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First record of *Petrorhagia dubia* (Raf.) G. López & Romo (Caryophyllaceae) in Lombardy

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Abstract - During floristic surveys conducted between May and June 2025 at the former industrial area of *La Goccia*, in the Bovisa district of Milan, a naturalized population of *Petrorhagia dubia* was discovered, a plant previously unreported for Lombardy. The species, native to the Mediterranean region and introduced in several continents, was found in ephemeral grasslands at the edges of abandoned paved areas. The species is described in detail, with particular focus on the features that distinguish it from *P. prolifera*, a very common species in Lombardy with which it can easily be confused. This finding contributes to improving knowledge of the urban flora of Milan.
Key words: Milan, secondary distribution, urban flora.

Riassunto - Prima segnalazione di *Petrorhagia dubia* (Raf.) G. López & Romo (Caryophyllaceae) in Lombardia.
Nel corso di indagini floristiche condotte tra maggio e giugno 2025 presso l'ex area industriale de *La Goccia*, nel quartiere Bovisa di Milano, è stata rinvenuta una popolazione naturalizzata di *Petrorhagia dubia*, una pianta mai segnalata in Lombardia. La specie, originaria dell'area mediterranea e diffusa in vari continenti con popolazioni secondarie, è stata osservata in prati effimeri ai margini di aree asfaltate abbandonate. Viene fornita una descrizione dettagliata della specie, con particolare attenzione ai caratteri che permettono di distinguerla da *P. prolifera*, specie molto comune in Lombardia e facilmente confondibile con essa. Il ritrovamento arricchisce le conoscenze floristiche regionali e della flora urbana di Milano.
Parole chiave: Distribuzione secondaria, flora urbana, Milano.

Petrorhagia dubia (Raf.) G.López & Romo (≡ *Dianthus dubius* Raf. = *Dianthus velutinus* Guss. ≡ *Petrorhagia velutina* (Guss.) P.W.Ball & Heywood) (Caryophyllaceae) is a Mediterranean species with a fragmented distribution extending from the Iberian Peninsula in the west to the Mediterranean coasts of western Asia in the east (Jalas & Suominen, 1986; Ball & Akeroyd, 1993; Kaplan *et al.*, 2021). Introduced populations are known in the U.S.A. (California, Oklahoma, Texas, and Hawaii), as well as in Australia, South Africa, Chile, Czech Republic, and southern England (Rabeler, 1985; Green, 1994; Zuloaga *et al.*, 2008; Stace, 2010; Frohlich & Lau, 2012; Kaplan *et al.*, 2021). This plant generally grows in ruderal pastures, dry wastelands, and rocky sites, preferably on sandy soils, from 0 to 600 m a.s.l. Introduced populations in the U.S.A. are reported to grow mainly along roadsides with little evidence of invasion of nearby native communities (Rabeler, 1985).
We observed *P. dubia* during fieldwork conducted in May – June 2025 at *La Goccia* former industrial site, in Bovisa district of Milan (Lombardy) (Fig. 1), where different populations of *P. prolifera* were also previously reported (G. Galasso personal communication). This area once hosted an energy production facility and served as a major industrial hub which was abandoned by the late 1990s. The entire site is characterized by heavily contaminated and sealed soils and is currently being

investigated within the framework of a European Urban Initiative (EUI) project (https://eui-goccia.eu/).

Petrorhagia dubia is a scapose therophyte of 10–40 cm tall, with erect, typically unbranched stems. The middle internodes are usually covered with glandular hairs, although Rabeler (1985) observed glabrous specimens both in the U.S.A. and in Italy, suggesting that this character is not consistently diagnostic. Leaves are opposite and linear, 1(–2)×30(–45) mm, with smooth margins and no stipules. They present sheaths with a long basal fusion, amplexicaul, 3.5–9.0(–10.0) mm long, 2–3 times as long as wide, with scarious margins. Inflorescences appear in compact apical cymes with 2 or more subsessile hermaphroditic flowers, sometimes with a single flower, which open one at a time. The calyx (8–14 mm), gamosepalous and tubular, is surrounded by an involucre of appressed and scarious bracts (epicalyx). These are broadly ovate, all mucronate, the outer ones ending in a thin point and completely enveloping the calyx or calyces in the group. The corolla is dialipetalous with 5 petals, 11–16 mm long, bright pink or purplish, rarely white, narrowed into a long claw, obcordate or bifid, generally with 3 marked veins per petal. The flowers have 10 stamens and 2 styles. The ovary is superior. The fruit is an ovoid capsule dehiscing by 4 teeth, containing numerous seeds measuring 1.0–1.4 mm, very concave and tuberculate on the dorsal side with conical papillae, black when mature (Rabeler, 1985; Romo, 1990; Pignatti *et al.*, 2017).

Seven taxa belonging to the genus *Petrorhagia* are currently recorded in Italy: *P. dubia*, *P. glumacea* (Chaub. & Bory) P.W.Ball & Heywood [alien], *P. nanteuilii* (Burnat) P.W.Ball & Heywood, *P. obcordata* (Margot & Reut.) Greuter & Burdet [alien], *P. prolifera* (L.) P.W.Ball & Heywood, *P. saxifraga* (L.) Link subsp. *gasparrinii* (Guss.) Pignatti ex Greuter & Burdet, and *P. saxifraga* (L.) Link subsp. *Saxifraga* (Bartolucci *et al.*, 2024; Galasso *et al.*, 2024). Most taxa are distributed near the Mediterranean basin. Until now, only *P. saxifraga* subsp. *saxifraga* and *P. prolifera* had been reported for Lombardy (Bartolucci *et al.*, 2024).

Specimina visa:

Italia; Lombardia; MI; Milano; Bosco La Goccia, zona degli ex gasometri tra Via M. Pacuvio e Via S. Siccoli (coord. geogr. WSG84: 45.504994N, 9.150527E), margini erbosi aridi, 136 m, no exp., leg. *L. Quaglini*, det. *L. Quaglini & G. Galasso*, 15/05/2025 (MSNM barcode MSNM54426); *ibidem* (coord. geogr. WGS84: 45.505474N, 9.149871E), margini erbosi aridi, 134 m, no exp., leg. *L. Quaglini*, det. *L. Quaglini & G. Galasso*, 21/05/2025 (MSNM barcode MSNM54427); *ibidem* (coord. geogr. WGS84: 45.505474N, 9.149871E), margini erbosi aridi, 134 m, no exp., leg. *L. Quaglini*, det. *L. Quaglini & G. Galasso*, 03/06/2025 (MSNM barcode MSNM54428); *ibidem* (coord. geogr. WGS84: 45.505489N, 9.149398E), margini erbosi aridi, 134 m, no exp., leg. *G. Galasso*, det. *G. Galasso & L. Quaglini*, 05/06/2025 (MSNM barcode MSNM54424); *ibidem* (coord. geogr. WGS84: 45.505474N, 9.149871E), margini erbosi aridi, 134 m, no exp., leg. *L. Quaglini*, det. *L. Quaglini & G. Galasso*, 12/06/2025 (MSNM barcode MSNM54339).

The specimens were identified according to Romo *et al*. (1990), Tison & de Foucault (2014), and Pignatti *et al.* (2017). A large population (>100 individuals) grows in ephemeral meadows near lawn grasslands and abandoned asphalted roads. These habitats are characterized by a species-rich assemblage of ruderal and dry grassland species, dominated by annuals and short-lived perennials, such as *Achillea collina* (Becker ex Wirtg.) Heimerl, *Anisantha sterilis* (L.) Nevski, *Bromus hordeaceus* L. subsp. *hordeaceus*, *Cerastium glomeratum* Thuill., *Clinopodium nepeta* (L.) Kuntze subsp. *spruneri* (Boiss.) Bartolucci & F.Conti, *Daucus carota* L. subsp. *carota*, *Festuca myuros* L. subsp. *myuros*, *Hypochaeris radicata* L., *Potentilla argentea* L., *Rumex acetosella* L., and *Trifolium campestre* Schreb.

The population of *P. dubia* observed at *La Goccia* site consisted entirely of individuals with pubescent internodes (Fig. 2). Notably, it occurred at one of the same locations where *P. prolifera* was previously observed. Weekly monitoring of the site revealed a clear phenological shift between these two similar species: *P. dubia* began flowering in mid-May, whereas flowering in *P. prolifera* was first observed approximately one month later, by which time *P. dubia* had already entered the fruiting stage.

Petrorhagia prolifera and *P. dubia* are morphologically similar species, but they can be reliably distinguished based on a combination of vegetative and reproductive characters. In *P. prolifera*, the sheath is about as long as it is wide, the stem is glabrous, and the leaf margins are clearly denticulate. The petals are pale pink, and the seeds are reticulate. In contrast, *P. dubia* typically has a sheath that is 2–3 times longer than wide with scarious margins, and the central part of the stem is generally densely covered with glandular hairs. The leaves lack marginal teeth, and each petal usually shows three marked veins. Furthermore, the seeds are characterized by the presence of cylindrical papillae rather than a reticulate surface (Fig. 2).

The discovery of *P. dubia* in the former industrial area of *La Goccia* represents the first record of this species in Lombardy and a significant addition to its flora. In the same area, the lichen *Bacidina adastra* (Sparrius & Aptroot) M.Hauck & V.Wirth (Ramalinaceae), also newly reported for Lombardy, was identified (Ravera *et al.*, 2023). These findings underscore the role of urban environments as reservoirs of floristic diversity (Martignoni *et al.*, 2019; Toffolo *et al.*, 2021; Gentili *et al.*, 2023). Given the ongoing transformations of urban landscapes, especially in post-industrial contexts, further floristic surveys are crucial to detect unnoticed species and monitor the dynamics of plant communities. These new discoveries highlight the importance of detailed fieldwork even in overlooked or heavily altered areas for understanding current biodiversity patterns and to update regional floristic inventories.

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Competing interest

The authors declare that they have no competing interests.

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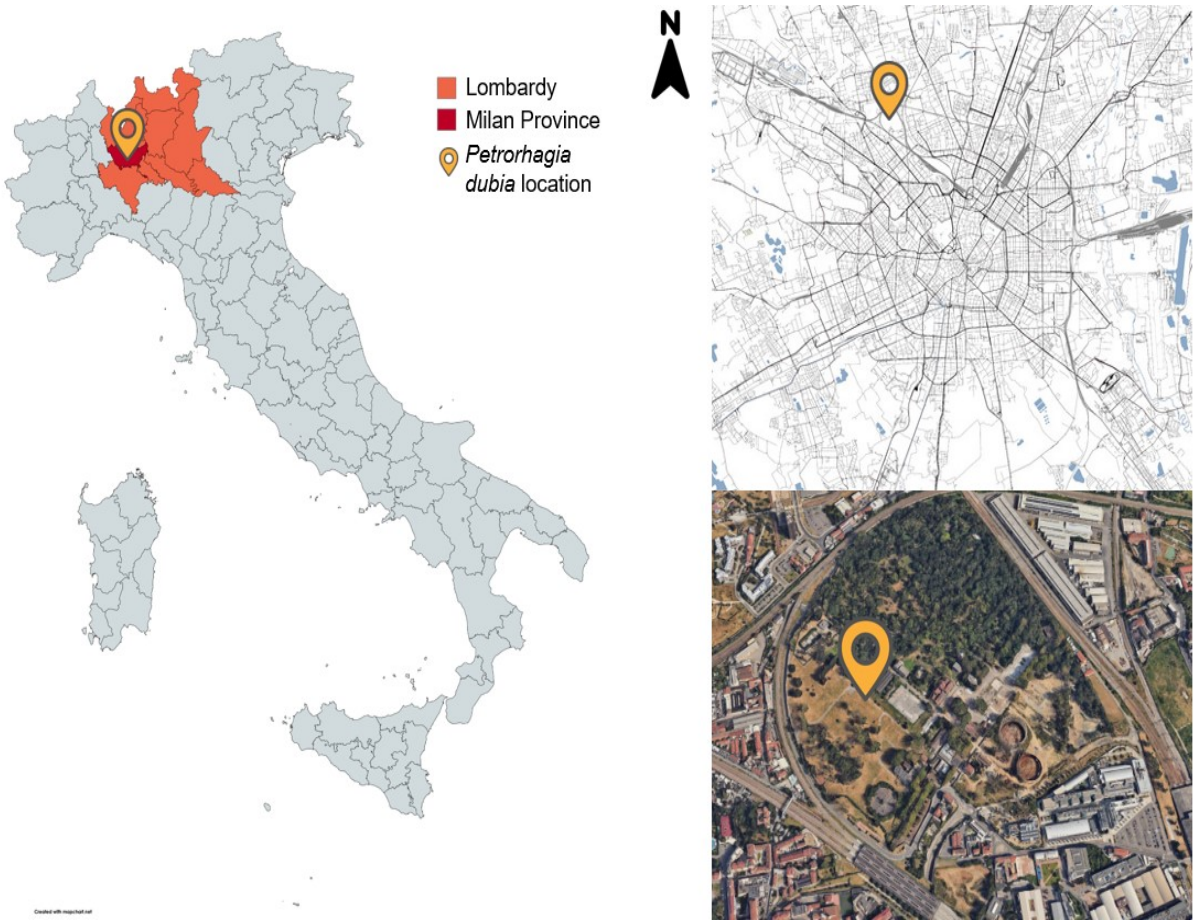

Fig. 1 – Location of the population of *Petrorhagia dubia* found at *La Goccia* former industrial site in Milan, Lombardy (Italy). / Localizzazione della popolazione di *Petrorhagia dubia* rinvenuta presso l'ex sito industriale de *La Goccia* a Milano, in Lombardia (Italia).

Fig. 2 – Flowering specimen images of (A) *Petrorhagia prolifera*, and (B) *Petrorhagia dubia*, highlighting the diacritical characters: (I) pale pink petals in *P. prolifera*, bright pink to purplish petals, usually with three marked veins in *P. dubia*; (II) sheath approximately as long as wide and leaf margin denticulate in *P. prolifera*, sheath 2–3 times longer than wide and entire leaf margin in *P. dubia*; (III) glabrous stem in *P. prolifera*, stem generally covered with glandular hairs in *P. dubia*; (IV) seeds reticulate in *P. prolifera*, seeds bearing cylindrical papillae in *P. dubia*. / Immagini di esemplari in fiore di (A) *Petrorhagia prolifera* e (B) *Petrorhagia dubia* che evidenziano i caratteri diacritici: (I) petali di colore rosa pallido in *P. prolifera*, petali di colore da rosa brillante a violaceo, di solito con tre venature scure in *P. dubia*; (II) guaina circa lunga quanto larga e margine fogliare denticolato in *P. prolifera*, guaina 2–3 volte più lunga che larga e margine fogliare intero in *P. dubia*; (III) fusto glabro in *P. prolifera*, fusto generalmente ghiandoloso in *P. dubia*; (IV) semi reticolati in *P. prolifera*, semi con papille cilindriche in *P. dubia.* (Photo / Foto: Lara A. Quaglini).