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

Romain Ulmer ^{1*}, Aude Couty ¹, Patrice Eslin ¹, Lucas Baliteau ², Anne Bonis ³, Nicolas Borowiec ⁴, Hervé Colinet ⁵, Lionel Delbac ⁶, Arnaud Estoup ⁷, Joris Froissard ⁷, Emilie Gallet-Moron ¹, Benjamin Gard ⁸, Romain Georges ⁵, Patricia Gibert ⁹, Isabelle Le Goff ⁴, Servane Lemauiel-Lavenant ¹⁰, Gregory Loucougaray ¹¹, Alice Michelot-Antalik ¹², Jean-Francois Odoux ¹⁰, Sylvain Pincebourde ¹³, Nicolas O. Rode ⁷, Marcel Thaon ⁴, Irène Till-Bottraud ³ and Olivier Chabrier ¹

¹ EDYSAN, UMR 7058 CNRS, Université de Picardie Jules Verne, 1 rue des Louvels, 80037 Amiens, France;

² CPIE des Pays de l'Oise, 6/8 rue des Jardiniers, 60300 Senlis, France

³ GEOLAB, CNRS, Université Clermont Auvergne, Maison des Sciences de l'Homme, 4 rue Ledru, 63000 Clermont-Ferrand, France

⁴ Institut Sophia Agrobiotech, Equipe Recherche et Développement en Lutte Biologique, UMR, 400 route des Chappes, BP167, 06903 Sophia Antipolis, France

⁵ UMR ECOBIO CNRS 6553, Université de Rennes 1, 263 Avenue du Général Leclerc, CS 74205, 35042 Rennes, France

⁶ INRAE UMR 1065 SAVE, Campus de la Grande-Ferrade, 71 avenue Edouard Boulaux, CS 20032, 33882 Villenave d'Ornon, France

⁷ CBGP, Univ Montpellier, CIRAD, INRAE, Institut Agro, IRD, 34090 Montpellier, France

⁸ CTIFL—Centre de Balandran, 751 Chemin de Balandran, 30127 Bellegarde, France

⁹ UMR CNRS 5558 Biométrie et Biologie Evolutive, Université Claude Bernard Lyon 1, 43 Bd du 11 Novembre 1918, 69622 Villeurbanne, France

¹⁰ UMR 950 INRAE UCN EVA "Ecophysiologie Végétale Agronomie et Nutrition NCS", Université de Caen Normandie, Esplanade de la Paix, 14032 Caen, France

¹¹ INRAE, LESSEM, University Grenoble Alpes, 2 rue de la Papeterie-BP 76, 38402 Saint-Martin-d'Hères, France

¹² INRAE, LAE, Université de Lorraine, 54000 Nancy, France

¹³ Institut de Recherche sur la Biologie de l'Insecte, IRBI UMR7261, CNRS, Université de Tours, Parc Grandmont, 37200 Tours, France

* Correspondence: romulmer@gmail.com

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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