

***Orthotrichum pulchellum* Brunt. ex Sm. (Bryophyta) in the Czech Republic. Distribution and ecology.**

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Abstract: *Orthotrichum pulchellum* was found as a new species of the Czech Republic in the year 2006. Now it is known from the 21 localities. All of them are situated along north-west and west border of the Czech Republic. Distribution and basic information of its ecology are presented.

Key words: *Orthotrichum pulchellum*, Czech Republic, bryophyta, epiphytes, distribution, expansive species, climate change

Introduction

Orthotrichum pulchellum, an epiphytic moss from family *Orthotrichaceae*, which has changed dramatically its distribution area during last 15 years. It was distributed from Spain to Norway, mostly along sea coast and very rarely in inland (Frey et al. 1995). Duell (1984) mention this species from Belgium, Crete, Denmark, France, Germany, Great Britain, Ireland, Netherlands, Norway, Poland, Romania?, Sicily, Spain, Switzerland, Sweden and Yugoslavia. From geographical point of view, Duell (1984) classify the moss as northern oceanic species. Dierssen (2001) subsequently includes the species among mediterranean-boreal and oceanic-suboceanic taxa.

Similar distribution like in Europe, where grow along the west sea coast *O. pulchellum* has in North America too. It grows from southern Alaska to Oregon there (Frahm 2002).

Its spread from the west to the east is well mapped in Germany by Frahm (2002). *Orthotrichum pulchellum* was historically recorded mainly in sea coast with only few inland localities. Only in 1996 new inland locality was found in Saarland /south-west Germany/ (Frahm 2002). In 2002 the moss was collected at the first time in Saxony (Mueller 2004) and subsequently in 2006 it was found as a new species in the Czech Republic (Plášek et Marková 2007, 2008).

O. pulchellum is included among LC-att taxa in the Red List of the bryophytes of the Czech Republic (Kučera et al. 2012). This subcategory is used for less well known taxa for which there is limited information on their current distribution and the potential threat to them (Kučera et al. 2012).

The names of the bryophytes follow the Check list of the bryophytes of the Czech Republic by Kučera et al. (2012). Phytogeographical characterisation was taken from Hejný et Slavík (1997).

Description of the species and ecological characterisation

Plants of the species grow to a height of about 1-1,5 cm with loosely-twisted and crisped flexuous leaves when dry. Capsule is exserted, during maturation covered with naked, longitudinally striped calyptra. Peristome has 16 conspicuously orange coloured teeth. For detailed description see Plášek et Marková (2007) and Plášek (2012).

Dierßen (2001) describes *Orthotrichum pulchellum* as subneutrophyt (bark pH: 5.7 – 7.0), mild mesophyt to xerophyt, mild sciophyt to hight photophyt, mild termophyt, mild nitrophyt, sensitive to atmospheric pollution, which grows on trunk and branches of trees and shrubs in sheltered, but not too heavily shaded places (e.g. along forest roads or streams, on low shrubs communities, and on quarries). The species was recorded mainly in deciduous wet and mesophytic wood (phytocoenologically belongs into order *Populetales albae*) or shrub communities (from alliance *Sambuco-Salicion capreae*). It is a colonist growing in bryophyte association evaluated as *Cryphaetum arboreae* (alliance *Syntrichion laevipilae*).

Occurrence of the moss *Orthotrichum pulchellum* in the Czech Republic

Phytogeographical division: *Mesophyticum*

Phytogeographical province: *Mesophyticum Massivi bohemic*

Phytogeographical district: **25. Krušnohorské podhůří**

- Krušné hory Mts (NW Bohemia), Lesná settlement, NNE of Chomutov town, on a rowan tree in young forest of *Picea pungens*, 1.5 km NEE Lesná settlement WGS 84: N=50°35'26.7'', E=13°27'44.6'', bark of *Sorbus aucuparia*, 900 m a. s. l., 15. IX. 2012 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No. 2/2012).

Orthotrichum pulchellum was found on the trunk of *Sorbus aucuparia* at the high of 60 cm above ground and with SW exposition. Size of the population was about 4 cm². No accompanying species were observed there.

Phytogeographical district: **26. Český les**

- Český les Mts, Tachov District, Diana settlement, beech forest, 1.2 km NEE of Operating building of the Kolowrat forests, WGS-84: N=49°38'21.2", E=12°36'38.2", 525 a. s. l., 28. V. 2009 leg. R. Mudrová, herb. in priv. coll. of R. Mudrová

Phytogeographical district: **28. Tepelské vrchy**

- Slavkovský les Mts (W Bohemia), Svatošské skály rocks, 5 km SW of Karlovy Vary town, the area of summer camp, 30 m behind the gate, bark of *Acer pseudoplatanus* on the right bank of the Ohře river, WGS 84: N=50°11'36'', E=12°48'37'', 380 m a. s. l., 16. IV. 2009 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No. 18/2009).

Orthotrichum pulchellum was found on the trunk of *Acer pseudoplatanus* at the high 180 cm above ground and with NWW exposition. Size of the population was about 1,5 cm². It was grown together with *Ceratodon purpureus* and *Chiloscyphus profundus* there. The record has already been published in Kučera et al. (2009).

Phytogeographical district: **33. Branžovský hvozd**

- Domažlice district (W Bohemia), Kdyně village, 10 km SE of Domažlice town, ruin of castle Nový Herštejn, 2.5 km NE of Kdyně village, forest, 700 m S of the ruin, on clump of *Acer pseudoplatanus* near red marked touristic path, 100 m NNW of cross-road "Vejpřahy – rozcestí", WGS 84: N=49°24'32.585", E=13°45'4.20", 640 m a. s. l., 18. IV. 2013 leg. & det. I. Marková, herb. in priv. coll. of I. Marková (No. 1/2013).

Orthotrichum pulchellum was found on the trunk of *Acer pseudoplatanus* at the high of 100 cm above ground and with NE exposition. Size of the population was about 1 cm². It grew together with *Hypnum cupressiforme* var. *cupressiforme*.

Phytogeographical district: **46. Labské pískovce**

- Bohemian Switzerland National Park, Chřibská town, valley of the Doubický potok stream, loc. "hájenka Saula", 2.5 km WNW of Chřibská town, bark of *Fraxinus excelsior*, WGS 84: N=50°52'21'', E=14°26'48'', 335 m a. s. l., 3. VIII. 2006 leg. I. Marková, det. V. Plášek, herb. in priv. coll. of I. Marková (No. 78/2006).

Orthotrichum pulchellum was found growing on the trunk of *Fraxinus excelsior* at the high of 205 cm above ground and with NEE exposition. Size of the population was about 2 cm². It grew together with *Brachythecium salebrosum*, *Hypnum cupressiforme* var. *cupressiforme* and *Orthotrichum pumilum*. The record has already been published by Plášek & Marková (2007, 2008).

- Bohemian Switzerland National Park (NW Bohemia), Krásná Lípa town, Medvědice hill, 4.5 km W of Krásná Lípa town, clump of *Acer pseudoplatanus* on a forest near the meadow, 100 m SE of the top of the hill, WGS 84: N=50°54'29.8'', E=14°26'35.7'', 430 m a. s. l., 25. IV. 2008 and 28. IX. 2008 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No. 27/2008 and No. 130/2008).

Orthotrichum pulchellum was found on the trunk of *Acer pseudoplatanus* at the high of 60 cm above ground and with N exposition. Size of population was about 4 cm². It was grown together with *Brachythecium velutinum*, *Chiloscyphus profundus* and *Hypnum cupressiforme* var. *cupressiforme*. The finding was published in Marková (2008).

- Bohemian Switzerland National Park, Mlýny hill, 2.5 km NE of Vysoká Lípa village, pile of branches from cutting trees near the asphalt road at the NW slope of the hill, 200 m below the branch roads going to the hunting lodge, which is situated below hill-top, *Larix decidua*, WGS 84: N=50°52'29'', E=14°21'53'', 430 m a. s. l., 31. V. 2009 leg. & det. I. Marková, herb. in priv. coll. of I. Marková.

Orthotrichum pulchellum was found at the branches of cutting trees (*Larix decidua*). Size of population was about 1 cm². The moss grew together with *Orthotrichum* sp (sterile). The record has already been published by Marková (2010).

- Bohemian Switzerland National Park, Jeřichovice village, 5 km NNW of Česká Kamenice town, Dolský mlýn ruin of mill, 3 km W of Jeřichovice village, fallen branch of *Salix* sp., WGS 84: N=50°50'26'', E=14°20'56'', 192 m a. s. l., 19. III. 2010 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková.

Orthotrichum pulchellum was found on fallen branch of *Salix* sp. Size of population was about 1 cm². No accompanying species were recorded there. The record has already been published by Marková (2010).

- Bohemian Switzerland National Park, Kyjov village, 3.5 km W Krásná Lípa town, Brtnický most bridge over the Křinice river, 4.5 km NNW of Kyjov village, *Acer platanoides*, WGS 84: N=50°55'25'', E=14°24'10'', 340 m a. s. l., 3. V. 2010 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No 11/2010).

Orthotrichum pulchellum was found on the trunk of *Acer platanoides* at the high 170 and 180 cm above ground and with NNW exposition. Two populations were observed there. Size of both populations together was about 12.5 cm². They grew together with *Hypnum cupressiforme* var. *cupressiforme*, *Orthotrichum pumilum* and *Pylaisia polyantha*. The record has already been published by Marková (2010).

- Elbe Sandstone Protected Area, Všemily village, "Meandry Chřibské Kamenice" Nature reserve, 500 m E of camp "U Ferdinanda", bark of *Prunus padus*, on a bank of Chřibská Kamenice river, WGS 84: N=50°50'11'', E=14°21'49'', 200 m a. s. l., 4. V. 2010 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No 13/2010).

Orthotrichum pulchellum was found at the inclined trunk of *Prunus padus* at the high 50 cm above ground and with SWW exposition. Size of population was 4 cm². There were no accompanying species. The finding was published in Marková (2010).

- Bohemian Switzerland National Park, Brtníky village, 6 km SSW of Šluknov town, unused meadow by Brtnický potok stream, 800 m NE of Brtnický most bridge, 3.5 km SW of Brtníky village, bark of *Fraxinus excelsior*, at margin of the meadow, WGS 84: N=50°55'41'', E=14°24'27,1'', 300 m a. s. l., 22. VII. 2012 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No 4/2012).

Orthotrichum pulchellum was found on the trunk of *Fraxinus excelsior* at the high 62 cm above ground and with SW exposition. There were found three populations. Their size together was about 2 cm². No accompanying species were recorded there.

- Bohemian Switzerland National Park, Brtníky village, 6 km SSW of Šluknov town, Severák hill near Kopeč settlement, left tributary of Bílý potok stream, forest in a valley of Bílý potok stream, 3 km SW Brtníky village, fallen log of *Fraxinus excelsior*, WGS 84: N=50°56'25.623", E=14°23'48.905", 340 m a. s. l., 22. VII. 2012 leg. & det., herb. in priv. coll. of I. Marková (No 5/2012).

Orthotrichum pulchellum was found on a fallen log of *Fraxinus excelsior* at the high of 30 cm above ground and with W exposition. Size of population was about 1 cm². The moss grew together with *Brachythecium salebrosum* there.

Phytogeographical district: **47. Šluknovská pahorkatina**

- Děčín district, Krásná Lípa town, 5 km SW of Rumburk town, small forest by local railway 1.7 km NW of Krásná Lípa town, bark of *Salix viminalis*, WGS 84: N=50°55.38'', E=14°29.42.3'', 455 m a. s. l., 15. VIII. 2007 leg. I. Marková, teste V. Plášek, herb. I. Marková (priv. herb. – number 111/2007 and 113a/2007).

Orthotrichum pulchellum was found on the trunk of *Salix viminalis* at the high of 70 and 150 cm above ground and SWW exposition. Two different populations were observed there. Their size were 4 cm² and 0.5 cm². The first population of the moss grew together with *Brachythecium salebrosum* and *Hypnum cupressiforme* var. *cupressiforme*. The second one was observed growing together with *Amblystegium serpens*, *Hypnum cupressiforme* var. *cupressiforme* and *Orthotrichum diaphanum*. The record has already been published by Plášek & Marková (2007).

- Lužické hory Protected Area, Krásná Lípa town, 5 km SW of Rumburk town, Široký vrch hill, 3 km SSW of Krásná Lípa town, clump of *Acer pseudoplatanus*, S of cross-road of "Rovná cesta" way, 508 m a. s. l., leg. & det. I. Marková, teste V. Plášek.

Two populations of the species were recorded there on different trees:

- i) bark of *Acer pseudoplatanus* on the back side of clump of trees, 5 m far from the forest road, WGS 84: N=50°53'45.7'', E=14°29'57.2'', 26. I. 2008, herb. in priv. coll. of I. Marková (No 11/2008).

Orthotrichum pulchellum was found on a trunk of *Acer pseudoplatanus* at the high of 60 cm above ground and with NWW exposition. Size of the population was about 2.25 cm². No accompanying species was observed there.

- ii) bark of *Acer pseudoplatanus*, WGS 84: N=50°53'47.7'', E=14°29'54.4'', 6. VII. 2008, herb. in priv. coll. of I. Marková (No 97/2008).

Orthotrichum pulchellum was found on a trunk of *Acer pseudoplatanus* at the high of 150 cm above ground and with NW exposition. Two populations grew there with total size about 1.5 cm². The population was associated with *Brachythecium salebrosum*.

The record has already been published by Marková (2008).

- Elbe Sandstone Protected Area, Kopec settlement, 10 km SWW of Rumburk town, the valley of Brtnický potok brook, 650 m S of pub "U Vyskočilů", bark of *Acer pseudoplatanus*, WGS 84: N=50°56'36.1'', E=14°24'49.1'', 370 m a. s. l., 23. IV. 2008 and 17. VIII. 2008 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No 23/2008 and 117/2008).

Orthotrichum pulchellum was found on a trunk of *Acer pseudoplatanus* at the high of 140 cm above ground and with E exposition. Size of population was about 2 cm². The population was associated with *Brachythecium salebrosum* and *Brachytheciastrum velutinum*. The record has already been published by Marková (2008).

- Lužické hory Protected Area, Doubice village, Spravedlnost hill, 4.2 km SW of Krásná Lípa town, N slope, fallen tree of *Salix caprea* on the border of Nature Reserve, near the yellow marked touristic way, WGS 84: N=50°52'53.48'', E=14°28'09.36'', 470 m a. s. l., 27. II. 2011 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No. 1/2011).

Orthotrichum pulchellum was found on the fallen log of *Salix caprea* at the high from 90 till 100 cm above ground and with NE exposition. Total 10 different populations were observed there. Size of all population together was about 22.5 cm². The species grew together with *Amblystegium serpens*, *Brachythecium salebrosum*, *Hypnum cupressiforme* var. *cupressiforme* and *Ulota* sp. (steril.). The record has already been published by Marková (2011).

- Děčín district, Šluknov town, arboretum of High school of Forestry near Kunratice village, 2.5 km SSW Šluknov town, bark of *Celtis australis*, WGS 84: N=50°59'4.850"; E=14°26'41.324", 380 m a. s. l., 13. VI. 2011 not. I. Marková.

Orthotrichum pulchellum was found on the west side of a trunk of *Celtis australis* there. Size of the population was about 0.25 cm². It grew together with *Brachythecium salebrosum*.

- Děčín district, Rumburk town, Dymník hill, 2.5 km SW of Rumburk town, in the forest situated SW of Dymník hill, along the bike way No. 3014, between yellow and blue market touristic way, bark of *Quercus robur*, WGS 84: N=50°56'05,2'', E=14°30'48,3'', 449 m a. s. l., 14. VIII. 2012 leg. & det. I. Marková, herb. in priv. coll. of I. Marková (No 10/2012 – monitoring).

Orthotrichum pulchellum was found on the trunk of *Quercus robur* at the high 145 cm above ground and with E exposition. There were occurred four different populations. Their size together was 3 cm². On next oak the species was recorded too. Its size was about 1.84 cm². No accompanying species was observed there.

Phytogeographical district: **50. Lužické hory**

- Lužické hory Protected Area, Česká Kamenice town, Studenec hill, 4 km NNE of the town, cross-road called “Sedlo pod Studencem”, cross of red and blue marked touristic ways.

Two populations were recorded there:

- i) *Acer pseudoplatanus* near the cross-road called “Sedlo pod Studencem”, WGS 84: N=50°49'47,2'', E=14°27'52,9'', 600 m a. s. l., 27. V. 2007 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No 61/2007).

Orthotrichum pulchellum was found on the trunk of *Acer pseudoplatanus* at the high 130 cm above ground and with NWW exposition. Size of population was 4 cm². The population was associated with *Orthotrichum pumilum*. The record has already been published by Plášek et Marková (2007).

- ii) *Fraxinus excelsior* in the meadow, 830 m SE of the top of Studenec hill, WGS 84: N=50°49'55,5'', E=14°27'56,6'', 614 m a. s. l., 3. VIII. 2008 leg. & det. I. Marková, teste V. Plášek, herb. in priv. coll. of I. Marková (No 160/2008).

Orthotrichum pulchellum was found on the trunk of *Fraxinus excelsior* at the high 13 - 20 cm above ground and with NEE exposition. Six different populations grew there with total size about 20 cm². The species was observed together with lichen *Physcia* sp. and moss *Brachythecium salebrosum*. The record has already been published by Marková (2008).

Phytogeographical division: ***Oreophyticum***

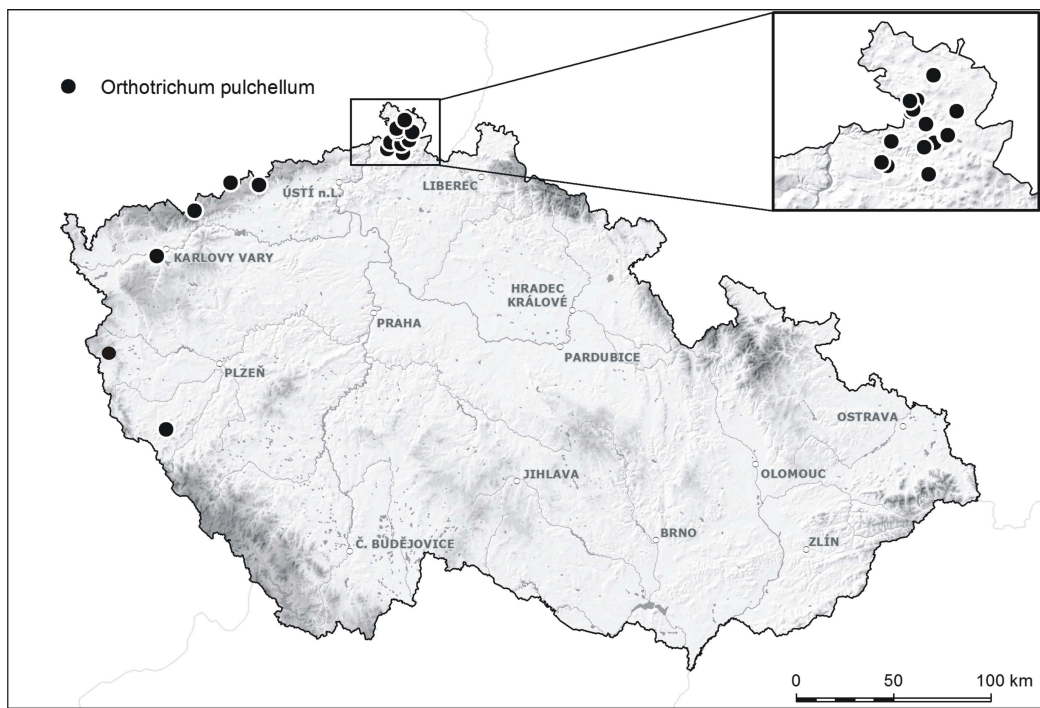
Phytogeographical province: ***Oreophyticum Massivi bohemic***

Phytogeographical district: **85. Krušné hory**

- Krušné hory Mts, Načetín village, NNW of Chomutov town, a settlement situated about 2.5 km WNW of Načetín village, SE side of settlement, *Salix* sp., WGS 84: N=50°34'52,302'', E=13°15'17,277'', 780 m a.s.l., 25. IX. 2010 leg. S. Biedermann, herb. in priv. coll. of S. Biedermann.

The record has already been published by Novozámská et Biedermann (2011).

- Krušné hory Mts, Kovářská village, NW of Klášterec nad Ohří town, by the way from train station to lime-pit, bark of *Acer* sp., *Salix* sp., *Sorbus* sp., WGS 84: N=50°25'42.712", E=13°1'42.325", 870 m a.s.l., 25. VII. 2011 leg. S. Biedermann, herb. DR.



Map 1: Distribution of the moss *Orthotrichum pulchellum* in the Czech Republic

Discussion

In the Czech Republic the moss *Orthotrichum pulchellum* was found on 21 localities till present. All of them are situated along northern, north-western and western border of the country. The most of localities are situated between altitudes of 300 – 500 m a. s. l. The lowest locality occurs at the elevation 192 m a. s. l. in Dolský mlýn (Bohemian Switzerland National Park) and the highest locality is placed at the elevation about 900 m a. s. l. in Lesná settlement (Krušné hory Mts). These localities are situated in the area with higher than average of rainfall - from 700 – 1000 mm (Míková et al. 2007). It seems the oceanic species prefers areas of high precipitation above 700 mm. Number of known Czech localities is far from final and our knowledge corresponds to sampling effort of the each region. It can be assumed increasing of the number of the localities in Krušné hory Mts considering the intensive bryological research - see Meinunger et Schröder (2007).

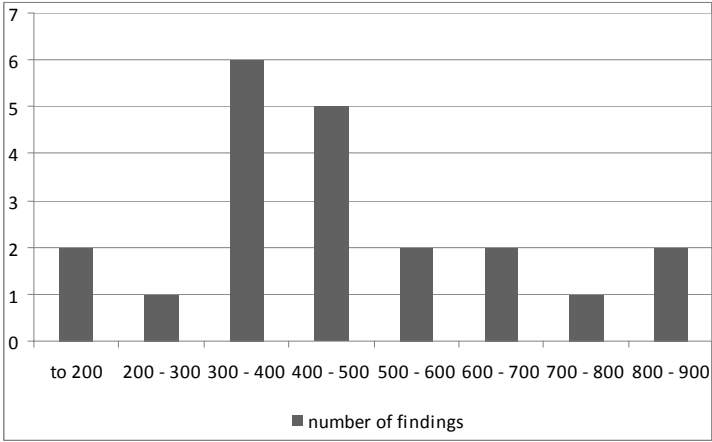


Fig 1: Vertical distribution of *Orthotrichum pulchellum* (meters above sea level). The lowest locality – Dolský mlýn (Bohemian Switzerland National park) 192 m a. s. l. The highest locality – surrounding of Lesná settlement (Krušné hory Mts.) 900 m a. s. l.

Orthotrichum pulchellum was found on 9 species of phorophytes. Most frequently it grows on bark of *Acer pseudoplatanus*, *Salix* sp. div. and *Fraxinus excelsior*. Whereas Frahm (2002) mention, as the most frequently species *Sambucus nigra*, *Salix* sp. and *Populus* sp. These data correspond with characteristic pronounced in Dierßen (2001). He mentions *O. pulchellum* as a species of mesophytic forests (order *Populetalia albae*) or shrub communities (alliance *Sambuco-Salicion capreae*). In Great Britain it grows most frequently on bark of *Salix* (Atherton et al. 2010).

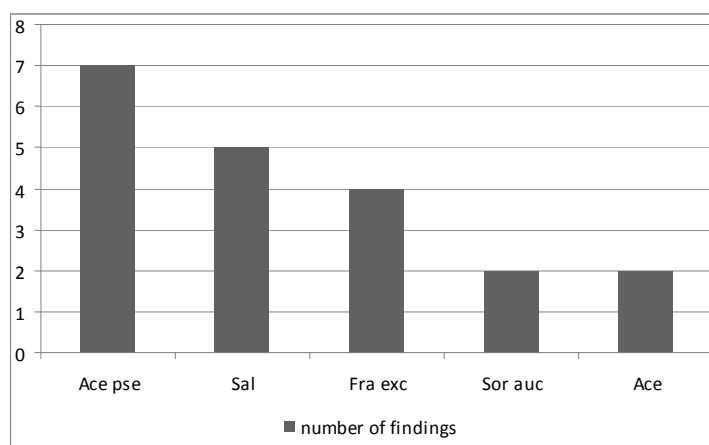


Fig 2: Distribution of *Orthotrichum pulchellum* on bark of different phorophytes (Ace pse – *Acer pseudoplatanus*; Sal – *Salix* sp. div.; Fra exc – *Fraxinus excelsior*; Sor auc – *Sorbus aucuparia*; Ace – *Acer platanoides*). Only once was *O. pulchellum* found on *Celtis australis*, *Larix decidua*, *Prunus padus* and *Quercus robur*.

The Czech populations occurred mostly at the height of 50 – 200 cm above ground. The lowest situated population was recorded at height of 13 cm and the highest at 205 cm above ground. A lot of cushions grew with south-western, north-western and north-eastern exposition.

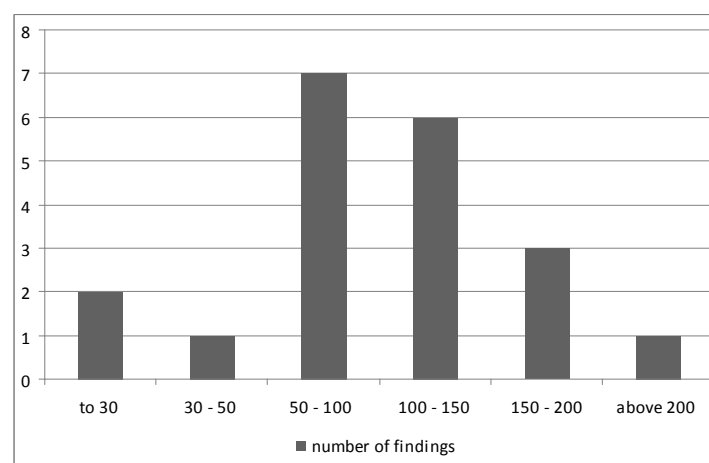


Fig 3: Vertical distribution of *Orthotrichum pulchellum* on the trunk of tree (cm above ground). The lowest position was recorded at the high of 13 cm and the highest at the high of 205 cm above ground.

Orthotrichum pulchellum forms small cushions of size about 1–5 cm². The smallest observed population had surface only about 0.04 cm² and the largest one about 22.25 cm² (sum of surfaces of all metapopulations in one phorophyte).

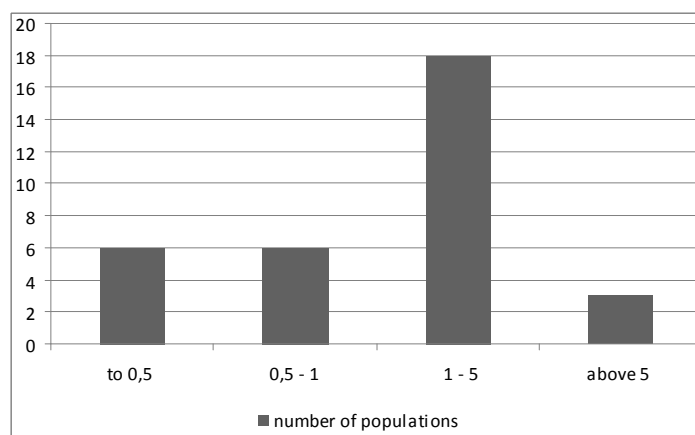


Fig 4: size of the populations of moss *Orthotrichum pulchellum* (in cm²). The smallest population occupied about 0.04 cm². The largest population occupied about 22.25 cm² (as a sum of different smaller populations on one tree).

All the populations were observed with sporogones. It grows commonly with accompanying species, often with *Brachythecium salebrosum*, *Hypnum cupressiforme* var. *cupressiforme* and other species from *Orthotrichum* genus.

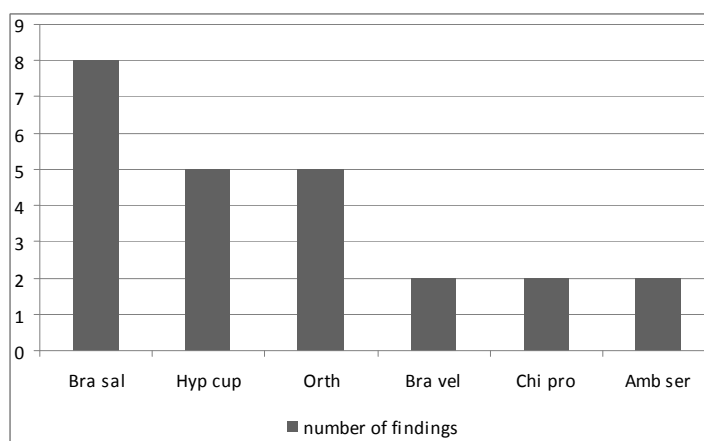


Fig 5: Accompanying species - presence of different taxons (Bra sal - *Brachythecium salebrosum*; Hyp cup - *Hypnum cupressiforme* var. *cupressiforme*; Orth - *Orthotrichum* sp. div.; Bra vel - *Brachytheciastrum velutinum*; Chi pro - *Chiloscyphus profundus*; Amb ser - *Amblystegium serpens*). Mosses *Ceratodon purpureus*, *Pylaisia polyantha*, *Ulotia* sp. and lichen *Physcia* sp. were noted only once as the accompanying species.

Orthotrichum pulchellum has suddenly begin to increase its areal in the last 15 years. In Great Britain dramatic upsurge of the abundance of *O. pulchellum* was observed (Atherton et al. 2010). In Germany the species occurs in all federal state now (Meinunger 2007). Spreading of *O. pulchellum* is given in the context of i) the improvement of air quality in Central Europe, ii) climate changes (Frahm 2002). These factors are intertwined. The improvement of air quality helps to return of the species to its historic localities and withal surviving on new localities. The climate change allows spreading of the species eastward. *Orthotrichum pulchellum* as a (sub) oceanic species required mild winter temperature, humid climate or high precipitation. All of these factors correspond to conditions in the known Czech localities. Míková et al. (2007) mention, that annual average of temperature varied strongly between 1961 – 2000 with a statically significant warming trend of about 0,03°C per year, warming is more noticeable in winter and spring, but negligible in autumn. These

warming and high precipitation are conducive to spreading of *Orthotrichum pulchellum* towards the Central Europe.

In the Czech Republic *O. pulchellum* is included among LC-att taxa in the Red List of the bryophytes of the Czech Republic (Kučera et al. 2012). This subcategory is used for less well known taxa for which there is limited information on their current distribution and the potential threat to them (Kučera et al. 2012).



Fig 6: Fertile plants of the moss *Orthotrichum pulchellum* (photo by V. Plášek)

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References

- Atherton I., Bosanquet S. & Lawley M. (2010): Mosses and Liverworts of Britain and Ireland a field guide. British Bryological Society, Plymouth, 848 pp.
- Duehl R. (1984): Distribution of the European and Macaronesian mosses (Bryophytina), Part I, Bryologische Beitrage, Band 4, Rheurdt, 232 pp.
- Dierßen (2001): Distribution, ecological amplitude and phytosociological characterization of European bryophytes. – Bryophytorum Bibliotheca, Band 56, J. Cramer, Berlin, Stuttgart, 289 pp.
- Frahm J.-P. (2002): Zur aktuellen Verbreitung von *Orthotrichum pulchellum*. – Bryol. Rundbriefe 52: 1-5.
- Frey W., Frahm J.-P., Fischer E. & Lobin W. (1995): Moos- und Farnpflanzen - Kleine Kryptogamenflora, Band IV, 6. Aufl., Gustav Fischer Verlag, Stuttgart, Jena, New York, 426 pp.
- Hejný S. & Slavík B. (1997): Květena České republiky I., 2. vyd., Academia, Praha, 557 pp.

- Kučera J., Váňa J. & Hradílek Z. (2012): Bryophyte flora of the Czech Republic: update of the checklist and Red List and a brief analysis. – *Preslia* 84: 813-850.
- Kučera J., Cykowska B., Kubešová S., Kučerová V., Manukjanová A., Marková I., Mikulášková E. & Vicherová E. (2009): Mechorosty zaznamenané během 16. jarního setkání bryologicko-lichenologické sekce ČBS ve Svatošských skalách na Karlovarsku. (Bryophytes recorded during the 16th Spring Meeting of the Bryological and Lichenological Section of the CBS in Svatošské skály near Karlovy Vary (W Bohemia). – *Bryonora* 43: 3-11.
- Marková I. (2008). *Orthotrichum pulchellum*. In Kučera J. [ed.], Zajímavé bryofloristické nálezy XII. (Interesting bryofloristic records, XII). – *Bryonora* 42: 40.
- (2010). *Orthotrichum pulchellum*. In Kučera J. [ed.], Zajímavé bryofloristické nálezy XV. (Interesting bryofloristic records, XV). – *Bryonora* 45: 44.
- (2011). *Orthotrichum pulchellum*. In Kučera J. [ed.], Zajímavé bryofloristické nálezy XVII. (Interesting bryofloristic records, XVII). – *Bryonora* 47: 58.
- Meinunger L. & Schröder W. (2007): Verbreitungsatlas der Moose Deutschlands, Band 3. – Regensburgische Botanische Gesellschaft, Regensburg, 709 pp.
- Míková T., Valeriánová A. & Voženílek V. (2007): Atlas podnebí Česka (Climate atlas of Czechia), ČHMÚ Praha, UP Olomouc, 255 pp.
- Mueller F. [ed.] (2004): Verbreitungsatlas der Moose Sachsens. Lutra Verlag, Tauer, 309 pp.
- Novozámská E. & Biedermann S. (2011): *Orthotrichum rogeri*. In Kučera J. [ed.], Zajímavé bryofloristické nálezy XVII. (Interesting bryofloristic records, XVII). – *Bryonora* 47: 58-59.
- Plášek V. (2012): Klíč pro determinaci zástupců rodů *Orthotrichum* a *Nyholmiella* v České republice. – *Bryonora* 50: 17-33.
- Plášek V. & Marková I. (2007): *Orthotrichum pulchellum* (Orthotrichaceae, Musci), new to the Czech Republic. – *Acta Musei Moraviae* 92: 223-228.
- (2008): *Orthotrichum pulchellum* – In: Ellis L. [ed.]: New national and regional bryophyte records, 18. – *Journal of Bryology* 30: 161-167.

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