Demonstration project "Exclusion netting for managing Spotted Wing Drosophila in fruit crops" – Results 2017

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Abstract

The invasive Spotted Wing Drosophila Drosophila suzukii *(Matsumura 1931) has become an enormous threat for European fruit cultivation. A technical possibility of control is the use of exclusion netting. In 2017, the BMEL-funded demonstration project started, including 19 producers of cherry, raspberry, blackberry and blueberry. The cherry orchards were covered with foil canopies and netted laterally. Berry cultures were equipped with foil tunnels in combination with nets or nets only. The nets had different mesh sizes varying between 0.8 x 0.8 mm and 1.3 x 1.3 mm. Due to frost damages and late infestation pressure in 2017, the examination was limited. Yet, the positive effect of exclusion netting was evident. Despite of captures of Spotted Wing Drosophila outside of the netted crops no or only limited fruit infestation occurred within the exclusion nettings. In most cases higher temperatures and lower relative humidity was measured within exclusion netting but to different extents in the course of the day. The different types of foil canopies or foil tunnels, mesh sizes, the surrounding environment, the crop management, the weather during the season and the time of day must be considered.*

Keywords: Exclusion netting, net, *Drosophila suzukii*, Spotted Wing Drosophila

Introduction

The invasive Spotted Wing Drosophila *Drosophila suzukii* (Matsumura 1931) (SWD) has become an enormous threat for European fruit cultivation (Asplen *et al.* 2015). In Germany, it was recorded for the first time in 2011 (Vogt *et al.* 2012) and spread rapidly throughout the country. Since 2014, it has been found in all Federal States of Germany (Asplen *et al.* 2015). Due to the high number of host plants, the short generation cycle and the high reproduction rate, chemical control is problematic. Exclusion netting (Exnet) is an alternative, technical measure (Kuske *et al.* 2014; Gamper 2015; Leach *et al.* 2016). The aim of the demonstration project is to optimize and spread the netting of fruit cultures into the practice. The process will be reviewed and evaluated by accompanying studies in all participating farms over three growing seasons at minimum. Further information on the project and Exnet can be found at "http://droso-demo-netz.julius-kuehn.de/".

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Material and Methods

In 2017, the demonstration project included 19 fruit growers in Baden-Wuerttemberg, Lower Saxony and North Rhine-Westphalia, which cultivated the highly vulnerable cultures cherries, raspberries, blackberries and blueberries. Different types of nets were used and mesh sizes varied from 0.8 x 0.8 mm to 1.3 x 1.3 mm. All cherries had foil canopies and were laterally netted. Berry cultures were equipped with a) foil tunnels and lateral nettings, b) foil tunnels completely covered with net, c) nets completely covering the cultures, d) lateral netting only. Investigations focused on monitoring of SWD by bait traps and fruit infestation as well as microclimate within Exnet in comparison to open cultures. Traps were prepared with 20 holes (d = 2.0 mm) in the upper half. As bait, 200 ml of naturally clouded apple cider vinegar was mixed with water (ratio 1:1) and 0,025 % detergent. Minimum one bait trap within and outside of Exnet were positioned in 1.50 m height in the culture. The traps were changed weekly and number and sex of SWD were determined. The fruit infestation was controlled by fruit examination at least once per week. A minimum sample of 30 fruits was randomly picked from within and 30 fruits from outside of netting. Fruit examination was done by visual check of eggs and pupa, by expelling larvae using the water method or by emergence of adults. The microclimate within and outside of Exnet were measured in a height of 2.00 m using data loggers (Tinytag Plus 2). Temperature (temp), relative humidity (rH) and dewpoint were measured every 10 minutes. The differences between measuring points within Exnet and outside were calculated and used to calculate the mean value of the differences. Also the occurrence of other pests and pathogens as well as beneficial insects was examined. The evaluation of the results in 2017 is ongoing.

Results

In 2017, frost damages as well as late and low SWD infestation pressure limited the assessments, especially in cherries. In berries similar problems occurred, but the success of Exnet was visible, e.g. producers No. 9 (fig. 1A) and No. 18 (fig. 1B). Outside of the netted cultures more SWD were trapped than within Exnet and no fruit infestation was detected within the netted culture. Only one Exnet system in blackberries was insufficient. In this case, more SWD were caught within the Exnet in comparison to outside. Nevertheless, the fruit examination revealed a lower infestation level within Exnet than without exclusion netting for about 3-4 weeks, but after 9.8.2017 fruit infestation increased to an extent that harvest was discontinued (fig. 1C). This producer used only lateral Exnet, the culture had no horizontal protection above and the closing to the ground level was insufficient (fig. 1C). With regard to the microclimate within Exnet, a marginal increase in temp and a marginal decrease in rH in comparison to fruits without nets or foil tunnels & nets were observed. When comparing the mean value of differences in temp & rH between Exnet and outside these were below 1 °C in most cases, reaching at maximum 1.6 °C in a few cases and for rH between 0.1 to 3.9 % lower in most cases. However, when looking at the diurnal temp profile, higher differences, up to 10 °C occurred (fig. 2). In the ongoing analysis of microclimate each system will be checked accordingly. The differences in temp and rH fluctuate with the time of day and according to the weather conditions. At some time points, a lower temp than outside was detected within Exnet. The different types of foil canopies or foil tunnels, the different types of nets, the surrounding environment, the crop management, the weather in the season and the time of day have to be considered. A number of problems were observed with Exnet of foil canopies. Often, gaps occurred in the canopies (fig. 3A) and within a short period of time damages in the nets were caused by friction (fig. 3B). In some cases, the new net with mesh-size 0.8 x 0.8 mm showed variation in mesh-size up to 1.6 mm (fig. 3C) or the meshes were shiftable (fig. 3D).

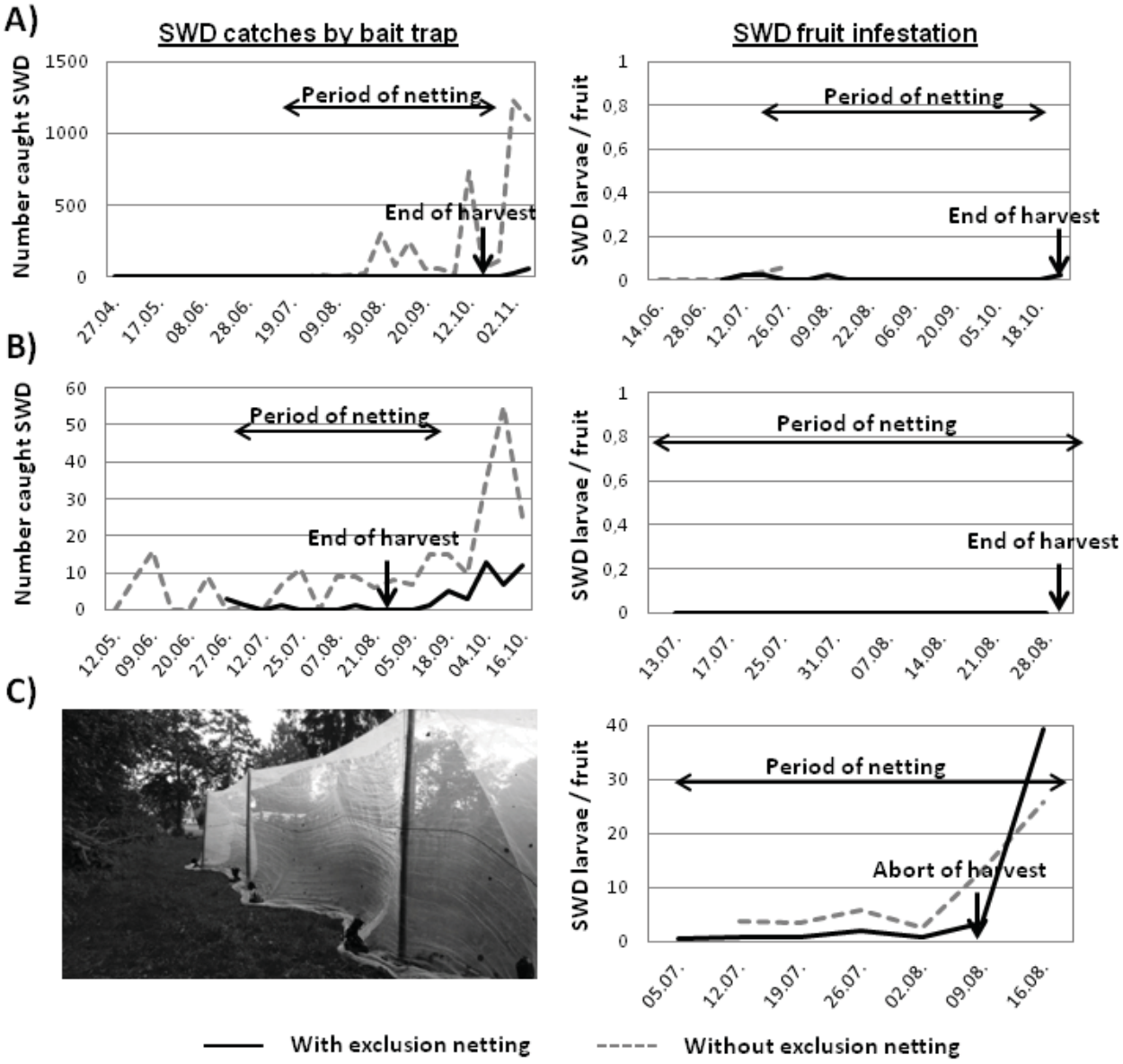

Figure 1: A) SWD catches by bait trap and SWD fruit infestation in blueberries of producer No. 9; B) SWD catches by bait trap and SWD fruit infestation in raspberries of producer No. 18; C) Insufficient lateral Exnet and SWD fruit infestation in blackberries of producer No. 12.

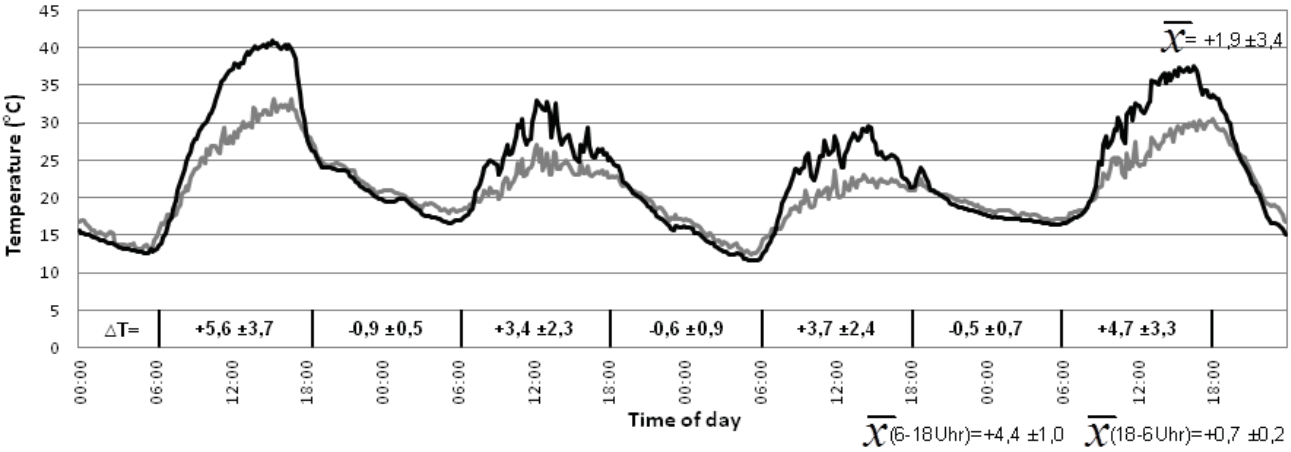

Figure 2: Temperature (°C) in the course of 4 days at beginning (15.6. – 18.6.2017) of Exnet of raspberries of producer No. 11 (foil tunnel completely netted).

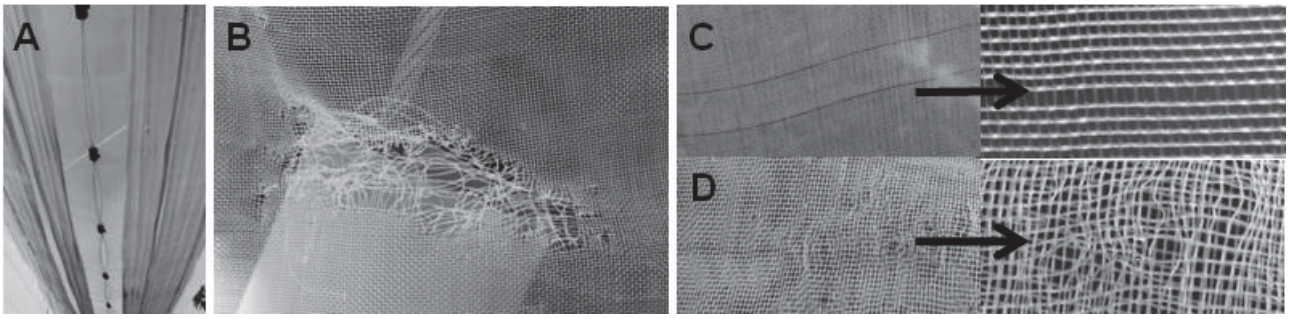

Figure 3: Gaps (A), damages caused by friction (B), Exnet with twice mesh size (C) and shiftable meshes (D).

Discussion

In the first year of the demonstration project, problems with the assembly of the nets became apparent. Most often, it was impossible to realize gapless netting with the existing foil canopy systems in cherries. Reasons are the ventilation openings in the canopy as well as the missing mounting options for the Exnet. Also the quality of the Exnet needs to be improved. The meshes of the net need to be fixed in the given size, must not be shiftable and the net needs to be resistant to damages. Because of the frost damages and the late and low infestation pressure the evaluation of the Exnet was limited. But the first results showed a positive effect of Exnet like in other studies (Kuske *et al*. 2014, Gamper 2015, Leach *et al.* 2016). The evaluation of changes in microclimate within Exnet has to be analyzed accurately. Preliminary results show an increase in temp and a decrease of rH within Exnet. However, the different types of foil canopies or foil tunnels, the different types of nets, the surrounding environment, the crop management, the weather in the season and the time of day must be considered. Also Volgenandt (2017) showed that the main change of microclimate is caused by foil tunnel or foil canopy and not by Exnet.

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