

## EPPO data sheet on Invasive Plants

### *Solidago gigantea*

#### IDENTITY

**Preferred scientific name:** *Solidago gigantea* Aiton

**Other scientific names:** *Solidago pitcheri* Nutt., *Solidago serotina* Aiton, non Retz., *Solidago serotina* var. *gigantea* (Aiton) A. Gray, *Solidago serotinoidea* A. & D. Löve, *Solidago shinnersii* (Beaudry) Beaudry

**Taxonomic position:** Asteraceae.

**Common names:** Giant goldenrod, late goldenrod, smooth goldenrod (English), verge d'or géant, solidage tardif (French), vara de oro gigantiflora (Spanish), Reisen-Goldrute (German), late guldenroede (Dutch), magas aranyvessző (Hungarian), verga d'oro maggiore (Italian).

**EPPO computer code:** SOOGI

#### Notes on taxonomy and nomenclature

*Solidago gigantea* belongs to the *S. canadensis* complex within the subgenus *Triplinervae*, having triple-nerved leaves. Whereas there is considerable taxonomic confusion within the genus *Solidago*, notably within this complex, *S. gigantea* appears to generally be one of the more clearly defined taxa. It is, however, a variable species, with five varieties described; var. *gigantea*, var. *leiophylla*, var. *pitcheri*, var. *serotina*, var. *shinnersii*, some having also been given subspecies or even species rank. Based on ploidy and leaf morphology, Beaudry (1963, 1974) separated *S. shinnersii* (2n=54, wide glabrous leaves) and *S. serotina* (2n=36, narrow glabrous leaves) from *S. gigantea* (2n=18, trichomes on midveins), also *S. serotina* forma *huntingdonensis* (2n=36, trichomes covering leaf underside). However, Melville and Morton (1982) found these morphologically inseparable due to overlapping variation, and were treated as a single species by Morton (1984), followed in this datasheet. Where introduced, var. *leiophylla* is described from Japan (Morita, 2002), and all cytotypes are found in Europe (Jakobs 2004) though the tetraploid form appears most common (Weber, 1997). The hybrid *S. canadensis* x *S. gigantea* has been reported from the USA and France (Wagenitz. 1979), and *S. asteroides* (Syn. *Aster ptarmicoides*) was occasionally observed to cross with various *Solidago* species, the hybrids formerly known as *Solidaster* (Semple et al., 1999).

## **MORPHOLOGY**

*S. gigantea* is a 50-150 cm tall, erect rhizomatous perennial with annual aboveground shoots and persistent belowground rhizomes. One to several rhizomes emerge near the base of the dying shoots in autumn, thus leading to a branched rhizome system rooted mainly at the old and current shoot bases. Each rhizome produces a single aerial stem from the rhizome apex the following spring. Stems are branched and mainly glabrous, or weakly hairy in the inflorescence only, and at the basis of the shoots are glabrous. During growth, the tip of the shoot is nodding. Leaves are triple-nerved, glabrous or sometimes pubescent beneath, lanceolate, often acuminate, with margins mostly serrate, occasionally entire. Inflorescences form broad pyramidal panicles with recurving branches and a central axis. Bracts of the involucre are linear, obtuse or somewhat acute. Ray florets are golden yellow, female and fertile, disc florets are bisexual and fertile, capitula 3-5 mm long. Achenes are pubescent, 1-2 mm long, with a pappus of 1 mm long.

## **SIMILARITIES TO OTHER SPECIES**

*S. gigantea* is distinguished from the closely related *S. canadensis* by having glabrous and glaucous stems. The shoots of *S. canadensis* are at least weakly pubescent. The calyxes of ligule flowers of *S. gigantea* are longer than the tubular flowers. *S. gigantea* has bright yellow flowers and the pappus is brownish-white, whereas the flowers of *S. canadensis* are somewhat lemon-yellow and the pappus silvery whitish.

## **PLANT TYPE**

*S. gigantea* is a herbaceous, seed and vegetatively propagated hemicryptophytic perennial.

## **BIOLOGY AND ECOLOGY**

*S. gigantea* is a rhizomatous hemicryptophyte with rhizome and seed propagation. Seeds of European plants do not show dormancy and do not need scarification or stratification (Voser-Huber, 1983). It is insect pollinated. Although seeds are essential for long-distance dispersal and the colonization of unoccupied sites, they are not important for the spatial extension of established populations.

Intensive shoot growth starts in April and increases nearly linearly until the end of July when final height is achieved. Inflorescences are formed from June onwards. Peak flowering time is between mid-August and end of September, but flowering can continue until October in central Europe. Seeds are easily dispersed by wind, but in dry weather conditions only. Rhizome buds are formed during the summer and grow to rhizomes in autumn when rosettes may form in autumn, but normally rhizomes produce shoots in spring of the following year. Good achene germination was recorded (20-30%) during spring though germination was highly variable (Laszlo and Lajos, 2000). The most suitable conditions for germination are the surface of undisturbed soils and gaps in uncut grasslands.

### **Environmental requirements**

*S. gigantea* is widespread in Europe and has shown itself well able to naturalize in temperate regions of the world, e.g. from the meridional to the subboreal belt in the eastern part of the European range (Meusel and Jäger, 1992). *S. gigantea* grows in a wide range of different soil conditions but is not shade tolerant (Ellenberg et al., 1992).

### **Climatic and vegetational categorization**

*S. gigantea* is associated with areas with a cool to warm wet summer and a cool to cold winter (wet or dry). It is said to be hardy to zone 6 (-23 to -18°C), but this conflicts with its recorded distribution in the EPPO region, to zone 3 (-40 to -34°C). It is associated with the vegetation zones: temperate deciduous forests and mixed conifer forests (extending to temperate steppes).

## **HABITAT**

The habitat preferences of North American *Solidago* species are wide, with *S. gigantea* in its native range growing mainly in forest edges and roadsides, secondary old-fields and unmanaged areas that it readily colonizes. In central Europe, *S. gigantea* is widely naturalized and is found in uncut grasslands, wetland edges, riparian habitats, forest edges, and along roadsides (Hartmann and Konold, 1995), also riverbanks in central Europe, and it establishes well in disturbed sites and abandoned meadows. Where introduced in Hungary, *S. gigantea* has proved to be a more successful invader than *S. canadensis*, whereas the latter has a wider natural geographical distribution than *S. gigantea* in their native North America (Dancza and Botta-Dukát, 2003).

## **CROPS / OTHER PLANTS AFFECTED**

In its native range, *S. gigantea* can occur in any crop; however, it is not a serious weed in annual crops since it is easily controlled by tilling. However, it invades poorly managed pasture and can be a considerable weed in forest nurseries and in perennial gardens and crops. Where introduced, *S. gigantea* is a principle weed in managed forests, and a serious weed in wetlands, on riverbanks/canalsides, on rail/roadsides, wastelands, urban areas and forest edges.

## **PATHWAYS FOR MOVEMENT AND DISPERSAL**

Seeds are produced in very large numbers and long-distance dispersal is by wind, aided in dry conditions. Short-distance dispersal is possible by rhizomes through infested soil. Seeds and rhizomes may also be dispersed as a result of movement of soil in the course of building work, and by attachment to vehicles or in the slip-stream of road and rail vehicles. Accidental introduction is possible through human activity, such as collecting fruited shoots as an ornament and then disposing of them on rubbish heaps. *S. gigantea* seeds are available by via mailorder catalogues and websites of commercial nurseries and botanical gardens as an ornamental species, and this may lead to further introduction.

## **USES AND BENEFITS**

*S. gigantea* is cultivated as an ornamental plant in Europe. *S. gigantea*-dominated areas are suitable for honey production (Stefanic et al. 2003), and it is also used as a medicinal plant.

## **GEOGRAPHICAL DISTRIBUTION**

**EPPO region:** Albania, Austria, Belgium, Bulgaria, Czechia, Denmark, Faroe Islands, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Luxembourg, The Netherlands, Norway, Poland, Portugal (mainland, Azores), Romania, Russia (Northern Russia, Central Europe, Southern Europe, Eastern Siberia), Serbia and Montenegro, Slovenia, Spain, Sweden, Switzerland, Ukraine, United Kingdom.

**Asia:** Japan (Hokkaido), Russia (Eastern Siberia).

**North America:** Canada (widespread), USA (continental, all states).

## **HISTORY OF INTRODUCTION / SPREAD**

*S. gigantea* is native to the USA and Canada between 30°N and 55°N. It was introduced into Europe as an ornamental plant in the mid 1700s, with naturalized populations first observed in the mid 1800s (Wagenitz, 1979). Continuous spread was noted between 1850 and 1950, by which time most of the present range was occupied (Weber, 1998).

## **IMPACT**

### **Economic impact**

In infested areas, litter accumulation makes field restoration difficult, and *S. gigantea* is an alternative host of insect vectors of plant pathogens.

### **Impact on biodiversity**

Established *S. gigantea* outcompetes native species with a resulting decrease in biodiversity in dominated communities, with native plant and animal species threatened, including common character species.

## **RISK AND IMPACT FACTORS**

*S. gigantea* has a negative impact on biodiversity, the environment, forestry production, human health, rare or protected species, native fauna, native flora and tourism.

## SUMMARY OF INVASIVENESS

*S. gigantea* has spread in a number of European countries after introduction as an ornamental plant from its native North America. It is an undesirable invader on account of its large rhizomes and vigorous growth leading to gross changes in the native vegetation and fauna. *S. gigantea* is not a serious weed in annual crops since it is easily controlled by tilling, however, it invades poorly managed pasture and can be a considerable weed in forest nurseries and in perennial gardens and crops. It continues to be available from commercial nurseries and botanical gardens and further deliberate introductions are likely.

CHARACTERISTIC		(Y)es, (N)o
<b>Invasiveness</b>		
1	Is the species invasive in its native range?	N
2	Has it proved invasive outside its native range? (i.e. is it an invasive alien species)?	Y
3	Is it highly adaptable to different environments?	N
4	Does it have high reproductive potential? (e.g. for weeds; prolific seed production, high germination rate, reproduction by rhizomes, tubers, stolons or root/stem fragments).	Y
5	Is it highly mobile locally? (i.e. for weeds, propagules capable of moving long distances by wind, water, attachment to machinery, animals or humans).	Y
6	Can its propagules remain viable for more than one year?	Y
7	Does it tolerate, or benefit from, cultivation, browsing pressure, mutilation, fire etc?	Y
<b>Impacts</b>		
8	Is it competitive to agricultural and plantation crops or pasture plants?	Y
9	Does it cause impacts on ecosystem processes? (e.g. hydrology, sedimentation, fire risk, nutrient cycling etc.).	Y
10	Does it adversely affect natural communities? (biodiversity, native populations, endangered or threatened species) by competition or hybridization (underline one or both).	Y
11	Does it adversely affect community structure? (e.g. effects on the food chain, elimination or creation of a canopy).	N
12	Does it adversely affect human health? (e.g. allergies, effects on water or air quality).	Y
13	Does it have sociological impacts on recreational patterns, aesthetics, property values?	Y
14	Is it harmful to animals? (e.g. poisonous plant parts or vector of animal diseases).	Y
15	Does it produce spines, thorns or burrs (or other discomfort)?	N
16	Is it a host or vector to recognised pests and pathogens of agriculture or forestry etc?	Y
<b>Likelihood of entry/control</b>		
17	Is it highly likely to be transported internationally (a) accidentally? (e.g. as a contaminant).	N
18	Is it highly likely to be transported internationally (b) deliberately? (e.g. as an ornamental)	Y
19	Is it difficult to identify / detect as a commodity contaminant? (e.g. due to small seed size)	Y
20	Is it difficult to identify / detect in the field? (e.g. similarities to other species, inconspicuousness)	N
21	Is it difficult / costly to control? (e.g. resistance to pesticides)	N



## **CONTROL**

### **Mechanical control**

*S. gigantea* is easily controlled in cultivated land by tilling. In grasslands, effective control is possible by mowing once a year and mulching, or mowing twice a year without mulching, over a period of three years (Hartmann and Konold, 1995). Continuous mowing or grazing is required every year to prevent establishment of *Solidago* species or to restore infested grasslands.

### **Chemical control**

Herbicides are effective on young plants but ineffective during the vegetative period. Glyphosate, 2,4-D and several other contact herbicides have proved suitable for the control of *Solidago* species.

### **Biological control**

Eight insects were considered as biocontrol agents of *Solidago* spp. by Fontes et al. (1994), though none have been released.

## **REGULATORY STATUS**

In Switzerland, this species is on the 'black list', i.e. neophytes whose negative ecological impacts have been documented, and which are problematic from a conservation point of view (CPS-SKEW, 2003).

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