

## **The biology and non-chemical control of Bulbous Buttercup (*Ranunculus bulbosus* L.)**

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### **Bulbous buttercup *Ranunculus bulbosus* L.**

#### **Occurrence**

Bulbous buttercup is a perennial with an annually renewed, swollen, corm-like stem base from which arise one or more aerial shoots (Harper, 1957). It is native in dry grassland and on grassy slopes (Stace, 1997). It is found upon the ridges of ridge and furrow pastures (Clapham *et al.*, 1987). Bulbous buttercup is primarily a lowland buttercup being recorded up to 1,800 ft in Britain (Salisbury, 1961). It is common throughout England and Wales but is less frequent in Scotland. Seedlings fail to establish in very wet conditions and this may restrict distribution in Scotland. It is often abundant on well drained or even thin soils due to the ability to survive summer drought. In loose soil such as dunes it can adjust its depth by up to 10 cm if it becomes covered by blown sand. Studies of distribution in chalk grassland indicated that distribution was not random and that plants were grouped in clumps rather than as isolated individuals (Blackman, 1942).

Buttercups are serious weeds of old pastures and hay meadows (Harper & Sagar, 1953; Grime *et al.*, 1988). Bulbous buttercup is characteristic of lightly grazed pasture (Gibson, 1997).

A number of varieties have been described. The petals are normally yellow but white flowered forms occur (Harper, 1957).

Cattle and horses usually avoid the foliage but poisoning can occur with new stock animals that have not come across it before (Harper, 1957). The foliage can be harmful if eaten fresh but is not poisonous when dried in hay (Salisbury, 1961). Bulbous buttercup has the highest protoanemonin content and is the least palatable buttercup (Harper & Sagar, 1953).

#### **Biology**

The first flowers are seen in March but peak flowering is normally from mid-May to June (Harper, 1957). Flowering is not linked to daylength. The flower head contains 20-30 seeds (achenes) that germinate mainly in autumn (Salisbury, 1961). The mean number of seeds per plant is around 70 (Sagar, 1970). Often seed will have ripened and been shed by early July. After seed has set, the aerial plant parts die (Harper, 1957).

Fresh seed is normally dormant and requires a period of after-ripening to achieve maximum germination. Buried seeds are ready to germinate as soon as exposed by cultivation. Seed sown in a 75 mm layer of soil in cylinders in the field emerged mainly from July to October. Most seedlings emerged in the first year after sowing but a gradually reducing number emerged over the 5 years of the experiment (Roberts & Boddrell, 1985). Seedlings emerged in autumn (Harper, 1957). The optimum

depth of germination in a light sandy soil was 16 mm (Sarukhán, 1974). Soil moisture level is important and it is the influence of the water table on germination and early seedling growth that determines the distribution of bulbous buttercup along the top of the ridges in ridge and furrow grassland (Harper & Sagar, 1953).

The plant finishes flowering in June then dies down and passes the summer as a corm (Harper, 1957). The corms remain dormant from July to September. The corms are buried 10-30 mm down in the soil and are 10-30 mm in diameter at the time of flowering. The corm is densely packed with starch plus around 1% of the glycoside ranunculin. Growth may begin again as early as July or August depending on rainfall levels. Sometimes this may lead to a brief second flush of flowers from the new shoots.

Corms do not need a period of cold to break dormancy just adequate moisture and favourable temperatures. In September the lateral bud of a corm that has flowered or the terminal bud of a corm that has not flowered become active and grow out from the corm. If the old corm has become buried by loose soil the new shoot can extend itself up to the surface. The foliage emerges in autumn and persists through the winter as a small rosette that expands in spring and produces new leaves in March. A new corm develops at the base of the shoot. The old corm transfers food reserves to the new corm in February/March then dies and by mid-May has disappeared (Sarukhán & Harper, 1973). The main foliage leaves form a basal rosette that is susceptible to shading (Harper, 1957). The leaves curl down to form a circular depression in the grass which excludes the development of other plants. This leaves a bare patch when the plant dies down in July/August. In late summer to early autumn rainfall stimulates a lateral bud to give rise to a new rosette which develops a new corm the following year (Sarukhán & Harper, 1973). It is impossible to determine the age of a plant because the all parts are renewed annually.

### **Persistence and spread**

Bulbous buttercup often occurs in clumps or large patches but this is not due to vegetative spread as just a single daughter corm replaces the parent each year. However, if the new shoot is damaged several axillary shoots may develop. The daughter plant develops to the side of the parent so that the position of individuals and clumps gradually changes. Seedling establishment in close proximity to the parents is not thought to occur (Harper, 1957).

The plant survives the dry period of summer as a corm (Harper, 1957). The ability of new shoots to emerge from deeply buried corms allows the plant to re-establish itself in newly sown leys after a permanent pasture has been ploughed up.

Seed is the main method of multiplication (Sarukhán, 1974; 1970). In general, the older the pasture the greater the seed population in the soil. Bulbous buttercup produces 5 times more flowers and 10 times more seed than creeping buttercup. Seeds normally fall around the parent plant. Cows eat the seed heads during grazing and fully mature seeds pass through the digestive tract unharmed. Seeds eaten by birds also survive digestive (Harper, 1957). The seeds and bulbs form a major part of the diet of partridge. Wood pigeons eat the seeds too and there is predation by voles and mice.

## Management

The abundance of bulbous buttercup in pasture depends on grassland management. In permanent grassland the percentage cover of bulbous buttercup is lower on fertilized than unfertilized areas (Williams, 1985). In undergrazed pasture the taller growing grasses reduce the development of bulbous buttercup (Kydd, 1964). It prefers sunny areas and cannot tolerate competition from taller plants unless this occurs after flowering (Harper, 1957). Bulbous buttercup seldom persists in grass that is allowed to grow long enough to cut for hay or silage. It may be eliminated from a grazing pasture if 2 or 3 hay crops are taken, unless corm formation takes place before plant competition becomes severe. Bulbous buttercup fails to survive when impeded drainage or other factors increase soil water levels. Regular irrigation can cause the species to disappear. Bulbous buttercup is intolerant of trampling by stock (Clapham *et al.*, 1987) and is usually absent from footpaths that traverse grassland (Harper, 1957). Good drainage and continuous grazing encourage the spread of bulbous buttercup. Bulbous buttercup becomes established where overgrazing has occurred or bare patches have developed due to urine burn or dung heaps, and where fresh soil is exposed by mole and rabbit activity.

Pigs eat the corms with relish and do not appear to be harmed. They will feed on the corms after ploughing (Harper, 1957). Geese will often pull up and consume bulbous buttercup (Morse & Palmer, 1925). Bulbous buttercup is able to tolerate grazing by rabbits (Tansley, 1949).

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