

EPPO data sheet on Invasive Plants

Heracleum mantegazzianum

Identity

Scientific name: *Heracleum mantegazzianum* Sommier & Levier

Synonyms: *Heracleum asperum* M. Bieb., *Heracleum giganteum* Fischer ex Hornem., *Heracleum lehmannianum* Bunge, *Heracleum persicum* Desf. ex Fischer, *Heracleum sibiricum* Sphalm, *Heracleum stevenii* Manden, *Heracleum villosum* Fischer ex Sprengel

Taxonomic position: Apiaceae

Common names: giant hogweed, giant cow parsnip, cartwheel flower (English), kæmpe-bjørneklo (Danish), berce du caucase, berce de Mantegazzi (French), Herkulesstaude, Riesenbärenklau, Kaukasischer Bärenklau (German), kaukasianjättiputki (Finnish), reuzenberenklauw (Flemish), kjempebjønnekjeks (Norwegian), barszcz mantegazyjski (Polish), kaukasisk jättefloka (Swedish)

EPPO code: HERMZ

Notes on taxonomy and nomenclature:

Other names used for *H. mantegazzianum* in the British Isles have included *H. persicum* Desf. ex Fischer, *H. stevenii* Manden., *H. sibiricum* Sphalm and *H. lehmannianum* Bunge, but it is understood that these are treated as distinct species by at least some authorities and are not strictly synonyms. Perennial plants with leaves pinnately divided into five segments may perhaps be referable to *H. lehmannianum* Bunge from central Asia. *H. persicum* is probably distinct and occasionally naturalized in Europe. See Similarities to other species.

Phytosanitary categorization: EPPO A2 List of invasive alien plants.

Morphology

Plant type

H. mantegazzianum is an herbaceous perennial (or biennial) seed-propagated herb.

Description

H. mantegazzianum is a biennial or perennial herb, growing from a yellow branched root system 40-60 cm deep and up to 15 cm in diameter at the crown when mature. It is usually known as monocarpic, but has been recorded to be pluricarpic too (Perrier, 2001). The root is somewhat contractile pulling the crown down to about 10 cm below the soil surface. There is a single hollow stem growing annually up to 2-5 m high and 10 cm in diameter. The stem is ridged, with purple blotches, and covered with pustulate bristles. Leaves are alternate, the lowermost up to 3 m long, to 1.7 m wide, ternately or pinnately lobed and coarsely toothed; upper leaves are progressively smaller, with the upper leaf surface glabrous, underside pubescent as is the petiole. The main inflorescence is a terminal compound umbel up to 80 cm in diameter with about 100 unequal hairy rays, each 10-40 cm long. There are also up to 8 satellite umbels which overtop the main one, and others developing on branches below. The main umbel is hermaphrodite; the lower ones, maturing earlier, may be only male. Flowers, on pedicels 10-20 mm long, are white or pinkish with petals up to 12 mm long. Fruit flattened, elliptical, 6-18 mm long by 4-10 mm wide, narrowly winged, the larger fruits occurring on the main inflorescence and the smaller on satellites; glabrous to villous, splitting into two mericarps, each with 3-5 elongated oil ducts.

Similarities to other species

The commonest other *Heracleum* species in Europe, *H. sphondylium*, and the correspondingly common species in the USA, *H. montanum* Bartr. (= *H. lanatum* Michx.) are not readily confused with *H. mantegazzianum*, being much smaller, rarely over 2 m high, with grey-green, pubescent and

less acutely toothed leaves. Hybridization seems possible between *H. sphondylium* and *H. mantegazzianum* (Perrier, 2001) but occurs very rarely.

More readily confused are some of the other more closely related species, including *H. persicum* which is also smaller, rarely over 2 m, with leaves more divided with two pairs of lateral leaf segments, less deeply serrate; and is apparently naturalized locally in the UK, Norway and possibly Finland. *H. lehmannianum* has leaves divided pinnately into five segments.

Biology and ecology

General

Reproduction of *H. mantegazzianum* is amphimictic, the flowers being insect-pollinated and self compatible. Flowers are visited by a wide range of insects, many of which are believed to be involved in pollination, including a number of Hymenoptera and Diptera and at least one Coleoptera. Propagation is exclusively by seeds, which are produced in very large numbers, 5000-100,000 per plant. Fruits comprise a pair of mericarps, which separate from each other before being shed. Seeds may remain viable for up to 15 years when stored dry but in the field this period is apparently much shorter and in one study no viable seeds were found after 7 years. Seeds are dispersed locally near the mother plants and by water courses for long distances.

Seeds will not germinate in the autumn after shedding but require moist chilling (stratification) over the winter to break dormancy. Germination then occurs in January to March in the UK. Drying tends to delay eventual germination or results in a requirement for additional or longer stratification. Exposure to light is not apparently required for germination. After germination, a strong tap-root is formed which soon contracts to pull the crown downwards. The first true leaf develops about April, small and almost round, replaced in succession by steadily larger leaves, the fifth or sixth taking the adult form. The established vegetative plant has 3-4 functional leaves at any time. The above ground parts of the plant senesce and die back in late September/October in the UK. Flowering occurs mainly in the third year of growth but may occur in the second year or be delayed to 4 or even 5 years, which appears to depend on the size of the crown and reserves in the root system. Plants destined to flower begin growth early, in January, and have more erect leaves, with stem elongation apparent in April/May. The terminal bud, sheathed in bracts, appears in June and flowers are open from June to August, but mainly in July and once the plant has flowered, it normally dies altogether.

The chromosome number of *H. mantegazzianum* is $2n=22$, shared by most if not all *Heracleum* species. Hybridization is recorded with *H. sphondylium* in Germany and the UK (Ochsmann, 1996; Tiley *et al.*, 1996), but this is relatively infrequent even where both species occur, perhaps because of the lack of common insect visitors for pollination, and the hybrids are virtually sterile.

Habitat

H. mantegazzianum in its native range is a plant of forest edges and glades, often alongside streams, in mountain areas with annual rainfall of 1000-2000 mm and a temperate, continental climate of hot summers and cold winters. In other areas, it has been commonly introduced to gardens as an ornamental and has spread from these foci, especially along river courses, roads and railways to invade riverbanks, damp places, rubbish dumps and waste ground (Pysek & Prach, 1993; Pysek & Pysek, 1995; Tiley *et al.*, 1996). Negative impacts are recorded on managed grasslands, natural forests, wetlands, riverbanks/canalsides, rail/roadsides, and urban areas.

Environmental requirements

Climatic requirements include temperate (mild, no dry season), and cold (no dry season) climatic regions, with reasonable moisture and cold winters, and some degree of protection from prevailing winds. Cold winters are required to ensure germination, but may also be necessary for flowering. Although it is generally a plant of open ground, it can establish and grow successfully in woodland, edges of clearings and partially shaded habitats, preferring moist conditions for much of the year, but can tolerate moderate summer droughts (Tiley *et al.*, 1996). *H. mantegazzianum* tends to be associated with lowland sites in the UK, mainly due to the sources of infestation being originally associated with gardens in the lowlands, and not due to a climatic limitation (Willis and Hulme, 2002). The seeds are shown to germinate at all elevations up to 600 m in north-east England.

H. mantegazzianum is usually found on alkaline or only slightly acid soils, from pH 6.0 upwards to 8.5 and appears to be favoured by soils with a high nitrogen content. Occurrence along riverbanks is usually associated with sandy or silty soils, but it is also recorded on a wide range of soil textures from gravels to clay and highly organic or waterlogged soils are also tolerated. It is occasionally found close to the sea and apparently has some tolerance of salt spray.

Climatic and vegetational categorization

H. mantegazzianum is associated with areas with a warm to hot wet summer and a cool wet winter. It is not favored by drier conditions. Hardiness not specified, but probably to zone 6 (-23 to -18°C). It is associated with the vegetation zones: temperate deciduous forests and mixed conifer forests.

Geographical distribution

EPPO region: Austria, Belgium, Czech Republic, Denmark, Finland, France, Georgia, Germany, Hungary, Ireland, Italy, Latvia, Netherlands, Norway, Poland, Russia (Southern Russia), Slovakia, Sweden, Switzerland, United Kingdom.

Asia: Georgia.

North America: Canada (British Columbia, Ontario), USA (Connecticut, Florida, Indiana, Maine, Maryland, Michigan, New York, North Carolina, Oregon, Pennsylvania, Vermont, Washington).

Oceania: Australia, New Zealand.

History of introduction and spread

H. mantegazzianum is native to southern Russia and south-west Asia, with Korovin *et al.* (1951) referring to its distribution as 'Caucasus: Ciscaucasus, W. Transcaucasus (N.)'. It is now becoming widely naturalised throughout northern Europe with a continuing increase in its distribution. It is considered invasive in most of the countries where it has been introduced, repeatedly, as a garden ornamental from the 1800s, after which there has been natural spread along rivers. It was introduced as early as 1917 into North America as a garden curiosity, and was first observed in southern Ontario, Canada in the 1950s. Further spread was observed recently in the USA, with new state records from Vermont in 2002, Maryland and Michigan in 2003 and Indiana in 2004 (NAPIS, 2004).

Pathways of movements*Natural dispersal*

Propagation is exclusively by seeds, which are produced in very large numbers. Short-distance dispersal (2-10 m) is by wind, while longer-distance dispersal is achieved by water, the seeds being able to float for at least 3 days (e.g. Pysek, 1994).

Accidental transports

Movement occurs by man, collecting the seed-heads for ornament and then disposing on rubbish heaps; also as a result of movement of soil in the course of building works, and along roads or railways by attachment to vehicles or by air currents.

Agricultural practices

Beekeepers have played a significant role in spreading this plant, as it is a preferred food plant for honeybees (Reinhardt, 2003).

Movement in trade

Deliberate introduction of *H. mantegazzianum* is quite likely, as it is used as a spice and also as an ornamental with such introduction encouraged by the availability of seed from commercial nurseries via mail order catalogues and from websites in, for example, Canada, The Netherlands and the UK. Seed can also be a contaminant of food produce in international trade, and Fowler (1998) notes that *H. mantegazzianum* is one of the three commonest regulated species to be detected at entry points to USA, comprising 14% of all such detections, one pathway being the accidental contamination of cumin seed (Westbrooks, 1991).

Impact

H. mantegazzianum has negative impacts on biodiversity and the environment in general, human health, native flora and tourism.

Effects on plants

H. mantegazzianum is not normally a weed of crops but there are reports of its encroachment into crop fields, for example, in potatoes in Sweden, and is also seen to invade pastures.

Significant cost is involved in measures taken to control the weed in amenity and other areas, and is also likely to increase soil erosion along stream banks where it occurs. There are no records of direct impact on crops, but *H. mantegazzianum* is an alternative host of the carrot fly, *Psila rosae*, and of *Sclerotinia sclerotiorum*. A German study has assessed the economic impact of *H. mantegazzianum* to be more than 11 million euros annually in the country, which consists of medical treatment and control costs (Reinhart, 2003).

Environmental and social impact

In amenity areas, established colonies compete strongly with, and rapidly replace most other plants except trees. Along riverbanks, it can almost totally replace the natural vegetation and threaten biodiversity, including fauna associated with native plants, building up to a 'giant hogweed landscape'. Since many stands of the species are linear, the biodiversity effects are often overestimated, as light can filter in from the sides (Starfinger *et al.*, 2003).

The bristly hairs on *H. mantegazzianum* contain furanocoumarins and any contact between the skin and the plant can result in painful watery blisters occurring within 2-3 days on exposure to sunlight (Clark, 1975). It may also occasionally cause a recurrent dermatitis that can become a serious handicap. Dense infestations can seriously interfere with access to amenity areas, riverbanks, etc., and along roadsides, large stands can reduce visibility and result in a road safety hazard.

Uses and benefits

H. mantegazzianum has been widely grown as an ornamental in Europe, thanks to its striking appearance and usefulness in flower arranging. It is reported to be widely sown in Switzerland by beekeepers to increase food resources for bees, and is used as a spice in Iranian cooking (Westbrooks, 1991). It has been cultivated for silage in Russia and has been suggested as a forage

crop in Poland with fresh weight yields exceeding 90 t/ha in the third year, and a study in Hungary suggested that acetone extracts of *H. mantegazzianum* could have useful allelopathic effects on other weeds (Solymosi, 1994).

Summary of invasiveness

H. mantegazzianum has spread rapidly in a number of European countries after introduction as an ornamental from its native area in Russia and Georgia. It continues to be available as an ornamental and seed may be a contaminant of food produce, so it is likely to spread further. It is an undesirable invader on account of its large size, prolific seed production and vigorous growth leading to gross changes in vegetation, obstruction of access to riverbanks, and soil erosion. However, it is the health hazards of this species via serious dermatological effects on skin contact that are one of the main reasons for concern over its spread.

Control

Cultural control

H. mantegazzianum is not effectively controlled by light grazing. However, intensive grazing, especially by sheep, the rooting of pigs, can be highly effective (Tiley *et al.*, 1996). Sheep were found to greatly reduce the weed after 2 years and completely eliminated it after 5 years when no viable seeds remained in the soil (Anderson & Calov, 1996). The weed may be slightly less palatable to cattle, but grazing by cattle as well as pigs is recommended in Ireland (Lucey, 1994).

Mechanical control

Hand-pulling (with gloves) is effective with young seedlings but impractical with larger plants. Mechanical cutting is frequently used to clear river banks, etc., but provides no long-term control as there is rapid re-growth from below ground, and it may also encourage the perennation of flowering shoots which would otherwise die after flowering. Mowing 2-3 times during the season hinders re-sprouting plants from setting seeds and is useful for large areas, with cutting in May-June more effective than cutting in March. Digging or ploughing to destroy the crown (below 10 cm soil depth) can completely kill the plant. Another efficient and less laborious method is to remove umbels when the seeds are formed but not yet mature.

Chemical control

Herbicides recommended for control of *H. mantegazzianum* include glyphosate, triclopyr and imazapyr but all must be applied early in the season (March-May) for best effect. Imazapyr has a residual effect in the soil that prevents further germination but may also impact on non-target species. Glyphosate is the most widely used compound (Williamson & Forbes, 1986), but owing to risks of toxicity to fish and algae, a buffer zone of 2 m should be left unsprayed adjacent to any river or other water body (Marcher, 2001).

Biological control

None of the organisms listed by Tiley *et al.* (1996) cause consistently serious damage, though the damage to roots by the curculionid *Liophloeus tessellatus* has resulted in suggestions for its exploitation for biocontrol (Burki & Nentwig, 1998). *H. mantegazzianum* appears to be attacked by a narrower range of insects than other Apiaceae, apparently due to the presence of angular furanocoumarins, more toxic than the more common linear furanocoumarins and not tolerated by the more generalist feeders. Initial surveys for natural enemies in the native area of the Caucasus were conducted in 2002 with the aim of identifying potential biological control agents (Seier *et al.*, 2003), and these revealed many fungi associated with *H. mantegazzianum*, most species being new records for this host.

Integrated control

Due to the likely spread of seed down a river, it is important to ensure that upstream infestations are dealt with before attempting eradication further down (Caffrey & Madsen, 2001). Tiley & Philp (1992) described an integrated 2-year programme of spraying with glyphosate in April/May, combined with cutting below ground when or where spraying was not feasible. Large plants to flower are dealt with before vegetative plants.

Regulatory status

In the UK, legislation requires that land owners should control it and prevent further spread (Willoughby, 1996). In the USA, *H. mantegazzianum* is declared a noxious weed and is specifically regulated in 13 states (Alabama, California, Connecticut, Florida, Massachusetts, Minnesota, New Hampshire, North Carolina, Oregon, Pennsylvania, South Carolina, Vermont, Washington). In State legislation, it is categorized under various terms: Class A noxious weed, pest plant, under quarantine, prohibited invasive species, etc. (USDA-ARS, 2005; USDA-NRCS, 2005).

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