

A new alien generic and a species records for the flora of Türkiye: *Soleirolia soleirolii* (Requien) Dandy (Urticaceae)

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Keywords

Alien flora,
Blacksea region,
New record,
Soleirolia soleirolii.

Abstract: The aim of this study is to reveal the presence of *Soleirolia soleirolii*, evaluated as an alien species for the flora of Türkiye, and to document its first record in Bartın province. Furthermore, *Soleirolia* is proved as a new genus record for the country, which has significant implications for the region's biodiversity. The detailed morphological descriptions, identification keys, distribution map, and photos are provided for this species, which will be beneficial for future research in this area. The findings contribute to a better understanding of the distribution and morphology of this species and emphasize the need for further research on the biodiversity of this region.

Türkiye Florası için yeni bir yabancı cins ve tür kaydı: *Soleirolia soleirolii* (Requien) Dandy (Urticaceae)

Anahtar Kelimeler

Karadeniz bölgesi,
Soleirolia soleirolii,
Yeni kayıt,
Yabancı flora.

Öz: Bu çalışmanın amacı, Urticaceae familyasından bir tür olan *Soleirolia soleirolii*'nin Türkiye'de yayılış gösterdiğini ortaya koymaktır. Türkiye Florası için yabancı bir tür olarak değerlendirilen *S. soleirolii* ilk kez Batı Karadeniz bölgesinde yürüttüğümüz floristik arazi araştırmaları sırasında, Bartın ilinden toplanmıştır. Ayrıca, *Soleirolia*'nın Türkiye için cins (genus) düzeyinde yeni bir kayıt olduğu da belirlenmiştir. Ek olarak, sonradan yapılacak araştırmalar için faydalı olacağı düşünülen, türe ait detaylı morfolojik betim, tanı anahtarı, dağılım haritası ve yayılış gösterdiği alanlardan çekilmiş fotoğraflar verilmiştir. Ortaya konan sonuçlar ile *S. soleirolii* adlı türün, dünyadaki dağılımı ve morfolojisinin daha iyi bilinmesine katkı sağlanmış olacaktır. Elde edilen bulgular bölgenin biyolojik çeşitliliği üzerine daha fazla araştırmaya ihtiyaç olduğunu vurgular niteliktedir.

1. Introduction

The dispersion of invasive alien species is often facilitated by anthropogenic activities such as the growing human population and expanding globalization [1]. These species possess a high capability of adaptation to different types of soil and climate [2, 3]. However, their adaptation to new environments can cause economic and public health issues as well as significant ecological problems [4], including population declines in many native species [2, 3]. Although the number of native species affected by invasive alien species is uncertain, there is evidence of a clear relationship [2, 3]. Invasive alien species is the second most frequent threat corresponding to species extinction events over the past 500 years [5].

Türkiye is considered as one of the countries that may face negative impacts from invasive alien

species. According to Uludağ et al. (2017), the total number of alien plant species in Türkiye has reached 340 [6]. In recent years, 14 additional alien species have been recorded in the country, as reported by various studies [6-21].

During the ongoing floristic studies, an interesting plant specimen was collected from Bartın province in West Blacksea region of Türkiye. It was identified as *Soleirolia soleirolii* (Requien) Dandy which has not been recorded from Türkiye so far. According to the related literature, the species in question may become invasive [22-24].

The first specimens of *S. soleirolii* (Urticaceae) were collected by Joseph Francois Soleirol, a captain of military engineers who travelled extensively throughout Corsica and created a large number of herbarium vouchers from the island [25]. He

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discovered this plant in Cervione, and it was also found to grow in Cap Corse [25]. Requien (1825) initially described these specimens as *Helxine soleirolii* [25]. Later, Dandy (1965) transferred the species to the genus *Soleirolia* which was previously established by Gaudichaud in 1830 as *S. soleirolii* [26]. *S. soleirolii* is native to the Balearic Islands, Mallorca, Corsica, Italy, and Sardinia, but it has been introduced and naturalized in many parts of Europe [24].

This study presents significant findings on the occurrence of *S. soleirolii* in Türkiye. Along with this important discovery, the study offers detailed information such as a morphological description, an identification key, and distribution map. Additionally, photographs taken from the species' distribution area are included, allowing for a better understanding of its characteristics. The presented results provide valuable insights into the biodiversity of the area, emphasizing the need for further research on this species and its impact on the local ecosystem.

2. Materials and Methods

To identify the plant samples, relevant literature from neighbouring areas (such as the Flora of Turkey, Flora Europaea, and Flora of the USSR) was consulted, along with online floristic studies (including the Flora of North America and Flora of China) [27-29]. The authors and plant names were verified using the International Plant Name Index (IPNI) (<http://www.ipni.org/>). Morphological description of the species presented in the "Results" section were provided by Ball (1964), Dalby (1968) [26, 27]. Collection details of the voucher deposited in Prof. Dr. Tuna Ekim Herbarium (GAZI) at the Gazi University, Faculty of Science are presented below.

Soleirolia soleirolii

Bartın: Damp places near shady walls in the city, 25 m, 02.06.2022, H. Yaşayacak, B.Bani (8183).

3. Results

Below is a key to Turkish genera in the family Urticaceae, including the newly recorded genus *Soleirolia*.

1. Leaves opposite, stipulate, dentate, with stinging hairs
..... ***Urtica***
1. Leaves alternate, exstipulate, entire, without stinging hairs

2. Stem spreading or decumbent, not rooting at nodes; most of the laves 1 cm or more, distinctly petiolate, flowers clustered

..... ***Parietaria***

2. Stem creeping, rooting at nodes; leaves not exceeding 6 mm, subsessile, flowers solitary

..... ***Soleirolia***

Genus *Soleirolia* Gaudich. Voy. Uranie, Bot. 504 (1830).

Perennial herb. Leaves alternate, entire; stipules 0. Flowers unisexual, green, solitary, axillary, surrounded by an involucre of 1 bract and 2 bracteoles. Perianth 4-lobbed. Flowers enclosed in perianth and involucre.

***Soleirolia soleirolii* (Req.) Dandy**, Feddes Repert. 70 (1-3): 4 (1965). (Figure 1).

Basionym: *Helxine soleirolii* Req. Ann. Sci. Nat. (Paris) 5: 384 (1825).

Synonyms

≡ *Parietaria soleirolii* (Req.) Spreng., Syst. Veg., 4(2.): 318 (1827).

≡ *Soleirolia repens* (Req.) Kuntze, Revis. Gen. Pl. 2: 633 (1891)

≡ *Soleirolia corsica* Gaudich., Voy. Uranie 504 (1830), nom. illeg.

Description

A slender creeping herb forming dense ever-green mats, sparsely to densely pubescent with falcate and straight hairs. Stems 5-20 cm, rooting freely at nodes. Leaves 2-6 x 2-4 mm, 3-veined; suborbicular, subsessile, base prominently oblique. Flowers unisexual; the lower female and the upper male. Female flowers enclosed in the connate involucre; perianth tubular, narrowly and shortly 4-lobbed. Male flowers with a 4-lobbed perianth. Achenes hard, light brown, shiny, symmetric, 0.8-0.9 × 0.6mm.

Flowering: 5-10.

Distribution: Native in Baleares, Mallorca, Corse, Italy and Sardegna (Figure 2) [24-30].

Naturalized in Europe: Azores, Great Britain, Canary Islands, France (Channel Is.), Netherlands, Spain, Portugal, Madeira. Denmark with Bornholm (Casual alien), Belgium and Ireland (status unknown), Türkiye (naturalized). Africa: Algeria (probably in Tunisia). North America: California, Mexico. Australia: wetter places in southern and north-western parts and also Tasmania (Figure 2) [24-30].



Figure 1. *Soleirolia soleirolii*. A and C: general view. B: male and female flowers.

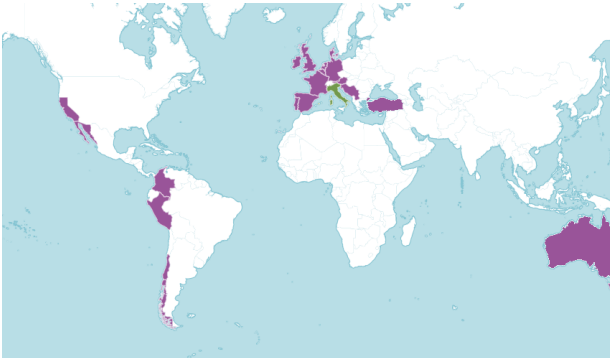


Figure 2. Distribution map of *Soleirolia soleirolii* in the world. (Natural distribution in green. Introduced or naturalized distribution in purple). Modified from POWO (2023) [30].

4. Discussion and Conclusion

Family Urticaceae in Türkiye was formerly represented by genera *Urtica* and *Parietaria* [28, 29]. *Soleirolia* has been added herein as the third one. The genus is close to *Parietaria*, but differs from it mainly in having rooting stems (at nodes), smaller leaves (not exceeding 6 mm,) and solitary flowers [28]. The genus is represented only one species namely *S. soleirolii* which is native to Balears, Mallorca, Corse, Italy, Sardegna, however it introduced and naturalized in many part of Europe [24, 27]. Additional records from various part of the world have been reported so far [31-33]. It, for instance, introduced to California and Mexico (Baja California) [31]. Recently *S. soleirolii* was recorded from Edough peninsula in Algeria and probably found in Tunisia [32]. This species is also becoming widely naturalised in the wetter parts of southern Australia (i.e. in some parts of eastern New South Wales, in the coastal

districts of southern Victoria, in Tasmania, in south-eastern South Australia, and in the coastal districts of south-western and northern Western Australia [33]. While Yılmaz et al (2018) previously reported the cultivation of this plant at Aşyan Cemetery in Istanbul [34], this study revealed the first discovery of naturalized alien populations of *S. soleirolii*. The species was found to be prevalent in damp areas near shady walls in the city center of Bartın. It was observed that the most abundant species growing in the same habitat were *Stellaria media* (L.) Vill., *Cardamine hirsuta* L., and *Asplenium adiantum-nigrum* L. These findings shed light on the plant's adaptability to new environments, indicating the potential for further spread of the species beyond its native range. The coexistence of other plant species in the same habitat also highlights the importance of studying the interactions and ecological relationships between species in these ecosystems.

Uludağ et al. (2017) reported that the alien flora of Türkiye includes 340 taxa, but the number of invasive species found in the country is continuously increasing, as shown in Appendix A. In fact, 14 additional alien taxa have been recorded in the last five years alone (Appendix A), bringing the total number of invasive plants in Türkiye to 355, including the new species recorded in this study. The presence of invasive alien species can have significant negative impacts on the native flora and fauna, including reduced biodiversity and ecosystem services. Therefore, it is important to monitor and control the spread of invasive species in Türkiye to protect the local environment and maintain a healthy ecosystem.

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Declaration of Ethical Code

In this study, we undertake that all the rules required to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with, and that none of the actions stated under the heading "Actions Against Scientific Research and Publication Ethics" are not carried out.

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Appendices

Appendix A. Recently recorded alien plant taxa for the Turkish Flora after Uludağ et al. (2017)

Family	Name of the taxa	Distribution in Türkiye	Origin	Reference
Anacardiaceae	<i>Rhus chinensis</i> Mill. var. <i>chinensis</i>	Eastern Black Sea (Artvin, Rize)	N. Pakistan, China, to Japan	[9]
Apiaceae	<i>Cyclospermum leptophyllum</i> (Pers.) Sprague ex Britton & P.Wilson	Eastern Black Sea (Trabzon)	Mexico to S. Tropical America	[11]
Asteraceae	<i>Bidens pilosa</i> L.	East Medit. (Osmaniye)	Tropical & Subtropical America	[14]
Asteraceae	<i>Gamochoeta coarctata</i> (Willd.) Kerguelen	Marmara (İstanbul)	South America	[18]
Asteraceae	<i>Symphyotrichum pilosum</i> (Willd.) G.L. Nesom var. <i>pilosum</i>	Western Black Sea (Zonguldak)	E. Canada to N. Central & E. USA	[10]
Balsaminaceae	<i>Impatiens balfourii</i> Hook. f.	Western Black Sea (Düzce)	N. Pakistan to W. Himalaya	[17]

Family	Name of the taxa	Distribution in Türkiye	Origin	Reference
Balsaminaceae	<i>Impatiens glandulifera</i> Royle	Eastern Black Sea (Giresun)	NE. Pakistan to Nepal	[19]
Cactaceae	<i>Opuntia macrorhiza</i> Engelm.	Western Black Sea (Kastamonu, Sinop)	Central & S. USA to N. Mexico	[21]
Iridaceae	<i>Iris foetidissima</i> L.	Western Black Sea (Sinop)	Azores, W. Europe to W. & Central Medit.	[7]
Malvaceae	<i>Malvastrum coromandelianum</i> (L.) Gracke	East Medit. (Osmaniye)	Central & S. America	[15]
Martyniaceae	<i>Proboscidea louisianica</i> (Mill.) Thell.	Northwest Aegean (Çanakkale)	South America and Mexico	[8]
Poaceae	<i>Arrhenatherum elatius</i> (L.) P.Beauv. ex J.Presl & C.Presl subsp. <i>bulbosum</i> (Willd.) Schübl. & G.Martens	Eastern Black Sea (Rize)	SW Europe	[16]
Sapindaceae	<i>Cardiospermum halicacabum</i> L.	Aegean (Aydın)	Tropics and subtropics	[12]
Verbenaceae	<i>Verbena brasiliensis</i> Vel.	Wester Black Sea (Bartın)	South America	[20]