

**PHLEUM ARENARIUM (POACEAE) IN THE VASCULAR FLORA OF ROMANIA**

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**Abstract:** In this paper, the occurrence of *Phleum arenarium* (Poaceae) is reported for the first time in the vascular flora of Romania, based on herbarium specimens. This is a psammophyte, native on the Mediterranean-Atlantic regions, where it usually grows on maritime sand dunes. We have identified a small population of this species among the unused railway lines from the Movileni-Șendreni train station (Galați county), on a sandy-stony ground. It is possible that it has been introduced here accidentally, by man, along the railway (and naval?) transport network. Based on current data, *P. arenarium* can be considered as a casual neophyte in Romania.

**Key words:** alien plants, neophyte, grasses, psammophytes, *Chilochloa* section

*Received: 06 January 2021 / Accepted: 09 August 2021*

**Introduction**

*Phleum* L. (Sp. Pl.: 59. 1753) is a small genus of Poaceae family which includes, depending on the various taxonomic approaches, between 15 (Barkworth 2007) and 20 species (Tzvelev 1983, 1999), most of which are native to Eurasia, especially in the Mediterranean region (El-Gazzar et al. 2013, Boudko 2014).

According to Valdés et al. (2009), in Europe and Mediterranean region there is a number of 17 species of *Phleum*, of which 10 occur as indigenous in Romania. Most species of *Phleum* reported from Romania so far (Șerbănescu & Nyárady 1972, Ciocârlan 2009, Humphries 2010, Valdés et al. 2009, Sârbu et al. 2013) are perennial plants (hemicryptophytes) and only two species are annual (therophytes), namely: *P. subulatum* (Savi) Asch. et Graebn. and *P. paniculatum* Huds. The first species belongs to the monotypic section *Achnodon* Griseb. (Scholz 1999), while the second one is part of the section *Chilochloa* (Beauv.) Griseb. (Humphries 2010).

In this paper we analyze the occurrence in Romania of a second annual species of *Phleum*, from the section *Chilochloa*, namely *Phleum arenarium* L.

**Material and methods**

The paper is a result of our recent field works (2020), in eastern Romania, on the lower course of the Siret river.

The geographic coordinates were recorded on the field using the offline navigation application OsmAnd, disponible at <https://osmand.net/>.

Voucher specimens were deposited in the Herbarium of the University of Agricultural Sciences and Veterinary Medicine Iași (IASI).

For species identification and nomenclature we followed *Flora Europaea* (Tutin et al. 2010a, b), but other references were also considered (Ovchinnikov 1934, Bergdolt

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et al. 1935, Pignatti 1982, Barkworth 2007, Valdés et al. 2009, Stace 2010, Verloove 2020 etc.).

### Results and discussion

***Phleum arenarium*** L., Sp. Pl.: 60. 1753 (Syn.: *Achnodon arenarius* Link; *Chilochloa arenaria* (L.) P. Beauv.; *Crypsis arenaria* Desf.; *Phalaris arenaria* (L.) Huds.). Section *Chilochloa* (Beauv.) Griseb.

**Distinctive features.** *Phleum arenarium* (Fig. 1) is easily distinguishable from other species of the genus by the following combination of characters (Ovchinnikov 1934, Bergdolt et al. 1935, Pignatti 1982, Conert 1983, Kula & Kutyna 2005, Barkworth 2007, Humphries 2010, Stace 2010): annual, 5-30 cm high; culm erect, with 1-4 nodes; leaf-sheaths inflated above; ligule rounded to acute, up to 3-5 mm long; leaf lamina of



Fig. 1. *Phleum arenarium*: a-herbarium specimens; b-spikelet; c-lemma and palea covering a cariopsis; d-cariopsis. Scale bar: 1 cm (a), 1 mm (b, c, d). Photo: C. Sirbu

2-6 cm × 2-4 mm; panicle dense, slightly lobed when bent (with short branches), tapered towards base, up to 5.5 cm long and 7 mm width; spikelets 2.2-4.4 mm long, glumes 3-veined, lanceolate, gradually narrowed into a short (0.3-1 mm) awn, long ciliate on the keel (in the upper half); rachilla prolonged, very short; lemma 1/3 as long as glumes, 5-veined, ± pubescent, dentate-truncate at the tip; palea subequal to the lemma; stamens 3, anthers 0.3-1 mm long; fruit brown, about 1 mm long, oblong-ovate to ellipsoidal.

*Phleum arenarium* differs from the other two annual species of the genus previously known in Romania (i.e. *P. subulatum* and *P. paniculatum*) (see Șerbănescu & Nyárády 1972, Ciocârlan 2009, Sârbu et al. 2013) especially by panicle obviously narrowed towards the base and glumes lanceolate, gradually narrowed into a short awn, long ciliate on the keel (as against glumes semi-elliptical, gradually narrowed into a short mucro, usually glabrous on the keel at *P. subulatum*, or swollen at apex, abruptly narrowed into a short awn, glabrous or scabrid on the keel at *P. paniculatum*). In addition, *P. arenarium* has shorter anthers (0.3-1 mm) than *P. subulatum* (1-1.5 mm), and much shorter lemma (1/3 as long as glumes) than *P. paniculatum* (2/3 as long as glumes).

Among the other species of *Phleum* reported so far in Romania, *P. hirsutum* Honck. and *P. montanum* C. Koch have also glumes gradually narrowed toward the apex (or rather obliquely truncated at *P. montanum*) and long ciliate on the keel. However, these two species are perennial, with non-flowering shoots at anthesis, have panicle truncated at the base, much longer lemma (2/3-3/4 as long as glumes) and longer anthers (over 1 mm) (Șerbănescu & Nyárády 1972, Ciocârlan 2009, Humphries 2010, Sârbu et al. 2013).

**Origin and general distribution.** According to the literature data (Ovkinnikov 1934, Bergdolt et al. 1935, Pignatti 1982, Ernst & Malloch 1994, Tzvelev 1983, 1999, Valdés et al. 2009, Humphries 2010), the natural area of *P. arenarium* includes the coastal regions of Atlantic and Mediterranean Europe, Crimea, Asia Minor and North-western Africa. It has also been reported on the Polish Baltic Sea coast (Ziarnek & Frey 2000) and, as a casual alien, from Lithuania (Valdés et al. 2009), Austria (Englmaier & Wilhelm 2018), Latvia (Roy et al. 2020), North America (under the bird-feeders and on ship ballasts) (Harris 1960) and Western Australia (Weiller et al. 2020). As well, according to Conert (1983) and Ernst & Malloch (1994), in continental Europe, *P. arenarium* naturally occurs on fluvial sand dunes of some rivers (e.g. the Rhine, Rhone, Senna), and recently (especially from 1950 onwards) it has been artificially expanded its range to inland sandy soils, mostly along the railway infrastructure.

**Distribution in Romania and historical considerations.** We identified this species in the village Movileni-Șendreni, Galați County, eastern Romania (N 45.403343; E 27.962366, 11 m a.s.l.; 22.07.2020; leg. & det.: C. Sîrbu & I. Șușnia), on the lower course of the Siret river.

The first mention of the species *P. arenarium* on the current territory of Romania was made by Baumgarten (1816), who reported it in the flora of Transylvania, as “*Phalaris arenaria*” (giving *Phleum arenarium* L., as a synonym), on sandy hills and slopes near Merghindeal (Morgonda), Sibiu County. Under the name of *Chilochloa arenaria* P. Beauv., the species was subsequently recorded in Transylvania, by Fuss (1866) and Schur (1866), who took location data of Baumgarten. However, according to Simonkai (1886), the plant indicated by Baumgarten in Transylvania actually belongs to the species “*P. viride* All.”, whose currently valid name is *P. paniculatum* Huds. In Moldova (eastern Romania), according to Brândză (1879-1883), *P. arenarium* was listed

(without a precise location) in the Szabo's manuscript (1873) on the flora of the Iași district. As this information was not validated neither by Brândză nor by other authors who later researched the flora of Moldova, it must be treated as uncertain. Subsequent to this data, the species has not been mentioned in Romania by any author (e.g. Prodan 1939, Borza 1947, Beldie 1979, Șerbănescu & Nyárády 1972, Oprea 2005, Ciocârlan 2009, Sârbu et al. 2013). As a result, leaving aside the doubtful data from the 19th century, Movileni-Șendreni remains the only locality in which *P. arenarium* has certainly been identified so far in Romania.

**Biology and ecology.** The biology and ecology of this species have been studied by many authors, and a comprehensive synthesis of these data has been published by Ernst & Malloch (1994). According to the literature, *P. arenarium* is a winter annual (Ernst & Malloch 1994), diploid ( $2n = 2x = 14$ ) (Ernst & Malloch 1994, Kula & Kutyna 2005, Humphries 2010), with a flowering time between early May to June, fully self-compatible, naturally dispersed starting the middle of June by shedding caryopses near the parent plants, and by the action of water or wind (Ernst & Malloch 1994). Caryopses can also be accidentally dispersed by man on long-distance (such as across the Atlantic), with ships ballast or as impurities in bird feed (Harris 1960). The occurrence of *P. arenarium* along railways in continental Europe (Ernst & Malloch 1994) suggests that rail transport of goods or passengers may also contribute to its long-distance dispersal. Seed germination begins in mid-June, but is maximum after a period of 1-2 months and is stimulated by exposure to light (Ernst & Malloch 1994).

From an ecological point of view, *P. arenarium* is a psammophilous species, heliophilous, mesothermophilous, of oceanic climate with mild winters, xerophilous, calcicolous, poorly tolerant to salinity, and usually grows on substrata poor in nitrogen and phosphorus (Conert 1983, Ellenberg et al. 1992, Ernst & Malloch 1994).

**Habitats and plant communities.** According to the literature (Ovchinnikov 1934, Pignatti 1982, Conert 1983, Tzvelev 1983, Ernst & Malloch 1994, Humphries 2010), the main habitats in which *P. arenarium* grows in the natural area are represented by maritime sand dunes. However, the species has also been reported on fluvial sand dunes or on inland sandy soils (Conert 1983, Ernst & Malloch 1994), as well as from man made habitats, such as uncultivated lands (Fanfarillo et al. 2019), waste lands in ports (Urbisz 2011), roadsides (Fanfarillo et al. 2019, Urbisz 2011), along the railway infrastructure (Conert 1983, Ernst & Malloch 1994) or on cultivated areas of gardens and parks (Roy et al. 2020).

In the natural area, the main plant associations in which *P. arenarium* occurs as dominant or codominant species are the *Bromo tectorum-Phleum arenarii* Korneck 1974, from the alliance *Sileno conicae-Cerastion semidecandri* Korneck 1974 (Central European annual open swards on stabilized base-rich inland sand dunes) (Conert 1983, Piccoli & Merloni 1989, Ernst & Malloch 1994) and *Tortula ruraliformis-Phleum arenarii* Br.-Bl. & De Leeuw 1936, from the alliance *Koelerion arenariae* Tx. 1937 corr. Gutermann & Mucina 1993 (open, low-growing vegetation colonizing semi-fixed temperate Atlantic calcareous dunes) (Boerboom 1960, De Raeve 1979, Ernst & Malloch 1994, Szwed & Sýkora 1996, Foucault 1999, Dengler 2004, Marcenò et al. 2016). It has also been reported from other psammophilous plant communities characteristic of sea dunes in the Mediterranean and Atlantic regions, belonging to various alliances, such as: *Syntrichio ruraliformis-Lomelosion argenteae* Biondi, Sbrulino

et Theurillat in Sburlino et al. 2013 (Sburlino et al. 2013, Marcenò et al. 2016); *Crucianellion maritimae* Rivas Goday & Rivas-Mart. 1958 (Ernst & Malloch 1994); *Euphorbio portlandicae-Helichryson stoechadis* Sissingh 1974 (Marcenò et al. 2016); *Linaron pedunculatae* Díez Garretas et al. in Izco et al. 1988 (Durán Gómez 2020). In addition, *P. arenarium* is quite common in some ruderal annual communities on the Mediterranean and Atlantic seaboard, such as: *Sileno conicae-Avellinietum michelii* Sburlino et al. 2013 (Sburlino et al. 2013) or *Bromo rigidi-Dasyphyretum villosi* Pignatti 1953 *brometosum diandri* Biondi et al. 1999 (Fanfarillo et al. 2019).

The ability of this species to thrive in ruderal communities from anthropogenic habitats in the native area could ensure its survival in similar habitats outside this area, such as eastern Romania. On July 22, 2020, we found a small population of *P. arenarium* consisting of about 20 dried individuals, in the dissemination phase, among the unused railway lines from the Movileni-Şendreni train station, on a sandy-stony substratum. The individuals of *P. arenarium* were scattered among other ruderal species, including many psammophytes, constituting a pioneer phytocoenoses with the following structure (numbers and signs in parenthesis are scores of abundance-dominance, according to the Braun-Blanquet scale): *Euphorbia glyptosperma* Engelm. (3), *Portulaca oleracea* L. (1), *Ambrosia artemisiifolia* L., *Anisantha tectorum* (L.) Nevski, *Anthemis arvensis* L., *Artemisia scoparia* Waldst. & Kit., *Cephalaria transsylvanica* (L.) Roem. & Schult., *Crepis foetida* L. subsp. *rhoeadifolia* (M. Bieb.) Čelak., *Echium vulgare* L., *Eragrostis minor* Host, *Erigeron canadensis* L., *Galium humifusum* M. Bieb., *Lepidium virginicum* L., *Linaria genistifolia* (L.) Mill., *Lolium perenne* L., *Phleum arenarium* L., *Plantago arenaria* Waldst. & Kit., *Potentilla argentea* L., *Tragus racemosus* (L.) All., *Xeranthemum annuum* L. (+).

**Introduction way.** As was pointed out above, *P. arenarium* can be accidentally dispersed on long-distance by man. Given that according to current data the species occurs in Romania only in anthropogenic habitats, it is quite obvious that it has been introduced here through human mediation. We suppose that the introduction in the country of this species of sea coasts could have been done accidentally via ships along the Danube, to the port of Galaţi, from where it could have reached the Movileni-Şendreni station (approx. 17 km away), along the railway

**Current status in Romania.** Based on current data, *P. arenarium* can be considered as a casual neophyte in the country. Although the species is not known as a threat anywhere, in or outside the natural area, the population from Movileni-Şendreni should be closely monitored in the future, for preventive purposes.

### Conclusions

*Phleum arenarium* L. (Poaceae), a psammophyte native in the Mediterranean-Atlantic regions, is reported in this paper for the first time in the spontaneous flora of Romania, based on herbarium specimens. This species has been identified in the Movileni-Şendreni train station (Galaţi county), on a sandy-stony ground. Based on current data, *P. arenarium* can be considered as a casual neophyte in Romania.

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