

and microorganism are poorly understood. In this study, 13 species of fungi were identified in an artificial diet fed by *D. suzukii*. 8 and 7 species of fungi were identified in cherry and grape fed by *D. suzukii*. Short-term and continuously life table experiments were conducted to determine the impact of three of these fungus species including *Geotrichum candidum*, *Talaromyces minioluteus* and *Actinomucor elegans* on the growth and development of *D. suzukii*. Results revealed that, compared to the control, *G. candidum*, *T. minioluteus* and *A. elegans* increased the mortality of *D. suzukii* adults in the short time, while extended the developmental time of pupal *D. suzukii* by 18.00%, 16.22% and 26.44%, respectively in the life table experiment. *T. minioluteus* reduced the total longevity of *D. suzukii* by 15.52%, while *A. elegans* enhanced the total longevity by 25.96%. *G. candidum* and *A. elegans* increased the fecundity by more than two folds. *T. minioluteus* elongated the mean generation time (T) by 31.34%, whereas *G. candidum* shortened it by 15.26% but increased the net reproductive rate (R0) by 217.76%, intrinsic rate of increase (r) by 88.89% and finite rate of increase ( $\lambda$ ) by 9.17%. It was concluded that *G. candidum* and *A. elegans* significantly had a beneficial effect on the growth and reproduction of *D. suzukii*, however, *T. minioluteus* had a negative effect on *D. suzukii*. Our results could provide a new integrated pest management strategy for *D. suzukii* which would be discussed in this study.

### Adult reproductive diapause in *Drosophila suzukii* females

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*Drosophila suzukii* (Diptera: Drosophilidae) is an emerging pest of soft fruits, but in this species diapause has not been thoroughly explored. We examined the effects of different temperatures and photoperiods on diapause induction and termination under laboratory conditions. There was variation in ovarian development and oviposition rate under different photoperiods at 10±1°C, and the percentage of adults with immature ovaries was higher during the short photoperiod (8L: 16D) than other photoperiods at 10±1°C. Adults were most sensitive to photoperiod within three days of eclosion. The optimal combination of photoperiod and temperature for diapause termination was long photoperiod (16L: 8D) at 25±1°C. The supercooling point was significantly reduced in reproductive diapause females, and trehalase, pyruvate kinase, sorbitol dehydrogenase, hexokinase and phosphofructokinase enzyme activities were significantly reduced (36.46%, 57.85%, 32.64%, 54.68% and 24.59%, respectively), and glycogen and triglyceride were significantly increased (42.17% and 120.36%). We conclude that *D. suzukii* is a typical short-day diapause species within a certain photoperiod range. This information might contribute to a more fundamental understanding of adult reproductive diapause for this important pest.

### Developing a molecular approach to analyze the diet of *Drosophila suzukii*

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*Drosophila suzukii* is overwintering as adult fly in a reproductive diapause, getting active at mild days in winter and spring. It has a wide range of host plants, mainly identified by oviposition and developmental experiments in fruits. Unfortunately, identifying the nutrition hosts by those methods is challenging, especially in winter. Observations of feeding activity in the field are problematic due to limited access (e.g. forest canopy, shruberies). The correct identification of moving flies in the field without a stereo microscope is difficult, too. A third problem is that in laboratory feeding-trials insects often feed and/or oviposit on host plants which are not typically used in-field. Thus, there is a big risk of overestimating the range of host plants used by *D. suzukii*. We developed an approach to examine ingested plant DNA in *D. suzukii*. Feeding experiments were established where adult *D. suzukii* from a laboratory colony were fed with raspberry (*Rubus idaeus*), allowing them to digest for up to 72 h. Applying PCR with species-specific primers, the DNA of *R. idaeus* was detectable for up to 48 h post-feeding in whole body extracts of *D. suzukii*. Further, a bleach experiment was conducted to exclude the risk of false-positive detection due to DNA sticking on the flies' body surface. Females fed with *R. idaeus* were contaminated at their tibia or wing-tip with mistletoe (*Viscum album*). Then half of the flies were washed with a bleach-solution and all individuals were tested for DNA of *R. idaeus* and *V. album* again using diagnostic PCR. While the DNA of *V. album* was successfully removed from the fly's body surface, the gut content was not negatively affected by decontamination. In a next step field trapped individuals will be used for next-generation sequencing for further analysis.

### Potential geographical distribution of *Drosophila suzukii* based on MaxEnt

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*Drosophila suzukii* is an important fruit insect pest and its global spread and damage has been paid more attention in recent years. In order to prevent invasion of *D. suzukii* and protect fruit production in China, we studied potential geographical distributions of *D. suzukii* in the world and in China under current and future climate conditions. MaxEnt combined with ArcGIS was applied as technical mode which based on collecting global geographical distributions information and screening main climate variables. Under current climate conditions, *D. suzukii* presented a relative wide potential geographical distribution in the world and 61.68% areas in China with suitability including 7.59% areas of high level, 27.81% areas of medium level and 2628% areas of low level. Under RCP26 and RCP85 climate conditions in 2050, potential geographical distribution of *D. suzukii* enlarged and northern borderline of suitable region expanded northward in the world as well as in China. We suggested related organizations in China to strengthen surveil-

lance, integrated pest management and export quarantine measures of *D. suzukii* systematically.

## Landscape effects on *Drosophila suzukii* dispersal and migration

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The presence and spatial distribution of various landscape elements play an important role in pest occurrence and damages. While high-resolution landscape data is widely available, sampling data are often not gathered with landscape studies in mind. In this presentation, we explore methods to analyze trap-capture data of *Drosophila suzukii* from south-west Germany with the objective of mapping spatio-temporal risk for their dispersal and migration based on landscape characteristics. We also present DROSOMON, a centralised, harmonized web platform for data gathering and easy access to trap-capture data and related parameters. The traps monitored by Julius Kühn-Institut over three years were all concentrated in three clusters, 75 km being the maximum distance between the traps. The trapping periods, baiting mixture and local environment vary between the traps. We study the correlations between the capture rates and landscape elements at local and landscape scales using buffer widths ranging from 10 m to 5000 m. In particular, we look into theorized hypothesis concerning *D. suzukii* captures to forested area, edge densities, residential areas and water bodies. The challenges in analyzing this dataset are the relatively homogeneous landscape distribution and the fact that trap captures probably do not reflect pest damage. With data from a wider region at German or European-scale, we expect to minimize the effects of these shortcomings.

## Ecological adaptation of *Drosophila suzukii* in northern China

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*Drosophila suzukii* was first collected in 1935 in China and widely spread at least to 22 provinces. This pest was reported to damage berry, blueberry and bayberry. In order to understand the occurrence, distribution and damage of *D. suzukii* population in Beijing, we have carried out research on the ecology adaptability of this pest. The development of *D. suzukii* Beijing population was tested at different temperatures (15, 19, 23 and 25°C) in the lab. Population dynamics were monitored by sugar-vinegar traps in orchard and forested semi-natural area near the city at five different elevations (from 300 to 1100 m) in Beijing from May 2014 to September 2015. Ovarian maturity and diapause stage of female *D. suzukii* were assessed by dissection. The cold resistance of *D. suzukii* adults was studied by measuring the supercooling point. The results showed that *D. suzukii* completely developed in the range of 15–25°C by fee-

ding on artificial diet and the best temperature was 23°C. Population dynamics trends were similar among all monitoring sites and the population peak was observed from mid-July to early August. *D. suzukii* entered diapause stage from late September to next May. The flies enter reproductive stage one month after terminating diapause stage. The supercooling point of different day-old females was not significantly different, but there was a significant difference for different day-old males. The range of supercooling points of female and male adults was -17.27°C to -18.89°C and -17.59°C to -21.09°C respectively. These results provide a theoretical basis for forecasting and control of this pest.

## SIMKEF – Development of a Decision Support System for *Drosophila suzukii*

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Within the project SIMKEF, a decision support system (DSS) which depicts the complex pathosystem host (fruit/grapevine) – *Drosophila suzukii* will be developed. The DSS is expected to predict the population dynamics of *D. suzukii* as well as the actual pest infestation risk for different berries, stone fruits and grapes. For this reason, the interaction of the entire life cycle of *D. suzukii* with the most important meteorological factors as well as the influence of the different host fruits on the biology and behavior is described or functionally determined. Laboratory tests, monitoring activities and already published data will be combined within the DSS. SIMKEF is divided into three different modules. Regarding the habitat, the potential infestation risk will be analysed in the first module. Orchards and vineyards nearby to forest or hedges could implicate a higher risk for an early occurrence of *D. suzukii* as isolated ones. In addition, in this first module a second factor is the temperature gradient during the winter period. Temperature has a significant influence on the survival and overwintering rate of adult flies. For the quantification of the initial population after winter period, laboratory experiments and monitoring data are analysed. As a result, the first module of the DSS identifies higher risk areas/habitats for fruit infestation and estimates the potential risk as an initial value in the DSS for the beginning of the season. In a second module of the DSS, phenological models describe the availability of host fruits. These ontogenetic models are based on the calculation of a daily growth rate of host plants depending on the daylight period and temperature. The summation of these growth rates will be correlated with monitoring data of growth stages of the different host fruits. In a third module depending on the current weather the population dynamics of *D. suzukii* will be calculated per host plant and over the fruit development period (from its beginning of attractive stage to its ripeness). Here, a multiplication factor per host plant passage and thus a risk factor for the infestation of the following host plant can be determined during growing season. The investigations on population dynamics as a function of temperature and relative humidity are carried out in laboratory trials. The provided output of SIMKEF should improve the timing of monitoring of fruit infestation and pest control of *D. suzukii*.