

Antennaria dioica (L.) Gaertn.

Mountain Everlasting

Antennaria dioica is a dioecious plant with pale-pink flowers, leaves that are usually green above but white-woolly on the underside, and stems that also have a dense woolly covering. It is an acid-sensitive species of low fertility soils with a pH of between 4.5 and 6, associated with calcareous grassland, maritime heath, dune slacks and mine waste in the lowlands, and well-drained basic to acid grasslands, dwarf-shrub heath, mountain slopes, rock ledges and summit heaths in the uplands. It is now rare in lowland England and Wales, but is widespread in upland areas of northern England, north Wales, Ireland and Scotland. It is assessed as of Least Concern in Great Britain, but as Vulnerable in England.



©Pete Stroh

IDENTIFICATION

Antennaria dioica is a dioecious perennial with a dense, white-woolly appearance on the stems (up to 20 cm) and underside of the leaves. The upperside of the leaves are usually green, although plants with white-woolly hairs occur at high altitudes in the English Lake District, Scotland and The Alps, and are referred to as var. *hyperborea*. These rarely form pure stands are often inter-mixed with the common variety (var. *dioica*) (Pearman *et al.* 2008). A variety with long peduncles (up to 4 cm) is known from Scotland and Ireland (var. *pedicellata*; Sell & Murrell 2006).

Flowers are pale to deep pink, tubular, and are clustered to form a close, terminal flower-head. Female flower-heads (12 mm across) are much larger than male flower-heads (6 mm across) and have narrow, pointed and erect and often pink-

tipped bracts. Male bracts are more rounded, blunt, spreading, and with usually white-tipped bracts. The achenes of female plants are long and slender, whereas male achenes have a club-shaped tip.

SIMILAR SPECIES

In a vegetative state *A. dioica* can resemble *Pilosella officinarum* in both growth-form and hairiness but the leaves lack latex and have an apiculate apex (Poland & Clement 2009). *Antennaria dioica* is told from other white-woolly cudweeds (*Anaphalis* spp., *Gnaphalium* spp., *Filago* spp.) by its stoloniferous stems (rooting at the nodes) and broader leaves.

HABITATS

Throughout Europe, *A. dioica* is an acid-sensitive species characteristic of slightly buffered soils with pH 4.5-6.0 (van den Berg *et al.* 2005). In Britain and Ireland it occurs on thin, basic to mildly acidic soils across a wide range of habitats (Ellenberg R = 4). In the lowlands these include chalk and limestone grassland (NVC CG2-5), maritime heath (H3), and calcareous dune grassland and mine waste (CG1). In the uplands, where it is much more abundant, it is a characteristic herb of well-drained basic to acid grasslands (CG9-10), dwarf-shrub heaths (H10, 13-17, 19-20), mountain slopes, rock ledges (CG11-14) and summit heaths (U10) (Preston *et al.* 2004). In the Netherlands *A. dioica* can be found on the dry parts of nutrient-poor heathlands and species-rich grasslands (van den Berg *et al.* 2005). Other habitats elsewhere include dry slopes on tundra, meadows, and conifer or semi-open forests.



Abundant *Antennaria dioica* flowering in the Burren, County Clare. ©Kevin Walker.

Antennaria dioica (L.) Gaertn.

BIOGEOGRAPHY

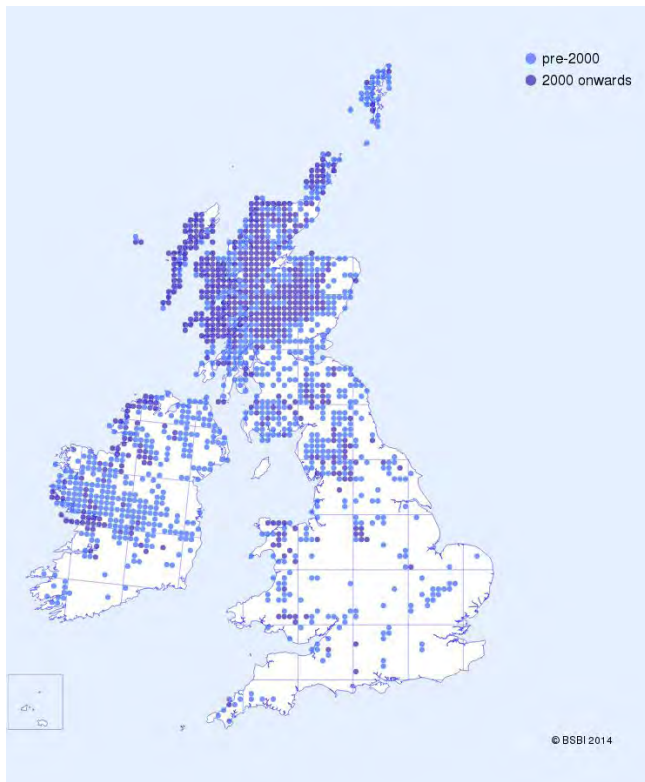
A. dioica is a Boreo-temperate species, distributed widely across temperate and arctic regions of Eurasia, extending from Britain to Japan (including Kazakhstan, Mongolia, Russia, China) and North America, where it is confined to Alaska (western Aleutian Islands).

In Britain and Ireland, *A. dioica* is relatively common in upland areas of northern England, north Wales, the Highlands and Islands of Scotland and Ireland, but is now very rare in most of England and Wales. Most populations (c.70%) occur below 400 m, but it ascends to 1071 m in Easternness (Mam Sodhail) and to 2700m in China.

In England, Wales and Europe, *A. dioica* has suffered serious declines. For instance, it is now extinct in Northumberland, 28 sites having been lost in the last 40 years (A.J. Richards pers. comm.). The regional population structure is now dominated by a few large and dense populations, and a majority of small, often single sex populations that comprise one or a few genets (Eriksson 1997). As a consequence it is seriously threatened in many countries including Norway (Asdal 2005), Finland (Von Numers & Korvenpää 2007; Rassi *et al.* 2010), Hungary (Gergely 2007), Holland (van den Berg *et al.* 2005) and is now extinct in Belgium (Quentin Groom, pers. comm.) and Luxembourg (Colling 2005).

ECOLOGY

A. dioica is a perennial, dioecious herb, flowering between June and July in north-western Europe. Each genet may



Distribution of *Antennaria dioica* in Great Britain and Ireland.

produce one to several ramets by clonal growth of surface-creeping stolons that root at the nodes. These can form dense patches, but more often they are intermingled with other species in the community (Eriksson 1997). Leaves are wintergreen, and genets flower, producing up to one shoot per ramet. Achenes are small (0.05 mg) with a pappus and dispersed over short distances in early-to mid-July (Eriksson 1997). The seeds appear to have very poor colonization ability, and in seeding experiments *A. dioica* only recruited under disturbed conditions (Eriksson 1997).

A. dioica forms part of a complex of species in which apomictic forms occur, especially in arctic and alpine habitats in North America (Bayer & Stebbins 1987). Although Clapham *et al.* (1962) state that *A. dioica* is apomictic, most British and Irish populations consist of intermingled male and female plants suggesting that normal sexual reproduction occurs (Kay & Stevens 1986), as in North America, where only sexual diploid plants are known ($2n = 28$; Bayer & Stebbins 1987).

Hermaphrodites have been reported from some European populations (e.g. Ubisch 1936), but would appear to be rare. The overall genet sex-ratio of populations is usually strongly female-biased, although this can vary markedly between populations and years (Varga & Kytöviita 2011).

In Finland, the flowering sex-ratio frequency is much more variable and possibly climatically controlled, where increased male flowering correlates with warmer February temperatures (Varga & Kytöviita 2011). In addition, a small proportion of plants have been shown to change sex (sex lability) (Varga & Kytöviita 2011). Although there appears to be no difference in the flowering frequency between sexes, males produce around twice as many shoots and flowers than females and have much heavier inflorescences (Varga & Kytöviita 2011). However, the overall cost of reproduction would appear to be similar between the sexes, unlike many other dioecious species where females invest more heavily in reproduction.

A. dioica is pollinated by generalist insects from several orders including Lepidoptera, Hymenoptera, Diptera and Coleoptera (Varga & Kytöviita 2011). In Scotland, it has also been observed as a nectar source for adults of several species of microlepidoptera (Heckford 2001).

Roots of *A. dioica* are colonized by a range of symbiotic arbuscular mycorrhizal fungi, and experimental studies have shown that infection has a significant positive effect on vegetative performance and plant growth under a range of conditions (Varga & Kytöviita 2008, 2011). This is especially the case for soils with a higher pH (c.6), as the presence of the fungi increases the amount of soil phosphorous available for plant growth (Varga & Kytöviita 2010). Similarly, mycorrhizal plants with moderate watering-regimes produced more biomass and ramets than mycorrhizal plants under a low water regime, whereas the opposite was found for non-mycorrhizal plants which were generally much smaller (Varga & Kytöviita 2008). Overall there appears to be no difference in infection levels between males and females, nor does sex affect the amount of resources supplied to the fungal symbiont or responses to environmental conditions (e.g. pH or water-regime; Varga & Kytöviita 2008, 2011).

Antennaria dioica (L.) Gaertn.

THREATS

Intensification of grassland management and habitat loss continue to threaten extant populations. In addition, atmospheric deposition of sulphate and inorganic nitrogen results in the acidification and eutrophication of heathland and grassland soils causing *A. dioica* to be outcompeted as more vigorous species occupy its shallow-soil sites. The depletion of buffering base cations such as Ca²⁺, Mg²⁺ and K⁺, leading to a change in soil buffering and acid-sensitive species may also be important (van den Berg et al. 2005). In Norway, *A. dioica* has disappeared from many sites as a result of the cessation of agriculture, and in some of the remaining populations, only males survive (Asdal 2005).

MANAGEMENT

A. dioica requires a short, open sward, best achieved by sheep grazing in late summer and early autumn, allowing it and other associate species to flower and set seed in the spring and summer months. Sites may require additional grazing pressure in late winter/early spring in some years.

REFERENCES

- Asdal, Å. 2005. Changes in grassland management and its effect on plant diversity. *Crop Wild Relative* 3: 15-17.
- Bayer, R. J. & Stebbins, G.L. 1987. Chromosome numbers, patterns of distribution, and apomixis in *Antennaria* (Asteraceae: Inuleae). *Systematic Botany* 12: 305-319.
- Eriksson, O. 1997. Colonisation dynamics and relative abundance of three plant species (*Antennaria dioica*, *Hieracium pilosella* and *Hypochaeris maculata*) in dry semi-natural grasslands. *Ecography* 20: 559-568.
- Gergely, K. (ed) 2007. *Red List of the Vascular Flora of Hungary*. Privately published, Sopron.
- Heckford, R.J. 2001. *Antennaria dioica* (L.) Gaertner, a food source for adult microlepidoptera. *Entomologist's Gazette* 52: 49.
- Kay, Q.O.N. & Stevens, D. 1986. The frequency, distribution and reproductive biology of dioecious species in the native flora of Britain and Ireland. *Botanical Journal of the Linnean Society* 92: 39-64.
- Öster, M. & Eriksson, O. 2007. Sex mediated pollen limitation in the dioecious herb *Antennaria dioica*. *Ecoscience* 14: 387-398.
- Pearman, D.A., Preston, C.D., Rothero, G. & Walker, K.J. 2008. *The Flora of Rum: an Atlantic Island Reserve*. Henry Ling, Dorchester.
- Rassi, P., Hyvärinen, E., Juslén, A. & Mannerkoski, I. (eds.) 2010. *The 2010 Red List of Finnish Species 2010*. Ministry Of The Environment & Finnish Environment Institute, Helsinki.
- van den Berg, L.J.L., Dorland, E., Vergeer, P., Hart, M.A.C., Bobbink, R. & Roelefs, J.G.M. 2005. Decline of acid sensitive plant species in heathland can be attributed to ammonium toxicity in combination with low pH. *New Phytologist* 166: 551-564.
- Van den Berg, L.J.L., Peters, C.J.H., Ashmore, M.R. & Roelefs, J.G.M. 2008. Reduced nitrogen has greater effect than oxidized nitrogen on dry heathland vegetation. *Environmental Pollution* 154: 359-369.
- Varga, S. & Kytöviita, M-N. 2008. Sex specific responses to mycorrhiza in a dioecious species. *American Journal of Botany* 95: 1225-12332.
- Varga, S. & Kytöviita, M-N. 2010. Interrelationships between mycorrhizal symbiosis, soil pH and plant sex modify the performance of *Antennaria dioica*. *Acta Oecologia* 36: 291-298.
- Varga, S. & Kytöviita, M-N. 2011. Sex ratio and spatial distribution of male and female *Antennaria dioica* (Asteraceae) plants. *Acta Oecologia* 37: 433-440.
- von Numers, M. & Korvenpää, T. 2007. 20th Century vegetation changes in an island archipelago, SW Finland. *Ecography* 30: 789-800.
- Ubisch, G.V. 1936. Genetic studies on the nature of hermaphroditic plants in *Antennaria dioica* (L.) Gaertn. *Genetics* 21: 282-294.

AUTHOR VERSION

Kevin Walker. Version 1: 19 November 2014.

SUGGESTED CITATION

Walker, K.J. 2014. *Antennaria dioica* (L.) Gaertn. Mountain Everlasting. Species Account. Botanical Society of Britain and Ireland.