CHROMOSOME NUMBERS IN *HIERACIUM* (ASTERACEAE) FROM CENTRAL AND SOUTHEASTERN EUROPE I.

**KRYSZYNA MUSIAŁ** and **ZBIGNIEW SZELĄG**

*Department of Plant Cytology and Embryology, Jagiellonian University, Gronostajowa 9, 30-387 Kraków, Poland

*Pedagogical University of Cracow, Department of Botany, Podchorzążych 2, 30-084 Kraków, Poland*

**Received August 12, 2015; revision accepted October 8, 2015**

Chromosome numbers for 16 *Hieracium* s.str. species from Bosnia and Herzegovina, Bulgaria, Macedonia, Montenegro, Poland, Romania and Serbia are given and their metaphase plates are illustrated. Chromosome numbers are published for the first time for *H. filarszkyi* Jáv. & Zahn 2n = 3x = 27, *H. fritschantanum* Hayek & Zahn 2n = 3x = 27, *H. fritzeiforme* Zahn 2n = 3x = 27, *H. hercegovinicum* (Freyn & Vandas) Szeląg 2n=3x=27, *H. nitimontis* (Oborny & Zahn) Chrtek fil. 2n = 4x = 36, *H. vagneri* Pax 2n = 4x = 36, as well as three undescribed species of hybrid origin between *H. olympicum* Boiss. and *H. sparsum* Friv. 2n = 4x = 36, *H. naegelianum* Panč. and *H. scardicum* Bornm. & Zahn 2n = 3x = 27, and *H. transylvanicum* Heuff. and *H. umbellatum* L. 2n = 4x = 36.

**Key words:** Asteraceae, chromosome number, Europe, *Hieracium*, karyotype.

**INTRODUCTION**

During several years of studies on *Hieracium* L. in Central and Southeastern Europe, the second author collected many living plants and transplanted them to an experimental garden for future taxonomic investigations. To date, many of them have never been analysed karyologically. Knowledge of ploidy level, which especially in *Hieracium* s.str. indicates the mode of reproduction, is of particular interest in understanding taxonomic and phylogenetic relationships within the genus.

The present paper gives chromosome numbers for 16 species of *Hieracium* s.str. including three undescribed species of hybrid origin. The ploidy levels of 9 species are published for the first time.

This study is a continuation of karyological investigations of *Hieracium* L. in Europe conducted at the Department of Plant Cytology and Embryology of the Jagiellonian University (Szeląg et al., 2007; Ilnicki et al., 2010; Ilnicki and Szeląg, 2011; Szeląg and Ilnicki, 2011).

For cytological studies, seeds of the investigated species were collected from natural populations. Then they were germinated on moistened filter paper in Petri dishes. Karyological analysis was performed as described by Marciniuk et al. (2012) with some modifications. Briefly, 3- or 4-day-old seedlings were incubated in saturated aqueous solution of 8-hydroxychinoline for 4 h at room temperature. Subsequently they were fixed in a mixture of absolute ethanol and glacial acetic acid (3:1, v/v) for 24 h. Fixed material was stained in 2% acetic orcein for 4 days at room temperature. Stained seedlings were transferred to 45% acetic acid and heated to boiling over a flame. For slide preparation, root tip meristems were cut off and squashed in a drop of 45% acetic acid. The cover-slip was removed after freezing in liquid nitrogen and the slide was thoroughly air-dried, and mounted in Entellan. The metaphase chromosomes were counted and photographed using Nikon Eclipse E400 microscope equipped with CCD camera.
RESULTS AND DISCUSSION

_Hieracium atratum_ s.l.; 2n = 4x = 36 (Fig. 1a)
Poland, Eastern Carpathians, Bieszczady Mts, Mt. Tarnica 1330 m a.s.l., rocky places with _Empetrum hermaphroditum_.

This is the first chromosome number report for this species from the Eastern Carpathians and from Poland which confirms the number previously published by Chrtek et al. (2004) from the Western Carpathians. Chrtek (1994) also published tri- and tetraploid chromosome numbers for two species belonging to the _Hieracium atratum_ aggregate from the Western Sudetes.

_Hieracium chrysostyloides_ (Zahn) Chrtek fil.; 2n = 5x = 45 (Fig. 1b)
Poland, Eastern Sudetes, Mt. Śnieżnik Kłodzki, 1410 m a.s.l., alpine grassy places on western slope.

This is the first chromosome number report for this species from Poland which confirms the number previously published from the Hrubý Jeseník Mts, Eastern Sudetes (Chrtek, 1996). _Hieracium chrysostoloides_ is endemic to the Eastern Sudetes and is one of three pentaploid _Hieracium_ s.str. species known so far. The second one, _H. pentaploideum_ P.D. Sell & D.J. Tennant, grows in Scotland and also belongs to the _H. nigrescens_ agg. (Sell and Murrell, 2006; Tennant and Rich, 2008). The third one is _H. viridum_ Pall. from Siberia in Russia (Pulkina and Tupitsyna, 2000).

_Hieracium filarszkyi_ Jáv. & Zahn; 2n = 3x = 27 (Fig. 1c)
Romania, Southern Carpathians, Rețetez Mts, Mt. Butea, 1820 m a.s.l., grassy slope with _Pinus mugo_ communities on schist.

This is the first chromosome number report for this endemic to the Rețetez Mts species.

_Hieracium fritschianum_ Hayek & Zahn; 2n = 3x = 27 (Fig. 1d)
Bosnia and Herzegovina, Prenj Mts, Mt. Otiš, 1900 m a.s.l., calcareous rocks on eastern slope.

This is the first chromosome number report for this species known until now only from Albania.

_Hieracium fritzeiforme_ Zahn; 2n = 3x = 27 (Fig. 1e)
Romania, Southern Carpathians, Rețetez Mts, Său ciurla pass, 1800 m a.s.l., grassy slope with _Pinus mugo_ communities on granite.

This is the first chromosome number report for this endemic to the Rețetez Mts species.

_Hieracium heldreichii_ s.l. sensu Zahn; 2n = 3x = 27 (Fig. 1f)
Serbia, Mt. Besna Kobila, 1840 m a.s.l., eroded slope along road on the summit, surrounded by pastures with _Festuca valida, Festuca nigrescens_ and _Deschampsia caespitosa_ on schist.

It is quite a frequent on the Balkan Peninsula collective species of the morphological formula _H. pannosum < H. racemosum_. The same chromosome number was earlier reported in plants of unknown origin (most probably from Bulgaria) by Gentscheff (1938). This is the first chromosome number report for this species from Serbia.

_Hieracium hercegovinicum_ (Freyn & Vandas) Szelag; 2n = 3x = 27 (Fig. 1g)
Montenegro, Prokletije Mts, Mt. Maja Rosave, below Zastan Koliba military checkpoint, 1430 m a.s.l., _Fagus sylvatica_ forest margin on calcareous bedrock.

This is the first karyological data for this species of presumably hybrid origin between _H. prenanthoides_ Vill. and _H. gymnocephalum_ Griseb. ex Pant., morphologically closer to the former species (Szelag, 2002). The plants analysed here were collected in the area in which diploid, sexual _H. gymnocephalum_ grows (Szelag and Ilnicki, 2011). The same chromosome number was reported by Niketić et al. (2003) in plants referred to as _H. calophyllum_ aggregate (morphological formula _H. gymnocephalum – H. prenanthoides_).

_Hieracium nigritum_ R. Uechtr.; 2n = 4x = 36 (Fig. 1h)
Poland, Eastern Sudetes, Mt. Śnieżnik Kłodzki, Hała pod Śnieżnikiem glade, 1260 m a.s.l., sub-alpine meadows with _Festuca supina_.

This is the first chromosome number report for this species from Poland which confirms the number previously published by Chrtek (1996) from the Hrubý Jeseník Mts, Eastern Sudetes, and from the Western Carpathians (Chrtek et al., 2004).
Chromosome numbers in *Hieracium* 117


**Fig. 1.** Metaphase plates of: (a) *H. atratum*, 2n = 36. (b) *H. chrysostyloides*, 2n = 45. (c) *H. filarszkyi*, 2n = 27. (d) *H. fritschianum*, 2n = 27. (e) *H. fritzeiforme*, 2n = 27. (f) *H. heldreichii*, 2n = 27. (g) *H. hercegovinicum*, 2n = 27. (h) *H. nigritum*, 2n = 36. Bar = 10 μm.
Hieracium nivimontis (Oborny & Zahn) Chrtek fil.; 2n = 4x = 36 (Fig. 2a)
Poland, Eastern Sudetes, Mt. Śnieżnik Kłodzki, 1380 m a.s.l., alpine grassy places on western slope.

This is the first chromosome number report for this species known only from Mt. Śnieżnik Kłodzki.

Hieracium schustleri Zlatník; 2n = 4x = 36 (Fig. 2b)
1. Poland, Eastern Sudetes, Mt. Śnieżnik Kłodzki, 1400 m a.s.l., alpine grassland on western slope (population with dark styles).
2. Poland, Eastern Sudetes, Mt. Śnieżnik Kłodzki, 1410 m a.s.l., rocky places on north-western slope (population with yellow styles) (Fig. 2b).

The same chromosome number was reported in plants from the Karkonosze/Krkonše Mts (Chrtek, 1994).

Hieracium sudetotubulosum Szeląg; 2n = 4x = 36 (Fig. 2c)
Poland, Central Sudetes, Góry Stołowe Mts, upper verge of Mt. Szczeliniec Wielki, NW cliff next to the lookout, 900 m a.s.l.

Newly validated species (Szeląg, 2014) known from the Western Sudetes and recently discovered also in the Góry Stołowe Mts (Szeląg and Wójcik, 2014).

The same chromosome number was reported in plants from the Karkonosze/Krkonše Mts, Western Sudetes by Chrtek (1994).

Hieracium vagneri Pax; 2n = 4x = 36 (Fig. 2d)
Poland, Eastern Carpathians, Bieszczady Mts, Mt. Bukowska Kopa, 1310 m a.s.l., rocky places on sandstone with calcicolous plants.

This is the first chromosome number report for this species of morphological formula H. alpinum – H. caesium which comprises a few taxa at the sub-species rank occurring in the Carpathians and Sudetes (Zahn, 1938).

Hieracium vulgatum Fries; 2n = 3x = 27 (Fig. 2e)
Poland, Wyżyna Miechowska upland, Kalina Lisiniec, 330 m a.s.l., termophilous chalk grassland Inuletum ensifoliae.

This is the first chromosome number report for this species from Poland. Triploid chromosome number was reported in plants from Great Britain (Morton, 1974). Information from Belarus (Dmitrieva, 1987) refers to H. lachenalii Suter.

Hieracium sp. ‘Botev’; 2n = 4x = 36 (Fig. 2f)
Bulgaria, Stara Planina Mts, Kamenlivica on the southern slope of Mt. Botev, 1200 m a.s.l., eroded, siliceous rocks along touristic road from Panicite to the chalet Raj.

A new, undescribed species of presumably hybrid origin between H. olympicum Boiss. and H. sparsum Friv.

Hieracium sp. ‘Ljuboten’; 2n = 3x = 27 (Fig. 2g)
Macedonia, Šarplanina Mts, Mt. Ljuboten, 2350 m a.s.l., calcareous rock crevices.


Hieracium sp. ‘Raušor’; 2n = 4x = 36 (Fig. 2h)
Romania, Southern Carpathians, Retezat Mts, above Raušor ski centre, 1520 m a.s.l., grassy slope on Picea abies forest margin.

A new, undescribed species of presumably hybrid origin between sexual H. transylvanicum Heuff. and sexual H. umbellatum L. An emascula-
tion experiment in the garden-cultivated plants shows that the new species reproduces apomictically. Detailed information on the experimental method followed here is given in Szeląg (2004).

The diploid chromosome number was stated in the artificial F1 hybrid received in experimental crosses between both diploid, parental species (Mráz and Paule, 2006).

The three above-enumerated undescribed species are the subject of ongoing studies to be pre-
sented separately (Szeląg, in prep.).

AUTHORS’ CONTRIBUTION

KM – karyological analysis, figures preparation and interpretation of results; ZS – idea, sampling and drafting of manuscript. The authors have declared that there is no conflict of interest.

ACKNOWLEDGEMENTS

We are grateful to two anonymous reviewers for helpful suggestions and corrections on the manu-
script. This study was funded by the National Science Centre, Poland (decision no. DEC-
Chromosome numbers in *Hieracium*

2n = 36. (a) *H. nivimontis*.
2n = 36. (b) *H. schustleri*.
2n = 36. (c) *H. sudetotubulosum*.
2n = 36. (d) *H. vagneri*.
2n = 27. (e) *H. vulgatum*.
2n = 36. (f) *Hieracium* sp. 'Botev'.
2n = 36. (g) *Hieracium* sp. 'Ljuboten'.
2n = 36. (h) *Hieracium* sp. 'Raušor'.

Bar = 10 μm.

**Figs. 2.** Metaphase plates of: (a) *H. nivimontis* 2n = 36. (b) *H. schustleri* 2n = 36. (c) *H. sudetotubulosum* 2n = 36. (d) *H. vagneri* 2n = 36. (e) *H. vulgatum* 2n = 27. (f) *Hieracium* sp. 'Botev'; 2n = 36. (g) *Hieracium* sp. 'Ljuboten'; 2n = 27. (h) *Hieracium* sp. 'Raušor'; 2n = 36. Bar = 10 μm.
2013/09/B/NZ8/03308) and by the Pedagogical University of Cracow through its research funds.

REFERENCES


