



First mature fruit description of *Pietrosia laevitomentosa* (Asteraceae) and its implications to the taxonomic position of the genus *Pietrosia*

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Abstract

For the first time we describe the morphology and anatomy of mature achenes bearing fertile seeds of *Pietrosia laevitomentosa*, an endemic plant species in the Eastern Carpathians. The new diagnostic features of the genus *Pietrosia* justify its taxonomic recognition as separate from *Andryala*; those are the achene size (between 2.5 and 4.3 mm long), the deciduous pappus, the single-rimmed achene apex, the elongate exocarpic cells, the complete ring of mesocarpic sclerenchyma (up to 11-layered), and the number and localization of the vascular bundles (5 bundles, in the small ribs). Furthermore, our data may also serve to reconsider the species ecology and conservation strategies.

Key words: carpology, Compositae, conservation, Eastern Carpathians, endangered species, endemism, Romania, sexual propagation

Introduction

Pietrosia laevitomentosa Nyár. in Sennikov (1999: 78) is still an enigmatic species despite being the subject of active scientific interest after its discovery fifty years ago. It was the only species assigned to the genus *Andryala* found so far north, as all the other species occur in the Mediterranean Region and Macaronesia (Lucas & Synge 1978). According to published reports, the plant has a very restricted distribution in an area of about 150 square meters on rocky slopes of the Pietrosul Bistriței Mountain (Eastern Carpathians, Romania). Since 2007, *P. laevitomentosa* was included among threatened vascular plants of the Ukrainian Carpathians, in the list of taxa whose occurrence needs to be confirmed (Kricsfalussy & Budnikov 2007), but the confirmation is still pending. One recent reliable field investigation showed that in the area of Pietrosul Bistriței Mountain there are only six small populations consisting of about 3000 individuals (rosettes) and covering a surface of about 50 square meters (Negrea & Pricop 2009). Due to the narrow distribution and small population size with such a low number of individuals, this species is included in the list of strictly protected plant species (Appendix I) of the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats, Bern, Switzerland, 1979), in Carpathian List of Endangered Species (Witkowski *et al.* 2003), in the list of the top 50 Threatened Species of the European Flora in need of urgent conservation measures (Lesouëf & Buord 2003), and in European Red List of Vascular Plants (Bilz *et al.* 2011). It has also been included in all the national red lists and books of endangered plant species issued after the species was discovered (Dihoru & Negrean 2009).

The first taxonomic placement of this plant was made in the 1960s to a new monotypic genus named *Pietrosia* after the place of its discovery (Nyárády 1963, 1965), with the species name “*Pietrosia levitomentosa* Nyár.” Since then, the systematic position of this species remained a matter of debate. Soó (1968) revised Nyárády’s classification and placed the species to *Hieracium* as “*Hieracium levitomentosum* (Nyár.) Soó”. In 1975 it was transferred to *Andryala* by P.D.Sell as “*Andryala levitomentosa* (E.I.Nyárády) P.D.Sell” (Sell 1975, 1976). Sennikov (1999) reconsidered the original taxonomic position of the species as *Pietrosia laevitomentosa* Nyár. As E.I.Nyárády has not validly published the names of the species and the genus because of the absence of type designations (Art. 40.1 of the ICN), Sennikov designated the holotype of *P. laevitomentosa* that is kept at the Finnish Museum of Natural History, University of Helsinki (H 1578347). Moreover, Sennikov included also *A. agardhii* Haens. ex Candolle (1838: 244), an endemic of Spain, to the same genus as *P. agardhii* (Haens. ex DC.) Sennikov (1999: 78) and speculated that *Pietrosia* is an

When the species was described, the assumption was that this species produces mature fruits with fertile seeds only in late autumn, whereas in August the achenes are still immature (Nyárády 1963). All the subsequent studies concluded that this species does not produce mature fruits with fertile seeds and also that it uses exclusively vegetative propagation to reproduce. However, this strategy for propagation cannot explain the presence of six populations clearly separated by steep and barren rocky peaks (although scattered over a small area). Propagation by seeds, even though with very low frequency, could be a reasonable explanation for presence of a few populations within the distribution area.

Previous conservation strategies involved *ex situ* approaches in terms of *in vitro* propagation (Aiftimie-Păunescu & Vântu 2002) and translocation at lower altitudes (Pricop 2009). Unfortunately, both methods led to negative results. The first approach was hampered by the fact that *in vitro* regenerated plants cannot adapt to *ex vitro* conditions, whereas in the second case the transplanted plants did not survive more than a few months in the new habitat. In the light of the present new findings we suggest as a new strategy the maximization in the collection of fertile fruits, followed by the proper growth of the plants *ex situ* and the transfer of the well-established plants into their natural habitat. On the other hand, further investigations are required to understand the causes of the low rate of sexual propagation of *P. laevitomentosa* and to improve the yield of fertile seeds.

Conclusions

Contrary to previous observations, *Pietrosia laevitomentosa* produces fertile fruits bearing seeds with well developed embryos. The rate of fertile achene formation is very low, of approximately 0.04 %. Although low, fertile seed production could shed light upon the species distribution and also help develop new approaches to an efficient strategy for the species conservation.

The newly described fruit features support recognition of the genus *Pietrosia* as separate from *Andryala* s.str., and the placement of *P. laevitomentosa* and *P. agardhii* into separate sections. These features concern the size, morphology and micromorphology of achenes, as well as the structure of the pericarp.

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References

- Aiftimie-Păunescu, A. & Toma, C. (2000) Morpho-anatomical characterization of the endemic species *Andryala levitomentosa* (E. Nyár.) Sell. [Serie de Biologie vegetale] *Revue Roumaine de Biologie* 45(1): 61–69.
- Aiftimie-Păunescu, A. & Vântu, S. (2002) Micropropagation of the endemic species for Romanian flora *Andryala levitomentosa* (E. Nyár) Sell. Serie de Biologie vegetale] *Revue Roumaine de Biologie* 47(1–2): 9–11.
- Bilz, M., Kell, S.P., Maxted, N. & Lansdown, R.V. (2011) *European Red List of Vascular Plants*. Publications Office of the European Union, Luxembourg, X + 130 pp.
- Candolle, A.P. de (1838) *Prodromus Systematis Naturalis Regni Vegetabilis*, vol. 7. Treuttel & Würtz, Paris, 801 pp.
- Corneanu, G. & Szabó, A. (1980) Chorological and caryological data for some endemic and rare plants from Romania (I). In: *Conservarea naturii pe baze ecologice. Studii si cercetari*. Drobeta-Turnu-Severin, pp. 73–81. [In Romanian]
- Dashek, W.V. (2000) Methods for the cytochemical/histochemical localization of plant cell/tissue chemicals. In: Dashek, W.V. (Ed.) *Methods in Plant Electron Microscopy and Cytochemistry* 1. Humana Press, Totowa, pp. 27–35.
http://dx.doi.org/10.1007/978-1-59259-232-6_2
- Dihoru, G., Negrean, G. (2009) *The Red Book of Vascular Plants of Romania*. Editura Academiei Romane, Bucuresti, 630 pp. [In Romanian]
- Fehrer, J., Gemeinholzer, B., Chrték, J. & Bräutigam, S. (2007) Incongruent plastid and nuclear DNA phylogenies reveal ancient intergeneric hybridization in *Pilosella* hawkweeds (*Hieracium*, Cichorieae, Asteraceae). *Molecular Phylogenetics and Evolution* 42(2): 347–361.

<http://dx.doi.org/10.1016/j.ympcv.2006.07.004>

- Greuter, W. (2003) The Euro+Med treatment of Cichorieae (Compositae) – generic concepts and required new names. *Willdenowia* 33: 229–238.
<http://dx.doi.org/10.3372/wi.33.33201>
- Kricsfalusy, V. & Budnikov, G. (2007) Threatened vascular plants in the Ukrainian Carpathians: current status, distribution and conservation. *Thaiszia – Journal of Botany* 17: 11–32.
- Lesouëf, J.Y. & Buord, S. (2003) *50 Threatened Species of the European Flora in need of urgent conservation measures*. Conservatoire de Botanique de Brest and Conseil de l'Europe, Strasbourg, 69 pp.
- Lucas, G. & Synge, H. (1978) *The I.U.C.N. Red Data Book*. I.U.C.N., Morges, 540 pp.
- Minea, B., Negrea, B.M. & Gostin, I. (2009) Contributions to the study of *Andryala levitomentosa* (E.I.Nyárády) P.D.Sell reproductive structures anatomy. [*Vegetal Biology*] *Scientific Annals of Alexandru Ioan Cuza University of Iasi* 55(2): 87–96.
- Negrea, B.M. & Pricop, E. (2009) Rediscovery of *Pietrosia levitomentosa* E. I. Nyárády ex Sennik., an endemic and endangered plant species from Pietrosul Bistriței Mountain, Romania. *Romanian Journal of Biology* 54(1): 101–114.
- Nyárády, E. (1963) Bereicherung der Wissenschaft mit einer für die Flora der RVR endemischen neuen Gattung und drei neuen endemischen Arten. *Revue de Biologie* 8(3): 247–260.
- Nyárády, E. (1965) *Pietrosia* Nyár. In: Savulescu, T. (Ed.) *Flora of Popular Republic of Romania*. vol. 10. Academia Republicii Populare Romîne, Bucharest, pp. 210–214. [In Romanian].
- Oprea, A. (2007) Flora and vegetation of the natural reserve “Zugreni Gorges” (Suceava County). *Romanian Journal of Biology* 52: 89–122.
- Pricop, E. (2009) Contributions to *Hieracium* L. (incl. *Pilosella* Hill) Flora of Ceahlau National Park (Romania). [*Vegetal Biology*] *Scientific Annals of Alexandru Ioan Cuza University of Iasi* 55(1): 139–144.
- Sell, P.D. (1975) Taxonomic and nomenclatural notes on the Compositae. Cichorioideae. In: Heywood, V.H. (Ed.) *Flora Europaea: Notulae Systematicae ad Floram Europaeam spectantes*. No. 19. *Botanical Journal of the Linnean Society* 71(4): 256.
- Sell, P.D. (1976) *Andryala* L. In: Tutin, T.G. (Ed.) *Flora Europaea*. vol. 4. Cambridge University Press, Cambridge, pp. 358.
- Sennikov, A.N. (1999) *Pietrosia* Nyárády – a restored genus of the subtribe *Hieraciinae*. *Komarovia* 1: 77–78.
- Sennikov, A.N. & Illarionova I.D. (2002) Carpological studies in Asteraceae-Cichorieae, 1. Subtribe *Hieraciinae*. *Komarovia* 2: 97–125.
- Soó, R. (1968) Species et combinationes novae florum Europae praecipue Hungariae. VII *Acta Botanica Academiae Scientiarum Hungaricae* 14(1–2): 147–156.
- Ștefureac, T. (1968) Quelques considérations sur l'écologie et la physiologie des Composées – *Pietrosia levitomentosa* Nyár. *Revue Roumaine de Biologie. Série de Botanique* 13(6): 361–366.
- Witkowski, Z.J., Król, W. & Solarz, W. (Eds.) (2003) *Carpathian List of Endangered Species*. Vienna & Krakow, XIII + 64 pp.