

The biology and non-chemical control of Thale cress
(Arabidopsis thaliana (L.) Heynh.)

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Thale cress

(common wall cress, jumping cress)

Arabidopsis thaliana (L.) Heynh.

(Arabis thaliana, Sisymbrium thalianum, Stenophragma thaliana)

Occurrence

An erect winter or sometimes summer annual, rarely biennial weed native on cultivated and bare ground, on banks, walls, rocks, and waysides throughout Britain (Stace, 1997). Thale cress also occurs on roadsides and railways (Rich, 1991). It is an abundant plant on dry, stony and usually acid soils (Salisbury, 1961). However, Grime *et al.* (1988), suggest it is absent from acidic soils and prefers a pH range of 6.0 to 8.0. It does not occur on wetland. Thale cress thrives on nutrient-rich, sandy or sandy-loam soils and is said to indicate the presence of sand (Hanf, 1970). In early surveys of Bedfordshire and Norfolk it was associated with light loams and sandy soils and was usually well distributed (Brenchley, 1913). It is frequently found in poached grassland and occurs sporadically as a garden weed.

Thale cress plants vary in response to the environment but populations also vary due to simple genetic mutations (Rich, 1991). The short life cycle and small growth habit have made it the ideal plant for genetic research. It is perhaps ironic that much of the GM technology that has led to the development of herbicide tolerant crops is based on the relatively simple genetics of this otherwise insignificant weed (Hamer, 2001).

Biology

Thale cress is said to flower from April to May and sometimes again from September to October (Clapham *et al.*, 1987). However, some authors suggest that it flowers throughout the year but mainly from April to July (Rich, 1991). Late-emerging plants may flower in September and October (Grime *et al.*, 1988). Some populations require vernalisation before flowering is initiated others do not. Also, some strains are short-day plants while others are unresponsive to daylength. The flowers are automatically self-pollinated but cross-pollination can occur. Plants have been known to produce seeds within 4 weeks of emergence (Salisbury, 1961). Seed pods contain an average of 33 seeds. The average seed number per plant is 2,739 (Pawlowski *et al.*, 1970).

Seed produced by plants grown under a low ratio of red to far red light was deeply dormant (Hilhorst & Toorop, 1997). Plants under a high ratio of red to far red light produced non-dormant seed. When seeds were put to germinate under a leaf canopy or in diffuse white light there was just 2% germination under the canopy and 45% in the light (Górski *et al.*, 1977). Seeds gave 23% germination at alternating temperatures under a 'safe' green light but only 3% in darkness (Grime *et al.*, 1981). Light and nitrate levels are limiting factors for field germination of some strains but other forms are indifferent to light (Salisbury, 1961). The light requirement is lost when the seedcoat is removed or even pricked (Toole *et al.*, 1956). In genetic studies, light indifference was found to be dominant. Dormancy is relieved by exposure to

warm temperatures. In many populations germination occurs in autumn and dormancy is then re-imposed by low winter temperatures. Fresh seeds require alternating temperatures but fully after-ripened seeds germinate equally well at constant temperatures (Toole *et al.*, 1956). Germination increases after a period of dry storage (Grime *et al.*, 1988). Field emergence in plots cultivated at monthly, 3 monthly or yearly intervals or not at all extended from February to December but most seedlings emerged in peaks in March-April and September-November (Chancellor, 1964). The least number of seedlings emerged in the plots cultivated monthly.

In Kentucky USA, and also apparently in the UK, thale cress behaves as a strict winter annual (Baskin & Baskin, 1972). This is a response to habitats that dry out in summer. In Kentucky, thale cress seed can only germinate in autumn and then only in the presence of light and moisture. Seed germinates in late September-October and seedlings form a leaf rosette by November. Flower buds develop in January-February, the flower stem elongates in March, and flowers open in early April. Seeds are dispersed in early May. The majority of fresh seeds are dormant but during burial in summer, both fresh and dormant older seeds after-ripen (Baskin & Baskin, 1983). The higher the ripening temperature, the greater the range of temperatures over which germination will occur. At first seeds germinate at low temperatures, then at gradually increasing temperatures. Seeds can after-ripen at 5°C but will then germinate only at relatively low temperatures. During the autumn and winter, seeds lose the ability to germinate at high then at low temperatures and then become dormant again. Winter and summer races are said to occur in mainland Europe (Baskin & Baskin, 1986).

Persistence and Spread

Thompson *et al.* (1993) suggest that based on the seed characters, thale cress seed should persist longer than 5 years. Thale cress forms a persistent soil seedbank (Grime *et al.*, 1988).

Management

Thale cress is not considered a serious arable weed and where it occurs may be controlled by hoeing and surface cultivation (Morse & Palmer, 1925).

Acknowledgement

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

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