

NOBANIS – Invasive Alien Species Fact Sheet

Impatiens glandulifera

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Species description

Scientific name: *Impatiens glandulifera* Royle (Balsaminaceae).

Synonyms: *Impatiens roylei* Walpers.

Common names: Himalayan balsam, Indian balsam, Policeman's Helmet (GB), Drüsiges Springkraut, Indisches Springkraut (DE), kæmpe-balsamin (DK), verev lemmalts (EE), jättipalsami (FI), risalísa (IS), bitinė sprigė (LT), puķu sprigane (LV), Reuzenbalsemien (NL), kjempespringfrø (NO), Niecierpek gruczołowaty, Niecierpek himalajski (PL), недотрога железконосная (RU), jättebalsamin (SE).



Fig. 1 and 2. *Impatiens glandulifera* in an *Alnus* stand in Helsinki, Finland, and close-up of the seed capsules, photos by Terhi Rytteri and Harry Helmisaari.



Fig. 3 and 4. White and red flowers of *Impatiens glandulifera*, photos by Harry Helmisaari.

Species identification

Impatiens glandulifera is a tall annual with a smooth, usually hollow and jointed stem, which is easily broken (figs. 1-4). The stem can reach a height of 3 m and its diameter can be up to several centimetres. The leaves are opposite or in whorls of 3, glabrous, lanceolate to elliptical, 5-18 cm long and 2.5-7 cm wide. The inflorescences are racemes of 2-14 flowers that are 25-40 mm long. Flowers are zygomorphic, their lowest sepal forming a sac that ends in a straight spur. The flower colour varies from white to pink and purple and flowering takes place from June to October. The seed capsules are 1.5-3.5 cm long and up to 1.5 cm wide. A capsule contains up to 16 seeds, each 4-7 mm long and 2-4 mm wide with a mean air dry mass of 2.35 mg (Beerling and Perrins 1993).

Native range

I. glandulifera is native to the western Himalayas. In its native area, it grows from 1800 to 4000m a.s.l. (Polunin and Stainton 1984, Gupta 1989).

Alien distribution

History of introduction and geographical spread

I. glandulifera was introduced to Europe (Kew Gardens) in 1839 (Coombe 1956, Valentine 1971). In continental Europe it began spreading around 1900, almost half a century later than in England (Berger and Schmidt 1925). In south-west Germany it was already common at some places in the 1920s spreading from a Swiss population (first naturalisation in 1904) via the Rhine.

It was introduced to the Helsinki Botanic Gardens at the end of 1800s (Kurtto 1992). The first naturalized populations were observed in Finland in 1947, in Sweden in the late 1920s and in Norway in the late 1930s (Kurtto 1996). In Denmark the species was recorded in 1888. In 1956 approx. 40 findings were recorded, mostly in the eastern part of Denmark (Pedersen 1956). In 1988 the species was recorded in all botanical districts in the country (Hansen 1991).

Today it is found also in more or less natural habitats throughout the Baltic area (Kuusk *et al.* 1996). In Latvia *I. glandulifera* has been introduced as garden plant. The first record of *I. glandulifera* in Latvia is from 1898 (Herbarium RIG 1). In Lithuania this species as escaped from cultivation was recorded in 1959 (Gudžinskas 1998). In Poland it was introduced to Sudety Mts. in the southern parts of the country in 1890. Nowadays it is found almost in the whole country, but it

is more frequent in the south (Tokarska-Guzik 2005). The first established populations in natural floodplain forests of valleys of Polish big rivers were observed at the beginning of 1960s (Dajdok and Anioł-Kwiatkowska 1998).

In Russia *I. glandulifera* has been cultivated from the end of the 19th century, and as escaped from cultivation it was recorded in 1914 (Moscow region: Сырейщиков 1914, Игнатов и др. 1990). Since 1960s, mass naturalization of species was observed (Марков и др. 1997). The plants with purple and pink flowers only are naturalizing (Виноградова 1992).

Pathways of introduction

The main pathway of introduction is by escape to nature from private gardens and (in Germany this has been the main way of distribution; F. Klingenstein, pers. comm.) by beekeepers. In Finland its spread has been mainly by introduction of seeds from abroad and private exchange of seed material. It is also often spread to the surroundings of settlements by the transport of garden refuse or soil (Kurtto 1996).

Alien status in region

The species is widely known as an invasive alien in temperate areas, at least in European and Asian countries, North America and New Zealand.

In Finland, the distribution of *I. glandulifera* is expanding and the species is also found in more or less natural habitats. Since the 1990s, the expansion has accelerated, and now the species is quite common in densely populated areas of southern and central Finland, and the northernmost established occurrences have reached the Arctic Circle.

In Sweden it has been classified as one of five most aggressive invasive plant species. It is found in all parts of Sweden except inner parts of Lappland (Larsson and Martinsson 1998). In Norway the species is rapidly expanding, and it is now found in natural and semi-natural habitats like moist forests, moist meadows, flooded ground, in ditches and on seashores as well as along watercourses, in addition to various types of moist ruderal sites. It is now found from south-eastern Norway and along the coast north to Tromsø at about 69.5 degrees north (Alm 2002, Lid & Lid 2005). It is not present in the two botanical gardens in Iceland, and not known to be naturalized anywhere in Iceland (Hörður Kristinsson, pers. comm.), see also table 1.

In Lithuania *I. glandulifera* is spreading along river banks most intensively, however, it occurs in many types of natural and human-made habitats (Gudžinskas & Sinkevičienė 1995, Gudžinskas 1998). Today it is considered to be a naturalized invasive species.

In Latvia the species is among the most invasive herbaceous alien species with high invasion potential. Recent studies of species dynamics in Latvia show that the species is rather common in Latvia, being closely related to human settlements and river corridors. Predominantly it occurs in ruderal habitats, moist depressions and ditch verges on road and railway verges, in riparian habitats, less common on forest edges and old parks. Since the end of the 20th century, the number of sites, where *I. glandulifera* has invaded riparian situations has grown considerably (Priede, 2009).

In Poland it is one of the top 20 invasive alien plants (Tokarska-Guzik 2003). In Germany the plant is amongst the most widespread alien plant species growing at river banks and other wet, nutrition rich natural habitats. In Germany it is discussed if the species should be classified as invasive, because there is no known case where it has been proven to affect endangered native species. *I. glandulifera* leads to a reduction of native species, but in the highly dynamic habitats of floodplains

there are always new suitable habitats arising and populations of *I. glandulifera* are destroyed over time (also in years with unsuitable weather conditions or flood regime). Moreover, it preferably displaces *Urtica dioica*, which is not a rare or endangered species (Kasperek 2004).

In Russia *I. glandulifera* is one of the widespread alien species from northern regions (Murmansk, Karelia) to Caucasus at the south. It occurs in floodplains, along river banks, wetlands and roads and in different human-made habitats (Марков и др. 1997). In Caucasus (Northern Ossetia) it is found at 1100 m a.s.l. (Комжа, Попов 1990).

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

Table 1. The frequency and establishment of *Impatiens glandulifera*, please refer also to the information provided for this species at 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

I. glandulifera occurs in many different habitats, but it thrives best on moist and nutrient rich habitats, especially on lake- and seashores and along rivers and brooks (Kurtto 1992). It is also often found in human influenced and man-made habitats such as grasslands, shrubbery, ditches, roadsides and hedges (Kurtto 1996). Research done by Garkāje (2006) has shown that the biotopes that are most suitable for *I. glandulifera* are those that have been affected by humans. The studies of species dynamics in Latvia suggest that in the initial phases of invasion the species prefers human-affected, weedy sites and dump sites, while on later invasion stages it appears to be successful and

frequent invader in riparian habitats (Priede, 2008). In these biotopes *I. glandulifera* most commonly grows together with species of plants that need nitrogen in the soil, like *Aegopodium podagraria*, *Urtica dioica*, *Calystegia sepium*, *Deschampsia cespitosa*, *Stellaria nemorum* and *Galium aparine*. The species invades the herbaceous perennial vegetation of river banks, light floodplain forests and wet meadows and it is found on a variety of soil types (Kowarik 2003).

In Europe *I. glandulifera* plants of all ages are frost intolerant. Usually all adult plants are killed by the first frost in the autumn and seedlings are killed by late frosts in spring (Sebald *et al.* 1998). In Karelia region (in the northern European part of Russia) seedlings are tolerant to late frosts in May-beginning of June (Антипина, Брюханчикова 2003). The species is also drought-intolerant and quickly wilts, and plants can survive only if the drought period is short (Beerling and Perrins 1993). The species is relatively shade tolerant (Beerling and Perrins 1993).

Reproduction and life cycle

I. glandulifera is an annual plant and is reported to be without any persistent seed bank. However, from England there are reports that the seeds can occasionally survive up to 18 months. When the species is not exposed to frost, most seedlings appear over a period of four weeks (Beerling and Perrins 1993). There are no observations from the region of seed survival for more than one year.

I. glandulifera has a good regenerative ability and on stems that have been cut down, new branches and flowers are formed. Also small individuals can develop flowers and seeds.

The time from germination to the onset of flowering is 13 weeks in Germany and the flowering continues for a further 12 weeks (Sebald *et al.* 1998).

Dispersal and spread

I. glandulifera spreads only by seeds. When the mature fruit capsule is touched, it explodes and ejects the seeds. The seeds have been reported to disperse up to 7 m from the mother plant. A single plant can produce more than 4000 seeds, and in pure stands the production of 32 000 seeds/m² has been reported (Koenies and Glavac 1979). The expansion of the species in river systems is especially due to the dispersal of seeds by water currents since they can be transported both by flowing water (in the sediment) and the dry seeds are buoyant. Plant parts containing seeds have to be handled carefully since the small seeds are easily transported with soil and in crevices of shoes to new habitats. The seeds are probably also spread by ants (myrmecochory). Fruiting specimens or their fragments are also transported with soil or floating in water (Kurtto 1993). For Great Britain a dispersal ability of 2,6 – 5 km per year has been calculated (NeoFlora 2006).

The reproductive strategy is based on active spreading of seeds and on rich seed-setting. The seeds have a high germination rate (80 %) according to Grime (1987). The plant competes on river banks by synchronous germination of a large amount of seeds to achieve sufficient biomass to suppress the performance of neighbouring species. It grows fairly fast and forms dense stands.

Impact

Affected habitats and indigenous organisms

I. glandulifera occurs in many different habitats, but it thrives best on moist and nutrient rich soils. It occurs on meadows, lake- and seashores, along rivers and brooks, and in black alder stands and in luxurious forests near settlements. It also often occupies wasteland and other "left over" areas close to human settlements (Kurtto 1996).

The species has been found to occupy "new" wet forest habitats. *I. glandulifera* stands have been reported to persist for at least 70 years in Sweden (Larsson and Martinsson 1998). In contrary, the observations in Latvia prove that in many cases the established populations in the vicinities of human settlements vanish after few years, mainly due to lack of suitable habitats or repeated introduction in the vicinity (A.Priede, pers. observation). Under some circumstances the species only reduce native species, who still find enough places to live *e.g.* in the highly dynamic floodplains (Kasperek 2004). But in other situations the plant forms dense stands that cover the soil and "suffocate" the underlying vegetation. Larsson and Martinsson (1998) state that it is reasonable to conclude that *I. glandulifera* outcompetes annual and even perennial plant species. In the Oslo area (Norway) it has been observed that the spread of *I. glandulifera* has reduced the species diversity at certain localities (Bård Bredesen, pers. comm.). In river valleys *I. glandulifera* forms dense vegetation patches of its own community classified phytosociologically as association *Impatiens-Calystegium* (Moor 1958, Soó 1971). The ability of *I. glandulifera* to outcompete native flora and its predicted expansion along water courses indicates that it could become a more serious threat to nature conservation in the future (Prach 1994, Pysek and Prach 1995). *I. glandulifera* is known to prevent forests regeneration in moist and half shaded habitats (Lhotska and Kopecky 1966).

Since *I. glandulifera* seems to react positively to an increase in CO₂ and temperature it is potentially a still more aggressive invader in a changing climate (NeoFlora 2006).

I. glandulifera is very good at attracting pollinators, and it seems that the species is able to outcompete other *Impatiens* species on pollinators (Daumann 1967). According to Chittka and Schürkens (2001) *I. glandulifera* may displace native species through competition for pollinators.

No native enemies to restrict its spread are known.

Genetic effects

No known genetic effects.

Human health effects

No known effects to human health.

Economic and societal effects (positive/negative)

The eradication of stands is costly and time consuming because of the high ability of the species to regenerate and spread. The Environment Agency of United Kingdom has estimated that the cost for eradicating *I. glandulifera* only in England and Wales would be from 210 to 240 million euros (NeoFlora 2006).

The plant is popular among butterfly collectors since it represents an important source for nectar and pollen. The flowers are often visited by bees and bumblebees (Beerling and Perrins 1993). Furthermore *I. glandulifera* is considered a beautiful ornamental and collecting and sowing of its seeds are likely to occur, and this will continue to play an important role in the spread of the species.

Management approaches

Prevention methods

Removal of invasive alien species should start as early as possible, before the problem has become too serious. The prevention actions should be well organized. The success of actions needs to have public acceptance and hence the public needs to be informed about the negative effects of the plant and its effective spread along waterways (especially beekeepers and growers of ornamental plants should be targeted with information on the species).

Since *I. glandulifera* is an annual species, the best way to manage its dispersal is to hinder the formation and spread of its seeds. Care has to be taken to hinder its seeds from spreading by transport of plant parts or soil containing viable seeds.

Eradication, control and monitoring efforts

I. glandulifera can easily be removed by pulling, grazing or cutting. The removal has to be continued until no more growth occurs for at least 2 to 3 years. The use of chemicals has to be made according to the management instructions and the national legislation.

Eradication and control measures include removal and preventing the formation and spreading of seeds. The timing of the eradication effort is most important. If the removal is too early the plants will regenerate, and if it is made too late the seeds formed will be able to germinate. The right time is when the first flowers occur, mostly at the end of July. Due to its strong regeneration ability (see above) it is extremely important to remove all plant material and to dispose of it appropriately. Sheep and cattle may also be used to graze the plant. Since *I. glandulifera* is sensitive to grazing and grazing animals eat it, grazing is a good method to eradicate the species (Larsson and Martinsson 1998). The use of herbicides should be avoided and are often not permitted especially along waterways. So far no biological control methods are available for *I. glandulifera* (Sheppard *et al.* 2006).

Large scale nationwide management and eradication activities in the region are lacking, but some local initiatives exist. In the Oslo area *e.g.* the municipality has developed a detailed yearly plan of action to control the spread of *I. glandulifera* (Bård Bredesen, pers. comm.).

One major obstacle to the management of *I. glandulifera* is the lack of up-to-date knowledge of its occurrences because the knowledge of its occurrence is mainly based on sporadic information obtained from natural history museums and the public and no nationwide monitoring activities have been reported for countries of the region.

Education and awareness

Materials and information about *I. glandulifera*, especially the negative effects it may cause and how to manage it, have to be made easily available in the internet. Campaigns in national and local media are a good way to reach the public. Also the commercial traders and the gardeners have to be informed to hinder its further spread and sale. Further national restrictions and sanctions should be taken to hinder the spread of the species when needed.

Knowledge and research

None of relevance.

Recommendations or comment from experts and local communities

None of relevance.

References and other resources

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Links

Washington State Noxious Weed Control Board – [Impatiens glandulifera](#)
Nordiska Riksmuseet (NMR) Den virtuella floran – [Impatiens glandulifera](#) (in Swedish)
NeoFlora - [Impatiens glandulifera](#) (in German).

References

- Alm, T. 2002. Kjempe-springfrø (*Impatiens glandulifera*) – en fremmed art i rask spredning i Nord-Norge. – Polarflokken 26(2): 123-131. Tromsø.
- Beerling, D.J. and Perrins, J.M. 1993. *Impatiens glandulifera* Royle, *Impatiens roylei* Walp Biological Flora of British Isles. No. 177. – Journal of Ecology (Oxford) 81(2):367-382.
- Berger, H. and Schmidt, E. 1925. Balsaminaceae. Springkrautgewächse. – In: Hegi, G. (ed.) Illustrierte Flora von Mittel Europa V (1): 309-320.
- Chittka, L. and Schürkens, S. 2001. Successful invasion of a floral market. – Nature 411, pp. 653-655.
- Coombe, D. E. 1956. Notes on some British plants seen in Austria. – Veröffentlichungen des Geobotanisches Institut 35:128-137, Zürich.
- Dajdok, Z. and Anioł-Kwiatkowska, A. 1998. Wstępne wyniki badań nad ekspansją niecierpka gruczołowatego (*Impatiens glandulifera* ROYLE) w dolinie Odry. – Bad. Fizjogr. Pol Zach. Ser. B. 47: 195-204.
- Daumann, E. 1967. Zur Bestäubungs- und Verbreitungsökologie dreier *Impatiens*-Arten. – Preslia 39: 43-58.
- Garkāje, A. 2006. *Impatiens glandulifera* (Royle) impact of the river banks in Latvia. Bachelor thesis, Rīga, 59.
- Grime, J.P. 1987. Dominant and subordinate components of plant communities: implications for succession, stability and diversity. Colonization, Succession, Stability and Diversity (eds. A.J. Gray, M.J. Crawley and P.J. Edwards) pp. 413-428. – Symposia of the British Ecological Society, 26. Blackwell Scientific Publications, Oxford.
- Gudžinskas, Z. 1998: Conspectus of alien plant species of Lithuania. 8. *Aceraceae*, *Balsaminaceae*, *Elaeagnaceae*, *Geraniaceae*, *Hippocastanaceae*, *Linaceae*, *Lythraceae*, *Onagraceae*, *Oxalidaceae*, *Rutaceae*, and *Vitaceae*. – Botanica Lithuanica 4(4): 363–377.
- Gudžinskas, Z. and Sinkevičienė, Z., 1995: Distribution, biology and naturalization of *Impatiens glandulifera* Royle (*Balsaminaceae*) in Lithuania. – Botanica Lithuanica 1: 21–33.
- Gupta, R.K. 1989. The Living Himalayas Vol. 2. Aspects of Plant Exploration and Phytogeography. – Today and Tomorrow Printers and Publishers, New Delhi.
- Hansen, K. (ed.) 1991. Dansk Feltflora. – Gyldendal.
- Herbarium RIG I, University of Latvia, Department of Botany and Ecology.
- Kasperek, G. 2004: Fluctuations in numbers of neophytes, especially *Impatiens glandulifera*, in permanent plots in a west German floodplain during 13 years. – Neobiota 3: 27-37.
- Koenies, H. and Glavac V. 1979. Über die Konkurrenzfähigkeit des Indischen Springkrauts (*Impatiens glandulifera* Royle) am Fuldaufer bei Kassel. – Philippia 4: 47-59.
- Kowarik I. 2003. Biologische Invasionen: Neophyten und Neozoen in Mitteleuropa. – Stuttgart, Germany: Ulmer.
- Kurtto, A. 1992. Jättipalsami (*Impatiens glandulifera*) – kuriton, mutta kiinnostava. – Lutukka 8: 14-29.
- Kurtto, A. 1996. *Impatiens glandulifera* (Balsaminaceae) as an ornamental and escape in Finland, with notes on the other Nordic countries. – Acta Universitatis Upsaliensis, Symbolae Botanicae Upsalienses 31(3): 221-228.
- Kuusk, V., Plotniece, M. and Jankeviciene R. 1996. Balsaminaceae A. Rich. Flora of the Baltic Countries II (eds. Kuusk V., Tabaka L., Jankeviciene R.). – Eesti Loodusfoto AS, p. 177.
- Larsson, C. and Martinsson, K. 1998. Jättebalsamin *Impatiens glandulifera* i Sverige - invasionsart eller harmlös trädgårdsflykting? – Svensk Botanisk Tidskrift 92: 329-345.
- Lid, J. and Lid, D.T. 2005. Norsk flora. (7. ed. by Reidar Elven.) – Det norske samlaget, Oslo (1230 pp).
- Lhotska, M. and Kopecky, K. 1966. Zur Verbreitungsbiologie und Phytozoölogie von *Impatiens glandulifera* Royle an den Flusssystemen der Svitava, Svratka und oberen Odra. – Preslia 38: 376-385.
- Pedersen, A. 1956. Rubiaceernes, Polygalaceernes, Linaceernes, Oxalidaceernes og Balsaminaceernes udbredelse i Danmark. – Botanisk tidsskrift 47: 373-480.
- Prach, K. 1994. Seasonal dynamics of *Impatiens glandulifera* in two riparian habitats in central England. – In: de Waal, L.C, Child, L.E and Wade, M. (eds.). Ecology and management of invasive riverside plants. John Wiley and Sons.
- Priede, A. 2008. Invazīvo neofītu sugu izplatība Latvijā. [Distribution of invasive alien plant species in Latvia]. - Latvijas Veģetācija, 17, 148 pp.
- Priede, A. 2009. Distribution of some invasive alien plant species in riparian habitats in Latvia. - Botanica Lithuanica 14(3), in press.
- Polunin, O. and Stainton, A. 1984. Flowers of the Himalaya. – Oxford University Press, Oxford.
- Pysek, P. and Prach, K. 1995. Invasion dynamics of *Impatiens glandulifera* - a century of spreading reconstructed. – Biological Conservation 74: 41-48.

- Sebald, O., Seybold, S., Philippi, G. and Wörz, A. 1998. Die Farn- und Blütenpflanzen Baden-Württembergs. – Ulmer, Stuttgart.
- Sheppard, A.W., Shaw, R.W. and Sforza, R. 2006. Top 20 environmental weeds for classical biological control in Europe: a review of opportunities, regulations and other barriers to adoption. – *Weed research* 46: 93-117.
- Tokarska - Guzik, B. 2003. The expansion of some alien plant species (neophytes) in Poland. – In: Child, L.E., Brock, J.H., Brundu, G., Prach, K., Pysek, P., Wade, P.M., Williamson, M. (eds.) *Plant invasions: Ecological traits and management solutions*, Backhuys Publishers, Leiden, The Netherlands, pp. 147-167.
- Tokarska - Guzik, B. 2005. The establishment and spread of alien plant species (neophytes) in the flora of Poland. – *Wydawnictwo Uniwersytetu Śląskiego, Katowice*, p. 192.
- Valentine, D.H. 1971. Flower-colour polymorphism in *Impatiens glandulifera* Royle. – *Boissiera* 19: 339-343.
- Van der Meijden, R. 2006. *Heukels' Flora van Nederland*, ed. 23. Groningen.
- Антипина Г.С., Брюханчикова Е.В. 2003. *Impatiens glandulifera* Royle - новый адвентивный вид флоры Карелии. В сб.: Проблемы изучения адвентивной и синантропной флоры в регионах СНГ. – М.-Тула, Бот. сад МГУ - Гриф и К. pp. 14-15.
- Виноградова Ю.К. 1992. Процессы микроэволюции у адвентивных и интродуцированных растений. – Дисс. докт. биол. наук. М.
- Игнатов М.С., Макаров В.В., Чичев А.В. 1990. Конспект флоры адвентивных растений Московской области. – В сб.: Флористические исследования в Московской области. Наука, М. pp. 5-105.
- Комжа А.Л., Попов К.П. 1990. Новые данные об адвентивной флоре Северной Осетии. – *Ботанический журнал* 75(1): 108-110.
- Марков М.В., Уланова Н.Г., Чубатова Н.В. 1997. Род Недотрога. – В сб.: Биологическая флора Московской области, вып. 13. М., Изд-во МГУ. pp. 128-168.
- Сырейщиков Д.П. 1914. Иллюстрированная флора Московской губернии. – Ч. IV. М. 191 pp.

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