The biology and non-chemical control of Himalayan Balsam (*Impatiens glandulifera*)

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Himalayan balsam

(Indian balsam, jumping-jack, policeman's-helmet)
***Impatiens glandulifera* Royle**
(*I. roylei*)

Occurrence

Himalayan balsam is an introduced summer annual naturalised along riverbanks and ditches. It prefers moist soils but will grow anywhere. Himalayan balsam grows up to 3 m tall and is reputed to be the tallest annual plant found in the UK (NRA, 1994). A native of the Western Himalaya, it is not a weed in its native environment (Fowler *et al.,* 1991). It was introduced in 1839 and is now recorded throughout Britain, particularly along river banks (Salisbury, 1961). Himalayan balsam is locally common in Wales and central England, it is less frequent elsewhere but is still increasing (Clapham *et al.*, 1987; Stace, 1997). It grows rapidly, spreads easily, readily colonises new areas and out-competes other vegetation (Skidmore, 2003; Weber, 2003). Himalayan balsam is said to be relatively shade tolerant. When the plants die down in winter they leave large bare areas that are sensitive to erosion.

Biology

Himalayan balsam flowers from June to October. It is pollinated by bumble-bees (Clapham *et al.*, 1987). Seeds are set from August to October or until frost kills the plants (Grime *et al.,* 1988). There are 4 to 16 seeds per pod and each plant can produce 800 seeds (NRA, 1994; Salisbury, 1961).

The seeds have a chilling requirement for germination to occur (Grime *et al.,* 1988). The entire seed population germinates synchronously in spring to form a dense stand of plants.

Persistence and Spread

Thompson *et al.* (1993) suggest that based on the seed characters, Himalayan balsam seed should persist for less than 5 years. The seeds can remain viable for up to 2 years (NRA, 1994). It does not form a persistent seedbank but a stand of Himalayan balsam can produce 30,000 seeds per m^2 (Weber, 2003).

The seed-pods are dehiscent and explode when touched or shaken (Skidmore, 2003). The seeds are expelled up to 7 m from the parent. The seed is transported by water but can also be carried in mud by animals and man. Himalayan balsam has spread at the rate of 645 km^2 per year in the UK (Weber, 2003).

Management

The plant is shallow rooted and is easily pulled up (Skidmore, 2003, Weber, 2003). Control is by grazing and by cutting or pulling before seeding. Repeated mowing will prevent the over-shading of other vegetation. Hand-pulling is often more effective

where small colonies or isolated plants are growing among bushes and rambling vegetation (Skidmore, 2003).

Himalayan balsam needs to be cut below the lowest leaves for a single operation to be effective otherwise the axillary buds will regrow (Skidmore, 2003). Plants should be cut to ground level by the end of June and before the plant flowers (NRA, 1994). Earlier cutting results in rapid regrowth of new stems that will flowers and set seed. Grazing by cattle and sheep should begin in mid-April and continue through the growing season.

Extensive stands of Himalayan balsam may reduce species richness by 25% (Hulme & Bremner, 2006). Where the weed is controlled the bare areas of soil are subject to erosion, particularly steeply sloping land such as riverbanks. Other non-native species may benefit from clearance of the weed. It is important to encourage the native vegetation to regenerate or to plant up with appropriate species.

As an introduced weed there is the potential to use biological control agents from its native range (Fowler *et al.*, 1991). However, there appears to be little knowledge of the natural enemies of Himalayan balsam.

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