

New insights into the ecology of *Drosophila suzukii* in Germany and its pest status

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Since its invasion to Germany in 2011, *D. suzukii*, commonly named Spotted Wing *Drosophila* (SWD), has become the most dangerous pest in stone and soft fruit. It is causing enormous economic losses. With the aim to develop sustainable control techniques, profound knowledge on SWD biology is indispensable. Main research areas at the JKI are: SWD phenology, GIS-based risk analysis, overwintering, feeding ecology, susceptibility of cherry varieties, impact of surrounding vegetation on pest pressure in orchards, effects of extreme heat and dryness, plant compounds, insecticides, bait mixes for traps, exclusion netting. Concerning SWD phenology, all-season higher captures occur in the landscape compared to orchards. Flies are active at mild days in winter. Lowest activity/population density is observed from April to June, highest in November to December. Our monitoring showed that in autumn and winter flies are preferably found in the canopy of evergreen trees like pines. In contrast, flies disappear with leaf fall in deciduous trees. Adults overwinter as winter morphs. We examined flies from our monitoring traps year round with regard to ovarian development, wing length and coloration. Compared to summer morphs, winter morphs are darker, have up to 0.5 mm longer wings and females do not produce eggs. In our region winter morphs occur from October to June, indicating their long life span. Egg production in winter morphs starts mid-March to April. Abiotic factors and food resources are most crucial for winter survival and early hosts in spring influence population built-up. We proved that mistletoe berries (*Viscum album*) are first host fruits in spring. Cherries play a major role for population built-up from May onward. Immigration into cherry orchards takes place in March to April each year, long before fruits are available. Oviposition starts in light red fruits and infestation increases quickly. SWD stays present in cherry orchards at least until leaf fall. Other cultivated fruits in the course of the year (raspberries, blackberries, blueberries, plums, elderberries, etc.) are used as reproduction hosts until late autumn. Temperatures above 30°C and low humidity have shown to slow down population built-up significantly. We demonstrated this by exposing flies to heat waves in a climate chamber. As a technical approach for SWD control the JKI is coordinating a demonstration project „Exclusion netting for managing Spotted Wing *Drosophila* in fruit crops“, which started in 2017.

Ecological status of Spotted Wing *Drosophila* (SWD), *Drosophila suzukii*, in Shandong Province, China

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Drosophila suzukii (Diptera: Drosophilidae) is able to lay eggs and feed on healthy ripening fruit. In this study, sugar-acetic acid-ethanol solution and sticky traps with different colours

were optimized and selected to monitor the phenology of *D. suzukii*. The results showed that flies had strong chemotaxis to sugar-acetic acid-ethanol solution after adding yeast and cherry fruits. Black sticky trap can attract more *D. suzukii* in the field; however, in the experiment of phobophototaxis we found that *D. suzukii* had stronger phobophototaxis to violet, blue and green light than to the other colours. *D. suzukii* and other *Drosophila* species were monitored in coastal (City of Weihai, Yantai, Rizhao) and inland region (City of Taian, Laiwu) of Shandong province. The number of flies in coastal region was higher than that in inland region due to the warm and humid climate. *D. melanogaster* and *D. suzukii* were the main *Drosophila* species and occurred at 13th May and 23th May, respectively. The number of *D. suzukii* was higher than *D. melanogaster* from 23th May to 1st June. In conclusion, the ecological niche of *D. suzukii* was different from other *Drosophila* species. Green and black can be the best selection for the colour of traps to monitor *D. suzukii* combined with the laboratory and field trial.

Using *Drosophila suzukii* as a comparative model for studying olfactory evolution.

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It has been demonstrated that *Drosophila suzukii* is capable of attacking ripening fruit, making it a unique species within a fly family named for their attraction towards the fermentation products associated with rotten fruits, vinegar, and yeast. It also has been hypothesized that *D. suzukii* is more attracted to the volatiles associated with the earlier ripening stages of fruit development, and in turn, that *D. suzukii* is less attracted to fermented food resources, especially when compared with *D. melanogaster*. Here, we demonstrate that *D. suzukii* and its close relative *D. biarmipes* are in fact more sensitive to volatiles associated with the fruit-ripening process. Our data also provide evidence for a similar evolutionary specialization to that observed within *Scaptomyza*, a close relative to *D. suzukii*, which possesses a serrated ovipositor and are leaf-miners. Moreover, we have unpublished evidence that the compound eye and visual activity of *D. suzukii* is far superior to that of *D. melanogaster*, a visual adaptation that may again support arrival at host fruit prior to ripening and the release of the full odour bouquet.

The attractivity of bayberry fruit volatiles to the vinegar fruit fly

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Chinese bayberry, *Myrica rubra*, is one of the most favourite hosts to vinegar fruit fly, *Drosophila suzukii*, which causes serious damage to Chinese bayberry fruits. The objective of our study was to identify new attractants for *D. suzukii* from Chinese bayberry volatiles. The bayberry fruit volatiles were collected by headspace absorption and identified by GC-MS, and the electro-physiological responses of *D. suzukii* to bayberry fruit volatiles were measured by coupled GC-EAD. The behavioural responses of the flies to bayberry fruits and their volatiles were tested in Y-tube olfactometer, and the attractivity of the synthetic compounds mixture was also confirmed by field trapping expe-