The biology and non-chemical control of Daisy (*Bellis perennis* L.)

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Daisy

(bachelor's buttons, Billy's buttons, dog daisy, English daisy, gowan)
***Bellis perennis* L.**

Occurrence

The daisy is a native perennial abundant throughout the UK, mainly in short turf (Stace, 1997). It is common on lawns and is generally absent from shaded and disturbed habitats and from robust vegetation (Grime *et al.*, 1988). It occurs on soils with a pH above 5.5 but prefers a pH of 7.0 to 8.0. Heavy infestations occur in lime-deficient lawns (Mitich, 1997). It is recorded up to 3,000 ft in Britain (Salisbury, 1961).

In a seedbank survey in swede-turnip fields in Scotland in 1982, it was found in 32% of the fields sampled (Lawson *et al.*, 1982). Daisies are sometimes found in gaps in the sward of heavily grazed pastures (Schmid & Harper, 1985; Gibson, 1996). In a survey of seeds in pasture soils in the Netherlands in 1966, daisy was common in the sward and in the soil seedbank (Van Altena & Minderhoud, 1972).

Daisy plants exhibit considerable phenotypic plasticity. Plants from established lawns may be lower growing than those from other grassland habitats due to the process of selection but there is no evidence that distinct races have developed (Warwick & Briggs, 1980). Nevertheless, there is considerable genetic variation in daisy (Grime *et al.*, 1988). Several double flowered ornamental cultivars have been bred with flowers of white to purple (Mitich, 1997). These are used as annual bedding for edging flowerbeds. They are often allowed to set seed and the resulting seedlings can become weedy and invade lawns and flowerbeds.

Daisy is used medicinally for external application to wounds (Barker, 2001). There is a long history of herbal use for relieving bruises and swellings (Mitich, 1997). Daisy has also been used as a cure for mouth ulcers, toothache, bronchitis and rheumatism.

The foliage is unpalatable due to an acrid secretion and plants suffer little insect damage (Mitich, 1997). The potato tuber rot nematode, *Ditylenchus destructor*, can infest daisy (Franklin, 1970).

Biology

Daisy flowers from March to October (Clapham *et al.*, 1987), sometimes all through the year if winters are mild but mainly from April to June (Grime *et al.*, 1988). It has been observed to flower in early February. The flowers are insect pollinated and self-compatible. While daisy is principally self-pollinated some cross-pollination can occur (Warwick & Briggs, 1979). The flower heads close at night and in wet weather (Mitich, 1997). Seed is shed from May onwards. The average seed number per flower head is 125 (Salisbury, 1961). The mean seed number per plant is 1,300 (Sagar, 1970).

In Petri-dish studies with low and high light intensity and in darkness, seed germination was 100% in all conditions (Grime & Jarvis, 1976). In the field, seeds germinate in summer and autumn, according to some reports and spring and autumn according to others (Salisbury, 1961). Around 17% of seeds sown in a 75 mm layer of soil in open cylinders in the field and stirred periodically emerged soon after sowing in autumn (Roberts, 1986). In the following year most seedlings emerged from March to October with the main peaks of emergence in June and September. A decreasing number of seedlings emerged in subsequent years but none after year 4.

The leaves form a basal rosette. Short prostrate shoots develop from the axils of some leaves to form a small patch of daisies (Mitich, 1997). Each short runner develops into a daughter rosette with its own root system (Schmid & Harper, 1985). The leaves of the parent die and decay leaving a branched runner system. Clonal expansion is relatively slow. The rosettes remain winter green and probably continue to grow in the winter (Grime *et al.*, 1988). The roots contain large amounts of the storage carbohydrate fructan in the winter.

Persistence and Spread

The seeds are thought not to persist (Grime *et al.*, 1988). Seeds did not persist beyond 4 years in cultivated soil (Roberts, 1986). Nevertheless, seeds have been recorded in large numbers in the soil beneath pasture even though the plant may be poorly represented in the vegetation (Chippindale & Milton, 1934).

Daisy seedlings often colonize small bare patches on lawns (Schmid, 1985). Daisy plants that do not set seed successfully may spread vegetatively (Warwick & Briggs, 1980). Daisy spreads horizontally by means of short runner-like growths or stolons on close-cut grass (Morse & Palmer, 1925). These emerge from the axils of the first rosette leaves (Salisbury, 1961). Clonal patches occur in lawns (Warwick & Briggs, 1979). Daisy is slow to respond to reduced competition when neighbouring plants are removed (Schmid, 1985).

The seeds are wind dispersed around the parent and may be carried by birds and ants (Mitich, 1997). The seeds may be dispersed in mud carried on shoes (Grime *et al.*, 1988). In feeding studies with earthworms, 17% of offered seed was ingested and of these 59% was recovered in the worm cast soil (McRill & Sagar, 1973). Germination levels increased from 83 to 97% following passage through earthworms.

Management

In grass, daisy is favoured by close mowing (Salisbury, 1929). In lawns, small patches may be removed by hand using a knife or daisy grubber (Morse & Palmer, 1925). The hole should be filled with a mixture of soil and grass seeds (Mitich, 1997). Control is improved by promoting the growth of surrounding vegetation. Daisy does not do well in long grass because the leaves have very limited powers of elongation (Kydd, 1964). In grazing studies daisy was unaffected by different strategies of tight and lenient grazing (NERC, 2006). However, heavily grazed swards are characterised by the presence of certain weeds including daisy (Gibson, 1997).

Regular mowing to 2-3 cm each week when the grass is actively growing will reduce but not prevent seed production (Warwick & Briggs, 1980). The flexibility of the flower stem, the type of mowing machinery and the frequency and seasonal pattern of mowing can all affect seed production. Irregular cutting or a failure to cut early or late in the season may allow flowers to ripen seeds. An uneven soil surface will also allow some flowers to escape decapitation.

The leaves of daisy are palatable to stock and are grazed when they grow erect in tall grass (Grime *et al.,* 1988).

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