Ecological conditions promoting plant specialization on a seed-eating pollinator differ from those stabilizing the interaction

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ABSTRACT

**Question:** What are the ecological conditions that promote plant specialization on a seed-eating pollinator when less costly alternative pollinators are present?

**Mathematical method:** An adaptive dynamics model including the ecological dynamics of a plant–seed-eating pollinator mutualistic system.

**Key assumptions:** Plants are initially pollinated by specialist seed-eating pollinators and by generalist co-pollinators. Plant specialization (floral morphology continuously ranging from closed to open) and seed-eating pollinator morphological preference co-evolve, while co-pollinators always prefer open flowers. When seed-eating pollinators and co-pollinators have similar preferences, seed-eating pollinators are less effective. The functional relationship linking plants and seed-eating pollinators involves pollination efficiency, oviposition rate, the range of floral morphologies an insect is able to deal with (its degree of specialization), and the pollination and oviposition handling times.

**Conclusions:** Specialization evolves only if pollinators interfere, and it is favoured when co-pollinators’ efficiency is low, when seed-eating pollinators’ oviposition rate is low, and when the range of floral morphology they deal with is greater for oviposition than for nectar- or mate-searching visits. Moreover, although high pollination efficiency of seed-eating pollinators is a key factor in the persistence of the specific mutualism nowadays, the first steps of the evolution of specialization require an intermediate pollination efficiency of seed-eating pollinators.

**Keywords:** adaptive dynamics, co-pollination efficiency, evolution, floral morphology, *Trollius europaeus–Chiastocheta* mutualism.

INTRODUCTION

Over the last decade, our view of plant–pollinator interactions has shifted from the long-standing concept of ‘pollination syndromes’, reflecting extreme specialization as the common outcome of natural selection in those systems, to the widely accepted idea that
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