

Radiola linoides Roth

Allseed

Radiola linoides is a diminutive annual, often only a few centimeters tall, with thin forked stems, opposite leaves and tiny white flowers with four petals as long as the four sepals. It is a calcifuge species of sparsely vegetated, well-drained soils, found in short acid grassland, grazed flushes, rutted tracks, dune slacks, and woodland rides. Following substantial losses inland, it now has a mainly coastal distribution across western Ireland, south-west England and Wales, northwards along the coast to western and north-east Scotland, with outliers in southern England and East Anglia. It is assessed as Near Threatened in Great Britain as a whole, Vulnerable in England, but of Least Concern in Wales.



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IDENTIFICATION

Radiola linoides is a very small annual with prostrate to ascending, greyish-green, often purple-flushed forked stems, 1-6(10) cm tall and 0.5mm in diameter. Plants have opposite, obovate-elliptic leaves (1.5-2 mm) that are 1-nerved and have transparent (hyaline) margins that appear ragged due to the presence of minute teeth or lobes (Poland & Clement 2009; Stace 2010).

The tiny flowers (1 mm across) have four white petals ±as long as the four sepals. The capsules are c.1 mm wide, globose, and have 8 valves with 2-seeded compartments (locules).



Habitat supporting *Radiola linoides* at Smallhanger Down, Devon. ©David Fenwick.

SIMILAR SPECIES

Polycarpon tetraphyllum can occur in similar habitats to *R. linoides* but is easily separated by its more robust habit, larger and rounder leaves in whorls of 4 and flowers with 5 petals and 5 white-margined hooded sepals (Rose 2006; Stace 2010).

HABITATS

R. linoides is a plant of sparsely vegetated, damp, infertile, moderately acid peaty, gravelly or sandy soils, often found in drawdown zones or where there has been some poaching by livestock (Edwards & Pearman 2004). It is found in short acid grassland, heathland, grassy cliff slopes, grazed flushes, the rutted edges of tracks, woodland rides and firebreaks, at the edges of ponds, in sandy grassland, machair and dune slacks and in soil-filled rock crevices (Wilmore 2002; Chater 2010; Rand & Mundell 2011). Rodwell (2000) includes *R. linoides* as an associate of short open turf belonging to the NVC MC5 *Armeria maritima*-*Cerastium diffusum* subsp. *diffusum* maritime therophyte community but its NVC affinities are likely to be much broader and include a range of grassland and heathland types.

Across Europe, *R. linoides* is also associated with annual-rich west Mediterranean siliceous grassland, the fumaroles of Pantelleria in Sicily, *Juncus bufonius*-dominated communities with *Centunculus minimus* and *Centaureum pulchellum*, and temporarily inundated small herb communities with associates including *Elatine* spp., *Damasonium bourgaei* and *Samolus valerandi* (Anon 2013). In the Netherlands, *R. linoides* is recorded from fields that are filled with water in the winter months for ice skating.

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BIOGEOGRAPHY

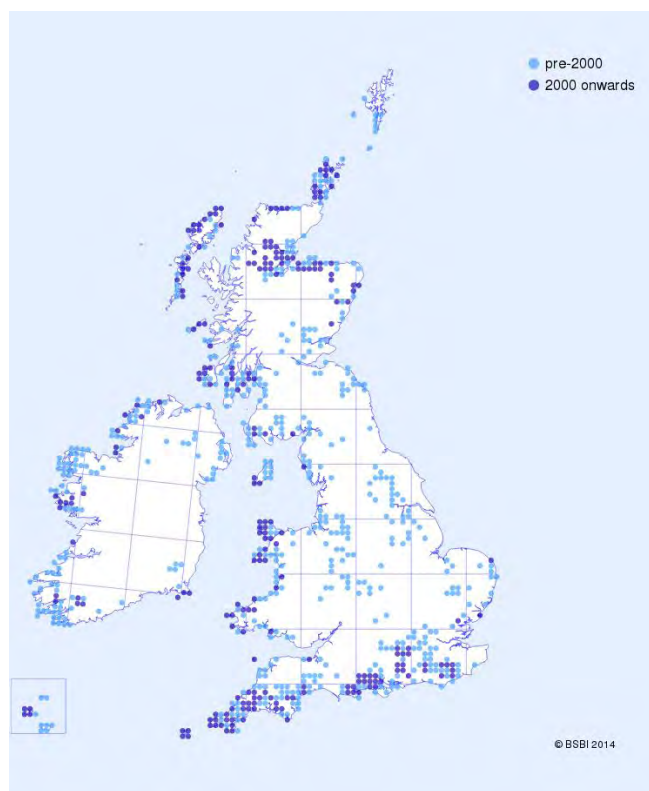
R. linoides belongs to the European Temperate element and reaches its absolute northern range limit at Papa Stour, Shetland (Preston 2007). It is relatively widespread across southern Sweden, south-west Norway, Denmark, Germany, France and Spain to Macronesia, becoming rarer in central and eastern Europe across to Greece and Turkey. It has a disjunct southern range across isolated locations in tropical mountains from Cameroon to Ethiopia extending to northern Malawi (Leistner 2005).

In Britain, *R. linoides* has a mainly coastal distribution across much of southern and western England and the western coastlines of Ireland, Scotland and Wales. It is largely absent from eastern coastlines, except for local populations in north-east Scotland, east Norfolk, and east Suffolk. Preston et al. (2013) assigns *R. linoides* to the largely calcifuge *Oenanthe crocata* biogeographical cluster that is concentrated in south-west England and Wales, northwards along the coast to western Scotland, with outliers in southern England, eastwards to the Weald. Inland populations have experienced substantial declines, and are now mainly concentrated in south-west England across to the South Downs.

ECOLOGY

R. linoides is an annual of early successional or ephemeral, nutrient-poor, damp habitats, flowering from July to August.

Plants produce very small (0.4-0.5 × 0.2-0.3 mm) obovoid to ellipsoid brown seeds that are slightly flattened on one side



Distribution of *Radiola linoides* in Great Britain and Ireland.

and have a smooth, lustrous surface (Bojňanský & Fargašová 2007). Seeds are able to persist in the soil after conditions have become unsuitable for mature plants to establish in the above-ground vegetation (Plassmann et al. 2009). *R. linoides* is therefore capable of opportunistically colonising areas from the seed bank when suitable conditions (e.g. bare, damp, open ground) become available, although it is not known how long the seed bank remains viable if unsuitable conditions continue for a prolonged period of time (i.e. more than five years).

As well as producing long-lived seeds, *R. linoides* displays other structural adaptations that help it to persist in ephemeral habitats, including very low nutrient demand, the ability to flower with very small vegetative apparatus, and the capacity to set seed within a few weeks after germination (Bagella & Caria 2012).

Very small, smooth seeds are known to be able to survive internal (endozoochorous) dispersal by animals, and the combination of seed morphology and habitat suggests that *R. linoides* seed also has the potential to be transported long distances on the feet or feathers of wildfowl (Salisbury 1970) or on the feet or hair of cattle. *R. linoides* has been recorded as a host for *Melampsora lini*, a fungal pathogen responsible for rust disease on flax and linseed (Lawrence et al. 2007).

THREATS

R. linoides is intolerant of competition and depends on a degree of disturbance and the subsequent creation of open areas for germination and establishment. The main threats to extant populations continue to be management changes (e.g. the cessation of grazing) that lead to a closed sward and the loss of small-scale disturbance, as well as eutrophication and field drainage.

MANAGEMENT

Micro-habitats supporting *R. linoides* are often sustained by a combination of vehicle movement and cattle grazing. Habitat management involving extensive cattle grazing over large areas provides open areas in the vegetation, and the creation of new tracks onto adjoining land, combined with the movement of livestock, may also contribute to the dispersal of seed to new and suitable locations.

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