational signals for 20 minutes or until copulation.

- Measured parameters on vibrational recordings:
- signal intensity as substrate velocity ($\mu\text{m/s}$)
 - pulse repetition time (PRT, ms)
 - signal duration (ms)
 - fundamental frequency (Hz)



- Results -

- From the videos five different stages of the mating behaviour of *D. suzukii* have been identified (Fig. 1).
- Two different vibrational signals have been associated to the mating behaviour and described (Table 1):

🔊 **Toot** (Fig. 2) → a frequency modulated sound with clear harmonic structure, the emission of «toot» was always associated with wing exposure when a male was facing a female;

🔊 **Abdominal ticking** (Fig. 3) → signals associated with dorso-ventral abdominal oscillations that resulted in emission of broadband pulse trains.

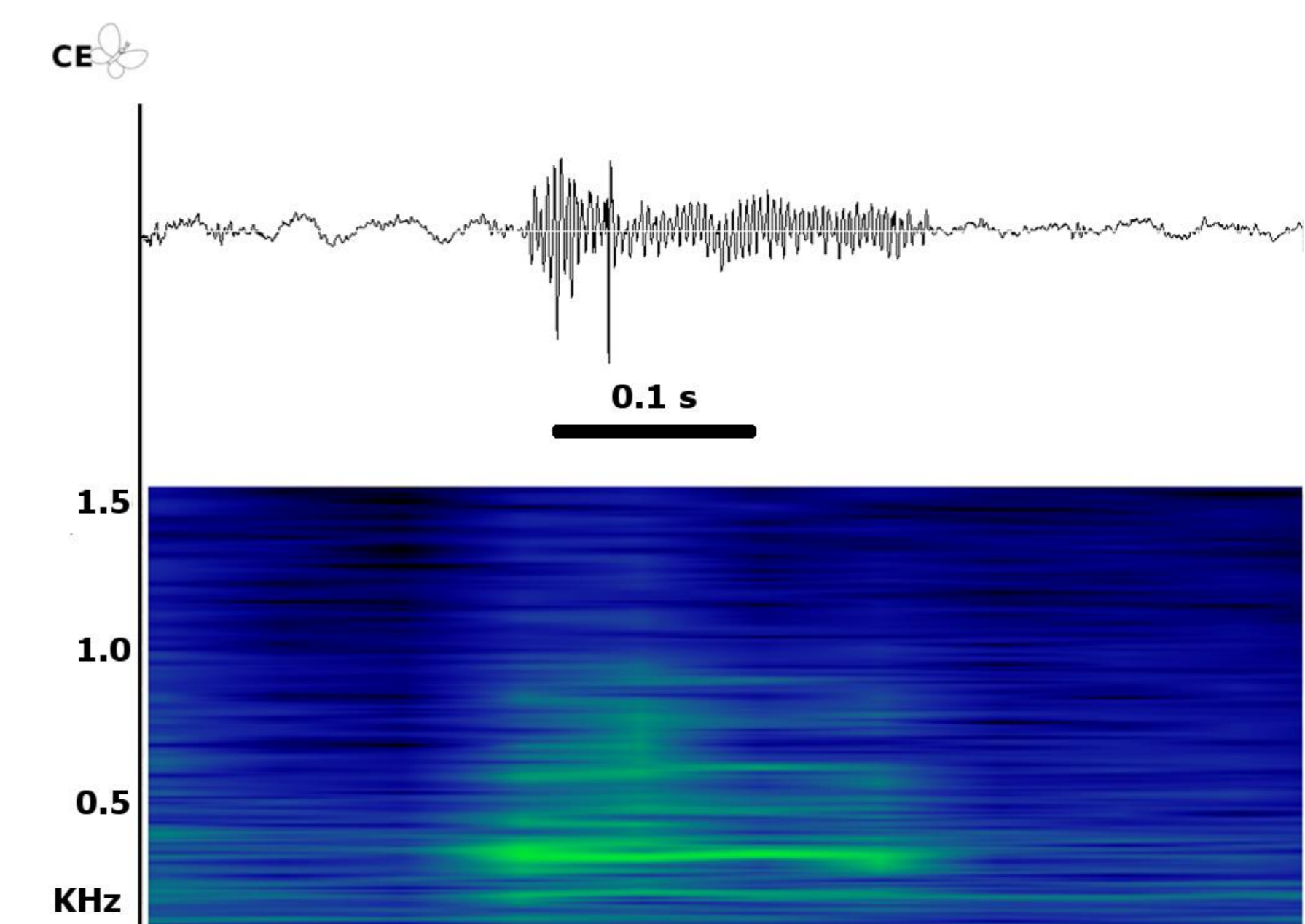


Fig. 2 - Oscillogram (above) and spectrogram (below) of a «toot».

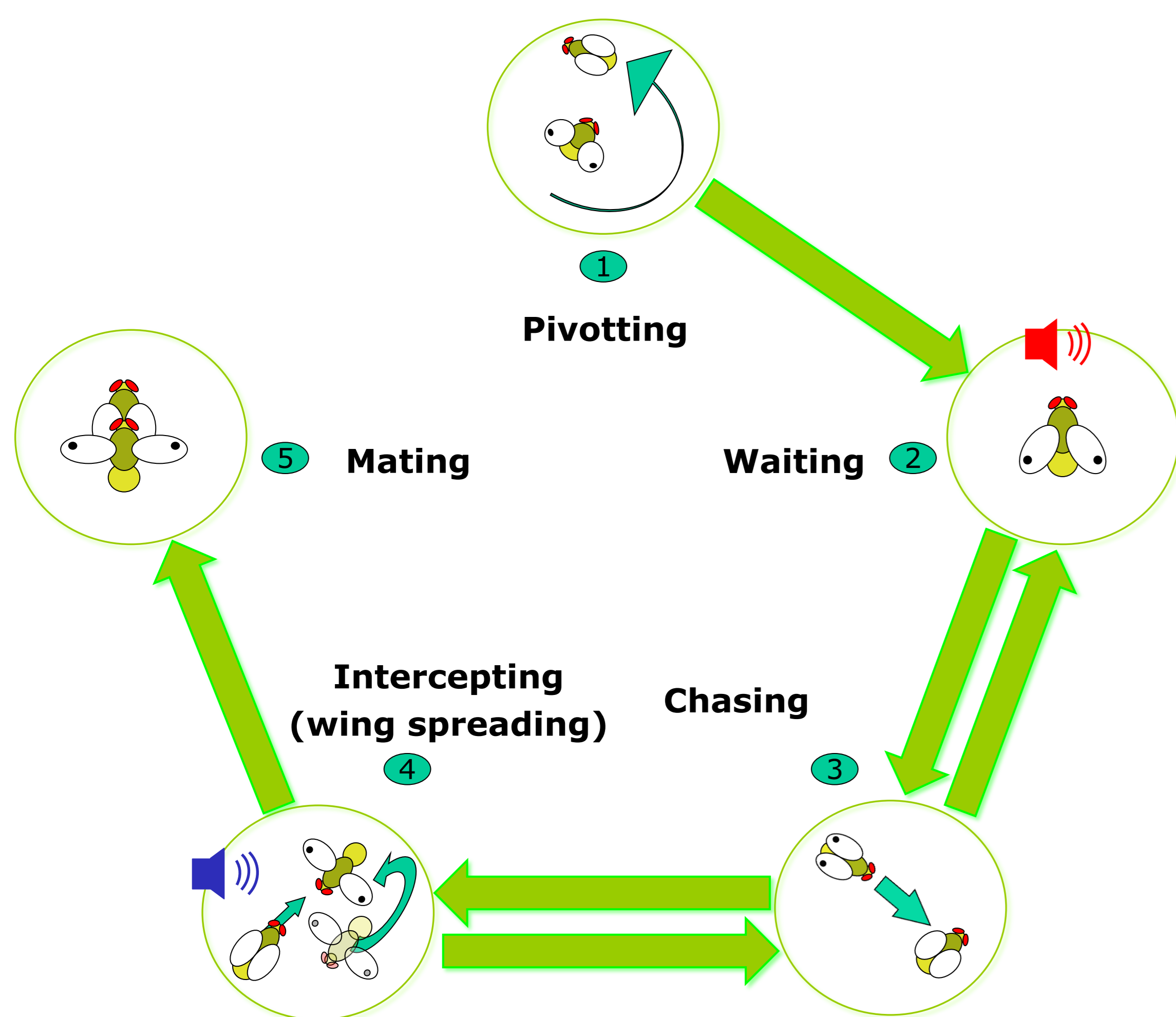


Fig. 1 - Sequence of courtship and mating behaviour of *D. suzukii* and association with vibrational signals.

Table 1 - Species-specific substrate-borne signals obtained by analysis of spectrograms and oscillograms

	N/n	Intensity ($\mu\text{m/s}$)	PRT (ms)	Duration (ms)	FF (Hz)
Abdominal ticking	5/20	4.2 ± 2.5	69 ± 18	-	-
Toot	8/30	26.7 ± 16.7	-	209 ± 77	268 ± 50

PRT, pulse repetition time; FF, fundamental frequency; N, number of individuals analysed; n, number of signals analysed per individual.

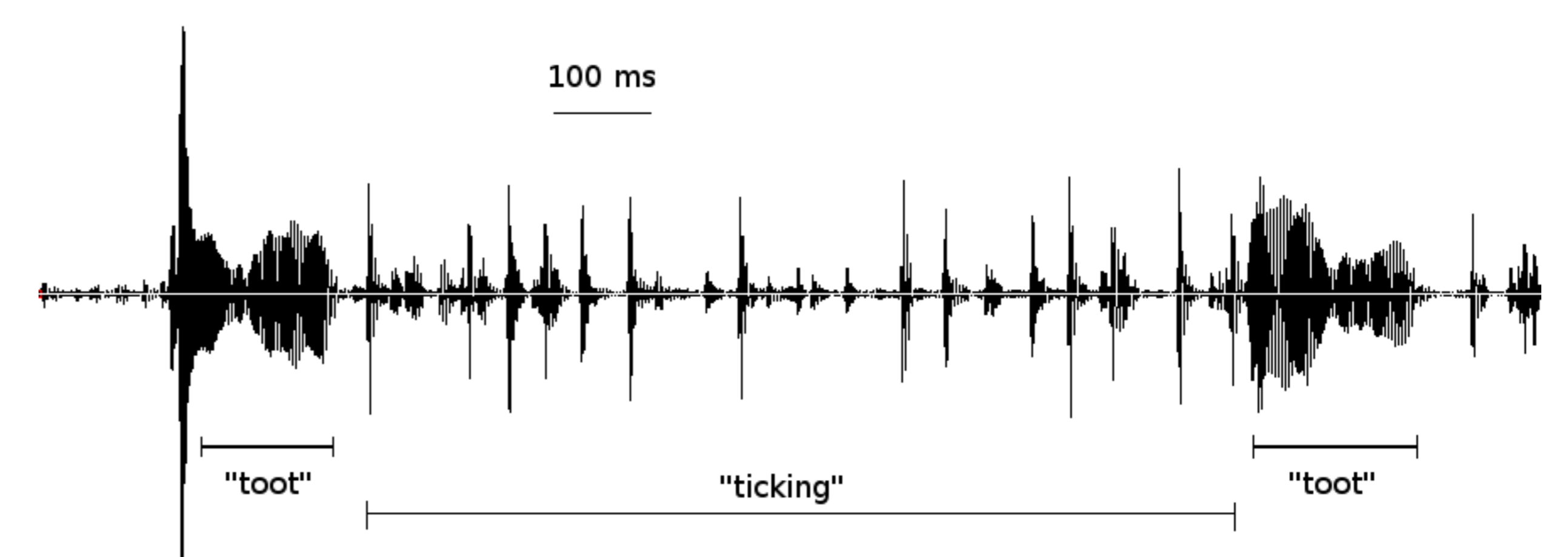


Fig. 3 - Oscillogram of male mating signals of *D. suzukii*. Two 'toots' interspaced by 'ticking' are showed.

- Conclusions -

Evidences:

- In contrast with the previous knowledge, the acoustic signals are extremely important in the mating behaviour of SWD.
- The analysis of the videos showed a tight connection between visual and acoustic/vibrational cues to increase females acceptance.
- Incidental vibrations induced by moving flies may provide continuous background vibrational information throughout the courtship.

Insights for the future:

- *Drosophila* species are ecologically highly divergent [5] and the relative importance of vibrational communication during courtship may reflect the use of a specific host (i.e. substrate) [6].
- Further studies on the relevance of vibrational signals over the visual ones can enable the development of a specie-specific mating disruption approach, as it has already been done for other insect pests [4].

References:

- [1] Cini *et al.* 2012, *Bull. Insect.* 65: 149-160.
 [2] Tomaru & Yamada, 2011, *Low Temp. Sci.* 69: 61-85.
 [3] Mazzoni, Lucchi, Čokl, Prešern & Virant-Doberlet, 2009, *Entomol. Exp. Appl.* 133:174-185.

- [4] Eriksson, Anfora, Lucchi, Lanzo, Virant-Doberlet & Mazzoni, 2012, *PLoS ONE*, 7, e32954.
 [5] Markow & O'Grady, 2005, *Annu. Rev. Biol.* 39: 363-291.
 [6] Cocroft & Rodriguez, 2005, *BioScience*, 55 No. 4: 323-334.