Contribuţii Botanice – 2015, L: 7-13
Grădina Botanică "Alexandru Borza"
Cluj-Napoca

CAREX VAGINATA – NEW RELICT SPECIES IN THE ROMANIAN FLORA

Daniel DÍTĚ[1], Petra HÁJKOVÁ[2,3], Irina GOIA[4], Michal HÁJEK[2]
[1.]Institute of Botany, Slovak Academy of Sciences, Dúbravská Cesta 9, **SK-845 23 Bratislava, Slovakia**
[2.]Department of Botany and Zoology, Masaryk University, Kotlářská 2, **CZ-611 37 Brno, Czech Republic**
[3.]Department of Vegetation Ecology, Institute of Botany, Academy of Sciences of the Czech Republic, 25/27 Lidická, **CZ-602 00 Brno, Czech Republic**
[4.]Babeș-Bolyai University, Faculty of Biology and Geology, Department of Taxonomy and Ecology, 42 Republicii Street, **RO-400015, Cluj Napoca, Romania**
e-mail: buriana@sci.muni.cz

Abstract: The boreal-arctic species *Carex vaginata* Tausch (Sheathed Sedge) has been found in Romania in 2014 during research on fen ecology. The species grows in the Rarau Mts., in an alkaline sloping fen of the *Caricion davallianae* alliance, transitional to *Cratoneurion commutati* springs (SE margin of Mt. Popii Rarăului, close to Plaiul Todirescu grasslands) and in a subalpine grassland at Mt. Popii Rarăului. Rarau Mts is the fourth locality for this species in the entire Carpathians, underlining its relictual distribution pattern in temperate Europe that may represent a remnant of formerly more continuous distribution during the glacial period. We further present a vegetation-plot record with *Carex vaginata* and basic chemical parameters of the water.

Keywords: *Cyperaceae*, relict and rare species, fens, Romania, East Carpathians.

Introduction

In recent decades many new plant species have been reported for the Romanian flora. Most of these are alien species that have extended their ranges recently [18, 19, 1, 32, 33]. Nevertheless, some new native species have been recorded as a consequence of a more targeted approach, i.e. a detailed focus on certain habitats. Such unexpected records of species that were overlooked for centuries in well-studied regions are, for example, *Plantago sempervirens*, discovered in 2003 as a result of the research on Transylvanian meadows [23], *Orobanche pubescens*, discovered in 2014, [37] and *Asperula laevigata* [5]. Here we present a biogeographically important record of *Carex vaginata*, a coldland moisture-demanding sedge species that has persisted in temperate Europe up until recent times only in local refugia.

The phenomenon of isolated occurrences of boreal species in the fens of south-eastern Europe [6, 36] is fascinating and inspiring, because it may give a hint to understanding European Quaternary history [10]. Isolated occurrences of mire species are further extraordinarily important in biodiversity conservation [7]. Suprisingly many isolated occurrences of boreal species in temperate Europe have been found during the last decade [6, 3], despite a long tradition of botanical research in this part of the world.

Materials and Methods

We provide a short description, and notes on ecology, habitats and distribution of *Carex vaginata* (Sheathed Sedge). The ecological and phytosociological data are based on field

investigations in July 2014, carried out in rich fens of the Romanian Eastern Carpathians. The species nomenclature follows *Flora Europaea* [35] for vascular plants and [8] for bryophytes. Coordinates were obtained using GPS equipment Garmin CS 60, using the WGS84 system. The map has been created using GIS software (ArcGis8.0). Geographical coordinates were transformed using an online software, from WGS 1984/ETRS 1989 to Stereo 70 [38]. For the map construction we used the SRTM – Worldwide Elevation data, open source data from http://geo-spatial.org/ [39].

Water pH and electrical conductivity values were measured using a multimeter HACH WTW 340i. A phytosociological relevé (vegetation-plot record) was recorded as a complete list of vascular plant and bryophyte species with their cover estimated in the nine-grade Braun-Blanquet scale [2].

A herbarium voucher has been deposited in the Herbarium of the Masaryk University (BRNU). Because of the species‘ great rarity and its easy identification we collected only one shoot of *Carex vaginata* as a herbarium specimen (Fig. 1).



Fig. 1: *Carex vaginata* (Sheathed Sedge) – herbarium voucher specimen

Results and Discussion

During our research in July 2014 on fen ecology and phytosociology, we found *Carex vaginata*, a sedge that has not been reported by national Floras or checklists up to now. [34, 14, 31, 17] The newly discovered species has been recorded in a well-studied area (Fig. 2), the Rarău Mts., a region which had been studied in detail by Raclaru, Oprea and Sîrbu [20, 21, 24, 25, 26,

27, 28, 29]. The species was previously overlooked, partially perhaps because of its similar habit to *Carex panicea*, which frequently occurs in fens.

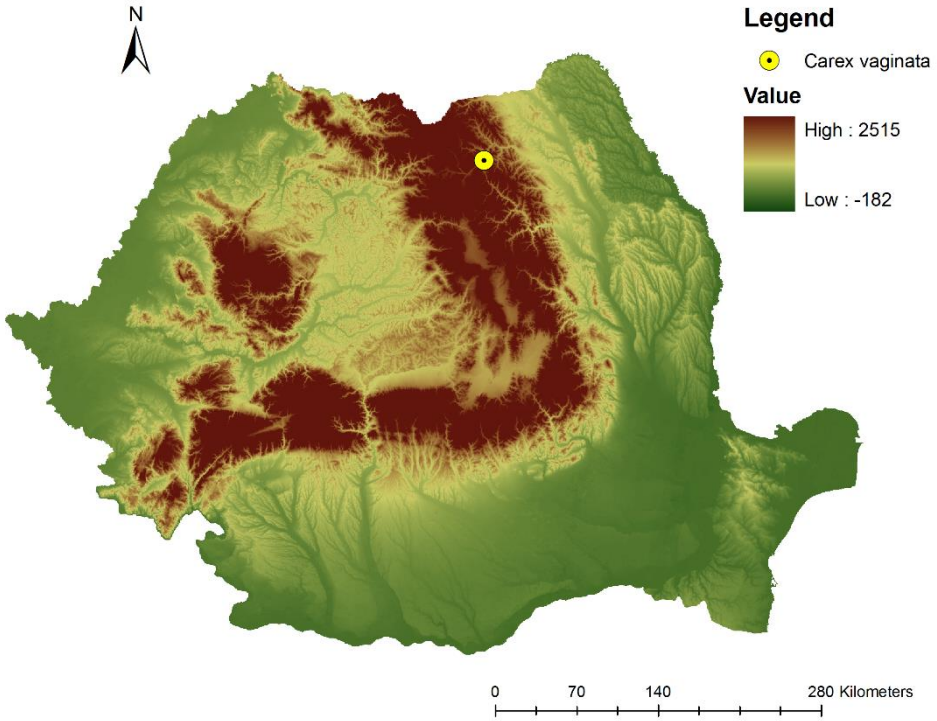


Fig. 2: The occurence of *Carex vaginata* in Romania

***Carex vaginata* Tausch.**

Description: Lax tufts (15–40 cm) with creeping rhizomes, brown roots and pale brown basal sheaths. Leaves glabrous, 3–5 mm wide, yellowish to dark green, keeled at base, abruptly pointed at the tip. Ligule short – *c*. 2 mm, obtuse to subacute. Spikes distant, the terminal entirely male, 7–15 mm, clavate, with an orange-brown glume and pale midrib 4.5 mm long. Female spikes 2–4, lax-flowered, erect, 5–25 mm, the lower spike with a peduncle 1–5 cm; glume reddish-brown with a pale midrib, 3 mm long, acute or mucronate. Lower bract shorter than the spike, sheathing and inflated. Utricle 3.8–5 mm, dull, glabrous, broadly obovoid, attenuated into a beak 0.5–1 mm. Stigmas 3.

General distribution: The taxon *Carex vaginata* s.l. has circumpolar distribution. *Carex vaginata* s.s., which is a member of a complex taxonomic group, is a boreal element with a distribution of continental character. It occurs in Iceland, northern Britain and, its centre of distribution, Scandinavia. From there it extends through the Baltic region and the European part of Russia to western Siberia (as far as the Yenisey river). Further south in Europe, where it is considered a glacial relict species, it occurs in the Pyrenees, Alps and the Sudetenland [11, 9]. In the Carpathians, *Carex vaginata* is very rare. Recently it has been found in the Western Carpathians as a species new for Slovakia, in the Kubínska hoľa Mts. [3]. The species has been

known for a long time from two localities in the Ukrainian East Carpathians: the Chornohora Mts. and Svydovets' Mts. [22, 13].

Ecology and habitat: *Carex vaginata* occupies several types of habitats within its distribution range. In the boreal-arctic zone it grows in wet tundra, forest-tundra and rich fens. In temperate Europe it occurs in quite isolated localities, but these do not share the same habitat. In Poland it grows in several isolated smaller areas in the north-eastern part of the country in light-exposed or semi-shaded moist places of different habitats: scree forests (*Tilio-Carpinetum*), oak-spruce forests (*Querco-Picetum*), pine fen woodlands with *Carex globularis* and *Carex dioica* and, more rarely, open fens [12]. In the Sudetes Mountains (southwestern Poland, Czech Republic) the species grows in the mountain tall-grass vegetation of the *Calamagrostion villosae* alliance [12] as well as in short-grass and short-herb moist subalpine grasslands, on irrigated rocks and around brooks, spring and fens, typically in glacial cirques [30]. Generally the species is considered to be light-demanding [9].

Romanian locality:

Rarău Mts., SE limit of Popii Rarăului, close to Plaiul Todirescu, mountain fen on the hillside springs, E25°35'50.7", N47°26'53.2", altitude 1532 m, relevé area 16 m^2, slope 5°, Aspect SE; E_1: 60 %, E_0: 80%, pH: 7,3; cond.: 274 µS/cm; 8. 8. 2014.

E_1: *Swertia perennis* 2b, *Allium schoenoprasum* ssp. *alpinum* 2a, *Carex flava* 2a, *Eriophorum latifolium* 2a, *Equisetum palustre* 2a, *Agrostis stolonifera* 1, *Caltha palustris* 1, *Carex echinata* 1, *C. vaginata* 1, *Dianthus superbus* ssp. *alpestris* 1, *Juncus alpinoarticulatus* 1, *Agrostis canina* +, *Cardamine rivularis* +, *Carex capillaris* +, *Crepis paludosa* +, *Cruciata glabra* +, *Dactylorhiza cordigera* +, *Deschampsia cespitosa* +, *Eriophorum angustifolium* +, *E. vaginatum* +, *Festuca rubra* +, *Galium palustre* +, *Parnassia palustris* +, *Persicaria vivipara* +, *Poa pratensis* agg. +, *P. trivialis* +, *Potentilla erecta* +, *Triglochin palustris* +, *Vicia cracca* +, *Picea abies* juv. r.

E_0: *Palustriella commutata* 2b, *Fissidens adianthoides* 2b, *Tomenthypnum nitens* 2b, *Plagiomnium elatum* 2a, *Calliergonella cuspidata* 1, *Campylium stellatum* 1, *Abietinella abietina* +, *Bryum pseudotriquetrum* +, *Climacium dendroides* +, *Palustriella decipiens* +, *Hypnum lindbergii* +, *Thuidium philibertii* +.

The vegetation of the Rarău spring fen resembles temperate calcareous fens of the *Caricion davallianae* alliance, but stays at the transition towards *Cratoneurion commutati* in the Popii Rarăului area. Raclaru [25] proposed a new subassociation „*dacicum*"of the *Calliergo sarmentosi-Eriophoretum angustifolii* (Oswald 1925) Nord. 1927 association that should grow in that area. However, this association originally represents non-calcareous acidic fens [15] and new name should be therefore found. In the summit parts of the Rarău Mts we observed *Carex vagianata* also in moist subalpine grasslands around the Popii Rarăului rocks.

There are some similarities between the newly discovered populations in the Rarău Mts and a population at the single Western Carpathian locality, the Kubínska hoľa summit in north-western Slovakia [3]. In both regions, calcium-rich mountain springs with *Swertia perennis*, *Allium schoenoprasum* subsp. *alpinum*, *Carex flava* and *Eriophorum latifolium* occur in a mosaic with mountain grasslands, and neither region represents the highest mountains with a developed alpine zone. We can postulate that *Carex vaginata* could have persisted in these areas since glacial times, because (i) it might have been quite common there during the last glacial because of less harsh conditions as compared to the highest mountains, (ii) it survived more forested

periods (Middle to Late Holocene before human impact) in open summit forests – the species grows in open northern boreal forests up to the present in Norway and Poland [16, 12], and (iii) it survived climatic fluctuations (dry versus moist periods) by alternating occurrence in either springs or grasslands.

Conclusions

The new locality of a relict species proves that botanical studies in Europe can offer new biogeographically important data even in well studied areas. It holds especially for studies with a detailed focus on a particular habitat at a broad geographical scale. The reported locality of *Carex vaginata* is the fourth known from the whole Carpathians, underlying the extreme rarity and conservation value of this species. Their habitats in the Rarau Mts are part of the Natura 2000 network, providing a chance for their future survival. Our record highlights the importance of habitat conservation, because some endangered species may stay undiscovered in their suitable habitats for a long time.

Acknowledgements: This study on European fen vegetation diversity is funded by the Czech Science Foundation (Centre of Excellence PLADIAS, project no. 14-36079G), institutional support of Masaryk University and long-term developmental project of Czech Academy of Sciences (RVO 67985939). Special thanks are due to Veronika Horsáková and Michal Horsák, the malacologists who accompanied us in the field.

REFERENCES

1. Anastasiu, P., Memedemin, D., 2012, *Conyza sumatrensis*: a new alien plant in Romania, *Botanica Serbica*, **36**(1): 37-40.
2. Barkman, J.J., Doing, H., Segal, S., 1964, Kritische Bemerkungen und Vorschläge zur quantitativen Vegetationsanalyse, *Acta Botanica Neerlandica*, **13**: 394-419.
3. Bernátová, D., 2011, *Carex vaginata* – new species in the Western Carpathians, *Biologia. Section Botany*, **66**(3): 429-432.
4. Biță-Nicolae, C., Sanda, V., 2011, *Cormophlora of Romania. Spontaneous and cultivated cormophytes in Romania*, Lambert Academic Publishing.
5. Dihoru, G., Goga, I., 2004, Asperula laevigata (Rubiaceae) – a new species to the flora of Romania, *Phytologia Balcanica*, **10**(2-3): 183-185.
6. Hájek, M., Hájková, P., Apostolova, I., Horsák, M., Plášek, V., Shaw, B., Lazarova, M., 2009, Disjunct occurrences of plant species in the refugial mires of Bulgaria, *Folia Geobotanica*, **44**(4): 365-386.
7. Hájek, M., Hájková, P., Apostolova, I., Horsák, M., Rozbrojová, Z., Sopotlieva, D., Velev, N., 2010, The insecure future of Bulgarian refugial mires: economic progress versus Natura 2000, *Oryx*, **44**(04): 539-546.
8. Hill, M.O., Bell, N., Bruggeman-Nannaenga, M.A, Brugues, M., Cano, M.J., Enroth, J., Flatberg, K.I., Frahm, J.P., Gallego, M.T., Gariletti, R., Guerra, J., Hedenas, L., Holyoak, D.T., Hyvönen, J., Ignatov, M.S., Lara, F., Mazimpaka, V., Munoz, J., Söderström, L., 2006, An annotated checklist of the mosses of Europe and Macaronesia, *J. Bryol*, **28**: 198-267.
9. Holub, J., 1999, *Carex vaginata* Tausch. In: Čeřovský, J., Feráková, V., Holub, J., Maglocký, Š., Procházka, F., Červená kniha ohrozených a vzácnych druhov rastlín a živočíchov SR a ČR, 5, Vyššie rastliny, Príroda, Bratislava: 82.
10. Horsák, M., Chytrý, M., Hájková, P., Hájek, M., Danihelka, J., Horsáková, V., Ermakov, N., German, D.A., Kočí, M., Lustyk, P., Nekola, J.C., Preislerová, Z., Valachovič, M., 2015, European glacial relict snails and plants: environmental context of their modern refugial occurrence in southern Siberia, *Boreas*, **44**(4): 638-657.
11. Hultén, E., Fries, M., 1986, *Atlas of North European vascular plants nort of the Tropic of Cancer*, T. 1–3. Koeltz Scientific Books, Königstein.

12. Jakubowska-Gabara, J,. 2014, *Carex vaginata* Tausch. In: Kaźmieraczakowa R., Zarzycki K., Mirek Z. (eds.). *Polish Red Data Book of Plants. Pteridophytes and flowering plants*. Cracow: 707-709.
13. Jílek, B., 1936, *Carex sparsiflora* (Wahlb.) Steud. na Podkarpatské Rusi, *Věda* Přír., **17:** 129.
14. Negrean, G., 2011, Addenda to "Flora Romaniae" Volumes 1-12. Newly published plants, nomenclature, taxonomy, chorology and commentaries (Part 1), *Kanitzia*, **18**: 89-194.
15. Nordhagen, R., 1927, Die Flora und Vegetation des Sylenegebietes. I. DieVegetation. Det. Norske Vid. Akad. Skrif. I. Mat.-Nat. Klass, (1).
16. Nordhagen, R., 1943, *Sikilsdalen og Norges Fjellbeiter. En plantesociologisk monografi*, Gries Botryk, Bergen.
17. Oprea, A., 2005, *Lista critică a plantelor vasculare din România (Checklist of vascular plants of Romania)*, Edit. Univ. "Alexandru Ioan Cuza" Iaşi.
18. Oprea, A., Sîrbu, C., Doroftei, M., 2011, New contributions to the flora of Romania, *Anal. Şt. ale Univ.i „Al. I. Cuza" Iaşi, Biol. veg*., s. II a., **57**(2): 79-90.
19. Oprea, A., Barina, Z., Sîrbu, C., 2012, *Euphorbia davidii* Subils *(Euphorbiaceae)*-An alien species new to the Romanian Flora, *Contrib. Bot*., **47**: 7-12.
20. Oprea, A, Sîrbu, C., 2012, The vascular flora of Rarău massif (Eastern Carpathians, Romania). Note I, *Memories of the Scientific Sections of the Roumanian Academy*, **35**: 55-84.
21. Oprea, A, Sîrbu, C, 2013, The vascular flora of Rarău massif (Eastern Carpathians, Romania). Note II, *Memories of the Scientific Sections of the Roumanian Academy*, **36**: 17-52.
22. Pawłowski, B., 1931, Dwie ciekawe turzyce z Czarnej Hory. Spraw, *Kom. Fizjograf*., **65**: 145-152.
23. Puşcaş, M., Bărbos, M., Başnou, C., Frink, J.P., Cristea, V., 2003, *Plantago sempervirens* Crantz, a new species for the Romanian Flora, *Contrib. Bot*., **37**(1): 7-12.
24. Raclaru, P., 1972a, Flora de la Pietrele Doamnei, *St. Com. Ocr. Nat., Suceava*, **3**: 121-133.
25. Raclaru, P., 1972b, Vegetația helofilă și mezohelofilă din masivul Rarău, *Acta Bot. Horti Bucurest*, 1970-1971: 611-625.
26. Raclaru, P., 1974, Completări la flora cormofitelor din Munţii Rarău (I), *St.Com., Muz. Şt. Nat. Bacău*: 41-46.
27. Raclaru, P., 1977, Completări la flora cormofitelor din Munţii Rarău (I), *St.cerc. Biol., Ser. Biol. Veget*., **29**(2): 93-96.
28. Raclaru, P., 1978, Espèces de *Carex* L. des monts Rarău, écologie et répartition, *Acta Bot. Horti Bucurest*, 1977-1978: 217-220.
29. Raclaru, P., 1979, Completări la flora cormofitelor din Munţii Rarău (II), *St.cerc. Biol., Ser. Biol. veget*., **31**(1): 23-27.
30. Řepka, R., Grulich, V., 2014, *Ostřice České republiky. Terénní obrazový průvodce*, Lesnická práce, Mendelova univerzita v Brně & ČSOP Hořepník Prostějov.
31. Sârbu, I., Ştefan, N., Oprea, A., 2013, *Plante vasculare din România. Determinator ilustrat de teren*, Publishing House Victor B Victor, Bucharest.
32. Sîrbu, C., Oprea, A., 2011, New records in the alien flora of Romania *(Artemisia argyi, A. lavandulaefolia*) and Europe (*A. lancea*), *Turk. J. Bot*., **35**: 717-728.
33. Sîrbu, C., Oprea, A., Patriche, C.V., Samuil, C., Vîntu, V., 2014, Alien Species of *Lepidium* in the Flora of Romania: Invasion History and Habitat Preference, *Not. Bot. Horti. Agrobot*., **42**(1): 239-247.
34. Săvulescu, Tr. (ed.), 1952-1976, *Flora R.P.R.-R.S.R.*, I–XII., Ed. Acad. Bucureşti.
35. Tutin, G.T., Heywood, V.H., Burges, N.A., Moore, D.M., Valentine, D.H., Walters, S., Webb, D.A. (eds), 1980, *Flora Europaea*, Vol. 5: Alismataceae to Orchidaceae (Monocotyledones), Cambridge University Press, Cambridge.
36. Vukojičić, S., Jakovljević, K., Matevski, V., Randjelović, V., Niketić, M., Lakušić, D., 2014, Distribution, Diversity and Conservation of Boreo-Montane Plant Species in the Central Part of the Balkan Peninsula and the Southern Part of the Pannonian Plain, *Folia Geobotanica*, **49**(4): 487-505.
37. http://www.romania-insider.com/new-parasite-plant-species-discovered-in-romania/132290/
38. http://www.geo-spatial.org:8080/transdatonline/
39. http://geo-spatial.org/

CAREX VAGINATA – O NOUĂ SPECIE RELICTARĂ ÎN FLORA ROMÂNIEI

(Rezumat)

Specia boreal-arctică *Carex vaginata* a fost identificată în România ca urmare a cercetărilor ecologice în mlaștini, desfășurate în anul 2014**.** Specia crește în Munții Rarău, în mlaștinile slab alcaline în pantă (limita SE a Popilor Rarăului la limită cu Plaiul Todirescu), ce sunt încadrate în alianța *Caricion davallianae,* aflate în tranziție spre comunitățile de izvoare aparținând alianței *Cratoneurion commutati* și într-o pajiște subalpină pe Popii Rarăului. Muntele Rarău reprezintă a patra localitate în care este semnalată această specie în intreg lanțul Carpatic, subliniind distribuția relictară în zona temperată a Europei, ceea ce poate reprezenta un rest al unei distribuții continue din timpul glaciațiunilor. Este prezentat releveul cu *Carex vaginata* și principalii parametri chimici ai apei.

Received: 24.11.2015; Accepted: 10.12.2015.