Temporal dynamics and multiscale factors driving infestations of walnut fruit by the invasive pest fly Rhagoletis completa

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Résumé

Rhagoletis completa is an invasive fruit fly from North-America damaging walnut production in its native area and in Europe since the 1990s. In the last few years, populations have spread to the north of France, probably favored by climate change and the large number of walnut trees planted in gardens or spontaneously spreading along roadsides, in hedgerows or fallow lands.
The aim of this study is to disentangle the relative roles of local environment, landscape and meteorological factors influencing the dynamics of this new pest.

In this context, walnut fruit infestation rates were monitored by sampling fruit on the ground and on trees from 24 sites every two weeks from July to December 2023. A set of measurements was carried out to characterize environmental conditions of the sites at different scales. Microclimatic temperatures were recorded every 60 min by Hobo loggers on the tree whereas daily macroclimatic temperatures and pluviometry were retrieved from regional meteoritical stations. Local environment was described within a 20 m radius by the cover and the height of plant strata and the proportion of local habitats. Multiscale composition of landscape was extracted from OSO database and integrated in a Geographic Information System (GIS) using buffers of 20 m to 5000 m radii around each walnut tree.
First results showed a high walnut infestation rate close to those habitually found in the south part of France. A total of 2,433 walnuts were collected (1,373 on the ground and 1,060 on trees) and, among them, 220 were infested by a total of 1,784 *Rhagoletis completa* individuals. The temporal dynamic of infestations showed a gradual increase from July to September followed by a progressive decrease from September to December. The peak of infestation was reached in the first half of September, with 1,239 individuals collected. During this period, 32 % of the walnuts were infested, with an average of 9.4 *Rhagoletis completa* per fruit and a maximum of 56 pupae found in one single fruit. A high contrast between sites infestation rates was also observed and suggests a strong impact of environmental factors (landscape structure, microclimate) on pest population distribution.

Mots-Clés: walnut husk fly, insect pest, biological invasion, walnut, landscape ecology, climate.

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