

## Research article

# New voucher records for the flora of Türkiye: *Heteranthera reniformis* Ruiz & Pav. and *Heteranthera rotundifolia* (Kunth) Griseb. (Pontederiaceae)

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**Abstract:** In this study, *Heteranthera reniformis* Ruiz & Pav. and *H. rotundifolia* (Kunth) Griseb were given as new alien records for the flora of Türkiye. These new taxa were recorded from Balıkesir province. Both taxa grow in rice fields. Descriptions, pictures, and a distribution map of the taxa are also presented.

**Keywords:** Pontederiaceae, *Heteranthera*, new records, alien species, Türkiye

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## Introduction

Exotic or Invasive species are used to describe species that have the ability to rapidly multiply and spread over large areas in ecosystems where they do not belong, creating undesirable effects on ecology or economy (Ricciardi, 2012). These species generally occupy areas with low biodiversity, compete with native species in newly entered regions, and cause changes in the structure of ecosystems (Sağlam et al., 2011). Thanks to their competitive power and genetic diversity, these species can easily adapt to many environments, from agricultural areas to meadows and pastures, from parks and gardens to historical areas, from wetland habitats, fields and roadsides to railways. (Özer et al., 2001; Uygur & Uygur, 2010). Anthropogenic activities are particularly effective in transporting plants to other areas where they are not native (Sefalı et al., 2020). People can transport plants

for medical, economic, food and landscape purposes. Türkiye hosts approximately 340 invasive plant taxa belonging to 251 genera and 92 families in its flora (Uludağ et al., 2017). In the last decade, it has been observed that many plant species that are not native to our country and are named as exotic, weed or invasive have been recorded (Üremiş et al., 2014; Ekizoğlu, 2016; Hançerli et al., 2018; Fırat, 2018; Yıldırım et al., 2019; Terzioğlu, 2020; Terzioğlu & Özkan, 2020; Karaer et al., 2020; Eker & Tuzlacı, 2021; Yılmaz, 2021; Yazlık, 2021; Bozkurt, et al., 2021; Önen, et al., 2021; Tunçkol, 2022; Coşkunçelebi & Terzioğlu, 2022; Sefalı & Eroğlu, 2022; Asal et al., 2022). The terms invasive, exotic and weed have been used interchangeably by different researchers for these recorded plants. There is no consensus on the integrity of meaning of more than one concept used for alien species (Colautti & Richardson, 2009).

In this article, the use of the term invasive has been deemed appropriate (Asal et al., 2022). The Asteraceae family ranks first among invasive plant species detected in Türkiye with 38 taxa and has a naturalization success of 82% (Uludağ et al., 2017). 30% of the invasive species naturalized in our country are of North American origin (Uludağ et al., 2017). Both species we identified are from the Pontederiaceae family, which originated in the New World.

The family Pontederiaceae Kunth. is represented by two genera, including *Heteranthera* Ruiz & Pavon, *Pontederia* L., and 46 species worldwide. The genus *Heteranthera* is represented by 19 species in the world. The native distribution range of this genus is America, Central and South Africa, and Madagascar. However, it was introduced to Europe and Japan (APG IV, 2016; POWO, 2022).

In Europe, *Heteranthera reniformis* Ruiz & Pav., *Heteranthera rotundifolia* (Kunth) Griseb and *H. limosa*, were first reported from Italy in 1962 as exotic taxa (Pirola, 1968). From that time, the taxa spread quickly across Europe, and now they can be seen widely in the rice fields of Italy, Spain, Portugal, and Greece. These species can remain in the area during the entire rice growing period and can germinate and form permanent seed banks during this whole growing period. Therefore, they have a high invasion potential (Ferrero, 1996). These three species can cover 80-90% of the paddy fields if suitable growing conditions are found. It can cause a loss of approximately 65% of rice production (Schiele, 1988; Gabela & Doll, 1974). In the last two years, Serbia and Bulgaria has been added to the list of European countries in which *Heteranthera* taxa have been recorded (Zlatković & Bogosavljević, 2020; Gussev et al., 2020).

In Türkiye, *H. reniformis*, *H. rotundifolia*, and *H. limosa* species were reported from rice fields without any voucher material by Sürek (2005) for the first time. Later, in the thesis written by the Damar in 2006,, stated that *H. rotundifolia* species were present in paddy fields in Ipsala, Edirne province. Yazlık et al. (2020), while giving a checklist of weeds seen in paddy fields in Türkiye, added the *H. rotundifolia* species to their own weed list by taking Damar's

(2006) study as reference. However, no detailed description, drawing or photograph of the genus or species was included in any of these studies. Besides that, the existence of a reference herbarium specimen belonging to taxa was not mentioned in these studies (Yazlık et al., 2020). In our study conducted in 2022, exotic species seen in rice fields in the current literature are listed. In this study, it was stated that *H. reniformis* and *H. rotundifolia* taxa are in need of confirmation due to the lack of information in the current literature (İldeniz, 2022). On this situation, an opinion was received from Sürek. Sürek stated that he saw these species and did not diagnose them, but only got opinions from other experts, so the diagnoses were not certain and he did not collect any herbarium specimens. Therefore, these two species were focused on and visits were made to paddy fields. For this reason, the existence of the genus in Türkiye was first recorded by Göktürk in 2014 with the identification of *H. limosa* (Sw.) Willd. In this study we confirmed that there are two extra *Heteranthera* taxa in Türkiye. The number of *Heteranthera* species in Türkiye has reached three with addition of new voucher records (Göktürk, 2016).

### Materials and Method

The samples were collected from the rice fields irrigated by Gönen River. Herbarium specimens are preserved in Tekirdağ Namık Kemal University Herbarium (NAKU) and Nezehat Gökyiğit Botanic Garden Herbarium (NGBB). They were identified by using Flora of Ecuador (Horn, 1987). The collected specimens were also cross-checked with Flora Orientalis, Flora of Europaea, Flora of Türkiye and the East Aegean Islands, Plant list of Türkiye (Vascular plants) (Boissier, 1888; Webb, 1980; Davis, 1965-1985; Güner et al., 2012).

### Results and Discussions

*Heteranthera reniformis* Ruiz & Pav., Fl. Peruv. 1: 43 (1798) (Figure 1)

**Syn:** *Heterandra reniformis* (Ruiz & Pav.) P.Beauv. in Trans. Amer. Philos. Soc. 4: 177 (1799), *Leptanthus reniformis* (Ruiz & Pav.) Michx. in Fl. Bor.-Amer. 1: 24 (1803), *Phrynum reniforme* (Ruiz & Pav.) Kuntze in

Revis. Gen. Pl. 3(2): 318 (1898), *Schollera reniformis* (Ruiz & Pav.) Kuntze in Revis. Gen. Pl. 2: 719 (1891), *Buchosia aquatica* Vell. in Fl. Flumin. 1: 33, t. 80 (1829), *Heteranthera acuta* Willd. in Neue Schriften Ges. Naturf. Freunde Berlin 3: 438 (1801), *Heteranthera pubescens* Vahl in Enum. Pl. Obs. 2: 43 (1805), *Heteranthera reniformis* var. *conjungens* O.Schwarz in Beih. Bot. Centralbl. 42(1): 287 (1926), *Heteranthera*

*virginicus* Steud. in Nomencl. Bot., ed. 2, 2: 29 (1841), not validly publ., *Leptanthus peruvianus* Pers. in Syn. Pl. 1: 56 (1805), *Leptanthus virginicus* Pers. in Syn. Pl. 1: 56 (1805), *Phrynium reniforme* var. *acutum* (Willd.) Kuntze in Revis. Gen. Pl. 3(2): 318 (1898), *Pontederia azurea* Schult. & Schult.f. in J.J.Roemer & J.A.Schultes, Syst. Veg., ed. 15[bis]. 7: 1148 (1830), nom. illeg.



Figure 1. *Heteranthera reniformis*; a) general view, b) habitat

### Description

Perennial, with a creeping stem that roots at the nodes. Leaves petiolate, floating or emersed; blade reniform 2-4 x 3-5 cm. apex obtuse; glabrous; petiole 5-17 cm.; stipule 1-6 cm. Inflorescences spicate, 2-6 flowered, usually shorter than spathes; 1-7 cm, glabrous; peduncle 0.5-5 cm, glabrous. Perianth white densely glandular-pubescent outside, salverform, tube 3-12 mm, limbs zygomorphic, lobes narrowly elliptic-lanceolat, 3-8 mm. Upper lobe with

yellowish-green or sometimes brown region at base; stamens unequal, lateral stamens 1-3.2 mm., central stamen 2-5 mm. filaments linear, sparsely pubescent; style pubescent. Seeds 8-14 winged.  $2n=48$ .

**Flowering:** Jun-Oct.

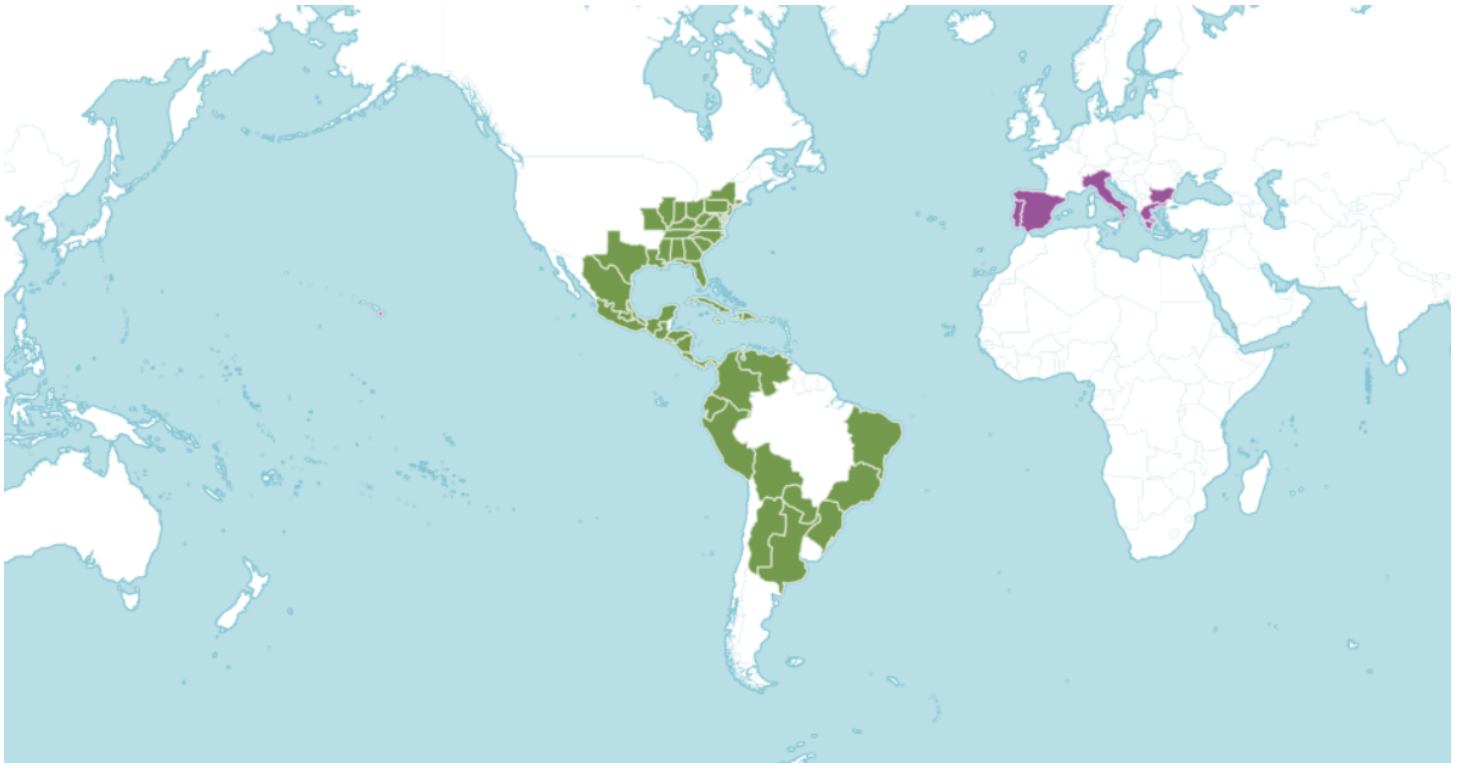
**Habitat:** Rice fields, shallow water.

**Distribution on Türkiye:** Türkiye: A1 Balıkesir, Gönen, East of Gündoğan Vilage, 40.166782; 27.654110, 23 m. shallow water and on the borders of rice fields. 05.09.2022. E.Boz & E. CABİ 1071 (NAKU,

NGBB). Balıkesir, Gönen, SW of Tuzakçı Vilage, shallow water and on the borders of rice fields, 40.142903; 27.658534, 26 m, 05.09.2022. E.Boz & E. CABİ 1072 (NAKU, NGBB).

**Distribution outside Türkiye:** Argentina, Bolivia,

Brazil, Colombia, Costa Rica, Cuba, Delaware, Dominican Republic, Ecuador, El Salvador, Greece, Haiti, Hawaii, Honduras, Italy Jamaica, Mexico, Nicaragua, Panamá, Paraguay, Peru, Portugal, Puerto Rico, Spain, USA, Venezuela.



**Figure 2.** Distribution of *Heteranthera reniformis* (Green: Native, Purple: Introduced) (POWO, 2022)

***Heteranthera rotundifolia* (Kunth) Griseb.** Cat. Pl. Cub.: 252 (1866).

**Syn.** *Heteranthera limosa* subsp. *rotundifolia* (Kunth) A.Galán in Arnaldoa 2: 54 (1994 publ. 1995), *Heteranthera limosa* var. *rotundifolia* Kunth in Enum. Pl. 4: 122 (1843)

**Description**

Annual. Stems procumbent; Flowering stems 5-18 cm long, distal internode 2-8 cm; Sessile leaves submersed, thickened, rosette at basal, blade linear to oblanceolate, 2.4-5 cm x 2-4 mm. obtuse at apex; Petiolate leaves floating or emersed, blade round to oblong, 1-5 cm x 0.5-2.5 cm, cordate to truncate at base, apex obtuse, stipule 1-5 cm, petiole 3-11 cm; Inflorescences 1 flowered; spathes tightly clasping

perianth tube 1–2.8 cm, glabrous. Perianth purple, or bluish- purple, salverform, tube 1.1-2.9 cm, lobes narrowly elliptic or oblong, 0.5-2 cm, 3 above, 2 across and 1 below, the central upper lobe with lateral flangs toward at the base and yellow region bordered above and below by dark bands. The lower band extending over the flangs. The lower lobes larger than others. Stamens unequal, lateral stamens 2.8-8 mm, central stamen 3.9-8.5 mm; filaments linear, curved downward apically, glandular-pubescent; style glabrous. Seeds 8-15-winged, 2n=14.

**Flowering:** Jun-Oct.

**Habitat:** Rice (*Oryza sativa* L.) fields and shallow water.



Figure 3. *Heteranthera rotundifolia*; a) habitat, b) general view

**Distribution on Türkiye:** Türkiye: A1 Balıkesir, Gönen, East of Gündoğan Vilage, 40.166782; 27.654110, 23 m. shallow water and on the borders of rice fields. 05.09.2022. E. Boz & E. CABİ 1073 (NAKU, NGBB). Balıkesir, Gönen, SW of Tuzakçı Vilage, shallow water and on the borders of rice fields, 40.142903; 27.658534, 26 m, 05.09.2022. E. Boz & E. CABİ 1074 (NAKU, NGBB).

**Distribution outside Türkiye:** Bolivia, Brazil, Greece, Italy, Mexico, Paraguay, Peru, Portugal, USA, Sardegna, Spain, Venezuela.

#### Key to Species

1. Leaf blade generally reniform; Inflorescence with 3-5 flowers; perianth arranged with 5 lobes opposite one smaller lobe; perianth limbs essentially zygomorphic .....*H. reniformis*
1. Leaf blade round to oblong or oblong to ovate; Inflorescence with 1 flowers; perianth lobes not arranged as above.

2. Upper perianth lobe with basal flanges; filaments of lateral stamens recurved near apex; mature leaves oval to round.....*H. rotundifolia*
2. Upper perianth lobe without basal flanges; filaments of lateral stamens straight; mature leaves elongate to oval..... *H. limosa*

#### 4. Conclusions and Discussion

Although the natural distribution of *Heteranthera reniformis* and *H. rotundifolia* species is in North, Central and South America, they are registered as alien species in Europe from France, Spain, Portugal, France and Greece (POWO, 2022). In Türkiye, the first record of the genus (*Heteranthera limosa*) was given by Göktürk (2014). With this study we have done, the number of species belonging to the genus *Heteranthera* has reached 3 in Türkiye. Both species

had a population of less than 100 individuals in the rice fields in the location we detected, but all areas close to this region and even in our country where rice is produced should be investigated in detail and their current situation in Türkiye should be revealed. Because it is necessary to analyze the negative effects

of the invasive potential of these species, which have been seen in Europe since the 1960s and cause about 65% losses in paddy production in the field where they are located, on paddy production in our country (Ferrero, 1996; Gabela, & Doll, 1974).

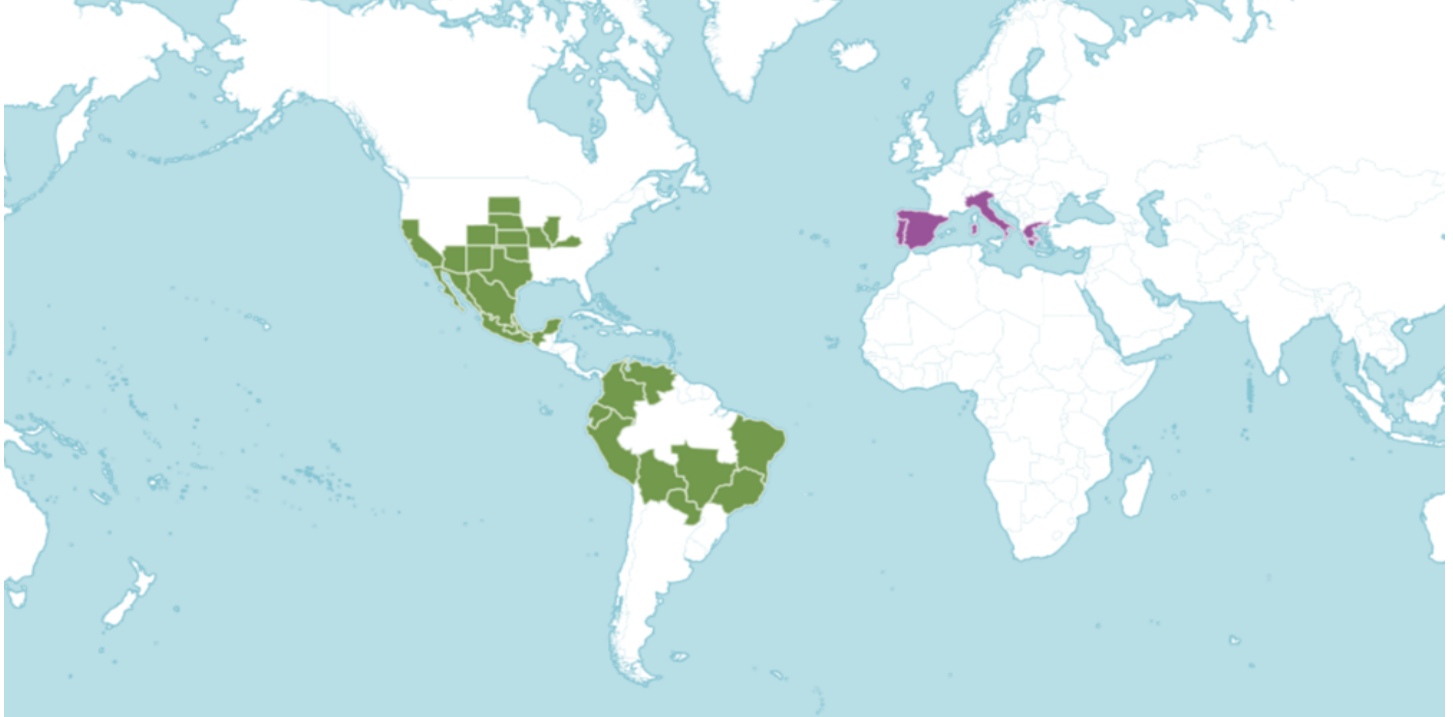


Figure 4. Distribution of *Heteranthera rotundifolia* (Green: Native, Purple: Introduced) (POWO, 2022)

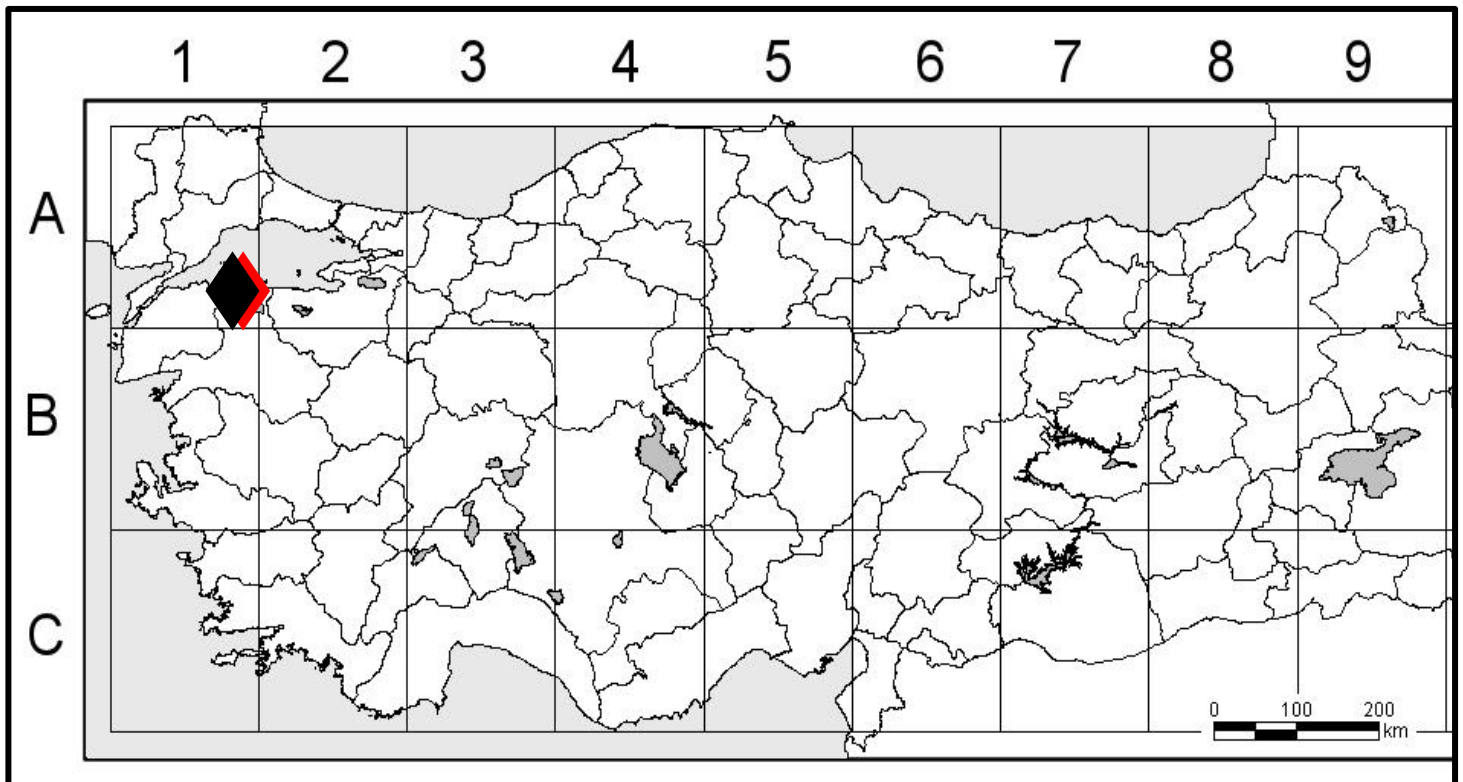


Figure 5. Distribution map of *Heteranthera reniformis* (Black) ve *Heteranthera rotundifolia* (Red) in Turkey.

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## Ethical Approval

No need to ethical approval for this study.

## Conflicts of Interest

The authors declare that they have no conflict of interest.

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