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Are birds, wind and gravity legitimate dispersers of fleshy-fruited invasive plants on Robinson Crusoe Island, Chile?

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ABSTRACT

Although fleshy-fruited species are usually dispersed by animals and gravity, previous research shows that the fleshy fruits of invasive plants on Robinson Crusoe Island (RC) are also moved by wind. To determine whether a bird (*Turdus falcklandii*), wind, and gravity could be legitimate dispersers of fleshy fruits from the invasive plant species *Aristotelia chilensis*, *Rubus ulmifolius* and *Ugni molinae*, we carried out germination trials with seeds defecated by *T. falcklandii* and hand-cleaned in the laboratory, and added another trial in field conditions, sowing intact fruits. Whole fruits sown intact are used to represent dispersal by wind or gravity. The field trials for *A. chilensis* and *R. ulmifolius* were performed in canopy gaps and closed forests to evaluate the effect of shadow on seedling emergence. Field trials for *U. molinae* were only established in open shrubland, since this species does not occur in forests on RC. Laboratory trials showed gut-passed *A. chilensis* seeds increased the germination percentage while gut-passed seeds did not affect germination in *R. ulmifolius* and *U. molinae*. In the field, trials revealed that seeds from intact fruits germinated in a similar way to gut-passed or hand-cleaned seeds, with the exception of *U. molinae*, which did not germinate inside fruits. In all field treatments, the germination percentage of *A. chilensis* and *R. ulmifolius* was higher in the canopy gaps than under closed canopy. These results indicate that *T. falcklandii* is a legitimate disperser for the three invasive species studied on RC. Wind and gravity should also be considered legitimate dispersers of *A. chilensis* and *R. ulmifolius*. Microhabitat (i.e., canopy gaps) plays a more important role in improving the establishment of *A. chilensis* and *R. ulmifolius* than the dispersal mechanism itself.

1. Introduction

Seed dispersal of fleshy-fruited invasive plants by vertebrates, specifically birds, is a common cause of naturalization and expansion of exotic plants that may influence the subsequent alteration of environments (Gosper et al., 2005). This phenomenon has been described on many oceanic islands (Chimera and Drake, 2010; Smith-Ramírez et al., 2013; Williams, 2006). When ingested, the vertebrate's gut produces seed coat scarification, which in some cases enhances and/or accelerates germination (Traveset, 1998; Traveset et al., 2001). Additionally, vertebrates remove the pericarp, eliminating inhibitors present in the pulp that impede or delay seed germination (Samuels and Levey, 2005).

Even though endozoochory (i.e., ingestion by vertebrates) is by far the most extensively studied dispersal mechanism for fleshy fruits, barochory (gravity-dispersed) and anemochory (wind-dispersed) are other frequent vectors to disperse fruits (Armesto et al., 2001; Guan et al., 2006; McAlpine and Jesson, 2008; Smith-Ramírez et al., 2013). When seeds of fleshy fruits are dispersed by wind or gravity they remain inside the pericarp. Seeds of some species can germinate inside the fruit, or remain viable inside the fruit until environmental conditions or other agents break the husk and pulp, but others can die if that does not happen (Figueroa and Castro, 2002; Robertson et al., 2006; Yagihashi et al., 1998, 1999, 2000). Samuels and Levey (2005) conducted a literature review of 99 articles and found only 22 studies in which germination was studied in intact fruits, a common seed fate in natural conditions. Lack of these types of germination studies, par-

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