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Macroecological Patterns of Fruit Infestation Rates by the Invasive Fly *Drosophila suzukii* in the Reservoir Host Plant *Sambucus nigra* †

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Abstract: The invasive pest *Drosophila suzukii* (Matsumura, 1931) is a fruit fly native to Asia that infests a wide variety of cultivated and wild fruits, causing important damages on agricultural production. Wild plant species are major reservoirs for *D. suzukii* populations but their infestation rates varies greatly among geographical areas. This heterogeneity could partly be caused by a heterogeneity of environmental conditions acting across different spatial scales. This study aimed to disentangle the relative roles of macroclimatic, landscape and local factors that could affect the success of *D. suzukii* infestation of elderberry fruits (*Sambucus nigra*), a major and widespread host plant along climatic gradients. We collected elderberry fruits and measured vegetative and reproductive life traits of the plants in 215 sites distributed in 13 regions from North to South France during summer 2020. We counted the number of *D. suzukii* emerging from sampled fruits and tested for an effect of macroclimatic, landscape and local abiotic and biotic variables, as well as plant traits using linear mixed models with region as random factor. Latitude and mean maximum temperature had respectively the strongest positive and negative effects on mean infestation rates across regions ($R = 0.761$, $p = 0.003$ and $R = -0.758$, $p = 0.004$). Mixed models also showed that fruit infestation rate increased with the number of mature fruits within corymb and with forest cover in a 100 m radius around sampling sites and decreased with

mean maximum temperature. The latitudinal and climatic clines in infestation rates suggests that *D. suzukii* population size might vary greatly among geographic regions. Our results also suggest that population sizes are larger in the presence of semi-natural habitats such as forest patches in the surrounding landscape. Our work contributes to enhancing our understanding of *D. suzukii* ecology, which is important to predict how infestation rates might change in the context of global climatic changes.

Keywords: spotted wing drosophila; exotic species; pest; biological invasion; wild plants; macroclimate; landscape