The Impact of Landscape Anthropization on Pollination Ecology: a One Health Perspective

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Keywords: Plant-pollinator interactions; Pollinator diet; One Health; Nutritional Ecology.

Abstract:
Biodiversity is the foundation of ecosystems and provides ecosystem services that are essential to ensure the quality of both natural systems and human welfare. These services are jeopardized by various human-induced pressures (e.g. land cover and land use changes, climate change, etc.); however, significant scientific knowledge gaps about the impact of human activities on biodiversity still persist. In this context, animal-mediated pollination stands out as a compelling investigation target due to its pivotal role in agriculture, food security, and biodiversity conservation. This project, divided into three main research areas, adopts a comprehensive multi-level integrative approach to explore neglected facets of the relationship between the environment, insect pollinators, and food security.

The first research area was focused on the investigation of the impacts of land use and Urban Heat Island effect on pollen and nectar chemistry, sampled from 7 different meadows species at 16 sites, distributed along gradients of urbanization and agricultural intensification in the metropolitan area of Milan. The analysis revealed how land use and temperature have significant effects on the nutritional profiles of these floral resources. The second research area looks into the nutritional profile and composition of the diet of a generalist pollinator species, *Bombus terrestris*. Commercial colonies of *B. terrestris* were positioned at 14 sites in the city of Milan characterized by different degrees of habitat fragmentation, and the nutritional composition of the pollen pellet was analyzed for their macronutrient and phytochemical content and taxonomic composition. The results obtained show a negative linear relationship between the nutritional quality of pollen loads and habitat fragmentation. In the last research area we investigated the effects of pollination on plants, specifically the influence of insect–mediated pollination on fruit and seed quality and chemical composition of two species, respectively *Fragaria vesca* L. and *Vigna unguiculata* L. Walp. The results obtained indicated significantly higher commercial quality of insect-pollinated fruits and seeds compared to self- or hand-pollinated ones. Notably, also the nutritional composition of insect-pollinated commercials showed higher concentration of many secondary metabolites endowed with nutraceutical properties.

In conclusion, this project advances the current understanding of the relationships between land use intensification, pollinator nutritional ecology, and human food security. The obtained results offer valuable guidelines for the implementation of pollinator monitoring strategies and landscape planning policies and serve as a clarion call for holistic conservation endeavours, fostering ecosystem resilience and supporting food security and human well-being.