Submitted Abstract

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Abstract

Pollination is essential for many plants, including most crops, and therefore is key to food security. To produce pollination-dependent crops such as apples, growers rely almost exclusively on the western honeybee, Apis mellifera. However, the recurrent loss of A. mellifera colonies associated with parasites, diseases and pesticides jeopardize agricultural production. Furthermore, the ongoing decline in wild pollinator species due to increasingly frequent stress factors related to climate change and anthropogenic pressure reduce their ecological redundancy, making agricultural and natural systems less resilient.

Heterogeneous landscapes with (semi-)natural habitats host wild pollinators, potentially contributing to efficient crop pollination services. However, how landscape configuration influences pollination provision and pollinator´s species richness is poorly understood. Recent studies indirectly measure the biodiversity of an area deriving it from landscape indices such as “naturalness” or “fragmentation”. Yet, pollinators have different flying ranges, and their presence is dependent on the abundance and location of the foraging resources. The choice of scale at which the landscape affects distinct pollinator species is very complex, and these approximations usually lead to less reliable results. For this reason, we collected data exclusively in sites where the biodiversity of other taxa was recently determined by the “Biodiversity Monitoring Survey of South Tyrol” carried out by Eurac Research (Institute for Alpine Environment).

Here we show that in South Tyrolean apple orchards with a still viable population of A. mellifera, the abundance and diversity of wild pollinators are negatively correlated with landscape homogeneity. The number of wild pollinators captured with pan-traps rather than their species richness was positively correlated with the species richness of other organisms detected, in the same site, by the biodiversity monitoring. In the year of study, the flower visitation rate of wild pollinators, constituted mainly by generalist species of solitary bees belonging to the genera Andrena, Lasioglossum and Osmia, was insufficient to sustain traditional apple production. On the other hand, the visitation rate of A. mellifera in the studied apple orchards exceeded the threshold value for optimal flower fertilization by two to eight times. Our study shows that at the moment, in an alpine region dominated by semi-natural habitats, a decline of A. mellifera in apple orchards would not have been compensated for by wild pollinators.