

CHARACTERISTICS OF THE LOCALITY OF *Liparis loeselii* (L.) Rich. ON CHEŁM HILLS (WEST POLESIE)

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Summary. *Liparis loeselii* (L.) Rich. is a rare and endangered species in the Polish flora. The investigations were conducted on a *Liparis loeselii* population inhabiting a spring fen on Chełm Hills. The locality analysed is situated at the foot of a spring fen dome; *Liparis loeselii* occurs here in a patch of the association *Caricetum davallianae* from the class *Scheuchzerio-Caricetea nigrae*. The analysis of shoots and flowers of *Liparis loeselii* specimens showed that they were smaller than specimens described by other authors. Based on several-year-long observations, it can be assumed that the species has a chance for survival in the locality if the habitat conditions do not change substantially. In the fen, localities of other rare and legally protected plant species were found besides *Liparis loeselii*, e.g. *Carex davalliana*, *Dactylorhiza incarnata*, *Epipactis palustris*, *Menyanthes trifoliata*, and *Climacium dendroides*.

Key words: *Liparis loeselii* (L.) Rich., habitat conditions, Chełm Hills (West Polesie)

INTRODUCTION

Liparis loeselii (L.) Rich. is a small, green or yellowish-green perennial plant (rhizomatous geophyte) reaching the height of 5–20 cm. It usually has two opposite, spatulate or broadly lanceolate leaves. The shoot (5–20 cm) grows from a pseudobulb. The inflorescence is composed of 1–18 yellowish-white flowers. *Liparis loeselii* occurs locally in Asia, on the eastern coast of North America, and in Europe. The strict geographical range covers central and central-eastern Europe. Insular occurrence of the species has been reported from western Spain, northern Corsica, northern Greece, and northern Italy [Szlachetko 2009, Baumann *et al.* 2010, Kucharski 2010, Jarzombkowski and Pawlikowski 2012]. It is one of the rarest species of the Polish flora; hence, it is a strictly protected species requiring active protection. According to the Polish Red Book of Plants [Każmierczakowa and Zarzycki 2001], *Liparis loeselii* belongs to cate-

gory VU (vulnerable species). It is also protected under the Bern Convention and Habitats Directive. In the Lublin Province, it has been classified as a critically endangered species [Kucharczyk and Wójciak 1995].

Due to its infrequent occurrence, the species is classified as critically endangered orchid species both in Poland and in neighbouring countries [Kucharski 2001]. Its localities have been most frequently reported from northern Poland. Additionally, *Liparis loeselii* is scattered across Central Lowlands, Polesie, and the belt of uplands [Kucharski 2001, Zając A. and Zając M. 2001, Szlachetko 2009, Jarzombkowski and Pawlikowski 2012]. Localities from the Lublin Province have been reported as well. They are situated in the Szyszła and Siniocha River valleys, near Dyniska [Michalczyk and Stachyra 2003], Wieprzec Reserve [after Kucharski 2001], the Poleski National Park [Kucharski 2001], midforest peatbogs in Sobibór Forests [Urban 2007a, 2008], Komarzyce peatbogs [Urban 1999, 2004, Urban and Błaszczak 2004], the Wyżnica River valley (near Wola Sosnowa) [Urban 1999], and near Pawłów [Urban and Sławiński 2003, Urban 2005].

Liparis loeselii inhabits peatbogs formed on a carbonate substrate recharged by upwelling ground water as well as on acidic peats of low-sedge bog springs and transitional moors [Kucharski 2001, Jarzombkowski and Pawlikowski 2012]. The species is primarily associated with phytocoenoses from the class *Scheuchzerio-Caricetea nigrae*. Most frequently, it occurs in communities from the order *Caricetalia davalliana*, and sometimes in moss-covered reed associations from the class *Phragmitetea*. Less frequently, it can be found in patches of the community *Cladium mariscus* and on variable-moisture meadows from the alliance *Molinion*. The species also occurs in acidic sphagnum bogs from the order *Scheuchzerietalia palustris* [Kucharski 2001, Jarzombkowski and Pawlikowski 2012] and more seldom in phytocoenoses of communities from the class *Oxycocco-Sphagmnetea* [Łachacz and Olesiński 2000]. *Liparis loeselii* has also been reported from anthropogenic localities, e.g. gravel or sand excavation pits [Molenda 2004, Czyłok *et al.* 2008, Urban 2009].

The aim of the study was to determine the habitat conditions and individual traits of a *Liparis loeselii* population inhabiting a small spring fen on Chełm Hills (Volhynian Polesie).

STUDY AREA, MATERIALS AND METHODS

In terms of administration, the fen with *Liparis loeselii* localities is situated in Rejowiec County, Chełm District, Lublin Province. According to the physical-geographical division developed by Kondracki [2002], it is located on Chełm Hills, a mezoregion of the Volhynian Polesie, in the area of state forests administered by Chełm Forestry and within the Pawłów Protected Landscape Area and Natura 2000 Pawłów.

The fen borders a dome of a spring fen in the southern part. It is covered by rush communities from the class *Phragmitetea* R.TX. et PRSG 1942, meadow

communities from the class *Molinio-Arrhenantheretea* R.TX. 1937, bryales-sedge peat communities from the class *Scheuchzerio-Caricetea nigrae* (NORDH. 1937) R.TX. 1937, brush and forest communities from the class *Alnetea glutinosae* BR.-BL. et R.TX. 1943, and riparian plant communities from the class *Quercu-Fagetea* BR.-BL. et VILEG. 1937. These communities comprise localities of several rare and protected plant species, e.g. *Liparis loeselii*, *Carex davalliana*, *Dactylorhiza incarnata*, *Epipactis palustris*, *Menyanthes trifoliata* and *Climacium dendroides*. Three types of habitats specified in Annex I of Council Directive 92/43/EEC have been recognised in the area, i.e. variable-moisture Molinia meadows, transitional mires, quaking bogs, mountain and lowland alkaline bog-springs, sedge meadows, and moss-covered bogs [Urban and Sławiński 2008].

The first *Liparis loeselii* locality with 20 flowering specimens was found in 2000 [Urban and Sławiński 2003, 2008]. Investigations carried out in 2008 confirmed the presence of *Liparis loeselii* specimens, although not in that locality. However, another locality was found at a distance of ca. 20 m from the first site, with a *Liparis loeselii* population comprising 18 individuals, including 8 flowering specimens. The inflorescences were composed of 1–9 flowers, and the shoot length ranged from 5.4 to 10.2 cm.

In the locality discovered in 2008, detailed analyses of local *Liparis loeselii* populations were performed in 2012. A photosociological relevé was recorded using the Braun-Blanquet method [1964]. The phytosociological classification and nomenclature of plant communities were based on the paper by Matuszkiewicz [2005], and the nomenclature for vascular plants followed Mirek *et al.* [2002]. Near the locality of *Liparis loeselii*, soil was sampled from the 0–10 cm layer, and reaction (pH) was determined with the potentiometric method, whereas the content of organic matter and total Ca was assessed with flame atomic absorption spectrometry (FAAS) technique.

Flowering specimens were analysed to determine the following individual traits: the length of shoots, the number of flowers per inflorescence, the number of leaves, and the length and width of the largest leaf.

RESULTS AND DISCUSSION

During the field study conducted in 2012, 48 *Liparis loeselii* individuals including 28 flowering specimens, were found in an area of 5.0 m². A substantial increase in the number of specimens was noted, compared with the abundance in 2008. Investigations carried out by other authors [Kucharski 2001, 2010, Jarzombkowski and Pawlikowski 2012] showed that the number of individual plants was inconsiderable in a majority of known localities, ranging from several to several tens of specimens. Quite numerous populations have been reported as well, particularly from eastern Poland [e.g. Michalczyk and Stachyra 2003, Pisarczyk 2006, Urban 2007a]. Abundant localities, with up to 1000 specimens, have been found in the lower Rospuda river valley, the Wiatrołuża river valley, and Jurkowy Róg

Peninsula [Jarzombkowski and Pawlikowski 2012]. The area covered by individual *Liparis loeselii* populations varies substantially and ranges from several m² to even several tens of hectares [Jarzombkowski and Pawlikowski 2012].

The locality analysed is situated at the foot of a spring fen dome. *Liparis loeselii* occurs here in a patch of the association *Caricetum davallianae* from the class *Scheuchzerio-Caricetea nigrae*. The species composition of this patch is illustrated by the photosociological relevé recorded on July 17, 2012; cover layer c – 100%, d – 90%; surface area of the relevé 8 m²; ChAss. *Caricetum davallianae*: *Carex davalliana*; ChO. *Caricetalia davallianae* – *Calliergonella cuspidata* 3, *Drepanocladus intermedius* 2, *Liparis loeselii* +, Cl. *Phragmitetea* – *Carex rostrata* 2, *Equisetum fluviatile* +, Cl. *Molinio-Arrhenatheretea* – *Climacium dendroides* 3, *Crepis paludosa* +, *Equisetum palustre* +, *Galium uliginosum* +, *Lysimachia vulgaris* +, *Potentilla reptans* +, Other – *Carex panicea* 1, *Gallium verum* +, *Geum rivale* 2, *Veronica chamaedrys* +. The population under study grows on peat soil formed on heavily silted bryales-sedge fen peat (organic matter content 56.9%). The substrate was characterised by alkaline reaction (in the 0–10 cm layer, pH in KCl – 7.12, in H₂O – 6.99). The calcium content was 76 g kg⁻¹. Similar conditions prevailed in many other *Liparis loeselii* localities in the Lublin Province [Michalczyk and Stachyra 2003, Urban 2007], and elsewhere in Poland [Jarzombkowski and Pawlikowski 2012].

Our investigations indicate that the locality analysed was dominated by flowering specimens, which represented 54.2% of the entire population. The specimens had from 1 to 3 leaves; most frequently they had two leaves, and very rarely 1 leaf (3 individuals) or 3 leaves (2 individuals). The length of the largest leaf in the flowering specimens ranged from 3.5 to 9.0 cm, mean 6.4 cm, average 6.2 cm (Tab. 1). The non-flowering individuals had shorter leaves in the range of 3.5–8.4 cm, mean 5.64 cm, average 5.65 (Tab. 2). The maximum and minimum width of the largest leaf in all the specimens analysed was the same and reached 0.8 and 2.0 cm (mean 1.40 cm in the flowering specimens and 1.16 in the non-flowering individuals; average 1.40 and 1.14 cm, respectively) – Tab. 1 and 2.

Table 1. Individual traits of flowering *Liparis loeselii* specimens

Trait	Min.	Max.	Arithmetic mean	Median	Most frequent	Standard deviation	Coef. of variation, %
Height of the shoot, cm	6.0	17.0	9.61	9.5	10.0	2.63	27.38
Number of flowers	1.0	7.0	2.35	2.0	2.0	1.57	66.81
Length of the largest leaf, cm	9.0	3.5	6.40	6.2	6.0	1.42	22.30
Width of the largest leaf, cm	0.8	2.0	1.40	1.4	1.2	0.27	19.40

Table 2. Individual traits of non-flowering *Liparis loeselii* specimens

Trait	Min.	Max.	Arithmetic mean	Median	Most frequent	Standard deviation	Coef. of variation, %
Length of the largest leaf	3.5	8.4	5.64	5.65	4.0	1.25	21.55
Width of the largest leaf	0.8	2.0	1.16	1.14	1.0	0.29	25.19

The maximum height of shoots of flowering individuals was 17.0 cm, minimum 6.0 cm, mean 9.61 cm, and average 9.50 cm. Specimens with the shoot height of 10.0 cm dominated. Szlachetko and Skakuj [1996] reported that the shoot height ranged from 5 to 20 cm, whereas the range reported by Bauman *et al.* [2010] was 7–17 cm.

The inflorescences were composed of maximum 7, minimum 1, and most frequently 2 flowers. According to Baumann *et al.* [2010], *Liparis loeselii* inflorescences comprise from 2 to 11 (18) flowers. Szlachetko and Skakuj [1996] report a range of 1–18 flowers.

The population investigated was characterised by a moderate and low level of diversity of the length (coefficient of variation 22.30%) and width (coefficient of variation 19.40%) of leaves in the case of the flowering specimens. A moderate level of diversity (coefficient of variation 21.55% and 25.19%) was noted in the case of the non-flowering individuals.

The analysis of the shoots and number of flowers in the *Liparis loeselii* specimens analysed showed that they were smaller than specimens described by other authors [Szlachetko and Skakuj 1996, Baumann *et al.* 2010]. The population exhibited moderate diversity of shoot length (coefficient of variation 27.38%) and very high diversity of the number of flowers (coefficient of variation 66.81%).

Based on the several-year-long observations, it can be assumed that has *Liparis loeselii* a chance of long survival in the locality analysed, provided the habitat conditions do not change substantially. According to Jarzombkowski and Pawlikowski [2012], potential threat to the localities of the species may be posed by disturbances in water relations in its occurrence area (both lowered water levels and increased recharge resulting in waterlogging of the peatbog) as well as succession of scrub communities and expansion of fringe and rush species (*Phragmites australis* in particular).

The abundance of *Liparis loeselii* populations depends of environmental conditions prevailing in a particular year and on herbivore and invertebrate pressure [McMaster 2001]. According to Rolfsmeier [after Jarzombkowski and Pawlikowski 2012], disappearance of germination sites, which provide suitable water conditions and necessary fungi, has a significant effect as well. Due to the unique natural values and protection status of the species, the population should be monitored extensively.

CONCLUSION

1. The investigated *Liparis loeselii* population is characterised by the presence of both flowering plants and plants in the vegetative stage.

2. The newly discovered *Liparis loeselii* locality is interesting due to the unusual abundance of specimens. Based on the long-term observations, it can be claimed that the *Liparis loeselii* population displays a tendency towards increasing abundance. It should be monitored in the coming years.

REFERENCES

- Baumann H., Künkele S., Lorenz R., 2010. Storzcyki Europy i obszarów sąsiednich. Multico Oficyna Wydawnicza, 327 ss.
- Braun-Blanquet J., 1964. Pflanzensoziologie. Gründzuge der Vegetationskunde. Springer Wien – New York, 865 pp.
- Czylok A., Rahmonov O., Szymczyk A., 2008. Biological diversity in the area of quarries after sand exploitation in the eastern part of Silesian Upland. Teka Kom. Ochr. Środ. Przyr., 5A, 15–22.
- Jarzombkowski F., Pawlikowski P., 2012. Krajowy program ochrony lipiennika Loesela *Liparis loeselii* (L.) Rich. Wyd. Klubu Przyrodników. Świebodzin, 26 ss.
- Każmierczakowa R., Zarzycki K. (red.), 2001. Polska czerwona księga roślin. Instytut Botaniki im. W. Szafera PAN, Kraków, 664 ss.
- Kondracki J., 2002. Geografia regionalna Polski. Wyd. Nauk. PWN, Warszawa.
- Kucharczyk M., Wójciak J., 1995. Ginące i zagrożone gatunki roślin naczyniowych Wyżyny Lubelskiej, Rostocza, Wołynia Zachodniego i Polesia Lubelskiego (in Polish). Ochrona Przyrody. 52, 33–40 p.
- Kucharski L., 2001. *Liparis loeselii* (L.) Rich. Lipiennik Loesela, w: R. Każmierczakowa, K. Zarzycki (red.), Polska czerwona księga roślin. Instytut Botaniki im. W. Szafera PAN, Kraków, s. 574–575.
- Kucharski L., 2010. 1903 Lipiennik Loesela *Liparis loeselii* (L.) Rich. , w: J. Perzanowska (red.), Monitoring gatunków. Przewodnik metodyczny 1. GIOŚ, Warszawa, s. 99–109.
- Łachacz A., Olesiński L., 2000. Flora i roślinność torfowiska Jezioro na Pojezierzu Mazurskim. Fragm. Flor. Geobot. Polonica. 7, 129–143.
- McMaster R.T., 2001. The population biology of *Liparis loeselii*, Loesel's twayblade, in Massachusetts wetland. Northeastern Naturalist 8(2), 163–178.
- Matuszkiewicz W., 2005. A guide for marking Poland's plant communities (in Polish). Wyd. Naukowe PWN, 536 pp.
- Michalczyk W., Stachyra P., 2003. Nowe stanowiska lipiennika Loesela *Liparis loeselii* (L.) Rich. na Zamojszczyźnie. Chrońmy Przyr. Ojcz. 59, 122–125.
- Mirek Z., Piękoś-Mirkowa H., Zając A., Zając M., 2002. Flowering plants and pteridophytes of Poland a checklist (in Polish). W. Szafer Inst. of Botany, Polish Academy of Sciences, Kraków, 442 pp.
- Molenda T., 2004. Antropogeniczne mokradła Wyżyny Śląskiej, w: Sympozjum „Torfowiska gór i wyżyn: Kielce-Białe Ługi, 21–22 czerwca 2004 r. Kielce, s. 34–35.
- Pisarczyk E., 2006. Nowe stanowisko stanowiska lipiennika Loesela *Liparis loeselii* (L.) Rich. na terenie Krakowa na tle rozmieszczenia gatunku w południowo-wschodniej Polsce. Chrońmy Przyr. Ojcz. 62, 50–54.

- Szlachetko D., 2009. Flora Polski, Storzycyki. Multico Oficyna Wydawnicza, 168 ss.
- Szlachetko D.L., Skakuj M., 1996. Storzycyki Polski. Sorus, Poznań, 258 ss.
- Urban D., 1999. Szata roślinna małych torfowisk wybranych dolin rzecznych Wyżyny Lubelskiej. Fol. Univ. Agric. Stein. 197 Agriculture (75), 339–344.
- Urban D., 2005. Ochrona i monitoring stanowisk lipiennika Loesela *Liparis loeselii* na torfowiskach Wyżyny Lubelskiej i Pagórów Chełmskich (in Polish), w: Materiały Międzynarodowej Konferencji Naukowej „Problemy wzbogacania i ochrony różnorodności biologicznej obszarów wodno-torfowiskowych – renaturyzacja, rekultywacja, restytucja, reintrodukcja”, 23–24 września, Janów Lubelski, s. 97–98.
- Urban D., 2007a. Floristic and phytosociological values of peat pits in the area of Komaszycze (The Chodel Basin). Teka Kom. Ochr. Środ. Przynr., 4, 278–284.
- Urban D., 2007b. Plant communities of peat pits and ponds in the area of Sobibór Forests (Łęczyńsko-Włodawskie Lakeland). Teka Kom. Ochr. Środ. Przynr., 4, 285–292.
- Urban D., 2008. Rare and vulnerable plant species of the peatlands in the eastern Łęczyńsko-Włodawskie Lake District, in: Mat. conf. „Significance and prospects of stationary research on conservation of biodiversity”. Proceedings of International Scientific Conference devoted to the 50th anniversary of high-mountain „Pozhyzehevka” Biological Station. Ukraina, Lwów – Pozhyzehevka, 23–27 IX 2008, p. 416–417.
- Urban D., 2009. Walory florystyczne i fitosocjologiczne wybranych piaskowni w województwie lubelskim. Zesz. Probl. Post. Nauk Rol., 535, 453–462.
- Urban D., Sławiński M., 2003. Walory przyrodnicze i turystyczne okolic Pawłowa (Pawłowski Obszar Chronionego Krajobrazu) i możliwości ich wykorzystania dla rozwoju turystyki. Zesz. Nauk. Wydz. Ekonom. i Zarz. Politechnika Koszalińska, 10, 297–308.
- Urban D., Sławiński M., 2008. Zbiorowiska roślinne torfowisk w dolinie Potoku Pawłowskiego (Pagóry Chełmskie), w: Torfowiska gór i wyżyn, S. Żurek (red.), Wyd. Uniw. Humanist.-Przynr. w Kielcach, s. 133–139.
- Zajac A., Zajac M., (eds) 2001. Distribution Atlas of Vascular Plants in Poland (in Polish). Kraków, 714 pp.

CHARAKTERYSTYKA STANOWISKA *Liparis loeselii* (L.) Rich. NA PAGÓRACH CHEŁMSKICH (POLESIE WOŁYŃSKIE)

Streszczenie. *Liparis loeselii* (L.) Rich. należy do rzadkich i zagrożonych gatunków flory Polski. Badaniami objęto populację *Liparis loeselii* występującą na niskim torfowisku źródłiskowym na Pagórach Chełmskich. Omawiane stanowisko znajduje się u podnóża kopuły torfowiska źródłiskowego, a *Liparis loeselii* występuje tu w płacie zespołu *Caricetum davallianae* z klasy *Scheuchzerio-Caricetea nigrae*. Analiza pędów i ilości kwiatów okazów *Liparis loeselii* wykazała, że były one mniej dorodne od okazów opisywanych przez innych autorów. Na podstawie kilkunastoletnich obserwacji można przypuszczać, że gatunek ten ma szansę przetrwać na omawianym stanowisku dłużej, o ile warunki siedliskowe nie ulegną znaczącej zmianie. Oprócz *Liparis loeselii*, na torfowisku odnotowano także stanowiska innych rzadkich i objętych ochroną prawną gatunków roślin, takich jak: *Carex davalliana*, *Dactylorhiza incarnata*, *Epipactis palustris*, *Menyanthes trifoliata* oraz *Climacium dendroides*.

Słowa kluczowe: *Liparis loeselii* (L.) Rich., warunki siedliskowe, Pagóry Chełmskie (Polesie Wołyńskie)