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Research Article

Oenothera rosea (Onagraceae): a newly naturalized alien plant species in Türkiye

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Abstract

Oenothera rosea (Onagraceae), native to central and southern Texas (USA), Mexico, Central America to El Salvador, and much of South America, was encountered within the Avşar campus of Kahramanmaraş Sütçü İmam University, located in Kahramanmaraş Province, southern Türkiye. The species was discovered serendipitously and was observed to be well established in two adjacent grassy areas, with two independently reproducing subpopulations totaling at least 250 individuals. Although the exact pathway of introduction remains uncertain, it is likely that *O. rosea* arrived unintentionally, possibly as a contaminant in soil or accompanying ornamental plants introduced for landscaping purposes. This perennial species, typically inhabiting temperate biomes, is also known for its medicinal uses. With the inclusion of *O. rosea*, the total number of *Oenothera* species documented in Türkiye now stands at five. The species is readily distinguishable from its congeners by its small petals and characteristic pink corolla. Key taxonomic features include: short stems (15–35 cm), either simple or branched, strigillose (sometimes mixed villous hairs); pink petals measuring 4–8 mm; floral tubes 3–5 mm; clavate to narrowly obovoid capsules (4–10 × 2–5 mm), angled or slightly winged valves; and a sterile stipe (pedicel) of 5–20 mm. A detailed botanical description, habitat characteristics, field photographs, and a distribution map are provided. Additionally, the identification key for the genus *Oenothera* in Türkiye has been updated to reflect this new record.

Key words: naturalized species, first occurrence, pink evening primrose, Kahramanmaraş, Southwest Asia

Introduction

The rate at which new information emerges regarding the distribution of alien plant species is increasing rapidly (Frean et al. 1997; Verloove and Sánchez Gullón 2012). This trend is largely attributable to the growing number of terrestrial studies focused on biological invasions (Chiu et al. 2023), which have significantly advanced our understanding of the dynamics of alien species (Qiu and Chen 2009).

One plant family known for including invasive representatives is Onagraceae Juss., commonly referred to as the willowherb or evening primrose family. It comprises approximately 650 species of herbs, shrubs and trees belonging to 18 genera, occurring from boreal to tropical regions (Dietrich et al. 1997; Wagner et al. 2007). Onagraceae is taxonomically

divided into two subfamilies—Ludwigioideae W.L.Wagner & Hoch and Onagroideae W.L.Wagner & Hoch—and seven tribes. The largest genus is *Epilobium* L., with around 189 species, followed by *Oenothera* L., an entirely American genus treated as comprising about 145 species according to Wagner et al. (2007). In contrast, most European authors apply a more splitting species concept, recognizing several hundred species in the genus. Originating from the New World, *Oenothera* occurs primarily in temperate and subtropical regions of North, Central and South America (Gonçalves Silva and Ferreira 2019). Many species of this genus have been introduced into Europe, where they have shown varying degrees of adaptation, and some have become invasive (Mihulka and Pyšek 2001).

In Türkiye, Onagraceae is currently represented by 35 taxa belonging to four genera (Chamberlain 1972; Seçmen 2000; Güzel 2012; Yüzbaşıoğlu 2014; Uzun and Verloove 2023). Several species from the genera *Epilobium*, *Ludwigia* L., and *Oenothera* are considered potentially invasive or weedy (Dietrich et al. 1997). However, the genus *Oenothera* remains relatively underexplored in Türkiye due to limited scientific attention and sparse distribution records (Uzun and Verloove 2023). Furthermore, extensive hybridization within certain sections of the genus complicates its taxonomy and identification (Dietrich et al. 1997). In the case of *Oenothera rosea* L'Hér. ex Aiton, the large number of synonyms (e.g., *Gaura epilobia* Moc. & Sessé ex Ser., *Hartmannia rosea* (L'Hér. ex Aiton) G.Don, *Oenothera rubra* Cav., *Xylopleurum roseum* (L'Hér. ex Aiton) Raim.) reflects historical confusion and highlights the need for further taxonomic and biogeographic research.

During a casual botanical survey on the campus of Kahramanmaraş Sütçü İmam University (KSU), in Kahramanmaraş Province, southern Türkiye, a large number of individuals of a pink-flowered plant with a small corolla were encountered. Based on initial morphological observations, the plant was identified as belonging to the genus *Oenothera*. However, existing floristic works covering Türkiye (Chamberlain 1972; Seçmen 2000; Yüzbaşıoğlu 2014; Uzun and Verloove 2023) list only four taxa (*O. biennis* L., *O. glazioviana* Micheli, *O. parodiana* Munz and *O. jamesii* Torr. & A.Gray), all of which have yellow and larger corollas (Uzun and Verloove 2023). This discrepancy prompted a more detailed examination in the laboratory, supported by broader taxonomic literature review. The plant was subsequently identified as *Oenothera rosea*, a species originally described from Peru and known from Central and South America (Aiton 1789; Dietrich 1977).

Materials and methods

Specimens of *Oenothera rosea* were collected in the field on the KSU campus. Subsequent morphological examination was carried out in the plant laboratory of the KASOF Herbarium (Faculty of Forestry), where the specimens were mounted on herbarium sheets and deposited for long-term preservation.

Taxonomic nomenclature follows IPNI (2025) and POWO (2025). Species identification was performed using standard floristic and taxonomic references relevant to the genus *Oenothera* (Raven et al. 1979; Rostański 1982; Dietrich et al. 1997; Rostański et al. 2004, 2010; Wagner 2005; Wagner et al. 2007; Rostański and Verloove 2015).

To assess the species' broader distribution, national and regional vascular plant checklists and floras were consulted, including: South America (Dietrich 1977), Macaronesia (Hansen and Sunding 1993), the Czech Republic (Pyšek et al. 2002, 2012, 2022), Ukraine (Protopopova et al. 2006), Slovakia (Medvecká et al. 2012), Bulgaria (Petrova et al. 2013), Poland (Tokarska-Guzik et al. 2014), Belgium (Rostański and Verloove 2015), Greece (Dimopoulos et al. 2016), Italy (Galasso et al. 2024), Moldova (Molnár et al. 2019), Algeria (Meddour et al. 2020), and China (Xu et al. 2012; Hao and Ma 2023).

In addition, several floras were reviewed to assess potential regional occurrences, including: *Flora of Iraq* (Raven 2013), *Flora Iranica* (Raven 1964), *Flora of North America* (Flora of North America Editorial Committee 2021), *Flora Europaea* (Raven 1968), and *Flora of China* (Chia-Jui et al. 2007). Relevant online plant atlases (e.g., Hassler et al. 2020), herbarium catalogues (Hyde et al. 2025; Herbarium Berolinense 2025; eFloras 2025a, b) were also consulted.

Comparative analysis was performed using herbarium specimens of *Oenothera* from the collections of B, K, and KASOF herbaria (abbreviations according to Thiers 2025) as listed in the appendix.

Results and discussion

Taxonomic notes

The following botanical description is based primarily on the collected specimens from the study area, complemented by comparative data from Chia-Jui et al. (2007).

***Oenothera rosea* L'Hér. ex Aiton in Hort. Kew ed. 1. 2: 3. 1789**

"Pink Evening Primrose" (Figures 1–3)

A many-branched, rhizomatous perennial herb, occasionally suffrutescent due to a woody caudex. **Stems** erect to ascending, 15–35 cm, densely strigillose, occasionally intermixed sparse villous hairs. **Leaves** subentire to sinuate-pinnatifid, elliptic or occasionally narrowly ovate, 2–3(–6) × 0.5–1.0(–2.5) cm, **petioles** 2–10(–25) mm. **Inflorescence** lax, open, simple raceme. **Flowers** open near sunrise, borne on erect to sprawling stems. **Floral buds** 5–8 mm, **hypanthia** 3–5(–6) mm. **Sepals** 5–8 mm long with tips remaining attached. **Petals** rose to rose-purple, obovate, 4–6(–8) mm. **Style** 4–5 mm, **stigma lobes** 2–3 mm, surrounded by anthers at anthesis.

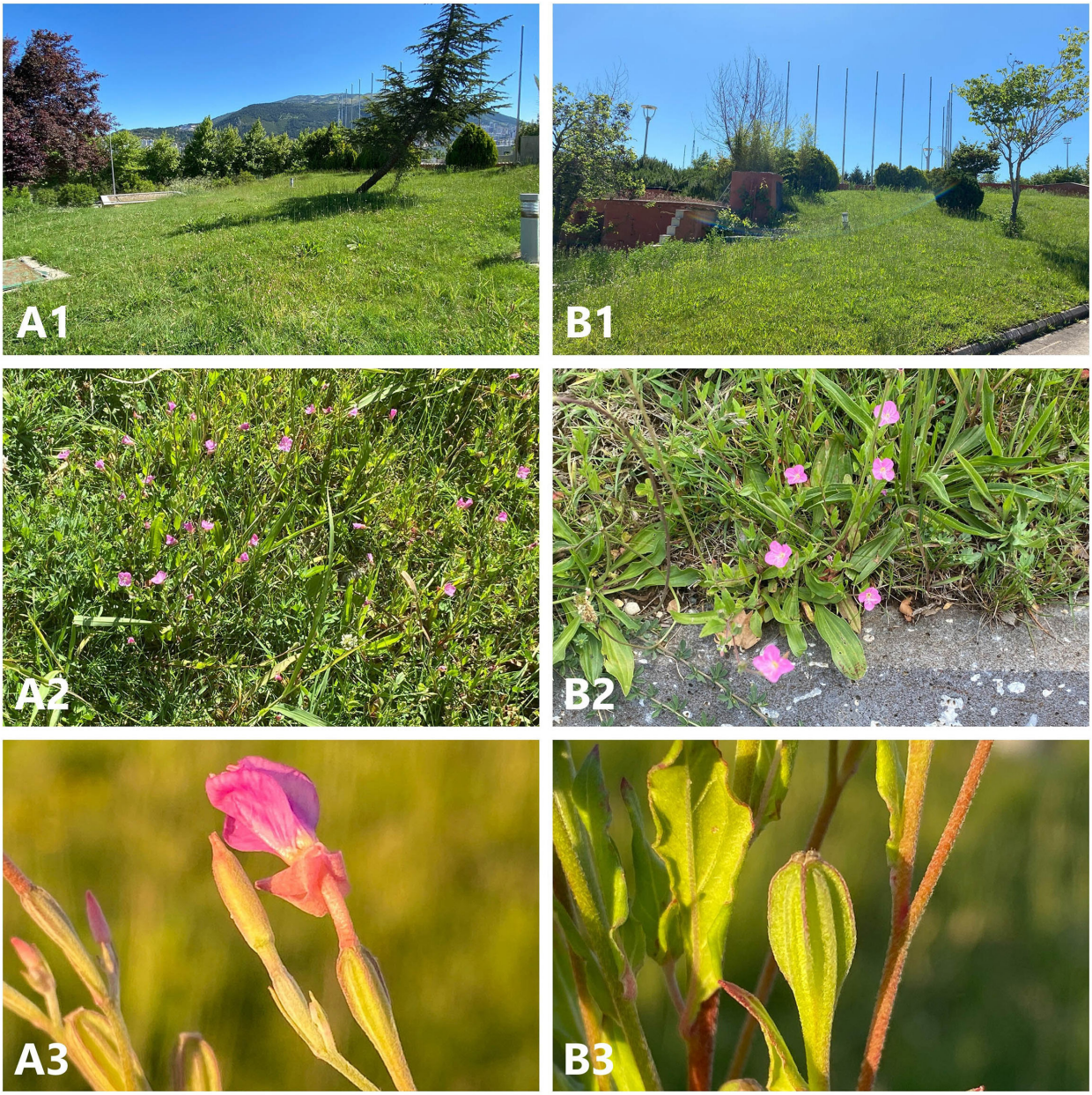


Figure 1. Habitats of *Oenothera rosea* in the campus: Site-A (photos A1, A2, A3) and Site-B (photos B1, B2, B3). Dates (A1, A2, B1, B2 flowering on 13.05.2025; A3 and B3 fruiting on 21.05.2025). Photographs by A. Uzun and S. Palabaş-Uzun.

Anthers 2–3 mm, **filaments** 4–5 mm. **Ovary** clavate to narrowly obovoid, 4–5 × 2 mm; **fruiting capsules** 7–10 × 5 mm at maturity, tapering into a sterile, stipe-like pedicel 5–20 mm. Each valve bears a prominent ridge and is narrowly winged and angled. **Seeds** numerous, arranged in several indistinct rows per locule, oblong-obovoid to obovoid, 0.7–0.9 mm, a finely granular surface and a characteristic dark spot at each end.

Phenology. Flowering from early May to early June; fruiting from late May through late June.

Habitat. In its native range, *O. rosea* grows in sandy to clayey soils, often along creeks or in weedy lowlands at elevations between 1000–2000 m (Dietrich 1977; Chia-Jui et al. 2007). In its newly recorded location in Türkiye,

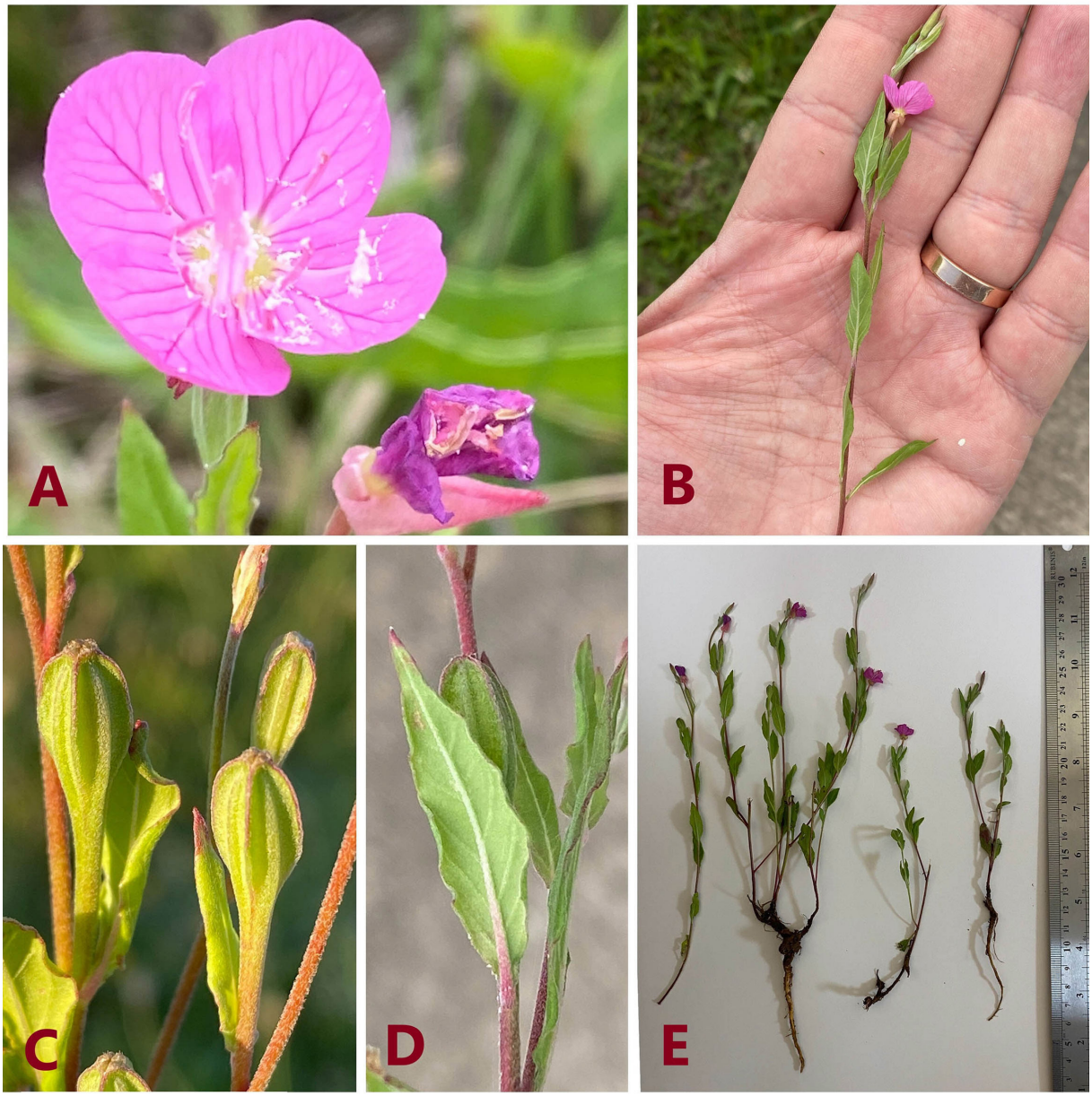


Figure 2. *Oenothera rosea* in the campus population. A: Corolla, B: Dwarf habit, C: Fruiting capsule, D: Stem leaf, E: Herbarium sample (Uzun 2215 & Pal.-Uzun, KASOF 1323). Photographs by A. Uzun and S. Palabaş-Uzun.

the species was found growing among perennial herbaceous vegetation in moist grassy places at 530–533 m elevation.

Propagation. Like many other *Oenothera* species, *O. rosea* is self-compatible and autogamous, resulting in high seed output and high rates of germination which are common traits in alien plants (Mihulka and Pyšek 2001). Field observations also recorded honeybee visits, which may enhance fruit and seed set, further facilitating establishment and spread.

Comparison with related species

Oenothera rosea is a distinctive species that can be readily distinguished from its congeners in Türkiye by its relatively small, pink flowers. It belongs to section *Hartmannia* (Spach) Walp., a group comprising only five taprooted

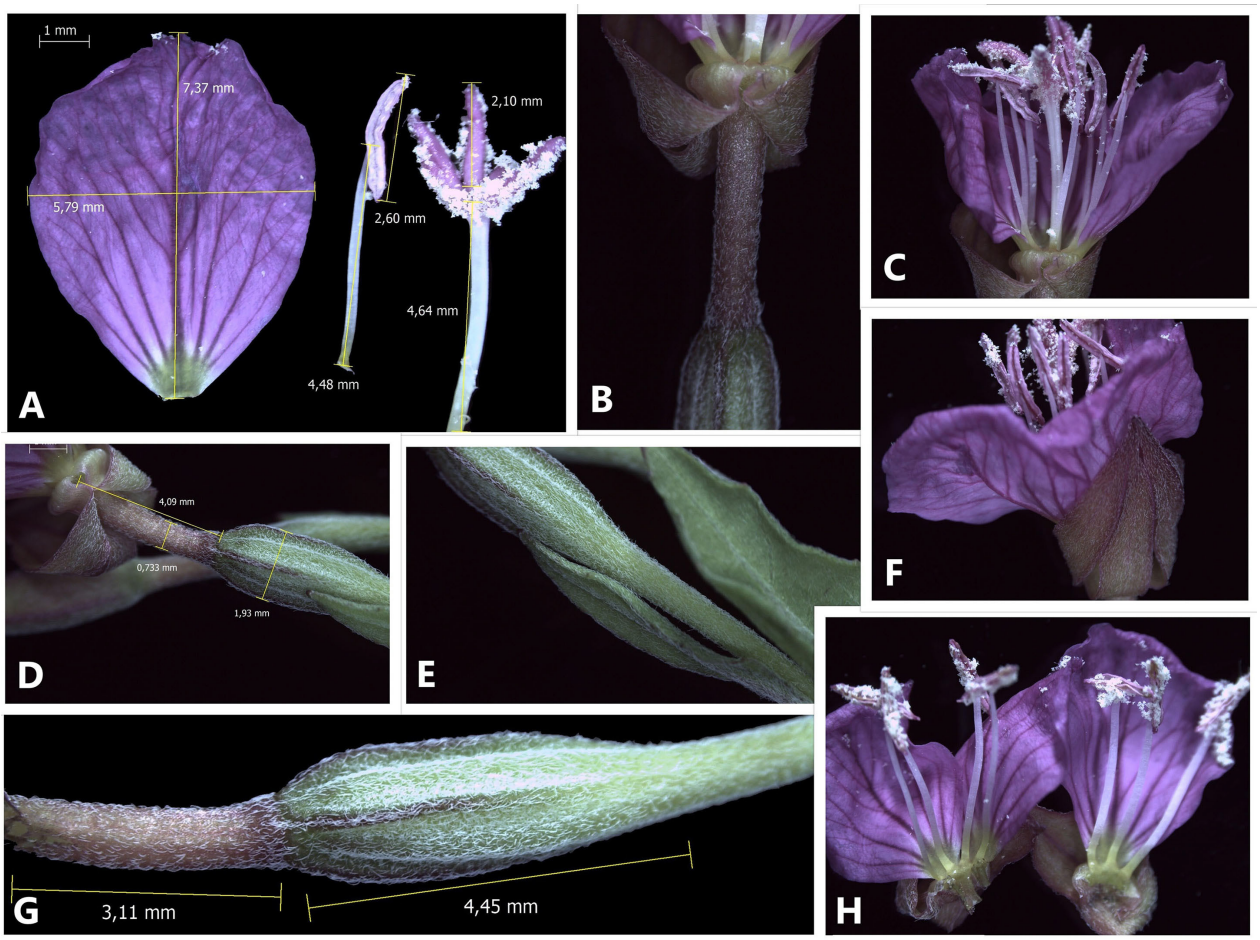


Figure 3. Diagnostic features of *Oenothera rosea* (Uzun 2215 & Pal.-Uzun) collected in the campus population. A: Petal, stamen, stigma, and style measurements, B: Stipe-like sterile portion, C: Corolla with same level anther and stigma, D: Measurements of sterile portion and hypanthia widths, E: Stem leaves, F: Posterior view of terminally fused sepals, G: Lengths of sterile portion and hypanthia (later capsule), H: Petals with stamens. Photographs by A. Uzun.

perennial species, all characterized by pinkish to rose-purple petals and clavate, angled, or narrowly winged capsules.

In addition to *O. rosea*, only one other representative of this section, *O. speciosa* Nutt., is known from the Mediterranean region. This species is widely cultivated across the world due to its attractive, showy flowers and ease of growth. It differs from *O. rosea* most notably by its usually much paler and significantly larger petals (25–40 mm vs. 4–8 mm), and by a longer hypanthium tube (10–20 mm vs. 4–6 mm). Based on observations from platforms such as iNaturalist, *O. speciosa* is almost certainly present in Türkiye; however, it remains unclear whether these records pertain to cultivated, subspontaneous, or truly naturalized individuals.

Another morphologically similar species within the Euro+Med Plantbase area is *O. tetraptera* Cav. (Raab-Straube 2018+). Although formerly placed in section *Hartmannia*, this species is now classified under section *Leucocoryne* W.L.Wagner & Hoch, which is defined by its distinctly winged capsules (with wings up to 4 mm wide) and rounded or obtuse capsule apices. Like *O. speciosa*, *O. tetraptera* has large, white petals, but its capsules

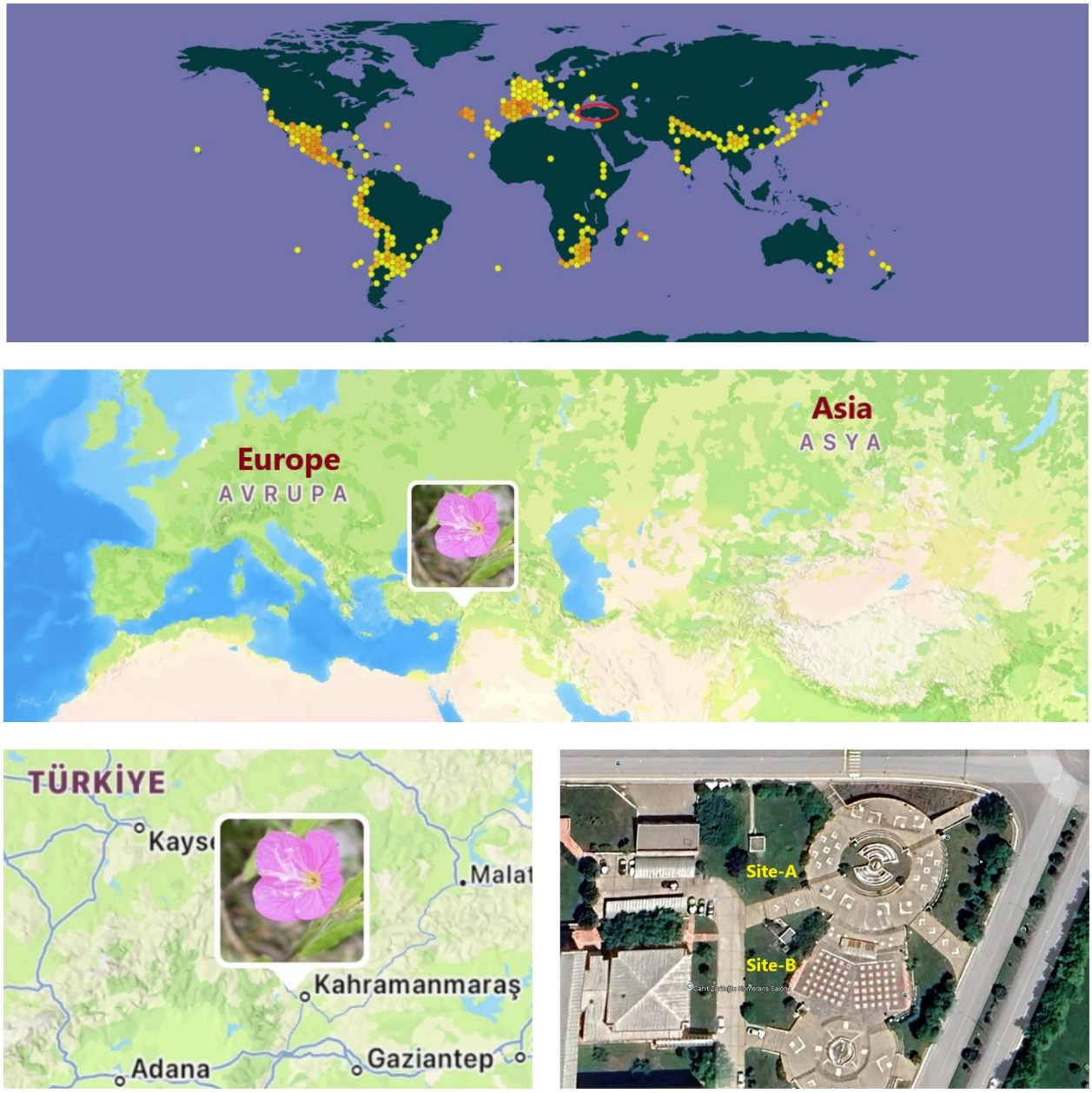


Figure 4. World distribution and the new location of *Oenothera rosea* in Türkiye, KSU (Uzun 2215 & Pal.-Uzun) (GBIF 2025; Google Earth 2025).

are more prominently and broadly winged, in contrast to the merely angled capsules seen in *O. speciosa*.

Revised diagnostic key to Oenothera species in Türkiye

(adapted from Uzun and Verloove 2023)

1. Corolla pink or purple. Capsule valves sharply angled, winged and ridged..... ***Oenothera rosea***
–. Corolla yellow. Capsules unwinged..... 2
2. Stem, rachis and ovaries with red bulbous-based hairs. Petals 30–50 mm long; cultivated species, sometimes escaping..... ***O. glazioviana***
–. Red bulbous-based hairs absent..... 3

3. Hypanthial tube (60–)80–120(–160) mm long. Stigma elevated above anthers at anthesis..... ***O. jamesii***
–. Hypanthial tube 11–35 mm long. Stigma surrounded by or below anthers at anthesis..... 4
4. Petals 20–30 mm long. Hypanthial tube 25–35 mm long. Seeds prismatic. Stem erect..... ***O. biennis***
–. Petals 6–15 mm long. Hypanthial tube 11–13 mm long. Seeds rotund. Stem often decumbent..... ***O. parodiana***

Occurrence of O. rosea in Türkiye and beyond

New record

Tu (A), Türkiye (Asiatic part): Kahramanmaraş Province, Onikişubat district, Kahramanmaraş Sütçü İmam University, Avşar Campus, Site-A (37°35′14.90″N, 36°49′09.03″E) 530 m (area of occupancy: 840 m^2), Site-B (37°35′14.23″N, 36°49′09.02″E) 533 m (area of occupancy: 275 m^2). Flowering and fruiting material was collected by Uzun (2215) on 13 May 2025 and by Pal.-Uzun (KASOF 1323) on 21 May 2025.

More than 250 individuals with a dwarf habit and very tiny flowers were counted at two adjacent sites (total A.O.O.: 1115 m^2), thriving in moist grassy habitats among perennial herbaceous species such as *Plantago lanceolata* L., *Trifolium repens* L., *Coronilla scorpioides* W.D.J.Koch, *Anthyllis circinnata* (L.) D.D.Sokoloff, and *Veronica persica* Poir. (Figure 1).

This finding suggests that the species may be considered a new addition to the Turkish flora. From this initial introduction, it is likely to spread to surrounding provinces and potentially to neighboring countries such as Iraq and Syria.

Native and introduced range

Oenothera rosea is native to central and southern Texas through Mexico and Central America to El Salvador, and widely across South America (Flora of North America Editorial Committee 2021). According to POWO (2025), it is also native to parts of Argentina, Chile, Colombia, and the Caribbean.

Over the last decades, *O. rosea* had been introduced in a wide range of regions, including Pakistan (Stewart 1972), South Africa (Frean et al. 1997), India (Paul 1998), France (Rostański et al. 2010), Germany (Rostański et al. 2010), Spain (Rostański et al. 2010), Belgium (Rostański and Verloove 2015), Algeria (Meddour et al. 2020), Japan (Egawa and Koyama 2023), and China (Hao and Ma 2023), often in warm climates. Recently, it has expanded its distribution to many other countries, including Korea (Kim et al. 2014), the island of Madeira in Portugal (Gonçalves Silva and Ferreira 2019), Brazil (da Cunha et al. 2024) and the Maltese Islands (Tavilla and

Lanfranco 2025). It is now also listed in the alien plant checklist for Crete (Verloove 2024).

Possible introduction pathway in Türkiye

Notably, many of the world's *Oenothera* species have become naturalized outside their native ranges, mostly via human-mediated pathways (Pyšek et al. 2017). The origin of the Turkish population is not yet fully clarified. In 2018, a survey of the university (KSU) campus flora (Uzun et al. 2018) identified 279 taxa, one of which was *Oenothera lindheimeri* (Engelm. & A.Gray) W.L.Wagner & Hoch, used as an ornamental plant, but *O. rosea* has never been encountered to date. This suggests either a very recent first introduction or that earlier populations went unnoticed.

Interviews with university groundskeepers revealed no knowledge of the plant's origin. Given the plant's small size and delicate structure, it is likely that seeds arrived unintentionally, possibly through contaminated soil or horticultural material rather than deliberate planting. University campuses are known to serve as potential initial entry points and sites of establishment for alien plants (Nelufule et al. 2024).

An alternative or complementary dispersal route could be avian-mediated seed dispersal, as some recent studies increasingly associate such alien plant distributions with migratory bird routes (Uludağ et al. 2024). Kahramanmaraş lies along major migratory bird routes between Europe and Africa (Biró et al. 2006) and serves as a natural crossroads for the movement of vehicles, people, and various organisms, including birds, plants, and mammals (Davis 1971; Uzun and Verloove 2023).

Records of Oenothera species in Türkiye

The genus *Oenothera* is not native to Türkiye but is steadily increasing in diversity:

- First record of *O. biennis* (Chamberlain 1972).
- Later additions: *O. glazioviana*, *O. parodiana*, *O. jamesii* (Güzel 2012; Yüzbaşıoğlu 2014; Uzun and Verloove 2023, respectively).
- Now joined by *O. rosea*, raising the total to five taxa.

Currently, only *O. biennis* is classified as invasive, while the others are considered naturalized. Future introductions of *O. depressa* Greene and *O. rubricaulis* Kleb. (Protopopova et al. 2006), *O. parviflora* L. and *O.* × *fallax* Renner (Medvecká et al. 2012), *O. villosa* Thunb. (Pliszko and Woźniak-Chodacka 2015), *O.* × *albipercurva* Renner ex Hudziok (Woźniak-Chodacka 2015), *O. speciosa* (Alkhesraji et al. 2016), *O. laciniata* Hill (Martínez Flores et al. 2012; Gena et al. 2018; Mahklouf 2016), and *O. indecora* Cambess. (Moradi and Mahdavifikajor 2022) are plausible, due to Türkiye's geographic position as a biogeographic crossroad.

Although the number of newly recorded alien plant species in Türkiye has increased in recent years (Terzioğlu 2020; Coşkunçelebi and Terzioğlu 2022; Terzioğlu and Coşkunçelebi 2022; Tunçkol 2022; Sefalı and Uzun 2023; Uzun and Verloove 2023; Merrick et al. 2024), the country still ranks within the 251–500 range globally in terms of total alien plant taxa (Pyšek et al. 2017). According to national floristic sources and recent alien plant checklists, Türkiye currently harbors at least 380 non-native taxa (Güner et al. 2012; Uludağ et al. 2017).

Phytochemical and medicinal significance

Members of Onagraceae family are rich in secondary metabolites, including triterpenoids, steroids, saponins, essential oils, flavonoids, and over 170 phenolic compounds (Munir et al. 2017; Shawky et al. 2021). *Oenothera* species are cultivated for medicinal purposes, particularly for their seeds, which contain gamma-linoleic acid and other biologically active oils (Greiner and Köhl 2014). Specifically, *O. rosea* has shown preventive potential against gastric cancer in experimental studies, with a high therapeutic index (Almora-Pinedo et al. 2017). The polarity of the solvents used to extract *O. rosea* metabolites influenced the total phenolic and flavonoid content, resulting in varying antioxidant and analgesic potentials (Márquez-Flores et al. 2009; Márquez-Flores et al. 2018). The plant's antinociceptive and anti-inflammatory effects are particularly associated with the presence of essential fatty acids, especially those obtained from the seeds of certain Onagraceae species, which are rich in linolenic and γ-linolenic acids (Pamplona 1997; Vargas-Ruiz et al. 2022). Moreover, the ethyl acetate extract reduced granuloma formation in a chronic inflammation model, demonstrating anti-inflammatory activity without inducing gastroduodenal damage (Márquez-Flores et al. 2018). Furthermore, the anti-arthritic effect of *O. rosea* hydroalcoholic extract and its isolated bioactive metabolites showed a significant reduction in paw edema and knee inflammation in mice (Vargas-Ruiz et al. 2020). In Mexico, where the species naturally occurs, *O. rosea* has also been reported to be used in folk medicine for skin diseases (bruises and wound healing), kidney and liver problems, as well as diarrhea and inflammatory conditions (Márquez-Flores et al. 2009; Shawky et al. 2021). Although further studies are needed to elucidate the mechanisms underlying *O. rosea*'s effects, these results confirm its potential as a medicinal plant and suggest its use in treating pain- and inflammation-related conditions (Márquez-Flores et al. 2018). Therefore, its global distribution is likely driven more by medicinal and aromatic values rather than purely ornamental appeal.

Conclusions

This paper reports the first confirmed record of *Oenothera rosea* in Türkiye (Southwest Asia), discovered serendipitously during a campus walk. As the species has not been previously documented in the Turkish

flora, this finding adds a new alien element to the country's vascular plant diversity and raises the number of *Oenothera* species known from Türkiye to five. Moreover, this study documents a new range expansion of *O. rosea* beyond its native range in the Americas and previously known occurrences in Europe, Africa and East Asia, contributing to a broader understanding of its global distribution.

The continuous increase in alien plant records in Türkiye reflects the growing mobility of species and the diversification of introduction pathways. This is the second record of a naturalized *Oenothera* species in Kahramanmaraş province, following *O. jamesii*. Despite the rising number of unintentional introductions of alien plants, studies on the distribution, ecological characteristics, and potential impacts of non-native species in Türkiye remain limited. In particular, scientific data concerning the role of global climate change in facilitating these introductions are scarce. Given the anticipated increase in naturalized and invasive alien plants, there is an urgent need for more detailed ecological and biogeographical studies.

The findings of this study contribute valuable baseline data for future distribution modelling of *Oenothera* species in Türkiye and may support broader efforts to understand their spreading strategies and ecological interactions in newly colonized environments.

Authors' contribution

A.U. and S.P.U. – plant and data collection; F.V. – taxonomical examination; A.U., S.P.U. and F.V. – research conceptualization, sample design and A.U., S.P.U. and F.V. – draft of manuscript. All authors discussed the results and commented on the manuscript.

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Supplementary material

The following supplementary material is available for this article:

Appendix 1. Representative specimens of *O. rosea*.

This material is available as part of online article from:
http://www.reabic.net/journals/bir/2026/Supplements/BIR_2026_Uzun_etal_SupplementaryMaterial.pdf