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# *OXALIS DEBILIS*, AN INDOOR ORNAMENTAL PLANT NEW NATURALIZED IN ROMANIA

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## ABSTRACT

*The aim of the paper is to report the success of the naturalization of Oxalis debilis Kunth, an exotic plant from Botanic Garden "D. Brandza" greenhouses collection.The species has been cultivated as a potted plant for over 30 years and in the last 15 years it has spread in greenhouses becoming a weed. Since 2013, individuals of the species have been observed outside of the greenhouses. Currently, several hundred individuals survive in the Historical Garden, where they bloom year after year. The plant does not produce seeds.*

## INTRODUCTION

Botanic gardens from all over the world play an important role in the dissemination, naturalisation and invasion of alien plants (Ni & Hume 2021). Moreover, these institutions have been implicated in the introduction and/or local spread of about half of 34 plants listed by the IUCN as among the 100 worst invasive species worldwide (Hulme 2011).

Documented examples are known from various countries and regions (Dawson et al. 2008, Nagodă et al. 2014, Ni & Hulme 2021, Konaikova & Peregrym 2023).

Not only the collections of outdoors plants in the botanical gardens can be sources of alien plants, but also the exotic plants from the greenhouses originating from warmer climatic zones (Galera & Ratyńska 1999).

The current study is a example of expansion and naturalization of an ornamental plant species from the greenhouses into others parts of the Botanic Garden "D. Brandza", University of Bucharest.

*Oxalis debilis* Kunth has been in the botanical garden's plant collection for over 30 years. It was introduced as an ornamental plant with other species of the *Oxalis* genus (*Oxalis bowiei* Herb.ex Lindl., *Oxalis tetraphylla* var. *tetraphylla*, *Oxalis teneriensis* R. Knuth, *Oxalis triangularis* A.St.- Hill).

Until 2023, the taxon was kept under the name *Oxalis rosea* Jacq. A revision, determined the matching of taxonomic characters (napiform root, oxalate deposits distributed at least around margins of distal 1/3 and often evenly over whole surface of leaf, sepals lanceolate, with two orange tubercles) with *Oxalis debilis* Kunth.

## MATERIAL AND METHODS

*Study area*. This research has been carried out within Botanic Garden "D. Brandza", University of Bucharest. The botanical garden is located close to downtown, in the West side of Bucharest, on the right bank of the river Dâmboviţa, at an altitude of 73-88 m. The geographic coordinates for the central area of the Botanic Garden are: N44.437847°, E029.063643°. The relief is typical of the plain regions, the soil is alluvial, and climate is temperate continental, with slightly excessive tendencies (Sârbu & Anastasiu 2001).

*Material*. The main object of our investigation is alien pink woodsorrel, *Oxalis debilis* Kunth, cultivated in the greenhouses of Botanic Garden "D. Brandza". The taxon was identified using a number of "Floras", guides and keys for determination (Khodashenas & Amini 2012, Brako & Zarucchi 1993, Tropicos, eFlora, Bernal et al. 2019, Fiaschi et al. 2020). The nomenclature of species is according to Plants of the World Online database (POWO 2023). A concise description of species is provided, with notes on the general native and alien distribution range. The collected herbarium specimen has been deposited in the herbarium of the Botanic Garden "D. Brandza", University of Bucharest (BUC).

## RESULTS AND DISCUSSIONS

*Oxalis debilis* Kunth belongs to the Oxalidaceae family, member of the bulb-forming section *Ionoxalis* (Denton, 1973). The members of this section form more or less spherical, imbricate bulbs from which leaves and inflorescences emerge during the rainy season.

**Nomenclature**:

*Oxalis debilis* Kunth in A. Humboldt et al., Nov. Gen. Sp. 5(qto.): 236. 1821.

*Acetosella debilis* (Kunth) Kuntze, Rev. Gen. Pl. 1: 92. 1891.

*Sassia debilis* (Kunth) Holub in Preslia 68: 285 (1996 publ. 1997)

TYPE: Venezuela. Inter La Venta Grande et urbem Caracas, alt. 550 hex, Jan 1800, Humboldt & Bonpland [681] (holotype: P fiche!).

**Voucher specimen**: Romania, Bucharest: Botanic Garden "D. Brandza", Historical Garden, 72 m alt., 21.07.2023, leg. et det. P. Camen-Comănescu [BUC 410360].

**Description** (Fig. 1): Perennial plant. Napiform root, vertical, thick with fibrous branches. Bulb globose, 1–3 cm long, tunics pale brown, vertically 3-ribbed, ciliate with long hairs; bulbils formed from old bulbs, sessile. Leaves basal; petioles 10-25 cm, with long sparse to moderately dense spreading white trichomes; trifoliolate; lamina of leaflet rounded-obcordate, abaxial surface hirsute, adaxial surface glabrous, oxalate deposits like dark spots, distributed at least around margins of distal 1/3 and often evenly over whole surface.

Flowers 8–15 in corymbose cymes, irregularly branched; sepals 5, lanceolate, with two orange tubercles; petals 5, obovate, cuneate, ± 3 times as long as the sepals, rounded at the apex, violet to lavender or rose-purple with dark veins. Stamens 10, filaments fused at base; ovary 5-locular, pubescent. Homostylous, semi-homostylous and tristylous. In homostylous flowers, the stigmas are at the level of long stamens, in semi-homostylous flowers, the stigmas are slightly below the long stamens or at the level of short stamens, and in tristylous flowers, there are three kinds of styles, i.e. short, intermediate and long

ones. In the first case, the stigmas are below two sets of stamens, in the second case, the stigmas are located between short and long stamens, in the last one, the stigmas are above two sets of stamens (Sakhraoui et al. 2023). Capsules and seeds not seen.

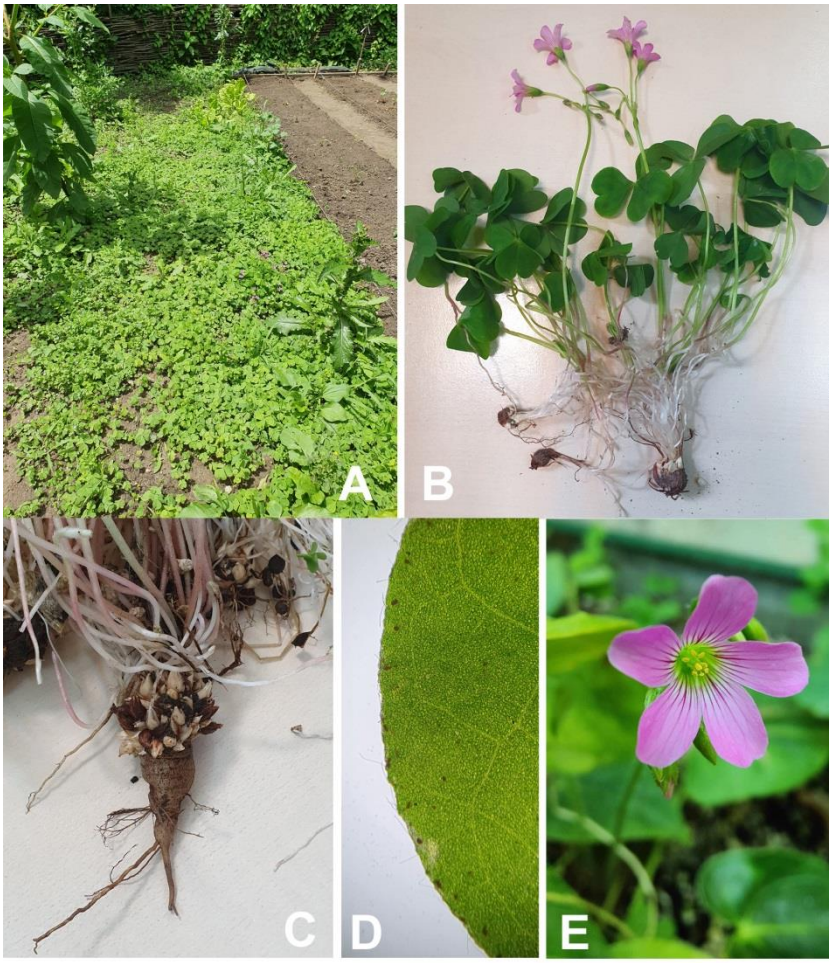


Figure 1. *Oxalis debilis* A - a plot from the Historical Garden occupied by individuals of *O. debilis;* B – habitus; C – napiform root with bulblets; D - oxalate deposits spots on the edge of the leaf; E – flower.

*O. debilis* contains diploid and tetraploid forms in its native as well as introduced range, which does not support a previous hypothesis that the predominant vegetative reproduction in this species is an escape from pentaploidy (Luo et al. 2006). 2n = 14 and 28, 35 rarely, and dysploids reported.

The species can be confused with *Oxalis articulata* Savigny which also has pink flowers but form capsules. This species has been introduced in Europe as ornamental plant in gardens and in some countries (Great Britain, Italy, Spain, Slovenia, etc.) it is considered established (Euro+Med 2006-). In Bulgaria, its

presence in natural habitats was reported in 2019 (Petrova & Vladimirov 2019). The species can be bought from flower shops in Romania and was found planted in 2023 in several cemeteries in Bucharest. We do not know if the species survives the winter in the conditions of our country.

**Flowering period**: In greenhouses the species blooms throughout the year, but with a maximum flowering in February-April. Outdoors, the observations showed that the specimens bloom from April to June.

**Biology, ecology**: Pollen viability is low (Luo et al. 2006) and plants does not produce seeds, but the formation of a large numbers of bulblets proves a very successful alternative for spreading. The expanding is carried out unintentionally by human activities (Stinca 2017).

*Oxalis debilis* grows in natural habitats, in shade with loose sandy soil and drainage (Muzafar et al. 2015) at 900 - 2660 m altitude. In places where was introduced, the species is found in flower beds, roadsides, disturbed areas, crops, sandy live oak forests, mesic forests, river and river terraces, at altitudes between 5-100 m (Nesom 2009).

**Distribution**: The native range of *Oxalis debilis* is Central America to Guyana, Argentina and Paraguay. It was widely naturalized in Africa, Asia, Australasia, Europe and Northern America (POWO 2023). In Europe, it is known as a naturalized element of the France, Great Britain, Ireland and Italy flora (Euro+Med 2006-).

In United States O*xalis debilis* appears to be spreading rapidly. The species produces numerous bulblets in a basal cluster and apparently also can spread laterally by production of bulblets at the tips of napiform roots; it can form large, dense colonies (eFlora 2023).

In Romania the species was mentioned until this year only just from the botanic gardens collections (Bucharest, Iasi). In the summer of this year, several specimens were found in a green space near a hotel in the Căciulata Resort (Sîrbu C. com. pers.).

Our observations made in Botanic Garden “D. Brandza” show that the species began to expand in greenhouses probably with the help of contaminated soil with bulbils, given that the species does not produce seeds. In the last 15 years, the species has spread in all the greenhouses of the botanical garden and can be considered a weed. The same behavior was observed also in other *Oxalis* species in greenhouses (Anastasiu 1995-1996).

In 2013, the first individuals were observed outside the greenhouses, close to the door, in areas with small cracks in the wall where contaminated soil probably accumulated. In the following years, more and more specimens were observed close to the greenhouses, at greater and greater distances.

In 2017, the Historical Garden was set up in a space close to the old Greenhouse, a space that was previously used for storing soil and pots used for growing plants in the greenhouse. Also, some transplanting operations were carried out here, which probably led to the spreading of soil from pots contaminated with *Oxalis debilis*. Landscaping works spread this soil over the surface of the new garden, in the following years, where dozens of specimens were observed. In the last two years, between May and July, part of the plant beds of the Historic Garden are covered by hundreds of specimens that form a compact layer

on the ground surface. The plants reach maturity and bloom, but the aerial part begins to dry at the beginning of August due to excessive dryness.

Regarding the morphology of the species, being a plant that prefers humidity, the specimens from the greenhouse, which are watered very frequently, are much more vigorous than those. outdoor Our measurements show that these plants can reach 43-45 cm in height compared to those outdoor that do not exceed 20 cm.

## CONCLUSIONS

A new naturalizated alien plant species is reported from Romania. This example illustrate the numerous and varied links that exist between horticulture, botanic gardens and (potential) plant invasions.

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