
A mechanistic understanding of plant-pollinator interactions in agricultural landscapes

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Abstract

Pollinator health is globally declining in agricultural landscapes and important factors include the use of insecticides, reduced habitat and lack of nutritional resources. Pollinators play a key role in ecosystem functioning because they mediate interactions between species and facilitate ecological and economic impacts. However, pollinator-mediated interactions in agricultural landscapes are insufficiently understood. One of the greatest challenges is to understand how pollination services contribute to maximize ecosystem functioning, thus enhancing ecosystem services.

We are using *Brassica carinata*, to study plant-pollinator interactions in agricultural ecosystem. We developed a mechanistic trait-based understanding of plant-pollinator interactions, to quantify the ecosystem services contributed by *carinata*. We observed pollinator visits to focal individuals of *carinata* and measured seed set, sampled floral resources (nectar and pollen), different plant traits, such as plant density, height and number of flowers. Thus, we established floral resource landscapes from individual-based maps at different spatiotemporal scales and related them to pollinator visits and crop seed set.

We found that pollinators are attracted to floral resources (nectar and pollen) at different spatial scales and in turn, pollinators provide pollination services to *carinata* by doubling seed set at high visitation rates. Moreover, *carinata* individuals can facilitate each other by attracting pollinators at a smaller scale but compete for pollination services at a larger scale with increasing resource availability. Focusing on *carinata* reveals that the addition of floral resources to the agricultural ecosystem can increase ecosystem functioning by stabilizing pollinator communities. However, species interactions are influenced by the use of insecticides and habitat size (area of planted crop fields) that might influence plant-pollinator interactions.

These results are important to mechanistically understanding the role of plant-pollinator interactions in agricultural ecosystems. Our results contribute to the understanding of ecosystem services such as wider ecosystem stability, crop production, food security, human welfare and crop associated biodiversity benefits.

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