Double mutualisms: a global island phenomenon

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Abstract

A double mutualism (DM) occurs when two interacting species benefit each other in two different functions, *e.g.* when an animal species acts both as pollinator and seed disperser of the same plant. Besides the double benefit, a DM also imposes a larger risk to both functions if the performance of one partner declines. We conducted the first global review of DMs involving pollinators and seed dispersers, aiming to: (1) assess their prevalence across ecosystems and biogeographical regions; (2) identify the main plant and animal taxa, and their traits, implicated in DMs; and (3) evaluate the conservation status of double mutualist species. We compiled published and unpublished DM records using specific search terms, noting the species involved, their conservation status and geographic location, as well as the type of study (species vs community-level) in which the DM was detected. We identified 302 DM cases involving 207 plant and 92 animal species from 16 mainland and 17 island areas. Most records come from tropical regions and islands. Animals included birds (62%), mammals (22%), and reptiles (16%), mostly opportunist species; only 18% were nectarivores. Plants were mainly fleshy-fruited shrub or tree species (59%) with actinomorphic flowers that were visited by several or many pollinator species (87%). Most (56%) DMs were detected in community-level studies. DMs are mostly prevalent in ecosystems with limited food resources and mutualist partners, and with high generalization levels. Nearly 30% of the species involved in DMs are threatened according to IUCN criteria, 68% of which are found on islands. The high prevalence of DM on islands paired with the threat status of island species suggest that the loss of a double mutualists and its cascading consequences may have a severe impact on community composition and functioning of fragile island ecosystems.

Keywords: pollination, seed dispersal, mutualism, global patterns

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