

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

KRYSTYNA MUSIAŁ¹, AGNIESZKA JANAS¹ AND ZBIGNIEW SZELĄG^{2*}

¹Department of Plant Cytology and Embryology, Jagiellonian University,
Gronostajowa 9, 30-387 Kraków, Poland

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

Received March 20, 2016; revision accepted May 4, 2016

Chromosome numbers for 12 *Hieracium* s.str. species from 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. albinum* Fries $2n=4x=36$, *H. bukovicæ* Rohlena & Zahn: $2n=3x=27$, *H. retyezatense* subsp. *subatratiforme* Neičeff & Zahn $2n=4x=36$, *H. velenovskiji* Freyn $2n=3x=27$, as well as two undescribed species belonging to the *H. bohatschianum* agg. $2n=4x=36$ and *H. nigrescens* agg. $2n=4x=36$ and a hybrid between *H. naegelianum* Pančić and *H. bifidum* s.lat. $2n=4x=36$.

Keywords: Asteraceae, chromosome number, Europe, *Hieracium*, karyotype

INTRODUCTION

This paper constitutes the second part of a series devoted to the chromosome numbers in *Hieracium* L. in Central and South Eastern Europe (Musiał and Szelać, 2015). We present here the chromosome numbers for next 12 species of *Hieracium* from 17 localities in Bulgaria, Macedonia, Montenegro, Poland, Romania and Serbia, including three undescribed species which will be the subject of ongoing studies to be presented separately. The chromosome numbers of 7 species are published for the first time.

This study is a continuation of karyological investigations of *Hieracium* conducted at the Department of Plant Cytology and Embryology of the Jagiellonian University (Szelać et al., 2007; Ilnicki et al., 2010; Ilnicki and Szelać, 2011; Szelać and Ilnicki, 2011; Musiał and Szelać, 2015).

MATERIAL AND METHODS

For cytological studies, seeds of the investigated species were collected from natural populations and from plants cultivated in an experimental garden. 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-hydroxy-ychinoline 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. The 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 coverslip 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 a Nikon Eclipse E400 microscope equipped with a CCD camera.

RESULTS AND DISCUSSION

Hieracium albinum Fries; $2n=4x=36$ (Fig. 1a) Poland, Western Sudetes, Karkonosze Mts, Szrenicki Potok valley along road from Szklarska Poręba to Mt. Łabski Szczyt, 900 m a.s.l., in *Picea abies* forest. It is the only presently known locality

* Corresponding author, email: azzszelać@wp.pl

of *H. albinum* in the whole Karkonosze Mts (Szelag, 2011).

This is the first chromosome number report for this endemic to the Karkonosze/ Krkonoše Mts species.

Hieracium atratum s.lat.; $2n=4x=36$ (Fig. 1b)
Poland, Western Carpathians, Polica Mts, Hala Kucalowa glade, 1120 m a.s.l., subalpine grassy places on northern slope.

This is the first chromosome number report from the Polish part of the Western Carpathians which confirms the numbers previously published from the Western Sudetes (Chrtek, 1994), Eastern Carpathians (Musiał and Szelag, 2015) and Western Carpathians (Chrtek et al., 2004).

The analysed plants are morphologically similar to *H. atratum* subsp. *atrellum* Zahn.

Hieracium bifidum s.lat.; $2n=3x=27$ (Fig. 1c)

1. Poland, Eastern Sudetes, Śnieżnik Massif, Kleśnica valley, Pulinka rock, 820 m a.s.l., calcareous rocks with *Sesleria tatrae* and *Galium anisophyllum*. It is the only known locality of *Hieracium bifidum* s.lat. in the Polish part of the Eastern Sudetes (Szelag, 2000).
2. Romania, Southern Carpathians, Mehedinți Mts, La Scărița west of the Poiana Țăsnei glade, 850 m. a.s.l., calcareous rock crevices (population with deep green leaves).
3. Romania, Southern Carpathians, Mehedinți Mts, La Scărița west of the Poiana Țăsnei glade, 850 m. a.s.l., calcareous scree (population with grey-green leaves) (Fig. 1c).
4. Romania, Southern Carpathians, Vâlcan Mts, Cheile Sohodolului gorge, 270 m a.s.l., calcareous rocks along road with *Selaginella selaginoides* (it is the same taxon like plants from the locality number two).
5. Serbia, Suva Planina Mts, Mt. Mosor, 950 m a.s.l., calcareous rock crevices with *Ramonda nathaliae*.

Hieracium bifidum s.lat.; $2n=4x=36$ (Fig. 1d)

Romania, Eastern Carpathians, Ciucaș Mts, Mt. Ciucaș, 1820 m a.s.l., calcareous scree on northern slope.

Our chromosome counts well match those previously published for *H. bifidum* s.lat. (e.g., Goldblatt and Johnson, 1979; Schuhwerk and Lippert, 1999; Mráz and Szelag, 2004; Ilnicki and Szelag, 2011).

Hieracium bohatschianum agg.; $2n=4x=36$ (Fig. 1e)
Montenegro, Prokletije Mts, Mt. Starac, 2200 m a.s.l., rocky places on granite.

The same chromosome number was earlier reported for *H. bohatschianum* Zahn s.str. from

the *locus classicus* in Romania (Ilnicki and Szelag, 2011).

The analysed plants belong to an undescribed species morphologically similar to *H. mirekii* Szelag from the Southern Carpathians.

Hieracium bukoviccae Rohlena & Zahn; $2n=3x=27$ (Fig. 1f)

Montenegro, Durmitor Mts, north of Crno Jezero lake, 1500 m a.s.l., *Picea abies* forest on limestone.

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

Hieracium naegelianum Pančić x *H. bifidum* s.lat.; $2n=4x=36$ (Fig. 1g)

Macedonia, Šarplanina Mts, Mt. Ljuboten, 2200 m a.s.l., calcareous scree.

This new, undescribed species of hybrid origin grows together with diploid, sexual *H. naegelianum* (Szelag and Ilnicki, 2011).

Hieracium nigrescens agg.; $2n=4x=36$ (Fig. 1h)

Poland, Western Sudetes, Karkonosze Mts, Wielki Śnieżny Kocioł glacial cirque, 1250 m a.s.l., open grassy places in *Pinus mugo* communities on granite.

The analysed plants belong to an undescribed species morphologically similar to *H. nigrescens* Willd. endemic to the Karkonosze/Krkonoše Mts.

The same chromosome number was earlier reported for *H. nigrescens* s.str. from the Czech part of the Karkonosze Mts (Chrtek, 1994).

Hieracium prenanthoides Vill.; $2n=3x=27$ (Fig. 2a)

Poland, Western Carpathians, Tatra Mts, Mt. Wielka Kopa Królowa, 1510 m a.s.l., open grassy places in *Pinus mugo* communities on carbonate bedrock.

Triploids have been reported from the Pyrenees (Castro et al., 2007; Chrtek et al., 2007), Sudetes, Western Carpathians (Chrtek, 1996; Májovský et al., 1974) and Caucasus (Nazarova, 1984).

This is the first chromosome number report for this species from Poland.

Hieracium retyezatense subsp. *subatratiforme*
Neičeff & Zahn $2n=4x=36$ (Fig. 2b)

1. Bulgaria, Vitosha Mts, Mt. Malak Rezen, 2100 m a.s.l., subalpine grassland on silicate bedrock with *Vaccinium myrtillus*.
2. Bulgaria, Rila Mts, Rilska Reka valley, 2100 m a.s.l., along road to Ribnite Ezera hut, grassy places in *Pinus mugo* communities on eroded granite bedrock (Fig. 2b).

This is the first chromosome number report for this taxon known only from Bulgaria, and first karyological data for *H. retyezatense* Degen & Zahn s.lat. sensu Zahn.

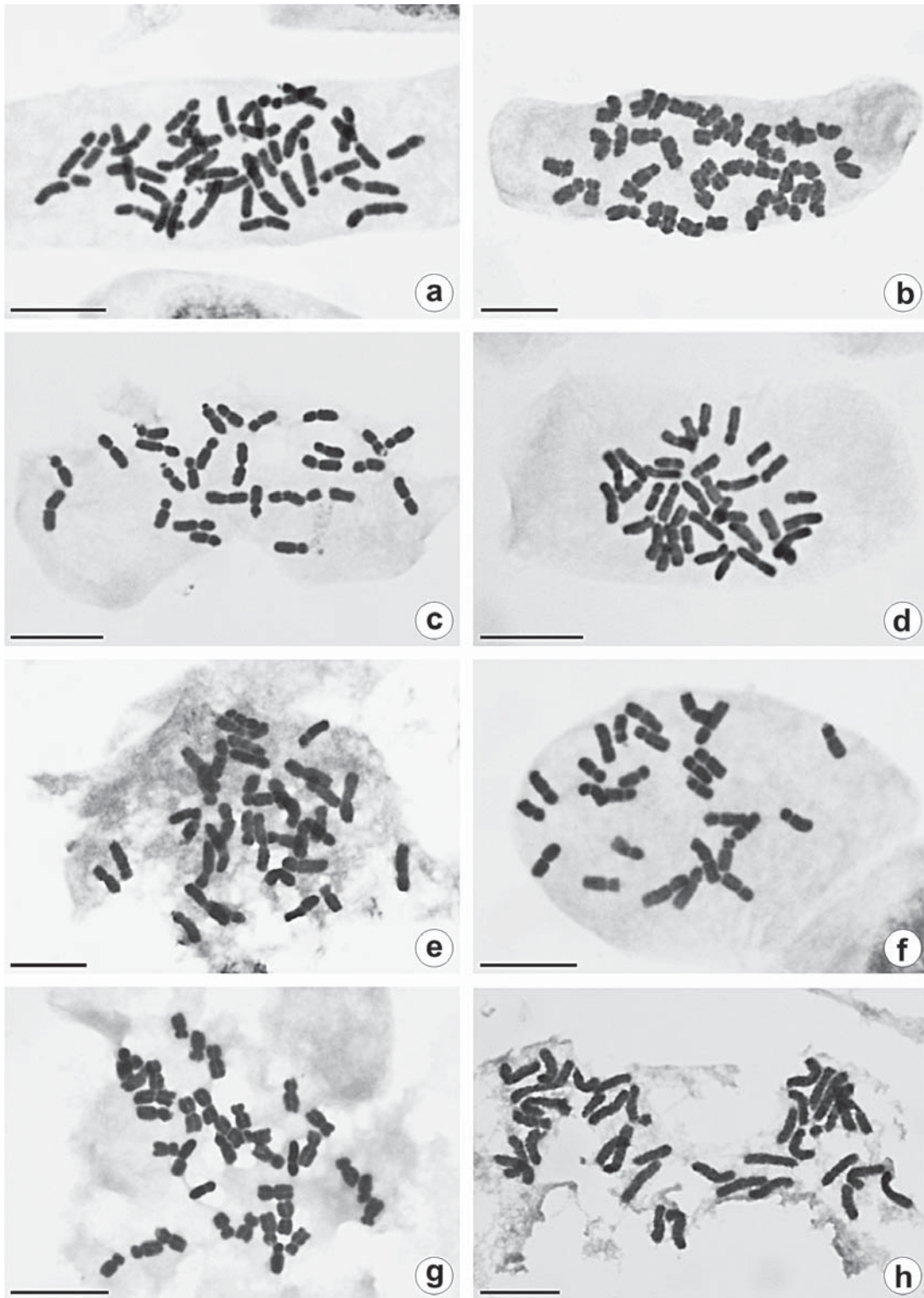


Fig. 1. Metaphase plates of: **(a)** *Hieracium albinum*, $2n = 36$. **(b)** *H. atratum* s.lat., $2n = 36$. **(c)** *H. bifidum* s.lat., $2n = 27$. **(d)** *H. bifidum* s.lat., $2n = 36$. **(e)** *H. bohatschianum* agg., $2n = 36$. **(f)** *H. bukovicæ*, $2n = 27$. **(g)** *H. naegelianum* x *H. bifidum* s.l., $2n = 36$. **(h)** *H. nigrescens* agg., $2n = 36$. Bar = 10 μm .

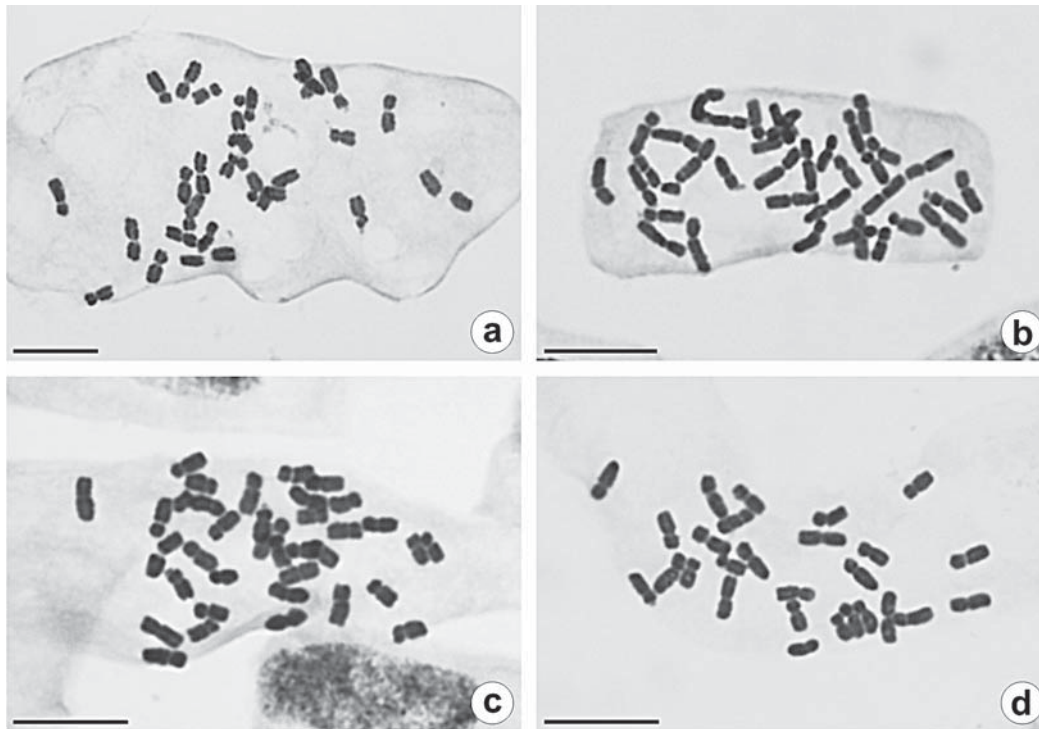


Fig. 2. Metaphase plates of: (a) *Hieracium prenanthoides*, $2n = 27$. (b) *H. retzezatense* subsp. *subatratiforme*, $2n = 36$. (c) *H. sudetotubulosum*, $2n = 36$. (d) *H. velenovskyi*, $2n = 27$. Bar = 10 μm .

Hieracium sudetotubulosum Szlag; $2n=4x=36$ (Fig. 2c)

Poland, Western Sudetes, Karkonosze Mts, Kocioł Łomniczki glacial cirque, 1250 m a.s.l., grassy places in *Pinus mugo* communities on granite.

A newly validated species (Szlag, 2014) known from the Western and Central Sudetes (Szlag and Wójcik, 2014).

The same chromosome number was reported for plants from the Karkonosze/Krkonoše Mts by Chrtek (1994) under the name *H. tubulosum* Tausch and from the Góry Stołowe Mts by Musiał and Szlag (2015).

Hieracium velenovskyi Freyn; $2n=3x=27$ (Fig. 2d)
Bulgaria, Vitosha Mts (*locus classicus* of the species), 1780 m a.s.l., forest margin along road from Sofia to Aleko hut.

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

AUTHORS' CONTRIBUTION

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

ACKNOWLEDGEMENTS

This work was supported by statutory research funds of the Department of Plant Cytology and Embryology, Faculty of Biology and Earth Sciences of Jagiellonian University in Cracow and by the Pedagogical University of Cracow through its research funds.

REFERENCES

- CASTRO M, MATEO G, and ROSSELLO JA. 2007. Chromosome numbers in *Hieracium* and *Pilosella* species (Asteraceae) from the Iberian Peninsula and the Balearic Islands. *Botanical Journal of the Linnean Society* 153: 311–320.
- CHRTEK J. 1994. Chromosome numbers in selected *Hieracium* species in the Krkonoše Mts. (the West Sudeten). *Folia Geobotanica et Phytotaxonomica* 29: 91–100.
- CHRTEK J. 1996. Chromosome number in selected species of *Hieracium* (Compositae) in the Sudeten Mts. and the Western and Ukrainian Eastern Carpathians. *Fragmenta Floristica et Geobotanica* 41: 783–790.
- CHRTEK J, MRÁZ P, and SEVERA M. 2004. Chromosome numbers in selected species of *Hieracium* s. str. (*Hieracium* subg. *Hieracium*) in the Western Carpathians. *Preslia* 76: 119–139.
- CHRTEK J, MRÁZ P, ZAHRADNÍČEK J, MATEO G, and SZLAG Z. 2007. Chromosome numbers and DNA ploidy levels of

- selected species of *Hieracium* s.str. (Asteraceae). *Folia Geobotanica* 42: 411–430.
- GOLDBLATT P and JOHNSON DE. [eds.] 1979. *Index to plant chromosome numbers*. Missouri Botanical Garden, St. Louis. (<http://mobot.mobot.org/W3T/Search/ipcn.html>)
- ILNICKI T, HASTEROK R, and SZELĄG Z. 2010. Cytogenetic analysis of *Hieracium transylvanicum* (Asteraceae). *Caryologia* 63: 192–196.
- ILNICKI T, and SZELĄG Z. 2011. Chromosome numbers in *Hieracium* and *Pilosella* (Asteraceae) from Central and Southeastern Europe. *Acta Biologica Cracoviensia Series Botanica* 53(1): 102–110.
- MARCINIUK P, MUSIAŁ K, JOACHIMIĄK AJ, MARCINIUK J, OKLEJEWICZ K, and WOLANIN M. 2012. *Taraxacum zajacii* (Asteraceae), a new species from Poland. *Annales Botanici Fennici* 49: 387–390.
- MÁJOVSKÝ J. et al. 1974. Index of chromosome numbers of Slovakia flora (Part 3). *Acta Facultatis Rerum Naturalium Universitatis Comenianae, Botanica* 22: 1–20.
- MRÁZ P, and SZELĄG Z. 2004. Chromosome numbers and reproductive systems in selected species of the genera *Hieracium* L. and *Pilosella* Hill (Asteraceae) from Romania. *Annales Botanici Fennici* 41: 405–414.
- MUSIAŁ K, and SZELĄG Z. 2015. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe I. *Acta Biologica Cracoviensia Series Botanica* 57(2): 115–120.
- NAZAROVA EA. 1984. Chisla khromosom kavkazskikh predstaviteley semeystv Asteraceae, Fabaceae, Limoniaceae. *Botanicheskij Zhurnal* 69: 972–975.
- SCHUHWERK F, and LIPPERT W. 1999. Chromosomenzahlen von *Hieracium* (Compositae, Lactuceae) Teil 3. *Sendtnera* 6: 197–214.
- SZELĄG Z. 2000. Rośliny naczyniowe Masywu Śnieżnika i Gór Białskich. *Fragmenta Floristica Geobotanica Polonica, Supplementum* 3: 3–255.
- SZELĄG Z. 2011. *Hieracium albinum* (Asteraceae) rediscovered. *Polish Botanical Journal* 56: 77–79.
- SZELĄG Z. 2014. *Hieracium sudetotubulosum* (Asteraceae), a new name for the illegitimate *H. tubulosum* (Tausch) Tausch. *Phytotaxa* 156(4): 250.
- SZELĄG Z, and ILNICKI T. 2011. Diploid chromosome numbers in *Hieracium* and *Pilosella* (Asteraceae) from Macedonia and Montenegro. *Acta Biologica Cracoviensia Series Botanica* 53(2): 124–126.
- SZELĄG Z, ILNICKI T, NIKETIĆ M, AND TOMOVIĆ G. 2007. Diploid chromosome numbers in five *Hieracium* species from Serbia and Montenegro. *Acta Biologica Cracoviensia Series Botanica* 49(1): 119–121.
- SZELĄG Z, and WÓJCIK G. 2014. *Hieracium sudetotubulosum* (Asteraceae) rediscovered outside the Karkonosze Mts. *Polish Botanical Journal* 59: 117–119.