The biology and non-chemical control of Coltsfoot (*Tussilago farfara* L.)

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Coltsfoot

(clayweed, claywort, colt's-foot, coughwort, floatweed, foal's-foot, horse-hoof)
***Tussilago farfara* L.**

Occurrence

Coltsfoot is a native rhizomatous perennial with long white, usually scaly rhizomes bearing short branches each of which terminate in a rosette of leaves (Clapham *et al*., 1987; Stace, 1997; Grime *et al.,* 1988). It occupies a wide temperature range in Britain and is found in the east and west of the country. It is recorded up to 3500 ft in the UK (Salisbury, 1961). Coltsfoot is widespread and occurs on all but the more acid soils, it can be especially troublesome on heavy land (Chancellor, 1970). Lime also appears to favour it (Long, 1938). In early surveys of Bedfordshire, Norfolk and Hertfordshire it was often confined to clay and heavy loam soils in some areas but was universally distributed in others (Brenchley 1911; 1913). It was often associated with horsetail (*Equisetum arvense*). It is common on disturbed ground in many habitats including arable and wasteland, spoil heaps, roadside verges hedgerows and woodland edges. Non-persistent seedlings may occur in arable fields (Grime *et al.*, 1988). It can be a problem weed in gardens (Copson & Roberts, 1991). It appears to be discouraged by root crops (Brenchley, 1920).

Coltsfoot has many medicinal and therapeutic uses including as a cough remedy (Barker, 2001; Morse & Palmer, 1925). The leaves contain unusually high levels of sodium, calcium, and magnesium (Grime *et al.,* 1988).

Biology

In southern Britain, flowering occurs in February-April but in the north, lower temperatures may delay the flowering period (Myerscough & Whitehead, 1966). Flowering and seed production often occur before the leaves emerge. The flowers are insect or self-pollinated. Fruits form from April to June (Grime *et al.*, 1988). Fertile seeds arise in the ray florets of the flower heads but rarely in the disc florets (Long, 1938). Seed numbers per flower head range from 200 to 350 (Guyot *et al.*, 1962). The mean number of seeds per flower head is 157 (Bostock, 1980). The number of seeds per stem is 1,080 (Bostock & Benton, 1979). Seed number per plant is around 3,500 (Hanf, 1970). The seed number of an average plant is 1,496 (Pawlowski *et al.*, 1970). The 1,000 seed weight is 0.324 g.

The seed will germinate more or less immediately, usually on the soil surface. It has no dormancy and will germinate at relatively low moisture levels (Bostock, 1978). However, seedling losses are high due to fluctuating moisture levels at the soil surface. Seed does not have a light requirement for germination and chilling has no effect. Seed germinates within 7 hours at 25^{o}C. In Petri dish tests with seed maintained under high or low light intensity or in darkness, seed germinated completely in all conditions (Grime & Jarvis, 1976). Seeds appear relatively indifferent to light but when seeds were put to germinate under a leaf canopy or in diffuse white light there was no germination under the canopy after 4 days and 92% in

the diffuse light (Górski *et al.*, 1977). However, within a further 4 days the seeds under the canopy had also germinated.

Germination takes place shortly after the seeds are shed in April and May. Seedlings initially form a taproot but after 6 weeks a strong adventitious root system arises from the stem (Myerscough & Whitehead, 1966; Ogden, 1974). Soon after this, rhizomes are initiated. The adventitious roots are strongly contractile and pull the shoot down into the soil and the rhizomes develop from the buried axillary buds. By the autumn, the large leaves are present, the rhizomes well developed and flower buds will have been initiated. In the winter the leaves die off leaving a cluster of flower buds on the short, non-rhizomatous stock. There is some winter growth of the flower buds and rhizome. The flower buds continue to develop through January and, with rising temperatures in early spring, the flower stems elongate and flowering commences. By April-May the seeds are ripe and dispersal takes place. The shoot then dies leaving the rhizomes that were formed the previous year. These produce leafy aerial shoots and the cycle continues. The shoot is therefore monocarpic. Shoot emergence in Scotland, recorded in field plots dug at monthly intervals, began in March was greatest in May and continued through until September (Lawson *et al.*, 1974). The rhizomes usually grow for a metre or more after initiation and before flowering. The rhizome has been traced 1 to 1.5 m down in heavy clay (Long, 1938).

In plants grown from seed, resource allocation to rhizome development was relatively constant between different individuals (Bostock, 1980). Resource allocation to seed production was lower in plants from stable habitats and greater in plants from disturbed, high fertility habitats. In a dense stand, more reserves are allocated to flower production (Grime *et al.*, 1988). While vegetative growth falls in dense populations, seed production does not (Ogden, 1974).

Persistence and spread

Seeds remain viable for 2-3 months under natural conditions. Seed does not survive for longer even when buried at 40 cm deep, possibly due to fatal germination.

The plumed seed is wind dispersed and can travel over 4 km (Grime *et al.*, 1988). However, laboratory tests suggest maximum dispersal distances of 3 and 4.4 metres at wind speeds of 10.9 and 16.4 km/hour respectively but this would be affected by plant height (Sheldon & Burrows, 1973).

Vegetative reproduction is by thick fleshy rhizomes that can penetrate one or more metres into the soil (Myerscough & Whitehead, 1966). Vegetative extension occurs at the rate of 60 to 100 cm per year. The rhizomes are relatively brittle. Fragments of the rhizomes can readily produce new shoots. The larger the fragment the more likely it is to regenerate. Fragments can emerge from burial at 60 cm deep. There have been observations that new rhizomes do not invade soil containing old rhizomes in a state of decay (Ogden, 1974). An allelopathic effect cannot be discounted.

Management

It is important to prevent seeding, and flowers should be hoed or spudded out (Long,1938). The leaves too should be spudded out or hoed to exhaust the rhizomes. Leaves should be cut in May and June to weaken the rootstock (Morse & Palmer, 1925). Nutrient reserves are lowest in summer. Encouraging a dense crop stand will

out-compete the weed. Mustard or vetches grown as a smother crop will help to suppress the weed further. Laying the land down to permanent pasture usually destroys it. Coltsfoot is vulnerable to grazing, cutting, mowing and trampling (Grime *et al.*, 1988). It is not affected by waterlogging.

A single shallow stubble cultivation immediately after cereal harvest followed by deep ploughing later in the autumn helps to contain populations of coltsfoot in an arable rotation (Pekrun & Claupein, 2006). In light soils, frequent cultivation can reduce coltsfoot (Soil Association, 2002). In hot weather, ploughing and cultivation will expose the rootstock and help to destroy it. The rhizomes are susceptible to drying during summer fallowing. A severe infestation may require bare fallowing. Lightening the soil with ashes, sand or lime may aid eradication but on wet and badly drained soils control is very difficult. Drainage on wet land followed by a summer fallow, deep ploughing and removal of as much rootstock as possible can be effective in reducing the weed.

Swift moth larvae, cockchafers and wireworms feed on the underground stems (Morse & Palmer, 1925). Birds may take the whole flowerhead when the seeds are developed (Bostock & Benton, 1979). Slugs have been seen to damage flower buds (Ogden, 1979).

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References

Barker J (2001). *The medicinal flora of Britain and Northwestern Europe*, Winter Press, West Wickham, Kent, UK.

Brenchley W E (1911). The weeds of arable land in relation to the soils on which they grow. *Annals of Botany* **25**, 155-165.

Brenchley W E (1913). The weeds of arable soil III. *Annals of Botany* **27**, 141-166.

Brenchley W E (1920). *Weeds of Farm Land*, Longmans, Green & Co, London, UK.

Bostock S J (1978). Seed germination strategies of five perennial weeds. *Oecologia* (Berl) **36**, 113-126.

Bostock S J (1980). Variation in reproductive allocation in *Tussilago farfara*. *Oikos* **34**, 359-363.

Bostock S J & Benton R A (1979). The reproductive strategies of five perennial Compositae. *Journal of Ecology* **67**, 91-107.

Chancellor R J (1970). Biological background to the control of three perennial broad-leaved weeds. *Proceedings 10th British Weed Control Conference*, Brighton, UK, 1114-1120.

Clapham A R, Tutin T G, Moore D M (1987). *Flora of the British Isles*, 3rd edition, Cambridge University Press, Cambridge, UK.

Copson P J & Roberts H A (1991). Garden weeds – a survey in Warwickshire. *Professional Horticulture* **5**, 71-73.

Górski T, Górska K, Nowicki J (1977). Germination of seeds of various herbaceous species under leaf canopy. *Flora Bd* **166**, 249-259.

Grime J P, Hodgson J G, Hunt R (1988). *Comparative Plant Ecology*, Unwin Hyman Ltd, London, UK.

Grime J P & Jarvis B C (1976). Shade avoidance and shade tolerance in flowering plants II. Effects of light on the germination of species of contrasted ecology. Reprinted from: *Light as an Ecological Factor :II, The 16th Symposium of the British Ecological Society, 1974*, Blackwell Scientific Publications, Oxford, 525-532.

Guyot L, Guillemat J, Becker Y, Barralis G, Demozay D, Le Nail Fr (1962). *Semences et Plantules des Principales des Mauvaises Herbes.* Association de Coordination Technique Agricole, Paris.

Hanf M (1970). *Weeds and their seedlings.* BASF UK Ltd.

Lawson H M, Waister P D, Stephens R J (1974). Patterns of emergence of several important arable weed species. *British Crop Protection Council Monograph No.* **9**, 121-135.

Long H C (1938). Weeds of arable land. *MAFF Bulletin* **108**, 2nd edition. HMSO, London, UK.

Morse R & Palmer R (1925). *British weeds their identification and control*. Ernest Benn Ltd, London, UK.

Myerscough P J & Whitehead F H (1966). Comparative biology of *Tussilago farfara* L., *Chamaenerion angustifolium* (L.) Scop., *Epilobium adenocaulon* Hausskn. *New Phytologist* **65**, 192-210.

Ogden J (1974). The reproductive strategy of higher plants: II. The reproductive strategies of *Tussilago farfara* L. *Journal of Ecology* **62** (1), 291-324.

Pawlowski F, Kapeluszny J, Kolasa A, Lecyk Z (1970). The prolificacy of weeds in various habitats. *Annales Universitatis Mariae Curie-Sklodowska Lublin-Polonia,* **25** (5), 61-75.

Pekrun C & Claupein W (2004). The effect of stubble tillage and primary tillage on population dynamics of Canada thistle (*Cirsium arvense*) in organic farming. *Journal of Plant Diseases and Protection Special Issue* **XIX**, 483-490.

Salisbury E J (1961). *Weeds & Aliens.* New Naturalist Series, Collins, London.

Sheldon J C & Burrows F M (1973). The dispersal effectiveness of the achene-pappus units of selected Compositae in steady winds with convection. *New Phytologist* **72**, 665-675.

Soil Association (2002). Organic weed and scrub control on nature conservation sites. *Soil Association Technical Guide*, Soil Association Producer Services, Bristol, UK.

Stace C (1997). *New Flora of the British Isles*. 2nd edition. Cambridge University Press, Cambridge, UK.