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Vegetation affinity of *Epipactis albensis* (Orchidaceae) in Central Europe

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ABSTRACT:
Epipactis albensis is an obligate autogamous orchid species which is widely distributed in central European countries. However, its phytocoenological affinities are not well known. They were investigated in this study based on 17 phytosociological relevés from the Czech Republic, Slovakia, and Poland obtained from the available literature and database sources, where the species has its centre of occurrence. The cluster analyses revealed three groups of vegetation types belonging to the hardwood floodplain forests of the *Fraxino-Quercion roboris* alliance, the riparian alder forests of *Alnion incanae* and the beech forests of *Fagion sylvaticae*. *Brachypodium sylvaticum*, *Circaea lutetiana*, *Geum urbanum,* and *Urtica dioica* (frequency 76%), followed by *Dactylis glomerata* agg. and the alien plant *Impatiens parviflora* (65%) are the most co-occurring species. This phytosociological study has highlighted the need for further and more detailed research supported by the collection of new vegetation data from across the range of *E. albensis*.

Keywords:
autogamous orchid, Czech Republic, *Epipactis*, floodplain and beech forests, orchids, Poland, Slovakia

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INTRODUCTION

Epipactis Zinn, 1757 is an orchid genus with a considerable number of species in Europe, ranging from 50 to almost a hundred, depending on the taxonomic concept (BAUMANN *et al.* 2006; DELFORGE 2016; BABORKA 2022). One of the species within the genus, *Epipactis albensis* Nováková et Rydlo, was described from the Elbe valley in the Czech Republic in the second half of the last century (NOVÁKOVÁ & RYDLO 1978). The orchid is mainly found in central European countries, including Austria (TIMPE 1995; GRIEBL 2013), the Czech Republic (NOVÁKOVÁ & RYDLO 1978; PRŮŠA 2019), Hungary (TIMPE 1995), Germany (WUCHERPFENNIG 1993; HENNIGS 2018), Poland (RYDLO 1989; BERNACKI 2000), and Slovakia (VLČKO *et al.* 2003; BABORKA 2022), while its occurrence in Ukraine (LJUBKA *et al.* 2014), Lithuania (RYLA *et al.* 2022) and Romania (MOLNÁR & SRAMKÓ 2012) remains marginal. This species is considered an obligate autogamous taxon, meaning it does not require the presence of insects for pollination. However, it produces flower nectar rich in chemical insect attractants (JAKUBSKA-BUSSE *et al.* 2022). The floral morphology of this species is associated with its adaptation to self-pollination, which is reflected in the presence of sessile anthers, a non-functional rostellum, the lack of a viscidium, an only slightly developed clinandrium and powdery pollinia (CLAESSENS & KLEYNEN 2011; MOLNÁR & SRAMKÓ 2012). The species also produces a chlorophyll-free form (JAKUBSKA & SCHMIDT 2005). The taxonomic classification of *E. albenisis* as a distinct species is uncertain, which is consistent with the ambiguity surrounding the classification system for the entire *Epipactis* genus. Based on the Delforge classification (DELFORGE 2016), *E. albensis* is part of a group which includes species such as *E. mecsekensis* A.Molnár & Robatsch, *E. moravica* Batoušek, *E. fibri* Scappat. & Robatsch, *E. rivularis* Kranjcev & Cicmir, *E. maricae* (Croce, Bongiorni, De Vivo & Fori) Presser & S.Hertel, *E. lucana* Presser, S.Hertel & V.A.Romano, *E. confusa* D.P.Young, and *E. bugacensis* Robatsch.

Epipactis albensis is divided into two infraspecific taxa, i.e. *E. albensis* var. *albensis* and *E. albensis* var. *fibri*

(Scappat. & Robatsch) P. Delforge (Roskov *et al.* 2019). Some researchers distinguish a separate subspecies, *E. albensis* subsp. *lusatia* Hennigs, based on morphological characteristics (Hennigs 2018). This species, like *E. purpurata* Sm., is one of the later flowering helleborines. Flowering typically occurs from the second half of July to the second half of August, although some authors suggest that it may continue into September, October, or even November (Delforge 2016).

It is classified as being of Least Concern (LC) on the IUCN Red List of Threatened Species (Rankou 2011) and the European Red List of Vascular Plants (Bilz *et al.* 2011). However, in the national red lists of plants, in the countries which make up the geographical centre of the species distribution (Czech Republic, Slovakia, Poland), less optimistic categories are defined for this orchid. In the Czech Republic, where the largest number of populations of *E. albensis* has been recorded so far, the species is nonetheless listed as a highly endangered plant (category C2, Kaplan *et al.* 2019). In Slovakia, *E. albensis* is considered Near-Threatened (NT) (Eliáš *et al.* 2015) and in Poland Vulnerable (VU) (Bernacki 2014). Conservation measures for rare plant species are linked to protecting their habitats, but current knowledge of the phytocoenological affinities of this species seems to be insufficient.

Epipactis albensis is undoubtedly characterised by its habitat preference and is often found in localities along river valleys (Bernacki 2001; Delforge 2016). This orchid can grow in a wide range of soil conditions, in both slightly acidic and slightly alkaline soils with a pH range of 4.6–7.65 (Procházka & Velísek 1983; Molnár & Sramkó 2012). The species shows a preference for flooded riparian forests (Vlčko *et al.* 2003; Molnár & Sramkó 2012; Ljubka 2018a; Průša 2019; Pacsai *et al.* 2022), but is also less commonly observed in other types of broad-leaved forests, such as beech forests (Pawlak 2012; Czarna *et al.* 2014; Pacsai *et al.* 2022), hornbeam forests (Gębala 2008; Pacsai *et al.* 2022) and poplar monocultures (Ljubka *et al.* 2014; Baborka 2022). It is rarely recorded in secondary non-forest habitats, as evidenced by several studies (e.g. Jatiová & Šmiták 1996; Vlčko *et al.* 2003; Molnár & Sramkó 2012). However, the vegetation type preferences of this species are often inadequately/poorly defined, lacking phytosociological relevés or floristic characteristics. In addition, the vegetation data are scattered among several local literature sources, thus requiring a more comprehensive vegetation study.

With this in mind, the aims of this study were: i) to analyse the available phytosociological material from the Czech Republic, Slovakia and Poland in relation to *E. albensis* and ii) to determine the phytocoenological affinity of the species and to test the assumption that floodplain forests are its preferred habitat type.

MATERIALS AND METHODS

Phytosociological relevés with the presence of *E. albensis* from the centre of the species distribution range in the Czech Republic, Poland, and Slovakia (Fig. 1) were obtained from available published references (see Table 1) and national phytosociological databases (Chytrý & Rafajová 2003; Šibík 2012). All 17 relevés obtained were stored using the Turboveg software package (Hennekens & Schaminée 2001) and then exported to the Juice program (Tichý 2002). The data set was classified in the PC-ORD program (McCune & Mefford 1999) using the Bray-Curtis distance as a measure of dissimilarity and the beta flexible linkage method ($ß$ = -0.25) with square-root data transformation. The diagnostic species of each cluster were determined according to the combined concept of frequency and fidelity, which measures the species concentration in vegetation units (Sokal & Rohlf 1995; Chytrý *et al.* 2002). To be included in the list of diagnostic species, a species had to show simultaneously: (i) $\Phi \geq 0.20$ and a significant occurrence within a given cluster (Fisher's exact test $p < 0.01$), (ii) frequency ≥ 50%, and (iii) differences in frequencies between clusters greater than 30%.

The names of higher syntaxa are presented according to Mucina *et al.* (2016), and plant nomenclature follows the Plants of the World Online database (POWO 2024), respectively.

RESULTS

The most common species co-occurring with *Epipactis albensis* in our dataset were *Brachypodium sylvaticum* (Huds.) P.Beauv., *Circaea lutetiana* L., *Geum urbanum* L., and *Urtica dioica* L. (with a frequency of 76%), followed by *Dactylis glomerata* agg. (incl. *D. glomerata* L. and *D. polygama* Horv.) and the alien plant *Impatiens parviflora* DC. (with a frequency of 65%). The numerical classification revealed 3 clusters of deciduous forest vegetation types with the occurrence of *E. albensis*. The first cluster is characterised by the presence of mesophilous species in the tree layer (*Carpinus betulus* L., *Fraxinus excelsior* L., *F. angustifolia* Vahl, *Quercus robur* L., *Tilia cordata* Mill.) and a combination of wetland (rare), mesophilous and nitrophilous species in the herb layer (e.g. *Brachypodium sylvaticum*, *Carex remota* L., *Circaea lutetiana*, *Geum urbanum*, *Stachys sylvatica* L. or *Urtica dioica*). The vegetation of this cluster can be classified as hardwood floodplain forests (*Fraxino-Quercion roboris* alliance) and/or a mesophilous type of riparian alder forest (*Alnion incanae*; both *Alno glutinosae-Populetea albae* class). The second cluster includes vegetation dominated by *Alnus glutinosa* (L.) Gaertn., *Populus nigra* L., *Prunus padus* L. and *Salix alba* L. in the tree layer with a well-developed shrub layer (e.g. *Prunus padus*, *Sambucus nigra* L.) and a combination of wetland and mes-

Fig. 1. The study area with the location of the phytosociological relevés (white circles – first cluster, grey circles – second cluster and black circles – third cluster; see Table 1).

ophilous, also partially nitrophilous, plants in the herb layer (e.g. *Aegopodium podagraria* L., *Galium aparine* L., *Geum urbanum*, *Symphytum officinale* L., *Urtica dioica*). This cluster belongs to riparian alder forests (*Alnion incanae*) and marginally also to softwood willow and poplar floodplain forests (*Salicion albae*; *Salicetea purpureae*). Finally, the third cluster is relatively homogenous in terms of species composition, with a strong dominance of *Fagus sylvatica* L. in the tree layer and the presence of mesophilous and typical beech forest species such as *Athyrium filix-femina* (L.) Roth, *Brachypodium sylvaticum*, *Carex sylvatica* Huds., *Galium odoratum* (L.) Scop., *Hedera helix* L. or *Oxalis acetosella* L. The vegetation is typical of beech forests (*Fagion sylvaticae*; *Carpino-Fagetea sylvaticae*).

DISCUSSION

Although *E. albensis* is a relatively common species in Central Europe (e.g. Timpe & Mrkvicka 1996; Bernacki 2001; Vlčko *et al.* 2003; Sulyok & Molnár 2011; Delforge 2016; Ljubka 2018b; Průša 2019), phytosociological material from this area is relatively rare.

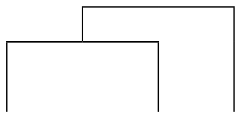
The phytosociological data on the plant communities where *E. albensis* is found varies significantly depending on the country of origin. Habitat variations and using different phytosociological classification systems across European countries contribute to these differences.

Our vegetation classification results, based on limited phytosociological material, indicate that *E. albensis* is mainly found in floodplain forests and less frequently in beech forests. The presence of floods, sufficient soil nutrients and moisture are typical ecological characteristics of floodplain forests (hardwood and riparian alder forests) and support the co-existence of moisture-demanding (including *E. albensis*) as well as mesophilous and nitrophilous plants (Ellenberg 2009; Douda *et al.* 2016). However, a literature review showed that the phytocoenological affinity of the species is reported to be wider. In 1978, Nováková and Rydlo discovered and described the first localities of *E. albensis* in riparian alder forests in the Czech Republic (Nováková & Rydlo 1978). The vegetation has been classified as belonging to the sub-alliance *Alnenion glutinoso-incanae* (=*Alnion incanae*; *Alno glutinosae-Populetea albae*) according to the Braun-Blanquet approach. This may also refer to the three older subunits of *Querco-Ulmetum medioeuropaeum*, including *Querco-Ulmetum alnetosum*, *Querco-Ulmetum carpinetosum*, and *Querco-Ulmetum typicum* (all *Alno glutinosae-Populetea albae*; Nováková & Rydlo 1978). In Austria, *E. albensis* populations have been found in the *Fraxino pannonicae-Ulmetum* association (*Alno glutinosae-Populetea albae*) of riparian forests. The orchid grew mainly on higher sites which were less frequently flooded, with a higher proportion of *Carpinus betulus* and *Tilia cordata* in the tree layer (Timpe & Mrkvicka 1996). *Epipactis albensis* was discovered in the Günser Mountains near Bozsok, on the border between western Hungary and eastern Austria in a high-moisture artificial forest with a hybrid poplar population. This forest is classified as the riparian forest *Pruno-Fraxinetum* (*Alnion incanae*, *Alno glutinosae-Populetea albae*; Timpe & Mrkvicka 1996). According to the literature (Bernacki 2001, 2008, 2014; Bernacki *et al.* 2002; Pawlak 2012), *E. albensis* also grows in the *Tilio-Carpinetum* oak-hornbeam phytocoenoses (*Carpino-Fagetea sylvaticae*) because of the optimal conditions they provide. Single occurrences of the species have also been recorded on the borders of the ecotone zone between the oak-hornbeam and i) the thermophilous beech (*Cephalanthero-Fagenion*) and ii) the fertile Carpathian beech forest (*Dentario glandulosae-Fagetum*; all *Carpino-Fagetea sylvaticae*). It has also been found in transitional phytocoenoses from oak-hornbeam to riparian *Carici remotae-Fraxinetum* (*Alnion incanae*, *Alno glutinosae-Populetea albae*; Bernacki *et al.* 2002; Czarna *et al.* 2014). In addition, *E. albensis* has been found growing on serpentinite near quarries in Austria, although these areas are generally considered unsuitable for plant growth (Timpe 1995).

Rarely, the species has been recorded in non-forest vegetation such as wet grasslands or the moist margins of forest roads (e.g. Kolník & Kučera 2002; Vlčko *et al.* 2003), but also in ruderal plant communities or shrubs (Jatiová & Šmiták 1996).

Although the habitat variability for this species is relatively high, the species preference for floodplain for-

Table 1 An abbreviated synoptic table generated by cluster analysis showing the occurrences of *Epipactis albensis* in Central Europe. Only species from at least 3 relevés are shown.
The relative frequency of the species is given as a percentage and the median cover values are given in superscript. E_3 – tree layer, E_2 – shrub layer, E_1 – herb layer and the frequencies of the diagnostic species of a given cluster are shown in bold.

Cluster number	**1**	**2**	**3**
Number of relevés	**10**	**4**	**3**
Cluster tree			
Relative number of relevés (%)			
Czech Republic	70	50	0
Poland	30	25	100
Slovakia	0	25	0
Diagnostic species of first cluster			
Carpinus betulus L. (E_3)	**80^{3}**	.	.
Quercus robur L. (E_3)	**60^{3}**	.	.
Tilia cordata Mill. (E_3)	**80^{3}**	25^{a}	.
Carex remota L. (E_1)	**60^{+}**	.	.
Diagnostic species of second cluster			
Alnus glutinosa (L.) Gaertn. (E_3)	10^{1}	**75^{a}**	.
Populus nigra L. (E_3)	.	**50^{a}**	.
Salix alba L. (E_3)	.	**50^{1}**	.
Prunus padus Brandis (E_3)	.	**50^{+}**	.
Prunus padus Brandis (E_2)	30^{1}	**100^{1}**	.
Sambucus nigra L. (E_2)	.	**50^{a}**	.
Galium aparine L. (E_1)	10^{+}	**75^{+}**	.
Symphytum officinale L. (E_1)	.	**50^{r}**	.
Diagnostic species of third cluster			
Fagus sylvatica L. (E_3)	.	.	**100^{4}**
Fagus sylvatica L. (E_2)	.	.	**67^{1}**
Fagus sylvatica L. (E_1)	.	.	**100^{+}**
Hedera helix	.	.	**67^{+}**
Other species			
Tree layer (E_3)			
Acer campestre L.	40^{1}	50^{+}	.
Fraxinus excelsior L.	40^{a}	.	.
Fraxinus angustifolia Vahl	30^{1}	.	.
Tilia platyphylla C. A. Mey.	30^{+}	.	.
Carpinus betulus L.	30^{1}	.	.
Ulmus laevis Pall.	20^{+}	25^{a}	.
Populus sp.	20^{3}	.	.
Ulmus minor Mill.	10^{+}	25^{+}	.
Shrub layer (E_2)			
Tilia cordata Mill.	60^{1}	25^{+}	.
Cornus sanguinea L.	30^{+}	50^{+}	.
Fraxinus excelsior L.	40^{+}	25^{1}	.
Euonymus europaeus L.	30^{+}	25^{r}	.
Corylus avellana L.	20^{+}	25^{4}	.
Crataegus sp.	20^{+}	25^{1}	.
Acer campestre L.	20^{+}	25^{+}	.
Quercus robur L.	10^{1}	25^{r}	.
Frangula alnus Mill.	10^{+}	25^{+}	.
Ulmus sp.	10^{1}	25^{1}	.
Crataegus laevigata (Poir.) DC.	10^{+}	25^{r}	.
Herb layer (E_1)			
Epipactis albensis Nováková & Rydlo	100^{r}	100^{+}	100^{+}
Brachypodium sylvaticum (Huds.)P.Beauv.	80^{a}	75^{+}	67^{r}
Circaea lutetiana L.	90^{+}	50^{+}	67^{r}
Urtica dioica L.	90^{+}	75^{a}	33^{r}
Geum urbanum L.	80^{+}	100^{+}	33^{r}
Impatiens parviflora DC.	80^{1}	25^{3}	67^{+}
Dactylis glomerata agg..	70^{1}	25^{+}	67^{+}
Stachys sylvatica L.	70^{+}	25^{a}	33^{+}
Rubus caesius Thunb. ex. Maxim.	60^{+}	50^{1}	33^{a}
Lamium maculatum (L.) L.	70^{+}	50^{+}	.
Carex sylvatica Huds.	50^{a}	25^{+}	67^{r}
Aegopodium podagraria L.	60^{1}	50^{a}	.
Glechoma hederacea L.	60^{1}	25^{1}	33^{1}
Milium effusum L.	50^{+}	25^{+}	33^{r}
Lysimachia nummularia L.	40^{+}	50^{+}	33^{+}
Rumex sanguineus L.	50^{+}	.	33^{r}
Pulmonaria obscura Dumort.	40^{+}	50^{1}	.
Lolium giganteum (L.) Darbysh.	50^{+}	25^{+}	.
Oxalis acetosella L.	30^{+}	.	67^{+}
Ajuga reptans L.	40^{+}	.	33^{+}
Chaerophyllum temulum L.	40^{+}	25^{3}	.
Viola reichenbachiana Jord. ex. Boreau	40^{+}	.	33^{+}
Scrophularia nodosa L.	20^{r}	50^{r}	33^{r}
Tilia cordata Mill.	40^{+}	.	.
Deschampsia cespitosa (L.) P. Beauv.	40^{+}	.	.
Acer campestre L.	40^{1}	.	.
Poa nemoralis L.	40^{+}	.	.
Veronica montana Pall.	30^{+}	.	33^{r}
Moehringia trinervia (L.) Clairv.	30^{r}	25^{+}	.
Lamium galeobdolon (L.) L.	20^{+}	25^{3}	.
Rubus idaeus L.	20^{+}	.	33^{1}
Athyrium filix-femina (L.) Roth	10^{+}	.	67^{r}
Acer pseudoplatanus L.	10^{+}	.	67^{r}
Ranunculus repens L.	20^{r}	25^{+}	.
Equisetum arvense L.	10^{+}	25^{1}	33^{+}
Fraxinus excelsior L.	30^{+}	.	.
Polygonatum multiflorum (L.) All.	20^{+}	25^{+}	.
Carpinus betulus L.	20^{+}	.	33^{r}
Lathyrus vernus (L.) Bernh.	20^{+}	.	33^{r}
Maianthemum bifolium (L.).F.W.Schmidt.	20^{r}	.	33^{+}
Rabelera holostea (L).M.T.Sharples & E.A.Tripp.	10^{+}	50^{+}	.
Euonymus europaeus L.	30^{+}	.	.

Fraxinus angustifolia Vahl	30^{1}	.	.
Geranium robertianum L.	30^{1}	.	.
Tilia platyphylla C. A. Mey.	30^{+}	.	.
Veronica chamaedrys agg.	30^{+}	.	.
Pulmonaria officinalis L.	30^{+}	.	.
Galium odoratum (L.) Scop.	10^{1}	.	67^{+}
Elymus caninus (L.) L.	20^{+}	.	.
Acer platanoides L.	10^{+}	25^{r}	33^{+}
Carex strigosa Willd. ex. Kunth	20^{1}	.	.
Asarum europaeum L.	20^{+}	.	.
Cirsium oleraceum (L.) Scop.	20^{+}	.	.
Viburnum opulus L.	20^{+}	.	.
Galeopsis pubescens Besser.	20^{+}	.	.
Campanula trachelium L.	20^{+}	.	.
Hypericum hirsutum Boiss.	20^{r}	.	.
Heracleum sphondylium L.	10^{+}	25^{+}	.
Memoremea scorpioides (Haenke) A.Otero, Jim.Mejías, Valcárcel & P.Vargas	10^{+}	25^{1}	.
Fragaria vesca L.	10^{r}	25^{+}	.
Epipactis purpurata Sm.	10^{r}	.	33^{+}
Quercus robur L.	20^{r}	.	.
Galeopsis bifida Boenn.	20^{+}	.	.
Aristolochia clematitis L.	20^{r}	.	.
Convallaria majalis L.	20^{+}	.	.
Carpinus betulus L.	20^{a}	.	.
Lapsana communis L.	20^{+}	.	.
Torilis japonica (Houtt.) DC.	20^{r}	.	.
Carex divulsa Stokes	20^{r}	.	.
Cardamine impatiens L.	20^{r}	.	.
Fallopia convolvulus (L.) Á. Löve	20^{r}	.	.
Tilia platyphylla C. A. Mey.	20^{1}	.	.
Anemone ranunculoides L.	20^{+}	.	.
Cornus sanguinea L.	20^{r}	.	.
Paris quadrifolia L.	10^{r}	25^{1}	.
Taraxacum sect. *Ruderalia*	.	25^{+}	33^{r}
Fraxinus excelsior L.	.	25^{r}	33^{r}

Sources of relevés in Table 1: 1 cluster: Vicherek ined. (CZ, 3 rels), Nováková & Rydlo (1978) (CZ, 1 rel.), Rydlo (1989) (CZ, 4 rels), Świerkosz (2004) (PL, 1 rel.), Czarna & Rahmonov (2009) (PL, 1 rel.); 2 cluster: Jakubska-Busse ined. (PL, 1 rel.), Nováková & Rydlo (1978) (CZ, 1 rel.), Ježek & Trávniček (1986) (CZ, 1 rel.), Hrivnák (1997) (SK, 1 rel.); 3 cluster: Czarna *et al.* (2014) (PL, 2 rels), Czarna & Michalak (2019) (PL, 1 rel).

ests suggests that sufficient soil moisture and trees providing shade are crucial ecological characteristics for the growth and development of this orchid. As a result, forests, particularly floodplain forests, have the highest concentration of this species. Ellenberg's indicator values for the Central European flora (Czech Republic), as well as the whole of Europe, show that *E. albensis* has a high tolerance to shady and partially shady environments and typically thrives in moderately moist but not excessively wet soils (Ellenberg *et al.* 1991; Tichý *et al.* 2023).

The results of our vegetation study from the Czech Republic, Poland, and Slovakia showed the strong vegetation affinity of *E. albensis* for floodplain forests and a rare occurrence in beech forests. This result is the first summary of the vegetation affinity of the species in Central Europe. However, a broader and more comprehensive understanding of *E. albensis* coenology in Europe requires a wealth of new phytosociological data from both the centre and edge of the species range.

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REZIME

Botanica SERBICA

Vegetacijski afinitet *Epipactis albensis* (Orchidaceae) u Centralnoj Evropi

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Epipactis albensis je obligatna autogamna vrsta orhideja koja je široko rasprostranjena u zemljama centralne Evrope. Međutim, njeni fitocenološki afiniteti nisu dovoljno poznati. U okviru ove studije istraživana je fitocenološka pripadnost *E. albensis* na osnovu 17 fitocenoloških snimaka iz Češke, Slovačke i Poljske, sakupljene iz literature i baza podataka, a u kojima je ova vrsta dominantno prisutna. Klaster analiza ukazuje na tri grupe tipova vegetacije koji pripadaju poplavnim šumama sveze *Fraxino-Quercion roboris*, priobalnim šumama jove *Alnion incanae* i bukovim šumama *Fagion sylvaticae*. *Brachypodium sylvaticum*, *Circaea lutetiana*, *Geum urbanum,* i *Urtica dioica* (sa frekvencijom 76%), za kojima sledi *Dactylis glomerata* agg. i alohtona vrsta *Impatiens parviflora* (65%) su vrste koje se najčešće javljaju kao propratne. Ova fitocenološka studija je istakla potrebu za detaljnijim istraživanjima praćenim prikupljanjem novih vegetacijskih podataka širom areala vrste *E. albensis*.

Ključne reči: autogamna orhideja, Češka republika, *Epipactis*, poplavne i bukove šume, orhideje, Poljska, Slovačka