

**9th INTERNATIONAL HIERACIUM WORKSHOP
9. MEDNARODNA DELAVNICA HIERACIUM**

**JOVAN HADŽI INSTITUTE OF BIOLOGY, SCIENTIFIC RESEARCH CENTRE OF THE
SLOVENIAN ACADEMY OF SCIENCES AND ARTS, LJUBLJANA, SLOVENIA
BIOLOŠKI INŠTITUT JOVANA HADŽIJA ZRC SAZU**

**TRENTA (JULIAN ALPS), SLOVENIA
TRENTA (JULIJSKE ALPE), SLOVENIJA**

LJUBLJANA 2006

6 – 11 SEPTEMBER, 2006

**ABSTRACTS OF LECTURES AND POSTERS
ZBORNIK IZVLEČKOV PRISPEVKOV**



ISBN 961-6568-61-2



9 789616 568616



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JOVAN HADŽI INSTITUTE OF BIOLOGY, SCIENTIFIC RESEARCH
CENTRE SASA, LJUBLJANA, SLOVENIA
BIOLOŠKI INŠTITUT JOVANA HADŽIJA ZRC SAZU



LJUBLJANA 2006





9th International Hieracium Workshop / 9. mednarodna delavnica Hieracium
Abstracts of Lectures and Posters / Zbornik izvlečkov prispevkov
Trenta (Julian Alps), Slovenia / Trenta (Julijske Alpe), Slovenija
6 – 11 September, 2006

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Edited by / Uredila:
Branko Vreš & Valerija Babij

Organizing Comitee / Organizacijski odbor:
Valerija Babij, Igor Dakskobler, Boštjan Surina, Branko Vreš, Tone Wraber

English revision by / Jezikovni pregled besedila: Tim C. G. Rich
Design by / Oblikovanje: Milojka Žalik Huzjan

Published by / Izdajatelj:
SRC SASA, Jovan Hadži Institute of Biology /
ZRC SAZU, Biološki inštitut Jovana Hadžija

Naklada: 100 izvodov
Printed by / Tisk: Collegium Graphicum, d. o. o., Ljubljana

Edition and workshop was supported by / Sofinanciranje publikacije in delavnice:
Agencija za raziskovalno dejavnost Republike Slovenije, Raziskovalni sklad ZRC
SAZU, Informacijsko središče Triglavskega narodnega parka in Prirodoslovni muzej
Slovenije.

Printed on / Natisnjeno: September 2006 / septembra 2006

Cover photo / Slika na ovitku: Photo / foto: Valerija Babij

CIP - Kataložni zapis o publikaciji
Narodna in univerzitetna knjižnica, Ljubljana

582.998(063)

MEDNARODNA delavnica Hieracium (9 ; 2006 ; Trenta)

Abstracts of lectures and posters = Zbornik izvlečkov prispevkov / 9th International
Hieracium Workshop, Trenta (Julian Alps), Slovenija = 9. mednarodna delavnica
Hieracium, Trenta (Julijske Alpe), Slovenija, 6-11 September, 2006 ; edited by, uredila
Branko Vreš & Valerija Babij. - Ljubljana : Jovan Hadži Institute of Biology, Scientific
Research Centre SASA = Biološki inštitut Jovana Hadžija ZRC SAZU, 2006

ISBN 961-6568-61-2
1. Vreš, Branko
228466944





WORKSHOP PROGRAMME / PROGRAM DELAVNICE

1st day: WEDNESDAY, 6 September

Arrival
(registration at 17.00 onwards, welcome party at 20.00)

2nd day: THURSDAY, 7 September

Excursion (full day) to the Mangart mountain
(by bus and walk; 9.00-18.00)

Dinner

After dinner: **Determination of herbarium specimens, discussions**

3rd day: FRIDAY, 8 September

Symposium (lectures and posters), round-table discussion

- 9.00: Opening session / Otvoritev in pozdrav
The Triglav National Park – presentation / Predstavitev TNP
- 9.30: T. Wraber: A short introduction to the phytogeographical
characterization of the Julian Alps / Na kratko o fitogeografski
oznaki Julijskih Alp
- 10.00: K. Krak, J. Fehrer & J. Chrtek: Molecular tools for inferring
phylogeny in *Hieracium*
- 10.40–11.00: Coffee break
- 11.00: F. Krahulec, A. Krahulcová, R. Rosenbaumová & S. Papoušková:
Diversity of breeding systems in *Hieracium* subgen. *Pilosella*:
present state of the knowledge





WORKSHOP PROGRAMME / PROGRAM DELAVNICE

- 11.30: J. Chrtek & P. Mráz: *Hieracium* s.str. in the Western Carpathians
12.00: T. Gregor: Agamospermous taxa in the Vegetation of Central Europe
12.20: P. Mráz, P. Taberlet, L. Gielly & J. Chrtek: Molecular phylogeography of the arcto-alpine species *Hieracium alpinum*
12.40: T. Rich: Current work on *Hieracium* in Britain and Ireland

13.00-14.30: Lunch

14.30-16.00

Lectures & discussion

- 14.30: A. Krahulcová, F. Krahulec & V. Vladimirov: Comparison of *Hieracium* subgen. *Pilosella* in Bulgarian and Czech populations: how is the interspecific hybridization reflected in population structure?
14.50: B. Šingliarová, P. Mráz, J. Chrtek & I. Plačková: *Pilosella alpicola* subsp. *ullepitschii*, a diploid endemic taxon of the Carpathians: notes on taxonomy, chorology and ploidy level
15.10: Presentation of IC TNP (free guided tour)

16.00-16.30: Coffee break

16.30-19.00:

Lectures, poster session & discussion

- T. Urfus, B. Šingliarová, P. Mráz & F. Krahulec: *Pilosella officinarum*: longitudinal differences in ploidy level distribution in the Czech Republic and Slovakia
J. Sawtschuk & T. Rich: Distribution and conservation of five Welsh endemic *Hieracium* species
K. Slade & T. Rich: Pollen studies in British *Hieracium* Section *Alpina*.
F. Krahulec, A. Krahulcová, R. Rosenbaumová & J. Fehrer: The role of apomictic species in agamic complexes of *Hieracium* subg. *Pilosella*.





WORKSHOP PROGRAMME / PROGRAM DELAVNICE

O. Rotreklová & P. Bureš: *Hieracium* subgen. *Pilosella*: progenies diversity in reproductive origin and ploidy levels in facultative apomictic and sexual taxa

O. Rotreklová: *Hieracium* subgen. *Pilosella*: Pollen viability in sexual, apomictic and sterile plants

B. Vreš & al.: *Hieracium* taxa of Soča valley (Slovenia, Julian Alps)/ Škržolice Posočja

18.00-19.00:

Round-table discussion

W. Gutermann: Towards a *Hieracium* checklist of (C. & E.) Europe

W. Greuter: The treatments of *Hieracium* and *Pilosella* in the Euro+Med Plantbase Project

20.00

Workshop dinner

4th day:

SATURDAY, 9 September

Excursion (full day) – The Soča valley

Trenta to Bovec, Učja valley and Kobarid (Museum of 1st World War) – by bus (8.30-18.00)

After dinner: **Determination of herbarium specimens, discussions**

5th day:

SUNDAY, 10 September

Half-day excursion

Visit of Botanical garden Juliana, Spring of Soča and the Vršič saddle (9.00-15.00)

6th day:

MONDAY, 11 September

Final departure





ABSTRACTS / IZVLEČKI

A SHORT INTRODUCTION TO THE PHYTOGEOGRAPHICAL CHARACTERIZATION OF THE JULIAN ALPS

TONE WRABER

Slovenia is a land of connections, transitions and crossroads, as very truly stated the Slovenian geographer A. Melik as early as in 1935. The same opinion holds good for the Slovenian Alps and the Julian Alps as part of them which at the same time is part of the Southern Alps. The Julian Alps extend in west-eastern direction from the rivers Tagliamento and Fella in NE-Italy to the river Sava Bohinjka in NW-Slovenia, and in north-southern direction from the rivers Fella (Italy) and Sava Dolinka to the rivers Idrijca and Selška Sora (Slovenia). Their highest summits are Triglav (2864 m, Slovenia) and Jof di Montasio (2754 m, Italy). The rock nature is prevalently Mesozoic limestone.

Their most common and important floral element is indeed the Alpine one. Certain species are all-alpine or even more widely distributed (e. g. *Aconitum lamarckii*, *Callianthemum coriandrifolium*, *Papaver alpinum* s. lat., *Draba tomentosa*, *Primula auricula*, *Cortusa matthioli*, *Eritrichium nanum*, *Aster alpinus*, *Leontopodium alpinum*, *Hieracium villosum*, and – seldom – some monocots). Considerable is the portion of the East-Alpine taxa, like *Salix waldsteiniana*, *Ranunculus hybridus*, *Saxifraga sedoides*, *Saxifraga burseriana*, *Astrantia bavarica*, *Rhododendron hirsutum*, *Rhodothamnus chamaecistus*, *Gentiana pannonica*, *Pedicularis rostratocapitata*, *Valeriana saxatilis*, *V. supina*, *Campanula cespitosa*, *Achillea clavenae*, and *Saussurea pygmaea*. Inside the East-Alpine element is worthy of notice the partition in the northeastern (Bavaria, Austria) and the southeastern (NE-Italy, Slovenia) representatives of the same closer affinity, e. g. *Minuartia cherlerioides* subsp. *quadrifaria*/*M. cherlerioides* subsp. *cherlerioides*, *Thlaspi alpinum*/*T. minimum*, *Heracleum austriacum* subsp. *austriacum*/*H. austriacum* subsp. *siifolium*, *Primula clusiana*/*P. wulfeniana*, *Soldanella austriaca*/*S. minima* (H. Merxmüller, 1952, T. Wraber, unpubl.).

Polhov Gradec 93a, SI-1355 Polhov Gradec, Slovenija



Quite important and characteristic is the segment of the South-Alpine species, especially of the Southeast-Alpine (*) ones, as *Ranunculus traunfellneri* (*), *R. venetus*, *Saxifraga crustata*, *S. exarata* subsp. *carniolica* (*), *Arabis vochinensis* (*), *Pritzelago alpina* subsp. *austroalpina* (*), *Spiraea decumbens* subsp. *decumbens* (*), *Alchemilla carniolica* (*), *Potentilla nitida*, *Primula wulfeniana* (*), *Paederota bonarota*, *Pedicularis elongata* subsp. *julica* (*), *Gentiana lutea* subsp. *vardjanii* (*), *G. froelichii* subsp. *froelichii* (*, in the Julian Alps only one locality in their Italian part), *Gentiana terglouensis*, *Campanula zoysii* (*), *Campanula carnica*, *Physoplexis comosa*, *Leontodon berinii* (*), *Leontodon hispidus* subsp. *brumatii* (*), *Centaurea dichroantha* (*), several taxa of the *Glauca*-section of the genus *Hieracium* and their hybrids with the species of other sections(*), *Crepis terglouensis*, *Paradisea liliastrum*, *Festuca calva* (*), and *F. laxa* (*).

Among the taxa listed till now there were already mentioned some endemics, especially those of the Southeastern Alps. Because of the smallness of the Julian Alps, their position »in the meeting point« of different phytogeographical territories strictly endemic taxa of the Julian Alps are not many: *Aconitum angustifolium*, *Papaver alpinum* subsp. *ernesti-mayeri*, *P. alpinum* subsp. *victoris*, *Moehringia villosa*, *Alyssum wulfenianum*, *Thlaspi cepaeifolium* subsp. *cepaeifolium* (both also – very locally – in the adjacent Carnic Alps of Austria), *Saxifraga exarata* subsp. *atropurpurea*, and *Centaurea haynaldii* subsp. *julica*. *Cerastium subtriflorum* and *Saxifraga tenella* have their main distribution in the Julian Alps too.

Beside the Alpine taxa in the Julian Alps exists a large group of the South-European taxa, especially in their southern valleys (e. g. the Soča Valley). It's the point of South-European taxa in broad sense (e. g. *Ostrya carpinifolia*, *Fraxinus ornus*, *Calamintha brauneana* *Chrysopogon gryllus*, *Stipa eriocaulis*), of the Dinaric (mostly Illyrian, e. g. *Trinia glauca* subsp. *carniolica*, *Gentiana lutea* subsp. *symphyandra*), Illyricoid (sensu Trinajstić 1992, e. g. *Anemone trifolia*, *Epimedium alpinum*, *Vicia oroboides*, *Scopolia carniolica*, *Omphalodes verna*, *Lamium orvala*), and Mediterranean-montane taxa (e. g. *Pinus nigra*, *Viola pinnata*, *Euphorbia triflora* subsp. *kernereri*, *Daphne alpina* subsp. *scopolii*, *Satureja montana* subsp. *variegata*). The latter group could be combined with the Alpine-Dinaric distribution pattern, represented by *Euphorbia saxatilis* (*E. barrelieri*, *E. kernereri*, *E. triflora*) group, *Ligusticum seguieri*, and *Iris pallida* s. lat. Differently from the more westerly lying Alpine territories (e. g. Garda Lake, or particularly the Maritime Alps) in the Julian Alps the Eumediterranean species are lacking. While in the adjacent Carnic Alps *Quercus ilex* thrives on their southern foothills, in the Julian Alps there is not a trace of it, possibly owing to the high precipitations there. In the late 18th century the Eumediterranean *Cephalaria leucantha* was found in the Trenta-Valley



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and described as *Scabiosa trenta*. The longstanding search for it remained fruitless. Surprising is the abundant occurrence of *Adiantum capillus-veneris* on the very southern foothills of the Julian Alps (Bača-Valley).

The near treatment of the Middle-European floral element, although strongly represented in the flora of the Julian Alps, is left undone here.



MOLECULAR TOOLS FOR INFERRING PHYLOGENY IN *HIERACIUM*

KAROL KRAK^{1,2}, JUDITH FEHRER¹ & JINDŘICH CHRTEK¹

Our main aim is to infer the molecular phylogeny of the genus *Hieracium* with emphasis on the subgenera *Chionoracium* and *Hieracium* s. str. (Zahn's basic and diploid intermediate species). The first results are based on the analyses of the nuclear ribosomal DNA internal transcribed spacer (ITS) and the chloroplast (cp) DNA *trnT-trnL* intergenic spacer, involving 28 and 38 in-group species respectively.

Cp DNA is maternally inherited, and thus allows us to trace back a phylogeny of maternal lineage only, and it often shows a geographical pattern. The ITS evolves faster and better reflects species relationships due to its biparental mode of inheritance.

According to our data, both subgenera are polyphyletic and the groups found in phylogenetic analyses are incongruent with sectional classifications based on morphology.

In the subgen. *Chionoracium*, four North American species (*H. scabrum*, *H. venosum*, *H. argutum*, *H. albiflorum*) are close to each other, and the chloroplast haplotypes of the North-western *H. albiflorum*-*H. argutum* are derived from those of North-eastern *H. scabrum*-*H. venosum*. Further geographic patterning of cp DNA clusters are (i) *H. carneum* from Arizona with *H. guatemalense* and (ii) all South American species except *H. antarcticum*.

In *Hieracium* s. str., both molecular markers identify three groups: (i) *H. porrifolium* and *H. glaucum*, (ii) *H. alpinum* and *H. pojoritense*, and (iii) *H. hryniawiense*, *H. umbellatum* and *H. eriophorum*. While cp DNA places *H. intybaceum* and *H. piliferum* in the *H. alpinum*-*H. pojoritense*-*H.*

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sparsum s. str. group, according to ITS they do not belong to *Hieracium* s.l. at all. This incongruence suggests at least one ancient hybridization event between the progenitor of *H. intybaceum*/*H. piliferum* and the ancestor of the above-mentioned group. The latter served as the maternal parent. Triploid *H. pictum* and surprisingly also the diploid *H. tomentosum* are of hybrid origin. In the case of *H. pictum*, *H. humile* was involved as the maternal parent, and a taxon close to the *H. murorum*-*H. transsilvanicum*-*H. amplexicaule* group was the paternal parent. *H. tomentosum* probably originated from *H. amplexicaule* (or a close relative) as the seed parent and a paternal taxon close to *H. humile*.

In several polyploid taxa only a single ITS sequence type was found. This suggests either these species are autopolyploids, or homogenization of different parental copies (a particular feature of multicopy ITS region) deleted any evidence of potential hybridizations. Therefore we are currently developing a single copy nuclear marker to distinguish between these two possibilities. Furthermore such a fast evolving marker is supposed to give a better resolution of species relationships in this recently diverged complex.





**DIVERSITY OF BREEDING SYSTEMS IN *HIERACIUM* SUBGEN.
PILOSELLA: PRESENT STATE OF THE KNOWLEDGE**

FRANTIŠEK KRAHULEC (with contribution of ANNA KRAHULCOVÁ,
RADKA ROSENBAUMOVÁ AND STANISLAVA PAPOUŠKOVÁ)

Breeding systems within *Hieracium* subgenus *Pilosella* are very diverse. All types have clonal growth (above or underground stolons, formation of new ramets on the root crown and/or on fine roots). Seed reproduction is sexual and/or apomictic. Sexual types have regular meiosis and the progeny from the breeding of sexual types are very uniform. On the other hand, apomicts produce diverse progeny. In addition to true apomixis, there are different proportions of other reproductive pathways: combination of reduced and unreduced gametes and haploid parthenogenesis. It seems that stabilized hybridogenous types have usually about 90% true apomictic progeny. In contrast, local hybridogenous types (and recent hybrids from experiments) have a high degree of true sexuality and/or haploid parthenogenesis (up to 80%). The origin of this variation is unknown to us.

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**HIERACIUM S.STR. IN THE WESTERN CARPATHIANS**JINDŘICH CHRTEK¹ & PATRIK MRÁZ^{2,3,4}

In the past decade, taxonomic revisions of *Hieracium alpinum*, *H. fritzei*, *H. nigrescens*, *H. piliferum*, *H. rohacsense*, *H. sparsum* and *H. villosum* (species in the broad sense, species groups) have been completed. In comparison with Zahn's account, most changes concern the *Hieracium nigrescens* group (several of Zahn's subspecies were assigned to other species groups). Recently, the taxonomic position of plants from the Nízke Tatry Mts., referred by Zahn erroneously to *Hieracium rohacsense* subsp. *glandulosodentatiforme* (the name is a taxonomic synonym to *H. rohacsense*), were examined. The plants show no close affinity to *H. rohacsense*, but are closely allied (but not conspecific) with *Hieracium vagnerii*, described from the Eastern Carpathians. *Hieracium rostanii* was discovered as a new species for Slovakia in the Západné Tatry Mts. (Mt. Sivý vrch). Chromosome numbers were reported for members of 27 species in the broad sense (species groups). Triploids and tetraploids predominate (53% and 45%, respectively), diploids ($2n = 18$) were only found in *Hieracium umbellatum*. Previously published diploid counts reported for *H. sabaudum* from Slovakia were found to be erroneous (misidentification with *H. umbellatum*). From the karyological point of view, the Western Carpathians belong to the best-explored areas of the *Hieracium* distribution range. Attention was also paid to the genetic variation of populations/

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species. Until recently, genetic structure was detected in 10 species (in the narrower sense). Considerable variation was revealed in *Hieracium alpinum* s.str. (using allozyme and RAPD markers), between-population variation was found in *H. pinetophilum*, *H. crassipedipilum* (both the *H. fritzei* group, using allozyme and RAPD markers), and *H. silesiacum* (*H. sparsum* group, allozyme markers). In the remaining species, i.e. *Hieracium halleri* (*H. alpinum* group), *H. krivanense*, *H. slovacum* (both the *H. fritzei* group), *H. jarzabczynum*, *H. vapenicanum* (both the *Hieracium nigrescens* group) and *H. rohacsense* (s.str.), genetic variation was very low or absent (allozymes, in some cases RAPD markers).





AGAMOSPERMOUS TAXA IN THE VEGETATION OF CENTRAL EUROPE

THOMAS GREGOR

The rich phytosociological literature of Central Europe was reviewed for the occurrence of predominantly agamosperous (apomictic s. str.) taxa, many of which, such as *Poa pratensis* s.l., *Taraxacum* sect. *Ruderalia*, *Poa nemoralis* or *Hypericum perforatum*, are commonly found in phytosociological relevés. The presence of apomictic taxa in phytosociological constancy tables was used as an indicator for their occurrence in vegetation types of the syntaxonomical unit alliance. All alliances were rated in a 5-step scale to 10 ecological traits: (1) water content of soil, (2) calcium and magnesium content of soil or water, (3) nutrient content of soil or water, (4) environment dynamics, (5) hemeroby ('naturalness'), (6) frequency of stress-tolerant species, (7) salt tolerance, (8) altitude, (9) height, and (10) frequency of annual taxa.

Mean numbers of apomictic taxa vary greatly between alliances. Fig. 1 gives the results at the level of vegetation type. The alliance with the highest number of apomicts was the Poion alpinae (2.76 taxa per relevé), the respective class was the Festuco-Brometea (1.55 taxa per relevé).

For further evaluation a correction factor for the mean number of taxa in a relevé was used for each alliance. Rank correlations between the mean number of apomictic taxa and 10 ecological traits of alliances were computed (fig. 2).

Only the traits water (negative), salt (negative), and altitude (positive) have significant correlations with the mean number of apomictic taxa in an alliance. The correlations for the traits "calcium/magnesium content of soil" (positive) and "frequency of annuals" (negative) were just below the significance margin. In a factor analysis, the variable "apomicts" was not of major importance for the variation in the data set.

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Vegetation type	Number relevés	Number apomicts per relevé (standard deviation)
Aquatic communities	9972	0.00
Swamps, tall herb fens, mires	20846	0.11 (\pm 0.03)
Maritime communities	9407	0.12 (\pm 0.09)
Cliff communities	3953	0.69 (\pm 0.21)
Vegetation of open habitats	33962	0.72 (\pm 0.26)
Woodlands and scrub	60503	0.78 (\pm 0.14)
Heaths	8057	0.92 (\pm 0.12)
Grasslands	52566	0.95 (\pm 0.25)

Fig. 1 Apomictic taxa in vegetation types.

From my data, the often-cited notion that apomictic taxa occur predominantly in habitats where competition is less than average must be dismissed. No marked difference was found between the number of apomictic taxa in long-term stable habitats (grasslands, heaths, woodlands) where competition is thought to be high, and open habitats with presumably low competition. Conversely, there was a tendency for higher frequencies of apomicts in long-time stable habitats. Likewise, no correlation was apparent between the frequency of apomicts and population densities, mean ranges of taxa, the aridity of habitats, or the hemeroby of a habitat. For these evaluations I also used the characteristics of closely related apomictic and amphimictic taxa. It can be confirmed that apomictic taxa are generally perennial hemicryptophytic polyploids. A positive correlation was confirmed between the frequency of apomictic taxa and altitude. I am uncertain if this result can be explained by a greater colonizing ability of apomicts, as it has been suggested before. There is a very clear negative correlation with the ecological traits water and salt. These are considered artefacts, as these alliances are generally very poor in species. Among neophytic apomicts originating from Central Europe we find a number of aggressive competitors: *Chondrilla juncea*, *Hieracium pilosella*, *Hypericum perforatum*, *Poa pratensis* s.l., *Rubus* div. spec., or *Taraxacum* div. spec.

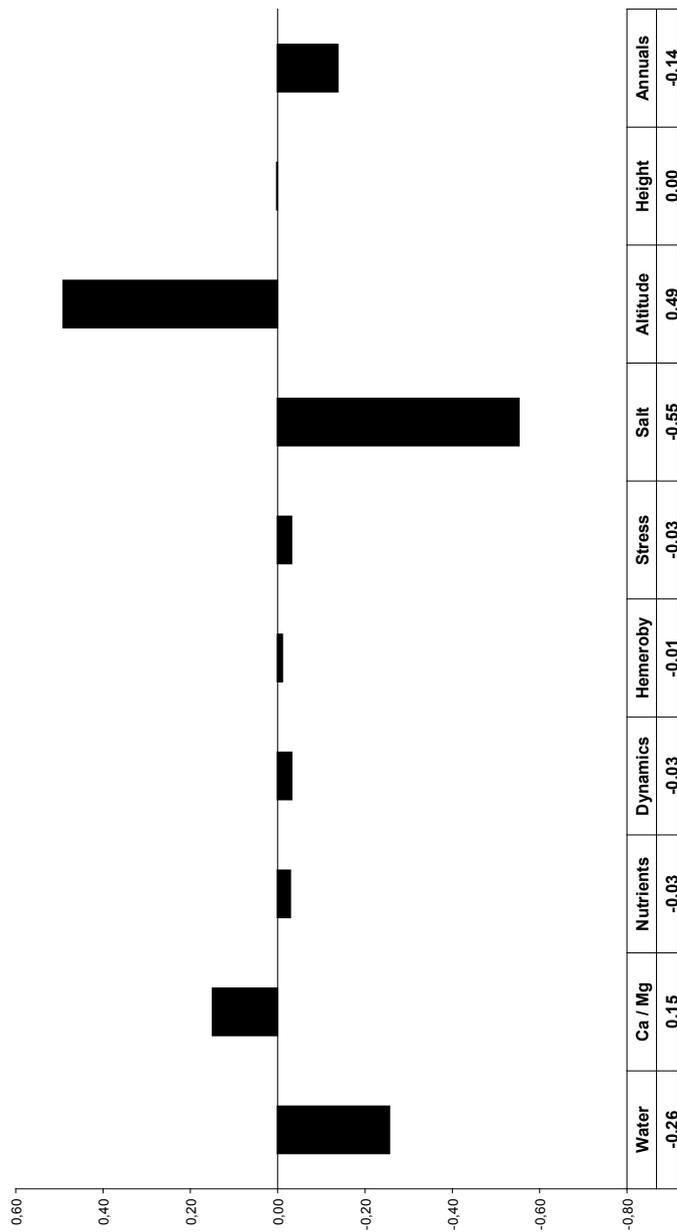


Fig. 2 Spearman's rank correlation coefficients between ecological factors and the occurrence of apomictic taxa in the alliances of the Central European flora; significance margin ± 0.16 for two-tailed test, error margin 0.05; n = 141.

MOLECULAR PHYLOGEOGRAPHY OF THE ARCTIC-ALPINE SPECIES *HIERACIUM ALPINUM*

PATRIK MRÁZ^{1,2}, PIERRE TABERLET¹, LUDOVIC GIELLY¹ & JINDŘICH CHRTEK³

Major climatic changes during the Pleistocene and early Holocene have influenced the contemporary plant diversity in Europe. The southerly-situated regions are supposed to be glacial refugia of many arctic-alpine plant taxa during glaciations, and served as genetic pools for northwards migration after the last retreat of the glaciers. At the same time, Pleistocene refugia are regarded as places with higher intraspecific diversity. Species with disjunct distributions, like *H. alpinum*, represent interesting models for the study of historical biogeography. Our specific objective is to search for a phylogeographic pattern of this perennial arctic-alpine species more or less throughout its range using AFLP and cpDNA markers.

H. alpinum is composed of two cytotypes with different breeding systems occupying non-overlapping geographic areas (Chrtek 1997). Diploid sexuals are confined exclusively to the E and S Carpathians, while the remainder of the range is occupied by triploid apomictic populations only. If the triploids are derivatives of diploid plants, then did E and S Carpathians or their foothills really act as a glacial refugium? Did the W Carpathians populations play the most important role in the successful northwards and westwards colonization of triploids? What are the relationships between the triploid populations of isolated European mountains at present? From which region(s) was Scandinavia recolonized? Almost 400 plants from the Alps, Carpathians, and the Sudeten Mts were

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collected in 2004 and 2005 and their DNA was extracted. Three AFLP primer pairs (cf. Lledó & Rich 2004) were selected to give a preliminary screen of genetic variation in individual plants in different regions. Six DNA fragments from a total of about 170 scored (of which 70% polymorphic) were present in all triploid plants tested but were missing in all the diploids studied. Final AFLP analysis will be completed after sampling plant material from Northern Europe this year.

Acknowledgements

This project is funded by European Commission (Marie Curie Intra-European Fellowship, project no. 10961). Sampling expeditions in 2004 and 2005 were supported from following projects: VEGA 1/1283/04 and APVT-51-026404.

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CURRENT WORK ON *HIERACIUM* IN BRITAIN AND IRELAND

TIM RICH

Peter Sell's major new revision of *Hieracium* and *Pilosella* in Britain and Ireland has finally been published (Sell & Murrell 2006). There are 412 species of *Hieracium* and nine species of *Pilosella*, including 94 new *Hieracium* species or combinations (many are British endemics, but some are also European). For each species there is a detailed description and a summary of the distribution, and occasionally for some taxa there are taxonomic or nomenclatural notes. The accounts are very brief.

David McCosh is continuing to work on his distribution database of British and Irish *Hieracium* and *Pilosella*, based on herbarium material in BM, CGE, E, MANCH and NMW, and occasionally other sources, and following the taxonomy of Sell & Murrell (2006). It is hoped to publish a distribution atlas within the next two years.

David Tennant's detailed monograph of British *Hieracium* sect. *Alpina* has been completed with the help of T. Rich and is in the process of being published. It is based on 30 years field work and cultivated plants, and incorporates DNA and cytological work at Leicester University. Each account has the usual descriptions, synonymy, distributions, keys, etc, with photographs and detailed line drawings to make the identification of taxa within the section accessible to amateur botanists. It is hoped that this will act as a model for monographs of further sections.

The Republic of Ireland Heritage Service have commissioned surveys of their seven endemic *Hieracium* species. The work will be carried out over the next 3 years by T. Rich. In 2006 six endemics were refound including *H. hartii*, last seen in 1891 and considered extinct. This complements on-going work on Welsh endemic *Hieracia*.

A recent review of the conservation status of British plants by Chef-

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fings & Farrell (2005) only included an incomplete list of IUCN Threat Categories for *Hieracium* sect. *Alpina*, ignoring the remainder of *Hieracium* and not even classifying them as 'data deficient'. It is hoped that this list will now be updated with all taxa following publication of Sell's revision.

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**COMPARISON OF *HIERACIUM* SUBGEN. *PILOSELLA*
IN BULGARIAN AND CZECH POPULATIONS: HOW IS
THE INTERSPECIFIC HYBRIDIZATION REFLECTED IN
POPULATION STRUCTURE?**

ANNA KRAHULCOVÁ¹, FRANTIŠEK KRAHULEC¹ &
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Frequent interspecific and intercytotype hybridization, in addition to polyploidy and a diverse reproduction mode, is a major source of variation in the polyploid apomictic complex of *Hieracium* subgen. *Pilosella*. Past and recent recurrent hybridizations produce many morphotypes, resulting in their intricate taxonomy. Hybrid swarms between facultatively apomictic *H. bauhini* and closely related sexual species *H. pilosella*/*H. macranthum*, common in the Czech Republic and Bulgaria, were chosen as model system. Populations at particular localities were evaluated with respect to species (morphotype) and cytotype composition, breeding system (apomictic or sexual) and to the clonal structure of apomictic biotypes. Effective interspecific hybridization operates in both regions under a different background: the explicit dominance of hexaploids and rare sexuality recorded in Bulgarian populations contrast with more diverse ploidy levels and more frequent sexual biotypes in Czech populations.

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**PILOSELLA ALPICOLA SUBSP. ULLEPITSCHII, A DIPLOID
ENDEMIC TAXON OF THE CARPATHIANS: NOTES ON
TAXONOMY, CHOROLOGY AND PLOIDY LEVEL**

BARBORA ŠINGLIAROVÁ¹, PATRIK MRÁZ^{1,2,3},
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Two alpine species, *Pilosella candollei* and *P. alpicola* [syn. *Hieracium alpicola*], are distinguished within the section *Alpicolina*. Beside *P. alpicola* subsp. *ullepitschii*, an endemic taxon of the Carpathians, five other subspecies with more or less restricted areas of distribution have been included in latter species: subsp. *furcotae* from the Vysoké Tatry Mts, the nominate subsp. *alpicola* from the Alps, and three Balkan subspecies - subsp. *rhodopea*, subsp. *glandulifolia* and subsp. *micromegas*.

The distribution of *P. alpicola* subsp. *ullepitschii* has a strongly disjunct character. *P. alpicola* grows in the Western Carpathians in the Vysoké and Západné Tatry Mts (Slovakia, Poland) and extremely rarely in the Eastern (Nemira Mts) and Southern Carpathians (Buçegi Mts, in both cases in Romania). In the Western Carpathians *P. alpicola* subsp. *ullepitschii* is confined to the primary alpine or subalpine meadows with acid bedrock in communities with *Avenella versicolor*. In contrast, in the Nemira Mts it occurs in man-made habitats (secondary pastures) in the spruce belt. Similarly, in the Buçegi Mts it was found in sites not typical for this taxon. These circumstances evoke the question of whether this taxon is native in Romania or not? If it is native, is there any genetic differentiation of the populations from the other areas?

Two different ploidy levels (diploid and tetraploid) have been previ-

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ously published for this taxon. However, all individuals from Vysoké and Západné Tatry Mts and Romanian plants from Buçegi and Nemira Mts analysed in 2000-2005 by flow cytometry and classical counting were diploid.

The genetic structure of six Western Carpathian populations was studied using 7 allozyme loci. We found that genetic variation is high within populations, but low between populations. Hence, sexual reproduction and strong gene flow could be suggested. Strict allogamy in this taxon was proved by isolation experiments. In three studied plants from Romania we found two unique alleles (*Lap-1-a*, *Shdh-1-d*), missing in Slovak samples, but present in nominate subspecies *alpicola* from the Col du Simplon (Suisse).

Acknowledgement:

This study was supported by project (APVT-51-026404).





DISTRIBUTION AND CONSERVATION OF FOUR WELSH ENDEMIC *HIERACIUM* SPECIES

JEROME SAWTSCHUK & TIM RICH

The distribution and conservation of four endemic Welsh *Hieracium* species has been studied at the National Museum of Wales by JS as part of an internship during his degree in conservation biology at Rouen University, France.

The species being studied are *H. cambricogothicum*, *H. pachyphylloides*, *H. pseudoleyi* and *H. rectulum*. For each species, historical records were reviewed and then used to direct field work to assess the current status of the plants, and assess their conservation needs. Only one site is now known for *H. cambricogothicum*. *H. pachyphylloides* was rediscovered after 50 years in two out of seven populations. *H. pachyphylloides* is locally frequent on the Great Orme in North Wales. *H. rectulum* has proved difficult to distinguish from *H. submutabile*.

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**PILOSELLA OFFICINARUM: LONGITUDINAL DIFFERENCES IN
PLOIDY LEVEL DISTRIBUTION IN THE CZECH REPUBLIC AND
SLOVAKIA**

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FRANTIŠEK KRAHULEC⁵

P. officinarum is a highly structured species with respect to ploidy level. Previous scattered data indicated possible differences in frequency of particular ploidy levels in the Czech Republic and Slovakia (e.g. Mráz & Šingliarová 2005, Rotreklová et al. 2005). Therefore, a detailed sampling and ploidy level analyses were carried out to reveal the boundary between the common occurrence of tetraploids on one hand and higher polyploids on the other. Ploidy levels and/or chromosome numbers were established for 987 plants using flow cytometry and/or classical counting. Samples were collected on 311 localities in the Czech Republic, Slovakia and North-Eastern Hungary. Four ploidy levels were found in the study area with contrasting patterns of distribution. The most widespread cytotype in Bohemian part of the Czech Republic was tetraploid, while the pentaploids and hexaploids clearly prevailed in Slovakia and Moravian part of the Czech Republic. Heptaploid level ploidy was found for the first time in Slovakia in one site. Mixed populations consisting of two different ploidy levels were recorded in nearly 12% of localities. The boundary between the common occurrence of tetraploids and higher polyploids is very obvious and represents the geomorphologic boundary between the Bohemian Massif and the Western Carpathians with adjacent part

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of Pannonia. This probably important biogeographical line is obvious also from the distribution of other taxa such as *Campanula rotundifolia* s.str., *Cirsium heterophyllum* or different cytotypes of *Pilosella bauhini* (cf. Rotreklová 2004) and ecological differentiation of cytotypes of *Allium oleraceum* (Šafářová 2004).

Acknowledgements

This study was financially supported from following projects: GA AV IAA605203 and VEGA 1/1283/04 and 2/6054/26.

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**POLLEN STUDIES IN BRITISH *HIERACIUM* SECTION *ALPINA***

KATHERINE SLADE & TIM RICH

In Britain, most *Hieracium* s.s. species are apomictic and triploid or tetraploid (exceptionally pentaploid), and only one diploid sexual species is known, *H. umbellatum*. It is generally reported that the polyploid apomicts produce no pollen or perhaps only small amounts of inviable pollen. Studies of herbarium material and field observations in some Welsh endemics showed that some species produced reasonable quantities of apparently viable pollen, which may be coupled with some degree of genetic variation. The involvement of pollen in sexual reproduction might help to explain evolution in the genus and concentrations of endemics.

As part of work trying to understand evolution and molecular variation within British *Hieracium* sect. *Alpina*, a survey of pollen production has been undertaken using Alexander's Stain. Alexander's Stain stains the outside of the pollen grain greenish-blue, and cytoplasm inside red, so well-formed pollen grains with cytoplasm (which are potentially viable) can be picked out quickly. It is a quick method to screen many plants, but does not prove that the grains are viable.

The widespread *H. alpinum* was investigated in detail as it has sexual diploids with high fertile pollen production (rare in Europe), triploids lacking pollen (reported to be the only cytotype in the UK, but widespread in Europe), and tetraploids (rare in Europe only). No viable pollen has yet been found in British herbarium specimens.

Most British *Hieracium* sect. *Alpina* species also did not produce pollen. Low potential pollen fertility was observed in *H. grovesii* (triploid) and apparently high fertility in *H. pentaploideum* (pentaploid). The results may have implications for the evolution of section *Alpina* taxa across Europe.

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THE ROLE OF APOMICTIC SPECIES IN AGAMIC COMPLEXES OF *HIERACIUM* SUBG. *PILOSELLA*.

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Apomixis is often considered as a 'blind alley' in evolution. The number of apomictic plants as well as their success suggests a different view. In *Hieracium* subgen. *Pilosella*, apomicts are facultative, with some degree of residual sexuality. We estimated the role of apomicts in populations by experimental crosses and comparison of progeny with composition of populations in the field. The reproductive pathways were quantified in two model systems of polyploid species: 1) *H. bauhini* (apomictic) crossed with *H. pilosella* (sexual) and 2) a hybridogenous apomict, *H. rubrum*, crossed with *H. pilosella*. The resulting variation and also variation of plants obtained from seeds collected in the field from particular facultatively apomictic mothers is surprisingly higher than progeny from fully sexual mothers. In addition to ordinary apomixis (without meiosis and gamete fusion), polyploid apomictic mothers can also reproduce via special additional pathways (haploid parthenogenesis or fusion of unreduced gametes), which omit one of the otherwise characteristic steps of asexual seed formation. These results were supported by studies of field populations. Chloroplast-DNA haplotypes revealed that facultatively apomictic species often function as maternal parents of polyploid derivatives of hybridization. Many of these hybridogenous types are stabilized and widespread, considered as separate taxonomic entities. Facultatively apomictic mothers also serve as a bridge for gene flow through agamic complexes.

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HIERACIUM SUBGEN. PILOSELLA: PROGENIES DIVERSITY IN REPRODUCTIVE ORIGIN AND PLOIDY LEVELS IN FACULTATIVE APOMICTIC AND SEXUAL TAXA

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In *Hieracium* subgen. *Pilosella* facultative apomixis of the aposporic type and sexual reproduction occur in majority of the species. Both amphimictic and apomictic seed production in the same capitulum is common (Gadella 1984, Krahulcová & Krahulec 2000). Both sexual and apomictic plants produce viable (stainable) pollen grains (Pogan & Wcisło 1995) and can serve as pollen donors.

In this study, flow cytometry seeds screen (FCSS) based on the comparison of the ratio of embryo/endosperm ploidy levels was used. The method is based on the different origins of endosperm in sexual and aposporic species. In sexual embryo sacs the endosperm is formed by the fusion of two polar nuclei of the central cell with reduced sperm cells, and embryo/endosperm ratio in seeds is 2:3. In apomicts with autonomous endosperm development (apospory), the embryo/endosperm ratio in seeds is 2:4 (Matzk et al. 2000). The aims of this study are (a) to compare the karyological variability of progenies from the field and from experimental hybridization and (b) to quantify the occurrence of sexual reproduction in the facultative apomictic *Hieracium bauhini*.

Progenies groups from the field and from experimental hybridization were studied with respect to reproductive origin (sexual versus apomictic) and karyological diversity. FCSS was used to detect reproductive origin and ploidy level of accessions of the pentaploid and the hexaploid apomictic *Hieracium bauhini* and the hexaploid sexual *H. pilosella*. 104 progenies of the hexaploid *H. bauhini* from the field and from experimental hybridization were uniform, the hexaploids of apomictic origin. All 232 progenies of the pentaploid *H. bauhini* from the field and from experimental hybridization were pentaploid, in 4 accessions (1.7%) sex-

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ual origin was found. 168 progenies of the hexaploid sexual *H. pilosella* from the field were hexaploid. Two ploidy levels were found among 48 progenies of *H. pilosella* from experimental hybridization, pentaploid (47.9%) and hexaploid (52.1%). Despite the low numbers of plants investigated it is clear that the sexual reproduction of apomictic plants and hybridization substantially increase the karyological variability of progenies in mixed populations of the apomictic *Hieracium bauhini* and the sexual *H. pilosella*.

Acknowledgement

This study was supported by the Ministry of Education (MSM 0021622416).

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**HIERACIUM SUBGEN. PILOSELLA: POLLEN VIABILITY IN
SEXUAL, APOMICTIC AND STERILE PLANTS**

OLGA ROTREKLOVÁ

Hieracium subgen. *Pilosella* is well known for its diversity of reproductive strategies. Sexual and apomictic species produce viable pollen grains and serve as pollen donors in sexual reproduction (Gadella 1987, Krahulcová & Krahulec 2000). This study is focused on the comparison of the pollen stainability of apomictic and sexual taxa and sterile hybrids in *Hieracium* subgen. *Pilosella*.

Pollen samples were obtained from sexual tetraploid *Hieracium bauhini*, apomictic pentaploid and hexaploid *H. bauhini*, sexual tetraploid *H. densiflorum*, apomictic pentaploid *H. pilosellinum*, sterile triploid *H. pistoriense* and sterile pentaploid *H. brachiatum*. Pollen samples were collected in the experimental garden twice a week in July and September 2005. Three heads per plant in one to three plants from the same locality were studied. Pollen grains were prepared from unopened central flowers of capitula that already had some open marginal flowers.

Two different stains were used to compare pollen stainability: acetocarmine and Alexander's stain (Alexander 1980). Pollen samples were placed on slides and incubated overnight in room temperature (Alexander's stain) or in Petri-dishes in a refrigerator (acetocarmine). Slides were observed with light microscope (Olympus BX 51) and photographed. At least 100 pollen grains were counted from each slide, and three slides were made from one capitulum.

The highest pollen stainability (93.7-98.4%) with low intra-population variability was found in tetraploid sexual *Hieracium bauhini* and *H. densiflorum*. Higher inter- and intra-population stainability variability was discovered among the apomictic plants. In four populations of pentaploid *H. bauhini*, two population of hexaploid *H. bauhini* and one

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population of pentaploid *H. pilosellinum* the results were similar to those in sexual tetraploid plants: stainability exceeded 92% and intra-population variability was low. In two pentaploid and one hexaploid population of *H. bauhini* the average pollen stainability was variable ($76.8 \pm 6.66\%$; $49.0 \pm 9.32\%$ and $75.4 \pm 11.64\%$). The lowest stainability was found in sterile triploid *Hieracium pistoriense* ($33.6 \pm 6.71\%$) and pentaploid *H. brachiatum* ($29.6 \pm 9.16\%$). This result, together with the sympatric occurrence of both taxa with possible parental species and their intermediate morphology, confirm the hybrid origin of these plants.

Acknowledgement

This study was supported by the Ministry of Education as research project MSM 0021622416.

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***HIERACIUM* TAXA OF THE SOČA VALLEY (SLOVENIA,
JULIAN ALPS) / ŠKRŽOLICE POSOČJA**

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Slovenia is one of the smallest countries in the world (it covers 20,251 km² = 0.004 % of the whole and 0.014 % of the continental Earth's surface) but harbours 1.3 % of all known living species. According to the last nomenclature source *Mala flora Slovenije* (Martinčič & al. 1999) ca. 3300 taxa of vascular plants are present in Slovenia, which represents about 1.3 % of all known vascular plants. Of these, 66 are endemic in broader sense. In this very last source 49 Slovenian hawkweed taxa (*s. latiss.*) are listed. The first basic list of Slovenian vascular plants (included the whole ethnic Slovenian territory) was published by Ernest Mayer (1952), where 380 hawkweed taxa (to subspecies level) were listed according to the nomenclature of Zahn (1921-1923). A critical revision of *Hieracium* data and herbarium material (LJU, LJM, BIJH ZRC SAZU) has not been done in Slovenia.

The here presented provisional hawkweed checklist of the Soča Valley has been made without any emphasis on hawkweed taxonomy and nomenclature. 37 hawkweed taxa from the subgenus *Hieracium* and 15 from the subgenus *Pilosella* are listed. The most interesting and common hawkweeds in the Soča Valley are several taxa of the *Glauca*-section of the subgenus *Hieracium* and their hybrids with the species of some other taxa (e.g. *Villosa*-Section). Some subspecies described from Soča Valley and Julian Alps by Zahn (1921-1923) and Nägeli & Peter (1885-1889) are endemic. The basic sources on hawkweeds of Soča Valley (and Slovenia) are listed in References below:

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Provisional *Hieracium* list of the Soča Valley:**Hieracium subgen. *Hieracium***

1. *Hieracium alpinum* L.
2. *Hieracium amplexicaule* L.
3. *Hieracium benzianum* J. Murr & Zahn
4. *Hieracium bifidum* Kit. ex Hornem.
5. *Hieracium bupleuroides* C.C.Gmelin
6. *Hieracium caesium* (Fries) Fries
7. *Hieracium chondrillifolium* Fries
8. *Hieracium crucimontis* Zahn
9. *Hieracium ctenodon* N.P.
10. *Hieracium dentatum* Hoppe
11. *Hieracium dollineri* C.H.Schultz ex F.W.Schultz
12. *Hieracium glabratum* Hoppe ex Willd.
13. *Hieracium glaucum* All.
14. *Hieracium humile* Jacq.
15. *Hieracium illyricum* Fries
16. *Hieracium incisum* Hoppe
17. *Hieracium lachenalli* Suter
18. *Hieracium laevigatum* Willd.
19. *Hieracium latifolium* Froelich ex Link
20. *Hieracium leiocephalum* Bartl.
21. *Hieracium murorum* L.
22. *Hieracium oxyodon* Fries
23. *Hieracium pilosum* Schleicher ex Froel.
24. *Hieracium porrectum* Fries
25. *Hieracium porrifolium* L.
26. *Hieracium pospichalii* Zahn

27. *Hieracium prenanthoides* Vill.
28. *Hieracium racemosum* W. & K.
29. *Hieracium sabaudum* L.
30. *Hieracium sanctoides* P.D.Sell & C.West (= *H. sanctum* N.P.)
31. *Hieracium saxatile* Jacq.
32. *Hieracium scorzonrifolium* Vill.
33. *Hieracium umbellatum* L.
34. *Hieracium valdepiosum* Vill.
35. *Hieracium villosum* Jacq.
36. *Hieracium vulgatum* Fr.
37. *Hieracium wilczekianum* Arvet-Touvet

Hieracium subgen. *Pilosella*

1. *Hieracium aridum* Freyn
2. *Hieracium aurantiacum* L.
3. *Hieracium bauhini* Schult.
4. *Hieracium brachiatum* Bertol. ex DC.
5. *Hieracium caespitosum* Dum.
6. *Hieracium cymosum* L.
7. *Hieracium glaciale* Reyn. ex Fries
8. *Hieracium guthnickianum* Hegetschw.
9. *Hieracium hoppeanum* Schult.
10. *Hieracium lactucella* Wallr.
11. *Hieracium pilosella* L.
12. *Hieracium piloselloides* Vill.
13. *Hieracium schultesii* F. W. Schultz
14. *Hieracium visianii* (C.H. et F. Schulz) N.P.
15. *Hieracium zizianum* Tausch

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THE TREATMENTS OF *HIERACIUM* AND *PILOSELLA* IN THE EURO+MED PLANTBASE PROJECT

WERNER GREUTER

Euro+Med Plantbase (<http://ww2.bgbm.org/EuroPlusMed/query.asp>) is a database freely available for online consultation. It includes accepted names, synonyms, nomenclatural source citations and county-by-county distributions of plants growing in Europe and the Mediterranean area, including Caucasia to the east and the Macaronesian Islands to the west. Eventually all vascular plants are to be covered. The present author takes responsibility for, and is busy working on, the first family to be fully treated: Compositae.

The data for *Hieracium* have been released to the public in June this year. At present, Euro-Mediterranean *Hieracium* consists of 222 species groups or aggregates or “Hauptarten”, 2770 accepted “microspecies” and 838 subspecies, under which 3307 synonyms are listed. The data have been checked and improved by several leading *Hieracium* specialists. Nevertheless the treatment is by no means final (nor have all the comments received been integrated in the online version yet).

Pilosella (definitely a separate genus) is the last missing morsel before the Compositae treatment is complete. The author is well advanced in its base-level treatment and will give an account of its present shape and the problems linked with it (which are of a quite different nature than those he encountered in *Hieracium*). He is keen to discuss his project with those present and, whenever possible, enlist them to assist in improving the result. It is to be expected that the treatment can be made available online before the end of October.

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