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# Effect of seed passage through vertebrate frugivores' guts on germination: a review

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### Abstract

The capacity of seeds to germinate after ingestion by frugivores is important for the population dynamics of some plant species and significant for the evolution of plant-frugivore interactions. In this paper the effects of different vertebrates on seed germination of nearly 200 plant species are reviewed, searching for patterns that predict the circumstances in which germination of seeds is enhanced, inhibited, or unaffected by the passage through the digestive tract of a seed disperser. It was found that seed dispersers commonly have an effect on the germinability of seeds, or on the rate of germination, or both, in about 50% of the plants they consume, although the diversity of animal species tested so far is still rather low (42 bird species, 28 non-flying mammals, 10–15 bats, 12 reptiles, 2 fishes). Enhancement of germination occurred about twice as often as inhibition.

In spite of the morphological and physiological differences in their digestive tracts, the

In spite of the morphological and physiological differences in their digestive tracts, the different animal groups tested have similar effects on seed germination, although non-flying mammals tend to influence germination slightly more often than the other groups. Data on fishes are still too scarce for any generalization. Seed retention time in the dispersers' digestive tract is one factor affecting germination, and helps to explain the variation in seed responses observed among plant species, and even within a species. However other factors are also important; for example, the type of food ingested along with the fruits may affect germination through its influence on chemical or mechanical abrasion of the seed coat. Seed traits such as coat structure or thickness may themselves be responsible for some of the variation in seed retention times. Seeds of different sizes, which usually have different transit times through frugivores, and seeds of either fleshy or dry fruits, show often similar germination response to gut passage.

Seeds of different plants species differ strongly in their germination response after ingestion, even by the same frugivore species. Congeneric plants often show little consistency in their response. Even within a species variation is found which can be related to factors such as the environmental conditions under which germination takes place, seed morphology, seed age, and the season when the seeds are produced.

The effect of gut passage on germination differs between tropical and temperate zones. Seed germination of both shrubs and trees (data on herbaceous species are still scarce) in the temperate zone is more frequently enhanced than in the tropics. This result supports the hypothesis that enhanced germination may be more advantageous in unpredictable or less constant environments. Significant differences in frugivore-mediated germination are also found among different life forms. In both tropical and temperate zones, trees appear to be consistently more affected than shrubs or herbs. This might be due to an overall higher thickness of the seed coats, or to a higher frequency of seed-coat dormancy in tree species.

The influence of frugivory upon the population dynamics of a species has to be evaluated relative to other factors that influence germination and seedling recruitment at a particular site. Whether seed ingestion by dispersers is really advantageous to a plant (as has commonly been assumed) can only be assessed if we also determine the fate of the ingested seeds under natural conditions, and compare it to the fate of seeds that have not been ingested.



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## Key words

frugivory; seed dispersal; seed ingestion; germination patterns

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