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Tree insects and pathogens display opposite tendencies to attack native vs. non-native pines

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ABSTRACT

Non-indigenous tree species are the foundation for a large (≈25%) and growing fraction of the world's planted forests. The choice of tree species in managed forests has strong broad effects on the community of insects and fungi that attack the trees, as well as on their predators, competitors, and mutualists. Several hypotheses have been proposed to explain and predict community interactions involving non-indigenous plants. Two leading ideas are the Enemy Release Hypotheses (ERH) and the Biotic Resistance Hypothesis (BRH). Predictions of the Enemy Release Hypothesis that a plant species introduced to a new region should experience reduced impacts from herbivores and pathogens compared to within their native range have been frequently supported. However, some studies show higher herbivory on introduced plants when compared with similar native species, which supports prediction of the Biotic Resource Hypotheses. When the introduced plant species is closely related with some natives, the abundance and diversity of insect and pathogens can be higher in the introduced because they are recognized as food by the native herbivores but are less defended than the native plants due to the lack of coevolution. In this paper, we tested prediction of both hypotheses in the important forestry area of Galicia (NW of Spain) by assessing how the choice of native *Pinus pinaster* vs. non-indigenous *Pinus radiata* influences stand risks from the main pests in the area. We compared nutritional quality, tree defenses and the abundance and diversity of plant enemies and their associates in stands of native and non-indigenous pine species. Additionally we assessed whether silvicultural thinning helps to protect forest resources. Results suggest that the choice of where and what to plant when establishing plantation forests will influence subsequent damage by pests and diseases. In our study, stands of the non-indigenous *P. radiata* were more vulnerable to fungi, and more suitable for a notable defoliating insect, than stands of the native *P. pinaster*. Relative to the non-indigenous pine species, stands of *P. pinaster* tended to experience more attacks by more species of stem borers, but these attacks were dramatically less in thinned stands and could be subject to stronger controls by predators and parasitoids. Managing for sustainably high forest productivity requires considerations of forest health when choosing tree species and silvicultural practices.

1. Introduction

Many countries with suitable conditions for forest productivity contribute to current and future demands for timber with plantations of fast growing trees. Globally, about 25% of all planted forests consist of introduced species (FAO, 2010). The tree species that are favoured (sometimes native and sometimes non-indigenous) are generally those that can tolerate the conditions of dense monocultures that achieve higher productivity than managed natural forests (Savill et al., 2002; Kelty, 2006). The area of planted forests is increasing rapidly, and represents today around 7% of the total forest area in the world providing perhaps 30% of global roundwood. Europe (excluding the Russian Federation) is not an exception, being today the area of the world with the second highest proportion of planted forest (FAO, 2010). Among the important threats for forest plantations are pests and pathogens (Jactel et al., 2009). Plantation monocultures are frequently regarded as more susceptible to outbreaks than natural forests (Kareiva, 1983; Andow, 1991; Jactel et al., 2005), partly because monospecific, even-aged aggregations of host trees are relatively easy for insects to locate in the landscape (Kelty, 2006; Jactel et al., 2009). The ecological consequences of plantation monocultures are even more dramatic when the tree species is non-indigenous (Wainhouse, 2005). For example, there are generally strong broad effects of non-indigenous tree species on the community of insect herbivores that arise through changes in resource availability, food suitability, tree resistance, and/or through

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