

New record of *Euphrasia frigida* Pugsl. in Colesdalen, Svalbard

Short Communication

Eugenia Markovskaya^{1*}, Nataliya Shmakova², Valentina Kostina²

¹Department of Botany and Plant Physiology, Petrozavodsk State University, Lenina, 33, Petrozavodsk, 185910, Russia

²Polar–Alpine Botanical Garden–Institute, Kola Research Center, Russian Academy of Sciences, Kirovsk, Murmansk Oblast, 184250, Russia

Abstract

In 2011, a new place with *Euphrasia frigida* Pugsl was found in the area of Colesdalen, Svalbard. In this paper, geographical location of the place is reported and a brief description of neighbouring vegetation given. The new place with *E. frigida* was found on SW-facing slopes (inclination of about 30°) at a shallow hollow. The clumps of *E. frigida* were located 1-1.5 m away from each other and formed an area of about 40 m². Altogether, 420 individuals were found, average length of which was 2 cm. The flower length and width reached 5 and 3.5 mm, respectively. The habitat related to willow-grassland-moss association. However, the surface of a hollow was slightly eroded probably due to anthropogenic transformation caused by proximity of old abandoned settlement and a harbour that have been used for coal shipping from Colesbukta. Finding of the new place with *E. frigida* within Colesdalen may be related to a spreading of the species at this particular Svalbard locality. It may also support the idea that the species could be ranked thermophilic and thus potentially fast responsive to warming of polar environment.

Key words: *Euphrasia frigida*, *Euphrasia wettsteinii*, discovery, Svalbard

DOI: 10.5817/CPR2013-2-11

Introduction

Annual plants are not typical elements of flora in the high latitudes of the Holarctic. That is why discoveries of annual plants are very interesting in the Arctic. For a long time, only two species

of annual plants were known in relation to the Spitsbergen archipelago - *Koenigia islandica* L. and *Euphrasia frigida* Pugsl. The latter was found only in one place in the area of warm springs in Bockfjorden

Received April 9, 2013, accepted December 11, 2013.

*Corresponding author: Eugenia Markovskaya <volev10@mail.ru>

Acknowledgements: The study was supported by AVCP (grant No. 5.5829.2011), FCP (grant No. GK 14.740.11.0300), and RFBR (project No. 12-04-01008_a). The authors thank an anonymous reviewers for valuable comments and suggestions.

(Lid et Lid 1994, Ronning 1996). Later studies reported two other locations in which *Euphrasia frigida* was found: Kongsfjord (NW Svalbard) and Colesdalen (W Svalbard). In Colesdalen, a small patch of about 0.5 m² with *E. frigida* was found in 1998 (see Alsos et Lund 1999). In 2002, a systematic survey of the area revealed in total 9 patches *E. frigida*

(Alsos et al. 2004), whereas a short visit in 2007 showed a more or less continues populations over an are of about 500 x 100 m. In this paper, we report new records of this species from Colesdalen that are located right between two already described patches: the coastal and the inland ones.

Material and Methods

Euphrasia frigida is common eglanular, small-flowered plant occurring in the North Atlantic. The plants reach height of (1.5–)5–10 cm. It is annual herb not caespitose with taproot present. Ground level or underground stem is absent. Aerial stems are erect, however, somewhat flexuous. Opposite leaves are distributed along the stems. They are not distinctly distichous. The leaves are not persistent, they die annually (Aiken et al. 2007).

For several decades, it has been considered under the name *Euphrasia frigida*. Recently the species is re-classified as *Euphrasia wettsteinii* for the plants in northern Europe and Canada and also for a major part of the Greenland plants. The Greenland type of *E. frigida* designated by Pugsley (1933) is glandular, large-flowered, and differs also in other aspects from the plant that has gone by that name. Therefore, name *E. wettsteinii* replaced the name *E. frigida* also for plants occurring at Svalbard (Gusarova 2005, <http://www.svalbardflora.net/> and <http://nhm2.uio.no/paf/810401>). In this paper, however, we report this species under original name *E. frigida**. Due to its scarce occurrence on Svalbard, the species is considered as rare

and Red listed (Alsos 2011). At Svalbard, *E. frigida* was discovered at Bockfjorden in 1960 (see Rønning 1961, Elvebakk et Spjelkavik 1981). Another locality at which *E. frigida* grows was found some further south, in Colesdalen in 1998 (Alsos et Lund 1999, Engelskjøn et al. 2003). In 2003, a small patch of *E. frigida* was found at Ossian Sarsfjellet, Kongsfjorden (TROM) - see Fig. 1 (left).

In 2011, a small patch of *E. frigida* was found by the authors of this paper on the Eastern coast of Colesdalen bay (N 78° 7' 4.21'', E 15° 1' 26.15'') on the slope of SW exposition (inclination of about 30°) of shallow hollow during the field studies. The clumps of *E. frigida* were located 1 - 1.5 m away from each other on the area of about 40 m². The slope of a hollow is slightly eroded and it borders the territories that were anthropogenically transformed (roads, abandoned buildings, etc.). The site is located close to the buildings forming abandoned port site. The site is located close to the area reported by Alsos et al. (2004). However, the new record site is located some 150 m SE from the southernmost site reported by Alsos et al. (2004) - see Fig. 1 (right).

* In fact, *E. frigida* is a taxon which do not occur in Svalbard according to recent taxonomical rules. The new name *E. wettsteinii* has been chosen because selected lectotype of *E. frigida* (wrongly selected) describes a different species.



Fig. 1. Left: Map of distribution of *Euphrasia frigida* on Svalbard: (1) Bockfjorden, (2) Kongsfjorden, (3) Colesdalen. **Right:** Localities of *Euphrasia frigida* in Colesdalen. Red points indicate the sites reported by Alsos et al. (2004). Yellow point indicates the site reported in this study. The map was extracted from <http://toposvalbard.npolar.no>.

Results and Discussion

The habitat relates to willow-grassland-moss association that includes *Salix polaris* Wahlenb., *Carex* sp., *Luzula confusa* Lindeb., *Alopecurus borealis* Trin., *Poa alpina* L., *Trisetum spicatum* (L.) K. Richt., *Bistorta vivipara* (L.) Gray, *Cerastium alpinum* L., *Equisetum arvense* L., *Oxyria digyna* (L.) Hill, *Saxifraga oppositifolia* L., *Sanionia uncinata* (Hedw.) Loeske, *Polytrichum piliferum* Hedw., *Polytrichum hyperboreum* R. Brown, *Peltigera* ssp. (see Fig. 3). For Colesdalen, Lang et al. (2007) reported the following 8 species *Bistorta vivipara*, *Festuca rubra* ssp. *richardsonii*, *Poa arctica*, *Salix polaris*, *Equisetum arvense* ssp. *alpestre*, *Stellaria crassipes*, *Trisetum spicatum* ssp. *spicatum* and *Alopecurus borealis* as possible host of *E. frigida*. Other studies from Svalbard (Alsos et

Lund 1999, Alsos et al. 2004) proposed that *Salix polaris* and *Bistorta vivipara* among others, are within host range of *E. frigida*.

The found specimens of *Euphrasia frigida* are small at the new site. The average length is about 2 cm, the flower length is 5 mm and the flower width is 3.5 mm. 420 individuals were registered within 5 clumps.

The new site of *Euphrasia frigida* described here is located on SW-facing slope of Colesdalen. It is due to fact that the species is considered thermophilic and thus co-occurring with other rare warmth-demanding species such as *Vaccinium uliginosum* ssp. *microphyllum*, *Betula nana* ssp. *tundrarum*, *Campanula rotundifolia* ssp. *gieseckiana* (Alsos 2011).



Fig. 2. General view on Colesbukta and Colesdalen. The site of new record of *Euphrasia frigida* is close to the buildings (indicated as a small plot with black-line margin). Photo by Olga Belkina.



Fig. 3. Photo of the small patch of *Euphrasia frigida*, a new place found on South-facing slope of Colesdalen.

Our finding of a new place of *E. frigida* within Colesdalen may indicate that the species is spreading in this part of Svalbard. Such conclusion may be supported by the fact the species is thermophilic and thus potentially fast responsive to warming of the environment (Nyléhn et Totland 1999) as shown by Klanderud (2008) in manipulated experiment. In Colesdalen, study of Lang et al. (2007) reported slightly higher soil temperature in the plots with *E. frigida* than those without the species. Predicted global warming, how-

ever, would have also adverse effects on spreading of the species in Colesdalen. Due to atmospheric and soil warming, less frost disturbance of the soil, and as a result of that, less bare ground will be available. Since bare soil is needed for seed establishment, it may limit the growth of *E. frigida* in some places in Colesdalen (Lang et al. 2007). Recently, molecular biology approaches are used in genus of *Euphrasia* so that genetic variation of the genus is evaluated for polar regions (Gusarova et al. 2008, 2012).

References

- AIKEN, S. G., DALLWITZ, M. J., CONSAUL, L. L., MCJANNET, C. L., BOLES, R. L., ARGUS, G. W., GILLETT, J. M., SCOTT, P. J., ELVEN, R., LEBLANC, M. C., GILLESPIE, L. J., BRYSTING, A. K., SOLSTAD, H. and HARRIS, J. G. (2007): Flora of the Canadian Arctic Archipelago: Descriptions, Illustrations, Identification, and Information Retrieval. NRC Research Press, National Research Council of Canada, Ottawa. <http://nature.ca/aaflora/data>, accessed on DATE. Publisher: NRC Research Press and The Canadian Museum of Nature. Type: CD-Rom. ISBN: 978-0-660-19727-2, e-ISBN: 978-0-660-19727-2.
- ALSOS, I. G., LUND, L. 1999: Fjelløyentrøst *Euphrasia frigida* funnet i Colesdalen, Svalbard. *Blyttia*, 57: 36.
- ALSOS, I. G. (2011): Current Work on Svalbardflora.net and Redlisted Species in Svalbard. In: Talbot, S. (ed.): Papers from the CAFF Flora Group (CFG) and Circumboreal Vegetation Map (CBVM) Workshops: 2009-2010. CAFF International Secretariat, CAFF Proceedings Series Report Nr. 1. ISBN: 978-9979-9778-7-2, p. 75-81.
- ALSOS, I. G., WESTERGAARD, K., LUND, L. and SANDBAKK, B. E. (2004): Floraen i Colesdalen, Svalbard. *Blyttia: Norsk botanisk forenings tidsskrift*, 62: 142-150.
- ELVEBAKK, A., SPJELKAVIK, S. (1981): Botanisering blant varme kjelder og vulkanar på Nord-Svalbard. Polarflokken, 5: 104-113. (In: Norwegian, Botanicizing among hot springs and volcanos in Northern Svalbard)
- ENGELSKJØN, T., LUND, L. and ALSOS, I. G. (2003): Twenty of the most thermophilous vascular plant species in Svalbard and their conservation state. *Polar Research*, 22: 317-339.
- GUSAROVA, G. (2005): Konspekt roda *Euphrasia* L. (Scrophulariaceae) Rossii i sopredelnikh stran (v predelakh bivtsego SSSR). *Botanicheskii Zhurnal*. Moscow & Leningrad [St. Petersburg], 90. № 7: 1087-1115. (in Russian)
- GUSAROVA, G., ALSOS, I. G. and BROCHMANN, C. (2012): Annual plants colonizing the Arctic? Phylogeography and genetic variation in the *Euphrasia minima* complex (Orobanchaceae). *Taxon*, 61: 146-160.
- GUSAROVA, G., POPP, M., VITEK, E. and BROCHMANN, C. (2008): Molecular phylogeny and biogeography of the bipolar *Euphrasia* (Orobanchaceae): Recent radiations in an old genus. *Molecular Phylogenetics and Evolution*, 48: 444-460.
- KLANDERUD, K. (2008): Species-specific responses of an alpine plant community under simulated environmental change. *Journal of Vegetation Science*, 19: 363-372.
- LANG, S., DEES, M. W. and BOCKMÜHL, K. (2007): Life in the Arctic – a struggle for survival? In: I. G. Alsos, C. Körner, D. Murray (Eds.): Arctic plant ecology: From tundra to polar desert in Svalbard. AB326 report 2007, ISBN 978-82-481-0009-6, p. 33-54.

- LID J., LID D.T. (1994): Norsk flora. 6 th edn. Det Norske Samlaget, 1994. Oslo.
- NYLÉHN, J., TOTLAND, O. (1999): Effects of temperature and natural disturbance on growth, reproduction, and population density in the alpine annual hemiparasite *Euphrasia frigida*. *Arctic Antarctic and Alpine Research*, 31: 259-263.
- RØNNING O. I. (1996): The Flora of Svalbard. Oslo: Norsk Polarinstitutt, 1996. 184 p.
- RØNNING, O. I. (1961): Some new contributions to the flora of Svalbard. Norsk. Polarinstitut, Skr. 124.

Other sources

- <http://nhm2.uio.no/botanisk/nbf/blyttia/200403a1.htm>
- <http://nhm2.uio.no/paf/810401>
- http://svalbardflora.net/index.php?id=168&searched=Euphrasia&advsearch=oneword&highlight=ajaxSearch_highlight+ajaxSearch_highlight1
- <http://toposvalbard.npolar.no>.