

Research report

Effectiveness of cold treatment in controlling of the spotted wing drosophila, SWD (*Drosophila suzukii* Matsumura, 1931) eggs in blueberry fruits (*Vaccinium corymbosum* L.) – large-scale study



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The research was conducted at the National Institute of Horticultural Research, Skierniewice, Poland, by using spotted wing drosophila flies (*Drosophila suzukii*) from the Plant Protection Unit, Research & Innovation Center Edmund Mach Foundation, Italy. The species does occur in our country, but usually in the fall (from September to December). We were unable to catch adults SWD during blueberry harvesting season (July-August) and, therefore, samples, such as pupae, were imported to Poland (Fig. 1).



Figure 1. Imported pupae of *Drosophila suzukii* in the medium.

The adults started to occur after 3 days from receiving the pupae (Fig. 2). During the next few weeks we had a rearing with a few thousands of SWD adults. The insects were maintained on a mixture of *Drosophila* diet (Blades Biological, Cowden, UK) and blueberries. The study was carried out on fresh, high quality blueberry fruits cv. 'Bluecrop' purchased from local growers having the GlobalG.A.P. Certificate.



Figure 2. *Drosophila suzukii* pupae (left) and adults (right) in rearing cages.

The effectiveness of cold treatment was calculated according to the Abbott formula: $C\% = (1 - T / K) \times 100\%$, where K = number of adults in the control cage; T = number of adults in the treated cage. Eight cages were used as replication, and twenty four cages were used in each treatment.

The natural infestation method was used on blueberries to avoid damage to the fruit by artificial infestation, which can cause the growth of microorganisms and affect the stages of development of *D. suzukii*. In addition, natural infestation can avoid egg damage through the collection and transfer processes to the fruits when artificial methods are used.

The course of the temperature conditions before the beginning of the experiment and during the experiment in a cold chamber is shown in Appendix 1.

Cold treatment for eggs

On July 9th 2023, in the Laboratory of Entomology (Department of Plant Protection), fresh blueberry fruits were kept in climatic chambers at $22.0 \pm 0.1^\circ\text{C}$ and 65% RH for 24 hours within 48 Bug-dorm cages (1,0 kg berries per cage) each containing 500 *D. suzukii* adults (250 females and 250 males) to laid eggs (Fig. 3-5). Following this infestation period, the blueberries with 24 cages were cleaned out of adult flies and then kept in separate semi thermostatic stainless steel chambers (4 cages/chamber) at $0.5 \pm 0.3^\circ\text{C}$ for 14 days, in the cold room at the Laboratory of Fruit and Vegetable Storage and Postharvest Physiology (Fruit and Vegetables Storage and

Processing Department) - Fig. 6. After that period, the cages were moved to the climatic chambers in the Laboratory of Entomology and kept at $22.0\pm 0.1^{\circ}\text{C}$ and 65% RH for 14 days, assessed daily for the presence of adult flies. Flies that appeared in cages were caught, in order that they do not reproduce. The remaining 24 cages were used as a control, and also cleaned out of the adult flies and then kept in the climatic chambers at $22.0\pm 0.1^{\circ}\text{C}$ and 65% RH, for the same periods of time as cooled cages. Adults who appeared in cages were caught systematically.



Figure 3. *D. suzukii* adults with blueberry fruits.



Figure 4. Blueberry fruits with *D. suzukii* adults in cages.

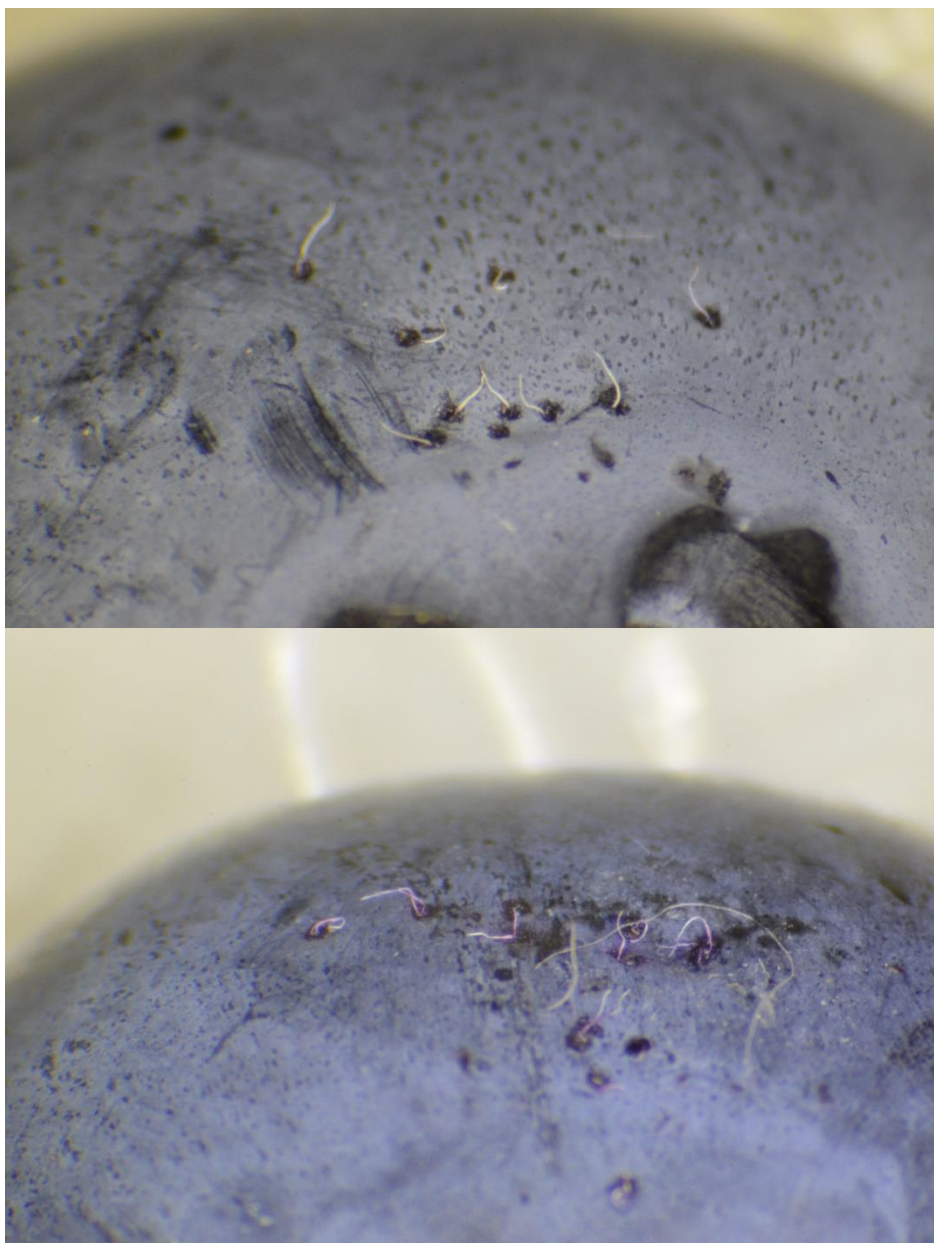


Figure 5. Filament of *D. suzukii* eggs in the blueberry fruit.



Figure 6. Blueberry fruits with *D. suzukii* eggs in the chambers, in a cold room.

Results

Drosophila suzukii adults only spent 24 hours with blueberry fruits, but it was enough to laid hundreds of eggs to fruits. However, fourteen days cold treatment was enough to reach 100% effectiveness in the pest eggs control (Tab. 1).

Table 1. Mortality of *D. suzukii* eggs in the blueberry fruits treated at 0.5 ± 0.3 °C for 14 days.

Replicate	Control		Treated		
	Amount of fruits (kg)	No. of adults	Amount of fruits (kg)	No. of adults	Effectiveness according to Abbott's formula (%)
1	8.0	15 329.00	8.0	0	100
2	8.0	16 889.00	8.0	0	100
3	8.0	12 849.00	8.0	0	100
Total	24.0	45 067.00	24.0	0	100

Conclusions

1. In this large-scale study, we provide the evidence of the *Drosophila suzukii* eggs responses to cold treatment at 0.5 ± 0.3 °C in blueberry fruits grown in Poland.
2. Fourteen days of exposure of the *D. suzukii* eggs stage to 0.5 ± 0.3 °C in blueberries was enough to achieve 100% mortality.



Appendix 1. Course of the temperature conditions in a cold chamber.

