



Original article

The role of the expansion of native-invasive plant species in coastal dunes: The case of *Retama monosperma* in SW Spain

Sara Muñoz-Vallés*, Juan Bautista Gallego-Fernández, Jesús Cambrollé

Departamento de Biología Vegetal y Ecología, Universidad de Sevilla, Ap.1095, 41080 Seville, Spain

ARTICLE INFO

Article history:

Received 18 April 2012

Accepted 11 December 2012

Available online 10 January 2013

Keywords:

Shrub encroachment

Dispersion

Facilitation

Dune stability

Plant community

Ecosystem functioning

ABSTRACT

Invasion by allochthonous plant species are identified, at present, among the main conservation hazards to coastal dunes. Nevertheless, the role of the expansion, with invasive character, of native species in these ecosystems has received little attention in ecological studies. In recent decades, *Retama monosperma*, a late colonizing legume shrub found in coastal sandy areas, endemic to the SW of the Iberian Peninsula and NW Morocco, has displayed invasive behavior in coastal dunes in different parts of the world, including its natural area of distribution. Its rapid expansion and increase in coverage has significantly contributed to the dune stabilization process, sometimes involving notable changes in the environment, plant community and shaping local distribution of some associated fauna, thus modifying the functioning of the whole ecosystem. In this review we examine the role of the expansion of *R. monosperma* in SW Spain coastal dunes, causes and implications, in the context of the ecological theory of invasions, and comparing it with other case studies.

© 2012 Elsevier Masson SAS. All rights reserved.

1. Introduction

Coastal dunes are dynamic, plastic systems that are subjected to natural perturbations (mainly through the actions of the sea and wind), as well as anthropogenic impacts, receiving the highest levels of human pressure of all the coastal habitats (Ranwell, 1972; Carter, 1988; Holdgate, 1993; Psuty, 2004; Hesp and Martínez, 2007; Nordstrom, 2008). Anthropogenic habitat degradation and destruction, dune stabilization or fixation, eutrophication, and invasion by allochthonous plant species are recognized among the main current conservation threats faced by these ecosystems (Kutiel et al., 2004a; Isermann et al., 2007; Jørgensen and Kollmann, 2009). These factors are closely related in some cases, and may be influenced by each other, creating synergistic relationships (Muñoz Vallés and Cambrollé, 2013).

Coastal dunes are susceptible to plant invasion due to the existence of open micro-sites suitable for plant establishment and low levels of plant–plant competition, as well as recurrent natural and non-natural perturbation (Castillo and Moreno-Casasola, 1996; Jørgensen and Kollmann, 2009). In addition, the direct and indirect introduction and expansion of allochthonous plant species in coastal dunes is often facilitated by human activities (Avis, 1989;

Van der Meulen and Salman, 1996; Wiedemann and Pickart, 1996; Campos et al., 2004; Kutiel et al., 2004a; Gallego-Fernández et al., 2006; Isermann, 2008a). In fact, half of the 34 plant species identified by the IUCN among the 100 of the world's worst invasive alien species occur in coastlands (Lowe et al., 2000). The degradation of coastal dunes and the conservation problems caused by the expansion of allochthonous species in these ecosystems have been recognized in recent years (Castillo and Moreno-Casasola, 1996; Vitousek et al., 1996; Sakai et al., 2001; Isermann et al., 2007; Nentwig, 2007; Marchante et al., 2008; Conser and Connor, 2009; Carboni et al., 2010; Damgaard et al., 2011; French et al., 2011; Muñoz Vallés and Cambrollé, 2013, among others). The expansion of invasive species in coastal dunes alters plant communities, decreases the abundance of sand-living organisms, and stabilizes or otherwise modify the dynamics active or semi-stabilized dunes, what leads to the decrease or loss of dune functionality and causes serious problems for the ecosystem conservation (Lubke, 1985; Avis, 1995; Wiedemann and Pickart, 1996; Kutiel et al., 2004a; Isermann et al., 2007; Isermann, 2008b; Marchante et al., 2008; Conser and Connor, 2009; Hellmann et al., 2011; Zarnetske et al., 2012).

Invasive allochthonous species are defined by the Convention of Biological Diversity as “alien species which threaten ecosystems, habitats or species”. However, according to Richardson et al. (2000), the term “invasive” is related to the ability of the alien species to reproduce and spread over considerable areas in relatively short

* Corresponding author.

E-mail address: saramval@us.es (S. Muñoz-Vallés).

periods of time (they suggest more than 100 m in less than 50 years for sexually spreading plants, and more than 6 m every 3 years for asexually spreading plants), irrespective of any detectable economic or environmental effects. According to these authors, an invasive alien plant species showing clear ecosystem impacts should be considered a “transformer”. However, invasive behavior can also be displayed by native species, rapidly spreading over wide areas, and sometimes causing significant changes in plant communities or ecosystem functioning – e.g., *Hippophae rhamnoides* in coastal dunes of Spiekeroog Island, North Sea (Isermann, 2008b) or *Larrea tridentata* in Chihuahuan Desert (Peters et al., 2006), but also see the review by Carey et al. (2012). According to Valéry et al. (2008), neither geographic origin nor impact extent define a species as invasive, but rather its ability for interspecific competition in a novel habitat, the property that allows an invasive species to spread rapidly and dominate. In this regard, a native species can be considered “novel” following a change in the environment that confers a competitive advantage through the disappearance of natural obstacles to proliferation, allowing the species to spread rapidly and become dominant (Meiners, 2007; Valéry et al., 2008, 2009; Carey et al., 2012). From this perspective, invasive species may also be native (Valéry et al., 2009). Moreover, according to Alpert et al. (2000), certain native species may display more acutely invasive expansion compared to non-native ones in stressful ecosystems because of better adaptations to these environmental traits. However, only a few studies deal with the invasive expansion of native species within their natural range (e.g., Van Auken, 2000; Peters et al., 2006), particularly in the case of coastal dunes (but see Isermann et al., 2007; Isermann, 2008b; Nielsen et al., 2011).

Retama monosperma (L.) Boiss. is a N-fixing leguminous, late colonizing shrub, native to the coastal sandy areas of the SW Iberian Peninsula and NW Morocco (Talavera, 1999). This species has also been introduced sometimes for ornamental purpose and naturalized in various parts of the world, (Muñoz Vallés et al., in press-a), where it is sometimes considered a non-native-invasive plant or noxious weed (Rejmanek and Randall, 1994; Randall, 1997, 2007; Jacobsen, 2000; Cal-IPC, 2006). In recent decades, this species has displayed invasive behavior by undergoing rapid expansion in different regions of the world, including within its native range (Valdés et al., 2007; Muñoz Vallés et al., 2011a, in press-a). The expansion of *R. monosperma* in some coastal areas of SW Spain has contributed to dune stabilization (Muñoz Vallés et al., in press-b). In addition, the considerable capacity of this species to transform the physical environment and surrounding vegetation has produced notable changes in its habitat and plant community, faunal distributions, and the overall functioning of some of these dune ecosystems (Muñoz Vallés et al., 2011a; Muñoz Vallés, pers. obs.).

2. Study species, habitat, distribution and plant communities

Retama monosperma (L.) Boiss (Family Leguminosae, tribe Genisteae) is a mid-successional dune shrub, native to the coastal zones of SW Iberian Peninsula (from Setúbal to Gibraltar) and NW Morocco (Talavera, 1999; Muñoz Vallés, 2009; Anthos, 2011; Fig. 1), that typically establishes on coastal sands and dunes at elevations of 0–300 m above sea level, in areas with a Mediterranean climate (Talavera, 1999; Muñoz Vallés et al., in press-a).

In SW Spain (Huelva and Cádiz provinces), *R. monosperma* is frequent in coastal dunes, accounting for 80–100% of the cover at some locations (e.g., Punta del moral, Isantilla, El Rompido spit, or Hierbabuena beaches) (Fig. 2). In such cases, *R. monosperma* dominance occurs in the absence of other competing woody species, such as pine (Muñoz Vallés et al., in press-b). Adult shrubs reach 3–4.5 m in height with maximum individual canopy

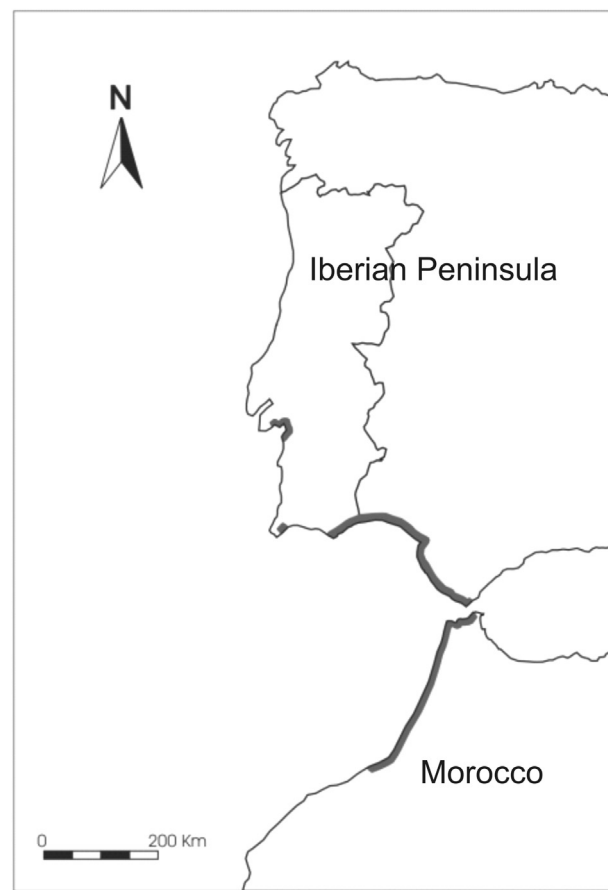


Fig. 1. Native range of *Retama monosperma* (L.) Boiss. (extracted from Muñoz Vallés, 2009, and based on Talavera and Salgueiro, 1999, and the Spanish Plants Information System of the Real Jardín Botánico de Madrid, Anthos, 2011).

diameters of around 10 m and lifespan estimates ranging between 55 years and 80 years (Muñoz Vallés et al., in press-a). This species is adapted to the harsh environmental conditions that characterize the dune habitat, such as scarcity of water and nutrients, substrate mobility, incidence of salt spray, high air and soil temperatures and intense light (Ranwell, 1972; Carter, 1988; Heslenfeld et al., 2004; Martínez et al., 2004; Maun, 2009). It tolerates relatively high pore water salinity (up to 16 mS/cm; Gallego-Fernández et al., 2010). Nevertheless, sand burial and saltwater intrusion appears to limit its establishment. In addition, the species ameliorates the typical harsh environmental conditions in dunes, thereby benefiting other plants, and provides refuge and food for wildlife and forage for livestock (Muñoz Vallés et al., in press-a). *Retama monosperma* also successfully establishes in acidic soils and inland areas (e.g., Iberian Peninsula, Canary Islands, Madeira, California, S Australia, the Aegean islands of Lesbos and Limnos, Sardinia Island and some locations in Ecuador, Bolivia and Argentina; Muñoz Vallés et al., in press-a).

The mature stage of coastal dunes in the native range of *R. monosperma* is typically colonized by psammophilous and xerophilous vegetation (Rivas Martínez et al., 1980). Rivas Martínez et al. (2002) describe the syntaxion *Retamion monospermae* Rivas and Cantó as “microphanerophyte communities with seral shrubby brooms, dominated by *R. monosperma*”. They refer this syntaxion to the *Pycnocomon rutaefolii*–*Retametum monospermae* association (Pérez Chiscano, 1982), which includes other characteristic species such as *Adenocarpus aureus* subsp. *gibbsianus* and *Cytisus grandiflorus* subsp. *cabezudo*. Nevertheless, data collected along the

Download English Version:

<https://daneshyari.com/en/article/4380845>

Download Persian Version:

<https://daneshyari.com/article/4380845>

[Daneshyari.com](https://daneshyari.com)