The biology and non-chemical control of Mugwort (*Artemisia vulgaris* L.)

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Mugwort

(chrysanthemum weed, common artemisia, felon weed, French tobacco, mugweed, wild chrysanthemum, wild wormwood)
***Artemisia vulgaris* L.**

Occurrence

Mugwort is an aromatic perennial with a branching rootstock, common throughout lowland Britain (Clapham *et al.*, 1987; Stace, 1997). It is native in waste places, waysides and hedgerows and is a casual on arable land. In an early survey of Bedfordshire and Norfolk it was distributed on light calcareous soils (Brenchley, 1913). Mugwort is associated with fertile but disturbed situations and tolerates a range of soil types and pH levels (Barney & DiTommaso, 2003). It is able to survive in both cool, dry, and in warm, wet conditions. Mugwort is absent from shaded and grazed sites (Grime *et al.*, 1988). In the urban situation it occurs near rivers and streams (Benvenuti, 2004).

Mugwort can grow up to 1.4 m tall and forms dense stands that smother other vegetation. Colonies can persist for many years (Grime *et al.*, 1988). In the vegetative state the plant has the appearance of a garden chrysanthemum, hence some of its common names. Plants in the UK exhibit some variation in leaf shape and flower colour. In North America the species also exhibits considerable variation in morphology (Barney & DiTommaso, 2003).

Mugwort is widely used in herbal medicine including use as a diuretic and the treatment of a variety of gynecological problems (Morse & Palmer, 1925; Barney & DiTommaso, 2003). Foliar extracts have also been used in the development of insect repellents. It is said to be good for deterring moths. Mugwort is considered to be potentially toxic to livestock (Grime *et al.*, 1988).

The related field mugwort (field wormwood, *A. campestris*) is a non-aromatic perennial with a branched creeping woody stock (Clapham *et al.*, 1987; Stace, 1997). It is native but is confined to the breckland heaths of East Anglia. It may be locally common but is nevertheless rare in the UK and is a protected plant under the Wildlife and Countryside Act, 1981 (HMSO, 1994). Another related plant is wormwood (*A. absinthum*), which occurs in similar situations but is mainly found in soils of high pH (Grime *et al.*, 1988). Wormwood has been much cultivated for culinary and medicinal use. In Canada it is a weed of overgrown pasture.

Biology

Mugwort flowers from July to September (Clapham *et al.*, 1987). Both ray and disc florets are present in more or less equal numbers. The flowers are primarily wind pollinated but are also visited by insects (Barney & DiTommaso, 2003). Seed is set from August to October (Grime *et al.*, 1988; Bostock & Benton, 1979). Seed number per flowering stem is 9,000 (Grime *et al.*, 1988). There are 1 to 16 stems per plant

(Bostock & Benton, 1979). Even small stems carry a few flowers. Seed numbers per plant range from 50,000 to 700,000 (Guyot *et al.*, 1962). The average seed number per plant in ruderal situations is given as 200,116 (Pawlowski *et al.*, 1967). The 1,000 seed weight is given as 0.182 g (Bostock, 1978), 0.12 and 0.14 g (Barney & DiTommaso, 2003). Some biotypes are reported not to produce viable seeds.

The seeds exhibit some dormancy. Light and alternating temperature were synergistic in increasing germination, chilling helped too (Bostock, 1978). Seeds gave 14% germination at alternating temperatures in the dark but this increased to 44% under a 'safe' green light (Grime *et al.*, 1981). There was just 2% germination at a constant temperature in darkness. When seeds were put to germinate under a leaf canopy or in diffuse white light there was no germination under the leaf canopy and 30% in the light (Górski *et al.*, 1977). Germination was faster in seeds that had been dry-stored. Seed germination is stimulated by soil cultivation (Chancellor, 1965). Seeds germinate in late spring. Seeds sown in a 75 mm layer of soil in cylinders in the field and stirred periodically remained dormant until they had passed through the first winter after sowing in autumn (Roberts, 1986). In the year after sowing, seedlings emerged from February to November with flushes of emergence following soil cultivations. Seedlings continued to emerge over the 5 years of the study and viable seeds still remained when the study ended.

Rhizomes are initiated when seedlings approach 4 weeks old, lateral branches are produced at 9 weeks (Barney & DiTommaso, 2003). The rhizomes are short, thick and woody with closely packed nodes (Bostock & Benton, 1979). The rhizomes vary in diameter from a few millimetres up to more than 1 cm. The finer rhizomes usually branch at the nodes and form a dense fibrous mass, thicker rhizomes exhibit minimal branching. Rhizomes can penetrate to a depth of 7-18 cm in soil. The flower stems die in the autumn and leave a number of separate rhizomes (Bostock & Benton, 1979). New shoots develop on the rhizomes and overwinter as low rosettes (Grime *et al.*, 1988).

Several volatile allelochemicals have been identified in fresh leaf tissue of mugwort (Barney *et al.*, 2005). The chemicals appear to act synergistically. The concentration is higher in the young leaves, which suggests that the chemicals may help in early establishment and spread in new habitats. Soil amended with mugwort plant material and leachate suppressed red clover seedling growth (Inderjit & Foy, 1999).

Persistence and Spread

Mugwort seed is considered to have the potential to form a persistent seedbank (Barney & DiTommaso, 2003). Seeds have remained viable for more than 5 years in cultivated soil (Roberts, 1986). Seed recovered during house demolitions and dated at 30, 92 and 600 years is reported to have germinated (Ødum, 1974; Ødum, 1978).

There is no obvious seed dispersal mechanism (Bostock, 1978). The light seed may be wind dispersed and/or water borne. It appears to have exploited road and rail systems as a route for dispersal. In the USA, mugwort is commonly dispersed by floodwater (Barney & DiTommaso, 2003).

Mugwort spreads slowly by short rhizomes, clumps may expand at 30 cm per year (Salisbury, 1961; Grime *et al.*, 1988). It can propagate from rhizome fragments. The

rhizomes may be spread or transported by cultivation equipment and among the roots of transplanted herbaceous plants infested with the weed. Rhizome fragments can be transported in top soil.

Management

Control is by hoeing, spudding, and hand pulling, or by frequent cutting when mugwort is growing at the margins of a field (Morse & Palmer, 1925). However, mugwort is said to be somewhat resistant to mowing and to cultivation (Grime *et al.*, 1988). The removal of top growth is reported to stimulate rhizome production (Barney & DiTommaso, 2003). Mowing may also increase shoot numbers. Frequent cultivation fragments the rhizomes which will desiccate if exposed at the soil surface under dry conditions.

A number of insects reside upon and feed on mugwort, some of them may be considered as potential biological control agents. There is predation of the seeds by insect larvae (Bostock & Benton, 1979). Up to 13% of seeds are destroyed in this way.

Acknowledgement

This review was compiled as part of the Organic Weed Management Project, OF 0315, funded by DEFRA.

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