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EDITORIAL

# Potential Ecological Interactions and Challenges for the Management of Spotted-Wing Drosophila in Recently Invaded Regions

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*Drosophila suzukii* Matsumura (Diptera: Drosophilidae), Spotted Wing Drosophila (SWD), represents one of the most relevant threats to global fruit production and trade. Unlike other drosophilids, *D. suzukii* can oviposit in intact fruits due to a serrated ovipositor (Kirschbaum et al. 2021). Among other biological traits, *D. suzukii* prefers fruits with a thin epicarp, allowing the larvae to feed upon the endocarp, which can facilitate contamination by microorganisms and cause rapid fruit rotting. Such disease development can lead to fruit embargoes of exportation for countries where this species is considered quarantine absent (Berry 2021).

Despite *D. suzukii* being a species originally from Asian lands (Hauser 2011), these flies have been established along the North, Central, and South America, Europe, Africa, and Oceania. In the Neotropical region, the reports of *D. suzukii* have been described in five countries: Argentina, Brazil, Chile, Mexico, and Uruguay (Andreazza et al. 2017; Ferronato et al. 2019; Garcia et al. 2022). Taking into consideration the diversity of hosts (native or cultivated) and the potential interactions with macroorganisms (e.g., parasitoids, predators) and microorganisms (e.g., entomopathogenic nematodes), as well as with abiotic factors, this special collection addressed novel and innovative information regarding these flies in the Neotropical region. The 14 manuscripts in the collection were written by 55 researchers from various science institutions and universities from the region. The information's major focus was potential distribution, diversity of management measurements, and ecological interactions.

In the Neotropical region, 64 plant species from 25 families are capable of hosting *D. suzukii* (Garcia et al. 2022). Thus, it would be worth evaluating the suitability potential of the commercial and non-cultivated plants occurring in the Neotropical region, in order to determine in which plant types favor the establishment, development, and dispersion of *D. suzukii*. For instance, based on a performance index as a measure of the host suitability, mulberry (*Morus* sp.) fruits proved to be an excellent host for the *D. suzukii* as individuals reared in these fruits exhibited shorter development time and maximum survival from egg to adult (Dettler et al. 2023). Neotropical flora can also inspire the search for novel control measures such as extracts and essential oils (de Albuquerque Melo Xavier et al. 2024; dos Santos et al. 2023). This is the case of *Ocotea indecora* (Lauraceae), whose essential oil showed toxicity to *D. suzuki*i but did not cause mortality to two species of predators and pollinators (Toledo et al. 2024). Monoterpenes are the most representative molecules in these plant-based biorational control measures, which stand out for their insecticidal efficiency in controlling *D. suzukii* (de Albuquerque Melo Xavier et al. 2024). However, the lack of information regarding the potential unintended effects of these products on non-target organisms (dos Santos et al. 2023; Haddi et al. 2020), investigations at field levels, and the regulatory environmental standards represents relevant backslashes for their adoption in integrated management of insect pests (Isman 2023), including *D. suzukii* in the Neotropical region (dos Santos et al. 2023).

Recent investigations, included in a Special Section of *Neotropical Entomology*, have shown that using biological control agents has become a trend in agriculture (Fontes & Laumann 2019). Biological control of *D. suzukii* is a sustainable and biorational approach that can reduce the impacts of management caused by the overuse and misuses of the chemical (synthetic and biorational) control measures. Investigations describing the potentialities of parasitoids

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for controlling *D. suzukii* and other correlated pests of thin-skinned fruits have captured attention and produced reasonable knowledge to form solid foundations for the adoption of biological control program in Neotropical region (Buonocore-Biancheri et al. 2024; Fischbein et al. 2023; Krüger et al. 2023, 2024; Reche et al. 2024). The pathogenicity and virulence of different entomopathogenic nematode isolates described in this special collection can further span the biological control tools to be integrated into a more sustainable management of these fly pests in the Neotropical region (Dias et al. 2023).

In terms of geographical approaches, investigations conducted in countries in the Neotropical region, such as Argentina (Buonocore Biancheri et al. 2023), Brazil, and Mexico (Andreazza et al. 2017; Ferronato et al. 2019; Garcia et al. 2022), have described basic and applied research to build solid knowledge for future management programs within area-wide integrated pest management. However, novel insights revealed that such approaches must be complemented by economic feasibility studies of management programs (De Ros and De Ros 2024) and ecological interactions with biotic and abiotic factors. As for most insects, temperature is one of the abiotic factors influencing the biological cycle and spatial distribution of *D. suzukii*. Assessments of thermal stresses and adult fitness in individuals of a Neotropical *D. suzukii* population revealed that the upper limit for developing fertile *D. suzukii* males is 28 °C (Faria et al. 2023), as males exhibited higher mortality, severe and permanent reductions in offspring production when they overextended this limit. Such findings highlight the need to evaluate the future distribution of *D. suzukii* using accurate modeling, considering global warming scenarios will allow the estimation of future changes in the distribution of *D. suzukii*. For instance, recent distribution models have predicted that the global area suitable for *D. suzukii* will decrease; these models also indicated a reasonable increment in suitable areas in specific regions, mainly central Brazil (Viana et al. 2023).

The research described for the management of *D. suzukii* in the Neotropical region is aligned with the Sustainable Development Goals of the United Nations, especially goal 2—i.e., end hunger, achieve food security, improve nutrition, and promote sustainable agriculture. The findings described here highlight the potential of the biodiversity of Neotropical flora (e.g., plant-based essential oils and extracts) and fauna (e.g., parasitoids, predators, and nematodes) for the development of more sustainable tools to be integrated into the management of this invasive pest.

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