A Five Years Analysis of Population-Dynamics in *Drosophila suzukii*

Usefulness of Monitoring Traps and Relevance for Viticulture

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Introduction

The Asian fruit fly *Drosophila suzukii* is a mayor invasive pest species for fruit and vine production systems in America and Europe. The species has been expanding its range (Rota-Stabelli et al., 2013) since 2008 in America and South Europe (Calabria et al., 2012 and Cini et al., 2012). In Germany, first observations of *D. suzukii* were made in 2011 (Vogt et al., 2012). In contrast to other *Drosophila* species, the females are attracted to ripening fruits, that are used for egg laying. The larvae and pupae develop inside the fruits, which can cause economic damage. The infestation of intact fruits with eggs is facilitated by the sclerotized ovipositor (Harris et al., 2014) of the females and the general wide host range (Steck et al., 2009 and Poyet et al., 2015). The males are easily detectable by their black dots at the tip of their wings, which the females lack.

To get a better understanding of the population dynamics of *D. suzukii*, a monitoring program was established at the State Institute for Viticulture and Enology. In this program, the characteristics of the local trap environment and vegetation with alternative hosts was taken into account . Additionally, semi field experiments with cages were conducted, to evaluate the attractiveness of the traps used in the monitoring program.

Material and Methods

Monitoring

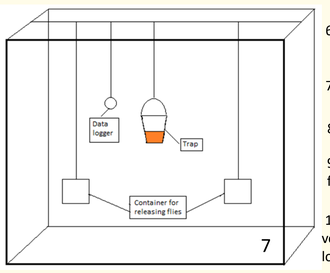
1. Trap location viticulture
2. Trap location orchard
3. Trap location edges of forests
4. Treetop forest trap location
5. Female ovipositor

The monitoring system was established in Baden-Württemberg in April 2012 and was controlled continuously up to date. There are different trap locations throughout the viticultural regions Kaiserstuhl, Ortenau, Markgräflerand and Kraichgau. In total, 55 traps were set up in 22 regions.

Each trap consists of a plastic cup with holes of 4 mm diameter at the edge of the top. The traps were filled with 125 ml of turbid apple vinegar and water (1:1) to which a drop of detergent was added. The traps were changed at least every two weeks and the numbers and the sex of the trap captures were determined.

To analyze the environmental surroundings of the traps, a circle of 100 m was mapped and categorized as vineyard, orchard, forest, hedges and other structure.

Cage experiments



6. Arrangement of the cages
7. Schematic of the cage
8. Monitoring trap
9. Overview for male and female *D. suzukii*
10. Examples for vegetation maps of the local trap environment

The cages have a base of 1.5 m x 1.5 m and are 2 m high. The monitoring trap was installed in the center of the cage. To assess the influence of structural components, additional to the trap, branches can be installed in the middle or at the side with or without cherries, respectively.

The experiments were performed over a period of at least 60 hours. The bait solution was changed every 12 hours and the number and gender of the captured flies was determined. The experiments were conducted between May and August 2017.

Results

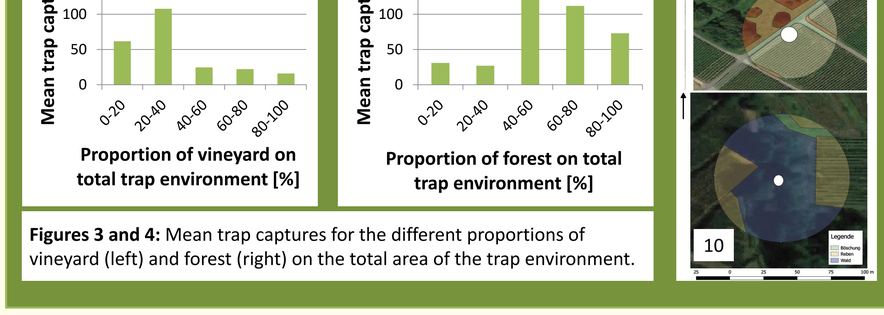


Figure 1: Mean trap captures over the five years of monitoring in the different locations. The year is visually divided in four periods

The mean trap captures over the five years of monitoring can be divided in four different periods (Figure 1).

Period	Time	Numbers of trap captures
A	December – January	Middle
B	January – July	low
C	July – October	middle
D	October – December	high

Vineyard and Orchard locations trap less numbers of flies than forest or edges of forest trap locations.

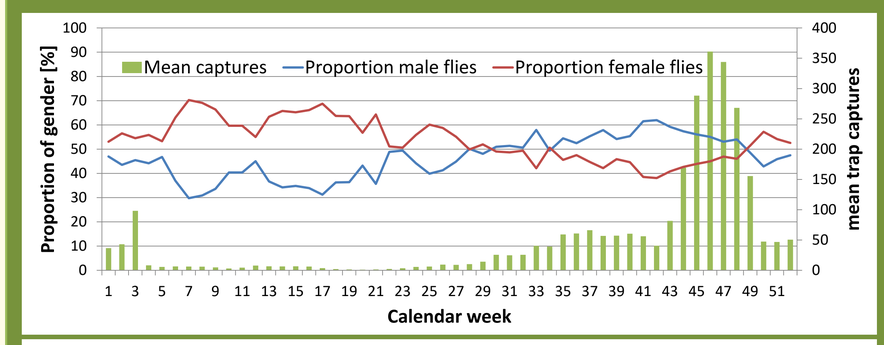


Figure 2: Mean trap captures over the five years of monitoring and the respective average gender distribution over the year.

The proportional gender distribution over the year can be divided in two periods (Figure 2):

Trap captures are dominated by males in the period of July to December. During the rest of the year more females were caught with the traps.

9. Overview of male (right) and female (left) *D. suzukii*

Figures 3 and 4: Mean trap captures for the different proportions of vineyard (left) and forest (right) on the total area of the trap environment.

The more heterogenous a trap environment is, the more flies were captured with the monitoring trap.

The highest mean trap captures were observed in vineyards with more than 60 % other structural environment (Figure 3).

The highest trap captures were observed in environments with at least 50 % forest (Figure 4). The higher the proportion of forest over 50%, the number of trap captures decreases.

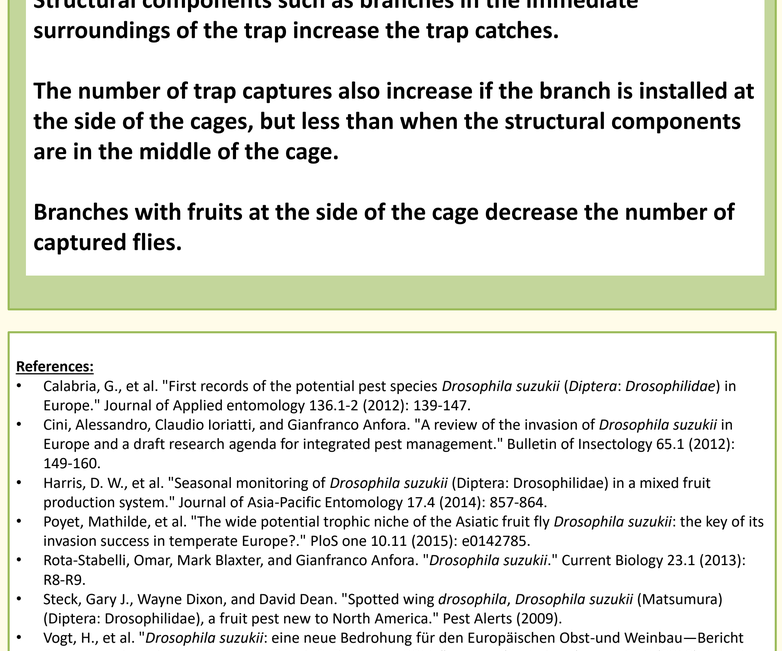


Figure 5: Effect of additional structural components (branches) and fruits on the trap catches within the cage experiments.

On average, one trap captures between 10% to 25% of the total introduced population.

Structural components such as branches in the immediate surroundings of the trap increase the trap catches.

The number of trap captures also increase if the branch is installed at the side of the cages, but less than when the structural components are in the middle of the cage.

Branches with fruits at the side of the cage decrease the number of captured flies.

Conclusion

Monitoring traps realistically mimic the environmental conditions and can give cues for viticultural practice.

***Drosophila suzukii*…**

…occurs mainly at edges of forests and inside the forest

…shows a positive gradient from low to high variety of landscapes in numbers of trap captures

…trap captures increase with structural diversity

…is a controllable problem for viticulture under the premise of good management practice

References:

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