

The spotted wing drosophila, *Drosophila suzukii*- new pest in Europe and in Poland

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Abstract

Drosophila suzukii is a new, invasive pest causing a lot of damage to plantations and economic losses for farmers in the USA and in Europe. In Poland, the monitoring of this pest has been carried out since 2012 by the Research Institute of Horticulture (RIH). At the beginning it was only carried out in central Poland, but in the next years also in other part of the country. Since 2013 observations of the pest had also carried out at the wholesale market near Warsaw. The monitoring of SWD was continued in 2015 in about 200 locations in all regions of the country.

The first traps were prepared at the RIH and filled up with the liquid attractant, based on the Italian experience and developed formula. In the following years, trials were also included other available traps and baits, e.g. manufactured by Spanish company Bioiberica (distributed in Poland by BioAgris) and Polish manufacturer ICB Pharma. The first specimens of *D. suzukii* were caught in late autumn (October) in western and southern Poland in 2014 in Polish and Spanish traps. In 2015, the first flies *D. suzukii* were caught in early September and some eggs/larvae were found in blueberry and sweet cherry fruits in mid-September.

Keywords: occurrence, spotted wing drosophila, *Drosophila suzukii*, Drosinal, Suzukii Trap

Introduction

Drosophila suzukii (spotted wing drosophila, SWD) is a polyphagous, invasive species originating from South-Eastern Asia (Kanzawa, 1935; Walsh *et al.*, 2011). SWD overwinter as adults (Dalton *et al.*, 2011). Flies emerge in spring, but some adults may be active even during warm winter days (Kanzawa, 1935; Kiss *et al.*, 2013). Males are distinguishable by the presence of a dark spot on the wing and by two short sex combs on the fore tarsi (Kanzawa, 1939). Females have a highly sclerotized and serrated ovipositor, which allows oviposition in ripening pre-harvest fruits as well as in ripe, overripe, and fallen or damaged fruits (Lee *et al.*, 2011). The larvae of *D. suzukii* destroy the fruit flesh by feeding, and this makes the fruit unsuitable for sale (Kanzawa, 1939; Grassi *et al.*, 2009). This pest infests a wide range of fruit crops (especially small and stone fruits with soft skin), including grape, as well as a number of fruits from non-cultivated plants (Walsh *et al.*, 2011; Cini *et al.*, 2012).

Due to the global fresh fruit trade, *D. suzukii* entered to Hawaii Islands in 1980 (Hauser, 2011), and then in 2008 to California (Burrack *et al.*, 2012) and to Europe (Spain, Italy and France) (Grassi *et al.*, 2009; Calabria *et al.*, 2010; Cini *et al.*, 2012). Since 2008 it has spread rapidly throughout the temperate regions of North and South America and Europe (EPPO, 2013). In the short period of time, *D. suzukii* became one of the most damaging pests in the temperate regions (Saguez, 2013). The aim of this study was to check the occurrence of *D. suzukii* in Poland.

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Materials and methods

Between 2012 and 2015 monitoring of the spotted wing drosophila was carried out in more than two hundred locations in Poland. In 2012, studies were only carried out in central Poland, but in 2013, also on the plantations in western region. Observations were also carried out at the wholesale market near Warsaw, where imported and domestic fruits are stored and traded as well as maintained prior to shipment to other countries. In 2014, research was continued, but extended to southern part of Poland. In 2015, monitoring of SWD was carried out on all territory of Poland by the Research Institute of Horticulture (RIH), and also by: the Main Inspectorate of Plant Health and Seed Inspection; Agricultural Advisory Centre; and Growers.

In order to verify the presence of *Drosophila suzukii*, several types of traps and liquid attractants (baits) were used and tested in our study. In 2012, traps and baits made at the RIH. The traps consisted of PCV bottles with a capacity of 1.0-1.5 L, filled of liquid attractant (apple vinegar + red wine). In 2013, the same traps and baits were used, in addition to traps and liquid attractant that were supplied by Polish company (ICB Pharma). In 2014, the traps and baits were used from Polish and Spanish (Bioiberica) companies. In 2015, the Polish traps and baits (Drosinal) and Spanish product- Suzukii Trap (distributed by the Polish company BioAgris) were used for the monitoring of *D. suzukii*.

The traps were filled between 300-600 ml of liquid baits. Traps were located on around blueberry, raspberry, sweet cherry, strawberry plantations and in the forests. In the tree orchards, traps were hung at a height of 1.0-1.5 m in a shaded area, while at bushes plantations traps were hung at the height of fruiting shoots. In the fresh fruit market, traps were placed on a fence in the shade. Every year, traps were placed at the beginning of July. These were monitored once or twice a week until a mid-December. The captured flies were removed from each trap and transported to the RIH, where they were identified.

Results

The monitoring of *D. suzukii* in 2012 and 2013, did not lead to the capture any flies of this species. In 2014, the first flies of *D. suzukii* were collected in western part of Poland in the third week of October (Fig. 1.). The flies were caught within November at this location. SWD specimens were also found in traps located in southern part of Poland in early December, 2014 (Łabanowska and Piotrowski, 2015). In early September (2015), the first flies of *D. suzukii* were captured in a few localizations in western part of Poland. In mid-September the flies were catching in many regions of the country, until late November (Fig. 2.), however the number of flies were not so numerous (usually less than 10 flies per trap in whole monitoring time).

Although this pest was detected in Poland the damage to the fruits was not observed in 2014. However, first eggs and larvae of *D. suzukii* were found in sweet cherry (late cultivar 'Sweet September') and blueberry fruits in 2015 (mid-September and early October, respectively). Economic damage was not calculated because the pest infected small number of fruits, which were remaining on plants after harvest.

Polish (Drosinal) and Spanish (Suzukii Trap) traps except *D. suzukii* also captured other flies as *D. melanogaster* and *D. immigrans*. However, their number was not dependent on the type of trap used. Furthermore, Spanish traps caught other flies, that were bigger than SWD because they were provided with larger openings- 10 mm, whereas in Polish traps- 5 mm. The most common insects found in Spanish traps were wasps (*Vespula vulgaris* L.), earwigs (*Forficula auricularia* L.), houseflies (*Musca domestica* L.). Sometimes, the number of other insects in Spanish traps were very high, which increased time needed for identification of *D. suzukii*.



Figure 1: Map showing where *Drosophila suzukii* was detected on the territory of Poland in 2014 (W. Piotrowski).



Figure 2: Map showing where *Drosophila suzukii* was detected on the territory of Poland in 2015 (W. Piotrowski).

Discussion

Morphologically, specimens of *D. suzukii* caught in Poland did not differ from the specimens of this species recorded in other parts of Europe (Grassi *et al.*, 2009; Calabria *et al.*, 2010; Vogt *et al.*, 2012).

Records of this invasive organism in Poland are not surprising, in connection with information about the rapid spread of this insect across Europe (Cini *et al.*, 2012). In our study the first record of *D. suzukii* in Poland took place in the third week of October (2014). A similar situation had happened in Spain (Calabria *et al.*, 2010), Italy (Grassi *et al.*, 2009, 2012), France (Cini *et al.*, 2012), Switzerland (Baroffio *et al.*, 2013), and Germany (Vogt *et al.*, 2012), where insect activity was recorded between mid-September and late October in the first year of capture. However, most of first findings were not associated with fruit damage, except for northern Italy (Grassi *et al.*, 2009).

To catch SWD, a number of prototypes and commercial traps and attractants were developed. A variety of trap prototypes made by many researchers from many countries and commercial traps are available to monitor adult *D. suzukii*. Comparisons among different trap design (size, colour, volatilization area, entry area) have been performed across different regions and crops (Lee *et al.*, 2012; 2013). Generally, traps with narrow entry points were considered better than those with wide holes because the narrow openings slowed evaporation of the bait and prevented entry of insects larger than *D. suzukii* (Kanzawa, 1939).

Bait is needed to attract the flies to the trap. Apple cider vinegar was one of the first baits used because it is readily available, inexpensive, and transparent to see captured bodies, but it is not the most attractive bait (EPPO, 2013; Lee *et al.*, 2013). This lure has recently been improved by adding wine (Landolt *et al.*, 2011) and wine and sugar (Grassi & Maistri, 2013). The combination of wine and apple cider vinegar caught more *D. suzukii* in the field compared to apple cider vinegar alone (Landolt *et al.*, 2012). Many other different baits are already present in the market. Many commercialized baits are also being evaluated, and it is a key step toward making trapping more effective. However, there are no baits on the market, which could be more effective to attract *D. suzukii* than ripe fruits. Traps used recently, cannot be replaced for chemical protection, because even 150-200 traps per hectare did not prevent damage of fruits (personal communication with Dr Kirsten Köppler, Center for Agricultural Technology, LTZ, Germany).

An ideal trap or bait should be selective and does not attract other flies, especially beneficial organisms. However, the published study revealed no differences in species selectivity by traps and baits. A good idea is to develop a trap based on mechanical selectivity (nets in all holes, with size of mesh about 3-5 mm) or few small holes in the traps walls. The openings of the commercial traps have at least 1 cm and consequently captured a large number of Lepidopterans, and Hymenopterans (Baroffio *et al.*, 2013). The number of *D. suzukii* captured increases consistently in traps with greater entry areas, but the proportion of nontarget drosophilids captured remained the same (Lee *et al.* 2013).

Poland is the main producer of several fruit species (strawberry, raspberry, blueberry, cherry, currant, as well as others) in EU. The first detection of *D. suzukii* in Poland may pose a serious threat in the future for soft skinned fruits. We expect that the new invasive *Drosophila* species might substantially change the fruit production strategy. The presence of SWD also implies that insecticide treatments must be adapted to address this new entomological challenge, especially because *D. suzukii* attacks fruit just before and during harvest. In 2015, the Polish Ministry of Agriculture and Rural Development promptly registered spinosad, thiacloprid and deltamethrin against *D. suzukii*. Spreading of the SWD may results in cost increases due to potential yield losses. Future research should include traps with improved physical characteristics, with an emphasis on lure improvement for early detection of flies. This will enable growers to predict crop risk and optimize timely management decisions.

Conclusion

1. The monitoring of *D. suzukii* between 2012 and 2015 showed the occurrence of this pest in Poland.
2. Both the Polish and Spanish traps and baits can be used for detection and monitoring of *D. suzukii*.
3. Identification of *D. suzukii* captured by Polish traps is easier due to the fact that smaller openings only caught small flies.

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