

Apium repens (Jacq.) Lag.

Creeping Marshwort

Apium repens is a light-demanding, low-growing clonal perennial of damp nutrient-rich grassland that is prone to winter flooding and disturbance. It is easily confused with a prostrate meadow form of *A. nodiflorum*, from which it is distinguished by a number of characters set out in the 'similar species' section below. *A. repens* is a very rare plant in the British Isles, categorized as Endangered in England, and currently only found as a native at Port Meadow, Oxfordshire and Walthamstow Marshes in Middlesex, and as an introduction at North Hinksey Meadow, Oxfordshire.



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IDENTIFICATION

Apium repens is a small, slender umbellifer forming rosettes that produce horizontal stems 'creeping' along the ground and rooting at each node. Leaves are arranged in 2-5 pairs, are simply pinnate, suborbicular and shallowly-toothed save for one deep indentation (Tutin, 1980; Rich & Jermy, 1998; McDonald & Lambrick, 2006). However, a range of flowering and fruiting characters are necessary for a confident determination (see also 'similar species' opposite).

Compound umbels containing hermaphrodite white flowers are held on 4-7 smooth rays (the stalk of a partial umbel – not to be confused with the peduncle, the main stalk of an inflorescence). Peduncles are usually clearly longer than the rays and adjacent petiole (Tutin, 1980) although in heavily grazed pasture this feature is not always obvious. Bracts and bracteoles are lanceolate to ovate and deflexed (Tutin, 1980). The fruit – a double achene consisting of two suborbicular



Port Meadow in Oxfordshire, one of only two extant native sites for *Apium repens* in the British Isles. © Judy Webb.

shaped fruits – is slightly wider than long, laterally compressed, has recurved styles and is smooth save for raised, slender ribs (Tutin, 1980).

SIMILAR SPECIES

Recent taxonomic work has led to a revision of *Apium sensu lato*, confirming that most of the European *Apium* species (including *A. repens* and *A. nodiflorum*, but excluding *A. graveolens*) belong to the genus *Helosciadium* (Ronse et al., 2010). This change is widely accepted across Europe, but for the purpose of this species account, we follow Stace (2010).

Apium repens can be easily confused with heavily grazed prostrate forms of *A. nodiflorum*. The most reliable characters to separate the two species (following T. O'Mahony in Stace *et al.* 2015, and with *A. repens* given first) are the number of bracts (2-6(-8) *versus* 0-2(3)), the petiole base (scarcely sheathing stem with narrow hyaline i.e. semi-transparent margin *versus* strongly sheathing stem with broad hyaline margin), peduncles and rays (rounded to more or less triangular in cross section *versus* four-sided in cross section), and leaflet apex (asymmetrically divided into two *versus* acute). Fruit shape is also useful, with *A. nodiflorum* having fruits that are longer than wide as opposed to *A. repens* which has fruits slightly wider than long (see illustrations in Tutin, 1980). Field observations also suggest that the leaves of *A. repens* are a brighter green than those of *A. nodiflorum*.

The F1 hybrid between the two species (*A. x longipedunculatum*) has recently been confirmed from Port Meadow, Oxfordshire using DNA analysis (S. Desjardins, pers. comm.) and is distinguished by having the petiole characters of *A. nodiflorum* and the bract and peduncle characters of *A. repens* (Stace *et al.*, 2015). The largest mature

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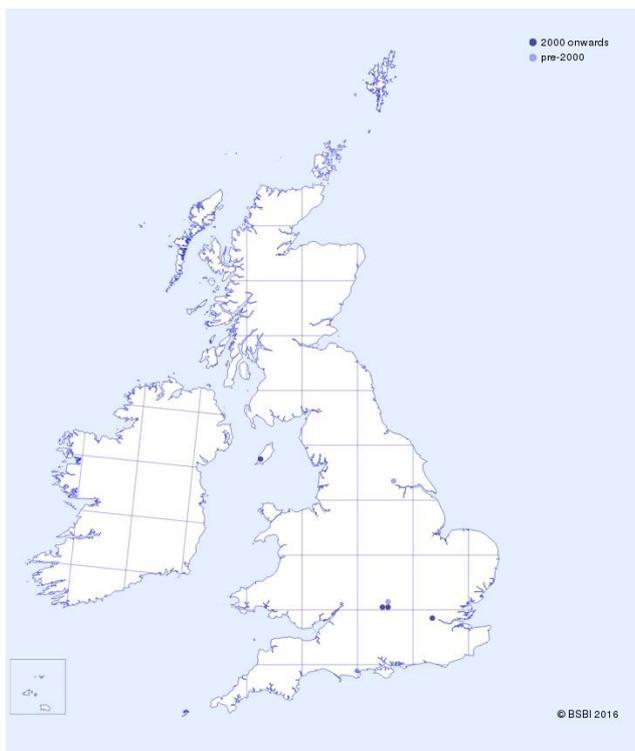
leaves also have an extremely deep indentation, almost dividing the leaves into two separate parts.

It is also worth mentioning here the recent discovery of a new hybrid genus between *Berula erecta* and *A. nodiflorum* (\times *Beruladium* A.C. Leslie), determined from Chippenham Fen material that was previously thought to be either putative *A. repens*, a variant of *B. erecta*, or the hybrid between *A. repens* and *A. nodiflorum* (Walters, 1980). Taxonomic treatment and notes on field identification for \times *Beruladium* are given in Desjardins *et al.* (2015).

HABITATS

Apium repens is a species of winter-inundated grassland that is prone to a rapid fall in water levels in the late spring resulting in abundant areas of bare, damp, warm mud, short vegetation and limited competition, assisted by livestock grazing.

At Port Meadow in Oxfordshire, water level fluctuation is influenced by an underground aquifer, with the water table raised and lowered depending on the quantity of rainfall flowing through river gravels (McDonald & Lambrick, 2006). Vegetation at this site has very poor fits with NVC types, reflecting the dynamic conditions operating from year to year, with relevés showing weak affinities with either a *Mentha aquatica* variant of M13 *Agrostis stolonifera*-*Alopecurus geniculatus* grassland, or open communities such as OV21 *Poa annua*-*Plantago major* trampled grassland and the OV28 *Agrostis stolonifera*-*Ranunculus repens* community of damp silts and clays.



Distribution of *Apium repens* in Great Britain and Ireland. The Isle of Man record, seen here as a dark blue dot, is in error for *A. nodiflorum*.

Common associates at Port Meadow include *Galium palustre*, *Oenanthe fistulosa*, *Myosotis scorpioides*, *Rorippa palustris* and *Veronica scutellata*, and although abundance of such species can fluctuate from year to year, *O. fistulosa* does appear to have experienced real decline in recent years (McDonald & Lambrick, 2006).

BIOGEOGRAPHY

Apium repens has a European Temperate distribution (Preston & Hill, 1997), being widely and very thinly scattered in northern southern and central Europe from England and Denmark to the Czech Republic, south to Italy and west to Spain, Portugal and the Canary Islands, where it reaches its southern range limit. It is also present in the Atlas Mountains of Morocco where it has been assessed as 'Vulnerable' (Garcia *et al.* 2010).

It has always been a rare plant in Great Britain, with confirmed historical records from Skipwith Common in south-east Yorkshire and three sites in Oxfordshire: Binsey Green, Port Meadow and Langel Common. Of these, *A. repens* is currently only known as a native from the Port Meadow site, where there has been a continuity of grazing for perhaps over 1000 years (Grassly & Harris, 1996). A second, small population of *A. repens* was found at Walthamstow marshes in Middlesex following ditch clearance works in 2002. The recent introduction of cattle grazing combined with targeted cutting and clearing of vegetation appears to have been successful in maintaining *A. repens* at this site following a period of neglect and the encroachment of tall dense vegetation (M. Spencer, pers. comm).

Apium repens has been the subject of a Species Recovery Programme since 1995, funded by English Nature and subsequently Natural England. Work by the Oxfordshire Flora Group and others resulted in an introduction of *A. repens* to North Hinksey Meadow in 1996 using stock from Port Meadow, and annual monitoring of both sites are ongoing (e.g. Webb, 2015a,b). A small number of plants from Hinksey were recently translocated to the southern end of Port Meadow to 'bulk up' the population in hydrologically suitable areas (Webb, 2015c).

ECOLOGY

In the British Isles *A. repens* is a light-demanding, low-growing clonal perennial of damp nutrient-rich and sparsely vegetated grassland prone to winter flooding and disturbance, flowering from late July to November. Regeneration is either vegetative via the propagation of stolons and/or by seed, which mature and are dispersed in the autumn months. Populations can fluctuate considerably from year to year depending on hydrology and grazing pressure.

Apium repens requires either light or cold-wet stratification to stimulate germination of its seeds and can tolerate a wide temperature range, with the exception of very high temperatures (Burmeier & Jensen, 2008). Seeds are capable of germination in the same season (Burmeier & Jensen,

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2008), although the survival of such seedlings into the following spring and summer is not known. Germination can also occur whilst seeds are submerged in the late winter months, giving a competitive advantage over other associate species whose seeds remain dormant when soil moisture levels are high.

Although the seeds of *A. repens* have been shown to be capable of remaining buoyant for at least 50 days in controlled *ex situ* conditions, at extant sites the potential for long distance dispersal is severely restricted by heavy rainfall events that lead to propagules sinking immediately (Burmeier & Jensen, 2008). However, juvenile plants or fragments of mature plants that become detached are capable of rooting and regenerating into bare damp ground within a four week period (McDonald & Lambrick, 2006; Burmeier & Jensen, 2009).

Apium repens forms a short-term persistent seed bank (potentially persistent) with Burmeier & Jensen (2008) calculating a density of 1,035 seeds per m² in the vicinity of extant populations. Relatively high soil seed density and persistence means that disturbance following periods of neglect can result in the recovery of populations, for example at Houtsaegerduinen in Belgium (Leten *et al.*, 2005) or at Binsey Green in Oxfordshire, although the population at the latter site did not persist and restoration work at a second historical site did not lead to the emergence of *A. repens* (McDonald & Lambrick (2006).

Cultivated *A. repens* would appear to be particularly susceptible to damage by molluscs as well as root and leaf aphids, although the plants palatability and the subsequent damage caused to *in situ* populations has not been studied.

THREATS

Apium repens can tolerate prolonged periods of fresh-water inundation in the winter months, but flooding into the early summer months can lead to soil anoxia and negative impacts on growth and biomass accumulation, sometimes leading to the death of plants (McDonald & Lambrick, 2006). However, the same conditions can also lead to substantial seedling emergence in mid-summer.

The cessation of grazing results in the shading out and displacement of *A. repens* by taller vegetation, and permanent alterations to the historical hydrological regime, especially if it consistently leads to a lack of disturbance via flooding in the winter months, will result in unsuitable conditions and the loss of the species.

Hybridisation with *A. nodiflorum* may constitute a future threat, but the rarity of such observations suggests this is currently of minor importance. The spread of *Crassula helmsii* at Port Meadow has been noted, and although the effects on *A. repens* are not known, as this non-native can dominate large areas of a 'drawdown' zone, it must be seen as a possible future threat to the extant *A. repens* population.

MANAGEMENT

As a weak competitor *A. repens* requires periodic disturbance to reduce shading and co-exist with other associate vegetation (Burmeier & Jensen, 2009), as high levels of competition limit nutrient availability and light which in turn reduce flowering and fruiting performance (Fukarek & Voigtländer, 1982).

Disturbance is achieved by the natural hydrological cycle i.e. fluctuating water levels and by extensive livestock grazing that suppresses competitive species and generates a patch mosaic with regeneration gaps for colonisation by *A. repens* stolons. Extensive grazing in itself does not inhibit the growth of *A. repens*, although excessive trampling through over-grazing can lead to the exclusion of *A. repens* (see Rosenthal & Lederbogen, 2008).

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AUTHOR VERSION

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