

## Contribution to the Alien Flora of Turkey: *Impatiens glandulifera* Royle (Balsaminaceae)

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**ABSTRACT:** During a few decades, rapidly increasing number of studies have documented about the spread and expansion of alien plant species all over the world. These species are either introduced intentionally or unintentionally outside of their natural ranges. *Impatiens glandulifera* Royle (Balsaminaceae) introduced in Europe intentionally as garden and nectar-producing plant but later it was spread and became a highly invasive annual species in many parts of Europe. This species was collected from outside of gardens in two close localities in Giresun (Turkey). So, we reported it as a new alien vascular plant for the Flora of Turkey. As well, the description together with Turkish name and photographs of the taxon are presented in the present study.

### Araştırma Makalesi

### Makale Tarihi

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### Anahtar Kelimeler

Anatolia

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## Türkiye'nin Yabancı Florasına Bir Katkı: *Impatiens glandulifera* Royle (Balsaminaceae)

**ÖZET:** Yabancı bitki türlerinin dünya üzerindeki yayılış ve dağılımları artan sayıdaki çalışmalarla ortaya konmaktadır. Bu türler, kasıtlı veya kasıtsız olarak kendi doğal alanlarının dışına taşınırlar. *Impatiens glandulifera* Royle (Balsaminaceae), kasıtlı olarak bahçe ve nektar üreten bitki olarak Avrupa'ya ulaştı, ancak daha sonra yayıldı ve Avrupa'nın birçok yerinde oldukça istilacı bir tür haline geldi. Bu türü, Giresun'da (Türkiye) birbirine yakın iki doğal habitattan topladık ve Türkiye Florası için yeni bir yabancı vasküler bitki olarak rapor ettik. Ayrıca bu makalede, taksonun Türkçe adı ve fotoğraflarıyla birlikte betimi verildi.

### Research Article

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### INTRODUCTION

Today, 3.9% (13168 species) of the plants in the world have naturalized outside their natural habitats as a result of human activity (van Kleunen et al., 2015). Increased introduction and movement of alien species were started by human activities around the planet since the 18th century (Emer et al., 2015). The number of alien species in Europe has increased by 76% in the last 40 years (CABI, 2021). Prolific seed production and high spread capability of alien species make them invasive outside their habitats. Unwary people around the world have contributed to move these taxa from their natural habitats to outside their native ranges. With its moderate climatic conditions (especially heavy rainfall and frequent mist throughout the year), NE Anatolia has hitherto hosted many of alien species (Terzioğlu and Anşın, 2001). Many people from this region of Turkey have stayed at different European countries, and spent their holidays in hometown, nearly every year. Both intentionally and unintentionally, these people have carried some seeds, bulbs or plants from Europe to

their localities. Although it is difficult and complex to explain the real factors of the naturalization process and the vectors of alien species, some ornamental plants were able to escape from gardens to natural and planted/naturalized habitats.

As a garden ornamental and nectar-producing plant, *Impatiens glandulifera* Royle (Himalayan balsam) was introduced into Europe from the Himalayas in the first half of the 19th century (Pyšek and Prach, 1995). It is included along with the 17 other terrestrial plant species in Europe's top 100 invasive species (DAISIE, 2010) and on the EPPO List of IAS since 2004 (Pacanoski and Saliji, 2014). It is reported as a highly invasive annual species spread in 18 European countries, North America and Russia (from northern regions to the Caucasus in the south) after its introduction as an ornamental (CABI, 2021; Pacanoski and Saliji, 2014; Cockel and Tannel, 2011; Tanner et al., 2013).

The genus *Impatiens* is represented with a native *I. noli-tangere* L. and many cultivars of *I. walleriana*

Hook. in Flora of Turkey (Güner, 2012). *I. glandulifera* is distributed as an invasive alien species in northern and western neighboring countries of Turkey (CABI, 2021), and has never been recorded from Turkey before.

### MATERIAL and METHOD

Specimens were collected from Çamlıca village (Keşap/Giresun) in 2020. All specimens were labelled, numbered, annotated with the date of collection, the locality, and the name of the collector during the field studies. After identification, voucher specimens were deposited in both KATO (Karadeniz Technical University, Faculty of Forestry) and KTUB (Karadeniz Technical University, Faculty of Science, Department of Biology) Herbariums in Trabzon. Materials were collected from two close populations around the settlement areas and, coordinated by GPS (UTM 50 Datum) which were given below. This species was named in Turkish according to the guidelines of Menemen et al. (2013).

### RESULTS and DISCUSSION

*Impatiens glandulifera* Royle, Ill. Pl. Himal. Mount. 151. t. 28, f. 2. (1834). (Figure 1)

Syn.: *I. glanduligera* Lindl., *I. macrochila* Lindl., *I. moschata* Edgew., *I. royleana* Payer, *I. roylei* Walp., *I. taprobanica* Hiern, *Balsamina glandulifera* (Royle) Ser., *B. macrochila* (Lindl.) Ser., *B. roylei* Hook. (TPL, 2021).

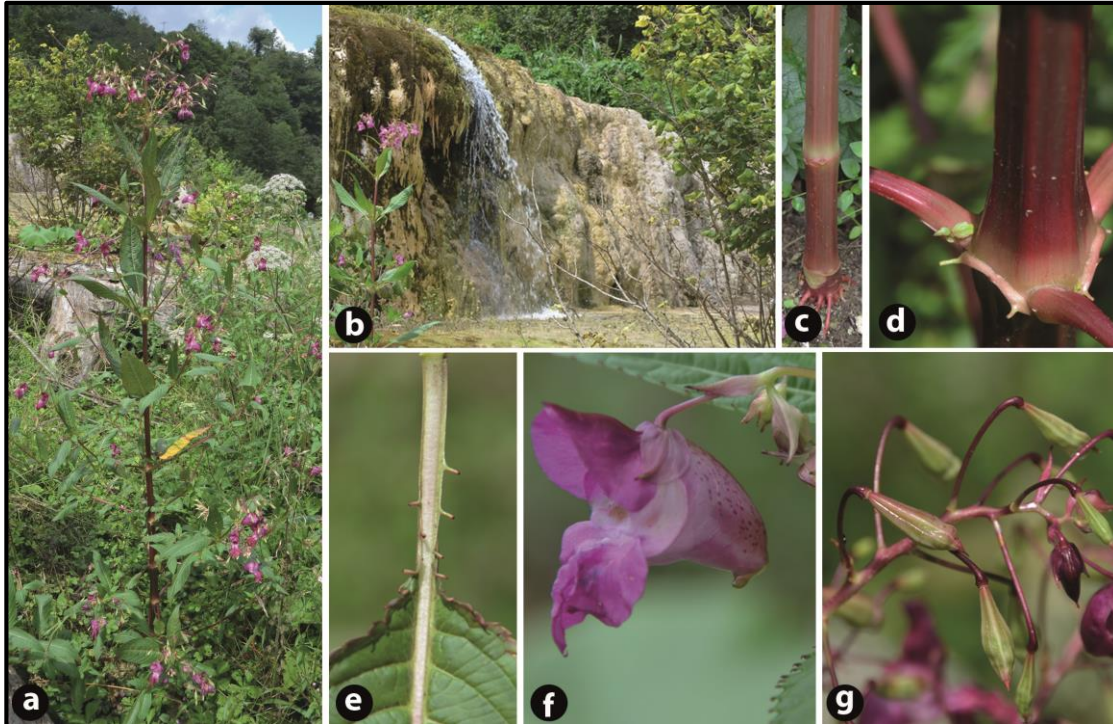
Annual, plant, robust, somewhat woody up to 2 m (-sometimes 3 m) in height, glabrous. Stem simple or rarely branching, hollow, green with a reddish tinge. Simple leaves opposite (upper ones verticillate, mostly by threes), wide up to 7 cm, 4-5 times longer than wide, ovate-lanceolate, base cuneate, glandular stipitate, petiole up to 5 cm. Sweetly scented flowers hermaphrodite, zygomorphic, peduncle 1 mm thick; calyx colored, central sepal enlarged and flaring, lateral sepals oblique-cordate, to 9 mm long, lower one saccate and abruptly ending in a 5-6 mm incurved spur; petals three, pinkish to purplish-red, often purple spotted, about 1.5 cm in length and 7 mm in width, central one widened. Fruits loculicide-fleshy capsule, clavate, up to 25 mm in length, nodding, slightly 5-angled. Seeds depressed, sub globose, 3 mm broad, pale grey-brown, ejected explosively. *Fl.*: July-August, *Fr.*: August-September, river banks, disturbed area.

**Type:** W. Himalayas, Kashmir.

**Turkish Name:** Himalaya Kınaçiçeği

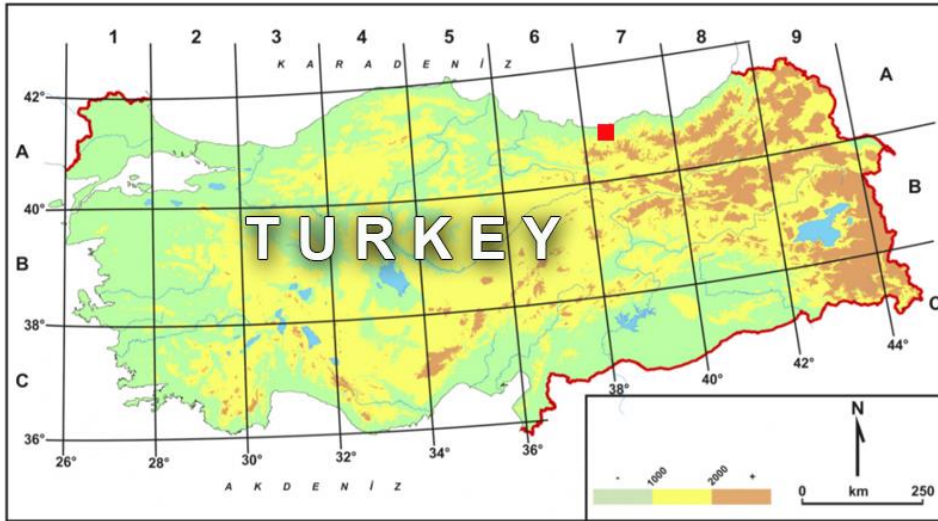
### Collected locality

A7 Giresun – Keşap district, Çamlıca village, edge of stream, 492 m, 12.08.2020, UTM: 0461015, 4515291, KATO 24449!, KTUB (Coşkunçelebi 1404a!); Same village, disturbed area, 579 m, 12.08.2020, UTM: 0460893, 4514718, KATO 24450!, KTUB (Coşkunçelebi 1404b!) (Figure 2).



**Figure 1.** *Impatiens glandulifera*: **a**-Habit of plant, **b**-Habitat-edge of stream, **c**-Somewhat woody base of stem, **d**-Stem node with glandular stipules, **e**-Base of leaf and petiole, **f**-Flower-side view, **g**- Fruit.

**Şekil 1.** *Impatiens glandulifera*: **a**- Bitkinin habitusu, **b**-Akarsu kenarındaki habitat, **c**-Kısmen odunsu kök boğazı, **d**-Gövde nodunda salgı tüylü kulakçık, **e**- Yaprak tabanı ve yaprak sapı, **f**- Çiçeğin yan görünüşü, **g**-Meyve.



**Figure 2.** Distribution of *Impatiens glandulifera* (■) in Turkey (Adapted from Güner, 2014).

**Şekil 2.** *Impatiens glandulifera* (■)'nin Türkiye'deki yayılışı (Güner 2014'den uyarlanmıştır).

According to Uludağ et al. (2017), the number of alien plant species in Turkey is 340 however literature surveys show that the number is ca. 450. This study aimed to give one more new alien species, *Impatiens glandulifera*, for Turkish Flora. As strongly emphasized, it is an extreme invasive alien species in Europe (Schönfelder and Bresinsky, 1990; Perrins et al., 1990; Bohušová, 1992; Beerling and Perrins, 1993; Pacanoski and Saliji, 2014; CABI, 2021) and Canada (Clements et al., 2008). To date, a doubtful presence of this species reported without any herbaria, vouchers and locality information from Black Sea Region of Turkey by Aksoy and Uludağ (2016). At the same time, this species was not listed in the first comprehensive compilation and analysis of all available records on alien plant taxa in Turkey by Uludağ et al. (2017). So, this species was not recorded/published before based on any confirmed materials from Turkey.

The introduction of the species is the result of its use as decorative plant and as a source of nectar to pollinators including bumblebees, honeybees, moths, and wasps (Beerling and Perrins, 1993, Helmisaari, 2010; ISSG, 2021). Considering its main pathway, in order to prevent its introduction to new ecosystems, public awareness is extremely important. As a tallest annual plant species of Europe (Pyšek and Prach, 1995), its high holocellulose contented stems persist until spring season and suppress competing seedlings of natural taxa in the following spring (ISSG, 2021). Because of its general distribution in damp woodlands near streams (as its new location in Turkey), water is an important vector for dispersing diaspores of the species, and the lower altitudes are in risk of easy invasion. Furthermore, the capacity of an individual to produce 2500 seeds (Koenies and Glavac, 1979), the ability to explosive ejection of seeds up to 5 (Fitch, 1976; Clements et al., 2008), a seed

rain of up to 6000 seeds/m<sup>2</sup> (Beerling and Perrins, 1993) and its ability surviving longer than a year (Perrins et al., 1990) extremely increase the invasion capacity of *I. glandulifera*. Though its young shoots are sensitive to frost (Beerling, 1993), the rapid growth rate of both its seedlings and young individuals (Koenies and Glavac, 1979) result shading other plants living in close vicinity of this tallest annual species.

During the field studies an ongoing project of "Addressing of Invasive Alien Species Threats in Terrestrial Areas and Inland Waters in Turkey", *I. glandulifera* was detected soon after its introduction to Anatolian ecosystems with the present study. It has already been known only from two close vicinities in Çamlıdere village, Keşap (Giresun) in NE Anatolian ecosystem where the populations are very sparse. Thus, it is easy to control its spreading and eradicate it from Turkey.

The best way in order to manage the *I. glandulifera*'s dispersal is to prevent flowering and the formation and spread of the seeds (Shaw, 2003). For this, mechanical eradication is quite easy due to the modest root system of the species (Pacanoski and Saliji, 2014), and effective especially before than seed ripen. In the one hand, sheep and cattle grazing is reported as a good method to manage this species (Larsson and Martinsson, 1998) on the other hand grazing helps the explosive ejection of the seed which helps its invasion. The rust, *Puccinia komarovii* Tranzschel ex P.Syd. & Syd. var. *glanduliferae* R.A. Tanner, C.A. Ellison, L. Kiss & H.C. Evans, is reported as a classical biological control agent for *I. glandulifera* in its invasive ranges and this rust negatively impacts on the growth of infected plants (Tanner et al., 2015; Varia et al., 2016). As well, Glyphosate application is effective against *I. glandulifera* (Stensones and Garnett, 1994). All the

methods above should be used for controlling this species in its different invasion steps, but in its small Turkish populations we strictly recommend the mechanical eradication.

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## Author's Contributions

The contribution of the authors is equal.

## Statement of Conflict of Interest

Author has declared no conflict of interest.

## REFERENCES

- Aksoy N, Uludağ A 2016. New records and distribution of vascular plants alien to northern regions of Turkey. Book of abstracts of the 2nd Croatian Symposium on Invasive Species with International Participation, 21-22 November 2016, Zagreb, Croatia: 49.
- Beerling DJ 1993. The impact of temperature on the northern distribution limits of the introduced species, *Fallopia japonica* and *Impatiens glandulifera*. *Journal of Biogeography* 20: 45-53.
- Beerling DJ, Perrins JM 1993. Biological flora of the British Isles. *Impatiens glandulifera* Royle (*Impatiens roylei* Walp). *Journal of Ecology* 81: 367-382.
- Bohušová K 1992. The spread of *Impatiens glandulifera* Royle in the territory of Slovakia. *Bulletin Slovenskej Botanickéj Spoločnosti*, 14: 7-15 (in Slovak with English summary).
- CABI, 2021. <https://www.cabi.org/isc/datasheet/28766> (available; 23.01.2021).
- Clements DR, Feenstra KR, Jones K, Staniforth R 2008. The Biology of Invasive Alien Plants in Canada. 9. *Impatiens glandulifera* Royle. *Canadian Journal of Plant Science* 88: 403-417.
- Cockel CP, Tanner RA 2011. *Impatiens glandulifera* Royle (Himalayan balsam). In: Francis RA. editor. *A Handbook of Global Freshwater Invasive Species*. Earthscan: London, UK. pp. 67-77.
- DAISIE, 2010. European Invasive Alien Species Gateway. *Impatiens glandulifera*. Available from: [http://www.europe-aliens.org/species/Factsheet.do?species\\_Id=17367#](http://www.europe-aliens.org/species/Factsheet.do?species_Id=17367#) (Accessed: 22 January 2021).
- Emer C, Vaughan IP, Hiscock S, Memmott J 2015. The Impact of the Invasive Alien Plant, *Impatiens glandulifera*, on Pollen Transfer Networks. *PLoS One*, 10(12): e0143532.
- Fitch IC 1976. Dispersal of Himalayan balsam, *Impatiens glandulifera*. *North Western Natur.*, 13.
- Güner A 2012. Balsaminaceae. In: Güner, A., Aslan, S., Ekim, T., Vural, M. & Babaç, MT (Eds.). *Türkiye Bitkileri Listesi (Damarlı Bitkiler)*. Nezahat Gökyiğit Botanik Bahçesi ve Flora Araştırmaları Derneği, Yayın No: 1, İstanbul.
- Helmisaari H 2010. NOBANIS – Invasive Alien Species Fact Sheet – *Impatiens glandulifera*. Online Database of the European Network on Invasive Alien Species – NOBANIS. <https://www.noban.is.org/> (Accessed 23 January 2021).
- ISSG 2021. <http://www.iucngisd.org/gisd/species.php?sc=942> (Accessed: 23 January 2021).
- Koenies H, Glavac V 1979. The ability of *Impatiens glandulifera* to compete on the banks of the River Fulda near Kassel, West Germany. *Philippia* 4, 47-9.
- Larsson C, Martinsson K 1998. Jättebalsamin *Impatiens glandulifera* i Sverige: invasionsart eller farligt trädgårtsflykting? *Svensk Botanisk Tidskrift* 92: 329-345.
- Menemen Y, Aytaç Z, Kandemir A 2013. Türkçe Bilimsel Bitki Adları Yönergesi. *Bağbahçe* 47: 28-31.
- Pacanoski Z, Saliji A 2014. The invasive *Impatiens glandulifera* Royle (Himalayan balsam) in the Republic of Macedonia: first record and forecast. *Bulletin OEPP/EPPO Bulletin* 44 (1): 87-93.
- Perrins J, Fitter A, Williamson M 1990. What makes *Impatiens glandulifera* invasive? In *The biology and control of invasive plants*, ed. J. Palmer. University of Wales, Cardiff, pp. 8-33.
- Pyšek P, Prach K 1995. Invasion dynamics of *Impatiens glandulifera* – a century of spreading reconstructed. *Biological Conservation* 74: 41-48.
- Schönfelder P, Bresinsky A 1990. *Verbreitungsatlas der Farn- und Blatnpflanzen Bayerns*. Eugen Ulmer, Stuttgart.
- Shaw RH 2003. Biological control of invasive weeds in the UK: opportunities and challenges. In: Child LE, Brock JH, Brundu G, Prach K, Pysek P, Wade PM & Williamson M (eds.). *Plant invasions: Ecological Threats and Management Solutions*, pp. 337-354. Backhuys Publisher, Leiden (NL).
- Stenones A, Garnett RP 1994. Controlling invasive weeds using glyphosate. In: de Waal LC et al. (eds.). *Ecology and Management of Invasive Riverside Plants*. pp. 183-188. John Wiley & Sons, Chichester (GB).
- Tanner RA, Pollard KM, Varia S, Evans HC, Ellison CA 2015. First release of a fungal classical biocontrol agent against an invasive alien weed in Europe: biology of the rust, *Puccinia komarovii* var. *glanduliferae*. *Plant Pathology* 64: 1130-1139.
- Tanner RA, Varia S, Eschen R, Wood S, Murphy ST, Gange AC 2013. Impacts of an Invasive Non-Native Annual Weed, *Impatiens glandulifera*, on Above- and Below-Ground Invertebrate Communities in the United Kingdom. *PlosOne* 8(6): e67271.
- Terzioğlu S, Anşın R 2001. A Chorological Study on

- Taxa Naturalized in The Eastern Black Sea Region. *Turkish Journal of Agriculture and Forestry* 25: 305-309.
- TPL 2021. The Plant List. Retrieved in January, 21, 2021 from [http:// www.theplantlist.org/tpl1.1/record/kew-2862533](http://www.theplantlist.org/tpl1.1/record/kew-2862533) (Accessed: 20 January 2021).
- Uludağ A, Aksoy N, Yazlık A, Arslan ZF, Yazmış E, Üremiş İ, Cossu TA, Groom Q, Pergl J, Pyšek P, Brundu G 2017. Alien flora of Turkey: Checklist, taxonomic composition and ecological attributes. *NeoBiota* 35:61-85.
- van Kleunen M, Dawson W, Essl F, Pergl J, Winter M, Weber E, Kreft H, Weigelt P, Kartesz J, Nishino M, Antonova AL, Barcelona JF, Cabezas FJ, Ca'rdenas D, Ca'rdenas-Toro J, Castan˜o N, Chaco'n E, Chatelain C, Ebel AL, Figueiredo E, Fuentes N, Groom QJ, Henderson L, Inderjit, Kupriyanov A, Masciadri S, Meerman J, Morozova O, Moser D, Nickrent DL, Patzelt A, Pelter PB, Baptiste MP, Poopath M, Schulze M, Seebens H, Shu W, Thomas J, Velayos M, Wieringa JJ, Pys'ek P 2015. Global exchange and accumulation of non-native plants. *Nature* 525(7567):100–103.
- Varia S, Polard K, Ellison C, CABI UK, Lane B, Surrey E 2016. Implementing Novel Weed Management Approach for Himalayan Balsam: Progress on Biological Control in the UK. *Outlooks on Pest Management* 27(5):198-203.