

# NOBANIS – Invasive Alien Species Fact Sheet

## *Solidago canadensis*

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## Species description

**Scientific names:** *Solidago canadensis* L., Asteraceae (Compositae)

**Synonyms:** *S. altissima* L., *S. canadensis* ssp. *altissima* (L.) Bolos et Vigo, *S. canadensis* var. *scabra* Torr. et A.Gray.

*Solidago canadensis* is a highly variable species. The taxonomic status is not clear and difficult to assess. In its native range in North America several different taxonomic subunits have been recognized within the *S. canadensis* complex, which are granted species status by some authors (Weber 2000). In a strict sense this complex species in Europe is *S. altissima* (Priedītis 2002).

**Common names:** Canadian goldenrod (GB), Kanadische Goldrute (DE), Kanadisk Gyldenris (DK), Kanada kuldvits (EE), kanadanpiisku (FI), kanadagullhrís (IS), kanadinė rykštenė (LT), Kanādas zeltgalvīte (LV), kanadagullris (NO), Nawłoc kanadyjska (PL), золотарник канадский (RU), kanadensiskt gullris (SE).



**Fig. 1 and 2.** Close-up of *Solidago canadensis* inflorescence and stem, photo by Normunds Rustanovičs.



**Fig. 3.** Stand of *Solidago canadensis*, photo by Normunds Rustanovičs.

### **Species identification**

In Europe *S. canadensis* shoot height is 70 - 210 cm, glabrous at the base, pubescent at least in the upper half, with 40-110 leaves scarcely decreasing in size upwards. Leaves are produced along the stem - lanceolate, long attenuate, pubescent beneath, with margins mostly serrate, with 2 prominent lateral veins. The inflorescences form a broad pyramidal panicle with a central axis and recurving branches. The bracts of the involucre are linear, obtuse or acutish. Flowers are yellow, borne on numerous small flower heads (capitula). The number of flower heads per shoots ranges from 41 – 4600 (mean 1443). Disc florets are usually fewer than ray florets, the corolla is 2.4-2.8 mm long. Fruit is an achene 0.9-1.2 mm, shortly pubescent, with a pappus of 2-2.5 mm.

The basic chromosome number of *S. canadensis* is 9, and in its native range it is most often hexaploid ( $2n = 54$ ), but triploid ( $2n = 27$ ) and tetraploid ( $2n = 36$ ) cytotypes also occur. In Europe, only diploid plants have been found ( $2n = 18$ ) (Tutin *et al.* 1976, Weber 2000).

### **Native range**

*S. canadensis* is native to North America (Galenieks 1959, Hegi 1979). In the USA it is found from North Dakota southwards to Florida, Texas and Arizona and in Canada from Nova Scotia to Ontario (Weber 2000). It occurs almost throughout the USA and Canada between 26° and 45° latitude, reaching 65° latitude in western Canada and Alaska (Weber 1998).

### **Alien distribution**

#### **History of introduction and geographical spread**

*S. canadensis* is one of the oldest ornamental introductions from North America to Europe. In England it is known from 1645 (Kowarik 2003). The species was first cultivated in botanical gardens and distributed by nurseries. Because the species is attractive and easy to grow, it was widely used by gardeners. The species soon extended its range in Europe (Weber 2000).

The current European distribution has its centre in Central Europe, but the species is present from southern Scandinavia to northern Italy. Besides Europe *S. canadensis* is naturalized in Australia, Japan, New Zealand, Taiwan, and Trans-Caucasia and Siberia (Weber 2000).

The first records of *S. canadensis* as a naturalized plant in the North European and Baltic regions are from Germany in 1857, in Sweden 1864, in Denmark 1866 (Weber 1998), in Poland 1872 (Tokarska-Guzik 2003), in Norway 1887 (Weber 1998), in Latvia 1907 (Kupffer 1907), in Finland 1910 (Jalas 1980) and in Lithuania 1983 (Gudžinskas 1997). In Estonia *S. canadensis* was introduced in 1807 in Tartu Botanical Garden. In Russia it was cited from the end of 18<sup>th</sup> century, but the first naturalised record was known from 1885 (Цингер 1885).

### Pathways of introduction

*S. canadensis* was introduced from North America to Europe as an ornamental plant (Weber 1998) and very often cultivated in botanical gardens. It was widely used by gardeners, because it was easy and fast to grow (Weber 2000). In Finland, many of the naturalized occurrences of *S. canadensis* are clearly traceable as escapes from nearby or more remote allotment gardens, from special areas of parcels with ornamental plants and vegetables or from old manors (Kurtto and Helynranta 1998). In Russia *S. canadensis* was often cultivated in parks where then founded as established (Сырейщиков 1910).

### Alien status in the region

The species is abundant in many northern European countries (see also table 1). In Norway, *S. canadensis* has been found once in Nordland County (about 65,5° N), but the species has scattered occurrences north to Central Norway (about 63° N). It is, however, common only in the southern part of SE Norway where it is spreading rapidly. It has sometimes been confused with *S. gigantea* (Sunding 1989). *S. canadensis* is abundant throughout Poland, but most commonly distributed in southern and middle Poland (Weber, 2000; Solarz *et al.* 2005). The species is found naturalised in Sweden (Ericsson 1997). In Finland the species is naturalised north to almost 63° N, but more or less commonly only in more southern densely populated areas, such as the metropolitan area of Hämeenlinna (Kurtto and Helynranta 1998, A. Kurtto, pers. comm.). In Estonia *S. canadensis* is distributed sporadically. In Latvia and Lithuania *S. canadensis* is naturalized in all districts (Kuusk *et al.* 2003, Gudžinskas 1997). In European part of Russia it is naturalized in all districts except the north. It occupies ruderal and non-natural habitats in cities and villages, occurs along roads but prefers soils with well-developed humus horizon (Игнатов и др. 1990). In Iceland *S. canadensis* has been cultivated as an ornamental perennial since early 1900s. It has been grown in the Reykjavik Botanic Garden since 1967. It is a late bloomer and is not known to have produced fertile seeds in Iceland (D. Jakobsdottir, pers. comm.).

Country	Not found	Not established	Rare	Local	Common	Very common	Not known
Denmark					X		
Estonia				X			
European part of Russia					X		
Finland				X			
Faroe Islands	X						
Germany					X		
Greenland	X						
Iceland		X					
Latvia					X		
Lithuania					X		
Norway				X			
Poland					X		
Sweden					X		

**Table 1.** The frequency and establishment of *Solidago canadensis*, please refer also to the information provided for this species at [www.nobanis.org/search.asp](http://www.nobanis.org/search.asp). Legend for this table: **Not**

**found** –The species is not found in the country; **Not established** - The species has not formed self-reproducing populations (but is found as a casual or incidental species); **Rare** - Few sites where it is found in the country; **Local** - Locally abundant, many individuals in some areas of the country; **Common** - Many sites in the country; **Very common** - Many sites and many individuals; **Not known** – No information was available.

## Ecology

### Habitat description

In its native range *S. canadensis* is found mainly in forest edges and roadsides, abandoned fields and other unmanaged areas, which are colonised rapidly after abandonment. *S. canadensis* can occur in any crop, but it is not a serious weed in annual crops since it can be controlled by tilling. However, it invades poorly managed pastures and can be a considerable weed in forest nurseries and among perennial gardens plants and crops (CABI 2004 cit. Werner *et al.* 1980), because *S. canadensis* spreads very quickly and it occurs over a wide range of soil fertility and texture conditions (Weber 2000).

In its alien range *S. canadensis* is found in many disturbed sites; along railways, on roadsides, abandoned fields, as well as in forest edges, open forests and on banks of rivers (Weber 2000, Priedītis 2002). The habitats are not always ‘disturbed’, since the species is present in very natural shore communities (A. Kurtto, pers. comm.). Recently in Latvia *S. canadensis* has been established in many forest edges, uncultivated fields, grasslands and even in open forests, and is a real threat to natural habitats, because it can grow in different habitats, and with different soil and moisture, *e.g.* dry grasslands or wet grasslands (B. Laime, pers. comm.).

### Reproduction and life cycle

*S. canadensis* is a rhizomatous hemicryptophyte and has a complex life cycle with rhizome and seed generation. Individual clones are long lived and reach an age of 100 years. Reproduction occurs every year, but individual shoots remain vegetative if too small. Plants are able to reproduce in their first year under good conditions (Weber 2000).

Flowering may start as early as the end of July, but peak flowering time is between mid-August and the end of September, it can even continue through October (Weber 2000).

*S. canadensis* is insect-pollinated. Inflorescences are very attractive to pollinators due to their dark yellow colour and sweet odour; they provide high amount of pollen and nectar. Frequent visitors of goldenrods in Europe are members of Phalacridae, Muscidae, Syrphidae, Apidae, Formicidae, Sphecidae, and Panorpidae (Weber 2000). The success of cross-pollination is crucial to the species due to its self-incompatibility (A. Kurtto, pers. comm.).

### Dispersal and spread

*S. canadensis* is propagated by seeds and rhizomes. Seeds are produced in large numbers - in Europe, an individual shoot may produce more than 10,000 seeds (Weber 2000 cit. Voser-Huber 1983, Meyer and Schmid 1991). Seeds are essential for long-distance dispersal and the colonisation of unoccupied sites. Long-dispersal is by wind due to the small size of the seeds and their low velocity during their fall to the soil (Weber 2000). Achenes released 1 m above the ground in winds of up to 5 m/s had a peak modal dispersal distance of 0.3 m, a mean of 0.6 m and a maximum of 2.4 m. Short-distance dispersal is possible by rhizomes (CABI 2004 cit. Werner *et al.* 1980). Population increase is mainly the result of clonal grow (Weber 2000).

Accidental introduction is possible through human activity, such as collecting fruited shoots as an ornament and then disposing of them on rubbish heaps. In autumn, it is customary to cut down the fruiting shoots and dump them on rubbish heaps, often outside the gardens on riversides or brook shores, from which floods can carry shoots downstream. In the same way, rhizome fragments may generate new populations along rivers and brooks (A. Kurtto, pers. comm.).

Seeds and rhizomes may also be dispersed as a result of movement of soil in the course of building works, and by attachment to vehicles or in the slip-stream of road and rail vehicles (CABI 2004).

## Impact

### **Affected habitats and indigenous organisms**

Large areas infested by *S. canadensis* are the result of the inappropriate land-use management, allowing *S. canadensis* to establish and out-compete native plants, leading to gross changes and negatively affecting both flora and fauna to the point where character species may disappear altogether. Species-poor communities of *S. canadensis* homogenize the landscape (CABI, 2004). Once established, *S. canadensis* can remain dominant for a long time. Due to its clonal growth, *S. canadensis* can build up dense stands. Shoot density in well established stands could reach 309 shoots/m<sup>2</sup> (Weber 2000, Kowarik 2003).

### **Genetic effects**

In its native range genetic variations in resistance to herbivores can exist within a population. In Europe high genetic variation was found both within and among populations in phenology and morphological characters (Weber 2000). *S. canadensis* occasionally hybridising with the native *S. virgaurea* at least in Fennoscandia (Nilsson 1976, Sunding 1989, Mossberg and Stenberg 2003). However, the species differ so much in flowering period – *S. canadensis* being considerably later – that detrimental large-scale hybridisation is highly improbable to occur (A. Kurtto, pers. comm.).

### **Human health effects**

Goldenrods, contrary to the opinion frequently held, play a very unimportant part in hay fever. The flowering period of these plants coincides with the season of greatest suffering from hay fever and as conspicuous plants they are often suspected. Pollen of the goldenrods can certainly produce hay fever symptoms but normally the heavy sticky pollen is carried by insects or drops to the ground close to the plant. Only occasionally, in dry, very windy weather would sufficient goldenrod pollen be blown into the air to disturb sensitive individuals (Frankton 1963).

### **Economic and societal effects (positive/negative)**

*S. canadensis* is an alternative host of insects that can be vectors of crop pathogens. However, no quantitative studies on the economic impact are available (CABI 2004).

*S. canadensis* is cultivated as an ornamental plant in Europe. Areas dominated by *S. canadensis* are also suitable for honey production. *S. canadensis* is a medicinal plant, and it has been used in European phytotherapy for a very long time as a urological and antiphlogistical medicament (Apáti *et al.* 2003). A study in Hungary suggested that acetone extracts of *S. canadensis* could have useful allelopathic effects on other weeds (CABI 2004 cit. Solymosi 1994).

## Management approaches

### **Prevention methods**

*S. canadensis* is listed in the [EPPO List of invasive alien plants](#) which lists the plants that have been identified to pose an important threat to plant health, environment and biodiversity in the EPPO region. Countries, which are endangered by these species, are recommended to take measures to prevent their further introduction and spread.

### **Eradication, control and monitoring efforts**

Biological control presents one method to manage *S. canadensis*, since it is known that biomass allocation and physiology of the plant in its native range are influenced by herbivores. In Europe herbivore pressure is low. Snails and small rodents rarely feed on stems and leaves. In Switzerland 18 phytophagous insects feeding on the *S. canadensis* are known (Weber 2000). There is no data about grazing, but this could be a good solution to control *S. canadensis* after mechanical control.

There are several mechanical control methods to combat *S. canadensis* stands. One effective method against *Solidago* species is mowing two times per year (May and August) for several years, or a soil rotation during summer at dry weather conditions. After mowing, sowing of a grass/forbs mixture can control growth of *S. canadensis* stands, resulting in the shoot density of plants to decrease strongly (Weber 2000 cit. Voser-Huber 1983). Covering goldenrods after mowing with light impenetrable plastic sheet can also reduce growth. This method, however, destroys all vegetation. The suitability of the different measures depends on the site condition (wet, dry), the infested area, and the other species present, e.g. the presence of rare species with high conservation values (Weber 2000).

Young plants could be controlled with chemical methods, because they are sensitive to soil herbicides, but later, during the vegetative period, soil herbicides are ineffective. At heights of 10-15 cm glyphosate and several contact herbicides are suitable for the control of *S. canadensis* (CABI 2004).

### **Information and awareness**

*S. canadensis* has spread in a number of European countries after introduction as an ornamental plant from its native area in North America. It continues to be available as an ornamental from mail order catalogues and web sites of commercial nurseries and botanical gardens, and as such further introduction is likely. There are several information sheets about *S. canadensis* biology, ecology and distribution, e.g. the German web page [NeoFlora](#) and [Crop Protection Compendium Web page](#).

### **Knowledge and research**

Species of *Solidago* have been intensively studied for chemical compounds. Diterpenes are common in *Solidago*. Diterpenoids of *Solidago* can act as insect antifeedants and growth inhibitors (Weber 2000). To identify the optimal date for cutting once a year experiments are made with three different dates for cutting at the National Environmental Research Institute, Denmark. Preliminary results show that late cutting (September) may favour the establishment and growth of *Solidago canadensis* (A.B. Hald, pers. comm.).

### **Recommendations or comments from experts and local communities**

None.

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## Links

NeoFlora [fact sheet on \*Solidago canadensis\*](#)  
[The virtual Flora of Sweden](#)

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