

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

KRYSZYNA MUSIAŁ<sup>1</sup>  AND ZBIGNIEW SZELAG<sup>2\*</sup> 

<sup>1</sup>Department of Plant Cytology and Embryology, Institute of Botany, Faculty of Biology,  
Jagiellonian University, Gronostajowa 9, 30-387 Cracow, Poland

<sup>2</sup>Pedagogical University of Cracow, Institute of Biology, Podchorążych 2, 30-084 Cracow, Poland

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Chromosome numbers of 17 taxa of *Hieracium* s.str. from Bulgaria, Greece, Poland and Romania are specified and their metaphase plates are illustrated. Chromosome numbers are published for the first time for *H. engleri* R. Uechtr. (4x), *H. kritschimanum* Mattfeld & Zahn (3x), *H. latifolium* Link (3x), *H. tephrosoma* subsp. *amaurocranium* Zahn (5x), as well as five undescribed species belonging to the *H. lachenalii* agg. (3x), *H. rohacsense* agg. (4x), *H. vagneri* agg. (4x), *H. vranjanum* agg. (4x) and *H. wiesbaurianum* agg. (3x), and a new hybrid between *H. caesium* s.lat and *H. umbellatum* (4x).

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

### INTRODUCTION

We continue the karyological studies on the genus *Hieracium* s.str., as the knowledge of the ploidy level indicates the possible mode of reproduction and is useful for taxonomic studies. Hitherto, we have analyzed the chromosome numbers of 88 taxa from over 110 populations in Central and Southeastern Europe (Musiał and Szelać, 2015, 2019; Musiał et al., 2016, 2017, 2018, 2020). This paper presents the chromosome numbers of 17 taxa from 21 populations in Bulgaria, Greece, Poland and Romania. Since the genus *Hieracium* is dominated by triploid and tetraploid taxa, the discovery of a pentaploid taxon in the Sudetes is noteworthy. We also present the first information on the occurrence of *H. latifolium* in Poland.

### MATERIAL AND METHODS

The seeds for karyological investigations were collected from plants in nature or in an experimental garden. Then they were germinated on moistened

filter paper in Petri dishes. The 3- or 4-day-old seedlings were incubated in saturated aqueous solution of 8-hydroxyquinoline for 4 h at room temperature. They were subsequently 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. The 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. At least 10 seedlings were analyzed for each taxon and, depending on the species, the somatic chromosome number was established on 9–15 well-spread mitotic metaphase plates in the meristematic cells of roots. The vouchers of the analyzed taxa are deposited in KRAM.

\* Corresponding author, e-mail: azszelag@wp.pl

## RESULTS AND DISCUSSION

*Hieracium bifidum* s.lat.;  $2n = 3x = 27$  and  $2n = 4x = 36$  (Fig. 1a,b)

1. Poland, Wyżyna Krakowsko-Częstochowska upland, Dolina Będkowska valley, Żarnowa hill, 320 m a.s.l., calcareous rocks with *Festuca pallens*,  $2n = 4x = 36$ .
2. Poland, Western Carpathians, Pieniny Mts., Góra Zamkowa hill, 740 m a.s.l., shadowed calcareous slope in *Fagus sylvatica* forest,  $2n = 3x = 27$  (Fig. 1a) and  $2n = 4x = 36$  (Fig. 1b).
3. Poland, Wyżyna Krakowsko-Częstochowska upland, Trzy Siostry rock near the Mirów castle, 370 m a.s.l., calcareous rocks with *Valeriana tripteris*  $2n = 3x = 27$ .
4. Poland, Wyżyna Krakowsko-Częstochowska upland, Zimny Dół valley, 270 m a.s.l., calcareous rocks with *Festuca pallens*,  $2n = 3x = 27$ .

This widely distributed in Europe and extremely morphologically variable collective species is known from triploid and tetraploid populations (Ilnicki and Szelaĝ, 2011; Musiał et al., 2016, 2017, 2018, 2020; Musiał and Szelaĝ, 2019).

*Hieracium caesium* s.lat.;  $2n = 3x = 36$  (Fig. 1c)  
Poland, Wyżyna Krakowsko-Częstochowska upland, Apteka hill near Podlesice, 380 m a.s.l., calcareous rocks with *Knautia kitaibelii*.

This is the first chromosome number report for this collective species from Poland. Previously the same number was reported from Austria, Germany and Sweden (Schuhwerk and Lippert, 1999; Chrtek et al., 2007).

*Hieracium caesium* s.lat. x *H. umbellatum* L.;  $2n = 3x = 36$  (Fig. 1c)

Romania, Southern Carpathians, Retezat Mts., Bucura river valley, along a tourist road from Poiana Pelegii galade to Bucura lake, 1800 m a.s.l., *Pinus mugo* scrub on granite.

The analyzed plants belong to a new hybridogenous species and will be the subject of future studies.

*Hieracium engleri* R. Uechtr.;  $2n = 4x = 36$  (Fig. 1d)  
Poland, Karkonosze Mts., Mały Śnieżny Kocioł glacial cirque, 1360 m a.s.l., eroded basalt slope.

This is the first chromosome number report for this very rare Sudetic endemic.

*Hieracium heldreichii* agg. sensu Szelaĝ (2018);  $2n = 4x = 36$  (Fig. 1e)

Greece, Giona Mts. (Γκιώνα όρη), above Kaloskopi village (Καλοσκοπή) by the asphalt road from Viniiani village (Βινιανή), 800 m a.s.l., *Abies cephalonica* forest margin on calcareous bedrock.

This is the first chromosome number report for this species from Greece. The same chromosome number for other taxa of the *H. heldreichii* agg. was published from Bulgaria (Musiał et al., 2018, 2020).

*Hieracium kritschimanum* Mattfeld & Zahn;  $2n = 3x = 27$

Bulgaria, Central Rhodopes, by the road from Kozarsko village to Zhrebichko village, 450 m a.s.l., rocky silicate slope on the edge of *Carpinus orientalis* thickets.

This is the first actual chromosome number for this species that confirms the ploidy level previously estimated by flow cytometry (Szelaĝ and Vladimirov, 2019).

*Hieracium lachenalii* agg.;  $2n = 3x = 27$  (Fig. 1f)  
Poland, Wyżyna Krakowsko-Częstochowska upland, Łysak hill near Podlesice village, 400 m a.s.l., calcareous rocks in *Fagus sylvatica* forest,  $2n = 3x = 27$ .

The analyzed plants belong to an unknown species which occurs in relict beech forests in the vicinity of Podlesice village.

*Hieracium latifolium* Link;  $2n = 3x = 27$  (Fig. 1g)  
Poland, Western Carpathians, Pogórze Wielickie foothills, Osieczany village near Myślenice, 300 m a.s.l., *Tilio-Carpinetum* forest margin.

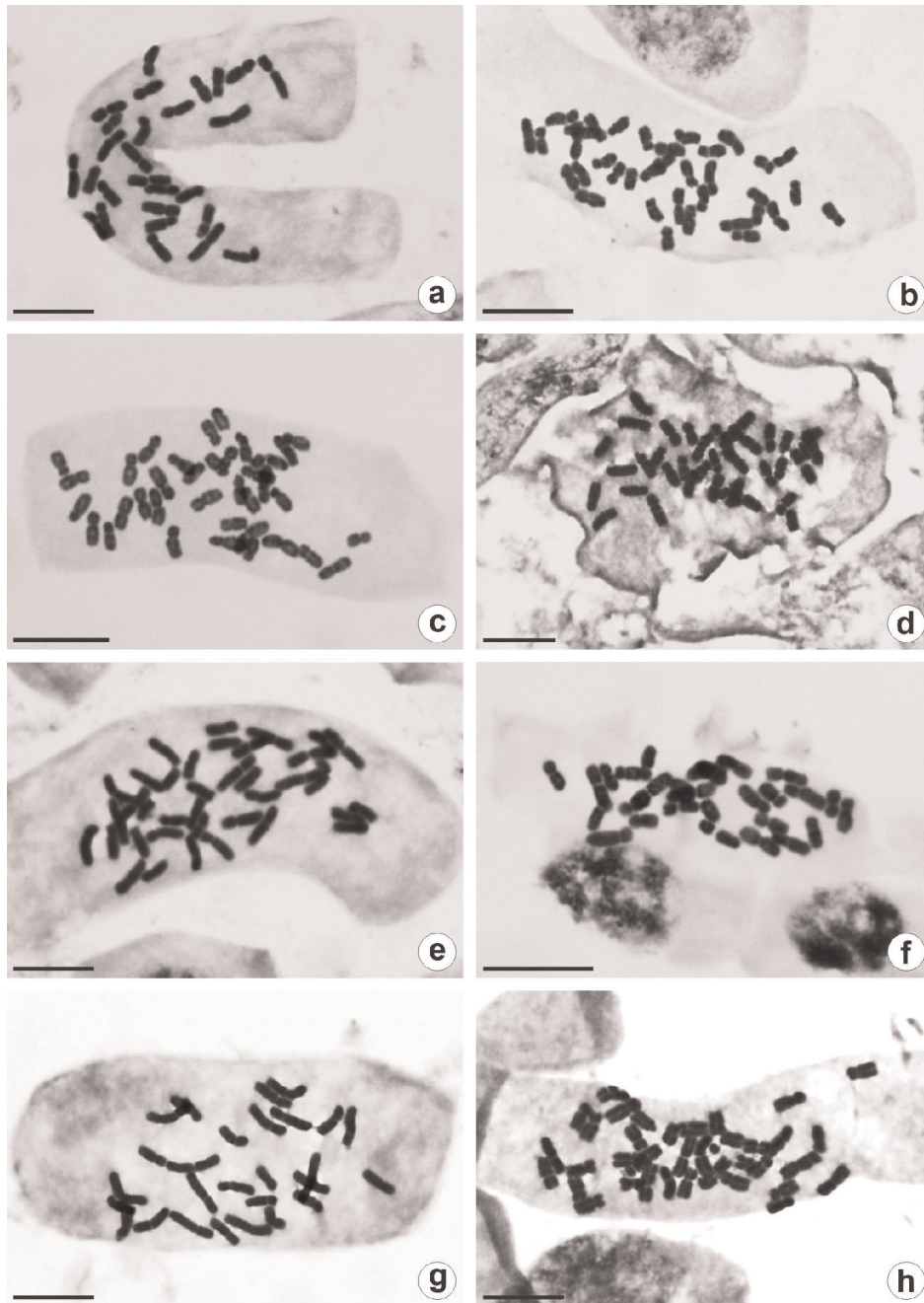
This is the first chromosome number report for this species of hybrid origin between *H. barbatum* Tausch and *H. umbellatum* L. and the first report of its occurrence in Poland. The analyzed plants grow in a mixed population with triploid and tetraploid *H. barbatum* (Szelaĝ and Vladimirov, 2005; Musiał et al., 2018).

*Hieracium pannosum* subsp. *parnassi* Nägeli & Peter;  $2n=4x=36$  (Fig. 1h)

Greece, Parnassus Mts. (Παρνασσός), near Vási Fterólakas ski resort (Χιονοδρομικό Κέντρο Παρνασσού - Βάση Φτερόλακας), 1760 m a.s.l., calcareous scree by the road.

So far, triploid and tetraploid populations of this taxon have been found (Musiał and Szelaĝ, 2019; Musiał et al., 2020).

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



**Fig. 1.** Metaphase plates of: **(a)** *Hieracium bifidum* s.lat.  $2n=3x=27$ , **(b)** *H. bifidum* s.lat.  $2n=4x=36$ , **(c)** *H. caesium* s.lat. x *H. umbellatum*  $2n=4x=36$ , **(d)** *H. engleri*  $2n=4x=36$ , **(e)** *H. heldreichii* agg.  $2n=4x=36$ , **(f)** *H. lachenalii* agg.  $2n=3x=27$ , **(g)** *H. latifolium*  $2n=3x=27$ , **(h)** *H. pannosum* subsp. *parnassi*  $2n=4x=36$ . Scale bars = 10  $\mu$ m

Bulgaria, Rila Mts., Monastirska reka valley, 1370 m a.s.l., open places in *Picea abies* forest on granite.

This is the first chromosome number report for this species from Bulgaria. Previously the same chromosome number was found in plants from the Carpathians, Dinaric Alps and Pyrenees

(Chrtek, 1996; Chrtek et al., 2004, 2007; Ilnicki and Szlag, 2011).

*Hieracium rohacsense* agg.;  $2n = 4x = 36$  (Fig. 2b) Romania, Retezat Mts., Mt. Zlata, 2100 m a.s.l., rocky grasslands among *Pinus mugo* thickets on silicate.

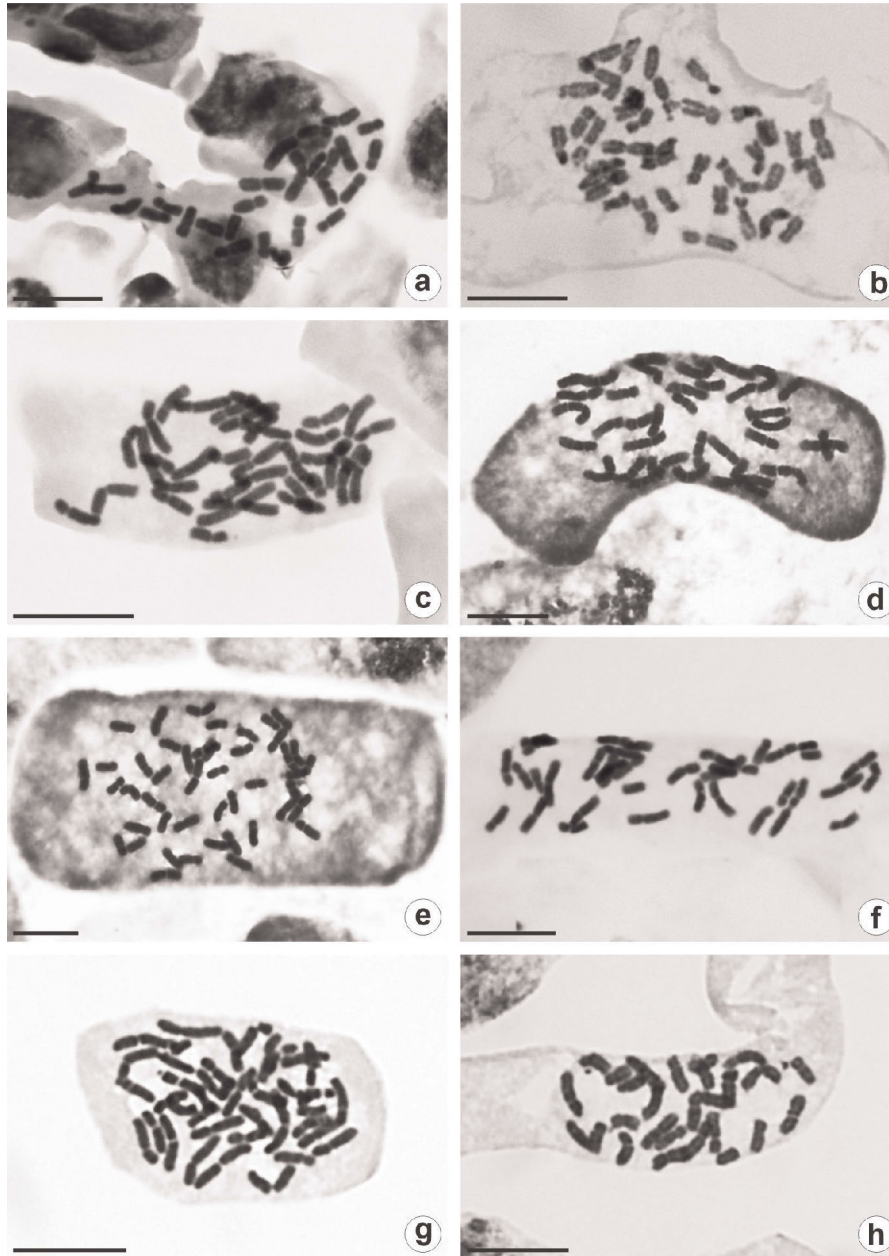
The analyzed plants probably represent a new species of the morphological formula *H. alpinum* < *H. bifidum* and will be the subject of future studies.

*Hieracium schmidtii* s.lat.;  $2n = 3x = 36$  (Fig. 2c)

1. Greece, Thasos, Mt. Toumpa (Τούμπα όρος), 1100 m a.s.l. rock crevices on gneiss.

2. Greece, Thasos Island, Mt. Toumpa (Τούμπα όρος), 1080 m a.s.l., shaded northern slope on schist mixed with marble (Fig. 2c).

This is the first chromosome number report for this collective species from Greece. The tetraploid cytotype of *H. schmidtii* is rare; it was previously found in Bulgaria (Musiał and Szelaġ, 2019).



**Fig. 2.** Metaphase plates of: (a) *Hieracium prenanthoides*  $2n=3x=27$ , (b) *H. rohacense* agg.  $2n=4x=36$ , (c) *H. schmidtii* s.lat.  $2n=4x=36$ , (d) *H. sericophyllum*  $2n=4x=36$ , (e) *H. tephrosoma* subsp. *amaurocranum*  $2n=5x=45$ , (f) *H. vagneri* agg.  $2n=4x=36$ , (g) *H. vranjanum* agg.  $2n=4x=36$ , (h) *H. wiesbaurianum* agg.  $2n=3x=27$ . Scale bars = 10  $\mu$ m

*Hieracium sericophyllum* Nejšeff & Zahn;  $2n = 4x = 36$  (Fig. 2d)

Bulgaria, Stara Planina Mountains, Triglav massif, Kurudere gorge, 1680 m a.s.l., subalpine grasslands on calcareous slopes.

A new chromosome number for this species. Previously, triploid plants were found in the same population (Musiał et al., 2020).

*Hieracium tephrosoma* subsp. *amaurocranum* Zahn;  $2n = 5x = 45$  (Fig. 2e)

Poland, Karkonosze Mts., Mały Staw lake glacial cirque, 1210 m a.s.l., rocky slope on granite.

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

*Hieracium vagneri* agg.;  $2n=4x=36$  (Fig. 2f)

Poland, Karkonosze Mts., Mały Staw lake glacial cirque, 1190 m a.s.l., grassy slope with *Pinus mugo* communities on granite.

The analyzed plants represent a new species and will be the subject of future studies.

*Hieracium vranjanum* agg. sensu Zahn (1935);  $2n = 4x = 36$  (Fig. 2g)

Greece, Giona Mts. (Γκιώνα όρη), along a tourist path from Kaloskopi village (Καλοσκοπή) to Grigoris Perdikis shelter (Καταφύγιο Γκιώνας Γρηγόρης Περδικής), 2050 m a.s.l., calcareous rock crevices.

The analyzed plants combine morphological features of *H. schmidtii* and *H. pannosum*, and probably belong to a new species.

*Hieracium wiesbaurianum* (*H. hypochoeroides*) agg.;  $2n = 3x = 27$  (Fig. 2h)

Greece, Giona Mts. (Γκιώνα όρη), above Kaloskopi village (Καλοσκοπή) along a road to the Battle of Dressa memorial (Μνημείο Μάχης Ντρέμισσας), 1200 m a.s.l., scree of bauxite rocks.

The first report on the number of chromosomes for this collective species from Greece. Most likely, the analyzed plants belong to a new species.

#### AUTHORS' CONTRIBUTION

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

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