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Phyteuma orbiculare in the High Sudeten Mts.: past and present.

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ABSTRACT: The history of the discovery of *Phyteuma orbiculare* L. in the *Sudeten* Mts. is outlined and the present state of the populations is described. Only old and poorly documented data are available from the Krkonoše Mts. (Western *Sudeten*), indicating that *P. orbiculare* L. once occurred there in two sites, Mt. Sněžka and the Velká kotelná jáma glacial cirque. None of the records has been confirmed in recent times. By contrast, two large populations thrive in the Hrubý Jesenik Mts. (Eastern *Sudeten*), at the Velká kotlina and the Malá kotlina glacial cirques. Field research has failed to substantiate the presence of *P. orbiculare* in the Králický Sněžník Mts. Evidence is presented that the *Sudeten* plants are referable to subsp. *montanum* R. SCHULZ. Their morphology, karyology, relationships, biology, ecology and phytocenological characteristics are briefly considered.

KEYWORDS: *Phyteuma orbiculare*, Sudeten Mts., morphology, infraspecific differentiation.

Introduction

It is a well known fact that there are striking dissimilarities in the composition and structure of the floras of the Western and Eastern *Sudeten*. One example, *Primula elatior* (L.) HILL, where differences in distribution and frequency are accompanied by taxonomic diversification, has been discussed (KOVANDA 1997). It is the purpose of the present paper to consider another case, where a taxon, *Phyteuma orbiculare* L. susbsp. *montanum* R. SCHULZ, is apparently missing from the Western but is represented by strong populations in one part of the Eastern *Sudeten*.

Western Sudeten

Early floras (e. g. MATTUSCHKA 1776, KROCKER 1787) do not record any *P. orbiculare* L. in the Western *Sudeten*. The first to report it was HAENKE (1791), the youngest member (age, 25) of the first scientific expedition to the Krkonoše Mts. organized by the physiographer Abbé T. GRUBER under the auspices of the Bohemian Society of Sciences in 1786 (see JENÍK 1986). He reported *P. orbiculare* L. from the "Vorderseite" of Mt. Sněžka. However vague this description of the site may appear, it undoubtedly refers to the southern or south-western side of the mountain. The expedition reached Mt. Sněžka from Mt. Liščí hora by way of Mt. Studničná and Bílá louka. It is obvious therefore that they approached Mt. Sněžka from the south-west and "Vorderseite" means the southern, Bohemian side of the mountain. JENÍK (1985) deduces from a reconstruction of the itinerary that the locality of *P. orbiculare* L. may have been Rudník, a major, conspicuous south-western cleft of Mt. Sněžka. He also casts doubt upon the credibility of the record and suspects that HAENKE might have confused *P. orbiculare* L. with *P. spicatum* L. subsp. *coeruleum* (GREMLI) R. SCHULZ. *P. spicatum* L. is common in the Krkonoše Mts. but subsp. *coeruleum* (GREMLI) R. SCHULZ (perhaps best treated as a variety or form) is exceedingly rare in Bohemia. A plant resembling it was once seen in the Mały Kocioł Śnieżny in the Polish Karkonosze Mts. (see ŠOUREK 1969). HAENKE (1791) reports *P. spicatum* L. from the same locality as *P. orbiculare*. Unfortunately, no herbarium material reliably documenting HAENKE's report is available. His collections from the Krkonoše expedition are probably kept in PR but are impossible to identify. As was not unusual in those times, the early collections are poorly labelled and names of collectors and/or dates are often missing (see KLÁŠTERSKÝ, HRABĚTOVÁ-UHROVÁ & DUDA 1982). Some of the old herbarium records of *P. orbiculare* L. and *P. spicatum* L. may be suspected to have been made by HAENKE. Despite his youth, he proved a keen observer and competent connoisseur of plants, having described a number of new species from material gathered on the expedition (for an appraisal, see JENÍK 1985, 1986). The vast majority of his data have never been questioned. His report of *Phyteuma*, whether it be *P. orbiculare* L. or *P. spicatum* L. subsp. *coeruleum* (GREMLI) R. SCHULZ, has however not been confirmed to this day.

In 1921 *P. orbiculare* L. was recorded in a blockfield ("kam. moře v Kotelné jámě, horská niva") in the Velká Kotelná jáma glacial cirque, in the western part of the Krkonoše Mts., about 16 km away from Mt. Sněžka. The record comes from manuscript material gathered by Professor K. DOMIN for a proposed flora of Czechoslovakia by excerpting all the floristic data available and his own diaries until about 1945. The name of the collector is not given but an exclamation mark is attached indicating that the collector was DOMIN himself, or that he saw herbarium material by someone else. DOMIN is known to have meticulously documented all his records by herbarium specimens and the only places where this voucher specimen could be housed are the herbaria PR and PRC. It has been sought here in vain.

Yet one herbarium record from the Velká kotelná jáma glacial cirque does exist, however. It was discovered only recently, in PRC, filed amongst material of *P. orbiculare* from abroad. The locality is described laconically as "Kesselfall". Kessel here means unequivocally Velká kotelná jáma, only it is not clear which part of it is concerned. "Fall" in German does not only mean a waterfall (there is none here) but also a steep slope of which several are present in the glacial cirque. The date of collection is not given. The collector was K. RUDOLPH (1881-1937), a palynologist, Professor of botany at the German University in Prague, who in the late 1920s and early 1930s studied peat bogs of Northern Bohemia, including the Krkonoše Mts.

Again, neither report from the Velká kotelná jáma glacial cirque has ever been confirmed by subsequent research. The present author dares to claim to have some knowledge of the blockfield having searched it repeatedly in the past twenty years when studying *Cryptogramma crispa* (L.) R. BR. ex HOOKER, *Dianthus superbus* L. subsp. *speciosus* (REICHENB.) HAYEK, *Primula elatior* (L.) HILL subsp. *corcontica* (DOMIN) KOVANDA and *Campanula* sp. div. for the Czech flora but has never seen any *P. orbiculare* L. there. The possibility cannot however be excluded that a few specimens survive on one of the precipitous and little visited "falls".

There are still no reports of *P. orbiculare* L. occurring in the Polish part of the Krkonoše Mts., but are available from the Góry Stołowe and Góry Bystrzyckie Mts. (see e. g. SCHUBE 1903-1904, TACIK 1971).

All these records have been disregarded in later floras (e. g. POHL 1809, ČELAKOVSKÝ 1871, WINKLER 1881, POLÍVKA, DOMIN & PODPĚRA 1928, HENDRYCH 1950, DOSTÁL 1954, ŠOUREK 1969). Exceptions include DOMIN who considered HAENKE´s and his own record in his unfinished project, and DOSTÁL (1989) who quotes my note (KOVANDA 1981) that early reports from the Krkonoše Mts. were not documented.

Eastern Sudeten

In the Eastern *Sudeten*, *P. orbiculare* L. was first recorded by GRABOWSKI in the Velká kotlina glacial cirque in 1836. A sizeable population occurs there at the present time and herbarium records and literature data abound (see Appendix 1). Later it was found in the nearby Malá kotlina glacial cirque where another population flourishes. There seem to be no previous records explicitly from the latter site but two may be referable to it: "Maiberg" (KOLENATI sine dato PRC[1]) and "Maiwiese" (MALENDE ex SCHUBE 1915). The Malá kotlina glacial cirque lies on the southern side of Mt. Máj (see Appendix 2). Likewise, records from Mt. Vysoká hole (FRÖHLICH 1900 BRNU, ANONYMUS 1907 BRNM, WERNER ex SCHUBE 1913) clearly refer to the Velká kotlina glacial cirque. No *P. orbiculare* has ever been found in the summit areas of the Hrubý Jeseník Mts. The two

[1] F. A. KOLENATI worked in the Hrubý Jeseník Mts. from about 1858 until his death there in 1864.

populations differ considerably in size: whilst in the Malá kotlina glacial cirque not more than 100 individuals could be found, the one in the Velká kotlina glacial cirque has a minimum of 250 specimens. Reports of *P. orbiculare* L. from the southern slopes of Mt. Praděd, the highest point in the Hrubý Jeseník Mts. (THEIMER 1862 BRNU, HRUBY 1914) and the slopes of Mt. Petrovy kameny (LAUS 1927) lack any later corroboration.

Only a single literature report of *P. orbiculare* L. is available from the Králický Sněžník Mts. HRUBY (1914) reports it from two sites in the summit area: at the tree line at about 1200 m and from the source area of the river Morava. Both are described in enough detail to be verifiable, but the plant has never been found there, either before 1914 or since, even though habitat conditions are favourable, and no herbarium record was left by the author. HRUBY published extensively on the flora of Moravia but relatively few of his data are supported by herbarium material and a number are downright doubtful, as for instance one of *Campanula rotundifolia* L. subsp. *sudetica* (HRUBY) SOÓ from Mt. Vozka in the Hrubý Jeseník Mts. (see KOVANDA 1977). There are no reports of *P. orbiculare* L. from the Silesian side of the mountains (see e. g. SCHUBE 1903-1904).

In contrast to the Krkonoše Mts. where *P. orbiculare* L. is scattered in the foreland but absent from the foothills proper, it is also represented in the foothills of the Eastern *Sudeten* whence a number of both herbarium records and literature reports are available. Again, HRUBY's data (vicinity of Klepáčov, Leskovec, valley of the river Desná, Ruda nad Moravou, Branná, Králíky) have never received any confirmation. It should however be remembered that *P. orbiculare* L. is a declining species and has become extinct in great many sites.

Infraspecific differentiation in *P. orbiculare* L.

P. orbiculare varies over a wide range particularly in the length of petioles of basal leaves, shape of leaves (both basal and cauline) and shape and position of involucral bracts. Certain combinations of characters show, in certain definite areas at least, a more or less distinct correlation with ecological preferences and geographical distribution. Obviously, the process of infraspecific differentiation started only in the postglacial era and is still in progress; hence the many intermediates linking the various divergent lines. A variety of character assemblages have been variously described at all ranks. SCHULZ (1904) recognized six subspecies, each containing an array of varieties and forms. His elaborate system has however found little understanding in subsequent floras (see e.g. DAMBOLDT 1976). Yet on examination it appears that a degree of justification can be granted to it, as far as subspecies level is concerned. No matter how unsatisfactory SCHULZ's delimitation of subspecies may be in other parts of the species range, three distinct taxa occur in this country corresponding very well to three of SCHULZ's subspecies (see KOVANDA 1981): subsp. *orbiculare* (scattered and rare at lower altitudes mostly in the northern part of the country), subsp. *flexuosum* R. SCHULZ (extending only marginally to the Bílé Karpaty Mts. from the east) and subsp. *montanum* R. SCHULZ (higher elevations of the *Sudeten*).

The latter (with petiole of basal leaves shorter or as long as blade, blade of basal leaves irregularly obtusely serrate, middle and upper cauline leaves serrate, with at least one or two pairs of teeth, semi-amplexicaul) is of particular interest here. Of the features given by SCHULZ to characterize it, only the short petiole of basal leaves, serration of middle and upper cauline leaves and their being semi-amplexicaul proved constant enough to be considered diagnostic, as far as the *Sudeten* material is concerned. It should be noted that the short petiole of the basal leaves relates only to the one to three oldest basal leaves in a rosette; the others may have the petiole longer than the blade, as in subsp. *orbiculare*. The middle and upper cauline leaves are semi-amplexicaul in subsp. *montanum* and subsp. *orbiculare* but tapering to the base in subsp. *flexuosum*. This difference is however not always evident in herbarium material. In subsp. *montanum* these leaves are irregularly serrate to crenate whereas those of subsp. *orbiculare* are entire or nearly so. The other characters given by SCHULZ (1904), especially the shape, length and position of the involucral bracts, are subject to unusual individual variation and are useless to characterize the subspecies.

One distinguishing character can be added: the remnants of previous year's basal leaves which are present in subsp. *flexuosum* are absent in subsp. *montanum* (as also in subsp. *orbiculare*).

In the only herbarium specimen from the Krkonoše Mts. (see above), the basal leaves are absent and the middle and upper cauline leaves are semi-amplexicaul, thus referring it to subsp. *montanum*.

Plants transitional between subsp. *orbiculare* and subsp. *montanum* are known to occur in the Krušné hory Mts. and western Bohemia but not in the foreland or foothills of the *Sudeten* where only subsp. *orbiculare* is found.

SCHULZ (1904) reports subsp. *montanum* from the mountains of Central Europe: Alps, Schweizer Jura, Schwäbischer Jura, Thüringer Wald, Harz, Hejšovina/Góry Stołowe, Krušné hory/Erzgebirge Mts., Brdy Mts. and explicitly including the Hrubý Jeseník Mts.

Subsp. *montanum* is a short-lived hemicryptophyte. None of the plants transferred live to the experimental plot lived more than five years. Perennation is by buds in the axils of the basal leaves. Material from the Velká kotlina glacial cirque proved diploid, with n=11, placing it at the same level as subsp. *orbiculare* and subsp. *flexuosum*. Polyploidy is not known to occur in *P. orbiculare* L. and seems to be absent in the whole genus (KOVANDA 1981). The plants flower regularly every year and produce plenty of viable seed.

In the *Sudeten*, *P. orbiculare* L. subsp. *montanum* R. SCHULZ is a plant of rocky ledges, scree and subalpine grassland from about 1150 to 1350 m above sea level and is tolerant of both dry and moist habitats, the latter being clearly preferred. The substrate is graphitic phyllite interspersed in places by minute beds of calcium carbonate. JENÍK, BUREŠ & BUREŠOVÁ (1983) report subsp. *montanum* from communities of the alliance *Agrostion alpinae* and associations *Pinguiculo vulgaris-Trichophoretum alpini* (ŠMARDA 1950) JENÍK, BUREŠ &

BUREŠOVÁ 1980, *Thesio alpini-Nardetum* JENÍK, BUREŠ & BUREŠOVÁ 1980 and *Laserpitio-Dactylidetum glomeratae* JENÍK, BUREŠ & BUREŠOVÁ 1980.

It is encouraging to see, in the *Sudeten*, that despite the apparent absence from the Krkonoše and Králický Sněžník Mts., both the extant populations in the Hrubý Jeseník Mts. are flourishing. Apart from general pollution, the only threat (not serious) to their conservation comes from the introduced chamois that use it as a delicacy.

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References

ČELAKOVSKÝ L. (1871): Prodromus der Flora von Böhmen 2. - Prag.

DAMBOLDT J. (1976): Phyteuma L. – In TUTIN T. G. & al. (eds.): Flora Europaea 3, p. 95-98. - Cambridge, London, New York, Melbourne.

DOSTÁL J. (1954): Klíč k úplné květeně ČSR. - Praha.

DOSTÁL J. (1989): Nová květena ČSSR. - Praha.

GRABOWSKI [H. E.] (1836): Nachträge zu dem "systematischen Verzeichniss aller in Mähren und in dem K. K. österreichischen Antheil Schlesiens wildwachsenden, bis jetzt entdeckten phanerogamen Pflanzen, von den Hrn. R. Rohrer in Brünn und A. Mayer in Gros-Herlitz. Brünn bei R. Rohrer 1835". - Flora oder Allg. Bot. Z. 19: 369-375.

HAENKE T. (1791): Die botanischen Beobachtungen auf der Reise nach dem böhmischen Riesengebirge. – In: JIRASEK J., HAENKE T., Abbé GRUBER [T.] & GERSTNER F.: Beobachtungen auf Reisen nach dem Riesengebirge, p. 31-159. – Dresden.

HENDRYCH R. (1950): Čeleď 128. Campanulaceae. Zvonkovité - Zvončekovité. – In: DOSTÁL J. & al.: Květena ČSR, p. 1418-1436. – Praha.

HRUBY J. (1914): Die Ostsudeten. Eine floristische Skizze. – Brünn.

JENÍK J. (1985): Přínos Tadeáše Haenkeho k floristice Krkonoš. – Zpr. Čs. Bot. Společ. 20: 197-209.

JENÍK J. (1986): Dvousté výročí výpravy České společnosti nauk do Krkonoš. – Opera Corcont. 23: 53-76.

JENÍK J., BUREŠ L. & BUREŠOVÁ Z. (1983): Revised flora of Velká kotlina cirque, the Sudeten Mountains, I. – Preslia 55: 25-61.

KLÁŠTERSKÝ I., HRABĚTOVÁ-UHROVÁ A. & DUDA J. (1982): Dějiny floristického výzkumu v Čechách, na Moravě a ve Slezsku. – Severočes. Přír., příl. 1982: 1-242.

KOVANDA M. (1977): Polyploidy and variation in the Campanula rotundifolia complex. Part II. (Taxonomic). 2. Revision of the groups Vulgares and Scheuchzerianae in Czechoslovakia and adjacent regions. – Folia Geobot. Phytotax. 12: 23-89.

KOVANDA M. (1981): Studies in Phyteuma. – Preslia 53: 211-238.

KROCKER A. I. (1787): Flora silesiaca renovata, emendata...1. – Vratislaviae.

LAUS H. (1927): Květena Petrštýna ve Vysokých Jesenících se zvláštním zřetelem na rozšíření našich arkticko-alpinských druhů vrb. – Čas. Vlasten. Spol. Mus. Olomouc 39: 27-52.

MATTUSCHKA H. G. (1776): Flora silesiaca I. – Leipzig.

POHL J. E. (1809): Tentamen florae Bohemiae. Versuch einer Flora Böhmens. - Prag.
POLÍVKA F., DOMIN K. & PODPĚRA J. (1928): Klíč k úplné květeně Republiky Československé. – Olomouc.
PRESL J. S. & PRESL C. B. (1819): Flora čechica. – Pragae.
SCHUBE T. (1903-1904): Die Verbreitung der Gefässpflanzen in Schlesien preussischen und österreichischen Anteils. – Breslau.
SCHUBE T. (1913): Ergebnisse der Durchforschung der schlesischen Gefässpflanzenwelt im Jahre 1912. – Jber. Schles. Ges. Vaterl. Cultur 90, Abt. 2b: 92-103.
SCHUBE T. (1915): Ergebnisse der Durchforschung der schlesischen Gefässpflanzenwelt im Jahre 1914. – Jber. Schles. Ges. Vaterl. Cultur 92, Abt. 2b: 43-61.
SCHULZ R. (1904): Monographie der Gattung Phyteuma. - Geisenheim a. Rh.
ŠOUREK J. (1969): Květena Krkonoš. - Praha.
TACIK T. (1971): Rodzina: Campanulaceae, Dzwonkowate. – In: PAWŁOWSKI B. & JASIEWICZ A.: Flora Polska 12, p. 50-99. - Warszawa, Kraków.
WINKLER W. (1881): Flora des Riesen- und Isergebirges. - Warmbrunn.

Appendix 1

Herbarium specimens of *P. orbiculare* L. subsp. *montanum* R. SCHULZ seen

Krkonoše Mts.

"Kesselfall", RUDOLPH sine dato PRC.

Hrubý Jeseník Mts.

Velká kotlina, OBORNY 1867 PRC, 1879 PRC, ANONYM 1884 OP, BUBELA 1884 PRC, BAENITZ 1893 PRC, SCHIERL 1893 BRNU, 1899 BRNM, OBORNY 1903 BRNM, HRUBY 1904 BRNU, LAUS 1905 BRNU, SUZA 1909 BRNU, DVOŘÁK 1911 BRNM, VÍTEK 1916 BRNM, STANĚK 1920 BRNM, ŠMARDA 1920, LENEČEK 1929 PRC, SCHUSTLER 1924 PR, MATAUCH 1934 PRC, OTRUBA 1934 BRNM, 1934 PRC, ANONYMUS 1934 PRC, JEDLIČKA 1946 BRNU, POSPÍŠIL 1946 BRNM, DEYL 1947 PR, DUDA 1947 OP, ŠMARDA 1947 BRNM, DEYL 1949 PR, 1951 PR, 1952 PR, KLÁŠTERSKÝ 1958 PR, VICHEREK 1958 BRNU, MĚSÍČEK 1961 PR, DEYL 1966 PR, 1967 PR; Vysoká hole, FRÖHLICH 1900 BRNU, ANONYMUS 1907 BRNM; Máj, KOLENATI sine dato PRC; Praděd, THEIMER 1862 BRNU.

Appendix 2

List of German topographical names (in common use before 1945)

Czech Republic

Bílá louka	Weisse Wiese
Branná	Goldstein
Desná	Tess
Hejšovina	Heuscheuer
Hrubý Jeseník	Hochgesenke, Altvatergebirge
Klepáčov	Kleppel

Králický Sněžník	Glatzer Schneeberg
	Grulicher Schneeberg
	Spieglitzer Schneeberg
Králíky	Grulich
Krkonoše	Riesengebirge
Krušné hory	Erzgebirge
Leskovec	Spachendorf
Liščí hora	Fuchsberg
Máj	Maiberg
Malá kotlina	Kleiner Kessel
Morava (river)	March
Petrovy kameny	Peterstein
Praděd	Altvater
Ruda nad Moravou	Eisenberg
Rudník	Kiesberg
Sněžka	Schneekoppe
Studničná hora	Brunnberg
Úpská jáma	Aupagrund, Aupagrube
Velká kotlina	Grosser Kessel
Velká kotelná jáma	Grosse Kesselgrube
Vysoká hole	Hohe Heide
Vozka	Führmannsteine

Poland

Góry Bystrzyckie	Habelschwerdter Gebirge
Góry Stołowe	Heuscheuer
Karkonosze	Riesengebirge
Śnieżnik Kłodzki	Glatzer Schneeberg

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