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Landscape and local variables benefit rare species and common ones differently

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Abstract Our ecological knowledge is mainly based on studies about frequent and abundant species, while the vast majority of species are rare; moreover, rare species play crucial role in the evolutionary adaptation of communities to changing land use. Therefore, spatial scale-dependent studies on rare species from the same community may contribute to understanding rare species' responses. At the same time, by taking into account the effect of landscape structure as well, results of such studies may ease the implementation of conservation management plans or environmental planning. In our research we aimed to assess and quantify the effects of local and landscape-level environmental variables on abundance, incidence and parasitism rates for rare parasitoids belonging to the same community. For this reason, we examined the parasitoid community exploiting the gall-inducing *Diplolepis rosae* to learn about rare species' responses to environmental variables at different scales. We have found that local effects on rare species composition diminished while landscape effects increased compared to effects on common species from the same community. Similarly, specific responses of rare species revealed a higher impact of landscape-scale processes than in the case of common species. Although in the case of rare species it is difficult to recognize the effects of environmental changes across spatial scales due to their rarity, we have concluded that the latter are more sensitive to landscape-level changes than common species. Our study underlines the varying importance of environmental changes across spatial scales in the case of both rare and common species; hence rarity and commonness contribute significantly to drawing reliable conclusions about community and interaction patterns.

Keywords Commonness · Dispersal · Landscape heterogeneity · Local effects · Parasitoid · Rarity

Introduction

Rare species have been receiving substantial attention from conservation biologists because their disproportionate disappearance contributes largely to the present-day mass extinction (Myers et al. 2000; Mouillot et al. 2013). With the accelerating loss of rare species for a wide range of endangered taxa much effort has been invested into identifying the extinction vulnerability correlated with taxonomic, life-history and ecological characteristics (Purvis et al. 2000; Hutchings et al. 2012).

Ecological knowledge is based mainly on studies about common species. However, communities are usually formed by a few common and several rare species; so the number of rare species is usually larger or much larger than that of common ones (Kunin and Gaston 1993). Although studies about rare species have increased in number, it is

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