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A new alien species record for the Flora of Türkiye: *Ipomoea indica* (Burm.) Merr. (*Convolvulaceae*)

Emire ELMAS[1*], Hasan YAŞAYACAK[2]
[1]*SinopUniversity, Science and Art Faculty, Department of Biology, Sinop, Türkiye*
[2]*General Directorate of Nature Conservation and National Parks, Department of Biodiversity, Ankara, Türkiye*
**eelmas@sinop.edu.tr, [2]hasan.yasayacak@tarimorman.gov.tr*

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Türkiye Florası için yeni bir yabancı tür kaydı: *Ipomoea indica* (Burm.) Merr. (*Convolvulaceae*)

Abstract: *Ipomoea indica* (Burm.) Merr. is an invasive species with a wide distribution in tropical and subtropical regions and its natural habitat is South America. *I. indica*, which is a new record for the flora of Türkiye, was collected and photographed on 27 June 2022 from Alanya-İncekum. Additionally, the species was observed and photographed in İzmir-Foça, Manavgat-Çenger and Muğla-Bodrum in the Mediterranean and Aegean regions of Türkiye between 27 June 2022 and 02 July 2023. Although this species is morphologically similar to *I. purpurea* and *I. tricolor*, *I. purpurea* differs from *I. indica* in having smaller flowers (4-6 cm), shorter sepals (1.1-1.6 cm) with hirsute surfaces and predominantly unlobed leaves. Similarly, *I. tricolor* differs from *I. indica* by having smaller flowers (3.5-6 cm) and sepals that are glabrous, have scarious margins and shorter (0.6-0.7 cm). The spread of *I. indica*, which has the potential to exhibit invasive behavior, risks putting pressure on native plant species and the ecosystem. Therefore, it is important to conduct additional studies to understand the impacts of alien species and determine management strategies.

Key words: Exotic species, invasive species, non-native plants, Mediterranean flora

Özet: *Ipomoea indica* (Burm.) Merr. doğal yaşam alanı Güney Amerika olan, tropikal ve subtropikal bölgelerde geniş yayılım gösteren ve istilacı özelliklere sahip bir türdür. Türkiye florası için yeni kayıt niteliğinde olan *I. indica* 27 Haziran 2022 tarihinde Alanya-İncekum'dan toplanmış ve fotoğraflanmıştır. İlave olarak, bu tür 27 Haziran 2022 ile 02 Temmuz 2023 tarihleri arasında İzmir-Foça, Manavgat-Çenger ve Muğla-Bodrum'da gözlemlenmiş ve fotoğraflanmıştır. Bu tür *I. purpurea* ve *I. tricolor* türlerine morfolojik olarak benzerlik gösterse de *I. purpurea* çiçeklerin daha küçük (4-6 cm), sepallerin kıllı ve daha kısa (1.1-1.6 cm) ve yaprakların çoğunlukla lobsuz olmasıyla *I. indica*'dan ayrılır. Benzer şekilde, *I. tricolor* çiçeklerin daha küçük (3.5-6 cm) ve sepallerin çıplak, zar kenarlı ve daha kısa (0.6-0.7 mm) olmasıyla *I. indica*'dan ayrılmaktadır. İstilacı davranış sergileme potansiyeli olan *I. indica*'nın yayılımı, yerel bitki türleri ve ekosistem üzerinde baskı oluşturma riski taşımaktadır. Bu nedenle, yabancı türlerin etkilerini anlamaya yönelik ek çalışmalar yapılması ve yönetim stratejilerinin belirlenmesi önem arz etmektedir.

Anahtar Kelimeler: Egzotik türler, istilacı türler, yerli olmayan bitkiler, Akdeniz florası

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1. Introduction

As a result of intensified global mobility, plant species are able to settle in areas far from their natural range. Due to their lack of natural limitations and their high success in adapting to different habitat types, these invasive species cause significant negative impacts on ecosystems, biodiversity and national economies (Pimentel et al., 2000, 2001, 2005; Andersen et al., 2004; Cushman and Meentemeyer, 2008; Simberloff et al., 2013).

According to Uludağ et al. (2017), a total of 340 alien species have been reported in Türkiye, including 321 Angiosperms, 17 Gymnosperms and 2 ferns. Most of the alien species originated from the Americas (44.7%) and Asia (27.6%), while a small number originated from Africa (9.1%), Eurasia (4.4%), Australia and Oceania (3.8%) and the Mediterranean (3.8%) (Uludağ et al., 2017). Located at the crossroads of three continents and having a very different habitat, climate and geological structure, Türkiye is very favorable for plant invasions (Arslan et al., 2015).

Ipomea L. is the largest genus of the *Convolvulaceae* family, represented by approximately 500-600 species worldwide (Austin and Huáman, 1996). The Convolvulaceae family, which has heart-shaped leaves and funnel-shaped flowers, is mostly distributed in tropical and subtropical regions, but there are also species distributed in temperate regions. Species belonging to the genus *Ipomoea* have a wide range of growth forms and can be herbaceous, shrubs, climbers, vines or trees. *Ipomoea* species are used as ornamental plants, food, medicine and in religious rituals (Srivastava and Rauniyar, 2020; Meira et al., 2012).

Some *Ipomoea* members containing biologically active compounds such as alkaloids like ergoline, indolizidine, nortropane, phenolic compounds, coumarin, isocoumarin, diterpene, benzonoid, flavanoid, anticyanoside, glycolipid, lignan and triterpenes have pharmacologically important properties and are considered as medicinal plants (Srivastava and Rauniyar, 2020). On the other hand, some species with the ability to synthesize phytotoxic compounds have great potential for the control of invasive

plant species through their allelopathic effects (Hernández-Aro et al., 2017).

According to the latest data, 6 species belonging to *Ipomoea* are recorded in Türkiye: *I. sagittata* Poir., *I. imperati* (Vahl) Griseb., *I. purpurea* (L.) Roth., *I. tricolor* Cav., *I. triloba* L. and *I. hederifolia* L. (Parris, 1978; Aykurt, 2012; Uludağ et al., 2017; Hançerli et al., 2018). However, the newly recorded species is distinctly different from the other species in terms of some characteristics. Although this species is morphologically similar to *I. purpurea* and *I. tricolor*, *I. purpurea* differs from *I. indica* in having smaller flowers (4-6 cm), shorter sepals (1.1-1.6 cm) with hirsute surfaces and predominantly unlobed leaves. Similarly, *I. tricolor* differs from *I. indica* by having smaller flowers (3.5-6 cm) and sepals that are glabrous, have scarious margins and shorter (0.6-0.7 mm).

The natural distribution range of *I. indica* is uncertain because it appears to be pan-tropical. It is probably listed as native to the tropics of Central and South America and is probably also native to Southeast Asia and some islands in the Pacific region. It is cultivated as a crop plant in Europe, Asia, South Africa, the United States, New Zealand, Australia and a few Pacific islands, as well as naturalized (CABI, 2024). This study confirms the presence of *I. indica* in Türkiye.

2. Materials and Method

Plant specimens were collected and photographed on 27 June 2022 from Alanya-İncekum. Additionally, the species was observed and photographed in İzmir-Foça, Manavgat-Çenger and Muğla-Bodrum in the Mediterranean and Aegean regions of Türkiye between 27 June 2022 and 02 July 2023. Photographs taken in natural habitats of these regions provide evidence of the naturalization of *Ipomoea indica* in Türkiye (Fig. 1). Species identification was made according to "Flora of the Southeastern United States" (Weakley and Southeastern Flora Team, 2024). The species name was verified using the International Plant Name Index (IPNI, 2024). The description of *I. indica* is adapted from eFloras (Flora of China, 2024). The examined specimen was deposited in the GAZI Herbarium under the following details: collected by Emire Elmas (specimen number 3624) on 27 June 2022 from Alanya-İncekum, Antalya, Türkiye. The species identification was conducted by Hasan Yaşayacak in 2023.

Figure 1. *Ipomoea indica* in its natural habitat in Türkiye

3. Results

The research on all species belonging to the genus *Ipomoea* L., especially on leaf, seed and flower structure were reviewed and as a result of the examination of the plant specimen, it was determined that the species was *Ipomoea indica* (Burm.) Merr. This species, commonly referred to as "blue morning glory" or "ocean blue morning glory" in English, has been deemed appropriate to be named "Hint kahkahaçiçeği" in accordance with the Turkish Scientific Nomenclature Guidelines prepared by Menemen et al. (2021).

The diagnostic key of the species belonging to the genus *Ipomoea* distributed in Türkiye, including the newly record, has been adapted from "Flora of the Southeastern United States" (Weakley and Southeastern Flora Team, 2024) and provided below:

1. Corolla salverform; tube long, cylindrical and narrow; limb abruptly flaring at the summit of the tube ……..……...…...***I. hederifolia***

1. Corolla funnelform; tube short to long, expanding in diameter upwards from below the middle; limb gradually to abruptly flaring at the summit of the tube

2. Pedicels and peduncles with spreading, or reflexed trichomes; ovary 3-locular; sepals 8-25 (-30) mm long

3. Sepals soft-pilose on the outer surface with slender trichomes……..…….***I. indica***

3. Sepals hispid-pilose on the outer surface, with swollen-based trichomes..…….... ***I. purpurea***

2. Pedicels and peduncles glabrous or with short, appressed trichomes; ovary 2-locular; sepals 4-15 mm long

4. Stems trailing, rooting at the nodes; leaves emarginate with obtuse lobes, truncate at base.……...…...***I. imperati***

4. Stems erect or twining, not rooting at the nodes; leaf apex acute to acuminate, cordate or sagittate at base

5. Corollas blue, the throat white or yellow; sepals 3-7 mm long……***I. tricolor***

5. Corollas pink, pink-purple, or white, the throat pink or purple; sepals 4-15 mm long

6. Leaf bases sagittate…….. ***I. sagittata***

6. Leaf bases cordate…….……..***I. triloba***

Ipomoea indica (Fig. 2) is a herbaceous perennial creeper with ± densely retrorse pilose axial parts. Stems 3–6 m, sometimes rooting at the nodes. Petioles measure 2–18 cm, and the leaf blades are ovate or circular, 5–15 × 3.5–14 cm, with the abaxial surface densely short and soft pubescent, while the adaxial surface is sparsely pubescent. The base is cordate, the margins are entire or slightly 3-lobed, and the apex is acuminate or abruptly acuminate. The inflorescences are dense umbellate cymes with several flowers. Peduncles are 4–20 cm long, and the bracts are linear, occasionally lanceolate. Pedicels range from 2–5(–8) mm. Sepals are subequal, measuring 1.4–2.2 cm, with gradually linear-acuminate apices. The outer three sepals are lanceolate to broadly lanceolate, and the inner two are narrowly lanceolate. Sepals are glabrous to appressed pilose.

Figure 2. *Ipomoea indica* (Burm.) Merr.: a. General view, b. Leaves and buds, c. Front view of the flower, d. Side view of the flower, e. Twining stems with pubescence, f. Form of pubescence on the calyx

The corolla is funnelform, bright blue or bluish-purple when fresh, aging to reddish-purple or red with a paler center, measuring 5–8 cm and glabrous. Stamens and pistil are included within the corolla. The ovary is glabrous, and the stigma is 3-lobed. The capsule is nearly globose, measuring 1–1.3 cm in diameter, and the seeds are approximately 5 mm long (Flora of China, 2024).

Ipomoea indica has been taxonomically referred to by different names in the past. Homotypic synonyms of the species include *Convolvulus indicus* Burm. and *Pharbitis indica* (Burm.) Hagiw. *Convolvulus indicus* was first described by Burman (1755), while *Pharbitis indica* was renamed by Hagiwara (1938).

Specimen examined: Antalya, Alanya-İncekum, 27 June 2022 (*GAZI*-E. Elmas 3624**).**

Taxonomy:
Family : *Convolvulaceae*
Genus : *Ipomoea* L.
Species: *Ipomoea indica* (Burm.) Merr.

Lectotype:

Convolvulus indicus flore violaceo. Designated by F.R. Fosberg in Bot. Not., 129: 35-38 (1976). Based on illustration in *Hortus eystettensis*, vol. 2, folio 7, fig. 2, by B. Besler (1613) (Link: https://bibdigital.rjb.csic.es/viewer/10913/?offset=#page=348&viewer=picture&o=bookmark&n=0&q=)

Homotypic synonyms:

Convolvulus indicus Burm. in Auctuarium, 2 verso (1755).

Pharbitis indica (Burm.) Hagiw. in Bot. & Zool., 6: 1238 (1938).

Ipomoea indica is most similar to *I. purpurea* and *I. tricolor* among other species distributed in Türkiye. The characteristics that distinguish these three species are summarized in Table 1 (Flora of China, 2024; Flora of North America, 2024).

4. Discussions

Ipomoea indica (Miller et al., 2004; Eserman et al., 2014), a member of the *Ipomoea* subgenus *Quamoclit* clade, is a perennial creeper that can flower and self-fertilize throughout the year (Delgado-Dávila et al., 2016). According to Wood et al. (2020), *I. indica* can be confused with *I. purpurea* but is easily distinguished by the grey pubescence or tomentose underside of the leaves and the clustered flower state with strong bracteoles. It has also been noted that it is a highly variable species; the leaves are sometimes glabrous, lobed or entire, the bracteoles may be reduced and, rarely, the flowers may be solitary forms with prominent dark bands in the middle of the petal in colours ranging from blue to dark violet (Wood et al., 2020).

Considering the worldwide distribution rate and habitat preferences of this species, its invasive potential should be taken into account. In general, the distribution of *Ipomoea*

Table 1. Morphological comparison of *Ipomoea indica*, *Ipomoea purpurea*, and *Ipomoea tricolor*

Features	*Ipomoea indica*	*Ipomoea purpurea*	*Ipomoea tricolor*
Stems	3-6 m, retrorse pilose, sometimes rooting at the nodes	2-3 m, short pubescent and retrorse hirsute	Twining, glabrous
Leaves	Ovate or circular, 5-15 × 3.5-14 cm, abaxially densely pubescent, adaxially sparsely pubescent, cordate base	Circular-ovate or broadly ovate, 4-18 × 3.5-16.5 cm, ± strigose, cordate base	± Cordate, 6-10 × 2.5-13 cm, glabrous surfaces, cordate base
Inflorescence	Dense umbellate cymes, several-flowered, peduncle 4-20 cm	1-5-flowered, peduncle 4-12 cm	Flowers solitary or few; peduncle glabrous
Sepals	Subequal, 1.4-2.2 cm, glabrous or appressed pilose	Subequal, 1.1-1.6 cm, spreading hirsute abaxially on the lower half, apex acuminate	Lance-ovate, triangular, or oblong-triangular, 0.6-0.7 cm, scarious margins, acute apex, muriculate abaxial surface
Corolla	Bright blue or bluish-purple, aging reddish-purple or red; limb 5-8 cm in diameter and length	Red, reddish-purple, or bluish-purple, fading to white center; limb 4-6 cm in diameter and length	Usually blue to deep blue, sometimes white; limb 5-9 cm in diameter, 3.5-6 cm in length.

species is correlated with high rainfall, but some species, such as *I. indica*, can also adapt to habitats with moderate rainfall (Boyjnath et al., 2024), which facilitates its spread over large areas. The fact that it is located in an area far from its natural distribution area strengthens the possibility that this species may have been transported by anthropogenic factors rather than natural factors. Although there are no significant risk factors at the invasive level in its distribution areas in Türkiye, the fact that its preferred habitats are also the common habitats of endemic or rare important local species in the region carries the risk of suppression of these species. Therefore, their distribution should be monitored to assess whether they are being suppressed by *I. indica*.

In subtropical countries, fast-growing species such as *I. indica*, *I. purpurea*, *I. nil*, *I. quamoclit* and *I. tricolor* are used as annual ornamental plants in gardens (Wood et al., 2020). It would be appropriate to evaluate and investigate the landscape potential of the species by taking advantage of its advantageous features such as remarkable flowers, wide ecological tolerance and long vegetation period. The species may be useful as an ornamental plant in hedges and walls. The presence of its secondary metabolites such as alkaloids, flavonoids, terpenoids, glycosides, saponins, steroids, and tannins (Srivastava and Rauniyar, 2020) highlights its potential as a species suitable for ecologic and economic research.

When distribution areas of *I. indica* indicated in the present study in Türkiye are evaluated, it is likely to be found in the coastal zones of the southern and western parts of the country.

Conflict of Interest

Authors have declared no conflict of interest.

Authors' Contributions

The authors contributed equally.

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