Evolution of diet specialization among life stages with antagonistic-mutualistic shift: implications for community dynamics

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Abstract

Population structures can have large implications for higher organizational scales (community structure, ecosystem functioning), especially when they imply ontogenetic changes in habitat or diet. Some species change not only their partners of interaction through life cycle, but also the type of interaction: for example, Lepidopterans are herbivores as larvae and pollinators as adults, and the diet specialization of the two stages was shown to be significantly correlated. In order to understand this correlation, we model a community of two plant species and one stage-structured insect species that predates plants as juvenile and pollinates them as adult. We study the coevolution of juvenile and adult diet specialization using adaptive dynamics. We consider ecological and evolutionary implications for the coexistence of species. As predicted from the indirect effects occurring between the stages and transmitted by the plants, the evolution of juvenile specialization leads to maximization of the diet overlap, while the evolution of adult specialization leads to diet separation. Different evolutionary constraints - on the trade-off structure, or the relative mutation rates of the adult and juvenile traits – lead to different ecological outcomes, such as dimorphism in the juvenile stage or evolutionary murder of a plant.

Keywords: evolution of specialization, stage structure, ontogenetic shift, pollination, predation, coevolution, adaptive dynamics, indirect effects

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