

***EPIPACTIS* × *SCHMALHAUSENII* K. RICHT. (ORCHIDACEAE), A NEWLY IDENTIFIED TAXON IN ROMANIAN FLORA**

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Abstract: The authors reports the presence in the Romanian wild flora of the nothospecies *Epipactis* × *schmalhausenii*. This taxon of hybrid origin (*Epipactis atrorubens* × *E. helleborine* subsp. *helleborine*) was recently identified, together with the two genitors, on some limestone mountains in the Romanian Eastern Carpathians (Bistriței Mountains; Ceahlău Mountains; Hășmaș Mountains), as well as in Southern Carpathians (Bucegi Mountains). Although, this one is relatively widespread in other European countries, even in Kazakhstan (Central Asia), nothosp. *Epipactis* × *schmalhausenii* has not been reported in botanical literature of Romania, until now.

Keywords: Carpathian Mountains, *Epipactis* × *schmalhausenii*, newly identified, *Orchidaceae*, Romania.

Introduction

The genus *Epipactis* Zinn includes approximately 20 species, distributed in the temperate zone of the boreal hemisphere [PAUCĂ & al. 1972]. In *Flora Europaea*, 9 species were mentioned only (to which was added another species, *Epipactis confusa* D. P. Young, from Denmark and South of Sweden, but not recognized at a species level) [MOORE, 1980].

In the scientific work *Flora României* [PAUCĂ & al. 1972], as well as in the field identification book of the vascular plants in Romania [BELDIE, 1979], 5 species were reported only.

The most recent field identification books of vascular plants in Romania [CIOCÂRLAN, 2009; SÂRBU & al. 2013], registered 6 and 7 species of *Epipactis* Zinn, respectively.

In recent years, new species of the genus *Epipactis* have been described. Thus, through the recent floristic researches [ARDELEAN, 2011; MOLNÁR & SRAMKÓ, 2012; ARDELEAN & al. 2018a, b] the number of reported species in Romania has doubled compared to previous evaluations.

In this paper we report another taxon within the *Epipactis* genus, previously unknown in the botanical literature of Romania, namely *Epipactis* × *schmalhausenii* K. Richt. nothosubsp. *schmalhausenii*.

Material and method

The species has been identified during our field surveys in several mountains in the Eastern and Southern Carpathians, over the last two years (2018 and 2019).

Some important regional or local floras were used in order to identify or confirming the authenticity of the samples collected in Eastern Carpathians (Romania), as: *Flora Europaea* [MOORE, 1980], *Flora of Romania* [PAUCĂ & al. 1972], *Flora of ex-USSR* [KOMAROV, 1968], web databases [PRIDGEON & al. 2006; e monocots, 2015; tropicos, 2012; IPNI, 2012; arnsidesilverdale, 2012; euoplusmed, 2019; species.wikimedia, 2019; science.kew, 2019], etc. Besides, there have been seen other scientific operas in order to check up the presence of this hybrid in Romania [GRECESCU, 1898; PANȚU, 1915]. Some of the international databases on the *Orchidaceae* Juss. have been seen [GOVAERTS & al. 2012; RICH & JERMY, 2019].

The local coordinations (northern latitude, eastern longitude, altitude) have been taken using a GPSMAP Garmin 60CSx.

The collected specimens were included in public herbaria (IASI, IAGB).

Results and discussions

The genus name, *Epipactis*, is a name still found in Dioscoride [PAUCĂ & al. 1972], being taken as such in the botanical nomenclature by the German anatomist and botanist Johann Gottfried Zinn, starting with 1757.

The epithet of this nothotaxon was given by the Austrian botanist Karl Richter (1855-1891) in his work *Plantae Europae* (t. I, p. 284) in honor of the Ukrainian botanist Johannes Theodor Schmalhausen (1849-1894), known for his studies on East European plant species [RICHTER, 1890]. But, the name of the nothospecies appears in Richter's work only in its binomial form, in the enumeration of the species of the genus *Epipactis*, as being the 5th of the 7 species counted by the author, without any description of this nothotaxon in the cited work.

Later on, to this name were given other names, which became synonymous, such as:

- homotypic synonyms: *Helleborine* × *schmalhausenii* (K. Richt.) Vollm. – this name was given by the German botanist Franz Vollmann (1858-1917), in his work *Flora von Bayern* [VOLLMANN, 1914], on page 169, thus emending the original name of the nothospecies;
- heterotypic synonyms: *Epipactis* × *trikalana* B. Baumann & H. Baumann – this name was given by the German botanists Brigitte Baumann and Helmut Baumann [BAUMANN & BAUMANN, 1988].

It is admitted that *Epipactis* × *schmalhausenii* includes 4 nothosubspecies, namely:

- nothosubsp. *capellonensis* (B. Baumann & H. Baumann) R. Govaerts (*E. atrorubens* (Hoffm.) Besser × *E. helleborine* (L.) Crantz subsp. *latina* W. Rossi & E. Klein) [GOVAERTS & al. 2012];
- nothosubsp. *fleischmannii* (Heimerl) R. Govaerts (*E. atrorubens* × *E. helleborine* subsp. *orbicularis* (K. Richt.) E. Klein) [GOVAERTS & al. 2012];
- nothosubsp. *zaisii* Riech. (*E. atrorubens* × *E. helleborine* subsp. *minor* (R. Engel) R. Engel) [RIECHELMANN, 2013; <https://www.ipni.org/n/77135233-1>];
- nothosubsp. *schmalhausenii* (*E. atrorubens* × *E. helleborine* subsp. *helleborine*) (cf. https://species.wikimedia.org/wiki/Epipactis_schmalhausenii).

During the field surveys of the last two authors conducted in the summer of 2019 in the Eastern Carpathians, near the town of Tulgheș, Harghita county, on Piatra Comarnicului Mountain (Bistriței Mountains), at the southern end, within the area of the rocks called “Pietrele Roșii”, an *Epipactis* population with intermediate characters between *E. atrorubens* (Hoffm.) Besser and *E. helleborine* (L.) Crantz subsp. *helleborine* has been identified. It has been found that this population belongs to *E. × schmalhausenii* nothosubsp. *schmalhausenii*, a taxon unknown so far in the Romanian botanical literature. Information on the presence of this taxon in the Bucegi Massif was previously disseminated, in the online environment (facebook), by the first two authors of this paper. The review of some previously collected herbarium specimens led us to find that, besides the two locations above mentioned, *E. × schmalhausenii* nothosubsp. *schmalhausenii* is also present in the Ceahlău and Hășmaș mountain ranges, in the Eastern Carpathians.

Description

Epipactis × schmalhausenii K. Richt. [Pl. Eur. 1: 284 (1890)] nothosubsp. *schmalhausenii*

Genitors: *Epipactis atrorubens* × *E. helleborine* subsp. *helleborine*

Perennial, geophyte, with stems of 20-75 (-80) cm, rigid, erect, short and whitish pubescent, reddish-purple tinted. The leaves are alternate, arranged until under inflorescence, 4-10 (-15), 7-21 cm long and (3-) 4-8 cm wide, longer than the internodes, semi-amplexicaul, without wavy edges; on the edges and on the ribs on the back are minutely scabrous. The leaves that accompany the flowers (= the bracts) are lanceolate, the lower ones longer than the flowers, the upper ones shorter. The flowers are arranged in elongated inflorescences, more or less unilateral, many flowered, with (10-) 15-60 (-80) flowers, 7-9 mm long, wide open, with the labellum longer than the other tepals (Figures 1-4).

Period of de anthesis: July-August.

The morpho-anatomical diagnostic features of the nothospecies *Epipactis × schmalhausenii* nothosubsp. *schmalhausenii* against its genitors, *E. helleborine* subsp. *helleborine* and *E. atrorubens* (according to data in: PANȚU, 1915; MOORE, 1980; PAUCĂ & al. 1972; JAKUBSKA-BUSSE & GOLA 2010; SÂRBU & al. 2013, as well as to our own researches) are shown in the next table (Table 1).



Figure 1. *Epipactis × schmalhausenii* nothosubsp. *schmalhausenii* – habitus (Pietrele Roșii, Tulgheș, Bistriței Mountains, Romania)



Figure 2. *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* – habitus (Zănoagei Gorges, Bucegi Mountains, Romania)



Figure 3. *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* – inflorescences (Pietrele Roșii, Tulgheș, Romania)



Figure 4. *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* – flower details (Pietrele Roșii, Tulgheș, Romania)

Table 1. Distinctive morpho-anatomical traits of nothospecies *Epipactis* × *schmalhauseni* and its genitors

	Species		
	<i>E. helleborine</i> subsp. <i>helleborine</i>	<i>E. × schmalhauseni</i>	<i>E. atrorubens</i>
Stem	(20-) 40-80 (-130) cm	20-75 (-80) cm	10-60 (-100) cm
Leaves shape	medium leaves elliptic-broad-ovate, with a thin, relatively soft lamina	middle leaves ovate to ovate-lanceolate, the upper lanceolate (> <i>E. helleborine</i>), thicker and more rigid lamina; basal leaf blade obtuse, patent	middle leaves ovate-lanceolate to lanceolate, with thicker and stiffer lamina
Leaves colour and edges	green leaves, usually with non-undulating edges, with pale green to whitish sheaths (basal sheaths are rarely light purple)	leaves green to blue-green, with edges, ribs and basal part of sheaths pale-violet or pink-purple (> <i>E. atrorubens</i>)	lamina green, but the edges, the tip, the base, the ribs and sheaths are red-purple
Leaves epidermis	margins and main ribs with papillary cells on 2-3 rows, elongated, tapered and slightly inclined (at the median row), shorter and rounded (the lateral rows)	papillae on the median row of variable length (in the form of those of <i>E. helleborine</i>); those on the lateral rows are shorter and flattened (in the form of those of <i>E. atrorubens</i>)	lamina edges always papillose, with papillae shorter and flattened than in <i>E. helleborine</i>
Rachis of inflorescences/flowers	inflorescences rachis and flower pedicels glabrous to scabrous	rachis with hairs; pedicels weakly hairy, with hairs	rachis densely-pubescent, gray-green
Flowers number	(10-) 15-40	10-80	10-15
Flowers fragrance	of <i>Valeriana</i> sp. (Schulze in Panțu 1915)	weak smelling	with a vanilla fragrance, but at the end with a fragrance of <i>Eugenia caryophyllata</i> (PANȚU, 1915)
Outer tepals	elliptic-ovate, green on the outside and pink or greenish-purple on the inside, 10-13 mm long	ovate-lanceolate to lanceolate, 7-9 mm long	ovate, acuminate, dark purple to purple-brown, 6-7 mm long, slightly pubescent on the outside
Inner tepals	shorter and wider than the outer ones, greenish, pinkish-purple towards the base	pink-purple	dark purple, elliptical, 6-7 mm long (rarely shorter), glabrous, wavy-curved at the edges
Labellum length	9-11 mm	9-11 mm	5,5-6,5 mm
Hypochil	concave, dark brown inside, with nectariferous glands	evidently concave, reddish-brown	oblong, concave, dark purple-red
Epichil shape, size & colour	triangular-cordate to broad-ovate, ± recurved, l > L → l = L, greenish-whitish to pinkish-purple, finely crenated on the edges	cordate to reniform, 6-7 mm long, pinkish-purple to green, 1.2 times longer than wide	cordate-reniform, l > L, dark reddish-purple, acuminate, often crenated on the edges
Epichil protuberances	at the base of the epichil, relatively small, elongated, smooth or slightly rough	half of the hpichil width, triangular (Rich & Jermy 1998)	at the base of the epichil, large, rough (crenated-wrinkled), darker colored, confluent at the tip

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Ovar	green, glabrous to rarely hairy, with 6 ribs, elongated	green to pinkish, slightly hairy	± pinkish, densely gray pubescent, with 6 ribs [VLČKO & al. 2003]
Capsula	(8-) 10-15 mm long, 5-8 mm wide, oblong-obovate, glabrous or glabrescent	9-10 mm long, 6-8 mm wide, oblong-ovate, sparsely and soft pubescent (> <i>E. atrorubens</i>)	ovate to oblong-ovate, obtuse at the tip, base sharply narrowed in a stalk, soft pubescent
2n	36, 38, 40, 44	?	40
Ecology	meso-hygrophyllous and in shady sites	on dry and moderately dry, sunny sites	on dry to moderately humid, heliophyllous sites
Frequency, habitat	frequent, from the oak area to the spruce floor, through forests, bushes, forest edges, parks and gardens, through shady places, in coniferous or mixed forests - up to 2000 m alt. (Jakubská-Busse et Gola 2010)	very rare to rare	sporadically, from the floor of the <i>Quercus petraea</i> to the floor of the Norway spruce (even in the subalpine floor), in rocky meadows, bushes, forest edges and ridges, grassy rocks, on limestone soils - up to 2400 m alt (JAKUBSKA-BUSSE & GOLA, 2010)
Coenology	<i>Epipactido-Fagenion</i> , <i>Fagetalia</i> , <i>Abieti-Piceion</i>	<i>Piceion excelsae</i> , <i>Epipactido-Fagenion</i>	<i>Epipactido-Fagenion</i> , <i>Pinetalia</i> , <i>Abieti-Piceion</i>
World distribution	Eurasian (from the Mediterranean area to the Boreal area), being identified also in North America and northern Africa (Jakubská-Busse et Gola 2010)	Eurasian (Europe: from the British Isles to the W Russia, including Crimea and Caucasus), Iran	Eurasian (Europe to Siberia, including the Caucasus and N Iran) (JAKUBSKA-BUSSE & GOLA, 2010)

Location of the nothospecies in Romania

Until now, the nothospecies of *Epipactis* × *schmalhauseni* nothosubsp. *schmalhauseni* has been identified in:

- Eastern Carpathians: Bistriței Mountains (in the neighborhood of Tulgheș town, South of the rocks “Pietrele Roșii” (GPS coordinations: N46°97849/E25°77029/altitude circa 1000 m s.l.), Ceahlău Mountains (near the rock called “Căciula Dorobanțului”), Hășmaș Mountains (near the rock called “Piatra Singuratică”);
- Southern Carpathians: Bucegi Mountains (in Zănoagei Gorges, in the lower half, towards the lake Scropoasa) (Figure 5).

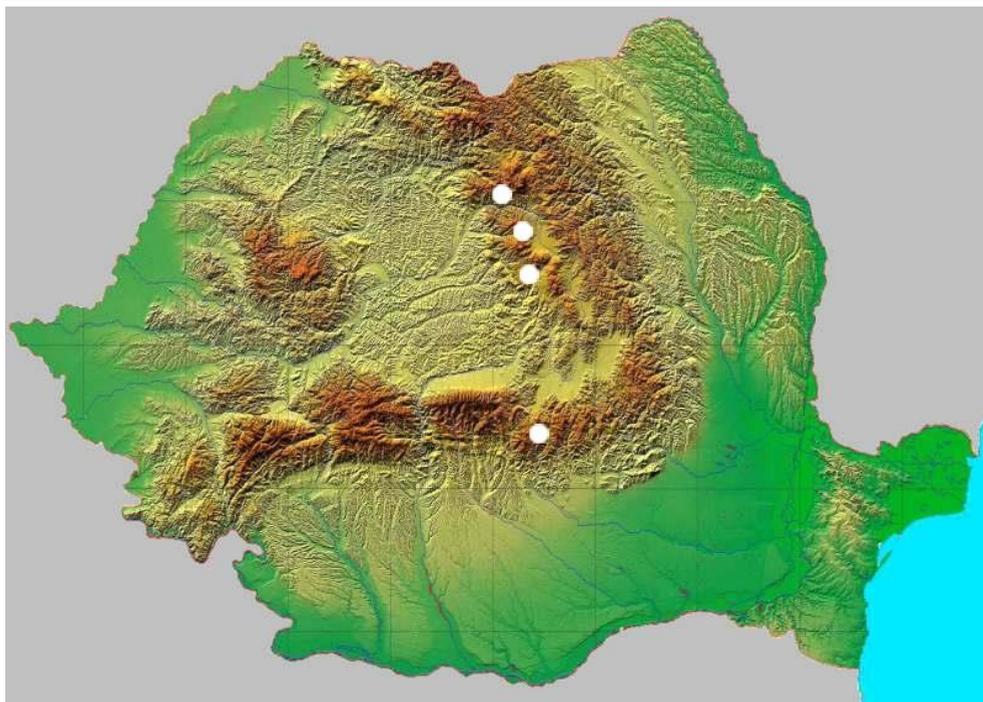


Figure 5. Map distribution of *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* in Romania (https://www.welcometoromania.eu/Romania/Romania_Harta_Geografica_e.htm)

The general distribution of nothosp. *Epipactis* × *schmalhausenii* is as follows:

- Central Europe: Austria, Belgium, former Czechoslovakia, Germany, Poland, and Switzerland;
- West and North of Europe: France (in the subalpine vegetation of the Alps), Spain, Great Britain, Sweden, South of Norway, the european part of North-West Russia;
- South and East of Europe: Greece, Italy, former Yugoslavia;
- Asia: East Kazakhstan, in steppe vegetation areas (ADAMOVSKI, 1995).

But, the general distribution of *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* is restricted to the European continent only, as follows: Sweden, Great Britain, France, Belgium, Germany, Poland, Switzerland, Austria, former Czechoslovakia, Greece, and the european part of North-West Russia, and Romania.

In herbaria: the collected individuals of *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* have been deposited in the public herbaria in Romania, thus:

- herbarium of the Botanic Garden “Anastasiu Fătu” (IAGB): sheet no. 47.704 - collected from nearby of Tulgheș, in Bistriței Mountains, Eastern Carpathians, Romania, leg. A. Oprea, at 13th of July, 2019;
- herbarium of the University of Agronomical Studies and Veterinary Medicine “Ion Ionescu de la Brad” in Iași (IASI): sheet no. 17960 - collected from nearby of Tulgheș, in Bistriței Mountains, Eastern Carpathians, Romania, leg. C. Sîrbu, at 13th of July, 2019.

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Ecology of the nothospecies *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* in Romania: it grows in shady and half shady places, on moist soils, on calcareous substrates.

Coenology: in Norway spruce forests (*Piceion excelsae* Pawł. în Pawł. et al. 1928) or in beech forests (*Epipactido-Fagenion* Boşcaiu et al. 1982). Besides the genitors (*Epipactis helleborine* subsp. *helleborine* and *E. atrorubens*), other accompanying plant species on the place, are: *Picea abies* (L.) H. Karst., *Fagus sylvatica* L., *Betula pendula* Roth, *Hieracium pojoritense* Woł. subsp. *pojoritense*, *Campanula carpatica* Jacq., *Aconitum anthora* L., *Arabis hirsuta* (L.) Scop., *Clinopodium vulgare* L. subsp. *vulgare*, *Erysimum witmannii* Zaw. subsp. *witmannii*, *Gnaphalium sylvaticum* L., *Silene nutans* L. subsp. *dubia* (Herbich) Zapal., *Hepatica transsilvanica* Fuss etc.

Sozology: in the Romanian Red Lists/Red Book, the parents of the nothospecies are listed as follows:

- in a red list on the vascular plant species of Romania [OLTEAN & al. 1994], *Epipactis helleborine* and *E. atrorubens* are considered to be rare (R) plant species;
- other authors [BOŞCAIU & al. 1994] does not consider the genitors as to be at risk in Romania;
- other authors [DIHORU & DIHORU, 1994] also does not consider the genitors as to be at risk in Romania;
- other authors [SÂRBU & CHIFU, 2003] consider both genitors as to be rare (R) species within the flora of the Moldavian province (the eastern part of Romania);
- the *Red Book* of plant species in Romania [DIHORU & NEGREAN, 2009] does not include any of the genitors in it.

Our proposal is: *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* could be considered as a vulnerable species in Romanian flora (VU, under the IUCN risk categories).

Conclusions

A new taxon of genus *Epipactis* was identified in Romanian vascular flora, namely: *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii*.

The distribution of this newly identified taxon in the wild flora of Romania is: mountains of Bistriţei, Ceahlău, Hăşmaş, and Bucegi.

Epipactis × *schmalhausenii* nothosubsp. *schmalhausenii* could be considered as a vulnerable (VU) plant species into the Romanian flora.

The world distribution of nothosp. *Epipactis* × *schmalhausenii* is in Central Europe, West and North of Europe, South and East of Europe, and East Kazakhstan, but the distribution of *Epipactis* × *schmalhausenii* nothosubsp. *schmalhausenii* is restricted to Europe, only.

Aknowledgements

We are very grateful to Dr. Ioan Sârbu (University “Alexandru Ioan Cuza” of Iaşi, Romania) for his valuable advices in revising of the herbarium specimens collected in the field. We are also much obliged to the anonymous reviewers of this paper, for their comments on the manuscript.

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How to cite this article:

DULUGEAC R., BOBOCEA M., SÎRBU C. & OPREA A.. 2019. *Epipactis* × *schmalhausenii* K. Richt. (*Orchidaceae*), a newly identified taxon in Romanian flora. *J. Plant Develop.* **26**: 137-146.
<https://doi.org/10.33628/jpd.2019.26.1.137>
