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

ALEKSANDRA GRABOWSKA-JOACHIMIAK[1] (ORCID: 0000-0002-0278-5409) AND ZBIGNIEW SZELĄG[2*] (ORCID: 0000-0002-7017-2823)

[1]*Department of Plant Breeding, Physiology and Seed Sciences, University of Agriculture in Kraków, Łobzowska 24, 31-140 Kraków, Poland*
[2]*University of the National Education Commission, Institute of Biology and Earth Sciences, Podchorążych 2, 30-084 Kraków, Poland*

* Corresponding author, azszelag@wp.pl

Running title: *Grabowska-Joachimiak and Szeląg ……. Chromosome numbers in* Hieracium

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Chromosome numbers of 15 *Hieracium* s.str. species from Bulgaria, Greece, Poland and Slovakia are presented and their metaphase plates are illustrated. Chromosome numbers are published for the first time for *H. babiogorense* Szeląg 2n = 4x = 36, *H. besseri* Szeląg 2n = 4x = 36, *H. boratynskii* Szeląg 2n = 4x = 36, *H. ferdinandi-coburgii* J. Wagner & Zahn 2n = 4x = 36, *H. purkynei* Čelak. 2n = 4x = 36, *H. sourekii* Szeląg 2n = 3x = 27, as well as three undescribed species of the *H. diaphanoides* agg. 2n = 3x = 27 and 2n = 4x = 36, *H. rohacense* agg. 2n = 4x = 36 and *H. tephrosoma* agg. 2n = 5x = 45.

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

INTRODUCTION

This paper continues studies on the karyology of *Hieracium* L. from Central and Southeastern Europe, previously conducted at the Department of Plant Cytology and Embryology of the

Jagiellonian University (Musiał and Szeląg, 2015, 2019, 2023; Musiał et al., 2016, 2017, 2018, 2020). So far, the chromosome numbers of 121 species belonging to nearly 150 populations have been determined.

The present paper gives the chromosome numbers of 15 *Hieracium* s.str. species from Bulgaria, Greece, Poland and Slovakia to help understand the taxonomic and phylogenetic relationships within the genus.

MATERIAL AND METHODS

The seeds used for karyological analyses were collected from plants in the wild or from plants cultivated in an experimental garden by the second author. Plants obtained from the seeds were grown in a vegetation room (temp. 19°C, photoperiod 12/12 h) of the Department of Plant Breeding, Physiology and Seed Science, University of Agriculture in Kraków. The radicles were collected, pretreated with saturated solution of α-bromonaphthalene for 24 h at 4°C, then fixed in a mixture of glacial acetic acid and absolute ethanol (1:3, v/v). Before squashing in 45% acetic acid, fixed root tips were hydrolyzed for 10 min in 1 M HCl at 60°C. The squashes were frozen, air-dried and stained with 0.1% aqueous solution of toluidine blue. For chromosome counting 10-12 well-spread metaphases were selected under a Nikon Eclipse E800 microscope. The images of mitotic metaphase plates were captured and processed with a Nikon DS-2MBWc camera and the NIS Elements software.

The vouchers of the analyzed taxa are deposited in the second author's herbarium.

RESULTS AND DISCUSSION

Hieracium atratum s.lat.; 2n = 4x = 36 (Fig. 1a)
Poland, Sudetes, Karkonosze Mts., Wielki Śnieżny Kocioł glacial cirque, Kryształowy Żleb couloir, 1320 m a.s.l., granite rocks crevices.

In the Karkonosze Mts., this morphologically highly variable collective species is represented only by tetraploid populations (Chrtek, 1994; Musiał et al., 2020, 2024).

Hieracium babiogorense Szeląg; 2n = 4x = 36 (Fig. 1b)
Slovakia, Western Carpathians, Babia Góra Massif, along the yellow tourist trail to the summit, 1560 m a.s.l.

Recently described species of the *H. juraniforme* agg., endemic to Mt. Babia Góra, grows on the Polish and Slovak sides of the massif (Szeląg, 2024).

Hieracium besseri Szeląg; 2n = 4x = 36 (Fig. 1c)
Poland, Western Carpathians, Babia Góra Massif, Kamienna Dolinka valley, 1550 m a.s.l., rocky grasslands among *Pinus mugo* thickets.

Recently described species of the *H. carpathicum* agg., endemic to the Babia Góra Massif (Szeląg, 2024).

Hieracium boratynskii Szeląg; 2n = 4x = 36 (Fig. 1d)
Poland, Sudetes, Karkonosze Mts., Kocioł Łomniczki glacial cirque, 1370 m a.s.l., grassy slope with *Pinus mugo* on granite.

Recently described species of the *Hieracium canescens* agg. known only from the type locality (Szeląg, 2022).

Hieracium caesium s.lat.; 2n = 4x = 36 (Fig. 1e)
Poland, Sudetes, Karkonosze Mts., Wielki Śnieżny Kocioł glacial cirque, Kryształowy Żleb couloir, 1310 m a.s.l., granite rocks crevices.

Our results well match those previously published for *H. caesium* s.lat. from Austria, Germany, Poland and Sweden (Schuhwerk and Lippert, 1999; Chrtek et al., 2007; Musiał and Szeląg, 2023; Musiał et al., 2024).

Hieracium decipiens Tausch; 2n = 4x = 36 (Fig. 1f)
Poland, Sudetes, Karkonosze Mts., Mały Śnieżny Kocioł Galcial cirque, 1260 m a.s.l., grassland with *Anemone narcissiflora*.

Endemic species to the Karkonosze Mts., the same chromosome number was published by Chrtek (1994).

Hieracium diaphanoides s.lat.; 2n = 3x = 27 (Fig. 1g) and 2n = 4x = 36 (Fig. 1h)
Bulgaria, Rila Mts., Monastirska reka valley, 1300 m a.s.l., in *Picea abies* forest along the road to the Cave of Saint John of Rila.

The analyzed plants probably belong to a new species being the subject of current studies. Triploid and tetraploid chromosome numbers for this collective species were reported from France (Auquier and Renard, 1979) and Sweden (Tyler and Jönsson, 2009), respectively.

Hieracium ferdinandi-coburgii J. Wagner & Zahn; 2n = 4x = 36 (Fig. 2a)
Greece, Taygetos Mt. (Ταΰγετος), northern slope of Mt. Profitis Ilias (Προφήτης Ηλίας), 2180 m a.s.l., on marble scree.

This is the first chromosome number for this very rare Greek endemic species, known from only three localities (Tomović et al., 2025).

Hieracium pedunculare Tausch; 2n = 4x = 36 (Fig. 2b)
Poland, Sudetes, Karkonosze Mts., Łabski Kocioł glacial niche, 1170 m a.s.l., grassy slope near the shelter.

The first karyological data from Poland for this species endemic to the Karkonosze Mts. The same chromosome number was published by Chrtek (1994) from the Czech side of the mountains.

Hieracium pilosum Froelich; 2n = 4x = 36 (Fig. 2c)
Poland, Western Carpathians, Babia Góra Massif, Kościółek Wschodni ridge, 1530 m a.s.l., sandstone rocks on the northern slope.

The first tetraploid chromosome number for this rare species in the Western Carpathians. Previously, triploid plants were found in the Western Tatra in Slovakia (Chrtek et al., 2004).

Hieracium purkynei Čelak.; 2n = 4x = 36 (Fig. 2d)
Poland, Sudetes, Karkonosze Mts., Łomnica valley, close to the Domek Myśliwski shelter, 1140 m a.s.l., *Picea abies* forest along a tourist trail.

This is the first chromosome number for this species endemic to the Karkonosze Mts., which was rediscovered after a century (Szeląg, 2023).

Hieracium rohacense s.lat.; 2n = 4x = 36 (Fig. 2e)
Poland, Sudetes, Karkonosze Mts., Złotówka glade, 1240 m a.s.l., grassy slope along a tourist path.

This is the first chromosome number for this collective species outside the Carpathians (Mráz, 2001).

Hieracium sabaudum L.; 2n = 3x = 27 (Fig. 2f)
Poland, southern Baltic coast, Jastrzębia Góra, 30 m a.s.l., *Fagus sylvatica* forest on a cliff.

These results well match those previously published from different parts of Central Europe (Chrtek et al., 2004; Schuhwerk and Lippert, 1999; Szeląg and Vladimirov, 2005).

Hieracium sourekii Szeląg; 2n = 3x = 27 (Fig. 2g)
Poland, Sudetes, Karkonosze Mts., Biały Jar glacial niche, on eroded porphyry rocks.

Newly described species of the *H. senescens* agg., endemic to the Karkonosze Mts. (Szeląg, 2025). This is the first chromosome number for this group known from the British Islands and Swiss Alps.

Hieracium tephrosoma s.lat.; 2n = 5x = 45 (Fig. 2h)
Poland, Sudetes, Karkonosze Mts., Czarny Kocioł glacial cirque, 1140 m a.s.l., on granite rocks.

The plants analyzed differ morphologically from *H. amaurocranum* (Zahn) Holub, the pentaploid species endemic to the Karkonosze Mts. (Musiał and Szeląg, 2023).

AUTHORS' CONTRIBUTION
AG-J – karyological analysis, interpretation of results and preparation of figures; ZS – sampling and drafting of manuscript. The authors have declared that there is no conflict of interest.

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REFERENCES

Auquier P, Renard R. 1979. Dénombrements chromosomiques chez quelques *Hieracium* d'Europe moyenne et méridionale. *Bulletin Société pour l'Échange des Plantes Vasculaires de l'Europe Occidentale et du Bassin Méditerranéen* 17: 73–79.

Chrtek J. jun. 1994. Chromosome numbers in selected *Hieracium* species in the Krkonoše Mts. (the West Sudeten). *Folia Geobotanica et Phytotaxonomica* 29: 91–100.

Chrtek J. jun., Mráz P, Severa M. 2004. Chromosome numbers in selected species of *Hieracium* s. str. (*Hieracium* subgen. *Hieracium*) in the Western Carpathians. *Preslia* 76: 119–139.

Chrtek J, Mráz P, Zahradníček J, Mateo G, Szeląg Z. 2007. Chromosome numbers and DNA ploidy levels of selected species of *Hieracium* s.str. (Asteraceae). *Folia Geobotanica* 42: 411–430.

Mráz P. 2001. Chromosome numbers in selected species of *Hieracium* sect. *Alpin*a (Asteraceae) from Central and Eastern Europe. *Folia Geobotanica* 36: 321–332.

Musiał K, Grabowska-Joachimiak A, Szeląg Z. 2024. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe VIII. *Acta Biologica Cracoviensia Series Botanica* 66(1): 6611. https://doi.org/10.24425/abcsb.2024.150382

Musiał K, Janas A, Szeląg Z. 2016. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe II. *Acta Biologica Cracoviensia Series Botanica* 58(1): 119–123. https://doi.org/ 10.1515/abcsb-2016-0007

Musiał K, Janas A, Szeląg Z. 2017. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe III. *Acta Biologica Cracoviensia Series Botanica* 59(2): 83–87. https://doi.org/ 10.1515/abcsb-2017-0013

Musiał K, Janas A, Szeląg Z. 2018. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe IV. *Acta Biologica Cracoviensia Series Botanica* 60(2): 75–79. https://doi.org/10. 24425/118052

Musiał K, Szeląg Z. 2015. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe I. *Acta Biologica Cracoviensia Series Botanica* 57(2): 115–120. https://doi.org/10.1515/ abcsb-2015-0020

Musiał K, Szeląg Z. 2019. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe V. *Acta Biologica Cracoviensia Series Botanica* 61(2): 63–68. https://doi.org/10.24425/ abcsb.2019.127748

Musiał K, Szeląg Z. 2023. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe VII. *Acta Biologica Cracoviensia Series Botanica* 65(1): 23–28. https://doi.org/10.24425/abcsb.2023.145593

Musiał K, Vladimirov V, Szeląg Z. 2020. Chromosome numbers in *Hieracium* (Asteraceae) from Central and Southeastern Europe VI. *Acta Biologica Cracoviensia Series Botanica* 62(2): 43–50. https://doi.org/10. 24425/abcsb.2020.131672

Schuhwerk F, Lippert W. 1999. Chromosomenzahlen von *Hieracium* (Compositae, Lactuceae) Teil 3. *Sendtnera* 6: 197–214.

Szeląg Z. 2022. *Hieracium boratynskii* (Asteraceae), a new species in the *H. canescens* aggregate from the Sudetes in Poland. *Phytotaxa* 541(2): 209–212. https://doi.org/10.11646/phytotaxa.541.2.11

Szeląg Z. 2023. *Hieracium purkynei* (Asteraceae): an endemic to the Sudetes rediscovered after a century. *Phytotaxa* 601(1): 90–96. https://doi.org/10.11646/phytotaxa.601.1.7

Szeląg Z. 2024. Two new species in *Hieracium* sect. *Alpestria* (Asteraceae) from Mt. Babia Góra, Western Carpathians, Poland. *Phytotaxa* 645(3): 278–285. https://doi.org/10.11646/phytotaxa.645.3.7

Szeląg Z. 2025. *Hieracium sourekii* (Asteraceae), a new species in the *H. senescens* aggregate and the discovery of *H. subortum* in the Sudetes, Poland. *Phytotaxa* 696(3): 217–223. https://doi.org/10.11646/phytotaxa.696.3.2

Szeląg Z, Vladimirov V. 2005. Chromosome numbers of Polish *Hieracia* (Asteraceae). *Polish Botanical Journal* 50: 139–143.

Tomović G, Sabovljević M, Lakušić S, et al. 2025. New records and noteworthy data of plants, algae and fungi in SE Europe and adjacent regions, 20. *Comprehensive Plant Biology* 49: 117–130. https://doi.org/10.2298/CPB2501117T

Tyler T, Jönsson J. 2009. Ploidy level analysis of apomictic *Hieracium* (Asteraceae) reveal unexpected patterns and variation. *Nordic Journal of Botany* 27: 490–502. https://doi.org/10.1111/j.1756-1051.2009.00476.x

FIGURES

Fig. 1. Metaphase plates of: **(a)** *Hieracium atratum* s.lat. 2n=4x=36, **(b)** *H. babiogorense* 2n=4x=36, **(c)** *H. besseri* 2n=4x=36, **(d)** *H. boratynskii* 2n=4x=36, **(e)** *H. caesium* s.lat. 2n=4x=36, **(f)** *H. decipiens* 2n=4x=36, **(g)** *H. diaphanoides* s.lat. 2n=3x=27, **(h)** *H. diaphanoides* s.lat. 2n=4x=36. Scale bar = 10 μm

Fig. 2. Metaphase plates of: **(a)** *Hieracium ferdinandi-coburgii* 2n=4x=36, **(b)** *H. pedunculare* 2n=4x=36, **(c)** *H. pilosum* 2n=4x=36, **(d)** *H. purkynei* 2n=4x=36, **(e)** *H. rohacense* s.lat. 2n=4x=36, **(f)** *H. sabaudum* 2n=3x=27, **(g)** *H. sourekii* 2n=3x=27, **(h)** *H. tephrosoma* s.lat. 2n=5x=45. Scale bar = 10 μm

Figure 1

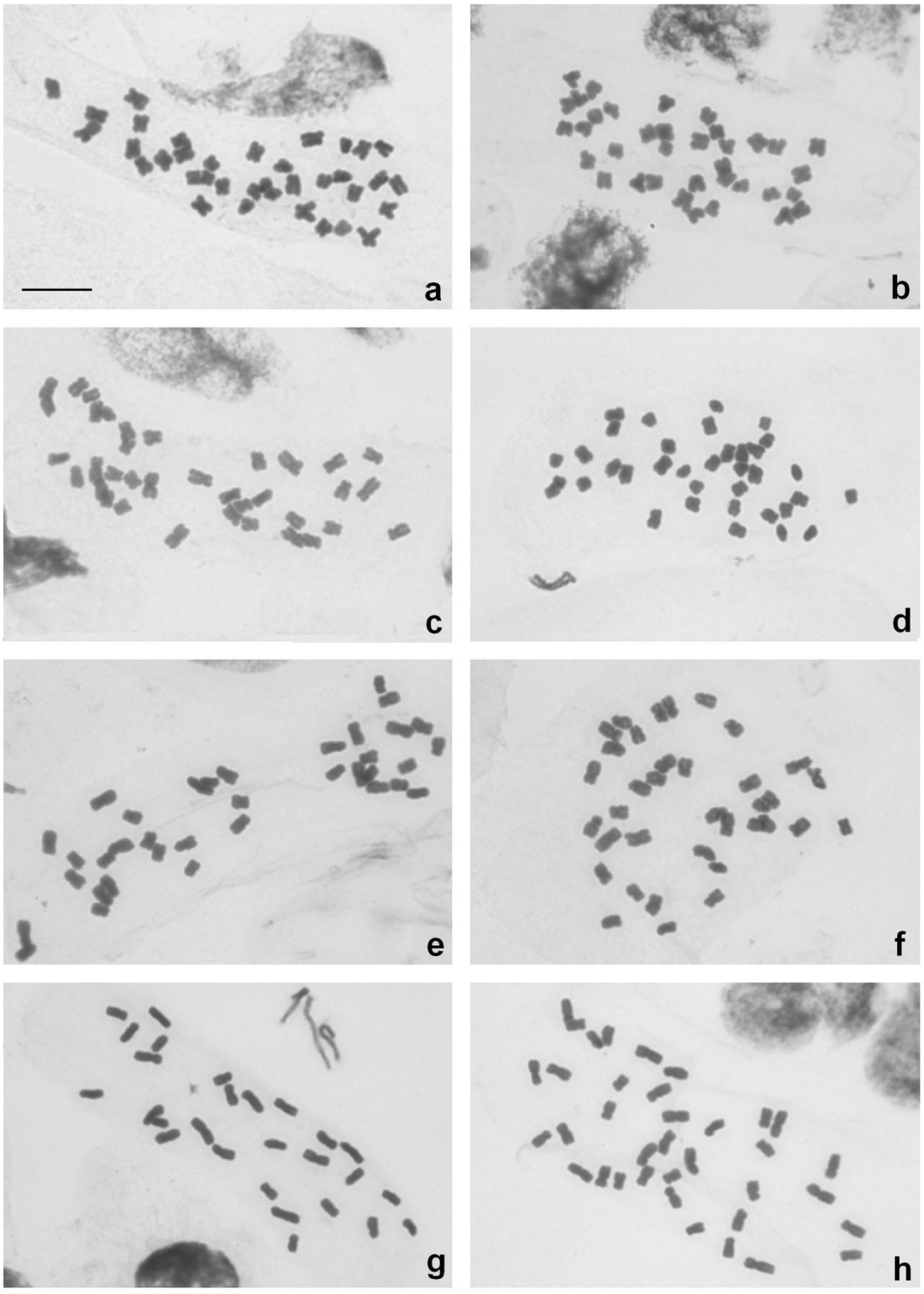

Figure 2