

Behavioral biology: Ripeness is all

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Drosophila suzukii, the spotted-wing *Drosophila*, on a wild cherry. Credit: Elora Gompel

In contrast to other members of the *Drosophila* family, the spotted-wing fly *D. suzukii* deposits its eggs in ripe fruits. Biologists from Ludwig-Maximilians-Universität (LMU) in Munich have now elucidated the sensory basis of their ability to exploit a novel ecological niche.

Unlike most species of the genus *Drosophila*, which deposit their eggs in fermenting fruits, the so-called spotted-wing *Drosophila*, *D. suzukii*, lays its eggs in ripe fruits. This apparently minor difference in behavior can have catastrophic consequences for commercial fruit-growers, and has made the species into a crop pest. For the puncture made by the female's ovipositor facilitates infections, while the hatched larvae feed on the fruit pulp. As a result, these infestations cause enormous damage to soft-fruit crops, such as cherries, raspberries, grapes and strawberries. LMU biologists led by Professor Nicolas Gompel, in a collaboration with the groups of Dr. Benjamin Prud'homme (CNRS, France) and Professor Ilona Grunwald Kadow (Technical University, Munich), have begun to explore the genetic basis for this unusual egg-laying behavior. Their findings appear in the latest

issue of the journal *Current Biology*.

The researchers combined behavioral tests and genetic methods to determine how the closely related drosophilid species *D. melanogaster*, *D. biarmipes* and *D. suzukii* go about choosing the ideal nursery for their brood, each in their own way. The experiments showed that, in the search for egg-laying sites, the flies respond to the texture of the fruit, to the chemical composition of the surface and to characteristic odor compounds. In other words, they use the senses of smell, touch and taste. *D. melanogaster* females lay their eggs exclusively in overripe and decaying fruits. In contrast, *D. suzukii* responds to the volatile chemicals emitted by freshly ripened fruits, and prefers the firm texture of their skins. *D. biarmipes* females are less choosy and therefore more versatile. Unlike *D. melanogaster*, they are not restricted to rotting fruits. However, because of the anatomy of their ovipositor, they are only able to deposit their eggs in fruits that have been damaged or otherwise softened up.

"We conclude from our findings that, in the course of evolution, the female perceptual system in *D. suzukii* females has been progressively remodeled, allowing the flies to detect and preferentially respond to stimuli that are typical of ripe rather than overripe fruits," says Gompel. "The flies can exploit this ecological niche because they have a larger and sturdier ovipositor, which is capable of penetrating the tougher skins of ripe fruits. And the behavioral modification developed in concert with the alteration in the egg-laying apparatus," says Gompel. "In addition, we believe that the enlarged ovipositor was a secondary acquisition - comparable to the adaptive change in the morphology of the teeth in mammals, which was also initiated in response to an alteration in diet."

The researchers now plan to study the genetic basis for the changes in the spotted-wing *Drosophila*'s perceptual systems. "These may well include mutations in genes that code for sensory receptors," Gompel suggests. "In that case, we will

also have to ask how such changes affected the functions and connectivity of the nerve cells involved."

More information: Marianthi Karageorgi et al, Evolution of Multiple Sensory Systems Drives Novel Egg-Laying Behavior in the Fruit Pest *Drosophila suzukii*, *Current Biology* (2017).
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