

## Distribution of mountain hawkweeds (*Hieracium* s. str.) in the Hrubý Jeseník Mountains

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**Abstract:** Field revision of current distribution of mountain hawkweeds (*Hieracium* s. str.) in the Hrubý Jeseník Mts was undertaken. *Hieracium atratum*, *H. chlorocephalum*, *H. engleri*, *H. grabowskianum* and *H. plumbeum*, whose last occurrence was documented many decades or even a century ago, were rediscovered. *H. plumbeum* was even found in new localities. The occurrence of *H. alpinum*, *H. bifidum*, *H. chrysostyloides*, *H. inuloides*, *H. nigritum*, *H. prenanthoides*, *H. silesiacum*, *H. stygium* and *H. villosum* was ascertained at many of their historical localities and a few new localities were found too. A neophyte species *H. mixtum* was discovered. *Hieracium moravicum* was not found. Accurate locality description and population size are provided for each finding. Herbarium revision and excerption of crucial literature were performed to provide historical distribution. Distributional changes as well as threatening and beneficial factors influencing *Hieracium* species in the Hrubý Jeseník Mts are discussed.

**Key words:** *Hieracium*, Hrubý Jeseník, distribution, field revision, rediscovery, mountain plants

### Introduction

The Hrubý Jeseník Mountains (referred to below as “HJM”, also as an adjective) are the second highest mountains range in the Czech Republic. Their botanical richness has been systematically studied for two centuries and current knowledge of the botanical richness of this area is at a high level (Bureš 2013). However, some plant groups, mainly the critical genera, cause persisting blank spaces in this knowledge. Although the distribution of the critical genus *Hieracium* s. str. (hawkweed) in these mountains was previously studied in detail by many authors in the past (e.g. Fiek 1881, Oborny 1906, Skrívánek 1956), contemporary knowledge of the species’ distribution and population condition is very limited.

### Diversity of hawkweeds in the HJM

Twenty species of hawkweeds occur in the HJM according to Chrtek (2004). Two ecological groups can be distinguished: hawkweeds that are fixed exclusively to the mountain environment (*Hieracium villosum*, *H. grabowskianum*, *H. alpinum*, *H. chrysostyloides*, *H. atratum*, *H. prenanthoides*, *H. moravicum*, *H. engleri*, *H. nigritum*, *H. chlorocephalum*, *H. stygium*, *H. inuloides* and *H. silesiacum*) and hawkweeds growing generally in lower altitudes reaching their altitudinal maxima in the HJM (*H. diaphanoides*, *H. murorum*, *H. lachenalii* and *H. laevigatum*). Between these groups, there is a transitional group of hawkweeds growing both in lowlands and in mountains (*H. caesium*, *H. vulgatum*, *H. bifidum*). This list of HJM hawkweeds is extended by two species recently discovered by J. Kocián in the HJM: *H. mixtum* Froel. (Kocián & Chrtek 2011) and *H. umbellatum* (Novotná *et al.* 2013). Thus, twenty two hawkweed species are contemporarily known to occur in the HJM. This number, however, is not accurate due to taxonomical inconsistencies. Meanwhile taxons such as *H. chrysostyloides*, *H. stygium* or *H. silesiacum* are microspecies (more or less equal to subspecies according to Zahn 1922-1938), other taxons such as *H. prenanthoides* or *H. inuloides* are aggregate species comprising

several yet taxonomically unresolved microspecies. Thus, the number of HJM species (on a microspecies level) is higher, but the exact number of them can only be known when all the local species have been taxonomically resolved. Since taxonomical research is not the aim of this article, we keep to the species classification and nomenclature given by Chrtek (2004) with one exception – we consider *H. plumbeum* a discrete species, not a subspecies of *H. caesium*.

In this article we focus on the species of the “mountain” group plus *H. bifidum* and *H. plumbeum*.

### *History of hieraciology in the HJM*

The history of HJM hawkweed research from the beginning of the 19th century until the end of the first half of the 20th century is provided by Skřivánek (1956). To briefly summarize, HJM hawkweeds were systematically treated for the first time by Wimmer & Grabowski (1829) and later by Grabowski (1843). The first monograph of the genus, including HJM species based on Wimmer’s findings, was worked out by Fries (1862). Two crucial works comprehensively treating HJM hawkweeds followed: Uechtritz’s treatment of the genus in Fiek’s flora (Fiek 1881) and Oborny’s monograph of Moravian hawkweeds (Oborny 1906). After that, Hrúby (1914) specifies a large number of localities of many hawkweed species. The known data about HJM hawkweeds are summarized in Zahn’s *Hieracium* monographs (Zahn 1921–1923 and even more comprehensive treatment Zahn 1922–1938) which are to date the most complex works on the whole genus. Skřivánek (1956) carried out field research on the south part of the HJM and its foothills and provided the findings of 16 *Hieracium* s. str. species. Since that time, no one has been systematically engaged in studying and monitoring HJM hawkweeds and only partial notes have been made about their distribution.

Jeník *et al.* (1983a, b) undertook detailed research of the flora and vegetation of Velká kotlina in the 1970s. They noticed six hawkweed species in the locality. Chrtek (1995) did a research on the *Hieracium alpinum* agg. and the *Hieracium nigrescens* agg. in the Eastern Sudeten Mts, treating HJM *Hieracium alpinum* and *Hieracium chrysostyloides* in detail. He also worked out the whole genus in Květena České republiky (Chrtek 2004). Štencl (2009) carried out a detailed revision of *Hieracium villosum* distribution in the HJM. Further data regarding recent findings of HJM hawkweeds are given in the flora inventories of HJM small scale protected areas (e.g. Kočí 2005, Albín 2005), however, some of the findings are dubious. Bureš (2013) worked out the flora of endangered HJM plants including all hawkweeds except the common ones. The treatment contains our preliminary field research results and in it many HJM hawkweeds are captured and published in colour photographs for the first time.

HJM hawkweeds were plentifully collected for herbarium purposes. However, herbarium specimens of only few species and only in selected, chiefly main herbaria were worked out: *Hieracium alpinum* and *H. chrysostyloides* by Chrtek (1995), *H. villosum* by Severa (2001), *H. silesiacum* by Szelag (2004), *H. bifidum* by Zavadil (2007) and *H. prenanthoides* by Kocián (2012). A comprehensive treatment of HJM hawkweed herbarium collections is missing; for selected species it was worked out just recently (Kaplan *et al.* 2016).

The aims of this study are to (1) revise current distribution and population condition of the species in the field, (2) summarize historical distribution of HJM mountain hawkweeds based on herbarium revision and literature excerpt, and (3) compare the current distribution with the historical one, discussing the distributional changes.

### **Materials and methods**

The results are given to particular species in a standardized structure: introductory text, historical distribution in the HJM and current distribution in the HJM. The introductory text gives brief information about general species’ distribution, distribution in the Czech Republic and in certain cases other specific or important notes. The historical

distribution data is based on two sources: the herbarium specimens and literature. Herbarium specimens were studied in BRNM, BRNU, MP, OLM, OP, OVMB, PR, PRC, SUM and WRSL (acronyms according to Thiers 2017). Herbarium records are given in a standard format “collector, year of collection, herbarium acronym, (ID of herbarium specimen)” and are arranged by localities from the oldest records to the newest ones. The localities are arranged from north to south, general or unclear localities are put at the end. The literature locality data from the crucial HJM hieraciological works (Fiek 1881, Oborny 1885, Oborny 1906 and Skřivánek 1956) is presented in its original version. A text summarizing historical distribution follows, eventually mentioning additional important literature sources. Current distribution is based on the first author’s extensive field research of the montane and subalpine zone of the whole main HJM ridge, i.e. from Šerák to Pec, which was undertaken between 2006 and 2016. The currently discovered/ascertained localities are given in the tables. Each finding comprises of: locality, GPS, altitude, date, count and herbarium evidence. Locality is described as accurately as possible with the information who noticed (not.) or collected (leg.) the specimens on the locality; GPS coordinates of WGS-84 are recorded by Garmin GPSmap 60CSx; altitude readings are measured from touristic map on www.mapy.cz; the date is the one when the species was first found in the locality during the field revision; the count is the number of flowering (fl.) or fruiting (fr.) stems, on occasions even sterile (st.) plants were counted (in cases when flowering or fruiting stems were not present) and the number given is either accurate in case of small populations or rounded up in the case of larger populations – then T = tens and H = hundreds, e.g. 8T fl. = ca 80 flowering stems; herbarium evidence gives information on whether a herbarium specimen was taken and if so, in which herbarium it is deposited, acronyms are according to Thiers 2017 (acronym KOC means the specimen was still in the first author’s private herbarium at the time of the article publication). The tables are followed by a text describing the present species’ occurrence in the HJM, a comparision of the historical distribution with the contemporary one, a discussion of population abundance trends and in some cases information about the observed morphological variability within/between populations in addition to other noteworthy observations.

## Results

### *Hieracium alpinum* L.

The range of *Hieracium alpinum* s. str. is not known, but it is presumably similar to the range of the whole *Hieracium alpinum* agg. (Chrtek 1995), which has a typical arcto-alpine range (*cf.* Bräutigam 1992). In the Czech Republic, *Hieracium alpinum* s. str. occurs in the Krkonoše Mts and the HJM (Chrtek 2004).

#### *Historical distribution in the HJM*

Herbarium specimens: Šerák: Spitzner 1892 BRNU (377361); Laus 1904 OLM (68662); Horák 1930 MP (59056); Horňanský 1947 BRNM (422230); Hynšt 1947 OLM (128612, 129756, 129757); Tomášek 1947 BRNM (422225); Jedlička 194? BRNU (s.n.); Skřivánek 1956 BRNM (251999); Bureš 1986 OLM (118834); Keprník: Oborny 1879 BRNU (335710); Bubela 1883 BRNU (335713); Müller 1886 BRNM (68444); Spitzner 1892 BRNU (377362); Baenitz 1893 WRSL (s.n.); Frimmel 1912 BRNU (308798); Staněk 1919 BRNU (314503); Černohorský 1947 PR (250169); Hynšt, Weber 1947 OLM (128611); Müller 1947 (405172); Svrček 1947 PR (P4S417/5102); Hrabětová 1959 BRNU (373771); Hynšt 1953 OLM (128608); Magurová(?) 1955 PR (P4S417/7716); Šula 1966 OLM (115211); Pospíšil 1966 BRNM (42222?); Chrtek, Chrtková 1979 PR (P4S417/9992); Žalostná: Skřivánek 1956 BRNM (251998); Vozka: Černohorský 1947 PR (P4S417/7500); Vřesová studánka (Červená hora): Teuber 1897 BRNM (18810); Šourek, Kurka 1947 PR (269824); Malý Děd: Bubela 1883 BRNU (335?03); Tabulové skály: Müller 1886 BRNM (68443); Müller 1889 BRNM (68449); Šmarda 1920 PR (109200); Skřivánek 1955 BRNM (252001); Janáčková 1969 SUM (5172); Velký Děd: Skřivánek 1955 BRNM (252004); Praděd: Oborny 1867 BRNU (335707, 335711); Oborny 1879 BRNU (335705); Müller 1886 BRNM (68442); Schierl 1890 BRNM (46008); Callier, Hirte, Scholz 1893 WRSL (s.n.); Skřivánek 1909 BRNM (251996); Staněk 1919 BRNU (314506); Staněk 1920 BRNU (335693); Laus 1926 OVMB (B3891); Laus 1930 OLM (68661); Laus 1930 PRC (s.n.); Weber 1934 PR (P4S417/9150); Skřivánek 1946 BRNM (251989, 251990); Kvapilík 1947 OLM (92575); Deyl 1949 PR (P4S417/7410); Deyl 1965 OLM (153179); Mravenečník: Jedlička 1946 BRNU (335638); Petrovy kameny: Oborny 1877 BRNU (64292); Freyn 1883 BRNU (335712); Spitzner 1888 BRNU (377363); Spitzner 1889 BRNU (351943); Krajina 1946 PRC (s.n.); Skřivánek 1946 BRNU (360962); Deyl 1949 PR (P4S417/7414); Součková 1949 BRNM (46005); Janáčková 1971 SUM (6698); Janáčková 1978 SUM (13776); Teuber 1903 BRNM (18811); Skřivánek 1915 BRNM (251984); Skřivánek 1915 BRNM (251987); Laus 1928 OP (20334); Zavřel 1947 BRNM (251997); Skřivánek 1955 BRNM (252002); Burša 1969 OP (128370); Vysoká hole: Poleck 1841 WRSL (s.n.); Kern 1874 WRSL (s.n.); Freyn 1883 BRNU (335709); Rieger 1890 OLM (88907); Rieger 1890 OP (96766); Kunisch 1893 WRSL (s.n.); Laus 1904 BRNU (413101); Richter 1906 SUM

(1000); Horák 1931 MP (59057); Thenius 1933 BRNU (332386); Kvapilík 1936 OLM (92548, 92550); Šmarda 1946 BRNM (18802, 18803); David 1953 MP (28922); Skřivánek 1955 BRNM (252003); Deyl 1965 OLM (153173); Burešovi, Jeník 1975 OLM (109668); Burešovi, Jeník 1976 OLM (109647); Kolenati s.d. PR (P4S417/6889); **Kamzičník:** Skřivánek 1955 BRNM (252005); Burešovi, Jeník 1974 OLM (109675); **Velká kotlina:** Suza 1909 BRNM (06899/32.); Dvořák & Suza 1911 BRNM (06898/32.); Thenius 1919 BRNU (332335); Pospíšil 1946 BRNM (78985); Burešovi, Jeník 1972 OLM (109674); **Velký máj:** Čouka 1905 BRNU (413139); Laus 1931 OP (97315); Kvapilík 1947 OLM (92574); Hrabětová 1959 BRNU (404144); **Jelení hřbet:** Gams 1907 BRNM (18806); **in subalpinis mt. Šerák et Keprník:** Deyl 1947 PR (P4S417/7393); **Schäferei[?]:** Skřivánek 1909 BRNM (251086); **Wege vom Jagdhaus zu den Drei Brunnen:** Lukas 1923 SUM (9889); **Skály na Pradědu, Praděd, Petrovy kameny, Vysoká hole:** Jilek 1948 BRNM (422229); **Vysoká hole-Jelení hřbet:** Čouka 1905 BRNU (413003); **Hrubý Jeseník:** Schierl 1887 BRNM (18805); Frimmel s.d. BRNU (308804).

Literature data: **Fiek 1881:** Im Gesenke [no specific localities given] **Oborny 1885:** Grasreiche und steinige Abhänge und Kuppen des Sudetenzyges über der Holzregion, seltener in das Waldgebiet hineinragend, stellenweise oft massenhaft. (ut *H. alpinum* L.  $\alpha$ ) *genuinum*:) Seltener und zerstreut, am häufigsten noch auf dem Köpernik. (ut *H. alpinum* L.  $\beta$ ) *holosericeum*:) Petersteine, Hohe-Heide, Altvater, Ameisenhügel, Schieferheide, Hirschbrunnen etc. (ut *H. foliosum* Wimm.:) im Gesenke. **Oborny 1906:** (ut *H. alpinum* L. ssp. *alpinum* Tsch.:) Die typische Form auf den Kämmen des Gesenkes [...], am Köpernik, Hochschar, Fuhrmannstein;  $\beta$  verbreiteret, an obigen Standorten und vom Köpernik längs des Kamms bis zur Schieferheide, so auf der Brünnelheide, auf dem Hausberge, Altvater, Peterstein hohe Heide, Heiligenhübel, Ameisenhügel, Hirschbrunnen, stellenweise sehr häufig;  $\gamma$  Köpernik bei Goldenstein. (ut *H. alpinum* L. ssp. *melanocephalum* Tsch.:) Die Normalform auf der Hochschar, dem Köpernik, Peterstein;  $\beta$  auf dem Altvater und sonst zerstreut. **Skřivánek 1956:** (ut *H. holosericeum* Backh.:) Nápadný jestřábík, charakteristický pro hřebeny, temena hor a vrcholové skály. Často pospolitě a v menších koloniích společně s *H. nigritum* Uechtr. a *H. stygium* Uechtr., ve společenství s *Festuca supina*, *Deschampsia flexuosa*, *Vaccinium myrtillus*, *Calluna vulgaris*, *Mutellina purpurea*, *Solidago alpestris*, *Achyrophorus uniflorus*. Výskytem omezen na horské hole v pásmu 1350–1490 m. Břidličná 5. 8. 1946, Máj, Svatá, Vysoká hole, Petrova skála 6. 8. 1955, Praděd, Tabulové kameny, Velký Děd, Jelení hřbet 7. 8. 1955.

Many localities of *Hieracium alpinum* are known from the whole HJM ridge from Šerák to Břidličná hora. Chrtek (1995) gives a detailed list of historical and at that time recently confirmed localities (though some of them are dubious – Vřesová studánka and Malá kotlina, or highly probably wrong – Volárna). He also analyses a complicated taxonomical treatment of *Hieracium alpinum* agg. in the HJM. Recently, Kočí (2005) states that there are relatively abundant populations on Tabulové skály, nearby Petrovy kameny and on the slopes of Vysoká hole to Petrovy kameny and that the species is rare elsewhere in the Praděd National Nature Reserve. Albín (2005) reports the distribution of the species from the summit areas of Šerák and Keprník in the Šerák-Keprník National Nature Reserve.

### Current distribution in the HJM

**Table 1:** Current localities of *Hieracium alpinum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
Šerák, alpine grassland along the tourist path between chairlift upper exit and Jiřího chalet, leg. J. Kocián	50°11'13.4"N 17°06'21.5"E	1340	15. 7. 2008	1H fl.	NJM
Šerák, scree partially covered by soil 20 m under the belfry, 100 m SSE of Jiřího chalet, not. R. Štencl	50°11'11.2"N 17°06'33.6"E	1315	7. 5. 2014 (2015)	15 fl.	-
Keprník, rocks 130 m NW of the summit, not. J. Kocián	50°10'18.5"N 17°06'56.8"E	1410	11. 9. 2012 (2014)	5T fl.	-
Keprník, alpine grassland around the summit rock, leg. J. Kocián	50°10'15.7"N 17°06'59.0"E	1422	15. 7. 2008	5T fl.	NJM
Žalostná, alpine grassland and small bushes on the rocks, not. J. Kocián	50°10'18.6"N 17°07'38.3"E	1350	11. 9. 2012	2T fr.	-
Sokol, Sokolí skála, summit area of the main rock, not. J. Kocián	50°05'40.5"N 17°15'00.9"E	1155	16. 9. 2012 (2015)	1H fl.	-

Locality	GPS	Alt.	Date	Count	Herb.
<b>Tabulové skály</b> , alpine grassland on the rocks, rocks themselves and around the path leading to them from Praděd, not. J. Kocián	50°05'11.3"N 17°13'50.8"E	1450	1. 8. 2012	4H fl. (2016)	-
<b>Praděd</b> , alpine grassland 210 m N of the summit, around the border stone and in surroundings, leg. J. Kocián	50°05'05.4"N 17°13'54.6"E	1480	9. 7. 2006	3T fl.	NJM
<b>Praděd</b> , alpine grassland, 100 m N of the summit, not. J. Kocián	50°05'02.3"N 17°13'51.9"E	1485	12. 7. 2015	5T fl.	-
<b>Praděd</b> , alpine grassland surrounding an unused path on SW slope of the mountain, scattered in a larger area spreading from the coordinates up towards the summit, not. J. Kocián	50°04'56.1"N 17°13'41.6"E	1475	12. 7. 2015	4H fl.	-
<b>Praděd</b> , S slope, stony ruin of a former chalet, 350 m SSE of altitudinal point 1356 and 900 m E of Barborka chalet, not. J. Kocián	50°04'42.1"N 17°14'38.5"E	1280	19. 8. 2013	4T st.	-
<b>Petrovy kameny</b> , alpine grassland around the rock, not. J. Kocián	50°04'07.2"N 17°14'01.4"E	1435	20. 7. 2013	5T fl.	-
<b>Petrovy kameny</b> , alpine grassland on the edge of a path between the rock and the red tourist path, leg. J. Kocián	50°04'02.9"N 17°14'05.1"E	1430	16. 7. 2008	several	NJM
<b>Vysoká hole</b> , alpine grassland, near the red tourist path, leg. J. Kocián	50°03'53.3"N 17°14'05.0"E	1460	16. 7. 2008	3T fl.	NJM
<b>Vysoká hole</b> , alpine grassland, 120 m SE of the field station, not. J. Kocián	50°03'31.9"N 17°13'56.8"E	1460	29. 8. 2015	1T st.	-
<b>Kamzičník</b> , alpine grassland, by the red tourist path, leg. J. Kocián	50°03'10.5"N 17°13'36.1"E	1420	16. 7. 2008	1T fl.	NJM
<b>Břidličná</b> , wind-swept vegetation with dwarf shrubs, 140 m SWW of the summit, not. J. Kocián	50°01'58.4"N 17°11'06.7"E	1345	12. 7. 2015	5 fl.	-

We confirmed the occurrence of *Hieracium alpinum* on most historical localities. The majority of them lie in the topmost areas of the main HJM ridge with two populations (Sokol and Praděd – ruin of a former chalet) surprisingly descending to lower altitudes. It is characteristic that the populations consist either of sterile plants or that the number of sterile plants far exceeds the number of the flowering ones.

We were not successful in confirming the species' occurrence on Vozka, Červená hora, Velká kotlina, Velký máj, Jelení hřbet and Suť. Although some of these historical localities are dubious, a decrease in population abundance, reduced vitality and even presumed extinction of some populations of *Hieracium alpinum* in the HJM had been noted by Chrtek (1995). *Hieracium alpinum* is also heavily grazed by herbivore mammals – at many localities only a fraction of plants, if any at all, successfully fructify.

### *Hieracium atratum* agg.

The range of this aggregate species comprises Greenland, Northern Europe from Iceland to the Ural Mts and also the higher mountains of Central Europe (Zahn 1922-1938). In the Czech Republic it is abundant in the Krkonoše Mts and rare on Mt. Králický Sněžník and in the HJM (Zahn l.c.).

### *Historical distribution in the HJM*

Herbarium specimens: **Keprník:** Bubela 1883 BRNM (46072); Bubela 1884 PR (s.n.); Bubela 1884 PRC (s.n.); Baenitz 1893 PRC (s.n.); Oborný 1895 PRC (s.n.); Oborný 1899 BRNM (46073, 46074, 46075, 46076); Oborný 1899 PRC (s.n.); Oborný 1900 BRNM (46071); Dostál 1947 PRC (s.n.).

Literature data: **Fiek 1881:** Für das Gesenke zweifelhaft. **Oborný 1885:** Als Seltenheit auf dem Köpernik (Bl. 1883). **Oborný 1906:** Auf dem Gipfel oberhalb der Köperniksteine auf dem Köpernik, hier truppweise. **Skřivánek 1956:** [not mentioned].

According to herbarium data only a few botanists have documented the occurrence of *Hieracium atratum* agg. in the HJM and all of them from only the single locality of Keprník. Apart from this locality, Praděd and Šerák are mentioned by Zahn (1922-1938). *Hieracium atratum* agg. was last documented in the end of the first half of the 20th century. Since that time it has been neither collected nor reliably reported on from the HJM.

### *Current distribution in the HJM*

**Table 2:** Current localities of *Hieracium atratum* agg. in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Keprník</b> , summit area, thufur covered mainly by grasses 15 m N of the summit, not. J. Kocián	50°10'15.9"N 17°06'59.3"E	1423	4. 7. 2016	1 fl.	-
<b>Keprník</b> , crevices on E base of the summit rock and alpine grassland nearby, leg. J. Kocián	50°10'15.4"N 17°06'59.5"E	1422	8. 7. 2015	8 fl.	BRNM
<b>Keprník</b> , summit area, thufur covered mainly by dwarf-shrub vegetation 18 m SW of the summit, not. J. Kocián	50°10'15.0"N 17°06'58.5"E	1423	4. 7. 2016	1 fl.	-
<b>Keprník</b> , summit area, dwarf-shrub vegetation 19 m S of the summit, not. J. Kocián	50°10'14.8"N 17°06'59.1"E	1422	4. 7. 2016	1 fl.	-

We rediscovered *Hieracium atratum* agg. at its traditional locality of Keprník. The occurrence is confined to the summit area of Keprník and the population is very small.

### *Hieracium bifidum* agg.

The range of this aggregate species comprises Northern Europe from Iceland to Finland and the higher mountains of Central and Southern Europe; it grows only insularly elsewhere in Central Europe, especially in the areas with limestone outcrops; isolated populations also exist in Russia in the Ural Mts and the Valdai Hills (Zahn 1922-1938). In the Czech Republic it has a disjunct distribution – it grows predominantly in floristically rich areas with basic bedrock (*cf.* Zavadil 2007).

### *Historical distribution in the HJM*

Herbarium specimens: **Velká kotlina:** Podpěra 1912 BRNU (4456?); Danihelka 1996 BRNU (626065)

Note: Zavadil (2007) presents another herbarium specimen of *Hieracium bifidum* [Skřivánek BRNM 1956 (n.?) from **Velká kotlina**. We were not able to find this specimen in the herbarium.

Literature data: **Fiek 1881:** Gesenke: Falkenfelsen bei Gabel (Oborný). **Oborný 1885:** Falkensteine am Abhange des Altvaters gegen Gabel, 1876 entdeckt. **Oborný 1906:** Kesselsteine im grossen Kessel und auf den Falkensteinen bei Gabel, nach Formanek auch auf der Donnerlahn und auf dem Schafberge bei Karlsbrunn. **Skřivánek 1956:** [not mentioned].

Only two localities of *Hieracium bifidum* agg. are historically known from the HJM – Sokolí skála which we did not find documented by any herbarium specimen, and Velká kotlina.

Formánek's localities Donnerlahn and Schafberg mentioned by Oborny (1906) were refuted by Formánek (1886) himself.

#### *Current distribution in the HJM*

**Table 3:** Current localities of *Hieracium bifidum* agg. in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Plošina</b> , rocks on a N slope, not. R. Štencl	50°07'14.7"N 17°19'15.6"E	930	29. 8. 2013	>1T fl.	-
<b>Plošina</b> , N slope, rocky ridge of up to 10 m high sunny rocks, not. R. Štencl	50°07'10.7"N 17°19'17.7"E	960	29. 8. 2013	1T fl.	-
<b>Sokol</b> , Sokolí skála and the rock 45 m W of it, uppermost grassy parts of the rocks, crevices on the rock walls, screes and grasslands in the vicinity of the rocks, leg. J. Kocián	many microlocalities	1135 - 1170	10. 7. 2007	>8T fl. (2016)	NJM, BRNU
<b>Divoký důl</b> , rocks in a mountain mixed forest, scattered individual plants on more places, not. R. Štencl	around 50°04'44.5"N 17°12'02.3"E	1020	4. 8. 2014	1T fl.	-
<b>Jelení hřbet</b> , rocks in a mountain mixed forest on a steep N slope ca 780 m NW of the summit, not. J. Kocián	50°02'44.7"N 17°11'41.9"E	1125	10. 7. 2016	1 fl.	-
<b>Jelení hřbet</b> , rocks in a mountain mixed forest on a steep N slope ca 780 m NW of the summit, not. J. Kocián	50°02'45.9"N 17°11'41.4"E	1105	10. 7. 2016	3 fl.	-
<b>Jelení hřbet</b> , rocks in a mountain mixed forest on a steep N slope ca 780 m NW of the summit, not. J. Kocián	50°02'44.4"N 17°11'45.1"E	1115	10. 7. 2016	2 fl.	-
<b>Břidličná</b> , Čertova stěna, rocks in a mountain mixed forest 190 m SE of Čertova stěna (altitudinal point 1075), not. R. Štencl	50°02'23.1"N, 17°11'15.9"E	1020	26. 8. 2014	1T fl.	-

We confirmed the occurrence of *Hieracium bifidum* agg. on the oldest known locality of Sokolí skály where it has relatively rich population. R. Štencl revised *Hieracium bifidum* agg. on the northern slope of Jelení hřbet (locality noted by Albín 2006 and Kočí 2009) and on the northern slope of Břidličná on Čertova stěna (locality noted by Kočí 2009) in 2013. He also newly found the species on Plošina and Divoký důl. We visited the locality Jelení hřbet and found three micropopulations (there are possibly more – we did not explore the wider area). These four newly discovered localities suggest that *Hieracium bifidum* agg. may occur on more localities in the HJM on botanically poorly explored remoted rocks.

We did not find the species in Velká kotlina but its persisting occurrence is likely.

#### *Hieracium chlorocephalum* R. Uechtr.

*Hieracium chlorocephalum* is known from the Krkonoše Mts and the HJM (Zahn 1922–1938) and it is most probably endemic to these mountain ranges (Chrtek 2004).

#### *Historical distribution in the HJM*

Herbarium specimens: **Vysoká hole:** Laus 1908 BRNM (28469); **Velká kotlina:** Freyn 1878 BRNM (s.n.); Freyn 1878 BRNM (s.n.); Freyn 1878 BRNM (s.n.); Freyn 1878 PR (P4S417/549); Oborny 1879 BRNM (s.n.); Oborny 1879 BRNM (s.n.); Oborny 1879 PRC (s.n.); Winkler 1879 WRSL (s.n.); Fiek 1880 WRSL (s.n.); Oborny 1882 PRC (s.n.); Ficinus 1883 WRSL (s.n.); Freyn 1883 BRNM (s.n.); Freyn 1883 BRNM (s.n.); Freyn 1883 PRC

(s.n.); Bubela 1884 PRC (s.n.); Oborny 1886 BRNM (s.n.); Oborny 1886 BRNU (377367); Fiek 1895 WRSL (s.n.); Oborny 1903 BRNU (64253); Oborny 1903 PR (P4S417/550); Oborny 1903 BRNM (s.n.); Oborny 1903 PRC (s.n.); Teuber 1903 BRNM (252323); Laus 1908 BRNM (s.n.); Laus 1908 BRNU (27741); Otruba 1930 OLM (68880); Otruba 1931 PR (P4S417/9383); Skřivánek 1946 BRNM (252322); Deyl 1949 PR (P4S417/7416, P4S417/7417, P4S417/7418); Skřivánek 1953 BRNM (252355); Deyl 1966 PR (P4S417/8095); Grabowski s.d. WRSL (s.n.); Zlatník s.d. PR (P4S417/10518); **Grützenberg:** Krause s.d. WRSL (s.n.).

**Literature data:** **Fiek 1881:** im Gesenke nur im gr. Kessel! (U., Bchm.). **Oborny 1885:** Grasige und steinige Abhänge, im Hochgesenke, selten. Im grossen Kessel (Ue) und zwar am oberen Rande, den Standort mit H. Engleri theilend, überdies noch unter den Fuhrmannsteinen, hier sehr selten (August 1879). **Oborny 1906:** Grasige und steinige Abhänge, Felshänge, zerstreut im Gesenke und selten. Grosser Kessel u. z. am mittleren und unteren Rande desselben, Abhänge der hohen Heide, am Klein-Mohrauer Gebirgswege, ziemlich nahe an der hohen Heide, am rothen Berge (Bänitz) und in schwächeren Exemplaren um die Fuhrmannsteine. **Skřivánek 1956:** horské stráně a skály ve Velkém Kotli, nehojně, 28. 6. 1946 a 4. 8. 1953.

The principal locality of *Hieracium chlorocephalum* in the HJM is Velká kotlina. Sole herbarium specimens are located from Vysoká hole and Grützenberg. A few other localities are mentioned in the literature. Similarly to *Hieracium atratum* agg., *Hieracium chlorocephalum* was last documented in the end of the first half of the 20th century. Since that time it has been neither collected nor reliably reported from the HJM.

#### *Current distribution in the HJM*

**Table 4:** Current localities of *Hieracium chlorocephalum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Velká kotlina</b> , upper part of Vitáskova rokle, edge and rocky slope under the path crossing the ravine, leg. J. Kocián	50°03'22.6"N 17°14'08.5"E	1320	23. 7. 2016	2T fl.	BRNU

We rediscovered *Hieracium chlorocephalum* in a single locality in Velká kotlina in one of the local floristical hotspots – the upper part of Vitáskova rokle. Population is small but seems to be stable. Even so *Hieracium chlorocephalum* is one of the rarest HJM hawkweeds.

We were not successful in confirming the species on Vozka, Červená hora and Vysoká hole.

#### *Hieracium chrysostyloides* (Zahn) Chrtěk fil.

*Hieracium chrysostyloides* is one of the most remarkable hawkweed species in the HJM. It is endemic of the highest Eastern Sudeten mountain ranges – Mt. Králický Sněžník and the HJM (Chrtěk 1995). The species is very interesting cytogenetically: it is a pentaploid (Chrtěk 1996, Kocián 2013); there are only five pentaploid *Hieracium* species known worldwide currently (Stace *et al.* 1995, Pulkina & Tupitsyna 2000, Tyler & Jönsson 2009).

#### *Historical distribution in the HJM*

**Herbarium specimens:** Šerák: s. coll. 1896 PRC (s.n.); Oborny 1902 PRC (s.n.); Laus 1904 OLM (69254); Kruber 1924 WRSL (s.n.); **Kepřník:** Oborny 1873 PRC (s.n.); Skřivánek 1956 BRNM (252015); **Vřesová studánka (Červená hora):** Bubela 1884 PRC (s.n., s.n.); Oborny 1886 BRNM (s.n., s.n.); Oborny 1886 PRC (s.n.); Oborny 1893 PRC (s.n.); Teuber 1897 BRNM (18810); Horák 1931 MP (59144); Horák 1947 MP (59127); Šourek, Kurka 1947 PR (269501); Hynšt 1953 OLM (128609); Novotný 1956 BRNM (422228); Skřivánek 1956 BRNM (252036, 252019); Deyl 1960 OLM (153176); **Tabulové skály:** Oborny 1879 PRC (s.n.); Laus 1930 OP (20387); Skřivánek 1955 BRNM (252009); **Praděd:** Oborny 1867 BRNU (61745); Freyn 1883 BRNM (s.n.); Müller 1886 BRNM (68440); Oborny 1887 BRNU (377365); Spitzner 1888 BRNU (135398, 195353); Müller 1889 BRNM (252024); Callier, Hirte, Scholz 1893 PRC (s.n.); Freyn 1893 PRC (s.n.); Teuber 1897 BRNM (18807); Laus 1909 BRNM (s.n.); Kruber 1931 WRSL (s.n.); Kvapilík 1947 OLM (92570); Deyl 1949 PR (P4S417/7403, P4S417/7411, P4S417/7404); Novotný 1956 BRNM (422227); Skřivánek 1946 BRNM (251990); Hochstetter s.d. BRNM (s.n.); s.coll. s.d. PRC (s.n.); **Petrovy kameny:** Freyn 1883 BRNM (s.n., s.n.); Oborny 1886 PRC (s.n., s.n.); Teuber

1902 BRNM (18809); Laus 1907 BRNU (27672); Laus 1907 BRNM (s.n.); Laus 1908 BRNM (252029); Laus 1908 BRNU (159152, 28364); Sedláček 1909 BRNU (09381); Laus 1911 BRNU (28363); Skřivánek 1915 BRNM (251995); Laus 1921 OVMB (B3819); Kruber 1924 WRSL (s.n.); Laus 1930 PRC (s.n.); Thenius 1933 BRNU (332383); Krajina 1946 PRC (s.n.); Skřivánek 1946 BRNU (360962); Horák 1947 MP (59124, 59131); Součková 1949 BRNM (46606); Skřivánek 1955 BRNM (252034); **Kleine Heide:** Freyn 1878 BRNM (s.n.); **Vysoká hole:** Freyn 1883 BRNM (s.n.); Formánek 1886 BRNM (s.n.); Oborny 1886 OLM (69252, 69253); Oborny 1886 PRC (s.n.); Spitzner 1888 BRNU (195352, 195400, 377364); Hora 1889 PRC (s.n.); Rieger 1890 OP (96766); Rieger 1893 OP (98230); Schierl 1899 BRNM (18808); Schierl 1899 PR (269524); Laus 1905 BRNU (413004); Laus 1906 BRNM (s.n.); Laus 1908 BRNU (28363); Laus 1910 PRC (s.n.); Thenius 1933 BRNM (251983); Thenius 1933 BRNU (332385); Šmarda 1946 BRNM (18802); Šmarda 1946 PR (P4S417/11053); Skřivánek 1946 BRNM (252020); Skřivánek 1955 BRNM (252031); Skřivánek 1955 BRNM (252010); Deyl 1965 OLM (153173); Burešovi, Jeník 1974 OLM (109648); Formánek s.d. BRNM (s.n.); Kolenati s.d. PR (P4S417/6889); **Kamzičník:** Oborny 1903 PRC (s.n.); Kvapilík 1936 OLM (92571, 92572, 92573); Skřivánek 1955 BRNM (252008, 252033, 252032, 252036); **Velká kotlina:** Bubela 1884 PRC (s.n.); Formánek s.d. BRNM (s.n.); **Velký máj:** Oborny 1879 BRNM (s.n.); Čouka 1905 BRNU (413102); Laus 1924 OLM (68847); Skřivánek 1955 BRNM (252011); **Při vodorovné cestě od Ovcárny ku Františkově myslivně:** Juza 1909 BRNU (30809); **Vysoká hole-Jelení hřbet:** Čouka 1905 BRNU (413003); **In pascuis elatis montis Wiesenbergs infrequens:** Freyn 1878 BRNM (s.n.); **Hrubý Jeseník:** Mükusch s. d. OP (12598).

Literature data: **Fiek 1881:** (ut *H. alpinum* L. d) *eximium* Backhouse: im Gesenke auf der Brünnelhaide an den Felsen über der Kapelle selten (Gr., Bchm.), Altvater, Janowitzer Haide, Köpernik, Hockschar (W. Gr.). **Oborny 1885:** (ut *H. eximium* Backh.:) Zerstreut, meist truppweise [...] auf dem Höhenrücken des Gesenkes. Um die Tafelsteine, auf dem Maiberge, auf dem Altvater, um die Petersteine, Hohe Heide und um die Köperniksteine; auf dem Hockschar oberhalb der Kapelle auf der Brünnelheide, hier jedoch selten (G. & Bm.) in einer kleinköpfigen Form auch am Abhange des Maiberges gegen den gr. Kessel. **Oborny 1906:** (ut *H. eximium* Backh.:) Zerstreut, meist truppweise [...] auf dem Kamme des Gesenkes über 1400 m, so auf der Hockschar, Köperniksteine, oberhalb der Kapelle auf der Brünnelheide in Felsspalten, auf dem Leiterberge, auf den Tafelsteinen und auf dem Altvater, Felsspalten der Petersteine, auf der hohen Heide, auf dem Heiligenhübel; in einer kleinköpfigen Form auch auf dem Maiberge, Abhang gegen den Neudorfer Kessel. Eine weitere Form wäre *γ tenellum* G. Sch. sehr zart, schmalblättrig und einköpfig, diese auf der Brünnelheide, Hausberge (N.) und auf der hohen Heide hie und da. **Skřivánek 1956:** (ut *H. nivimontis* Oborny et Zahn:) společně s předchozím [*Hieracium alpinum*], nehojně, Svatá, Petrova skála 6. 8. 1955, Tabulové kameny 7. 8. 1955.

Chrtěk (1995) elucidated complicated taxonomical treatment of *Hieracium chrysostyloides* and raised this taxon to species level. According to herbarium and literature data the species occurred at about nine localities scattered in the summit areas of the main HJM ridge. Although it is referred to grow above 1400 m a.s.l. (Oborny 1906, Chrtěk 2004), localities Šerák, Vřesová studánka, Malý Děd and Velký Máj lie in lower altitudes – therefore the lowest altitudinal limit should be stated more precisely to be 1300 m a.s.l. *Hieracium chrysostyloides* has similar ecology as *Hieracium alpinum* (*cf.* Chrtěk 2004) and the two species shared the same localities (Skřivánek 1956, also see the lists of localities) but *Hieracium chrysostyloides* was apparently rarer. There has been no information about the condition of populations since the 1950s. J. Chrtěk confirmed the species occurrence on Petrovy kameny in 1994 (Chrtěk 1995) and later mentions that it probably occurs contemporarily in this locality only (Chrtěk 2004).

#### Current distribution in the HJM

**Table 5:** Current localities of *Hieracium chrysostyloides* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
Červená hora, outcrops on a summit alpine grassland above Vřesová studánka, leg. J. Kocián	50°08'44.6"N 17°08'09.3"E	1320	15. 7. 2008	10 fl.	NJM
Tabulové skály, alpine grassland on the rocks, leg. J. Kocián	50°05'11.7"N 17°13'52.0"E	1455	1. 8. 2012	2 fr.	NJM
Tabulové skály, alpine grassland on the rocks, not. J. Kocián	50°05'11.7"N 17°13'51.6"E	1455	2. 7. 2016	9 fl.	-

Locality	GPS	Alt.	Date	Count	Herb.
<b>Tabulové skály</b> , alpine grassland on the rocks, not. J. Kocián	50°05'11.6"N 17°13'51.8"E	1455	2. 7. 2016	1 fl.	-
<b>Tabulové skály</b> , alpine grassland on the rocks, not. J. Kocián	50°05'11.5"N 17°13'51.0"E	1455	12. 7. 2015	1 fl.	-
<b>Tabulové skály</b> , alpine grassland on the rocks, not. J. Kocián	50°05'11.1"N 17°13'50.8"E	1455	12. 7. 2015	1 fl.	-
<b>Tabulové skály</b> , alpine grassland on the rocks, not. J. Kocián	50°05'10.9"N 17°13'49.7"E	1455	12. 7. 2015	1 fl.	-
<b>Tabulové skály</b> , small rocks by the path leading from Praděd to Tabulové skály, not. J. Kocián	50°05'07.5"N 17°13'49.7"E	1460	12. 7. 2015	11 fl.	-
<b>Praděd</b> , alpine grassland 190 m N of the summit, nearby the border stone, along the path to Praděd, leg. J. Kocián	50°05'04.8"N 17°13'54.3"E	1480	9. 7. 2006	19 fl. (2015)	NJM
<b>Praděd</b> , alpine grassland, 100 m N of the summit, not. J. Kocián	50°05'02.3"N 17°13'51.9"E	1485	12. 7. 2015	22 fl.	-
<b>Praděd</b> , alpine grassland on the summit, 80 m W of summit, not. J. Kocián	50°04'59.4"N 17°13'47.3"E	1485	12. 7. 2015	51 fl.	-
<b>Praděd</b> , alpine grassland nearby the unused path on SW slope of the mountain, 180 m SWW of the summit, not. J. Kocián	50°04'56.6"N 17°13'44.3"E	1480	12. 7. 2015	17 fl.	-
<b>Petrovy kameny</b> , alpine grassland between Petrovy kameny and the chairlift upper exit, not. J. Kocián	50°04'07.2"N 17°14'01.4"E	1435	20. 7. 2013	85 fl. (2016)	-
<b>Vysoká hole</b> , alpine grassland, by summit red tourist path, leg. J. Kocián	50°03'53.3"N 17°14'05.0"E	1460	16. 7. 2008	10 fl.	NJM

We revised all historical localities of *Hieracium chrysostyloides* and ascertained its current occurrence on five of them. It grows together with *Hieracium alpinum* in all localities except for Červená hora. Populations on Červená hora, Tabulové skály and Vysoká hole are very small, the ones on Praděd and Petrovy kameny are relatively rich. All populations are very negatively influenced due to nibbling by herbivore mammals. For example, we have never seen flowering plants of *Hieracium chrysostyloides* on Vysoká hole since 2008, despite the plants were still present there in later years, but the flowering stems and partially also the leaves were always grazed. There is a similar situation on Praděd – there were 109 flowering plants in total on four sites on 12th July 2015 but all(!) flowering stems were grazed two weeks later. Thus, the seed production is usually completely thwarted. Moreover, the comparision of historical distribution with the recent one shows a decline in number of localities – from about nine to five. *Hieracium chrysostyloides* was probably exterminated by *Pinus mugo* Turra planting on Šerák and it could have been exterminated by intensive herbarium collecting on Kamzičník (and weakened on other localities, mainly on Vysoká hole and Červená hora – see Fig 9). It is necessary to pay maximal conservational attention to this pentaploid endemic.



**Fig 1:** a – *Hieracium alpinum* on Praděd (9. VII. 2006), b – *Hieracium chrysostyloides* on Vysoká hole (16.VII. 2008), c – *Hieracium chrysostyloides* population on Červená hora (15. VII. 2008). Photos Petr Kocián.

### *Hieracium engleri* R. Uechtr.

The range of *Hieracium engleri* comprises the Krkonoše Mts (a single locality – Mały Kocioł Śnieżny – on the Polish side of the mountain range), the HJM and the Tatry Mts (Zahn 1922-1938). In the Czech Republic it grows only in the HJM (Zahn l.c.).

#### *Historical distribution in the HJM*

Herbarium specimens: **Velká kotlina:** Engler 1867 WRSL (s.n.); Freyn 1878 BRNM (s.n.); Ficinus 1883 WRSL (s.n.); Freyn 1883 BRNM (s.n., s.n.); Baenitz 1893 BRNM (s.n.); Fiek 1895 WRSL (s.n.); Oborny 1903 BRNM (s.n.); Weber 1932 PR (P4S417/10207&324702); Šmarda 1946 BRNM (68260); Skřivánek 1956 BRNM (252388); Danielka 1996 BRNU (DA96/108); **Hohes Gesenke:** Freyn 1878 BRNM (s.n.).

Literature data: **Fiek 1881:** Steinige u. grasige Lehnen, Felsen des Hochgeb., sehr selten. Gr. Kessel des Gesenkes! (schon Gr.). **Oborny 1885:** Steinige und grasige Abhänge, sehr selten. Bisher nur am oberen Rande des gr. Kessels im mähr. Gesenke (Grabowsky, später Engler). **Oborny 1906:** Steinige und grasige Abhänge, sehr selten. Bisher nur im grossen Kessel u. z. am mittleren und unteren Rande desselben zerstreut, in der Nähe des Standortes von *H. villosum*. **Skřivánek 1956:** [not mentioned].

*Hieracium engleri* was discovered in Velká kotlina by A. Engler in 1867 (though confusingly Grabowsky is mentioned as the first collector of this species in later literature) and described from this locality by Uechtritz (1871). Velká kotlina is the only historically known locality of this species in the HJM and its occurrence was always reported as very rare. Chrtěk (2004) states that *Hieracium engleri* was collected many times in the past (however, as shown above, only a few herbarium specimens exist) and that the contemporary population condition is not known and requires a revision. Although the species was collected a few times during the 20th century, these herbarium specimens were either wrongly determined or undetermined until our revision, so in fact nothing has been known about the species occurrence in the HJM for a century.

#### *Current distribution in HJM*

**Table 6:** Current localities of *Hieracium engleri* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Velká kotlina</b> , scree in the upper part of Vitáskova rokle, leg. J. Kocián (independently by Z. Kaplan in 2013)	50°03'23.0"N 17°14'08.8"E	1300	22. 7. 2012	4T fl.	BRNU
<b>Velká kotlina</b> , Mildeho skalka, N facing part of the rock, not. J. Kocián	50°03'15,2"N 17°14'06,6"E	1285	18. 7. 2015	1 fl.	-

We confirmed *Hieracium engleri* on two sites in Velká kotlina and actually rediscovered it in the HJM. The current population in Vitáskova rokle seems to be vital and although it grows in an unstable biotope of moving scree such permanent natural disturbance seems to be crucial for the species existence. We found only one flowering plant on the second site – on Mildeho skalka. It is possible that *Hieracium engleri* grows on more sites on the barely accessible rocks of Velká kotlina. In any case, the species is one of the rarest HJM hawkweeds and requires a high degree of conservational attention.



**Fig 2:** *Hieracium engleri*: a – herbarized plants showing typical habitus, b – peduncle and involucre (10. VII. 2016), c – biotope in Vitáskova rokle (18. VII. 2015), d – site on Mildeho skalka in red circle (18. VII. 2015). Photos Jiří Kocián.

### *Hieracium grabowskianum* Nägeli & Peter

The range of *Hieracium grabowskianum* is limited to the HJM and the Carpathian Mts (Zahn 1922-1938). In the Czech Republic it grows only in the HJM (Zahn l.c.).

#### *Historical distribution in the HJM*

Herbarium specimens: **Velká kotlina:** Bittner 1895 BRNM (22130/36); Peter s.d. BRNM (22128/36, cultivated plant).

Literature data: **Fiek 1881:** Aeusserst selten unter den Eltern auf Felsplatten des gr. Kessels im Gesenke! (Gr., U.). **Oborny 1885:** Sehr selten, bisher nur auf Felsen und Felsplatten in der westlichen Abdachung des gr. Kessels im Mähr. Gesenke, oberhalb des Standortes von *H. villosum*. **Oborny 1906:** Sehr selten, bisher nur unter den Stammlertern auf Felsen in der westlichen Abdachung des grossen Kessels im Gesenke. **Skřivánek 1956:** [not mentioned].

*Hieracium grabowskianum* is the rarest HJM hawkweed. We found only two herbarium specimens of this species. The rarity of the species and its occurrence only in Velká kotlina is confirmed by the literature. Nothing has been known about its population condition for more than a century.

#### *Current distribution in the HJM*

**Table 7:** Current localities of *Hieracium grabowskianum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
Velká kotlina, Roemerovy výchozy, upper edge of the rock, leg. J. Kocián	50°03'14.6"N 17°14'08.5"E	1255	20. 7. 2013	2 fl.	BRNM



**Fig 3:** *Hieracium grabowskianum*: a – plant (20. VII. 2013), b – Roemerovy výchozy, the site of *Hieracium grabowskianum* in red circle (18. VII. 2015). Photos Jiří Kocián.

We rediscovered *Hieracium grabowskianum* at a single locality on Roemerovy výchozy in Velká kotlina. It is probably the same site which was mentioned historically since the locality characteristics match those mentioned in literature: the plant grows on the rocks on the west slope of Velká kotlina and even both “parental species” *Hieracium villosum* and *Hieracium prenanthoides* are present there. *Hieracium grabowskianum* is truly very rare since only 1-3 flowering stems develop from probably a single rhizome. Despite this rarity the plant seems to be prosperous – it bloomed and fruited every year from 2013 to 2016. On the basis of this rediscovery *Hieracium grabowskianum* can be stated not only as one of the rarest HJM plant species, but even as one of the rarest plant species in the whole Czech Republic.

### *Hieracium inuloides* agg.

The range of *Hieracium inuloides* agg. is disjunctional and comprises mainly the mountains of Western, Northern and Central Europe (Zahn 1922-1938). In the Czech Republic it is reported from the Krkonoše Mts, Mt. Králický Sněžník and the HJM (Zahn l.c.).

#### *Historical distribution in the HJM*

Herbarium specimens: *Hieracium inuloides* agg. is a taxonomically unresolved aggregate species and therefore only the overview of herbarium localities is given: Šerák, Kepník, Vozka, Vřesová studánka (Červená hora), Praděd, Vatergraben, Mooselehne, Ovcárna, Petrovy kameny, Vysoká hole, Velká kotlina, Františkova myslivna, Velký máj, Malá kotlina, Pecny, Horizontalweg, Mentschik graben.

Literature data: **Fiek 1881:** (ut *H. tauschianum* a) *inuloides*: im Gesenke am Altvater! (Gr.), Peterstein!, im gr. Kessel! (W. Fl.) u. bei Franzens Jagdhaus in der Kriech (Oborný)! (ut *H. tauschianum* a) *inuloides* β *striatum*: im Gesenke am Köpernikstein (Wkl.)!, auf der Brünnelhaide (Z.)!, im gr, Kessel! (U.), hier mit Uebergängen zur Grundform!; am Altvater eine niedrige 1-3köpfige Form mit sehr grossen bis 0,02 m. breiten Hüllen! (ut *H. tauschianum* b) *pachycephalum*: im Gesenke am Altvater!, Hirschkamm! (Freyn), an der Janowitz Haide!, im gr. Kessel! (Gr.), kl. Kessel (Bchm.)!, in der Kriech bei Franzensjagdhaus (Oborný)! u. am Schlössel (Fr.)! **Oborný 1885:** (ut *H. inuloides*): Südliche Abdachung des Altvaters, Oppaquellen, hier am häufigsten; seltener am Petersteine (Ue.), im gr. Kessel (W. Fl.), beim Franzensjagdhause, in der Kriech, hier in einer ziemlich stark grauflocken Modification; typisch auf dem Ameisenhügel bei Wiesenbergs, hier nicht selten. (ut *H. striatum*): im Hochgesenke: Köperniksteine (Winkler), Fuhrmannsteine, Brünnelheide, Horizontalweg zwischen dem Franzensjagdhause und dem Petersteine; auf dem Altvater eine 1-3köpfige, niedrige Form mit sehr grossen Hüllen, überdies noch am grossen Hirschkamm und im kleinen Kessel (Freyn). (ut *H. pachycephalum*): im Hochgesenke zerstreut: Altvater und zwar Abdachung gegen die Oppa-Quellen; Hirschbrunnen, Horizontalweg, Franzensjagdhause; am Schlössel (Fritze) und am Ameisenhügel. In einer stylosen Form nicht selten, und zwar im gr. und kl. Kessel und am Wege von da zum Jagdhause. **Oborný 1906:** (ut *H. inuloides* Tsch.): Auf der südlichen Abdachung des Altvaters gegen die Oppaquellen, hier am häufigsten, seltener um die Petersteine (Ue.), im grossen und kleinen Kessel, beim Franzens-Jagdhause, in der Kriech, au dem Ameisenhügel und als Seltenheit auf der Brünnelheide. (ut ssp. *pseudostriatum* Z.): Hochschar, Abdachung unterhalb des Gerog-Schutzhäuses, um die Köperniksteine (Winkler), Fuhrmannsteine, Brünnelheide, Altvater, Abhang gegen die Oppaquellen, Klein-Mohrauer Gebirgsweb, grosser und kleiner Kessel, Horizontalweg zwischen dem Franzens-Jagdhause und den Petersteinen, auf den Abhängen des Maiberges gegen das Jabdhaus. [...] Fuhrmansteine [...] Brünnelheide, Schäferei, Oppaquellen, grosser Kessel, Maiberg, Abhang gegen Franzens-Jagdhause. [...] in einem Schlag oberhalb des Drei steines bei Goldenstein. (ut ssp. *corymbosum* Fr. in litt. ad Vulp.): Horizontalwege beim Franzens-Jagdhause [...] Karlsdorf am Waldessaume hinter den Olbrichhäusern bei 800 m Seehöhe. (ut *H. striatum* Tsch.): Brünnelheide, Fuhrmannsteine, Altvater, Abdachung gegen die Oppaquellen, Hirschbrunnen, Janowitz Heide, grosser und kleiner Kessel, Hirschkamm, Horizontalweg zwischen dem Franzens-Jagdhause und den Petersteinen, am Schlössel (Fritze), am Ameisenhügel. Zuweilen tief herabgehend, so bei 1000 m im oberen Marchthale bei Gr.-Mohrau. **Skřivánek 1956:** (ut *H. inuloides*): na horských nivách společně s předchozími [*H. prenanthoides* and *H. lanceolatum*]. Velký kotel, Praděd 4. 8. 1946, Vysoká hole 4. 8. 1953, Malý kotel 5. 8. 1953. (ut *H. striatum*): horské nivy, dosti častý. Velký kotel, Praděd 4. 8. 1946, Vysoká hole 4. 8. 1953, Malý kotel 5. 8. 1953.

*Current distribution in the HJM*

**Table 8:** Current localities of the *Hieracium inuloides* agg. in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Ovčárna</b> , mountain meadow above Ovčárna chalet, leg. J. Kocián	50°04'14.1"N 17°14'20.2"E	1300	19. 8. 2010	15 fl.	KOC
<b>Velká kotlina</b> , upper north part of subalpine tall grassland under Wilschowitzovy výchozy, leg. J. Kocián	50°03'29.0"N 17°14'18.0"E	1300	5. 8. 2012	28 fl.	KOC
<b>Velká kotlina</b> , Kratochvílova stráň, <i>Molinia</i> grassland, not. J. Kocián	50°03'27.6"N 17°14'16.9"E	1285	15. 8. 2015	3 fl.	-
<b>Velká kotlina</b> , small rock 50 m NE of Kettnerova skála, not. J. Kocián	50°03'26.6"N 17°14'10.8"E	1315	5. 8. 2012	1 fl.	-
<b>Velká kotlina</b> , Kolenatiho skály, vegetation with grasses, dwarf bushes and ferns under small rock, not. J. Kocián	50°03'25.8"N 17°14'12.5"E	1295	23. 7. 2016	2 fl.	-
<b>Velká kotlina</b> , subalpine tall grassland SW of Vításkova rokle, above the path crossing the ravine, two close micropopulations, not. J. Kocián	50°03'21.7"N 17°14'07.2"E	1330	22. 7. 2012	2+3 fl.	-
<b>Velká kotlina</b> , <i>Molinia</i> grassland under Suzova stěna, leg. J. Kocián	50°03'17.5"N 17°14'12.1"E	1205	31. 7. 2012	12 fl.	KOC
<b>Velká kotlina</b> , S edge of Fiekovy ohlazy, grassland, not. J. Kocián	50°03'16.8"N 17°14'03.5"E	1335	5. 8. 2012	1 fl.	-
<b>Velká kotlina</b> , Fiekovy ohlazy, small grassy rock with small <i>Salix</i> bushes, not. J. Kocián	50°03'16.3"N 17°14'05.1"E	1310	23. 7. 2016	1 fl.	-
<b>Velká kotlina</b> , NW edge of Otrubova stráň, steep slope (ferns, grasses, blueberry bushes), not. J. Kocián	50°03'15.7"N 17°14'09.5"E	1240	20. 7. 2013	rare	-
<b>Velká kotlina</b> , south edge of Fiekovy ohlazy, grassy slope, not. J. Kocián	50°03'15.4"N 17°14'04.8"E	1310	23. 7. 2016	2 fl.	-
<b>Velká kotlina</b> , subalpine tall grassland above Roemerovy výchozy, not. J. Kocián	50°03'15.0"N 17°14'07.3"E	1275	29. 8. 2015	7 fl.	-
<b>Velká kotlina</b> , grassy slope south of Fiekovy ohlazy, not. J. Kocián	50°03'14.9"N 17°14'05.6"E	1295	23. 7. 2016	2 fl.	-

Although the *Hieracium inuloides* agg. grew scattered on many localities throughout whole HJM in the past, today we only find it in two localities: in Velká kotlina (several sites) and on a single site above the Ovčárna chalet. Most populations are small and the upper parts of flowering stems are usually nibbled. *Hieracium inuloides* agg. shows the highest decline of localities and also the greatest relative difference between the number of herbarised plants and plants remaining in nature from all HJM *Hieracium* species (see Fig 9). The causes of this situation are unclear.

The *Hieracium inuloides* agg., like the *Hieracium prenanthoides* agg., is a taxonomically unresolved aggregate species. Taxonomical research is required to elucidate its diversity and variability – even endemic HJM microspecies are likely to be revealed.

### *Hieracium mixtum* Froel.

The natural range of this species comprises the Pyrenees and the Cantabrian Mountains where it grows on the rocks and steep slopes on calcareous shallow soils (Mateo 2007). It is a neophyte in the Czech Republic discovered in a sole locality in the HJM (Kocián & Chrtěk 2011).

#### *Historical distribution in the HJM*

We found *Hieracium mixtum* in the HJM in 2006 on a stony ditchy slope along the road to Praděd nearby the Kurzovní mountain hotel. The finding was already published together with the species' description, ecology, further information about the Praděd locality and hypothesis about its origin (almost certainly intentional planting or sowing; Kocián & Chrtěk 2011).

#### *Current distribution in the HJM*

**Table 9:** Current localities of *Hieracium mixtum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Žárový vrch</b> , summit rock, leg. R. Štencl	50°06'31.3"N 17°18'38.3"E	1090	2013	unk.	BRNU
<b>Praděd</b> , S slope, stony ruin of former chalet, 350 m SSE of altitudinal point 1356 and 900 m E of Barborka chalet, not. R. Štencl	50°04'42.1"N 17°14'38.6"E	1280	22. 8. 2016	1 fr.	-
<b>Praděd</b> , stony ditchy slope along the road to Praděd, 200 m NW of Kurzovní mountain hotel, leg. J. Kocián	50°04'38.1"N 17°13'24.5"E	1355	9. 7. 2006	2 fl.	NJM



**Fig 4:** *Hieracium mixtum*: a – original cluster mother plant on the Praděd locality (9. VII. 2006), b – locality of *Hieracium mixtum* on Praděd, site of the plants in red circle (2. VII. 2016). Photo a Petr Kocián, photo b Jiří Kocián.

After the discovery of the Praděd locality of *Hieracium mixtum*, R. Štencl found another one on Žárový vrch in 2013 and another locality on Praděd in 2016. The population on Praděd stagnates. The original cluster mother plant persists on the locality, blooms every year and slowly ramifies. The number of juvenile plants in 2012 (five) was the same as in 2010 and 2011. All localities originated undoubtedly via intentional planting or sowing. After eleven-years of monitoring in the Praděd locality it is possible to state that the species does not have a tendency to spread to surrounding areas.

### ***Hieracium moravicum* Oborny**

*Hieracium moravicum* is endemic to the HJM and the Western Carpathians (Zahn 1922-1938). In the Czech Republic it grows only in the HJM (Zahn l.c.).

#### *Historical distribution in the HJM*

Literature data: **Fiek 1881:** (very probably ut *H. albinum* Fr.) Im gr. Kessel des Gesenkes (Bchm.). **Oborny 1885:** Grasige und steinige Abhänge, ziemlich selten und nur im Hochgesenke. Im gr. Kessel den Standort mit *H. Engleri* und *H. silesiacum* theilend und sonst am oberen Rande des Kessels zerstreut; Franzens Jagdhaus und häufig im Kiesgraben (Ficinus), am Horizontalwege zwischen dem Petersteine und dem Jagdhause, beim Petersteine, Abhang des Altvaters gegen die Schweizerei; seltener auf dem Hochschar (Bl.) und auf dem Schlosskamme bei Annaberg. **Oborny 1906:** Im Verlaufe des Hochgesenkes auf der Hochschar, bei der Johannishütte, um die Fuhrmannsteine, Brünnelheide, Altvater, Petersteine, beim Franzens-Jagdhause, Hirschbrunnen, Maiberg, grosser und kleiner Kessel, schwarze Koppe bei Klein-Mohrau, Klein-Mohrauer Gebirgsweg, am Horizontalwege zwischen dem Franzens-Jagdhause und den Petersteinen, bei der Alfredshütte bei Altendorf, wilder Steinengraben bei Winklersdorf; hi und da tief in die Thäler herabgehend, so bei Karlsdorf noch etwa bei 800 m. **Skřivánek 1956:** endemický typ Jeseníků, svahy Petrovy skály k Ovcárně 3. 8. 1953, Velký Kotel 4. 8. 1953, nehojně.

Oborny (1885, 1906) reported *Hieracium moravicum* from many HJM localities, however, Skřivánek (1956) notes that the species is not abundant and comes from only two localities.

*H. moravicum* is the only species we did not find in the HJM during our field revision but it could have been neglected. Since the taxonomical value of this species is unclear it requires further study.

### ***Hieracium nigritum* R. Uechtr.**

The range of *Hieracium nigritum* comprises the highest Sudeten and Carpathian mountains and one locality in the Alps (Zahn 1922-1938). In the Czech Republic it grows in the Krkonoše Mts, Mt. Králický Sněžník and the HJM (Zahn l.c.).

#### *Historical distribution in the HJM*

Herbarium specimens: **Šerák:** Baenitz 1893 BRNM (225676); Baenitz 1893 PR (s.n.); Oborny 1895 PR (s.n.); Teuber 1903 BRNM (19211); Laus 1906 BRNU (28470); Schenk 1929 BRNM (19209); s.coll. 1931 BRNM (19210); Zavřel 1947 BRNM (252338); Skřivánek 1956 BRNM (252342); **Keprník:** Oborny 1879 PRC (s.n.); Winkler 1879 BRNM (22567?); Bubela 1883 PR (P4S417/10705); Bubela 1884 PRC (s.n.); Formánek 1884 BRNM (225671); Oborny 1893 PRC (s.n.); Oborny 1895 PRC (s.n.); Oborny 1896 BRNU (04211, 44336); Teuber 1903 BRNM (19212); Laus 1908 BRNU (44331); Oborny 1908 PR (s.n.); Horák 1947 MP (54393, 54394); Skřivánek 1956 BRNM (252346); Schustler s.d. PR (s.n.); **Vozka:** Winkler 1879 WRSL (s.n.); Formánek 1884 BRNM (225672); Laus 1904 BRNU (206720); Laus 1904-5 BRNU (413105); Laus 1905 BRNU (28468); Skřivánek 1956 BRNM (252343); Schustler s.d. PR (s.n.); **Knížecí chata:** Oborny 1896 BRNM (225675); **Vřesová studánka (Červená hora):** Oborny 1886 BRNU (46341); Šmrarda 1949 BRNM (19208); Skřivánek 1956 BRNM (252389); Oborny s.d. PR (s.n.); Schustler s.d. PR (s.n.); **Königskoppe:** Freyn 1883 BRNM (225704); **Švýcárna:** Baenitz 1893 PRC (s.n.); Baenitz 1893 WRSL (s.n.); Oborny 1908 OLM (102959); Skřivánek 1955 BRNM (252337); **Malý děd:** Bubela 1883 PRC (s.n.); Freyn 1883 BRNM (225703); **Praděd:** Fiek 1870 WRSL (s.n.); Winkler 1879 WRSL (s.n.); Ficinus 1883 WRSL (s.n.); Freyn 1883 BRNM (225706); Spitzner 1887 BRNU

(377368); Spitzner 1888 BRNU (195430); Andres 1893 PR (269715); Oborny 1900 BRNM (225696); Hofmann 1901 PR (s.n.); Laus 1910 BRNU (44329); Laus 1910 OP (20335); [Horák] 1930 MP (54395); Skřivánek 1946 BRNM (252340); **Sut'**: Freyn 1883 BRNM (225712); **Mravenečník**: Oborny 1879 BRNU (64344); Oborny 1879 PRC (s.n.); **Petrovy kameny**: Freyn 1878 BRNM (225701, 225702, 225715); Laus 1904 BRNM (22569?); Laus 1905 BRNU (44334); Teuber 1905 BRNM (252349); Laus 1907 OLM (69258); Laus 1907 BRNU (44330); Laus 1908 BRNM (225692); Laus 1908 BRNU (413103); Laus 1908 PR (s.n.); Laus 1928 PRC (s.n.); Zavřel 1950 BRNM (252351); Schustler s.d. PR (s.n.); **Malá Jezerná**: Šmarda 1947 BRNM (66586); **Kleine Heide**: Freyn 1878 BRNM (225708, 225710, 225711); **Vysoká hole**: Oborny 1876 BRNU (64342); Oborny 1879 BRNM (225687); Freyn 1883 BRNM (225713, 225716); Freyn 1883 PRC (s.n., s.n.); Schierl 1886 PR (s.n.); Hora 1889 PRC (s.n.); Laus 1904 BRNU (28466, 413107); Laus 1905 BRNU (44333); Laus 1906 BRNU (413104); Laus 1908 BRNM (225691); Laus 1908 BRNU (s.n.); Hrúby 1909 BRNU (162837); Laus 1930 OLM (69256); Thenius 1933 BRNM (252359); Thenius 1933 BRNU (332403, 332389, 332400); Dvořák 1946 OP (86754); Skřivánek 1946 BRNM (252344); Skřivánek 1946 MP (28941); Skřivánek 1946 PR (269713); Šmarda 1946 BRNM (252341); Skřivánek 1953 BRNM (252348); s. coll. s.d. BRNM (225686); **Velká kotlina**: Freyn 1878 BRNM (225709); Freyn 1883 BRNM (225714); Bubela 1884 PRC (s.n.); Spitzner 1888 BRNU (195431); Spitzner 1889 BRNU (351941); Oborny 1892 WRSL (s.n.); Oborny 1903 BRNM (225694); Oborny 1903 BRNU (64340); Oborny 1903 PRC (s.n.); Souček 1930 MP (28934); Souček 1930 PRC (s.n.); Otruba 1933 OLM (69262, 69261); Šourek 1946 PR (269499); Skřivánek 1956 BRNM (252347); **Kamzičník**: Skřivánek 1955 BRNM (252352); **Františkova myslivna**: Oborny 1886 PR (s.n.); Laus 1905 BRNU (28467); **Jelení hřbet**: Freyn 1878 BRNM (225680, s.n.); Skřivánek 1946 BRNM (252350); Skřivánek 1946 BRNU (360979, 572993); Šmarda 1947 BRNM (19204, 19206); **Malá kotlina**: Freyn 1878 BRNM (225699, 2256??); **Velký máj**: Oborny 1879 PR (s.n.); Oborny 1879 WRSL (s.n.); Oborny 1893 PRC (s.n.); Čouka 1905 BRNU (413102); Laus 1924 OLM (68847); Skřivánek 1955 BRNM (252354); **Pecny**: Oborny 1882 PRC (s.n.); Formánek 1886 BRNM (225679); **am Wege vom Jagdhaus zum Maiberg**: Oborny 1904 PRC (s.n.); **Triften am Wiesenbergl 1350 m**: Freyn 1878 PR (s.n.); **In pascuis montis Wiesenbergl**: Freyn 1878 BRNM (225680, 225681, 22570?; s.n.); **Waldrand bei Gabelkreuz ob. Waldenburg**: Freyn 1883 BRNM (225700); **Steinberg oben Altendorf**: Freyn 1878 BRNM (22568?); **Peterswald-Wiesenbergl**: Oborny 1895 BRNM (225688); **Triften der Abhänge unter ?. Vaterbaude gegen das Oppatal**: Freyn 1883 BRNM (225707); **Zwischen Köpenik u. Hockschar**: Baenitz 1893 BRNM (225677).

Literature data: **Fiek 1881:** Wiesen u. grasige Lehnen des Hochgeb. Im Gesenke nicht selten: Fuhrmannsstein (Bchm.), Köpernikstein (Wkl.), Hockschar (O. Reinhardt), Hungerlehne (U.), Altvater! (U.), Peterstein (U.), kl. Haide (Bchm.), im gr.! (U.) u. kl. Kessel (Freyn), Schieferhaide, Ameisenhügel (Oborny), grosser Hirschkamm, Wiesenbergl u. Steinberg über Altendorf (ders.). **Oborny 1885:** Grasige und steinige Lehnen und Abhänge in den Sudeten, stellenweise massenhaft und weit häufiger als alle übrigen Habichtskräuter. Im Gesenke längs des ganzen Zuges am Hochschar, Köpernik, am Fuhrmannsteine, auf der Brünnelheide, auf dem Altvater und auf der Hungerlehne (Ue.), Petersteine, hohe Heide, im gr. und kl. Kessel, Maiberg, Horizontalweg zwischen dem Petersteine und dem Jagdhause, auf dem Ameisenhügel, am gr. Hirschkamm, auf der Schieferheide und von da über die Backofensteine bis zu den verlorenen Steinen oberhalb Kleppel; auf dem Wiesen- und Steinberge bei Altendorf (Freyn). **Oborny 1906:** Grasige und steinige Lehnen und Abhänge am Spiglitzer Schneeburge und im Gesenke häufig. Im Gesenke längs des ganzen Kammes und auf dessen Abhängen, so auf dem Saalwiesenrücken, der Hochschaar. Peterswalder Wiesenbergl, Köpernik, Fuhrmannstein, Brünnelheide, Hausberg, Altvater, Hungerlehne, Petersteine, hohe Heide, Maiberg, Ameisenhügel, im grossen und kleinen Kessel, am Horizontalwege zwischen dem Franzens-Jagdhause und den Petersteinen, am grossen Hirschkamm, Schieferheide und von da über die Backofensteine bis zu den verlorenen Steinen, wie auch auf dem Wiesen- und Steinberge bei Altendorf, auf der schwarzen Koppe bei Kl.-Mohrau, oft auch tief in die Thäler gehend und noch bei 1000 m nicht selten anzutreffen. **β eriocline Borb.**: Grosser Kessel, Maiweise bei Karlsdorf, Hochschar. **Skřivánek 1956:** sudetcko-karpatský druh, mající právě v Jeseníkách svá nejbohatší naleziště. Častý jak na horských holích, tak i na horských nivách, ojediněle i v nižších polohách. Při cestě od Švýcárny do Kout 29. 6. 1946, Praděd 29. 6. 1946 a 7. 8. 1955, Břidličná 5. 8. 1946, Vysoká hole 4. 8. 1946 a 6. 8. 1955, Svatá, Máj, Petrova skála 6. 8. 1955, Jelení hřbet 7. 8. 1955, Velký kotel 9. 8. 1955.

*Hieracium nigritum* is historically one of the most widespread HJM mountain hawkweed species. Both herbarium and literature records provide a long list of localities encompassing the whole HJM main ridge from Šerák to Pecny. The species had to grow in large numbers in the HJM – for example Skřivánek's herbarium specimens contain tens of plants from many localities.

*Current distribution in the HJM*

**Table 10:** Current localities of *Hieracium nigritum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Šerák</b> , scree partially covered by soil 20 m under belfry, 100 m SSE of Jiřího chalet, leg. J. Kocián	50°11'11.2"N 17°06'33.6"E	1315	8. 7. 2015	6 fl.	BRNU
<b>Šerák</b> , alpine grassland on the edge of the tourist path 60 m SSE of the belfry (14 fl.) and along the path towards it (7 fl.), not. J. Kocián	50°11'09.8"N 17°06'32.7"E	1320	8. 7. 2015	21 fl.	-
<b>Šerák</b> , alpine grassland on the edge of the tourist path, 50 m NE of touristic signpost "Šerák – rozc.", not. J. Kocián	50°11'05.3"N 17°06'35.6"E	1305	8. 7. 2015	2 fl.	-
<b>Keprník</b> , alpine grassland on the edge of the tourist path to Keprník on the N slope of the mountain, not. J. Kocián	50°10'59.4"N 17°06'40.7"E	1300	8. 7. 2015	3 fl.	-
<b>Keprník</b> , alpine grassland on both left and right edges of the tourist path to the summit on the N slope of the mountain, not. J. Kocián	50°10'25.5"N 17°06'52.2"E	1375	8. 7. 2015	15 fl.	-
<b>Keprník</b> , alpine grassland by the rocks 130 m NW of the Keprník summit, not. J. Kocián	50°10'18.2"N 17°06'55.1"E	1410	8. 7. 2015	7 fl.	-
<b>Keprník</b> , alpine grassland on the right edge of the tourist path to the summit, 15 m N of the summit path branching, not. J. Kocián	50°10'16.4"N 17°07'00.8"E	1415	8. 7. 2015	4 fl.	-
<b>Červená hora</b> , alpine grassland 30 m NE of the summit along the yellow path, leg. J. Kocián	50°08'46.9"N 17°08'11.0"E	1320	15. 7. 2008	rare	NJM
<b>Vřesová studánka</b> , anthropogenic herb-rich slope 50 m NEE above the spring, not. J. Kocián	50°08'44.0"N 17°08'05.4"E	1290	7. 7. 2011	16 fl.	-
<b>Červená hora</b> , SE slope, drainage along the red tourist path 90 m NW of Bílý sloup signpost, not. J. Kocián	50°08'22.8"N 17°08'23.1"E	1225	7. 7. 2011	10 fl.	-
<b>Tabulové skály</b> , alpine grassland under the rocks, not. J. Kocián	50°05'11.6"N, 17°13'49.9"E	1450	2. 7. 2016	2 fl.	-
<b>Praděd</b> , alpine grassland 30 m SE of border stone, not. J. Kocián	50°05'04.6"N 17°13'55.4"E	1480	12. 7. 2015	1 fl.	-
<b>Praděd</b> , summit, unused path descending southward and anthropogenically influenced place nearby, not. J. Kocián	50°04'56.4"N 17°13'52.6"E	1485	12. 7. 2015	5T fl.	-
<b>Praděd</b> , alpine grassland along the unused path on SW slope of the mountain, not. J. Kocián	50°04'55.1"N 17°13'40.7"E	1470	12. 7. 2015	7 fl.	-
<b>Praděd</b> , alpine grassland along the unused path on S slope of the mountain, not. J. Kocián	50°04'51.9"N 17°13'52.1"E	1450	26. 7. 2015	7T fl.	-
<b>Vysoká hole</b> , left grassy edge of the road to Praděd, 400 m NW of Ovcárna, not. J. Kocián	50°04'22.4"N 17°14'01.2"E	1315	6. 7. 2011	18 fl.	-
<b>Petrovy kameny</b> , alpine grassland 40 m NE of the rock, not. J. Kocián	50°04'07.9"N 17°14'02.7"E	1425	10. 7. 2016	7 fl.	-
<b>Vysoká hole</b> , alpine grassland along the path to Petrovy kameny branching from the red tourist path, 150 m SE of Petrovy kameny, not. J. Kocián	50°04'02.3"N 17°14'05.6"E	1425	12. 7. 2015	13 fl.	-
<b>Vysoká hole</b> , alpine grassland in an artillery hole, 300 m SEE of the field station, not. J. Kocián	50°03'29.4"N 17°13'55.1"E	1455	29. 8. 2015	25 fl.	-

Locality	GPS	Alt.	Date	Count	Herb.
Velký máj, alpine grassland along the red tourist path, leg. J. Kocián	50°02'41.2"N 17°12'47.2"E	1380	16. 7. 2008	rare	NJM



**Fig 5:** *Hieracium nigritum*: a – plant, b – locality along the tourist path to Keprník; the only surviving Keprník's *Juniperus communis* subsp. *nana* Syme on the background (both photos 8. VII. 2015). Photos Jiří Kocián.

*Hieracium nigritum* still grows in several localities scattered throughout the whole HJM main ridge, however, it is apparently less abundant than in the past.

The typical feature of this species is that there are often several flowering stems growing in clusters from one rhizome.

### *Hieracium plumbeum* Fries

Complete general distribution of *Hieracium plumbeum* is not known. Its range in Fennoscandia and Eastern Europe comprises south and central parts of Norway and Sweden, Denmark, south part of Finland, north part of Latvia and northwest parts of Estonia and Russia (Sennikov 2005). In Central Europe there are only several localities reported from the HJM and the Carpathians (Zahn 1922-1938); the occurrence in the Harz Mts is also possible (Tyler & Jonsson 2009). In the Czech Republic it grows only in the HJM (Zahn 1922-1938).

#### *Historical distribution in the HJM*

Herbarium specimens: **Keprník:** Bubela 1884 PR (P4S417/538); Müller 1887 BRNM (252335); Oborný 1900 BRNM (02677/31, 02678/31); Oborný 1900 BRNU (64302); Laus 1904 BRNU (44562); Missbach 1906 PR (P4S417/536); Oborný 1908 PR (P4S417/539); **Hochšar. Köpernik:** Laus 1905 BRNU (28503).

Literature data: **Fiek 1881:** An felsigen Orten des Hochgeb., sehr selten u. bisher nur sparsam am Köpernikstein im Gesenke (Wk!). **Oborný 1885:** Felsige Orte im Hochgesenke, höchst selten, bisher nur am Köperniksteine (Winkler). **Oborný 1906:** Felsige Orte im Hochgesenke sehr selten und nur um die Köperniksteine zu finden. **Skřivánek 1956:** [not mentioned].



**Fig 6:** *Hieracium plumbeum* on Keprník (a-e): a – plants, b – involucre, c – basal leaf, d and e – subpopulations. Keprník summit rock (f): plants and subpopulations of *Hieracium plumbeum* in red circles, population of *Hieracium atratum* agg. in pink ellipse (all photos 8. VII. 2015). Photos Petr Kocián.

The only traditional and reliably documented locality of *Hieracium plumbeum* in the HJM is Keprník. The species was last documented from there at the beginning of the 20th century. No one has confirmed the species' occurrence in the HJM since that time.

#### *Current distribution in the HJM*

**Table 11:** Current localities of *Hieracium plumbeum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Keprník</b> , crevices on the E part of the summit rock, leg. J. Kocián	50°10'15.4"N 17°06'59.5"E	1423	11. 9. 2012	18 fl. (2015)	BRNU
<b>Königskoppe</b> , dry scree under one of the rocks above the forest road on S slope, leg. L. Bureš	50°06'06.2"N 17°14'20.6"E	1065	11. 8. 2009	8 fl.	SUM
<b>Praděd</b> , grassy slope on the right edge of the road to Praděd ca 50 m SW of touristic signpost "Pod Pradědem", leg. J. Kocián	50°05'00.3"N, 17°13'17.9"E	1420	9. 7. 2006	20 fl.	NJM, BRNU

Besides rediscovering *Hieracium plumbeum* on Keprník we also newly discovered it in two localities: Königskoppe and Praděd. The populations are small but seem to be stable in time. The traditional population on Keprník is occasionally damaged by tourists sitting on the rock where the plants grow.

Although we determined the plants found on Praděd in 2006 as *Hieracium bifidum* agg., we started to doubt this determination later. Thus, we decided to send the plants to Alexander Sennikov, an expert on this hawkweed group. He confirmed our suggestion and determined plants as *Hieracium plumbeum*. HJM plants differ slightly from the typical Fennoscandinavian ones in the leaf base shape. Nevertheless, all other features (branching pattern of inflorescence, size and shape of heads, shape and pubescence of phyllaries, size and colour of hairs, colour and pubescence of leaves) match with the features of the Fennoscandinavian plants (A. Sennikov in litt. 2013). Thus, based on morphology, HJM plants are classifiable as *H. plumbeum*. However, it is strange for an apomictic species to occupy such a large area. A genetic study would be required to elucidate the exact relationship of HJM plants and the Fennoscandinavian ones.

#### *Hieracium prenanthoides* agg.

*Hieracium prenanthoides* is a highly polymorphic, polyploid and taxonomically difficult aggregate species. It has a vast but disjunctive range encompassing particularly European, Western and Central Asian mountain ranges, descending to lower altitudes in the north part of its range (Zahn 1922-1938). Its occurrence in the Czech Republic is known from the Krkonoše Mts, Mt. Králický Sněžník and the HJM (Zahn l.c.).

#### *Historical distribution in the HJM*

Herbarium specimens: *Hieracium prenanthoides* agg. is taxonomically unresolved aggregate species and therefore only the overview of herbarium localities is given: Keprník, Vozka, Vřesová studánka, Malý Děd, Praděd, Barborka, Mravenečník, Divoká Desná valley, Petrovy kameny, Vysoká hole, Velká kotlina, Františkova myslivna, Alfrédova myslivna.

Literature data: **Fick 1881:** (ut *H. prenanthoides* Vill. a) *bupleurifolium* W. Gr.: Leiterberg im Gesenke (Gr.)! (ut *H. prenanthoides* Vill. β *perfoliatum* Froel.:) im Gesenke im Kessel (M. Wkl.)! (ut *H. prenanthoides* Vill. b) *angustifolium* Tausch:) So besonders [...] im Gesenke. **Oborny 1885:** (ut *H. prenanthoides* Vill. a) *bupleurifolium* W. Gr.:) In den niederen Lagen des Hochgesenkes, namentlich an den Wasserläufen oft bis zu den Dörfern, etwa zu 850<sup>m</sup>. herabreichend, so um Annaberg an der Thess, am Fusse des Leiterberges bei Winkelsdorf, knapp oberhalb der Försterei Hubertuskirchen bei Karlsbrunn (N.) etc; häufiger im Gebiete bis zur oberen Waldregion: Leiterberg,

Brünnelheide, Wiegenstein, Bärenkamm, Ameisenhügel, Franzensjagdhaus; eine forma lanceolata [...] in der Waldregion des Altvaters und im Thessgraben bei Annaberg und eine deutlich gezähnte Form [...] am Leiterberge. (ut *H. prenanthoides* \* *ramigerum* Fr.:) am Leiterberge (Gr.). (ut *H. prenanthoides* Vill.  $\beta$  *perfoliatum* Fröhl.:) Sehr selten: Gr. Kessel im Gesenke (Winkler), eine ähnliche Form auf dem Ameisenhügel bei Wiesenberg. (ut *H. prenanthoides* Vill. b) *angustifolium* Tausch;) im mähr. Gesenke häufig, namentlich in den Höhen nahe um die Grenze des Waldwuchses und über diese Grenze fast auf allen Höhen: Köpernik, Hochschar, Fuhrmannstein, Brünnelheide, Leiterberg, Altvater, Hohe Heide gr. und kl. Kessel, Hirschbrunnen, Ameisenhügel, Franzensjagdhaus und sonst fast überall auf diesem Gebirgskamme. **Obořny 1906:** (ut *H. prenanthoides* Vill. ssp. *bupleurifolium* Tsch.:) Beide Formen im Verlaufe des Gesenkes nicht selten und oft denselben Standort theilend. Der Typus häufiger u. z.: Leiterberg (Grabowsky), [...] Köpernik, Gr.-Seeberg (Fm.), Brünnelheide, Bärenkamm, Ameisenhügel, Franzensjagdhaus, Altvater, Neudorfer Kessel, grosser Kessel, Hubertuskirchen bei Karlsbrunn u. a. O.  $\beta$  seltener: Grosser Kessel (Winkler), Thessgraben bei Annaberg, Neudorfer Kessel, Franzens-Jagdhaus. (ut *H. prenanthoides* ssp. *lanceolatum* Vill.:) im Verlaufe des ganzen Gesenkes ziemlich häufig, so auf den Abhängen des Köpernik, der Hochschar, Abhänge der Fuhrmannsteine, der Brünnelheide, am Leiterbrge, Altvater, beim Jagdhause, im grossen und kleinen Kessel, auf der hohen Heide, Petersteine, am Hirschkamm, Ameisenhügel u. a. O. (ut *H. prenanthoides* Vill. var.  $\beta$  *strictissimum* Froel.:) im grossen Kessel, bei der Schäferei, am Horizontalwege zwischen dem Franzens-Jagdhause und den Petersteinen. **Skřivánek 1956:** *Hieracium prenanthoides* Vill. – horské nivy, občas na prameništích a podél horních toků říček, ssp. *bupleurifolium* (Tausch) Zahn – Velký Kotel 28. 6. 1946 a 4. 8. 1953, Malý Kotel 8. 8. 1955. *Hieracium lanceolatum* Vill. – na podobných místech jako předchozí [*H. prenanthoides*], ale daleko hojnější. Radim sem typy označené jako *H. angustifolium* Tausch. Jižní svahy Pradědu a kolem Barborky 4. 8. 1946, Velký Kotel, Vysoká Hole 4. 8. 1953, svahy mezi Velkým a Malým Kotlem 9. 8. 1955.

#### *Current distribution in the HJM*

We ascertained three contemporary localities of *Hieracium prenanthoides* agg. The centre of distribution is located in Velká kotlina where it grows at about 35 sites (ca 750 flowering plants in total; the sites are displayed on Map 1). Rich populations (ca 175 flowering plants in total) are to be found on anthropogenically influenced slopes above the Ovčárna chalet and around the mountain rescue service lodge. The third locality is in Malá kotlina – we recorded seven flowering plants in 2012, only 2 dried plants in 2013 and no plants in 2016 on a small rock in the upper south part of glacial cirque at 1225 m a.s.l., GPS: 50°02'20.7"N, 17°12'34.3"E (all localities leg. or not. by J. Kocián). We did not find the species on Vřesová studánka, Malý Děd, Praděd and Barborka in spite of intensive endeavour to find it on these localities since 2008.

*Hieracium prenanthoides* agg. comprises several microspecies in the HJM. The aggregate's complicated taxonomy and variability in Central Europe (i.e. including the HJM) is a subject of ongoing long term research undertaken by the first author of this article. Because of many yet unresolved questions in this hawkweed group the localities given both in the text and in the map showing the distribution in Velká kotlina (Fig 1) are related to the whole aggregate, not distinguishing microspecies.

#### *Hieracium silesiacum* E. Krause

*Hieracium silesiacum* is HJM subendemic species. Apart from the HJM (Zahn 1922-1938) it grows very rarely in the Western Carpathians in the Západní Tatry Mts and west part of the Vysoké Tatry Mts (Chrtek *et al.* 2002, Mráz 2005). Formerly noted occurrence in the Nízké Tatry Mts was refuted by Ronikier & Szeląg (2008) – the plants from this area belong to another species. *Hieracium silesiacum* is the only Sudeten species of *Hieracium* sect. *Cernua* Uechtr.; the section has a centre of distribution on the Balkan Peninsula and in the South Carpathians (Szeląg 2003).

### *Historical distribution in the HJM*

Herbarium specimens: **Praděd:** Šourek, Skřivánek 1946 PR (275931); **Barborka:** Skřivánek 1953 OP (24754); Deyl 1965 OLM (147156); **Vysoká hole:** Laus 1927 OLM (69711); Laus 1930 BRNU (217311, 399659); Laus 1935 PR (P4S417/5737); Laus 1938 OLM (69708, 69709, 69710); **Velká kotlina:** Oborný 1877 BRNU (62616); Freyn 1878 PR (P4S417/3071); Freyn 1883 PRC (22252/36); Freyn 1883 PR (P4S417/3067); Bubela 1884 BRNU (195455); Bubela 1884 PR (P4S417/9417); Spitzner 1886 BRNU (135456); Oborný 1887 PR (P4S417/3069); Schierl 1890 PR (275933); Missbach 1906 BRNU (159382); Missbach 1906 PR (P4S417/3070); Laus 1908 BRNU (28022, 413012); Laus 1908 PR (P4S417/5944); Oborný 1908 PR (P4S417/3072); Laus 1909 BRNU (28023); Laus 1909 PR (P4S417/3068); Laus 1911 BRNU (28021); Laus 1911 OLM (69714); Laus 1929 BRNU (378347); Otruba 1931 OLM (69715); Prinz 1931 PR (P4S417/7047); Laus 1932 OLM (69712, 69713); Laus 1932 OP (164497); Otruba 1932 PR (P4S417/9205); Laus 1933 OP (20338); Otruba 1933 OLM (69716); Skřivánek 1946 BRNU (360961); Skřivánek 1946 MP (28933); Šourek 1946 PR (275932); Dostál, Bednář 1965 PR (P4S417/9037); Janáčková 1971 SUM (6801, 6837); Deyl 1975 OLM (147155).

Note: Szelag (2004) presents many other herbarium specimen of *Hieracium silesiacum* in BRNM and WRSL from several HJM localities: **Praděd:** Callier, Hirte, Scholz 1893 WRSL (s.n.); Teuber 1925 BRNM (66577); **Kleiner Vaterberg:** Oborný 1900 BRNM (22248/36); **Pramen Opavice:** Skřivánek 1946 BRNM (19270); **Opavice:** Skřivánek 1946 BRNM (255192, 255185); **Vysoká hole:** Freyn 1883 BRNM (22253/36); Skřivánek 1953 BRNM (255193); **Velká kotlina:** Winkler 1849 BRNM (22251/36); Fiek 1874 WRSL (s.n., s.n.); Oborný 1876 BRNM (22244/36); Freyn 1878 BRNM (22256/36, 22255/36, 22254/36); Fritze 1878 BRNM (22250/36); Winkler 1879 WRSL (s.n.); Oborný 1882 WRSL (s.n.); Bubela 1884 WRSL (s.n.); Formánek 1884 BRNM (22240/36, 22241/36, 22242/36); Fritze 1888 WRSL (s.n.); Müller 1889 BRNM (255186); Oborný 1900 BRNM (22247/36); Oborný 1903 BRNM (22246/36); Laus 1908 BRNM (22243/36); Laus 1908 BRNU (28022, 413012); Otruba 1937 BRNM (255190); Skřivánek 1946 BRNM (255139, 399658, 255187, 255191); Zavřel 1950 BRNM (255183, 255195); Skřivánek 1953 BRNM (255194); Černoch 1962 BRNM (516951); Fiek s.d. WRSL (s.n.); Freyn, Oborný s.d. BRNM (22249/36); s. coll. s.d. BRNM (22245/36). We were not able to find these specimens in the herbaria.

Literature data: **Fiek 1881:** Wiesen u. grasige Lehnen der östl. Hochsudeten, selten. Im Gesenke an der Hungerlehne (Kr.), Leiterberg vereinzelt, zahlreich am Abhange des Altvater beim Oppafalle (Oborný), oberer Rand des Kessels! (hier 1846 von Kr. entd.), Ameisenhügel am Wege von Franzens Jagdhause zur Lehmbaude bei Wiesenbergs spärlich, 1300 m. (Oborný). **Oborný 1885:** Wiesen und kräuterreiche Grasplätze, nur im mähr. Gesenke, selten. Oberer Rand des gr. Kessels (Krause, 1846 entdeckt.); Hungerlehne (Kr); vereinzelt auf dem Leiterberge, Abhang gegen Thomasdorf (1879), häufiger auf dem Altvater, Abdachung gegen die Oppa-Quellen; seltener auf dem Ameisenhügel, am Wege vom Jagdhause zur Lehmbaude bei Wiesenbergs, etwa bei 1300m Seehöhe. **Oborný 1906:** Kräuterreiche Grasplätze im Mähr. Gesenke: Gr. Kessel (hier 1846 von Krause entdeckt), Abhang den hohen Heide gegen Karlsdorf, Altvater, Abhang gegen die Oppa-Quellen, Ameisenhügel, Hungerlehne, Leiterberg, hier sehr selten. **Skřivánek 1956:** horské nivy, nehojně, horní okraj Velkého kotle, prameny Opavice a svahy Pradědu k Barborce 4. 8. 1946, Vysoká hole 4. 8. 1953. -- V roce 1946 zjistil jsem u pramene Opavice pod chatou Barborkou bohaté naleziště vzácného druhu *H. silesiacum*. Jmenované naleziště, jak jsem se v roce 1955 přesvědčil, bylo důsledkem terénních úprav koryta Opavice a úpravy prostoru kolem chaty Barborky zničeno a na místě nyní vegetuje *H. vulgatum*.

*Hieracium silesiacum* was discovered on Hungerlehne and in Velká kotlina in 1846 by E. Krause who later described it from the latter locality (Krause 1851). Although about eight localities were reported from the HJM, the considerable majority of herbarium specimens are located from Velká kotlina (see Fig 9). The occurrence on Praděd, near Bílá Opava and on Vysoká hole is documented by only a few herbarium specimens and there is only one from Kleiner Vaterberg. No herbarium specimens for other localities are available. This significantly reflects historical species' abundance on particular localities. The centre of distribution and the richest locality is clearly Velká kotlina. Then the only relatively rich occurrences are documented and as that also mentioned in literature (Fiek 1881, Oborný 1885) from Praděd or Bílá Opava springs / near Bílá Opava current and from Vysoká hole. The occurrence was rare on the rest of the localities. Sole findings on Hungerlehne (Krause's finding first mentioned in Krause 1851) and Mravenečník (Oborný's finding first mentioned in Fiek 1881) were only adopted by later authors. The occurrence on Šerák is mentioned only by Hrúby (1914).

*Current distribution in the HJM*

**Table 12:** Current localities of *Hieracium silesiacum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Praděd</b> , S slope, grassy vegetation 80 m W of Barborka chalet, not. J. Kocián	50°04'36.7"N 17°13'47.8"E	1325	1. 8. 2012	14 fl.	-
<b>Praděd</b> , S slope, grassy vegetation 50 m W of Barborka chalet above the place with benches, leg. J. Kocián	50°04'36.4"N 17°13'49.1"E	1325	1. 8. 2012	30 fl.	BRNU
<b>Velká kotlina</b> , Kunzova stráň, subalpine tall grassland, not. L. Bureš	50°03'33.2"N 17°14'07.6"E	1430	27. 7. 2012	5 fl.	-
<b>Velká kotlina</b> , Kunzova stráň, subalpine tall grassland around a small rock, three microsites, not. J. Kocián	50°03'29.6"N 17°14'10.7"E	1360	10. 7. 2016	5 fl.	-
<b>Velká kotlina</b> , sparse vegetation on elevated rocky place between two rivulet streambeds in the upper part of Velká kotlina, 40 m NE of Kettnerova skála; another 3 flowering individuals ca 10 m NE of this population, leg. J. Kocián	50°03'26.6"N 17°14'10.0"E	1330	22. 7. 2012	35 fl.	BRNU
<b>Velká kotlina</b> , under N edge of Kettnerova skála, outcrop, blueberry vegetation, not. J. Kocián	50°03'25.5"N 17°14'09.1"E	1330	22. 7. 2012	2 fl.	-
<b>Velká kotlina</b> , subalpine grassland SW Vitáskova rokle, above the continuation of path across the ravine, several scattered clusters of few individuals and sole plants, not. J. Kocián	around 50°03'21.7"N 17°14'07.2"E	1330	22. 7. 2012	20 fl.	-
<b>Velká kotlina</b> , Fiekovy ohlazy, smooth rock with dwarf bush vegetation, not. J. Kocián	50°03'21.1"N 17°14'08.7"E	1295	10. 7. 2016	6 fl.	-
<b>Velká kotlina</b> , Fiekovy ohlazy, smooth rock with sparse vegetation, not. J. Kocián	50°03'20.8"N 17°14'07.8"E	1305	20. 7. 2013	10 fl.	-
<b>Velká kotlina</b> , Fiekovy ohlazy, grassy vegetation on the small rocks, not. J. Kocián	50°03'20.6"N 17°14'08.7"E	1290	10. 7. 2016	14 fl.	-
<b>Velká kotlina</b> , Fiekovy ohlazy, grassy edge of small outcrop, not. J. Kocián	50°03'20.2"N 17°14'05.1"E	1335	5. 8. 2012	20 fl.	-
<b>Velká kotlina</b> , S edge of Fiekovy ohlazy, subalpine tall grassland, not. J. Kocián	50°03'16.8"N 17°14'03.5"E	1335	5. 8. 2012	2 fl.	-
<b>Velká kotlina</b> , Molinia grassland under Suzova stěna, not. J. Kocián	50°03'16.6"N 17°14'11.8"E	1205	18. 7. 2015	1 fl.	-
<b>Velká kotlina</b> , Fiekovy ohlazy, small grassy rock, two microsites, not. J. Kocián	50°03'16.3"N 17°14'05.1"E	1310	23. 7. 2016	6 fl.	-
<b>Velká kotlina</b> , S edge of Fiekovy ohlazy, dense subalpine tall grassland, not. J. Kocián	50°03'15.7"N 17°14'04.8"E	1310	20. 7. 2013	1 fl.	-
<b>Velká kotlina</b> , Mildeho skalka, steep slope with subalpine tall grassland, not. J. Kocián	50°03'15.2"N 17°14'06.4"E	1285	20. 7. 2013	5 fl.	-

We confirmed current occurrence of *Hieracium silesiacum* at two localities: in Velká kotlina and on the south slope of Praděd near Barborka chalet. In Velká kotlina the species grows, in conformity with literary data, mostly in its upper part. We found three numerous populations and eleven smaller ones. Two populations near Barborka chalet grow on the place which was heavily anthropogenically influenced in the past but which has semi-natural character contemporarily.

We were not successful in confirming *Hieracium silesiacum* at other historical localities (Vysoká hole, Mravenečník, Malý Děd, Hungerlehne, Šerák). The species might have been neglected but considering its rare occurrence in these localities in the past and vegetation changes in subalpine zone of the HJM during the last decades it is most likely to be extinct there now.

### *Hieracium stygium* R. Uechtr.

*Hieracium stygium* grows in the East Sudeten Mts and the Western Carpathians (Zahn 1922-1938). In the Czech Republic it grows on Mt. Králický Sněžník, in the Rychleby Mts and in the HJM (Zahn l. c.).

#### *Historical distribution in the HJM*

Herbarium specimens: Herbarium specimens of *Hieracium stygium* are the second most numerous among all HJM hawkweed species and they are present in all studied herbaria. Their locations cover the whole main HJM ridge.

Oborny (1906) and Skřivánek (1956) report *Hieracium stygium* as the most abundant HJM hawkweed together with *Hieracium vulgatum*. Also Chrtek (2004) denotes it as the most abundant hawkweed in the subalpine zone of the HJM despite the species' decline during the second half of the 20th century.

#### *Current distribution in the HJM*

Contemporarily, *Hieracium stygium* is still the most abundant HJM hawkweed. It grows scattered in the whole subalpine and less often in the supramontane zone of the HJM. Its estimated population size is a few thousand plants. The prevailing sites are the edges of tourist paths. It is remarkable that it grows only rarely in Velká kotlina. It is also rather rare on the alpine grasslands of the south part of Pradědská hornatina (from Vysoká hole to Pec).

### *Hieracium villosum* Jacq.

*Hieracium villosum* grows in the mountains of Central and Southern Europe (Zahn 1922-1938). In the Czech Republic it grows only in the HJM (Zahn l.c.).

#### *Historical distribution in the HJM*

Herbarium specimens: **Petrovy kameny:** Formánek 1884 BRNM (02430/31); **Velká kotlina:** Zimmermann 1875 WRSL (s.n.); Oborny 1876 PRC (s.n.); Oborny 1877 BRNM (02436/31); Freyn 1878 BRNM (02433/31); Winkler 1879 BRNM (02434/31); Winkler 1879 WRSL (s.n.); Freyn 1883 BRNM (02435/31); Ficinus 1883 WRSL (s.n.); Rieger 1890 OP (96710); Fiek 1895 WRSL (s.n.); Teuber 1902 BRNM (18800); Schustler 1919 PR (P4S417/10543); Laus 1930 OLM (69803); Laus 1930 OP (20352); Otruba 1930 OLM (69805, 69806, 69808); Skřivánek 1946 BRNM (254592, 254595); Šmarda 1946 PR (P4S417/11054); David 1947 OP (88417); Deyl 1947 PR (P4S417/7392); Dostál 1947 PRC (s.n.); Deyl 1949 PR (P4S417/7412); Deyl 1952 PR (P4S417/5124, P4S417/5141); Šmarda 1954 BRNM (69836); Skřivánek 1955 BRNM (254594); Skřivánek 1956 BRNM (254593); Měsíček 1961 PR (P4S417/7284); Deyl 1966 PR (260080); Burešovi, Jeník 1972 OLM (109674); Severa 2000 PRC (s.n.); Grabowski s.d. BRNM (02432/31); Formánek s.d. BRNM (02431/31); Spatzier s. d. OP (12516); s. coll. s. d. OP (98188); s. coll. s. d. PR (P4S417/10071).

Note: Severa (2001) presents other herbarium specimens of *Hieracium villosum* from Velká kotlina in PRC but we were not able to find them in the herbarium.

Literature data: **Fiek 1881:** An Felsen in den östl. Hochsudeten, sehr selten. Im grossen Kessel des Gesenkes! (1834 von Gr. entd.). **Oborny 1885:** Felsspalten, steile Felshänge, sehr selten, bisher nur im grossen Kessel des Gesenkes, westliche Abdachung der Janowitzhaide, 1834 v. Grabowsky entdeckt. **Oborny 1906:** im grossen Kessel des Gesenkes auf Felswänden bei 1440 m u. z. nur am Westrande des unteren Kessels. **Skřivánek 1956:** skály na západním okraji Velkého Kotle, pořídku, společně s *Agrostis alpina*, *Hedysarum obscurum*, *Aster alpinus*, *Arabis sudetica*, *Helianthemum grandiflorum*, cca 1200 m, 28. 6. 1946, 9. 8. 1955.

The distribution of *Hieracium villosum* in the HJM is very well known thanks to the species' attractivity. The traditional locality is Velká kotlina where it was first found by E. H. Grabowski as early as in 1834 (Wimmer 1840). All herbarium specimens but one (Formánek's one from Petrovy kameny – this localization is, however, for many reasons almost certainly wrong) come from this locality. Velká kotlina is also the only locality of *Hieracium villosum* mentioned in the older literature. Another two HJM localities – Sokol and Volárna – were discovered only at the end of the 20th century. Sokol is listed by Chrtek (2004) for the first time but it is unknown who discovered this locality and when. The locality of Volárna near Mezikotlí was discovered by L. Bureš in 1989 (Bureš 2013). The plants grew on the wall of the former ox stable. Bureš (l.c.) also reports a locality along the path in the summit area of Kamzičník, however, this locality is wrong – plants of *Hieracium alpinum* were misidentified as *H. villosum* (*cf.* herbarium specimen in OLM, no. 109675). *Hieracium villosum* was discovered at another three new localities as late as the new millennium. M. Kočí found it on the ruins of a former sheep house located ca 900 m E of Barborka chalet on the south slope of Praděd and he mentions one flowering cluster on Tabulové skály found by V. Kavalcová (Kočí 2005). J. Chlapek found *Hieracium villosum* on Žárový vrch in 2006 (Bureš 2013). R. Štencl performed a field revision of all known localities in 2007 and 2008 (Štencl 2009). In conclusion, eight localities of *Hieracium villosum* were reported from the HJM, five of them are trustworthy (Velká kotlina, Sokol, Volárna, Praděd – ruins of a former sheep house, Žárový vrch), one is slightly doubtful (Tabulové skály), one is almost certainly wrong (Petrovy kameny) and one is wrong (Kamzičník).

#### *Current distribution in the HJM*

**Table 13:** Current localities of *Hieracium villosum* in the HJM

Locality	GPS	Alt.	Date	Count	Herb.
<b>Žárový vrch</b> , summit rock, leg. J. Kocián (independently by J. Chlapek in 2006)	50°06'31.4"N 17°18'38.5"E	1094	14. 9. 2007	17 fl. (2008)	NJM
<b>Žárový vrch</b> , flat rock 25 m SE of the summit rock, leg. J. Kocián (independently by J. Chlapek in 2006)	50°06'30.9"N 17°18'39.9"E	1090	14. 9. 2007	16 fl. (2008)	NJM
<b>Sokol</b> , Sokolí skála, S summit area of the main rock, leg. J. Kocián	50°05'39.8"N 17°15'01.1"E	1170	10. 7. 2007	16 fl.	NJM
<b>Praděd</b> , S slope, stony ruin of former chalet, 350 m SSE of altitudinal point 1356 and 900 m E of Barborka chalet, not. J. Kocián	50°04'42.1"N 17°14'38.5"E	1280	19. 8. 2014	2 fl.	-
<b>Velká kotlina</b> , upper part of Vitáskova rokle, rock above the path crossing the ravine, sole individuals also on the rock left of Šmardova stěna, not. J. Kocián	50°03'22.6"N 17°14'08.5"E	1320	13. 8. 2011	6T fl.	-
<b>Velká kotlina</b> , Vitáskova rokle, N wall of first pillar of the ravine, not. L. Bureš	50°03'20.7"N 17°14'10.9"E	1250	20. 7. 2009	2T fl.	-
<b>Velká kotlina</b> , Hilitzerova skála, N facing rock wall and steep slopes, leg. J. Kocián	50°03'15.8"N 17°14'08.3"E	1260	18. 7. 2015	7T fl.	BRNU
<b>Velká kotlina</b> , Mildeho skalka, rock crevices, not. J. Kocián	50°03'15,2"N 17°14'06,6"E	1285	18. 7. 2015	7T fl.	-
<b>Velká kotlina</b> , Roemerovy výchozy, rock crevices, not. J. Kocián	50°03'14.6"N 17°14'08.5"E	1255	18. 7. 2015	9T fl.	-

We confirmed the occurrence of *Hieracium villosum* in four localities. The species can be found at five sites in Velká kotlina; L. Bureš (in litt. 2017) noticed it also on upper part of Kolenatiho skály in 1974 and on Suzova stěna during 1992-1998 but these occurrences were not confirmed recently. The species does not grow on Tabulové skály anymore (confirmed also by R. Štencl in litt. 2015). Two flowering clusters were last recorded on Volárna in 2008 by R. Štencl (Štencl 2009). L. Bureš did not find the species there in the following years although he searched the site thoroughly – *H. villosum* almost certainly does not grow on Volárna anymore (L. Bureš in litt. 2017).

It is interesting that there are two at first sight distinguishable types of *Hieracium villosum* in the HJM. A type growing in Velká kotlina has narrower and grassier green leaves, denticulate lower stem leaves, slightly shorter simple hairs and the whole plant is less pubescent. Meanwhile a type growing on Žárový vrch, Sokol and Praděd has broader, entire and grayish leaves, slightly longer simple hairs and whole plant is more pubescent (see Fig 7). Another noteworthy fact is that Velká kotlina is the only historically long-time known locality of this conspicuous species. Surprisingly, all other localities were discovered just recently. The origin of new localities is controversial. For example, Hrúby (1914) did not report *Hieracium villosum* from Sokol although he performed a detailed floristical research there and reported several hawkweed species. Vicherek (1962), focusing his study on calcareous vegetation on Sokol, did not mention it either. Considering the morphological differences between the plants at the traditional locality of Velká kotlina and the plants at new localities (at least Sokol, Žárový vrch and Praděd; the plants from Volárna and Tabulové skály are documented neither by herbarium specimens nor by photos) an introduction of allochthonous plants seems to be very probable. A similar, attractive species of hawkweed, *Hieracium mixtum*, was recently introduced on Praděd and Žárový vrch (see above) and it is not the only case of allochthonous introduction in the HJM (cf. Bureš 2013). The comparison of HJM plants with Western Carpathian ones (taxonomically solved by Severa 2001) gives another clue strengthening the introduction hypothesis: the occurrence of *Hieracium villosum* in the HJM is florogenetically related to the species' occurrence in the Western Carpathians and meanwhile the plants from Velká kotlina look the same as the most common Western Carpathian type of *Hieracium villosum*, the plants from other current localities do not resemble any type of *Hieracium villosum* growing in this mountain area. Further comparison with the plants from other European mountain ranges where the species occur would be crucial to resolve the origin of the plants growing on the recently discovered HJM localities.

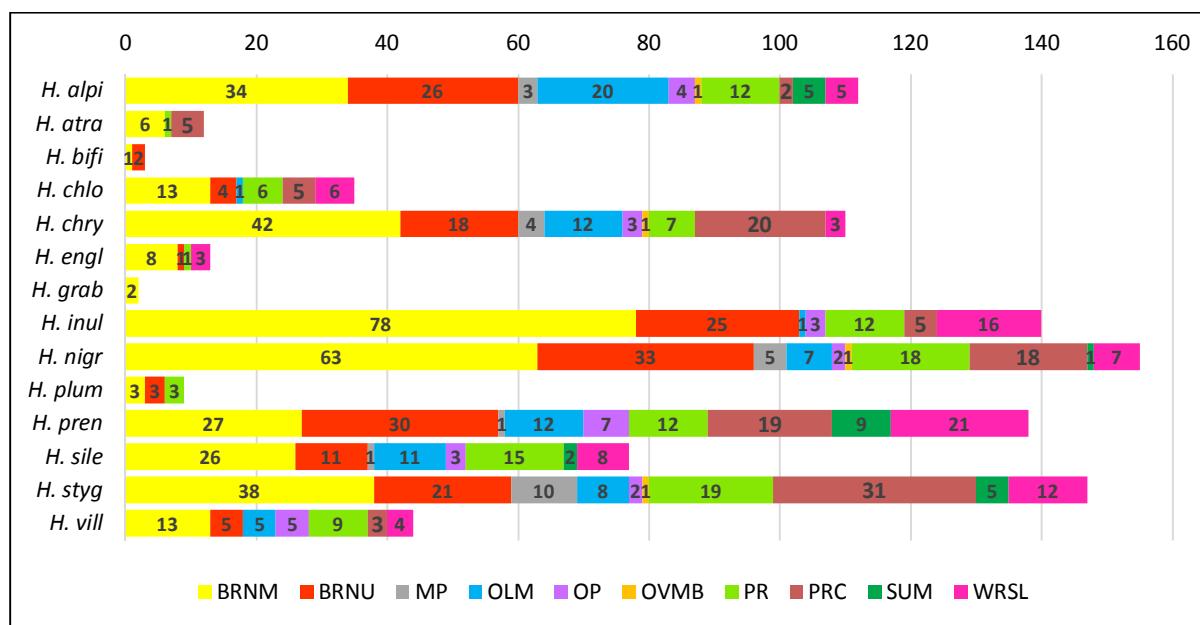


**Fig 7:** a – *Hieracium villosum* in Velká kotlina on Mildeho skalka (20. VII. 2013), b – *Hieracium villosum* on Sokol (10. VII. 2007). Photo a Jiří Kocián, photo b Petr Kocián.

## Overall chorological data

Figure 8 displays the number of examined herbarium specimens of each species reflecting their abundance. BRNM and BRNU were the most important herbaria for our study since they provided more than half herbarium specimens for many species. But local herbaria such as OLM and SUM were also significantly contributing since in some cases they comprised as many or even more herbarium specimens than the Czech largest herbaria PR and PRC. Some valuable specimens collected by old Silesian botanists are preserved in WRSL.

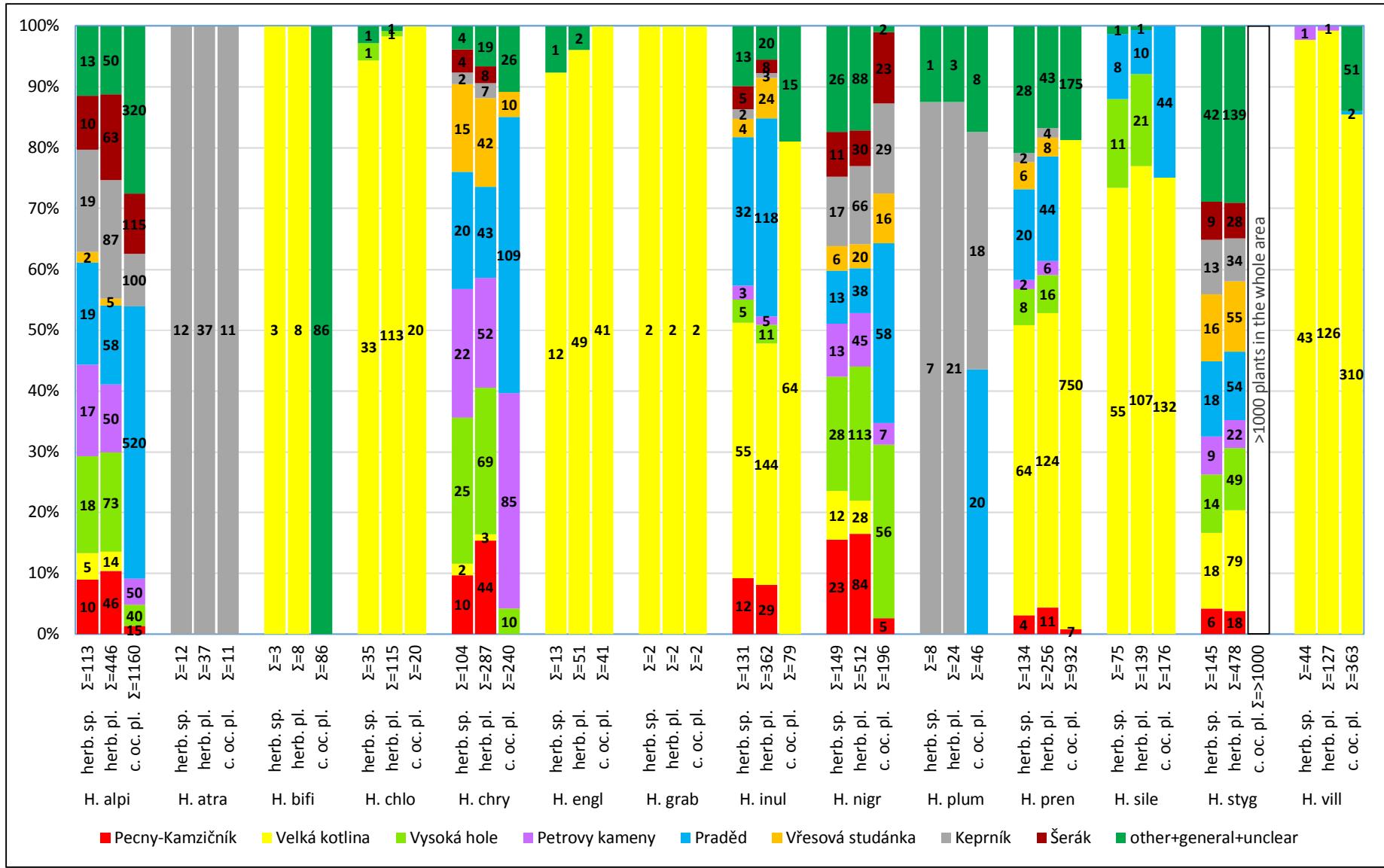
The genus *Hieracium* is exceedingly taxonomically difficult. Therefore, *Hieracium* collections are generally somewhat disordered. Thus, we surely did not find some herbarium specimens in the large herbaria, mainly in PRC. This influences the results gained by herbarium revision to some extent.



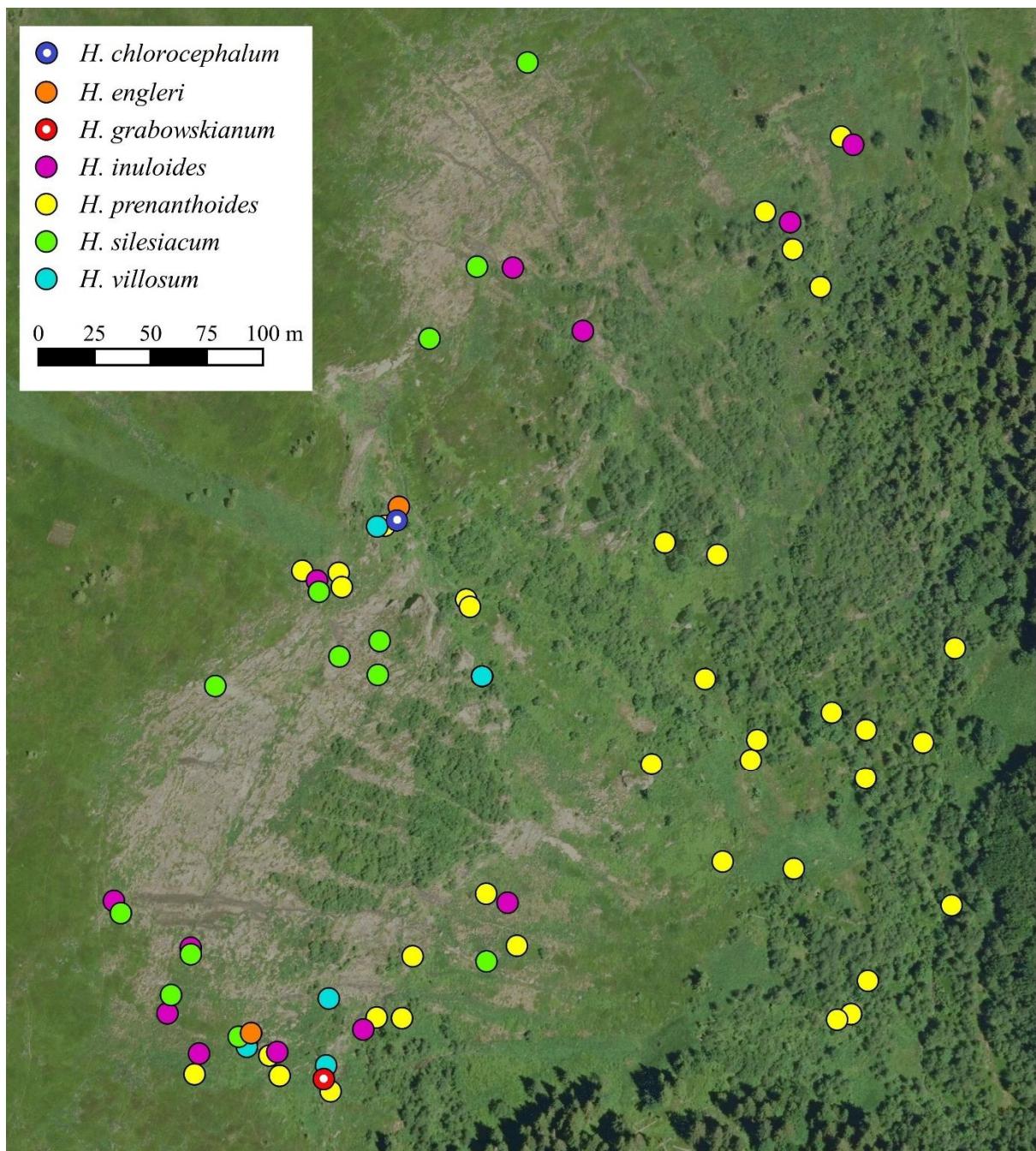
**Fig 8:** Number of herbarium specimens in studied herbaria.

Relatively compared numbers of herbarium specimens, herbarized plants and currently occurring plants for each species on the localities are displayed on Fig 9. There are usually several plants on one herbarium specimen, e.g. four plants per average in *Hieracium alpinum* (compare the first and the second column within one species). Conclusions about historical and present population sizes in each locality and the HJM in general can be made comparing the second and the third columns within one species (however, with some limitations – see Discussion).

Velká kotlina is the HJM *Hieracium* hotspot. All but two (*Hieracium atratum* agg. and *H. plumbeum*) mountain hawkweed species were historically reported from there (though the occurrence of *H. alpinum* and *H. chrysostyloides* is questionable due to their ecology – the localizations of these species to Velká kotlina refer perhaps rather to the slopes above Velká kotlina than to the glacial cirque itself). We ascertained eight species still growing in the locality – see Fig 10.



**Fig 9:** Relatively compared numbers of herbarium specimens (herb. sp.), herbarized plants (herb. pl.) and currently occurring plants (c. oc. pl.).



**Fig 10:** Contemporary distribution of mountain hawkweeds in Velká kotlina (*H. stygium* not displayed). Map basis - Ortophoto, 2014 © Czech Office for Surveying, Mapping and Cadastre, [www.cuzk.cz](http://www.cuzk.cz).

## Discussion

### Population sizes and changes

Our field research was successful in confirming the contemporary occurrence of the majority of mountain hawkweeds in the HJM, providing accurate population localizations and bringing information about the current population size of the species. However, stating population size proved to be tricky since we observed relatively high interannual fluctuations in the number of flowering plants. This was caused partly due to population flowering dynamics influenced by interannual climatic fluctuations and ontogenetic development of the plants. Another factor influencing the population size assessment was the timing of counting. Although

we searched the localities during the flowering period of particular species, this period is narrowed down by strong herbivore grazing pressure. Grazed plants are hardly visible, so it is likely that a certain portion of plants in some localities remained uncounted. It is possible that some populations even remained undiscovered. All these factors – climatic, ontogenetic and interspecific – influenced the population size statements to some extent.

Comparing contemporary population sizes with the past ones is hard since no exact population sizes were stated in the past. Historical data consists merely of locations sometimes supplemented by generally defined population abundance. However, the number of herbarium specimens and herbarized plants collected from particular localities provides a more accurate image of population abundance (see Fig 9), although such numbers must be perceived only as relative historical abundance, moreover influenced by factors such as the species or locality attractivity. It is alarming that the number of herbarized plants from some populations of some species are higher than the number of currently occurring plants – see Fig 9 where, moreover, the disappearance of the species at some localities is demonstrated. For example, the number of currently occurring plants of *Hieracium nigritum* is smaller in all but one locality, ranging from between 2–80 % of the number of herbarized plants. In total, the number of currently occurring plants is only 38 % of the herbarized ones, and we were not able to find the species in one historical locality at all.

#### *Threatening factors influencing HJM hawkweeds negatively*

Weakening or even extinction of some populations can be ascribed to four main causes and their synergy:

(1) The most visible one is a strong grazing pressure of wild herbivore mammals. *Hieracium alpinum*, *H. chrysostyloides*, *H. inuloides* agg., *H. prenanthoides* agg. and *H. silesiacum* suffer by grazing the most, other species are also affected to various extents. Herbivores prefer to nibble flower heads with the upper part of the stem (see Fig 11). Meanwhile *H. inuloides* agg. and *H. prenanthoides* agg. are able to produce side flowering stems after the main stem is nibbled, *H. alpinum* and *H. chrysostyloides* are not so they cannot produce the seeds in the year of grazing deprivation. The herbivore most responsible for grazing is a non-native chamois which we often observed in many localities and whose negative effect on HJM plants is well known (Bureš 2013). Chamois are even more dangerous to hawkweeds because they (similarly to goats or sheep) prefer to nibble attractive flowers and avoid less attractive grasses. We observed this in many localities – hawkweeds or other attractively flowering plants were nibbled meanwhile neighbouring grasses stayed intact. But other herbivores are responsible too - we found hare excrements nearby and in the grazed clusters of *H. alpinum* and *H. chrysostyloides* on Praděd and Tabulové skály regularly. We also occasionally observed red deer and doe in Velká kotlina.

(2) Less obvious but also an important threat are the vegetation changes in the subalpine zone of the HJM, mainly the grasses density increase and undecomposed biomass accumulation. Although the processes are not completely understood yet, the main causes are historical pasturing and its cease, chemism changes by sulphur atmospheric deposition, eutrophication by nitrogen atmospheric deposition and climate change (Klimeš & Klimešová 1991, Banaš *et al.* 2012). All HJM *Hieracium* species are rather competitively weak species. Although adult established plants seem to persist in dense and connected vegetation for long time, the seedlings are not able to establish successfully in such vegetation. There is a negative synergic effect of grazing and vegetation changes: most flowering stems are grazed and even if a few of them are saved from grazing and produce seeds successfully, there are usually no suitable patches near to the mother plants where seeds could germinate and establish new plants. Therefore, generative reproduction of many HJM hawkweed populations seems to be severely thwarted.



**Fig 11:** a – nibbled *Hieracium chrysostyloides* on Praděd (12. VII. 2015), b – nibbled *Hieracium silesiacum* in Velká kotlina (18. VII. 2015). Photos Jiří Kocián.

(3) The third threat is a habitat loss due to historical *Pinus mugo* planting. *Pinus mugo* is a non-native species in the HJM (Skalický 1988) which was introduced in the past in endeavour to heighten the upper limit of the forest and to prevent erosion and both snow and soil avalanches (Hošek 1963, Banaš *et al.* 2001). However, it influences the natural processes, subalpine ecosystems and majority of the species negatively (Bureš *et al.* 2009, Zeidler *et al.* 2012). Hawkweeds, similarly to vast majority of other subalpine plant species, are not able to grow under *Pinus mugo*. Since this shrubby conifer was planted mainly in the highest parts of the HJM it is a threat mainly for *H. alpinum*, *H. chrysostyloides* and *H. nigritum* whose populations growing close to the shrubs can be overgrown and doomed by them. This happened possibly mainly in the past since many *Pinus mugo* stands are dense and completely connected today. Some floristically rich localities, e.g. Hungerlehne where *H. silesiacum* was found for the first time ever (Krause 1851), were presumably destroyed just by *Pinus mugo* planting (Bureš *et al.* 2009). Nowadays the direct influence of *Pinus mugo* on hawkweeds is visible mainly on Šerák and Keprník. Besides, *Pinus mugo* plantations possess also indirect influence on subalpine ecosystems in preventing avalanches, disturbance caused by creepy snow and erosion. These natural processes are crucial for maintaining ecosystem structure and biodiversity mainly in glacial cirques (Jeník 1961).

(4) Finally, collecting hawkweeds for herbaria certainly caused severe weakening or possibly even extinction of some populations. As mentioned above and shown on Fig 8, in some cases there are more plants in herbaria than currently growing in the localities. The collecting was not too considerate since e.g. there are four plants per one herbarium specimen on average in *H. alpinum* or *H. engleri* and three plants per one herbarium specimen on average in *H. atratum* agg., *H. chlorocephalum* or *H. plumbeum*. Fortunately, no HJM hawkweed species had the same destiny as *Hieracium purkynei*. This Krkonoše Mts endemic was exterminated just due to overcollecting (Chrtek 2004). Herbarium collecting affected HJM hawkweeds especially in the past. Nowadays, the majority of HJM mountain hawkweed localities are strictly protected in the Praděd and the Šerák-Keprník national natural reserves – collecting plants and even visiting these localities is prohibited without a special permit.

### *Beneficial factors influencing HJM hawkweeds positively*

On the other hand, there is one anthropogenic effect generally considered negative but it is beneficial for hawkweeds: terrain disturbance. Many populations of HJM hawkweeds grow on sites which were or are disturbed by various human activities. The vast majority of the most common HJM mountain hawkweed *H. stygium* populations grows on the edges of tourist paths. These are also the preferred biotope of *H. nigritum* which moreover thrives well on the historically heavily disturbed place near former Vřesová studánka chalet. Such similar places around mountain chalets are preferred also by other species: *H. silesiacum* grows near Barborka and a numerous population of *H. prenanthoides* agg. above Ovčárna and around mountain rescue service lodge. *H. alpinum* grows on the trampled surrounding of the border stone on Praděd. These examples are congruent with ecological behaviour of hawkweeds, which in general tend to grow in disturbed, less dense vegetation. This hemerophilous tendency is noticeable also among many other HJM plants since anthropogenically disturbed places in HJM subalpine zone are often floristically richer than some types of natural vegetation (V. Kavalcová 2006, pers. comm.).

The above mentioned anthropogenic biotopes are only a substitute for natural biotopes where natural processes such as avalanches, creepy snow, sweeping winds or frost soil erosion maintain naturally disturbed patches preferred by hawkweeds. Conservation strategies in the HJM should focus on maintaining these processes. For example *Pinus mugo* stands above Velká kotlina should be removed since they impede snow accumulation in the glacial cirque and thus lessen the frequency of avalanches. This particular intention is even more important nowadays when the snowfall is decreasing due to the climate change.

### Conclusion

The data provided in this article can serve as a basis for future revisions of distribution and population sizes of HJM mountain hawkweeds. The knowledge about distribution is also essential for potential further studies of the genus in the HJM. The threats to HJM hawkweeds are identified so appropriate conservational measures ought to be taken in order to protect these species which constitute an important part of biodiversity of the HJM.

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