Hieracium in Croatia: an overview

According to the "Index Florae Croaticae" (PLAZIBAT 2000) genus *Hieracium* is represented by 141 species in Croatia. Endemic to this country are at least the following species :

- *H. falcatiforme* Degen & Zahn
- *H. leucopelmatum* Naeg. & Peter
- *H. malovanicum* Degen & Zahn
- *H. mirificissimum* Rohl. & Zahn
- *H. obrovacense* Degen & Zahn
- *H. velebiticum* Degen & Zahn

A further series of taxa not known to occur elsewhere (numbering at least 20), were described from Croatia in the rank of subspecies, the great majority of them being representatives of subgen. *Hieracium*.

All those endemic taxa had been described in the period from 1854 to 1935. Most of them had been described by K. H. Zahn and his collaborators (A. v. Degen, K. Malý, J. Rohlena) who had investigated floristically the area of the present territory of Croatia since 1906 (cf. Zahn 1922–1938). Six taxa had previously been described by Nägeli & Peter (1885, 1886), and further five species by other authors (L. Vukotinović, G. Beck, R. v. Uechtritz, J. Freyn). Since 1935, no new research is known on *Hieracium* in Croatia. For most of the endemic taxa any information still is restricted to the diagnosis. Only 12 Croatian endemic taxa were mentioned in the "Flora Europaea" (SELL & WEST 1976). Additional data relating to distribution, ecology and phytosociology is lacking as well as recent taxonomic researches and nomenclature revisions.

Antun Alegro, Zlatko Liber, Ivana Sočo, Petra Cigić

A case of reversal: the evolution and maintenance of sexuals from parthenogenetic clones in *Hieracium pilosella*, an invasive weed of New Zealand

We provide evidence for the evolution of sexual populations from parthenogenetic (apomictic) progenitors, in the adventive invasive polyploid, *Hieracium pilosella*. Such a reversal from clonal to sexual reproduction is extremely unusual, and demands an explanation in terms of evolutionary theory for the maintenance of sex. We used crossing experiments to confirm sexuality, and chromosome counts and flow cytometry for ploidy analysis. ISSR and allozyme markers were employed to identify the closest relatives of sexual individuals from three sites, each comprising co-existing sexual and parthenogenetic populations. The same markers were used to estimate levels of ramet diversity, which were equally high among the parthenogens and sexuals. Despite having evolved from clones, the sexuals were not 'equal' to their co-existing progenitors in terms of morphology, seed production and two allozyme phenotypes. We discuss the evolutionary consequences of this breeding system reversal in terms of the evolution ofinvasiveness in plants.

Hazel Chapman, Gary J. Houliston, Beth Robson

Hieracia of the Pálava Biosphere Reserve (South Moravia, Czech Republic)

The Pálava Biosphere Reserve (Pálava BR) is situated in southernmost Moravia between the Dyje River and the Austrian border. It includes the Pavlov Hills and their surroundings. In an extended concept (prepared since 1998), the BR should comprise the alluvium of the Dyje river downwards to its confluence with the Morava River and the surrounding mildly modulated hill country. The region is one of the warmest and driest parts of the Czech Republic and includes a variety of habitats from thermophilous oak forests to ravine and alluvial forests, from alluvial meadows to dry grassland as well as sandy areas, surrounded mainly by arable land.

In 1992, J. Danihelka, V. Grulich, and K. Šumberová started grid recording of vascular plants[1] in the area roughly corresponding to the extended concept of the Pálava BR. The grid mapping is based on the scheme developed for C. Europa (cf. Niklfeld 1971) but the grid is further subdivided into fields of 60"×36" E resp. N (~1.36 km^2), which number 261 in the area concerned.

The *Hieracium* flora of this region has never been investigated in detail. Some records are scattered in the early Moravian floras written by Makowsky (1863), Oborny (1879, 1886), and Formánek (1897), as well as in a few papers; but only some of these records can be considered reliable. More reliable information is found in Oborny's monograph on Moravian *Hieracia* (1905, 1906) and in two occasional papers (Skřivánek 1963, Čáp 1995). All these records were summarised, together with most available regional floristic literature. Apart from field recording (see Table), the herbarium collections held in Mikulov (MMI) and Brno (BRNU) were searched for *Hieracium* specimens from the region mapped.

Subgenus *Hieracium*		Subgenus *Pilosella*	
H. bifidum	*H. maculatum*	*H. aurantiacum*	*H. densiflorum*
H. lachenalii	*H. murorum*	*H. bauhini*	*H. kalksburgense*
H. laevigatum	*H. sabaudum*	*H. caespitosum*	*H. pilosella*
H. umbellatum		*H. cymosum*	*H. pilosellinum*
		H. rothianum	

Hieracium species recorded in the Pálava BR since 1992 (taxonomy according to Gottschlich 1998)

The literature records include another eight taxa: *H. auriculoides*, *H. bifurcum*, *H. bracchiatum*, *H. echioides*, *H. flagellare*, *H. glaucinum*, *H. obornyanum*, and *H. piloselloides* (selected references: Formánek 1887, Oborny 1879, 1885, 1886, 1905, 1906, Skřivánek 1963), but some of them are probably erroneous. *H. echioides*, for instance, has probably never been collected in the study area, and all 10 revised specimens that had been originally identified as *H. echioides* actually belong to *H. rothianum*.

Hieracium bifidum is restricted to three sites on limestone rocks in the Pavlov Hills. *H. laevigatum* has a few populations in thermophilous oak forests on sand between the towns of Valtice and Břeclav (together with e. g. *Nardus stricta*). *H. cymosum* is confined to dry grasslands of the Pavlov Hills. *H. bauhini* is rather uncommon, growing mainly in man-made habitats (abandoned limestone quarries and railway stations) and is often replaced by *H. densiflorum* in dry grasslands. *H. pilosellinum* is encountered quite frequently where *H. densiflorum* and *H. pilosella* meet.*H. caespitosum* was found near the town of Lednice where it was recorded more than a century ago (cf. Oborny 1905). *H. rothianum*, so far recorded from more than 10 sites, is surprisingly common in dry grasslands. *H. aurantiacum* was found only in settlements as a rare garden escape.

Most species recorded were found in the hilly part of the study region. The alluvium of the Dyje river, by contrast, is very poor in *Hieracium* species: only *H. pilosella*, *H. umbellatum*, *H. rothianum*, and *H. sabaudum* (the latter two at one site only) were recorded over an area of 50 km^2 near the confluence of the Dyje and Morava rivers (Šumberová et al. 2000).

Jiří Danihelka

[1] This research was supported by the Grant Agency of the Czech Republic (project nr. 206/01/P115).

INFOCOMP — the Compositae types digital imaging project in Munich: *Hieracium*

INFOCOMP is a project which uses modern archiving techniques for traditional botanical resources to make them globally available. It involves the digital imaging of *Compositae* nomenclatural types and their publication on the Internet. This Munich-based project is part of the BMBF-funded ”Biodiversity and Global Change” (BIOLOG) research program and represents the first specifically funded project of its kind in Germany.

There are two parallel areas of operation: the photographic and computer work, and the library based research. On average, five images per type are taken: the original label(s), the entire sheet, relevant habit detail, and macro-images of taxonomically important features. The images are linked with text information including basionym, author, protologue citation, type status, collector, and collection number. Special emphasis is placed upon the correct and accurate citation of the protologue. The validity of the material and its status as a type is thoroughly checked in the literature.

Hieracium types form nearly a quarter of the *Compositae* types in the Munich herbarium (M). An estimated number of 720 type collections are recorded under *Hieracium* in the herbarium (*Stenotheca* 20; *Pilosella* c. 500; *Hieracium* c. 200). Additional c. 40 types from the Hans Schack herbarium are also held in Munich. The geographical distribution of the *Hieracium* types held in Munich has also been recorded.

The most significant taxonomic characters in *Hieracium* are the quantity, type and distribution of indumentum on the leaves and involucre. Pubescence is, however, notoriously difficult to image. New imaging techniques have been specially developed for the archiving of Munich's *Hieracium* types. Several alternatives using both digital and analogue formats have been tested with varying degrees of success.

The type data are gradually being completed and should be fully available over the Internet within this year.

Alison M. R. Davies, Philomena Bodensteiner, Angela Pillukat, Franz Schuhwerk

Clonal distribution of apomictic *Hieracium* subgen. *Pilosella* species revealed by mini- and microsatellite fingerprinting

The geographic distribution of five apomictic species of *Hieracium* subgen. *Pilosella*, which differ by their assumed origin and species status, has been analysed in a transect from the Erzgebirge to the Krkonoše (Riesengebirge) where their distribution areas overlap. 83 populations (239 plants) were analysed in detail (populations/plants): *H. caespitosum* (21/63), *H. glomeratum* (17/51), *H. iseranum* (21/69), *H. floribundum* (20/45), and *H. aurantiacum* (4/11).

In southern hybridisations, a human minisatellite probe (33.15) in combination with *Taq*I-digested genomic DNA produced highly variable individual-specific patterns which allowed to discriminate between single or multiple origin. Although some of the so-defined apomictic clones showed slight variation (more clearly demonstrated by a $(GATA)_5$ microsatellite probe) attributed to somatic mutations, this intraclonal variation could be neglected in comparison to the large differences between the assumed clones (near-isogenic lineages) of single origin.
The following distributions of apomictic clones were found:

- *H. caespitosum*: Unexpectedly, this species was represented by two clones only, a tetraploid (abundant in the whole region) and a pentaploid one (restricted to the Erzgebirge).
- *H. glomeratum*: Most plants formed a single pentaploid clone spreading from the Oberlausitz region to the Riesengebirge. A single tetraploid population/clone was detected in the Riesengebirge and another pentaploid one in the western Erzgebirge (the only *H. glomeratum* population that we found in that mountain range).
- *H. iseranum*: This species also consisted of a widespread clone with similar distribution like the abundant *glomeratum* clone, but six further clones were found (among them subsp. *confinium*), two even within the same population. All plants were tetraploid.
- *H. floribundum*: This species showed most lineages; two of the clones were somewhat more widespread (one in the Erzgebirge and one in the Riesengebirge), the others were local lineages. Material from the type locality did not correspond to any one of the other clones.
- *H. aurantiacum*: Only one tetraploid clone was found in the whole region.

The so-called ”Hauptarten” (*H. caespitosum* and *H. aurantiacum*) showed the least variability, comprising of 1–2 clones only in the whole investigation area. The other species (”Zwischenarten”) form stabilised clones covering broad areas and also local populations indicating polytopic origin on a different scale (e.g., few in *H. glomeratum*, many in *H. floribundum*). A certain geographic isolation between the mountain ranges (Erzgebirge/others) was present.

In some cases, the fingerprinting detected erroneously determined plants that could properly be assigned by morphological re-examination. The almost complete correspondence between genotypes and morphological findings – as expected, not all clones could be distinguished morphologically – make the DNA fingerprinting a valuable tool for the detection of apomictic lineages in *Hieracium*.

Judith Fehrer, Roman Šimek, Siegfried Bräutigam

Host-specificity investigations of phytophagous insects associated with hawkweeds

Several Eurasian species of *Hieracium* subg. *Pilosella* are weeds on pastures and in clear-cut areas in North America, i. e., *H. caespitosum*, *H. aurantiacum*, *H. glomeratum*, *H. floribundum* and *H. praealtum*, and in grasslands and conservation areas in New Zealand, i.e. *H. pilosella, H. praealtum*, *H. caespitosum* and *H. lepidulum*. Because of their mat-forming growth, hawkweeds are of limited value for stock and escape mowing successfully. They severely reduce the pastoral and conservation values of grasslands. None of the insect species that specialize on *Hieracium* spp. in Europe have been found during surveys in New Zealand indicating the potential benefits of a biological control programme. Since traditional management efforts to control invasive hawkweeds are either impractical or not economical, a biological control project was started for New Zealand in 1993. Classical biological control is the deliberate introduction of suitable natural enemies, e.g. specialized phytophagous insects or pathogens from their native range into another country to control an exotic weed. Biological weed control is founded on two broad ecological principles: that one organism can be used to control another, and that some control organisms have a limited host range. The aim is to reduce weed density to economically insignificant levels.

In 2000, a consortium of North American sponsors joined the project to develop biological control of exotic hawkweeds in Canada and the US. Differences in the two programmes are (i) a different range of weedy *Hieracium* species which partially overlap, and (ii) the presence of native North American *Hieracium* species whereas hawkweeds are not indigenous to New Zealand. One major step in a biological control programme is the study of the host-specificity of the natural enemies to ascertain their safety. The current project is managed in two approaches: Firstly, all five insect species screened for New Zealand – all of them received authorisation to be released in New Zealand – are tested on native North American plant species including native hawkweeds to see whether they are at risk. The gall wasp *Aulacidea subterminalis* galling only *H. pilosella* and *H. aurantiacum* is probably the most specific insect. Gall formation of *Macrolabis pilosellae*, a multivoltine gall midge, occurs only under no-choice conditions to a certain extent on some native North American *Hieracium* species but not under less restricted conditions. This insect has the potential to gall a variety of invasive *Hieracium* species as e.g. *H. pilosella*, *H. piloselloides*, *H. glomeratum* and *H. floribundum*. The remaining three insects, *Cheilosia urbana*, *Cheilosia psilophthalma* (*Diptera, Syrphidae*) and *Oxyptilus pilosellae* (*Lepidoptera, Pterophoridae*) need more testing to obtain conclusive results.

In a second approach, surveys were made in Europe to explore phytophagous insects associated with *Hieracium* species that are weeds in Canada and the USA.

Gitta Grosskopf

Distribution patterns of *Hieracium* (*Pilosella*) echioides in Lithuania and problems of its protection

Hieracium (*Pilosella*) *echioides* is distributed in Central and Eastern Europe and in the steppe zone of Asia. Western limits of its distribution reach C. Germany, the Czech Republic and E. Austria. Separate northernmost localities of this species are registered in the Leningrad region of Russia (Sell & West 1976; Peckert & Chrtek 2000; Sennikov 2000). In Latvia and Estonia *H. echioides* is a very rare species, the occurrence of which is documented by old literature data and herbarium specimens (Kuuk 1999; Gavrilova & Šulcs 1999).

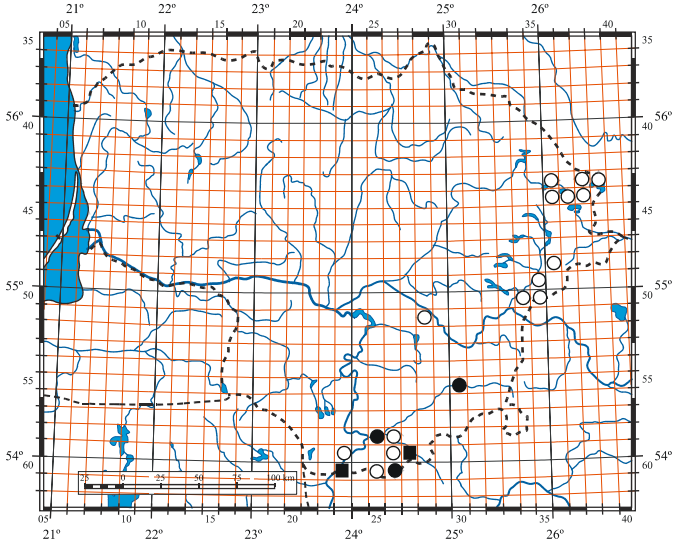

Fig. 1. Distribution of (●) *Hieracium echioides* and (○) *H. rothianum* in Lithuania, (■): both species.

In Lithuania *Hieracium echioides* formerly was reported (Snarskis 1954; Lazdauskaitė & Lekavičius 1980) to occur in southern as well as eastern parts of the country. However, revision of the herbarium specimens revealed that collections from the eastern districts in fact belong to *H. rothianum* – an intermediate taxon linking *H. echioides* with *H. pilosella*, whereas localities of *H. echioides* are concentrated mainly in the southern part of the territory. It grows on well-illuminated slopes, on the edges of pine forests, and in open dry grasslands on sandy (usually calcareous) soils.

Search for *Hieracium echioides* was unsuccessful so far in eastern districts, where *H. rothianum* is sparsely distributed. Thus, it may be presumed, that (i) *H. echioides* is extinct due to introgression of *H. pilosella*, or (ii) *H. echioides* has never occurred in this region, but *H. rothianum* has its own distribution range not overlapping with the range of its one parental species. The former hypothesis may be favoured, and recent hybridisation of *H. echioides* and *H. pilosella* may be presumed at least in South Lithuania, where the extinction of *H. echioides* is definitely known for some localities but its former occurrence confirmed by herbarium specimens. In some places *H. echioides* was recorded in 1950s–1960s, but now only *H. rothianum* is known.

Hieracium echioides is included in the Red Data Book of Lithuania (Lygis 2000) as a rare species. Its largest populations are situated in protected areas such as Dzūkija National Park, Čepkeliai Strict Nature Reserve, but it seems that passive measures may be insufficient to ensure its protection. The main threat for *H. echioides*, apart from direct destruction of habitats and populations, is hybridisation with *H. pilosella* that usually is abundantly present in the same habitats.

Zigmantas Gudžinskas

NATOH – a new database

The present database – an information system relating to nomenclatural and taxonomic data – has evolved in connection with work linked to a new edition of the ”Liste der Gefäßpflanzen Mitteleuropas”. The data base NATOH is designed to contain such information linked to the genus *Hieracium*, hence the name (Names And Taxa Of Hieracium). It should help to master the chaotic nomenclatural situation in this genus (with thousands of published names), and to manage taxonomically important data in a flexible manner.

The aim was therefore to present a structure for all relevant nomenclatural information of scientific plant names connected with *Hieracium*, as are those related to the first publication, to rank and nomenclatural state, and to typification. On the other hand the data base should harbour essential data published for taxa of *Hieracium* such as geographic distribution, chromosome numbers, etc. A fundamental trait is the separation of these two fields notwithstanding a common name list as a basic structure.

The basic name list contains, besides generic names, the epithets of infrageneric, specific, and infraspecific combinations with their ranks attached to them. Infrageneric and specific epithets are related to their generic name, as are infraspecific ones to the binominal species combination. Each data set comprises in addition author(s) of the name (combination), bibliographic reference and publication date, nomenclatural state (validity, legitimacy), and relates either to type properties, or to the basionym. Standardised abbreviations for name authors, for journal titles (according to B-P-H) and monographs (according TL-2) are provided by lists linked to the database, or can be added to it. Likewise, a standard set of expressions (such as nom. illeg., etc.) is available, that covers all cases necessary to evaluate the formal nomenclatural state of the name, and can quickly be supplemented by the corresponding ICBN article. For each of these settings (name, nomenclature, type information) an additional text field is open for supplementary notes, and nomenclatural additions (as e. g. lectotypification) can be related to a bibliographic database linked with NATOH.

Taxonomic data are linked to taxa, defined by authors (usually those of monographs or floras), not simply to names represented by types only. Taxa are defined, in the database NATOH, by a name (supplied by the basic name list) in conjunction with a certain publication (linked to the bibliographic database mentioned). This renders a possible ”formal” input of data independent of present knowledge or ignorance, but allows further expert evaluation and correction at any time. The data (relating to chorology, chromosome numbers, etc.) stored in this manner may be used, updated, or shifted to their taxonomically ”correct” box.

To make these data useful not only to the expert but also to the botanical community, they have to be related to taxa presently acknowledged, applicable in practice, and incorporated in a systematic scheme that should represent a ”consensus taxonomy”, agreed by a majority of serious Hieracium taxonomists, but permanently open to emendation and refining.

Walter Gutermann

Catalogue of *Hieracium* and *Pilosella* specimens from the British Isles in the Welsh National Herbarium (NMW)

This catalogue makes available the data from 5655 *Hieracium* and 506 *Pilosella* specimens from the British Isles held in the Welsh National Herbarium (NMW) up to December 2000 (see also RICH 2000). The majority of the British and Irish *Hieracium* material was verified by D. McCosh.

The *Hieracium* collection is at least nationally important and contains one of the top three collections of British hawkweeds. It contains a number of type specimens, mostly taken from Pugsley (1948). The main collection is that of W. A. Shoolbred (1852–1928), a physician from Chepstow, who was one of the main hawkweed workers of his day. By himself, or with E. S. Marshall, he collected numerous specimens mainly from Scotland. The *Pilosella* collection is not of especial note in its own right.

The computerised data include information abstracted from the labels as well as determination and revision to current taxonomy.

Any *bona fide* research worker is welcome to visit the collections.

Scott Hand, David McCosh, Tim C. G. Rich

The rôle of the environment on residual sexual reproduction in facultative apomictic *Hieracium pilosella*

Hieracium pilosella is a problematic invasive weed in much of the New Zealand high country. Up to 1 million hectares of land are infested to the point that this is the dominant species (Hunter 1991), and estimates have put the cost of this species to New Zealand agriculture at up to 40 million US dollars per annum. Due to the immense costs to both agriculture and conservation, there is considerable interest in this group in New Zealand.

My research focuses on whether the environment plays a role in the expression of facultative apomixis in *Hieracium pilosella* under field conditions. My research has involved recording the levels of sexual reproduction in field populations of *H. pilosella* by artificially pollinating with *H. aurantiacum.* The resulting progeny of the putative crosses were grown to flowering, and the progeny examined for morphological traits that would indicate hybrid origin, and therefore sexual reproduction (Houliston & Chapman 2001). The sexual origin of these plants was also confirmed using RAPDs and flow cytometry.

This experiment was carried out over a total of seven field sites for the three years of the study, making it possible to identify relationships between environmental parameters and the rate of residual sexual reproduction. Three of the field sites were chosen due to their close proximity to weather stations. From these sites it was possible to compare the levels of temperature, rainfall and relative humidity with the frequency of sexual reproduction. The time period of interest was the seven days prior to capitula anthesis, as this is thought to be the critical period for development of the ovule in this species (Koltunow 2000). We hypothesised that if an effect of environment was to be found, the conditions during this period would be most informative. Analysis of these data has shown that the level of residual sexual reproduction in New Zealand populations of *H. pilosella* increases as temperature and rainfall increase. It was also found that a strong genetic component explained a large amount of the variation in this trait among populations.

Further work investigated the relationship between the level of residual sexual reproduction and population genetic variation, as detected by ISSRs. Significantly higher population genetic variation was found in populations with a higher proportion of sexually produced progeny over the three field seasons investigated. This indicated that recruitment of sexual seed into populations plays an important and significant role in determining population structure. Also discovered was a considerable amount of between population differentiation, with no shared clones found in the three populations examined. This has been further confirmed from flow cytometric analysis of populations, with significant differences found between DNA ploidy level at the pentaploid state.

Gary J. Houliston

Diversity in breeding system in *Hieracium* subgen. *Pilosella*: comparison of experimental and field data

The diverse mode of seed production contributes significantly to a complicated pattern of variation in this polyploid agamic complex. Moreover, the different ways giving rise to seed progeny can be combined within one individual female plant. Both the sexual reproduction (allogamy, which can be accompanied by autogamy) and apomixis (i. e., the asexual seed production) are known to operate in subgenus *Pilosella*. Apomixis is of the aposporous type, but with autonomous development of endosperm. Pollination, therefore, is not necessary for endosperm formation and successful seed production. Since apomixis in *Pilosella* is often facultative, one female plant can produce seeds in both, sexual and asexual, ways. In addition, two different mechanisms occur there, which give rise to seed progeny without fertilisation: somatic parthenogenesis (the embryo develops from an unreduced egg cell and haploid parthenogenesis (the embryo develops autonomously from a reduced egg cell). While the former way maintains the mother genome (including the ploidy level), the latter is connected with meiosis, possible recombination and reduction of mother ploidy level to a half.

The demonstration of the breeding system is impossible without experimental work. All ways of seed production mentioned above were recorded in experiments with *Pilosella*, and the capability of diverse modes of reproduction was proven in this way. The hybridisation experiments resulted in hybrid progeny, which were compared with corresponding types from nature (e.g., Peter 1884, Gadella 1991, 1992). New cytotypes, different from parental ones, were recorded among progeny of experimental crosses (e.g. Gadella 1987, 1988, Chapman & Bicknell 2000, Krahulcová & Krahulec 2001), demonstrating the participation of unreduced gametes on the origin of highly polyploid hybrids. The self-fertilisation, operating under the influence of foreign pollen, was recorded in two sexual species, *H. pilosella* and *H. lactucella* (Krahulcová et al. 1999). The facultatively apomictic species (as e. g. *H. aurantiacum*, *H. caespitosum* and *H. praealtum*) hybridise both as male and as female parent (Chapman & Bicknell 2000, Krahulcová & Krahulec 2001, unpubl. data). The variation in asexual seed production, including the formation of polyhaploid progeny *via* haploid parthenogenesis, was demonstrated in experiments with *H. aurantiacum* (Skalińska 1971, Bicknell 1997), *H. rubrum* (Krahulcová & Krahulec 2001) and *H. brachiatum* (Krahulcová & Krahulec, unpubl. data).

In the field, it is more difficult to reveal the origin of particular individuals, the parents of which are unknown. In such populations, where both the putative parents and their hybrids occur together, recent hybridisation events can be studied and documented. A shift to more frequent sexual reproduction (and hybridisation) is evidently important for adaptive radiation in New Zealand populations of *H. pilosella* (Chapman & Brown 2001). The capability for hybridisation in this facultative apomict was evidenced in field experiments in New Zealand (Houliston & Chapman 2001). Study of the expression of sexual reproduction and its correlation with environmental conditions is now in progress. The first case of a polyhaploid progeny (as a seed) was demonstrated in *H. rubrum* from nature (Krahulcová & Krahulec, unpubl. data). The feasibility to detect in nature the origin of rarely recorded highly polyploid hybrids, and of the putative polyhaploids, is discussed.

Anna Krahulcová, František Krahulec

The Sudetic group of *Hieracium* subgen. *Pilosella*: a synthesis

Detailed research on the Sudetic group of *Hieracium* subgen. *Pilosella* has recently been carried out at Görlitz and Průhonice. It included population and species-level studies based on the following methods: studies of karyology and breeding systems, DNA-based studies (haplotypes, fingerprinting), and isozyme studies. This complex research allowed us to make the following conclusions:

● The agamic complex of Sudetic species is composed of the following basic species:
Sexual diploids: *H. lactucella, H. onegense, H. cymosum* subsp. *cymosum*;
sexual tetraploids: *H. pilosella*;
apomictic tetraploids: *H. caespitosum, H. aurantiacum*.

● This complex involves common types which behave as independent apomictic entities, and rare types, probably the results of recent hybridisation events.
The common types are: *H. glomeratum, H. schultesii, H. floribundum, H. iseranum, H. piloselliflorum, H. rubrum, H. blyttianum, H. cymosum* subsp. *cymigerum*. This group represents already established hybridogenous species, some of them produced by recent hybridisation events (*H. schultesii, H. piloselliflorum*, *H. cymosum* subsp. *cymigerum*).
The rare ones involve: *H. dubium, H. macranthelum, H. macrostolonum, H. tubulascens, H. fuscoatrum, H. stoloniflorum*, and a diploid type corresponding to *H. floribundum* (probably the recent hybrid between *H. onegense* and *H. lactucella*). These rare types are usually represented by one population only, or very rare individuals dispersed within populations of other types.

● Most of the polyploids are represented by one common and one or two rare cytotypes.

● It is evident that most of the hybridogenous species with broader distribution are of polytopic origin (originated several times). There are big differences in number of types and scale, where this phenomenon is expressed. This phenomenon is documented by different cytotypes, different isozyme- and fingerprinting-based phenotypes.

● There is growing evidence that at least some of the hybridogenous species might be of polyphyletic origin. Repeatedly, the same phenotype has been obtained from crossings involving different parent species. The differences in haplotypes of *H. piloselliflorum* suggests this phenomenon occurs in the field, too.

Evidence obtained from hybridisation experiments and haplotype studies allows us to suggest the detailed history of individual members of the agamic complex. For example, hexaploid *H. rubrum* seems to result from a combination of unreduced female gametes (egg cells) of tetraploid *H. aurantiacum* and diploid pollen of *H. pilosella*; pentaploid *H. stoloniflorum* was probably produced by reduced gametes of *H. rubrum* and *H. pilosella* (the mother plant should be determined by haplotype study).

František Krahulec, Siegfried Bräutigam, Judith Fehrer, Anna Krahulcová, Jindřich Chrtek, Roman Šimek

Pollen shape and size in *Hieracium* and related genera

In apomictic taxa, the male meiosis can result in normal reduced pollen grains, but also various disturbances can occur, leading to unequal pollen grain size and shape, or even to full male sterility (Rutishauser 1967). These irregularities have been often used as indication of apomictic reproduction (cf. Tschermak-Woess 1949). The fact that little attention has been given to pollen grain size and shape in the genus *Hieracium* led us to study this problem in detail. The aim of our present study was to look for relationships of pollen production, pollen grain size and shape, ploidy level, and mode of reproduction. We have also compared *Hieracium* in this respect with other related genera such as *Pilosella*, *Andryala* and *Tolpis*.

Pollen samples were taken from unopened capitula both from herbarium specimens and living cultivated plants with mostly known ploidy level. Acetolysed pollen grains were subjected to measurements and observation of basic descriptive characters using light microscopy.

Preliminary results presented here are based on more than 80 plants belonging to nearly 40 taxa. Diploid, sexually reproducing taxa of *Hieracium* s. str. were found to produce large amounts of normal pollen grains (3-zonocolporate) of equal size, which is in agreement with data obtained for the genus *Taraxacum* (Tschermak-Woess 1949). Some triploid and tetraploid taxa of *Hieracium* did not produce any pollen at all, or produced only malformed pollen grains with sporopollenine remnants. Other polyploid representatives of this genus produced a lower amount of pollen of equal size as compared with diploid taxa. Some of these pollen grains were found 4-zonocolporate (with 4 apertures), or of various malformed shapes, or with abnormal exine structure (e.g. with poorly developed ridges and echinae), in agreement with data published on *Taraxacum* (Blackmore 1984). Generally, pollen producing tetraploid taxa showed a higher number of pollen grains compared to pollen producing triploids. The comparison of the size of pollen grains on taxa of *Pilosella* and *Hieracium* brought interesting results. Pollen grains of species of *Hieracium* were bigger than those of *Pilosella* at the same ploidy level. Pollen grain size is probably closely related to DNA content of the nucleus, and differentiation in this character may support separation of *Pilosella* and *Hieracium* as genera. The small size of pollen of *Pilosella* was similar to that of the genus *Andryala* and *Tolpis staticifolia* (All.) Schultz Bip.

Patrik Mráz, Katarína Kovalčíková, Karol Marhold

The *Hieracium gymnocephalum* complex: a taxonomic revision

The group of *Hieracium gymnocephalum* (sensu stricto) is present in subcontinental and oro-mediterranean mountain ranges of the western Balkan Peninsula (Hercegovina, Montenegro, Kosovo, Albania, W. Macedonia (FYR), and an isolated locality in NW Greece), with a diversity centre in the mountains of Montenegro. According to Zahn's classification (1921, 1936), this group belongs to the Balkan-Anatolian sect. *Pannosa* (characterised by extremely plumose indumentum). After the pioneer works by Pantocsek (1873), Freyn (1895), Kerner (1874), Zahn (1921, 1936) and others, no attempts have been made to review these taxonomic groups, although the necessity of such an action was pointed at by Buttler (1991). Many years of our own field research as well as the revision of the pertinent materials of nearly all European herbaria with important Balkan collections have supported this claim completely. According to our preliminary results, this aggregation is composed of 4–5 independent species: *H. gymnocephalum*, *H. orienii*, *H. blecicii*, *H. spirocaule*, *H. paratrichum* (the last three being new to science). The precise position of Zahn's *H. g.* "subsp. *laxipellitum*" (from now: SW. Montenegro) has not yet been determined. The same author has shifted his "subsp. *anastrum*" later (1936) to *H. pichleri*, which was well justified. The matching of several remaining minor taxa described by Zahn with the species mentioned is difficult (though possible to estimate), as most of Zahn's original material was destroyed, and detailed data on the distribution of these forms and varieties are missing in the protologue.

The present work includes the main diagnostic, morphometric and phytochemical results, together with a detailed presentation of the chorological pattern. As suggested by the epithet of the main species, the significant differential character of the group is its mostly glabrous involucre. However, there is never a complete absence of phyllary hairs in these populations. Although these hairs are very scarce (there may be even only one in a whole capitulum), their type and distribution represent important diagnostic characters. This is also true for other morphometric and qualitative traits of generative and reproductive organs, which were tested by multivariate and correspondence analyses.

One of the main goals of this research was to determine basic morphological characters, variability, and geographic distribution of *H. gymnocephalum* itself. All populations show at least some long and usually very sparsely distributed glandular hairs on the involucre. It is important to note that populations of *H. gymnocephalum* are significantly rich in individuals, and the areas of the other species are included within the range of that species. It is interesting that these species often grow alongside each other in the same habitat, and this fact may be helpful for a more precise account of their ecological and phenological differentiation.

Most similar to the type species is *H. blecicii*, which often develops in an aberrant fashion (lower stature, less hairy leaves, tubular ligules), and rarely constitutes independent populations. Analysis of flavonoid content has shown great similarities with *H. gymnocephalum*, but there are also certain differences. Further analyses will have to determine the definitive status of this taxon. The remaining three species, *H. orienii*, *H. spirocaule* and *H. paratrichum,* are clearly distinct, both according to morphological characters (indumentum type of phyllaries, leaves etc.) and ecological requirements (somewhat more arid habitats). Additionally, they often grow as separate populations. So far they were recorded only from Montenegro (and Herzegovina: *H. paratrichum*). All the information gathered so far points to a hybrid origin of these taxa. They may represent members of "hybridogenous lines" towards the groups of *H. prenanthoides*, *H. naegelianum* and *H. pannosum*. Further research is needed in order to determine the validity of this hypothesis.

Marjan Niketić

Morphology and karyology of *Hieracium echioides* and *H. rothianum* in Central Europe

Hieracium echioides occurs in three ploidy levels (diploid, triploid, and tetraploid, x = 9) in Central Europe. Co-occurrence of two or three cytotypes was detected at some localities in Southwest Moravia and in adjacent Austria. More than one ploidy level was also ascertained at some localities in Central and Northwest Bohemia. Diploids only were found in North-eastern Germany, Poland and East Slovakia, at localities with relict character.

With respect to morphology, *H. echioides* is a rather homogeneous species within this region. However, a distinct type is represented by populations from Northeastern Germany and adjacent areas of Poland, characterised by dense long patent hairs on the upper part of the stem and on the peduncles. In contrast, plants from the Czech Republic, Slovakia, Austria and Hungary usually show only scattered hairs (or even none) on the upper part of the stem and on the peduncles. Plants from South Slovakia constitute another quite different type. The latter were proven to be apomictic tetraploids that markedly differ by having smaller flower heads, thinner and longer leaves and less rigid hairs. Revision of herbarium material revealed other similar types occurring in Hungary.

Hieracium rothianum is an agamospermous tetraploid species with conspicuous morphological variability within populations. Most variable characters are the presence/absence of glandular hairs in the inflorescence, the number and length of heads and the number of stem leaves. Polytopic origin and introgression from other sympatrically occurring species of subgen. *Pilosella* are suspected at some localities. Hybrid plants between *H. echioides* and *H. rothianum* were found in the Czech Republic.

Tomáš Peckert

Distribution and conservation [2] of rare British hawkweeds

● *Hieracium holosericeum* Backh. (sect. *Alpina*) is an endemic alpine plant that is widespread and locally frequent in the Scottish Highlands but occurs more rarely in southern Scotland, the Lake District and Snowdonia. Historical records indicated between five and seven sites, and it was locally abundant in at least some of those. A project between the National Museums & Galleries of Wales and the Countryside Council for Wales was established to determine its current status. Field surveys[3] in 2000 revealed only seven patches in two sites, though another recent site remains to be revisited. The most likely cause of the decline is over-grazing. The shyness of flowering in the wild may be a consequence of sub-optimal climatic conditions, and longer-term there may be significant implications for its survival from global warming. Further surveys are planned in 2002.

● *Hieracium cambricum* (Baker) F. J. Hanbury (sect. *Oreada*) is known only from three sites in Wales (Rich 2000). It is probably extinct at Treorchy; 38 plants were refound at Llangollen (the first time it has been recorded since 1907). It is well known on the Great Orme, where 75 plants were found scattered along a c. 25% sample of sites along 2.5 km of cliff. At the Great Orme and Llangollen *H. cambricum* is? a member of the open limestone rock crevice communities, and may have been on basic rocks ledges on Pennant Sandstone at Treorchy.

● *Hieracium radyrense* (Pugsl.) P. D. Sell & C. West (sect. *Vulgata*) is a very rare endemic species of South Wales, recorded from at least three sites in Glamorgan. In Radyr in 1998, a total of nine plants was found in one garden where it grows on grassy banks and lawns, often in shade. It was not found at the type locality of Radyr Quarry where it was last seen in 1985. At Bridgend, six plants were found on an old garden wall, but the identification has not been resolved.[4] Neither the species nor the sites have any legal protection, and it could be under significant threat of survival in the long term from inappropriate gardening. This is one of the rarest species in Britain. Seed has been sent to the Millennium Seed Bank, and plants are being cultivated.

● *Hieracium cillense* (sect. *Vulgata*) is a rare endemic species confined to cliffs around Craig y Cilau National Nature Reserve (NNR), Brecon, in South Wales. It was first found in the 1890s and named as a variety, and was later raised to species status. It is easily recognised by the dense stellate hairs covering the leaves. There was a decline of plants reported from the NNR from 253 (in 1975) to 204 (in June 2000). However, another 263 plants were found in an extension of the population to the east outside the NNR. As half of the sole population is included within an NNR and the other half is on cliffs, mostly inaccessible to sheep, it is not at significant risk (Rich 2002).

● *Hieracium linguans* (Zahn) Roffey (sect. *Tridentata*), known since 1898 from 4 localities, was so rare that it was included in the 1999 *Vascular Plant Red Data Book*, but the most recent record was 1957 and nobody knew if it was still present. After learning how to identify it from our collections and researching the old records, we set out to re-find it. Eventually eighty plants were found on one waterfall in Cwm Haffes, its only remaining site. This must rank as one of Wales' rarest plants (Rich & Motley 2001).

● *Hieracium tavense* (W. R. Linton) A. Ley (sect. *Foliosa*) is restricted to one site in Wales, in the Upper Tawe Valley, Brecon. It grows on base-rich ledges of a waterfall where thirteen plants were counted by climbing. The only real threat to its survival is a rock fall. Seed has been deposited in the Millenium Seed Bank, and it is being grown in cultivation (Rich & Houston 2000).

Tim C. G. Rich

[2] Part of a collaborative project on conservation and ecology of critical species. This work was jointly funded by Cardiff County Council and the National Museum and Gallery, Cardiff.
[3] with Scott Hand.
[4] Investigations by George Hutchinson & Tim Rich.

Chromosome numbers and breeding systems of *Hieracium bauhini* (s. l.) in Central Europe [5]

Hieracium bauhini is a collective species distributed from NE. France to C. Russia, in the southeastern part of its range reaching the Caspian Sea, and from the Balkans and Turkey in the south to S. Finland in the north. In course of the present study, chromosome numbers and reproductive mode in populations from Central Europe were investigated. The study included plants from the Czech Republic (40 populations), Slovakia (8 populations), Hungary (3 populations from limestone highland in N. Hungary), Poland (2 populations from a limestone area near the city of Krakow), and Romania (1 population); each population was represented by 3–5 (in some few cases only 1 or 2) individuals.

Three ploidy levels were detected among 160 plants from 54 populations: tetraploids, pentaploids, and hexaploids. Pentaploid plants prevailed in populations from the Czech Republic. Plants from the southeastern part of the area, namely from Slovakia and Hungary, were mainly tetraploid. Hexaploids seem to be rare: they were detected only in a few populations from the Czech Republic and Slovakia. In the Romanian population, very similar tetraploid and hexaploid plants were found; a similar mixed population, with tetraploids and pentaploids, was found in Biele Karpaty Mts., Slovakia. Also in the Bílé Karpaty, on Czech territory, two populations were found with pentaploid and hexaploid plants occuring together.

The mode of reproduction was studied from one to three plants per population. In total 16 populations were investigated. Tetraploid plants reproduced sexually, whereas pentaploids and hexaploids were apomictic. In one population of pentaploid plants from the Bílé Karpaty Mts., Czech Republic, more achenes were yielded from open pollinated heads than from bagged heads. This may be due to an apo-amphimictic mode of reproduction, but chromosome counts in seedling are needed to confirm this hypothesis.

An additional 18 plants from 8 localities of probable hybrid origin, and morphologically linked to *Hieracium bauhini* and *H. cymosum*, were studied. They are classified as *H. densiflorum* and occur frequently in south Moravian dry grasslands. All were tetraploid; in two populations sexual mode of reproduction was discovered.

Olga Rotreklová

[5] This study was supported by the Ministry of Education of the Czech Republic, research project no. 143100010.

Hieracium subglaberrimum – a peculiar hawkweed of the northern Alps

About 150 ago Sendtner had discovered this hawkweed when collecting materials for his famous ”Vegetations-Verhältnisse Südbayerns”, and first classified under *Hieracium villosum* (Sendtner 1854). Later Naegeli & Peter (1886) described it and shifted it as subspecies but under *H. glabratum*, noting its curiousity as ”eigenartige Variationsrichtung”. Only in 1921 was this raised to species rank by Zahn, who, however, combined under this name all those taxa that already had been described as *H. sparsiramum* (s. l.). These hawkweeds show attributes characteristic for members of sect. *Drepanoidea [Glauca]* but variously combined with some features pointing to sect. *Villosa*.

Hieracium subglaberrimum is reminiscent of smaller plants of *H. bupleuroides* (which, however, is usually more hairy, with hairs distinctly blackish at base). In overall appearance and glabrousity of the lower parts of the plant it is indeed very similar to *H. glabratum*, but exhibits significant differences in its involucrum. While the latter shows a distinctly ‘villosoid’ indumentum, the involucrum of *H. subglaberrimum* is very sparsely hairy (as suggested by the epithet). Apart from the tomentum-like characteristic ‘glaucoid’ pubescence confined to the lower part of the phyllaries (and the peduncles), there are only few singular long hairs (up to 5 mm) though the long-acuminate tips of the phyllaries are usually bearded or at least prolonged by a single hair (of 0.5–1.5 mm). Its most peculiar feature is, however, a crown of minute hairs around the achene apex just below the pappus rays, so far otherwise observed only in *H. bupleuroide*s. Very characteristic (though easily observable only in living material) are the distinctly spreading phyllaries of the head when entering the fruiting stage.

In comparison with the taxa of *Hieracium sparsiramum* (s. l.), and in addition to the above mentioned attributes, the stem of *H. subglaberrimum* is furnished with stellate hairs nearly to the base (confined to the upper third, or to the peduncles, in the former species and in *H. bupleuroides*), and the middle stem leaves are distinctly ovate, widest in the lower third (as in *H. sparsiramum* subsp. *halense*; narrowly ovate to lanceolate in subsp. *sparsiramum*). In both these Bavarian representatives of *H. sparsiramum* the involucrum is moderately to abundantly hairy, the phyllaries are less pointed, but rarely ending in a hair (of at most 0.5 mm), and usually provided with some glandular hairs (missing in *H. subglaberrimum*).

Hieracium subglaberrimum (s. str.) seems to be confined to the Northern Calcareous Alps between the rivers Rhine and Lech. At present it is reliably known from Bregenzer Wald, Lechquellengebirge and the western part of Allgäuer Alpen; localities from outside of this area quoted by Zahn (1930) remain doubtful until verification. The responsibility for the conservation of this rare endemic hawkweed rests, apart from a few spots in Germany (Bavaria), especially at Austria (Vorarlberg) where also the type locality is situated at the eastern slopes of ”Gottesacker” in Kleinwalsertal.

Since the original material obviously is lost (probably through A. Peter in Göttingen), we tried to recover the hawkweed in its type locality fortunately well localised by Sendtner (”ober der H[G]ierenalpe ...”) with an exact altitude (”4963' ” = 1612 m) above sea-level. In 2001 we were lucky to find it at the very place, to re-collect it and thus to provide a neotype (from: ”Karst-Gelände 0,6–0,8 km WNW oberhalb der Jagdhütte bei der ehem. Schneiderküren-Alpe ... 1650–1670 m”) for nomenclatural purposes. Plants from this place taken into cultivation (Botanical Garden, Munich) show a chromosome number of 2n = 27 (five counts by E. Vosyka, Institute for Systematic Botany Munich).

Franz Schuhwerk, Walter Gutermann

Past and present of *Hieracium* studies in Finland

The history of *Hieracium* studies in Finland started with early articles of the famous phytogeographer and lichenologist Juhan Petter Norrlin (1842–1917), who began his *Hieracium* studies with floristic notes and reports on Finnish taxa of *Pilosella* (1870–1884). He also was among the very few botanists of the 19th century who treated *Pilosella* as a separate genus, which status is currently adopted in Finland. The early work by Norrlin was definitely based on the monographs by E. Fries, but the attempt to describe all possibly dissimilar morphotypes was quite different. For the new taxa, the ranks of both species and subspecies were used by Norrlin to indicate the variability of the taxa. The number of *Hieracium* and *Pilosella* species described by Norrlin exceeds 500; these novelties were published in 18 papers and exsiccata. The last Norrlin's article dealing with the Siberian material was published posthumously in 1928. Norrlin's method of *Hieracium* treatment was to recognize morphotypes possessing a certain geographical area, on the basis of studies on rather large territories, and to produce keys and comparative descriptions for all the species accepted. Most species in *Hieracium* accounts in Mela's manuals have wide distributions, but some more local taxa were briefly mentioned in notes. Since 1900, Norrlin was assisted by Harald Lindberg (1871–1963), who accepted all Norrlin's taxa in his list of plants native to East Fennoscandia. Lindberg arranged many Norrlin's "microspecies" as subspecies with varieties subordinated within broadly defined (aggregate) species.

After Norrlin's death, one of his pupils, Alvar Palmgren (1880–1960) carefully checked and properly labelled Norrlin's *Hieracium* herbarium kept mostly separate in H, where many specimens initially had plant names not on original labels but on covers only. Palmgren went through the whole *Hieracium* collection at least twice, in 1920's and in 1950's, checking most of the Finnish specimens and making a revision of sect. *Oreadea*, but unfortunately he did not publish any of his findings.

Another prominent Finnish *Hieracium* expert, Mårten Magnus Wilhelm Brenner (1843–1930), in contrast to Norrlin, based his numerous (23, rather voluminous) contributions almost exclusively on his own collections. He published some critical regional *Hieracium* floras of Finland, and also occasional contributions and corrections from his collection, which was kept privately and therefore almost inaccessible to other botanists. Brenner described almost 300 *Hieracium* species, most of which were not mentioned since their original publication but in his own papers. After Brenner's death his collection was incorporated in H, still being kept mostly separate.

Among other Finnish botanists, considerable attention to *Hieracium* was paid by Thiodolf Saelan (1834–1921) and Edvard August Vainio [Wainio] (1853–1929) who both made significant collections at the early phase of *Hieracium* studies, and tried to recognise some species themselves. Juho Pekkarinen (1850–1932), a skillful amateur from Kuopio, created a significant *Hieracium* collection in the Kuopio Museum of Natural History (KUO). After 1930, *Hieracium* studies in Finland were very seldom published. Only a few papers appeared, mostly dealing with local floras. At present, the tradition of local taxonomical activities on Finnish *Hieracium* has declined.

In total, 3276 *Hieracium* and *Pilosella* names were published or mentioned in 90 articles by Finns or in the Finnish literature. Such a nomenclatural luggage burdens seriously the next attempt to produce taxonomic accounts and keys. At the moment, a nomenclatural revision has been recently published, to precede taxonomy in this case (Sennikov 2002); a typification work will follow thereafter.

Alexander N. Sennikov

On *Hieracium villosum* and some related taxa in the Western Carpathians

Hieracium villosum Jacq. belongs, together with its intermediate taxa, to the most interesting groups of mountain hawkweeds in the Western Carpathians (Slovakia, S Poland). We examined pattern of morphological and genetic (using isozyme analysis) variation, chromosome numbers and modes of reproduction of *H. villosum* (16 populations), *H. scorzonerifolium* Vill. (*H. villosum* ≥ *H. bupleuroides*, 2 populations), *H. dentatum* Hoppe (*H. villosum* ≥ *H. bifidum*, 2 populations) and in one still unnamed and taxonomically unclear taxon resembling (but not fully identical with) *H. valdepilosum* Vill. (*H. villosum – H. prenanthoides,* 6 populations).

Based on morphology, chromosome numbers, and multilocus isozyme genotypes, 5 types were recognised within *H. villosum*. Generally, all of them are geographic vicariants; a co-occurrence of two types was observed at only three localities. The most widespread type, corresponding to *H. villosum* subsp. *villosum*, proved to be an apomictic triploid (2n=27) with aborted pollen; no genetic variation was discovered. The remaining types are apomictic tetraploids (2n=36) with viable pollen grains, confined to rather small geographic areas. Both intra- and interpopulation genetic variation was detected in two of them; the remainig two are homogeneous in this respect. One of them shares the same multilocus isozyme genotype with *H. villosum* subsp. *villosum*; genotypes of two other differ remarkably from *H. villosum* subsp. *villosum* by occurrence of unique alleles.

Hieracium dentatum was found to be an apomictic tetraploid with surprisingly the same genotype as detected in *H. villosum* subsp. *villosum*. The same chromosome number and mode of reproduction was found in *H. scorzonerifolium*; comparison of isozyme genotypes of *H. scorzonerifolum* and its putative parent species (*H. villosum* and *H. bupleuroides*) supports the hypothesis about its hybrid origin. A geographic pattern of both morphological and genetic variation (more or less different races in particular mountain ranges of the Western Carpathians) was detected in a still unnamed taxon from the vicinity of *H. valdepilosum*; both triploids and tetraploids were found.

In addition, two remarkably distinct isozyme genotypes were found in *H. bupleuroides*. No relationship between genotypes and morphology was observed; on the other hand, geographic areas of particular genotypes are vicariant.

The observed variation pattern of *H. villosum* resembles generally that of some other ”Hauptarten” of *Hieracium*. The core taxon (*H. villosum* subsp. *villosum*) is surrounded by tetraploid apomictic (but pollen-producing) lineages that show some morphological characters of other *Hieracium* species (nevertheless, they cannot be treated as ”Zwischenarten”, because they are very similar to *H. villosum* subsp. *villosum*). Their origin is difficult to trace; further detailed studies can perhaps elucidate particular evolutionary processes.

Michal Severa, Jindřich Chrtek

Phytocenological characterisation of Romanian *Andryala* and *Hieracium* species

The vascular spontaneous flora of Romania is a relatively rich one, representing approximately one-third of the European flora (excl. the European part of the former Soviet Union). The most recent Romanian flora (Ciocârlan 2000) counts 3136 vascular plant species, and 840 subspecies; in addition, there are ca. 500 hybrids. With at least 56 species *Hieracium* is one of the largest genera.

One of the most spectacular endemics of the Carpathians was originally described as a monotypic genus (*Pietrosia levitomentosa*) but later referred to *Hieracium*. It is presently classified as *Andryala levitomentosa* (Sell 1976), which is concordant with morphological, anatomical, and chloroplast DNA haplotype (J. Fehrer, C. Cojocariu, S. Bräutigam in prep.) investigations. Future re-appraisal of the complex evolution of *Hieracium* (s. l.) may throw new light not only on this species, but also on those taxa growing along the chain of the S. Carpathians, especially the Retezat massif, well known as a centre for hybridogenesis. Many taxa are confined to certain geographic or ecological niches.

The Romanian representatives of *Hieracium* show a wide variability responding to particular physico-geographical features. We can already confirm that a series of *Hieracium* taxa are characteristic for certain vegetation types in Romania, thus showing a strong correlation between features of the vegetation and the ecological requirement of certain species. According to our preliminary analysis of this relationship, we were able to identify those *Hieracia* (and *Andryala*) that are characteristically linked to certain syntaxa (here referred to by the phytocoenological classes distinguished by Mucina 1997), within Romania, as follows:

Hieracium alpicola subsp. *ullepitschii*: Juncetea trifidi (Caricion curvulae)
H. alpinum: Loiseleurio-Vaccinietea, Juncetea trifidi
H. bauhinii: Festuco-Brometea, Quercetea pubescentis (Quercetalia pubescentis)
H. bifidum: Asplenietea trichomanis
H. caespitosum: Molinio-Arrhenatheretea
H. cymosum: Trifolio-Geranietea, Festuco-Brometea, Quercetea pubescentis (Quercetalia pubescentis)
H. hoppeanum: Juncetea trifidi
H. lachenalii: Querco-Fagetea
H. lactucella: Calluno-Ulicetea
H. [Andryala] levitomentosum: Thlaspietea rotundifolii
H. maculatum: Querco-Fagetea
H. murorum: Querco-Fagetea
H. pilosella: Calluno-Ulicetea, Festuco-Brometea, Koelerio-Corynephoretea, Molinio-Arrhenatheretea
H. pojoritense: Vaccinio-Piceetea
H. transsylvanicum: Vaccinio-Piceetea, Querco-Fagetea
H. umbellatum: Calluno-Ulicetea, Festuco-Brometea, Querco-Fagetea
H. villosum: Elyno-Seslerietea (Seslerion bielzii)

Some of these species define, by their presence, certain coenotaxa, which may be associations either widely distributed throughout temperate Europe, or restricted to even small regions within the Romanian vegetation. Thus, *Hieracium transsylvanicum* [*H. rotundatum* auct.] is a character species for the association Hieracio 'rotundati'-Piceetum, reflecting the wide ecological capacity of this species. On the other hand, *Andryala levitomentosa* is the character species for the association Sempervivo soboliferae-Andryaletum levitomentosae, which is confined to a mountain peak of the Bistriţa Mountains (E. Carpathians), and reflects the stenotopic character of *Andryala levitomentosa* with this extremely punctiform distribution.

Nicolae Ştefan, Adrian Oprea, Ciprian Mânzu

The present state of hieraciology in Romania

After H. Zahn's monographic studies (Zahn 1922–1938) the genus *Hieracium* has been investigated by E. I. Nyárády who also presented a detailed account of this genus in the "Flora R. P. Romîne" (Nyárády 1965). In recent times, the genus was revised by other authors for various identification books (Beldie 1979, Ciocîrlan 1990, 2000).

According to the "Flora R. P. Romîne" *Hieracium* is represented in our country by 42 species, with an additional 160 taxa classified as hybrids or hybridogenous species (Nyárády 1965). Later authors reduced these figures to 33 species (with 30 subspecies) and 69 hybrids (Beldie 1979), or to 56 species with 34 subspecies (Ciocîrlan 2000). On the other hand, "Flora Europaea" (Sell & West 1976) mentioned 134 species (and additional 72 hybrid species) of *Hieracium* (incl. *Pilosella*) for Romania.

The most recent checklist for the Romanian flora (Popescu & Sanda 1998, accepted as "Standard flora" by the Euro+Med PlantBase Editorial Committee 2001) gives *Hieracium* with 139 species and 60 hybrids.

Apart from the considerable number of endemic *Hieracium* species in the Romanian flora, its most remarkable representative is the species presently classified as *Andryala levitomentosa* (Sell 1976), which initially was described as a monotypic genus (*Pietrosia*) but later tranferred to *Hieracium* (Soó 1968). This endemic species has been investigated by Dr. Anca Păunescu from an anatomical point of view; she also has attempted to multiply this species "in vitro", but the results so far have remained unsatisfactory. Further studies on this species concerning the plastidic DNA are being carried out by J. Fehrer (Görlitz/Praha) and her team and should contribute to a better understanding of the phylogenetic relationships of this affinity.

Nicolae Ştefan, Adrian Oprea, Ciprian Mânzu

RAPDs in *Hieracium* and other apomicts: an evaluation

RAPD (random amplification of polymorphic DNA) belongs to molecular techniques capable of revealing genetic differences on the lowest possible level – among individuals. Populations of apomictic species are frequently derived from one parent by means of asexual seed production. In some cases, not only one population, but a set of populations (metapopulation) or even the entire species could represent a clonal line with low genetic variation generated through somatic mutations. Thus, RAPD markers can be adopted for the identification of individuals as well as for tracking the biological history of populations or apomictic species.

The utility of RAPD was demonstrated in the study of 6 species of *Hieracium* sect. *Alpina* in the Tatry Mountains, Slovakia. Infra- and inter-population genetic variation and relationships among 40 populations were estimated using RAPD and compared to the results obtained by allozyme studies of the same set of plant individuals. The results of both these methodical approaches were in full agreement.

Allozymes are a traditional and low-cost methodic suitable for population studies. In contrast to RAPDs, allozymes differentiate between homozygotes and heterozygotes, so direct estimation of allelic frequency is possible. The requirement of fresh plant material, non-neutral character of markers, and limited set of useful loci are the main disadvantages of allozymes. AFLP (amplified fragment length polymorphism) technique has come into prominence over the last five years in population studies. Similar to RAPDs, preliminary knowledge of DNA sequences is not necessary; the markers show dominant inheritance. AFLP is considered to be more reproducable than RAPDs, but investment in a sequencing machine and fluorescent dyes or radioisotopes is required.

It has been shown that the reliability of RAPDs can be improved using a thorough and repeated optimisation of the PCR reaction, repeating RAPD reactions with various concentrations of plant DNA and accomplishing all analyses shortly after PCR optimisation. A less common RAPD data analysis, the compatibility test, was demonstrated in *Hieracium alpinum* and *H. crassipedipilum*. This test can reveal past recombination events on the basis of the RAPD or AFLP markers.

Helena Štorchová

Distribution maps and IUCN threat categories for *Hieracium* sect. *Alpina* (Asteraceae) in Britain [6]

Distribution maps and IUCN threat categories for the 30 named species of Hieracium sect. Alpina in Britain are given, based on taxonomic and distribution studies by D. J. Tennant and others over the last 30 years. Twenty-seven taxa are endemic to Scotland, one to England, one to Britain and one also occurs in mainland Europe and the Arctic. There are three main centres of diversity in Scotland, the Eastern Highlands (especially the Cairngorm Mountains), the Western Highlands, and the Northern Highlands.

Under the IUCN threat categories, seven taxa are ”Critically Endangered,” seven are ”Endangered”, two are ”Vulnerable”, ten are ”Near Threatened” and seven are ”Nationally Scarce”. The main threats are collecting, natural events such as rock falls and avalanches, global warming, acid rain, over-grazing and tourism. There is particular concern for the long-term survival of four taxa.

David J. Tennant, Tim C. G. Rich[7]

[6] in press, Edinburgh Journal of Botany 2002.
[7] Correspondence author

Chorology of *Pilosella* sect. *Pratensina* [*Hieracium* sect. *Pratensina*] in Siberia

The occurrence of *Pratensina* species in Siberia was established by several monographers of this group (Juxip 1960; Šljakov 1987, 1989; Bräutigam 1992) and by Siberian botanists. The present study aims to refine and update the knowledge of this section and to evaluate the chorological character of its species in Siberia in connection with florogenesis.

Based on literature sources, but above all on a taxonomic revision covering material from all Siberian herbaria (IRK, KRAS, LE, NS, NSK, SSBG, TK, and others) we can comment on the following seven species representing *Pilosella* sect. *Pratensina* in Siberia:

- *P. altaica* (Naeg. & Peter) Schljak. [*Hieracium altaicum* (Naeg. & Peter) Juxip]
- *P. aurantiaca* (L.) Schultz fratr. [*H. aurantiacum* L.]
- *P. caespitosa* (Dumort.) P. D. Sell & C. West [*H. caespitosum* Dumort.]
- *P. dublitzkii* (B. Fedtsch. & Nevski) Sennik. [*H. dublitzkii* B. Fedtsch. & Nevski]
- *P. floribunda* (Wimm. & Grab.) Fries [*H. floribundum* Wimm. & Grab.]
- *P. fuscoatra* (Naeg. & Peter) Soják [*H. fuscoatrum* Naeg. & Peter]
- *P. onegensis* Norrl. [*H. onegense* (Norrl.)Norrl.]

Most of these species show a principally European distribution. The Eastern boundaries of their areas are situated in Central or Eastern Europe. Some of them occur, as aliens, also in other parts of the world.

Although *Pilosella onegensis* occurs throughout the whole territory of Siberia, it is extremely rare, as are *P. aurantiaca*, *P. caespitosa*, and *P. fuscoatra*, and only a few locations of each species are known. The latter three have been found in Western Siberia only. The features of their occurrence and ecology testify that all these species are adventive in Siberia, and they do not show a tendency to settle into new places.

Pilosella floribunda was initially known only from Eastern Siberia (southeast coast of Lake Baikal). Later on this species was found also in Middle Siberia (northeast of Western Sayan). It is also a non-indigenous species but, in contrast to those mentioned above, *P. floribunda* is naturalised and has been settling in the territory.

Pilosella dublitzkii is the only native species of the section within Siberia, and is endemic in the South Siberian and Middle Asian mountain ranges. Its occurrence is linked to vegetation communities with genetic relations to deciduous forests, as are Siberian fir (*Abies sibirica*) and Siberian pine (*Pinus sibirica*) taiga, or subalpine grasslands. The species is distributed in Altai, Kuznetsky Alatau, northeastern part of Western Sayan, and at the southeastern coast of Lake Baikal, regions known as refugia for tertiary forest species in Siberia. *Pilosella dublitzkii* is similar in appearance to the European *P. onegensis*. These vicarious taxa show a distribution pattern which can be explained by the separation of a continuous area in the past, obviously in connection with the climatic change in Siberia during glacial periods. Thus, the morphological similarity of *P. dublitzkii* (2n=18: Krogulevič & Rostovceva 1984) to its European counterparts, its phytocenotic features, and the character of the area serve as convincing evidence that this species represents a relict of the tertiary forest flora in Siberia.

Pilosella altaica has not been confirmed for Siberia; any testifying material from the territory is missing.

Natalia N. Tupitsyna

The present state of Swedish hieraciology

About a century ago, several skilful Swedish taxonomists were working with the genus *Hieracium*. By 1935 most of the Swedish species of *H.* sect. *Hieracium* and sect. *Vulgata* had been distinguished and described, and a considerable amount of more or less unorganised information about the other sections had been gathered. In total, approximately 1500 *Hieracium* species were reported from Sweden. However, there were hardly any monographic publications covering all species within any section or geographic area, and no publications with determination keys or notes aiding identification were available. Between 1950 and 1990, virtually no attempts were made to study Swedish *Hieracia*, and by the end of that period no single botanist was able to identify any apomictic species. Since 1995 I have been working with Swedish *Hieracia*. My first aim has been to try to recapitulate as much as possible of the knowledge acquired by early 20th century hieraciologists and to organise this basic information in a form accessible to modern Swedish botanists. I have begun to make regional treatments for each Swedish province covering all species of *Hieracium* sect. *Hieracium* and sect. *Vulgata* with standardised descriptions, simple illustrations and identification keys. So far, 7 of the southernmost Swedish provinces have been covered. Simultaneously, I try to compile detailed distribution maps for the species and regions treated, and to evaluate this distributional information in a framework of historical biogeography and dispersal biology. In addition, studies in *Hieracium* sect. *Oreadea* as well as evolutionary and genetic studies employing molecular markers have been initiated.

Torbjörn Tyler

Hieracium collections in the Bulgarian herbaria

Study of the *Hieracium* species in Bulgaria was initiated by J. Freyn for preparation of the Velenovský's "Flora Bulgarica" (Freyn 1891) and then continued by K. H. Zahn in the beginning of the 20th century. The latter author cooperated with some Bulgarian botanists who collected herbarium specimens for him. Among those botanists who deserve mention are: I. Neichev, I. Urumov, N. Stojanov, B. Stefanov, and particularly T. Georgiev, who was the only Bulgarian botanist to study extensively the genus *Hieracium* in his country. This cooperation resulted in a number of publications that report many novelties for the Bulgarian flora, including taxa new to science.

Also, thanks to the efforts of those earlier botanists, *Hieracium* collections in the Bulgarian herbaria were stablished, enriched later by many other workers engaged in Flora projects related to the four editions of Stojanov & Stefanov's Flora of Bulgaria (Zahn 1925, Georgiev 1933, 1948, Stojanov & al. 1967) and the still ongoing "Flora Reipublicae Bulgaricae" (Jordanov 1963→).

Today, the most important *Hieracium* collections in Bulgaria are kept in three herbaria:
- Agricultural University, Plovdiv (SOA),
- Sofia University, Sofia (SO)
- Institute of Botany of the Bulgarian Academy of Sciences, Sofia (SOM).

The discussion will include the present state of these collections and their relevance for a comprehensive study of the genus. For each herbarium the total number of *Hieracium* specimens are given, and the *Hieracium* sections as well as floristic regions that are best represented. A list of authentic specimens (potential type material, original collections) will be provided, and recommendations for further collecting are given.

VladimirVladimirov

Hieracium lasiophyllum, a rare hawkweed of the Slovenian Karst

This hawkweed was first mentioned by Biasoletto (1829), who tentatively identified it as *Hieracium lawsonii*. Later on, Koch described the plant as *H. lasiophyllum*, based on plants from "Grube Draga bei Orlich auf dem Karst" (Koch 1844) provided by Biasoletto. From the type locality the species was repeatedly collected in great numbers, as documented by the materials held, e. g., in the herbaria of TSM or WU, and reported in the regional floras by Marchesetti (1996/7) and Pospichal (1899). It was further noticed by the latter from "... einer kleineren Nachbardoline bei Fernetič am Karste". Perhaps the most recent collection from the locus classicus, by Zirnich, dates from 1926 (Mezzena 1986; preserved at TSM). A single specimen was found by Justin in the Raša valley near Senožeče (LJU; revised by H. Zahn). In recent years it was discovered from several additional places in the hinterland of Trieste, from both sides of the border between Italy and Slovenia (revised by G. Gottschlich).

The type locality Orleška Draga ("dolina of Orlek") is a typical collapse sinkhole, situated about 3 km SW of Sežana (Slovenia). Its western slope is crossed by the state border that divides the "draga" into a smaller Italian and a bigger Slovenian part. Its upper ± circular edge reaches 350 m altitude above sea level, with the bottom at 260 m. The surrounding karst plateau as well as the thermophilous slopes are covered by a submediterranean woodland dominated by *Ostrya carpinifolia* (Seslerio autumnalis-Ostryetum s. lat.), while the bottom of the kettle carries a mesophilous hornbeam forest (Asaro-Carpinetum betuli) of a C. European floristic composition. Some small scree areas are formed on the western slopes, where, in 2001, we were lucky to recover 2 individuals of *H. lasiophyllum*, growing within the association Allio globosi-Iberidetum intermediae. – According to L. Poldini (verb.) the hawkweed also grows in the association Drypio jacquinianae-Festucetum carniolicae. However, the exact phytosociological position of the species as well as the particular distribution around Trieste remains to be executed in detail.

According to Zahn's monographs (1921, 1931, as *H. pallidum* subsp. *lasiophyllum*) the hawkweed is present, in addition to NE. Italy and SW. Slovenia, also in Spain, SE. France and Corsica, NW. Italy (Liguria, Elba), Croatia, Serbia (Mokra Gora), Romania and Bulgaria. Similar forms were reported from the British Isles; it was further recorded from Hungary (SOÓ 1970). Such a widespread occurence is, however, not very probable, and it remains to be evaluated as well as the uncertain taxonomy: It has been classified as a species (following Koch) or "microspecies" (Sell & West 1976, within the "*H. schmidtii* group"), or as a subspecies (Zahn 1921) or variety (Hayek 1931, both under *H. pallidum*) within a collective *H. schmidtii*.

As regards the conservation status, the situation seems now less critical after the discovery of several previously unknown populations in Slovenia as well as in Italy. It must be stressed, however, that the near-extinction at the type locality obviously has its cause in the collection mania of some 19th century's botanists. Achenes from one of the two surviving individuals of Orleška Draga have been brought to the Ljubljana Botanical Garden to establish descendants which in the future may revive the original population.

Tone Wraber

On the embryology and mode of reproduction of selected diploid species of *Hieracium* s. l. (Asteraceae) from Bulgaria

Five Bulgarian populations of three diploid species (2n = 2x = 18) from the genus *Hieracium* s. l. have been studied embryologically: *H. caespitosum* Dumort., *H. pavichii* Heuff. (both subgen. *Pilosella*) and *H. transylvanicum* Heuff. (subgen. *Hieracium*).

The following specific features of the embryological structures and processes have been established:

The anther wall is four-layered consisting of epidermis, endothecium without clearly expressed fibrous thickenings, ephemeral middle layer and tapetum. In the diploid taxa investigated, the initially cellular (secretory) tapetum after the one-nuclear pollen stage transforms into false (*H. caespitosum*, *H. pavichii*) to true periplasmodium (*H. transylvanicum*).

The sporogenous tissue is one-layered. Meiosis and simultaneous microsporogenesis normally run with some insignificant deviations. Only in *H. pavichii* a higher degree and more numerous deviations (different type of microsporic tetrads, dyads, polyads, syncytia) have been observed.

Mature pollen grains are three-celled, three-colporate with echinate exine. In the anthers of the three species, different amounts of sterile and degenerating pollen have been observed together with the normal, fertile pollen.

Development of the legitimate embryosac follows the basic (monosporic) Polygonum type. In *H. pavichii* somatic apospory (characteristic for polyploid taxa of subgen. *Pilosella*) and integumental embryony also have been established. Highest plasticity of the embryological structures of the female gametophyte has been observed in *H. transylvanicum* – two egg cells in a single egg apparatus, haustorising synergids, two legitimate embryosacs in a single ovule.

The above-mentioned peculiarities in *H. transylvanicum* and the trend toward apomixis in *H. pavichii* provide better trophical function of the female gametophyte and thus more successful reproduction and adaptability.

Petka Yurukova-Grancharova, **Penka Robeva** , **Vladimir Vladimirov**