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REVIEW OF *DROSERA INTERMEDIA* HERBARIUM SPECIMENS AND NEW DATA ON ITS DISTRIBUTION AND ECOLOGY IN LITHUANIA

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Abstract

Sprainaitytė S., 2015: Review of *Drosera intermedia* herbarium specimens and new data on its distribution and ecology in Lithuania [*Drosera intermedia* Lietuvoje: herbariumo pavyzdžių apžvalga ir nauji duomenys apie paplitimą ir ekologiją]. – Bot. Lith., 21(1): 39–45.

Drosera intermedia Hayne is one of four species of the genus *Drosera* in Lithuania. It has the status of an endangered species, however, relatively little is known about its abundance, population size and habitat preference. Seven localities of the species have been indicated in Lithuania till now. Evidence of herbaria is known from four localities. Revision of herbarium specimens revealed the fact that only one sample consisting of six plants was proved to be *Drosera intermedia*. It was collected in Kamanos raised bog. Distribution of *D. intermedia* based on recent findings includes two localities in the northern and the eastern parts of Lithuania.
Detailed investigations of *D. intermedia* habitat preference and population size were pursued in the Kamanos State Strict Nature Reserve (Akmenė distr.) in 2013–2014 in five sample plots situated in the *Rhynchosporion albae* W.Koch 1926 community. The highest density of *D. intermedia* plants was recorded on bare peat in the mosaic microhabitats of *Rhynchospora alba* (L.) Vahl and *Sphagnum* spp. Microhabitats with *Sphagnum cuspidatum* Ehrh. ex Hoffm. were more favourable than that of *Sphagnum magellanicum*. There were counted 376 (2013) and 322 (2014) individuals in three sample plots. Next year, 83 plants were appended in two additional plots. Vegetative individuals were more abundant in less favourable areas, while up to 30% of the flowering plants were registered in the depressions of bare peat and *Rhynchospora alba* mosaic.

INTRODUCTION

There are four species of *Drosera* spp. in Lithuanian flora (Pipinys, 1961). *D. rotundifolia* L., *D. anglica* Huds. and *D.* × *obovata* Mert. et W.D.J.Koch are common in mire habitats; the remaining *Drosera intermedia* Hayne is one of the rarest and least studied red-listed plant species. The worldwide range of *D. intermedia* includes coastal areas of the Atlantic Ocean: western, eastern and middle Europe and eastern part of North America with some isolated locations inside the continents (Meusel et al., 1965).

D. intermedia was listed as protected species in 1962 and since 1992 it has been entered in the Lithuanian Red Data Book List. *D. intermedia* belongs to 1 (E) category as endangered species on the verge of extinction that can be preserved only with the implementation of special conservation measures. Only seven localities were known in Alytus, ilutė, Zarasai, Utena, Akmenė and Telšiai districts (Pipinys, 1961; Snarskis, 1968; Lapelė, 1992; Matulevičiūtė, 2007).

The main habitats of the species are depressions on peat substrates of the *Rhynchosporion albae* W.Koch 1926 (Pipinys, 1961; Lapelė, 1992; Matulevičiūtė, 2007). Swampy lakeshores, peatlands and quagmires are also specified as appropriate habitats of *D. intermedia* (Pipinys, 1961).

Except for a brief description of the habitat, there were no more detailed data on the abundance, ecology

and recent findings of the species in Lithuania. The species was reported as known from literature data only (Tabaka et al., 1993); however, four locations have evidence of old herbaria samples (BILAS, WI).

The aim of this work was to revise herbarium samples and clear distribution of *D. intermedia* in Lithuania as well as carry out detailed investigation of the population in the Kamanos State Strict Nature Reserve (SSNR) by evaluating the composition and coverage (%) of vegetation and abundance of *D. intermedia* in different microhabitat types.

MATERIALS AND METHODS

All specimens of *D. intermedia* and other *Drosera* species deposited at the Herbaria of Vilnius University (WI) and the Institute of Botany of the Nature Research Centre (BILAS) were revised in 2013. A total of 6 Lithuanian samples containing 45 plants referred to *D. intermedia* were checked. The samples were defined using keys (Pipinys, 1961; Snarskis, 1968) together with the comparison of standard specimens from exsiccatae collection (WI).

Field studies were carried out in the Kamanos SSNR in five sample plots of 50 × 50 cm in size. That size was chosen because of very small-scale variation of vegetation communities over the raised bog surface as some distinct homogenous communities may be only 50 × 50 cm in size or less. Nevertheless, it must be ensured that the minimal area for the plant community including most of its characteristic species is covered (Kelly & Schouten, 2002).

The plots were chosen in various microhabitats with different most abundant plant species: No 1 – with dominant *Lycopodiella inundata*, No 2 – overgrowing pool with dominant *Sphagnum magellanicum*, No 3 and No 4 – with dominant *Rhynchospora alba*, No 5 – with dominant *R. alba* and *S. cuspidatum*. Despite some differences, these sites are referable to *Rhynchosporion albae* W.Koch 1926. Microtopographically, the area of *D. intermedia* population might be characterized as a lawn (Kelly & Schouten, 2002) with some hollows and pools. Plots No 3, 4 and 5 were studied for two years (2013–2014), while No 1 and 2 – for one year (2014).

Vegetation cover (%) of each species of bryophyte, herb and dwarf shrub layer was assessed. Total number of *D. intermedia* plants were counted in each sample plot by assessing the quantity of the flowering and vegetative individuals. The number of investigated plants growing on bare peat or together with *Sphagnum magellanicum*, *S. cuspidatum*, *Lycopodiella inundata*, *Rhynchospora alba* were presented in percent (%) of each sample plot separately.

RESULTS

Revision of herbarium specimens

The revision of herbarium specimens revealed the fact that only one specimen, containing six plants, definitely can be referred to *D. intermedia*. Two samples (including 16 specimens) had been defined wrongly and the remaining ones are lacking characteristic attributes to identify the species correctly (Appendix). *D.* × *obovata* or *D. anglica* were subsumed as *D. intermedia*. No questionable samples were obtained in the collections of *D. rotundifolia*.

The oldest specimen of *D. intermedia* in the Herbarium WI was found in 1822. It was collected without indication of exact locality. The single plant is vegetative and has reference to *D. longifolia* (now – *D. anglica*), too. Later (1972, 1975) two samples were gathered in the Kamanos SSNR, Akmenė distr. (3 plants) and Telšiai district (19 plants) by J.Tupčiauskaitė and D.Taurinskaitė. Overall, all specimens lack specific attributes to distinguish the species very precisely. No examples of characteristic plants have been found. Species indicated as *D. intermedia* can be prescribed as *D. anglica* or *D.* × *obovata*.

First specimens to the Herbarium BILAS were collected in 1946 and 1962, but the species was not correctly defined by early researchers. Based on these data, it was reported about *D. intermedia* localities near Daugai (Alytus distr.) and Zarasai in the quagmires of lakes (Pipinys, 1961; Snarskis, 1968). The collected samples definitely belong to *Drosera anglica* and *D.* × *obovata* species.

First six correct Lithuanian specimens alongside with precise description of the habitat were picked by Mindaugas Lapelė in the Kamanos SSNR in 1992. The species was found in the complex of pools and hollows in the central part of Kamanos raised bog. The population was abundant, particularly on bare peat (BILAS).

In addition to the herbarium specimens, there are some notes about *D. intermedia* localities in Šilutė (Pipinys, 1961; Snarskis, 1968), Žuvintas (Alytus distr.) (Malakauskienė et. al., 1979) and Utena (Obelevičius, 1998) without evidence of photography or herbaria (Fig. 1). The location in Utena district is the second viable population. According to the authors definition of morphological characteristics and personal confirmation in 2014, small population has survived until now and *D. intermedia* prefers growing on bare peat.

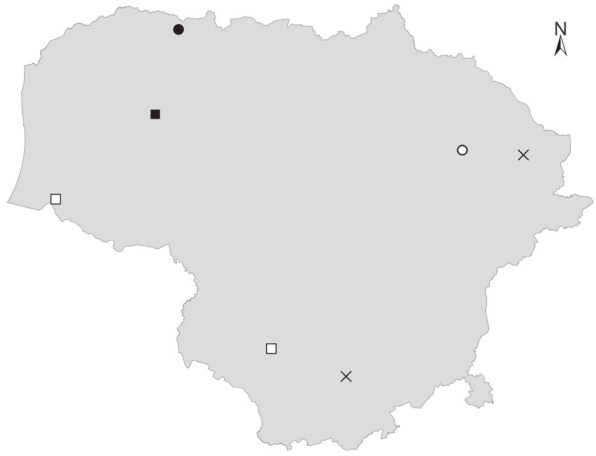

Fig. 1. Current distribution of *Drosera intermedia* in Lithuania:
● – investigated locality in Akmenė district;
○ – uninvestigated locality in Utena district without evidence of herbaria (Obelevičius, 1998; personal communication, 2014);
■ – locality of uncertain status in Telšiai district including indistinct herbarium specimens;
□ – localities of uncertain status in Šilutė district and Žuvintas (Alytus distr.) without evidence of herbaria;
× – false localities in Alytus and Zarasai districts submitted by wrongly described herbarium specimens

Habitat characteristics

The exact location and the state of the *D. intermedia* population in the Kamanos SSNR have not been known for many years. For the second time, the species was recorded in an open area called Didžioji Plynė in 2013. Plant communities with *D. intermedia* were referred to *Rhynchosporion albae*. They consisted of *Rhynchospora alba, Scheuchzeria palustris*, sparse *Utricularia minor*, *Lycopodiella inundata*, etc. Moss layer comprised of *Sphagnum cuspidatum*, *S. magellanicum* and other species (Table 1).

Table 1. Composition and cover (%) of plant species in five sample plots

No of sample plots	No 1	No 2	No 3		No 4		No 5	
Investigation year	2014	2014	2013	2014	2013	2014	2013	2014
Dwarf shrub layer	2	0.2	0.4	0.3	1	1	0.4	0.4
Andromeda polifolia L.	0.4	0.1	0.1	0.1	0.1	0.2	0.1	0.1
Calluna vulgaris (L.) Hull	1.5			0.01	0.01	0.01		
Oxycoccus palustris Pers.	0.1	0.1	0.3	0.2	0.8	1	0.3	0.3
Herb layer	60	20	40	50	90	90	58	46
Drosera anglica Huds.	0.1							
Drosera intermedia Hayne	2	2	4	15	4	4	3	1.5
Drosera × *obovata* Mert. et W.D.J.Koch	0.1							
Drosera rotundifolia L.	0.5	0.1			0.01	0.01	0.01	0.01
Eriophorum vaginatum L.		1			0.3	0.3		
Lycopodiella inundata (L.) Holub	30							
Rhynchospora alba (L.) Vahl	25	0.3	35	35	85	85	55	40
Scheuchzeria palustris L.	0.3	0.3	0.3	0.3	0.3	0.5	1.5	3
Utricularia minor L.		15					1	1
Bryophyte layer	14	55	15	15	8.5	10.5	30	46
Sphagnum cuspidatum Ehrh. ex Hoffm.		5					30	45
Sphagnum magellanicum Brid.	8	50	15	15	8	10	0.2	0.5
Sphagnum majus Russow ex C.O.E.Jens.								0.2
Sphagnum rubellum Wilson					0.2	0.1		
Sphagnum tenellum (Brid.) Bory	6				0.2	0.3	0.3	0.3
Bare peat	30		35	30	10	5	20	12
Covered with water		25					80	
Total number of species	12	10	6	7	11	11	10	11

The largest number of *D. intermedia* plants were found in *Rhynchospora alba* and bare peat mosaic in 2014 (plots No 3 and 4). In each plot, the individuals (48.2% and 42.3%, respectively) were counted in the depressions on bare peat (Table 2). Less of the investigated plants grew between *Rhynchospora alba* (49% and 35.4%, respectively) and the smallest number were found between *Sphagnum* mosses with dominant *S. magellanicum* (2.8% and 22.3%, respectively).

D. intermedia plants were less abundant in *Rhynchospora alba* and *Sphagnum cuspidatum* mosaic microhabitats (plot No 5). Equal distribution of the investigated plants growing between *Rhynchospora alba*, *Sphagnum cuspidatum* and bare peat was the main difference from the first two plots in the first year, while 62% of all individuals preferred to grow on *S. cuspidatum* in the second year.

Dry margins of the *Rhynchosporion* and shallow pools were less advantageous microhabitats. Repartition of plants was totally different and more even in the sample plot No 1 (with dominant *Lycopodiella inundata*). In 2014, 30% of *D. intermedia* individuals grew between *Lycopodiella inundata*, another 34% of the plants occupied the carpets of *Sphagnum magellanicum* and *S. tenellum* and the remaining 36% – grew together with *Rhynchospora alba*.

The smallest part (6.7%) of the investigated population occupied shallow raised bog pool overgrowing with *Utricularia minor*, *Sphagnum magellanicum* and *S. cuspidatum* in 2014 (plot No 2).

A total of 376 plants were recorded in three sample plots (2013) and 405 – in five sample plots (2014). Vegetative plants comprised 69.1% (2013) and 76% (2014) of all investigated population (Table 3). The difference occurred when two more sample plots with less favourable conditions were added in 2014. Vegetative individuals dominated by 93% and 100%, respectively, in the plot No 1 (dominant species *Lycopodiella inundata*) and plot No 2 (overgrowing

Table 2. Number of *D. intermedia* plants growing with different plant species in five sample plots

No of sample plot	No 1	No 2	No 3		No 4		No 5	
Investigation year	2014	2014	2013	2014	2013	2014	2013	2014
On bare peat	20 (30%)			70 (48.2%)		55 (42.3%)		9 (19%)
With *Rhynchospora alba*	17 (36%)			71 (49%)		46 (35.4%)		9 (19%)
With *Sphagnum magellanicum*			5 (4.8%)	4 (2.8%)	35 (20%)	29 (22.3%)		
With *S. magellanicum/ S. tenellum*	19 (34%)							
With *S. magellanicum/ S. cuspidatum*		27 (100%)						
With *Sphagnum cuspidatum*								29 (62%)
Total number	56 (100%)	27 (100%)	105 (100%)	145 (100%)	174 (100%)	130 (100%)	97 (100%)	47 (100%)

Note. Table 2 lacks some data on plots No 3–5 in 2013. Plants were not counted very precisely underlining equal distribution of *D. intermedia* growing together with *Rhynchospora alba* and on bare peat (plots No 3 and 4). Even repartition of the investigated plants growing between *R. alba*, *Sphagnum cuspidatum* and bare peat was stated in the plot No 5.

Table 3. Number of *D. intermedia* individuals in five sample plots

No of sample plot	No 1	No 2	No 3		No 4		No 5	
Investigation year	2014	2014	2013	2014	2013	2014	2013	2014
Number of vegetative plants	52 (93%)	27 (100%)	62 (59%)	89 (61.4%)	144 (82.8%)	99 (76.2%)	54 (55.7%)	41 (87.2%)
Number of generative plants	4 (7%)		43 (41%)	56 (38.6%)	30 (17.2%)	31 (23.8%)	43 (44.3%)	6 (12.8%)
Total number	56 (100%)	27 (100%)	105 (100%)	145 (100%)	174 (100%)	130 (100%)	97 (100%)	47 (100%)

raised bog pool). Nevertheless, the number of non-flowering plants was 60.4% (No 3), 79.9% (No 4) and 66% (No 5) in three remaining more favourable microhabitats in two years. Mature individuals of *D. intermedia* formed from 1 to 5 fruits, mean number of fruits was 1.84 ± 0.09 in 2014.

DISCUSSION

The shape of leaf makes the main problem of characterizing *Drosera intermedia* species correctly in the field or herbarium. If the specimen is collected in early summer without stem, it might be subsumed to *D. intermedia*, *D. anglica* or *D.* × *obovata* species. The length, width and shape of the leaves of these species are highly variable. The only *D. rotundifolia* has very specific set and can be easy separated from others (Pipinys, 1961).

Comparing the moss substrate, *Sphagnum cuspidatum* probably forms more favourable conditions for the growth of *D. intermedia* than that of *S. magellanicum*. That fact coincides with the results of other researchers (Thum, 1986; Bradley, 2010). They defined the relationship between raised bog height and location of different species from the genera *Sphagnum* and *Drosera*. The only difference is that *S. magellanicum* is not specialized in forming higher and dryer hummocks in Kamanos raised bog. The species is widespread in very different habitats and successfully occupies wet hollows and shallow pools as well. Bradley (2010) discussed that *D. intermedia* has better competitive abilities against *Sphagnum* species in hollows, while it is not so strong to occupy lawns with red (hummock) *Sphagnum*. The different moisture needs should be considered, too.

Worldwide, the variety of *D. intermedia* habitats is more diverse (De Ridder & Dhondt, 1992), while the investigated population in the Kamanos SSNR is abundant in very specific conditions and was not found in very similar habitats in the same territory. According to De Ridder & Dhondt (1992), the species is sensitive to water table fluctuations and may be extinct at the extreme sites. Central part of Kamanos raised bog is not disturbed by draining, and characterized by smaller ground water level fluctuations than marginal areas.

CONCLUSIONS

The results of the published data and the review of the herbaria specimens revealed that *Drosera intermedia* is even rarer in Lithuania than it could have been predicted. Except for two approved locations, the remaining data on the species abundance are old and its status is uncertain.

The species is related to the *Rhynchosporion albae* communities. Mosaic lawns of *Rhynchospora alba* and bare peat depressions are the most favourable growth places, where *D. intermedia* tend to dominate over other species of *Drosera* spp. and reach the highest density as well as more individuals form generative structures.

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DROSERA INTERMEDIA LIETUVOJE: HERBARIUMO PAVYZDŽIŲ APŽVALGA IR NAUJI DUOMENYS APIE PAPLITIMĄ IR EKOLOGIJĄ

Sigita Sprainaitytė

Santrauka

Mažalapė saulašarė (*Drosera intermedia* Hayne) – viena iš keturių saulašarių rūšių Lietuvoje. Priskiriama išnykstančių rūšių, kurioms reikalinga speciali apsauga kategorijai, nors beveik nėra duomenų apie populiacijų būklę, gausumą ir ekologiją. Iki šiol buvo žinomos septynios mažalapių saulašarių radvietės Lietuvoje. Herbariumuose saugomi pavyzdžiai iš keturių vietų, tačiau tik Kamanų aukštapelkėje surinkti šeši individai tikrai priskirtini *D. intermedia* rūšiai. Šiuo metu Lietuvoje žinomos dvi gyvybingos mažalapių saulašarių populiacijos Utenos ir Akmenės rajonuose.

Detalesni mažalapių saulašarių populiacijos ir buveinės tyrimai atlikti 2013–2014 m. penkiuose 50×50 cm dydžio kvadratuose Kamanų valstybiniame gamtiniame rezervate (Akmenės r.). Rūšis aptikta baltojo saidryno (*Rhynchosporion albae* W. Koch 1926) bendrijoje. Palankiausios sąlygos ir didžiausias individų skaičius užfiksuoti mozaikiškose baltųjų saidrų (*Rhynchospora alba* (L.) Vahl) ir atvirų durpių buveinėse. Mažalapės saulašarės geriausiai tarpsta ant plikų durpių ir vengia kiminų, tačiau smailiašakių kiminų (*Sphagnum cuspidatum* Ehrh. ex Hoffm.) kilimai yra palankesnė buveinė nei Magelano (*S. magellanicum* Brid.). Trijuose tyrimų ploteliuose 2013 m. buvo suskaičiuoti 376, 2014 m. – 322 augalai; šį skaičių antraisiais metais papildė 83 individai iš papildomai įrengtų dviejų kvadratų. Mažiau palankiomis sąlygomis (užaugantys vandens telkiniai ir sausesni baltojo saidryno pakraščiai) dominuoja vegetatyviniai augalai, o atvirų durpių ir saidrų mozaikoje iki 30 % tirtos populiacijos sudaro fertilūs individai.

APPENDIX

Specimens of *Drosera intermedia* Hayne (№ 3136) deposited at the Herbarium WI:

Drosera longifolia

**Drosera intermedia*

In paludibus Lithuaniae rare! 1822

Later new tag was added:

Zaklad Botaniki Ogolnej, Uniw. St. Batorego w Wilnie. Otrzymane z Bibljoteki Uniwersyteckiej 1920 r.

[Note: only one vegetative plant. Attribution to *D. anglica* or *D. intermedia* is arguable. The sample was possibly collected by S.B.Gorski].

Herbarium universitatis Vilnensis LRSS

Kamanos raised bog, Viekšniai circuit (Akmenė district).

21 June 1972, leg. et .det. J.Tupčiauskaitė

[Note: the sample consists of 3 large plants; one of these is vegetative. The stem is not curved. Attribution to *D. intermedia* or *D.* × *obovata* is arguable].

Herbarium universitatis Vilnensis LRSS

Drosera obovata

Transitional mire in the forest, Kalniškiai (Telšiai district).

18 June 1975, leg. et det. D.Taurinskaitė

[Note: on 24 November 1975, the species was defined as *D. intermedia* by J.Tupčiauskaitė. The sample consists of 19 vegetative plants. Attribution to *D. intermedia* or *D. anglica* is arguable].

Specimens of *Drosera intermedia* Hayne deposited at the Herbarium BILAS:

Herbarium Academiae Scientiarum RSS Lituaniae

Alytus county, Daugai circuit, swampy shore of Lake Gelukas [today – Dėlukas].

15 August 1946, leg. et det. Prof. J.Minkevičius. № 63551.

[Note: the sample consists of 10 plants belonging to species of *D. anglica* and *D.* × *obovata*. None of these is referable to *D. intermedia*. The stem is long and vertical; leaves are lanceolate or have shape of a spade].

Herbarium Academiae Scientiarum RSS Lituaniae

Zarasai distr., 3 km to the east of Salakas town, in the lakeside swamp, infrequent.

26 July 1962, leg. A.Lekavičius. № 63550.

[Note: the sample consists of six plants with long vertical stems and spade-shape leaves. The specimens belong to *D.* × *obovata* species, some of these might be *D. anglica.* None of these are referable to *D. intermedia*].

Herbarium instituti botanici Lithuaniae

Akmenė distr., Kamanos Nature Reserve, in the hollows between small pools in the central plain; abundant on bare peat.

9 July 1992, leg. et det. M.Lapelė. № 51261.

[Note: the sample consists of six plants with typical attributes].