

## **POLYCARPON TETRAPHYLLUM IN ROMANIAN FLORA**

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### **Abstract**

This paper brings additional information about the red listed species *Polycarpon tetraphyllum* from the spontaneous flora of Romania. The research on this taxon started after the identification of a plant material collected from ruderal places of the municipality of Craiova (Dolj County). *Polycarpon tetraphyllum* is the only species belonging to the genus *Polycarpon* (Family Caryophyllaceae) that is spread on the Romanian territory. At European level, two species are known (*P. polycarpoides*, *P. tetraphyllum* with three subspecies: *P. tetraphyllum* sp. *tetraphyllum*; ssp. *diphyllum*; ssp. *alsinifolium*). In some European countries, including Romania, this plant is considered to be adventive. The plant analyzed by us in this paper is an Atlantic - Mediterranean taxon, located at the northern limit of the range, found in southern and eastern Europe. In Romania, it is known only from Mehedinți County (i.e. from the localities of Orșova and Vârciorova) and from Dolj County (Valea Stanciului and Craiova). Our research on this species focused on information related to chorology (literature, herbarium and field data), habitat and the phytosociological context in which it was mentioned in the literature and in which it was found in the last two years.

**Key words:** chorology, critically endangered, spontaneous flora, Romania.

### **INTRODUCTION**

The critically endangered species in Romania (category to which the taxon analyzed by the authors of the present paper also belongs) have drawn the attention of many specialists.

The genus *Polycarpon* L. comprises about thirty-six species that are present in the temperate and warm areas of the two hemispheres (Beldie & Váczy, 1976).

According to *Flora Europaea* (Chater, 1964), four species are known [*P. polycarpoides* (Biv.) Zodda, *P. tetraphyllum* (L.) L., *P. diphyllum* Cav. and *P. alsinifolium* (Biv.) DC.]. The first of them is perennial, while the other three are annual. The second edition of this scientific work (Chater & Akeroyd, 1993) treats the annual species as subspecies of *P. tetraphyllum* [*P. tetraphyllum* (L.) L. ssp. *tetraphyllum*; ssp. *diphyllum* (Cav.) O. Bolòs & Font Quer; ssp. *alsinifolium* (Biv.) Ball] and it is this version that the authors of this paper also accept.

In the flora of Romania, this genus is represented by the taxon *Polycarpon tetraphyllum* (L.) L. *Syst. Nat.* ed. 10.2: 881

(1759) subsp. *tetraphyllum* (Family Caryophyllaceae) (Chater, 1964, Beldie & Vaczy 1976). Its basionym is *Mollugo tetraphylla* L., Sp. Pl. 1: 89 (1753). It is a native taxon of the Atlantic-Circum-Mediterranean area and it is spread from Europe to Sri Lanka, Macaronesia, northern and northeastern tropical Africa, and the Arabian Peninsula (Figure 1) (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77224385-1#distributions>).

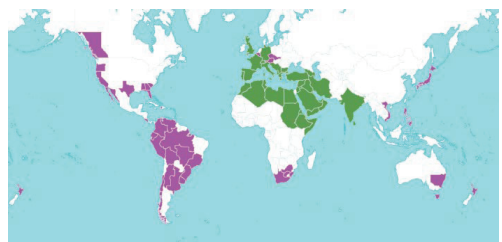


Figure 1. Distribution of the species *Polycarpon tetraphyllum*; green - native; purple - introduced (<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77224385-1#distributions>)

*Polycarpon tetraphyllum* (L.) L. subsp. *tetraphyllum* is an Atlantic-Mediterranean taxon

(Jalas & Suominen, 1983), with a northern distribution limit in Romania (Dihoru & Negrean, 2009), widespread in southern and western Europe, while in Belgium and the former Czechoslovakia it is found as an adventitious plant (Chater & Akeroyd, 1993). According to DAISIE, it is also adventive in other European countries (Austria, Czech Republic, Germany, Hungary, Holland, Slovakia, Slovenia, Romania, etc.). It was identified for the first time in the spontaneous flora of Romania by the botanist Iuliu Morariu and it was on that occasion that it also appeared in the specialized literature (Morariu, 1963). Subsequently, it is to be found in different field guides for the identification of spontaneous flora in Romania (Beldie, 1977; Ciocârlan, 2000; 2009; Sârbu et al., 2013). In the Romanian specialized literature, it is mentioned as endangered (Oprea, 2005), critically endangered (Oltean et al., 1994; Dihoru & Negrean, 2009; Negrean 2011; Schneider-Binder, 2014), possibly even extinct (Dihoru & Dihoru, 1994; Dihoru & Negrean, 2009). It is also mentioned from Vârciorova and from the former Ada-Kaleh island on the Danube (Roman, 1974), as well as in the Porțile de Fier [Iron Gates] region, but without specifying the settlement (Roman, 1972, in: Milcu et al., 1972). In Oltenia, it was identified in Craiova Municipality (Cârțu & Hulungă, 1987; Cârțu & Hulungă, 1989) and in Valea Stanciului settlement, both located in Dolj county (Răduțoiu & Costache, 2012).

## MATERIALS AND METHODS

The present research started from the identification of a plant material in Dolj County, in ruderal places, among the spaces left by the stones used to pave the alleys.

The authors carried out a follow-up of the adaptation of this species to the conditions imposed by the places where it grows (high temperature, dryness both in the soil and in the atmosphere, pollution, noise stress, etc.).

A few specimens were collected in order to conduct a correct identification based on the botanical literature. Most of the identified specimens were also photographed. Some of them are also inserted in the present work.

The determination of the collected material was carried out using the specialized Romanian and

foreign literature (Beldie & Váczy 1976; Chater 1964; Chater & Akeroyd 1993; Beldie 1977; Chater & Akeroyd 1993; Ciocârlan, 2000; 2009; Dihoru & Negrean, 2009; Sârbu et al., 2013). The voucher specimens were stored in the herbarium of the University of Craiova (CRA) (Figure 2) and in that of the "Alexandru Ioan Cuza" University of Iași (I). The authors consulted the main herbaria in the country: Iași ("Alexandru Ioan Cuza" University Herbarium - I), Cluj-Napoca ("Babeș-Bolyai" University Herbarium in Cluj-Napoca - CL), Bucharest (Herbarium of the Institute of Biology of the Romanian Academy - BUCA; Herbarium of the University of Agricultural Sciences and Veterinary Medicine in Bucharest - BUCAG, Herbarium of the "D. Brândză" Botanical Garden in Bucharest - BUC), Craiova (Herbarium of the University of Craiova - CRA), Galați (Herbarium of the Galați Museum of Natural Sciences - GLHM), Timișoara (Herbarium of the University of Timișoara TIM). The acronyms of consulted herbaria are in accordance with Index Herbariorum (Thiers, 2022+).



Figure 2. Herborized plant material with *Polycarpon tetraphyllum*, included in the CRA herbarium

## RESULTS AND DISCUSSIONS

The comparative analysis of data collected from the specialized literature, from Romanian herbaria and from personal observations in the field enabled the authors to obtain information that contributes to the enhancement of

chorological and phenological data related to the taxon *Polycarpon tetraphyllum* ssp. *tetraphyllum* from Romania.

**Short history.** In the specialized literature, this species is mentioned for the first time by Schur (1866) in Transylvania (near Cluj, in the Transylvanian Plain), this information being in accordance with Lerchenfeld's herbarium, 1870 (data disputed by Simonkai 1886) (Sirbu & Oprea, 2011). D. Mititelu collected the species for the first time and deposited it in a public herbarium; the respective herbarium specimen was collected from Orșova (Mehedinți county) on July 20, 1962 (herbarium I, sheet no. 186660). However, the first publication in which the species *Polycarpon tetraphyllum* from Romania appears is the one elaborated by Morariu, who mentions the species from Orșova, Mehedinți county (Morariu, 1963; Beldie & Vaczy, 1976). In this respect, evidence is given by the herbarium sheets with this plant species collected by the author, stored in the herbarium of Cluj-Napoca (CL), or collected by D. Mititelu (1962) and deposited in the herbarium of the "Alexandru Ioan Cuza" University in Iași (I). In Orșova (Mehedinți County), the species grows in uncultivated, ruderal, sunny places, among trees and on the side of the streets (Morariu, 1963; Ciocârlan 2000; 2009). In the Romanian herbaria, there are herbarium sheets with this plant also collected by: Vicol & Schneider (1968) and Roman (1968) from Ada-Kaleh Island (material existing in the herbarium of "Babeș-Bolyai" University in Cluj-Napoca (CL) and, respectively, in the herbarium of the "D. Brândză" Botanical Garden in Bucharest - BUC (Popescu, 1968) and from Orșova (material existing in the BUCA herbarium), as well as by Costache and Răduțoiu (2010) from Valea Stanciului settlement in Dolj county.

In recent times, it has been also identified as follows:

- near the Mraconia Monastery, Mehedinți County, on the left bank of the Danube, on the side of the Orșova - Baziaș road (August, 2020, leg. Adrian Oprea, personal herbarium);
- in Calafat (leg. Dino Marchetti, personal communication, 2017);
- in Craiova, in the "Nisipuri" cemetery (Cârțu & Hulungă, 1987; Cîrțu & Cârțu, 1989; Negrean, 2011).

**Taxonomy.** *Polycarpon tetraphyllum* ssp. *tetraphyllum* is a taxon that differs from the other subspecies, irrespectively ssp. *diphyllum* and spp. *alsinifolium* taxa present in the flora of Europe through the following characteristics: leaves without purple shades, lax inflorescence, with visible ramifications and sepals less than 2 mm long.

The main discriminating features found in the material collected by us are the following: short plant, with a strongly branched stem (Figure 3) on which there are obovate leaves, usually four at a node. The inflorescence is loose, strongly branched, with visible branches. The flowers are small, with petals shorter than the sepals, hyaline and emarginate.

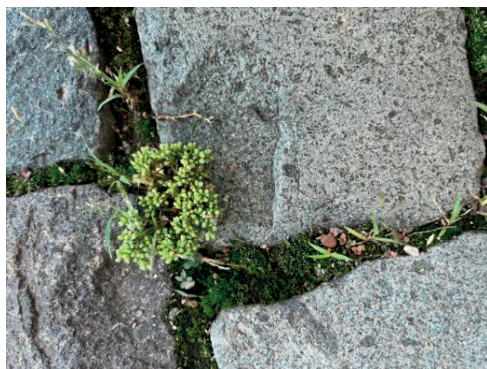


Figure 3. Physiognom/habitus of *Polycarpon tetraphyllum* in the areas where it was identified

**Biology.** It is an annual-perennial plant, hexaploid,  $2n=54$  (Ciocârlan, 2000), which blooms from June to September. During fieldwork, we noticed that along with the climate changes, the anthesis period has also changed; thus, in the field, we also found flowering specimens in November.

#### **Habitat and coenology**

It is a species that prefers anthropophilic habitats or those where humans exert a strong influence on their floristic composition. The analysis of the areas where this plant was identified leads to the conclusion that it is a heliophilous, thermophile taxon, which does not tolerate competition with other species and, therefore, it prefers ruderal places or those with different degrees of anthropization (Figure 4).

During the first year of observation (2021), the species was growing alone or accompanied by *Arenaria serpyllifolia* L., *Sagina procumbens* L.

and *Bryum argenteum* Hedw. and during the second year, the authors found that the analyzed plant developed very well, expanding its range. In the places where it was identified, the plant grows alongside a few species: *Arenaria serpyllifolia* L., *Stellaria media* L., *Polygonum aviculare* L., *Eragrostis minor* Host, *Bryum argenteum* Hedw., *Veronica hederifolia* L., *V. persica* Poir., *Sagina procumbens* L., *Euphorbia maculata* L.



Figure 4. Habitat of the species *Polycarpon tetraphyllum*

In most phytosociological studies on the vegetation, this taxon is mentioned as belonging to the class *Plantaginetea majoris* Tx. et Prsg. 1950 (Dihoru & Negrean, 2009; Sârbu et al., 2013; Schneider-Binder, 2014; Sanda et al., 2003). The analysis of the places where this species was observed and studied justifies our opinion that the vegetation of these surfaces evolves towards the association *Sagino-Bryetum argentei* Diemont, Siss. et Westhoff 1940.

**Chorology.** The distribution maps of the species were obtained by using the *Corolog 2010* program, realized in the Institute of Biology Bucharest and authored by Sorin Ștefănuț. The program uses an Access database, with information originating in the specialized literature, in herbaria and in the field, as well as two types of maps, i.e. the map of average annual temperatures in Romania (Figure 5) and the map of average annual precipitation in Romania (Figure 6).

## CONCLUSIONS

Along with a brief history, taxonomy, biology, habitat and coenology information, the paper also presents chorological data originating in the

botanical literature, herbarium collections and personal observations in the field, which are also represented on two maps that show correlations with average annual temperatures and precipitation amounts. Thus, the present paper contributes to a better understanding of the chorology and phenology of the species.

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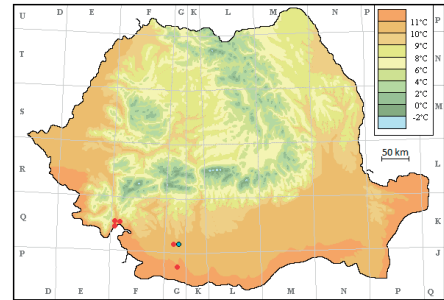


Figure 5. Distribution of the species *Polycarpon tetraphyllum* in Romania, correlated with the average annual temperatures

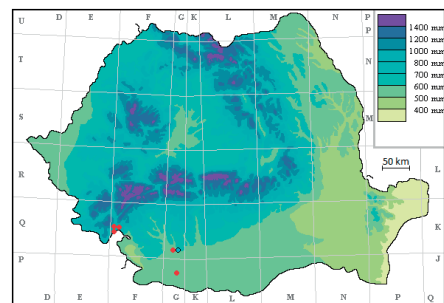


Figure 6. Distribution of the species *Polycarpon tetraphyllum* in Romania, correlated with the average annual precipitation

## REFERENCES

- Beldie, Al., Váczy, C. (1976). Taxoni noi pentru flora României, publicați după editarea volumelor respective din “Flora R.S.R.”, 13: 35-53. In: Săvulescu



- Tr. (edit.), Pop E. (coord.). *Flora României*. Edit. Acad. Române.
- Beldie, Al. (1977). *Flora României. Determinator ilustrat al plantelor vasculare*. 406, pp. Vol. I. Edit. Acad. Rom. București.
- Cârțu, D., Hulungă M. (1987). *Polycarpon tetraphyllum* (L.) L. In: Index Semin. Universitas Craiovensis. Hortus Botanicus, 30: 32.
- Cârțu, D., Cârțu M. (1989). *Polycarpon tetraphyllum* (L.) L. In: Index Semin. Universitas Craiovensis. Hortus Botanicus, 31/1988/: 61.
- Chater, A.O. (1964). *Polycarpon*. In: T. G. Tutin, V. H. Heywood, N. A. Burges, D. H. Valentine, S. M. Walters & D. A. Webb (Eds.). *Flora Europaea*. Vol. I. pp. 153. Cambridge: Cambridge University Press.
- Chater, A. O. & Akeroyd, J. R. (1993). *Polycarpon*. In: T. G. Tutin, N. A. Burges, A. O. Chater, Edmondson J. R., V. H. Heywood, D. M. Moore, D. H. Valentine, S. M. Walters & D. A. Webb (Eds.). *Flora Europaea*. Vol. I. Pp. 184-185. Cambridge: Cambridge University Press.
- Ciocârlan, V. (2000). *Flora ilustrată a României. Pteridophyta et Spermatophyta*. Edit. Ceres. București. 1038 pp.
- Ciocârlan, V. (2009). *Flora ilustrată a României. Pteridophyta et Spermatophyta*. Edit. Ceres. București. 1041 pp.
- Daisie (2009). *Handbook of Alien Species in Europe*. Springer Science+Business Media B.V., 400 pp.
- Dihoru, G., Dihoru, Alexandrina (1994). Plante rare, periclitare și endemice în flora României – Lista roșie. *Acta Bot. Horti Bucurest.*: 173-197. București.
- Dihoru, G., Negrean, G. (2009). *Cartea roșie a plantelor vasculare din România*. Edit. Academiei Române. București. 630 pp.
- Jalas, J., Suominen, J. (ed.). (1983). *Atlas Florae Europaeae*. 6. Caryophyllaceae (Alsinoideae and Paronychioideae). 176 pp. Helsinki.
- Milcu, Șt.-M., Nicolăescu-Plopșor, C. S., Vulcănescu, R. & Ionescu, M. (coord.), Mutihac, V., Iancu, M., Banu, A., Orghidan, Tr., Negrea, Șt., Ștefureac, Tr., Ionescu, M., Pușcariu, V., Toniuc, N., Dumitrescu, H., Nicolăescu-Plopșor, C. D., Bujor, E., Surdu, B., Cicală, I., Constantinescu, N. N., Teaha, T., Vulcănescu, R., Ghinoiu, I., Simionescu, P., Ionescu, Gr., Curinschi, Gh. (red.). (1972). *Atlasul Complex "Porțile de Fier"*. Edit. Acad. R.S.R. 261 pp.
- Morariu, I. (1963). Două spermatofite noi pentru flora R.P.R. *Com. Acad. Rom.* XIII, nr. 5: 427-431.
- Negrean, G. (2011). Addenda to „Flora Romaniae” volumes 1-12. Newly published plants, nomenclature, taxonomy, chorology and commentaries (Part 1). *Kanitzia*, 18: 89-194.
- Oltean, M., Negrean, G., Popescu, A., Roman, N., Dihoru, Gh., Sanda, V. & Mihăilescu, S. (1994). Lista roșie a plantelor superioare din România. *Studii, Sinteze, Documentații de Ecologie*. Acad. Română: 5-52. București.
- Oprea, A. (2005). *Lista critică a plantelor vasculare din România*. Edit. Univ. “Alexandru Ioan Cuza”, Iași, 668 pp.
- Răduțoiu, D., Costache, I. (2012). Contribution to rare taxa chorology of the Romanian flora. Muzeul Olteniei Craiova. *Olenia. Studii și comunicări. Științele Naturii*. Tom. 28, no. 1: 37-40.
- RoBioAtlas, (2023). *Romanian Atlas Web App for Biology* - Open Access. Available online: <https://www.teon.ro/robioatlas/index.html> (accessed on 2023.3.8)
- Roman, N. (1972). Cartograme. Comentarii. Cormophyta: taxoni noi; taxoni rari. Pp. 161-162. În: *Atlasul complex „Porțile de Fier”*, Edit. Academiei R. S. România, București.
- Roman, N. (1974). *Flora și vegetația din sudul podișului Mehedinți*. 222 pp. Edit. Acad. Române, București.
- Sanda, V., Biță-Nicolae, C. D., Barabaș, N. (2003). *Flora cormofitelor spontane și cultivate din România*. 316 pp. Edit. ”Ion Borcea”, Bacău.
- Sârbu, I., Ștefan, N. & Oprea, A. (2013). *Plante vasculare din România. Determinator ilustrat de teren*. Edit. Victor B Victor, București, 1320 pp.
- Sîrbu, C., Oprea, A. (2011). *Plante adventive în flora României*. Iași: Edit. “Ion Ionescu de la Brad”. 734 pp.
- Schur, Ph. J. F. 1866. *Enumeratio Plantarum Transsilvaniae exhibens: stirpes phanerogamas sponte crescentes atque frequentius cultas, cryptogamas vasculares, characeas, etiam muscos hepaticasque*. Vindobonae, G. Braumüller, 984 pp. + 18 pp. intr.
- Schneider-Binder, E. (2014). Phytogeographical importance of the mountains along the Danube mountain gap valley and surrounding area. *Transylvanian Review of Systematical and Ecological Research*, 16(3), 11-28.
- Simonkai, L. (1887) (“1886”). *Erdély edényes Flórájának helyesbített Foglalata (Enumeratio Florae Transsilvanicae vesculosae critica)*. Ex mandato Societas Scientiarum Naturalium Regiae Hungaricae. Budapest: Kiadja a Kir. Magyar Természettudományi Társulat. Franklin-Társulat könyvsajtója. i-xlix + 1-678.
- Thiers, B. (2022+) [continuously updated]. *Index Herbariorum: a global directory of public herbaria and associated staff*. New York Botanical Garden’s virtual herbarium. Published at <http://sweetgum.nybg.org/science/ih/> [Accessed: Nov., the 2<sup>nd</sup>, 2022].
- \*\*\*<https://powo.science.kew.org/taxon/urn:lsid:ipni.org:names:77224385-1#distributions> 28.01.2023; 19.33