

***Drosophila suzukii* control using Kaolin, lime and rock dusts**

T. Strack^{1,2}, F. Cahenzli¹ and C. Daniel¹

Abstract

The Spotted wing drosophila, Drosophila suzukii, is an invasive pest in Europe and North America, infesting various soft-skinned fruits. Because D. suzukii attacks ripening fruits shortly before harvest, only insecticides with short pre-harvest intervals can be applied. Alternatively, kaolin, lime and rock dusts are non-toxic to non-target organisms, but the whitish coating on fruits potentially deters oviposition of D. suzukii. Therefore, we tested oviposition deterrence and insecticidal effects of such substances. Female D. suzukii flies were exposed to treated blueberries under laboratory conditions for 24 hours. Kaolin, clinoptilolite, clinoptilolite + Heliosol (pine-oil based wetting agent) and calcium carbonate significantly reduced oviposition, whereas calcium hydroxide only had a marginal effect and diatomaceous earth had no significant effect. None of the tested products had an insecticidal effect. Kaolin, lime and rock dusts are therefore a promising tool to reduce damage of D. suzukii in soft-skinned fruits.

Keywords: Spotted wing drosophila, *Drosophila suzukii*, control, kaolin

Introduction

The spotted wing drosophila *Drosophila suzukii* Matsumura (Diptera: Drosophilidae), a devastating pest of soft-skinned fruit crops, is originally native to Southeast Asia, but has been introduced into Europe (Calabria et al. 2012). In contrast to native Drosophilidae, *D. suzukii* females possess a serrated ovipositor to cut through the epicarp of their host fruit. Thus, they can feed and oviposit on previously undamaged fruits. Since *D. suzukii* prefers ripe fruits shortly before harvest, only insecticides with short pre-harvest intervals can be applied. Alternatively, kaolin, lime and rock dusts are non-toxic to non-target organisms (EPA 1999), but the whitish coating on fruits potentially deters oviposition due to particle adherence on insect bodies and/or (in case of lime products) due to altered pH level and microorganism flora (Ebeling 1971, Daniel 2014). In a laboratory experiment, we tested oviposition deterrence and insecticidal effects of different dusts products (kaolin, clinoptilolite, clinoptilolite + Heliosol, calcium carbonate, calcium hydroxide and diatomaceous earth) by exposing treated blueberries to *D. suzukii* females

Material and Methods

Cleaned organic blueberries (Snowchase, Spain) were treated to run-off in a spinning table spray booth with the following substances dissolved in deionized water: Spinosad (0.025 % Audienz, Omya AG), kaolin (2 % Surround, Stähler Suisse SA), clinoptilolite (2 % Klinospray, Unipoint AG), clinoptilolite (2 %) + 0.5 % Heliosol (Omya), calcium carbonate (1.7 g/l, 95% pure), calcium hydroxide (1.7 g/l Nekapur, Kalkfabrik Netstal AG) and diatomaceous earth (0.34 g/l Pflanzen-Aktivator P2032, AMU-Systeme). Deionized water was applied to the control berries. In each of the six replicates, three berries were provided in cardboard cups to six *D. suzukii* females for oviposition. After 24 hours, mortality of adult flies and the number of eggs were counted under a binocular. A generalized linear model with binomial errors

¹ Forschungsinstitut für biologischen Landbau (FiBL), Ackerstrasse 113, 5070 Frick, Schweiz, claudia.daniel@fibl.org, fabian.cahenzli@fibl.org

² Hochschule Geisenheim, Von-Lade-Strasse 1, 65366 Geisenheim, Deutschland, timo.strack@gmx.de

was fitted to the number of eggs and analyzed with a Tukey post-hoc test. Efficiency of the substances was calculated according to Abbott: $100 * (1 - [\text{number of eggs laid in treated berries}] / [\text{number of eggs laid in untreated berries}])$.

Results and Discussion

Kaolin, clinoptilolith, clinoptilolith + Heliosol and calcium carbonate significantly reduced oviposition, whereas diatomaceous earth had no significant effect (Fig. 1). Calcium hydroxide had a marginal effect on oviposition ($P = 0.07$). In contrast to Spinosad, where almost all flies already died after 12 hours, the tested substances showed no insecticidal effects (only one single fly died in the Kaolin treatment). By physical deterrence, kaolin reduced oviposition as effectively as Spinosad, which prevented oviposition by killing the flies. However, visible residues make the use of kaolin unsuitable in table fruits. Calcium carbonate caused less visible residues and reduced oviposition also significantly, but could affect vinification of grapes by altering the pH level (Daniel et al. 2015). In accordance to the crop and its processing, kaolin, lime and rock dusts offer an interesting opportunity to reduce fruit damage by *D. suzukii*.

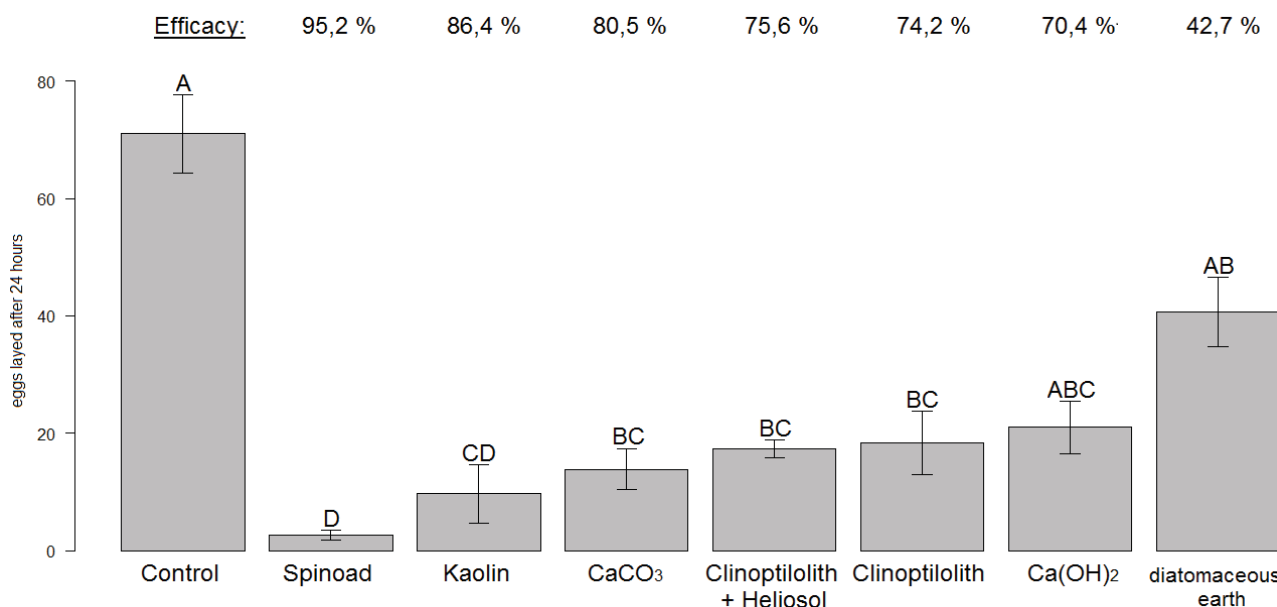


Figure 1: Number of eggs on blueberries treated with different dust products 24 hours after exposition. (Mean values \pm standard errors, $P < 0.05$). Different letters indicate significant differences between treatments.

Acknowledgements

We thank the Bundesamt für Landwirtschaft and Interreg (project 4.2 InvaProtect) for funding the study.

References

- Calabria, G., Máca, J., Bächli, G., Serra, L. & Pascual, M. (2012). First records of the potential pest species *Drosophila suzukii* (Diptera: Drosophilidae) in Europe. *Journal of Applied Entomology* **136**: 139-147.
- Daniel, C. (2014). *Rhagoletis cerasi*: Oviposition Reduction Effects of Oil Products. *Insects* **5**: 319–331.
- Daniel, C., Matray, S., Gallati, P. & Tuchschnid, A. (2015). Einfluss von stäubenden Substanzen auf die Vinifikation von Wein. Online verfügbar unter <http://orgprints.org/29158/> (23.07.2016)

Ebeling, W. (1971). Sorptive dusts for pest control. *Annual Review of Entomology* **16**: 123 -158.
Environmental Protection Agency (EPA) (1999). Kaolin fact sheet. Online verfügbar unter https://www3.epa.gov/pesticides/chem_search/reg_actions/registration/fs_PC-100104_01-Jun-99.pdf (23.07.2016)

Citation of the full publication

The citation of the full publication will be found on Ecofruit website as soon as available.