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Mediterranean plant karyological data – 33

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Mediterranean plant karyological data – 33/1

Karyological data on wild pears (*Pyrus*, *Rosaceae*) of Armenia

Anahit Ghukasyan & Janna Akopian

Abstract

For the first time, the chromosome number was determined for 5 species of the genus *Pyrus* L. (*Rosaceae*) from Armenia, viz. *P. daralaghezii*, *P. hyrcana* var. *yeghegisi*, *P. medvedevii*, *P. oxiprion*, *P. takhtadzhianii*, and the previous count of chromosome number for *P. caucasica* was confirmed. All the explored species have a diploid chromosome number $2n = 34$ with the basic chromosome number x = 17.

Keywords: *Pyrus*, Armenian flora, chromosome number, karyology.

Introduction

Pyrus belongs to subtribe *Pyrinae* (formerly subfamily *Maloideae*) of family *Rosaceae* (Campbell & al. 2007). The area of the genus *Pyrus* occupies the territories from the Atlas Mountains in Northern Africa and South of France and through the whole Eurasian continent, including the Japanese seashore, and in the north from the Baltic to India in the south (Fedorov 1954; Browicz 1993). According to paleontological evidence, *Pyrus* probably originated in Tertiary in the mountainous regions of China (Rubtsov 1944). Centers of *Pyrus* diversity are in the mountain regions of East and South-West Asia, the Mediterranean and the Caucasus (Fedorov 1954; Browicz 1993). The number of the genus *Pyrus* species differs from 20-40 (Browicz 1993) to 80 (Phipps & al. 1990). Currently, the genus is subdivided into four sections: *Pyrus*, *Xeropyrenia* Fed., *Argyromalon* Fed., *Pashia* Koehne (Koehne 1890; Fedorov 1954).

The Caucasus is an important diversity center for the genus *Pyrus* (Fedorov 1954; Gladkova 1990; Korotkova & al. 2018). Some *Pyrus* regional taxonomic studies for the Caucasus (Medvedev 1919; Gladkova 1990) and for Armenia have been done (Fedorov 1958; Akopian 2007, 2022).

The territory of Armenia is a center of high diversity and local narrow endemism of the genus *Pyrus*. About 32-34 species of *Pyrus* grow in Armenia, 18 of which are endemics to Southern Transcaucasia and Armenia (Akopian 2007, 2021, 2022). In all of the pear habitats, especially in arid woodlands of the southern and south-eastern regions of the country, rich diversity of species and intraspecific hybrid forms of pears are observed (Akopian 2022).

Until now, the Armenian species of the genus *Pyrus* remain insufficiently studied in cytologenetical terms. According to the literature, only one publication is known in which was determined chromosome number ($2n = 34$) for 7 pear species of the Armenian flora, viz. *P. caucasica* Fed., *P. communis* L., *P. complexa* Rubtzov, *P. fedorovii* Kuth., *P. nutans* Rubtzov, *P. salicifolia* Pall. (including var. *angustifolia* Kuth. and var. *serratula* Browicz),

P. pseudosyriaca Gladkova and for hybrid forms *P. pseudosyriaca* × *P. salicifolia* and *P. pseudosyriaca* × *P. caucasica* (Gladkova & Sveshnikova 1990). Since pear polymorphism is determined not only by natural variability, but also by species hybridization and naturalization of cultivars, the study of chromosome number and karyotype in *Pyrus* species is of particular interest. Native population-based karyological studies of *Pyrus* species will provide new data on chromosome number and ploidy level of Armenian *Pyrus* species and hybrid forms.

Materials and methods

The research was based on the *Pyrus* seed material, collected in nature and from the wild pears living collection of the Yerevan Botanical Garden NAS RA (Akopian 2010). Karyological investigations were made on the mitotic metaphases of the meristematic cells from root tips of germinated seeds. The root tips were pretreated in 0.4% colchicine solution and fixed in Carnoy (3:1 alcohol and glacial acetic acid). After hydrolysis in HCl for 12 minutes, the root tips were stained in Schiff reagent and were squashed on a glass slide in 45% acetic acid. For all chromosome counts, a minimum of 10 plates were examined for each taxon. The slides were examined under light microscope AmScope Photomicroscope using an oil immersion objective (100×). Determination of chromosome number was carried out by light microscope AmScope (×40, ×100) with photo camera for photomicrography.

Results and discussion

Chromosome number was determined for 6 species of the genus *Pyrus* from sections *Pyrus*, *Xeropyrenia* and *Argyromalon* native to Armenia.

Pyrus Sect. *Pyrus*

2014. *Pyrus hyrcana* var. ***yeghegisi*** Akopian **—** 2*n* = 34 (Fig. 1A).

Ar: Vayots Dzor province, Yeghegis river gorge, in the vicinity of village Vardahovit, pear open woodland, 1970 m a.s.l., 39° 53’ N, 45° 27’ E, 11 Oct 2019, leg. *J. Akopian, A. Ghukasyan & M. Oganesian* (ERE 199486).

Tree up to 7–8 m in height with spherical crown; branches without thorns. Bark greyish-brown, perennial and one-year-old branches dotted with small whitish lenticels. Leaves 6.5×3.4 cm, lustrous green, elliptic, long acuminate or attenuate at apex, cuneate at base. Fruits 2×1.8 to 2.5×2.5 cm, globose, single or by 2–3, light or bright brown with lenticels, juicy and sweet. Sepals persistent in fruit, erect, crown-like, not deciduous. In Armenia it grows in pear open woodlands, 1950-2000 m a.s.l. Local endemic to Vayots Dzor province of Armenia.

In the studied specimens of *P. hyrcana* var. *yeghegisi* from its *locus classicus* (vicinity

of village Vardahovit, Vayots Dzor province) a characteristic diploid cytotype 2*n* = 34 was identified, the chromosome number is given for the first time.

2015. ***Pyrus caucasica*** Fed. **—** 2*n* = 34 (Fig. 1B).

Ar: Ararat province, hills in the vicinity of village Getazat, 930 m, 40° 02’ 18’’ N, 44° 33’ 49’’ E, 03 Jul 2022, leg. *J. Akopian, G. Gabrielyan, A. Rudov & G. Zaroyan* (ERE 291412).

Tree 10–20 m in height, thorny. Leaves arachnoid-hairy along the edges and below, sometimes almost glabrous, broadly elliptical or ovate, 3–6×2–4 cm, pointed or obtuse at the apex, entire, blackening in drying. Fruits are round or slightly oblate, 2.5–3 cm in diameter, have a varied taste.

It is highly polymorphic species considered to be the ancestor of several native pear cultivars. In Armenia it grows in broad-leaved forests, by river valleys, from 600 to 2200 m a.s.l. The species was described from Armenia. General distribution: Caucasus, Northern and South-Western Anatolia.

In the karyologically studied samples of *P. caucasica*, a characteristic diploid cytotype 2*n* = 34, with a base number x = 17, was revealed. Previously, a diploid cytotype was also reported for this species from Armenia (near Dilijan, Tavush province) and from Dagestan (Gladkova & Sveshnikova 1990).

Pyrus **Sect.** ***Xeropyrenia***

2016. ***Pyrus daralaghezi*** Mulk. **—** 2*n* = 34 (Fig. 1C & Fig. 2A).

Ar: Vayots Dzor province, in the vicinity of village Kechut, in the forest along the road, 2072 m a.s.l., 39° 49’ 21’’ N, 45° 40’ 38’’ E, 23 May 2019, leg. *J. Akopian, A. Ghukasyan, M. Oganesian & Zh. Hovakimyan* (ERE 201408).

Tree 5 m in height with a pyramidal crown. Leaves at the base broadly cuneate-shaped, at the apex shortly acuminated, elliptical, 8–10×3–5 cm, equally narrowed to both ends, finely sharp-dentate, ciliated, above glabrous, from beneath with scattered hairs, dry in blackening. Fruits are pear-form, fruit-stalk thick, up to 3–4 cm long. It grows in broad-leaved forests, 1700–2200 m a.s.l. Endemic to Armenia.

In karyologically studied specimens of this species from its *locus classicus* (Kechut forest, Vayots Dzor province) a characteristic diploid cytotype 2*n* = 34 was revealed (Fig. 2). The chromosome number is given for the first time.

2017. *Pyrus oxyprion* Woronow **—** 2*n* = 34 (Fig. 1D).

Ar: Ararat province, in the vicinity of village Narek, 1030 m a.s.l., 39° 59’ 57’’ N, 44° 39’ 58’’ E, 18 Jun 2017, leg. *J. Akopian, Zh. Hovakimyan & Z. Paravyan* (ERE 201411).

Tree up to 5 m in height, with dense canopy, thorny. Leaves bright green, lustrous, usually glabrous, on the margins unequally acute-serrate, narrow-oblanceolate, with the utmost width higher the middle, 3.0–7.0×1.0–1.5 cm. Fruits pear-shaped, green, very hard, ripen late. It is very ornamental with glossy green leaves, and numerous whitish-rose flowers. In Armenia it grows in arid light forests, from 1.400 up to 1.900 m a.s.l.

The species was described from North-Eastern Anatolia. General distribution: Southern Transcaucasia, North-Eastern Anatolia, Northern Iran.

In karyologically studied specimens of this species the characteristic diploid cytotype 2*n* = 34 was revealed. The chromosome number is given for the first time.

Pyrus* Sect. *Argyromalon

2018. *Pyrus medvedevii* Rubtzov **—** 2*n* = 34 (Fig. 1E).

Ar: Vayots Dzor province, right bank of the river Yeghegis, in the vicinity of village Vardahovit, 2000 m a.s.l. 39° 53’ 52’’ N, 45° 28’ 12’’ E, 11 Oct 2019, leg. *J. Akopian, A. Ghukasyan & M. Oganesian* (ERE 201409).

Tree 10-12 m in height, usually thorny. The leaves are entire-edged, wavy, oblanceolate, 9–11×3–4 cm, more pointed at the base than at the top, asymmetrical, above green, glabrous, whitish from beneath, petioles 2.5–3 cm long. Fruits are small, 2.5–3 cm in diameter, green-yellow, pear-shaped or globular, soft, sour-sweet, stalk 4–5 cm long. In Armenia *P. medvedevii* grows in arid woodlands, from 1.400 up to 2.200 m a.s.l. It was described from Nakhichevan. Endemic to Southern Transcaucasia.

In karyologically studied specimens of this species, collected from the Vayots Dzor province of Armenia, a characteristic diploid cytotype 2*n* = 34 was revealed. The chromosome number was given for the first time.

2019. *Pyrus. takhtadzhianii* Fed. **—** 2*n* = 34 (Fig. 1F & Fig. 2B).

Ar: Vayots Dzor province, Noravank gorge, 1480 m a.s.l., 39° 41’ 07’’ N, 45° 13’ 50’’ E, 26 Aug 2018, leg. *J. Akopian, N. Korotkova, G. Parolly & Z. Asanidze* (ERE 201410).

Thornless tree 5–7 m in height. The leaves are serrate or small-toothed, sometimes entire, obovate, ovate, rhombic, or narrowly elliptical, on one branch of various shapes, 4–7×2–4 cm. It has large, pear-shaped, brown, juicy fruits. According to Fedorov (1954) the

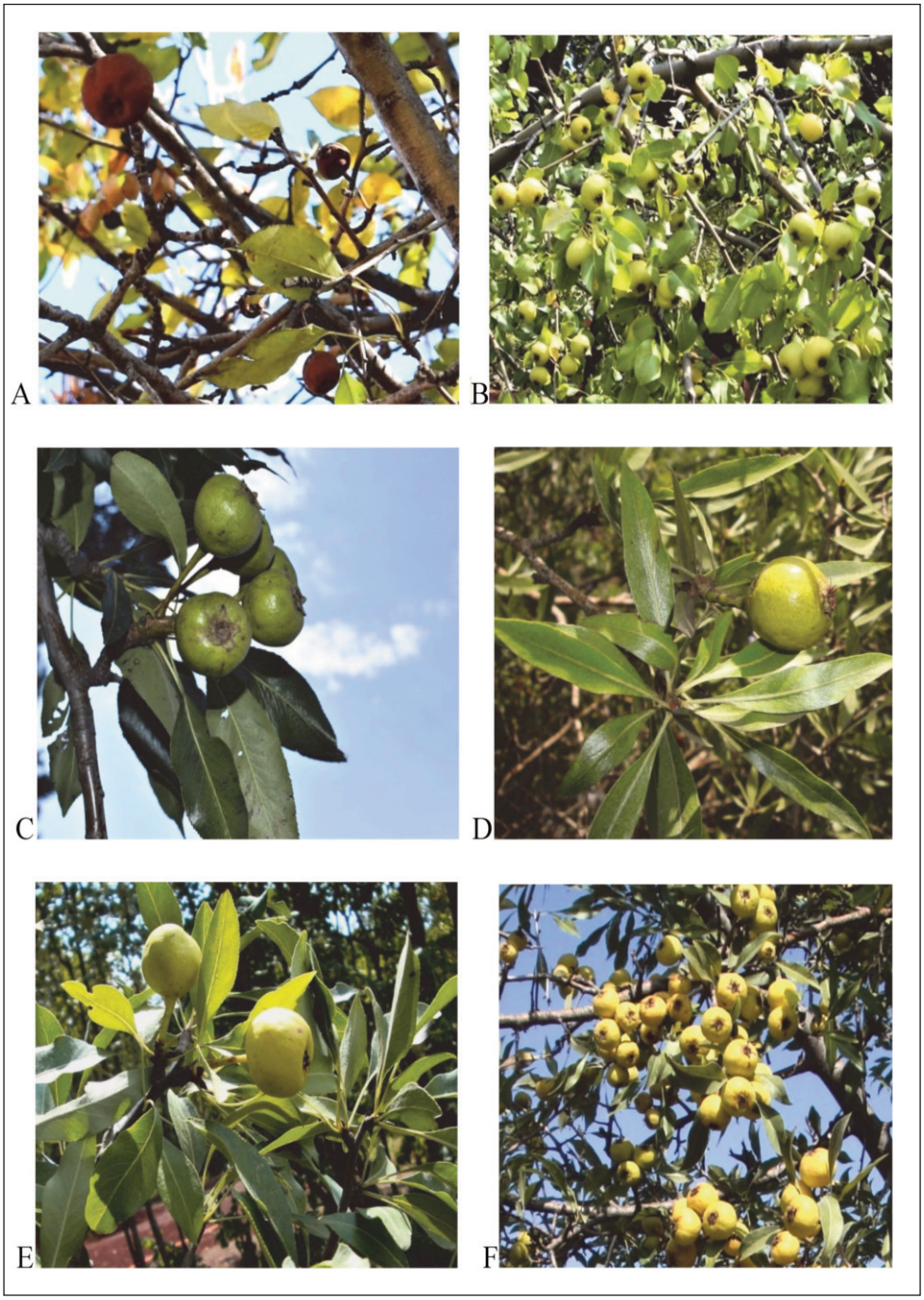

Fig. 1. *Pyrus* species studied: A) *P. hyrcana* var. *yeghegisi*; B) *P. caucasica*; C) *P.daralaghezi*; D) *P. oxyprion*; E) *P. medvedevii*; F) *P. takhtadzhianii* (Photos by Janna Akopian).

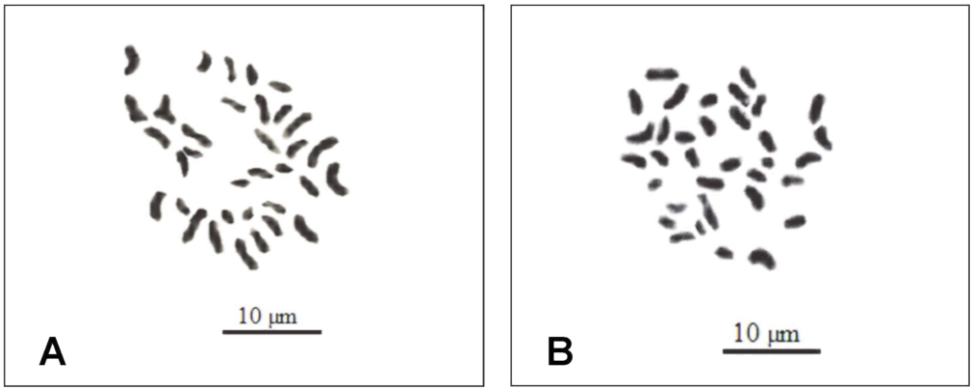

Fig. 2. Metaphase chromosome plate of: A) *Pyrus daralaghezi*, 2*n* = 34; B) *P. takhtadzhiani*, 2*n* = 34.

species may have originated from ancient local pear cultivars. *P. takhtadzhianii* is ornamental with a crown of grayish leaves of various shapes. In Armenia it grows in broad-leaved and arid light forests, among mountainous xerophytic vegetation, from 800 up to 2.200 m a.s.l. The species was described from Armenia. Endemic to Transcaucasia.

In karyologically studied specimens of *Pyrus takhtadzhianii* from Vayots Dzor province of Armenia we revealed a characteristic diploid cytotype 2*n* = 34 (Fig. 3). The chromosome number was given for the first time.

It is interesting to note that the morphological variability and hybridization processes characteristic of pear species are not accompanied by the process of polyploidization. According to Gladkova & Sveshnikova (1990) polyploidy in the genus *Pyrus* is found mainly in cultivated species. As noted by Zelinski & Thompson (1967), speciation within the genus *Pyrus* occurred without changing the chromosome number, apparently the Pomoideae group arose as an allopolyploid between two primary forms having basic numbers of 8 and 9.

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Mediterranean plant karyological data – 33/2

New karyological data for *Hieracium* and *Pilosella* (*Asteraceae*) from Southern Italy

E. Di Gristina, V. Gianguzzi & E. Bajona

Abstract
The chromosome numbers of three *Hieracium* and one *Pilosella* taxa from Southern Italy are given. The chromosome number of *Hieracium grovesianum* subsp. *rigoanum*, *H. grovesianum* subsp. *luteobarbatum* and *H. hypochoeroides* subsp. *serinense* is resulted triploid (2*n* = 3x = 27). The tetraploid chromosome set (2*n* = 4x = 36) found in the population of *Pilosella testimonialis* from Mt. Alpi (Basilicata region) differs from the previous counts (2*n* = 2x = 18) reported for this taxon in literature.

Keywords: Apomixis, Basilicata and Calabria regions, chromosome number, collective species, endemism, *Hieracium* sect. *Grovesiana.*

2020. *Hieracium hypochoeroides* subsp. *serinense* (Zahn) Greuter — 2*n* = 3x = 27 (Fig. 1a).

It: Potenza, Monte Sirino (Lagonegro), 40° 08’ 13” N, 15° 50’ 17” E, rocky stony slopes, 1.715 m a.s.l., 22 Jul 2022, *E. Di Gristina & E. Bajona 100110* (*SAF*).

Hieracium hypochoeroides subsp. *serinense* (Zahn) Greuter is a chasmophytic hawkweed endemic to Mt. Sirino (Basilicata) (Di Gristina & al. 2016a). The collective species *H. hypochoeroides* s. l. includes many apomictic microtaxa which have evolved probably during the postglacial period (Di Gristina & al. 2015a). In southern Europe, many of the taxa described seem to be relict (Gottschlich & al. 2017) and they are punctual endemics (Di Gristina & al. 2015b).

The chromosome number 2*n* = 3x = 27 (Fig. 1a), found here for the first time on material from the *locus classicus* (Mt. Sirino, Basilicata region) of this subspecies, is included in the variability (2*n* = 27, 2*n* = 36) reported for the *H. hypochoeroides* aggregate by Sell and West (1976) and Di Gristina & al. (2021).

2021. *Hieracium grovesianum* subsp. *luteobarbatum* Gottschl. **—** 2*n* = 3x = 27 (Fig. 1b).

It: Cosenza, Parco Nazionale della Sila, Monte Scuro (Camigliatello Silano), 39° 17’ 20.95” N, 16° 26’ 10.01” E, 1,670 m a.s.l., rocky stony slopes, 23 Jul 2022, *E. Di Gristina & E. Bajona* (SAF 100109).

Hieracium grovesianum subsp. *luteobarbatum* Gottschl. is a pseudorosulate hemicryp-

tophytic Italian endemic hawkweed described for the first time from Abruzzo (Gottschlich 2009) and subsequently found also in the Marche (Bartolucci & al. 2018). Recently its range has also been extended to Calabria (Di Gristina & Gottschlich 2023). It belongs to the *H.* sect. *Grovesiana* although *H. grovesianum* subsp. *luteobarbatum* is also similar to *H. murorum* due to the characteristics of the inflorescence (Gottschlich 2009).

The chromosome number 2*n* = 3x = 27 (Fig. 1b), found here for the first time on material from Mt. Scuro (Calabria region), is included in the variability (2*n* = 27, 2*n* = 36) reported for the other taxa belonging to the *H.* sect. *Grovesiana* (Brullo & al. 2005; Di Gristina & al. 2021).

2022. *Hieracium grovesianum* subsp. ***rigoanum*** (Zahn) Zahn — 2*n* = 3x = 27 (Fig. 1c).

It: Reggio Calabria, Parco Nazionale dell'Aspromonte, Gambarie (Santo Stefano in Aspromonte), 38° 10' 16.01" N 15° 51' 40.84" E, quartzarenitic rocky slopes, 1,450 m a.s.l., 23 Jul 2022, *E. Di Gristina & E. Bajona* (SAF 100108).

Hieracium grovesianum subsp. *rigoanum* (Zahn) Zahn is a pseudorosulate hemicryptophytic Italian endemic hawkweed currently known only from Calabria, where it was described for the first time, Basilicata and Abruzzo (Di Gristina & Bajona 2023). It belongs to the *H.* sect. *Grovesiana* which comprehends a complex of similar morphotypes resulting from hybridisation processes of *H. grovesianum* Belli and *H. racemosum* Willd. (Gottschlich & al. 2013; Di Gristina & al. 2014, 2016b).

The chromosome number 2*n* = 3x = 27 (Fig. 1c), found here for the first time on material from the *locus classicus* (Aspromonte, Calabria region) of this subspecies, is included in the variability (2*n* = 27, 2*n* = 36) reported for the other taxa belonging to the *H.* sect. *Grovesiana* (Brullo & al. 2005; Di Gristina & al. 2021).

2023. *Pilosella testimonialis* (Nägeli ex J.Hofm.) Gottschl. — 2*n* = 4x = 36 (Fig. 1d).

It: Potenza, Parco Nazionale del Pollino, Monte Alpi (Latronico), 40° 06' 20.59" N, 15° 58' 45" E, 1,570 m a.s.l., rocky stony slopes, 22 Jul 2022, *E. Di Gristina & E. Bajona* (SAF 100111).

Pilosella testimonialis (Nägeli ex J. Hofm.) Gottschl. is a very polymorphic hawkweed, widespread in central and south-east Europe (Sell & West 1976). In Italy, it is distributed along the southern periphery of the eastern Alps, in Campania, Basilicata and Calabria (Di Gristina & al. 2013).

The chromosome number 2*n* = 4x = 36 (Fig. 1d), found here for the first time on material from Mt. Alpi (Basilicata region) differs from the other counts (2*n* = 2x = 18) reported for this taxon (Grau & Erben 1988; Suda & al. 2007; Di Gristina & al. 2013). This suggest that the *P. testimonialis* population of Mt. Alpi needs critical treatment.

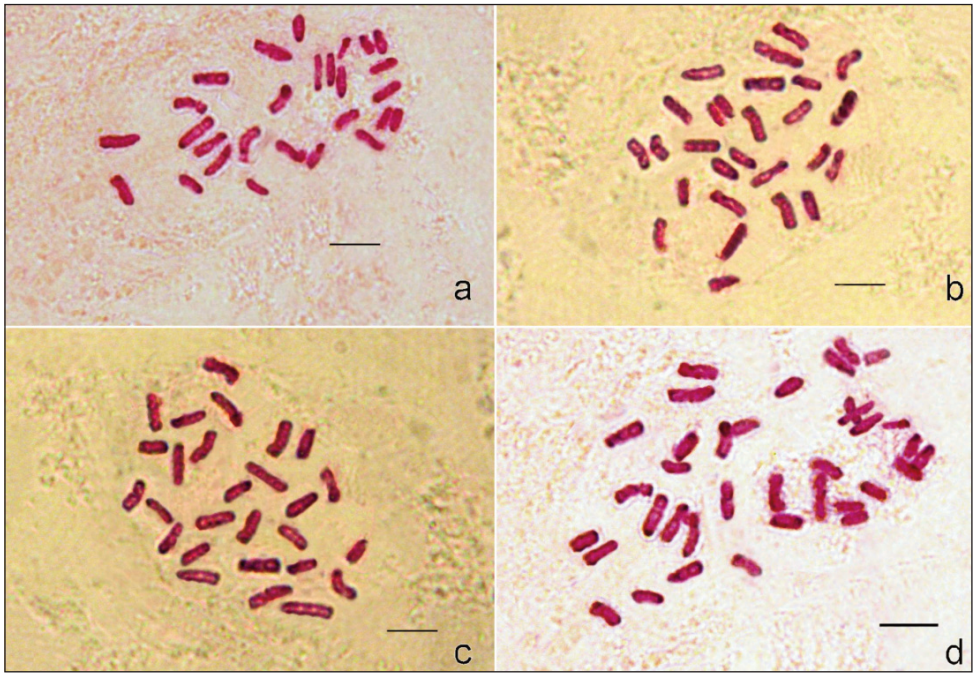

Fig. 1. Microphotographs of mitotic metaphase plates of: **a**, *Hieracium hypochoeroides* subsp. *serinense*, 2*n* = 27; **b**, *H. grovesianum* subsp. *luteobarbatum*, 2*n* = 27; **c**, *H. grovesianum* subsp. *rigoanum*, 2*n* = 27; **d**, *Pilosella testimonialis*, 2*n* = 36. – Scale bars = 10 μm.

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Mediterranean plant karyological data – 33/3

Karyological investigation of some Greek taxa with special reference to cases of polyploidy

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Abstract
Chromosome numbers and karyotypes are given for 8 taxa occurring in Greece. Microphotographs and karyotype morphology are provided, and polyploidy in some of them is discussed. Specifically, a polypoid karyotype is recorded in the species *Centaurea spruneri* s.l. (2*n* = 10x and 2*n* = 11x) *Muscari spreitzenhoferi* (2*n* = 4x) and *Allium neapolitanum* (2*n* = 3x).

Keywords: Chromosome number, distribution, Greece, karyomorphology, polyploidy.

Introduction

In the context of updating the PhytoKaryon database (Kamari & al. 2017-onwards), which aims to record the chromosomal diversity of the plants of Greece, populations of eight native taxa were studied. Chromosome numbers and karyotypes are provided along with microphotographs of metaphase plates and karyotype morphology, while polyploidy in some of them is discussed.

2024. ***Allium neapolitanum*** Cirillo — 2*n* = 3x = 21 (Fig. 1A).

Gr: East Aegean Islands (EAe), Chios Island, Prov. Ionia, near provincial road Tholopotami-Kalamotis, locality named Plakouria, 38° 17’ 53” N, 26° 04’ 54” E, alt. 223 m, 04 Apr 2022, leg. *E. Kriemadi E28* (AUA).

Allium neapolitanum is a Mediterranean element with a wide distribution in Greece in almost all phytogeographical areas, except North Pindos (NPi) and North Central (NC).

Several polyploid and aneuploid chromosome numbers have been reported for the species, with the basic chromosome number x = 7 (2*n* = 14, 21, 28, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40), originated from several countries (see Christou & al. 2008 for references). In Greece, triploid, tetraploid and pentaploid populations have been found by Tzanoudakis (1986) from Sterea Hellas (2*n* = 21, 35), Peloponnisos (2*n* = 21), and East Aegean Islands (2*n* = 21, 28), while the tetraploid chromosome number of 2*n* = 28 was given by Karavokyrou & Tzanoudakis (1991) in material from the Aegean islands of Leros, Kos, Rhodos and Lesvos.

The triploid chromosome number found here has already been given from another population of Chios island (Tzanoudakis 1986). The karyotype is symmetrical, consisting of metacentric and submetacentric chromosomes, ranging in size from 13.27 to 8.00 μm. The karyotype formula is given as: 2*n* = 4x = 12m + 9sm = 21 chromosomes.

2025. ***Allium subhirsutum*** L. — 2*n* = 2x = 14 (Fig. 1B).

Gr: Kriti (KK), Nomos Hanion, Prov. Kissamos, Falassarna village, 35° 30' 02" N, 23° 35' 04" E, alt. 56 m, 18 Apr 2022, leg. *E. Kriemadi E33* (AUA).

Allium subhirsutum is a widely distributed Mediterranean species. In Greece it grows all over the country except North Pindos (NPi).

The diploid chromosome number as well as karyotype morphology have been given by several authors in material originated from numerous countries (Cela Renzoni & Garbari 1971; Garbari & Tornadore 1972; Ruiz Rejón & Sañudo 1976; Badr & Elkington 1977; Jacobsen & Ownbey 1977; Capineri & al. 1978; Bartolo & al. 1981; Strid & Franzén 1981; Johnson 1982; Wittman 1984; Montmollin 1986; Tzanoudakis & Vosa 1988; Karavokirou & Tzanoudakis 1991; Lovka 1995; Brullo & al. 1997; De Sarker & al. 1997; Ohri & Pistrick 2001; Badr & El-Shazly 2022).

The karyotype of the population originated from Falassarna (Kriti) is symmetrical consisting of 2*n* = 2x = 10m + 4sm = 14 chromosomes. The size of the chromosome varies between 13.73 and 8.33 μm.

2026. ***Bellevalia cilliata*** (Cirillo) Nees — 2*n* = 2x = 8 (Fig. 1C).

Gr: Sterea Hellas (StE), Nomos Viotias, Viotias, Mt. Sagmata, at summit Ypato, near Church of Transfiguration of Jesus, 38° 23' 58" N, 23° 24' 44" E, alt.734 m, 16 May 2021, leg. *E. Kriemadi E25* (AUA).

Bellevalia ciliata is distributed in the Mediterranean area, while in Greece it is found in Macedonia, Thessalia, Sterea Hellas and Peloponnisos, as well as Evvia and Scopelos islands (WAe). Its habitat includes open ground, fields and cultivated places (Bareka & al. 2008).

The diploid chromosome number of 2*n* = 2x = 8 reported here has been previously reported by several authors (Feinbrun, 1938-1940; Constantinidis & al. 1997; Bareka & al. 2008, 2012). Moreover, a tetraploid karyotype with 2*n* = 4x = 16 chromosomes from material originated from NE Peloponnisos on serpentine substrate has been reported (Bareka & al. 2008, 2012). In the population studied here 2-4 satellited chromosomes are observed, while up to 6 satellited chromosomes have been reported for the species (Bareka 2008). It should be noted that satellites in the genus species are small, spherical and not always visible. The karyotype of the population studied here consists of 2*n* = 2x = 2m-SAT + 2st + 2sm-SAT + 2sm = 8 chromosomes ranging in size from 12.00 to 6.13 μm.

2027. ***Bellevalia trifoliata*** (Ten.) Kunth — 2*n* = 2x = 8 (Figs 1D, 1E).

Gr: East Aegean Islands (EAe), Chios Island, Prov. Ionia, near provincial road Tholopotami-Kalamotis, locality named Plakouria, 38° 17’ 53” N, 26° 04’ 54” E, alt. 223 m, 04 Apr 2022, leg. *E. Kriemadi E27* (AUA). – Fig. 1D.

— East Aegean Islands (EAe), Lesvos Island, NE of the village Larisos, 50 m from provincial road Panagiouda-Larisos, alt. 65 m, 39° 07’ 43” N, 26° 28’ 28” E, 3 Apr 2022, leg. *E. Kriemadi E26* (AUA). – Fig. 1E.

Bellevalia trifoliata is a Mediterranean element, distributed in Greece at the East and West Aegean Islands, Kriti and Karpathos islands, Kithira, Ionian Islands (Kerkira) and South Pindos, where it is found in open stony places, olive groves, meadows and cultivated fields.

The diploid chromosome number (2*n* = 2x = 8) and the karyotype morphology found here from Lesvos and Chios islands, are previously given from Greece and other countries (see Bareka & al. 2008, 2012 for references). All populations studied have a diploid chromosome number with a karyotype formula consisting of two long metacentric chromosomes with small spherical satellites on their shorter arm, two acrocentric and four submetacentric chromosomes, where one pair of them bears satellites on their long arm (2*n* = 2x = 2m-SAT + 2st + 2sm-SAT + 2sm = 8). Chromosome size varies from 12.33 to 6.00 μm.

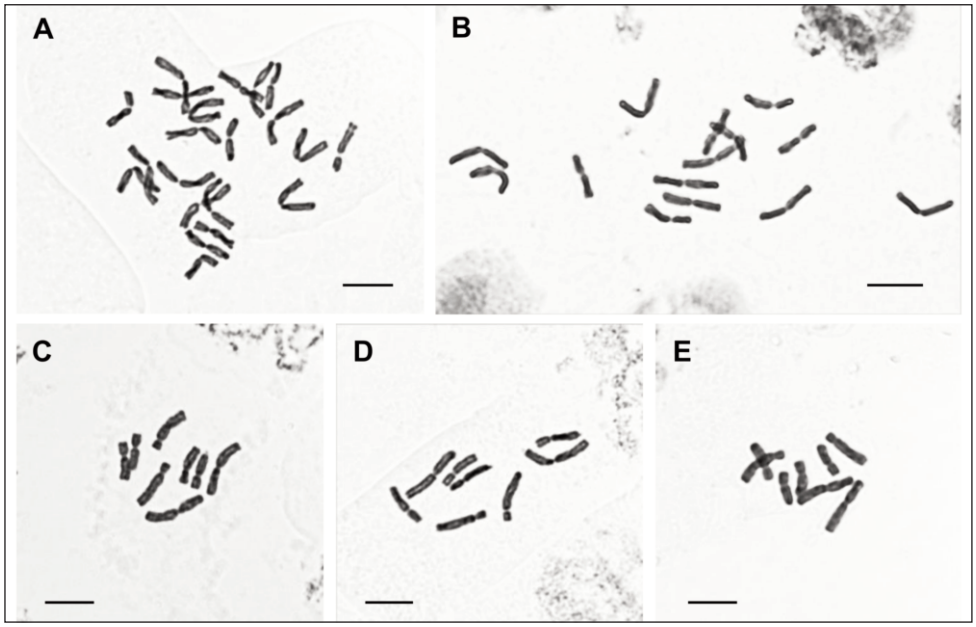

Fig. 1. Microphotographs of mitotic metaphase plates of: **A)** *Allium neapolitanum*, 2*n* = 3x = 21; **B)** *A. subhirsutum*, 2*n* = 2x = 14; **C)** *Bellevalia ciliata*, 2*n* = 2x = 8; **D)** *B. trifoliata*, 2*n* = 2x = 8 (*E27*); **E)** *B. trifoliata*, 2*n* = 2x = 8 (*E26*). – Scale bars = 10 μm.

2028. ***Centaurea spruneri*** Boiss. & Heldr. subsp. ***spruneri*** — 2*n* = 2x = 110 (Fig. 2A).

Gr: Sterea Hellas (StE), Nomos Attikis, Marathon, locality named Ramnouda, Limiko, next to a rural road, 30 Aug 2021, leg. *E. Kriemadi E24* (AUA).

Centaurea spruneri s.l. (sect. *Acrocentron*) is a Balkan endemic distributed in Albania and Greece. According to Rechinger (1943) is divided into three subspecies; subsp. *spruneri*, endemic to Attiki; subsp. *guicciardii* with a wider distribution in S Albania, Ionian Islands, CW continental Greece and N Peloponnisos and subsp. *minoa* (Heldr.) Rech fil., which is a Cretan endemic. However, according to POWO (2023) the Cretan plants belong to subsp. *guicciardii*.

Polyploid karyotypes of 2*n* = 10x = 100 and 2*n* = 11x = 110 have been already given for the typical subspecies (Phitos 1970; Phitos & Kamari 1973). In the population studied here a microphotograph of a symmetrical karyotype with 2*n* = 11x = 110 chromosomes is given. The above karyotype comprises of mostly metacentric and submetacentric chromosomes varying in size from 4.08 and 1.38 μm.

2029. ***Centaurea spruneri*** subsp. ***guicciardii*** **(**Boiss.) Hayek — 2*n* = 10x = 100 (Fig. 2B).

Gr: Ionian Islands (IoI), Lefkada Island, low peak Pirgos, SW slopes, alt. 112 m., near Ammousa beach, 38° 36’ 36.6’ N, 20° 38’ 00.2’ E, 15 Aug 2021, leg. *E. Kriemadi E23* (AUA).

Centaurea spruneri subsp. *guicciardii* has (as mentioned above) a wide distribution in the SW of the Balkan peninsula. The polyploid chromosome numbers of 2*n* = 10x = 100 and 2*n* = 11x = 110 are already reported for subsp. *guicciardii* (Phitos 1970; Phitos & Kamari 1973; Routsi 1993). Additionally, a dekaploid karyotype (2*n* = 10x = 100) is reported from Kriti (under subsp. *minoa*) by Kamari & al. (1993).

The population studied here from Lefkada Island is also decaploid with a symmetric karyotype of 2*n* = 10x = 100 metacentric and submetacentric chromosomes. The chromosome size ranges from 3.10 to 0.85 μm.

2030. ***Muscari comosum*** (L.) Mill. — 2*n* = 2x = 18 (Figs 2C, D).

Gr: Kriti (KK), Nomos Hanion, Prov. Selinou, N part of Omalos plain, near Omalos village, fallow field, 35° 20’ 26.8” N, 23° 54’ 06.4” E, alt. 1055 m, 18 Apr 2022, leg. *E. Kriemadi E40* (AUA). – Fig. 2C.

— Peloponnisos (Pe), Nomos Messinias, close to the village Skliros, next to provincial road Andritsenas-Epikouriou Apollona, at the foothills of Mt. Likeon, 37° 27’16” N, 21° 55’ 30” E, alt. 1110 m, 9 Apr 2022, leg. *E. Kriemadi E31* (AUA). – Fig. 2D.

Muscari comosum occurs from Middle East Asia to the Iberian Peninsula and Canary Islands and from central Germany and S Russia to N Africa (Bentzer 1973).

There are numerous studies on the karyotypic variation of the species, the majority of which gives the chromosome number 2*n* = 18. Material from several countries e.g. Turkey, Italy, Spain, Portugal, France, and Switzerland has been studied revealing a diploid karyotype (Garbari 1966, 1969; Ruiz Rejon 1976; Ruiz Rejon & Oliver 1981; Valdés & al. 1978; Natarajan 1979; Löve & Löve 1982; Lozano & al. 1990; Ruiz Rejón & al. 1990; Dalgiç 1991; Steck-Blaser 1992; Johnson & al. 1996; Özhatay & Johnson 1996; Johnson & Brandham 1997; Garrido-Ramos & al. 1998; Demirci Kayiran & Özhatay 2017; Kiran & al. 2020).

There are also references reporting the same somatic number 2*n* = 18 from Balkan Peninsula (Dalgiç 1991; Lovka 1995), Algeria (Azizi & al. 2016), North Africa (Corsi & al. 1996) and Cyprus (Christou & al. 2008). Several Greek populations are studied (Bentzer 1972, Bentzer & Ellmer 1975, Bentzer & Landström 1975, Montmollin 1986, Kapasa & al. 2001), while cases of trisomic karyotype with 2*n* = 18 + 1 = 19 chromosomes, triploidy (2*n* = 3x = 27), tetraploidy (2*n* = 4x = 36) and diploid karyotypes with 1-2 B chromosomes are reported (Bentzer 1972; Ruiz Rejón & al. 1981, 1986).

Additionally, a heterozygosity at the second in size chromosome pair, caused by a pericentric inversion has been reported in several studied (Garbari 1969, 1973; Bentzer 1972; Bentzer & Ellmer 1975; Bentzer & Landström 1975; Ruiz Rejón & Oliver 1981; Ruiz Rejón & al. 1990; Lozano & al. 1990; Garrido-Ramos & al. 1998; Kapasa & al. 2001; Christou & al. 2008; Azizi & al. 2016).

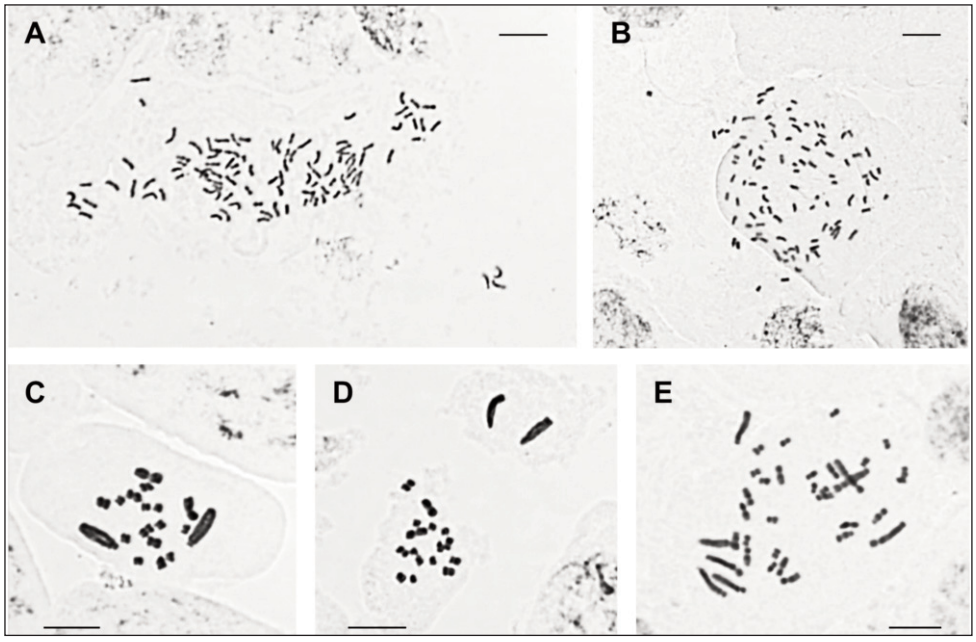

Fig. 2. Microphotographs of mitotic metaphase plates of: **A)** *Centaurea spruneri* subsp. *spruneri*, 2*n* = 11x = 110; **B)** *C. spruneri* subsp. *guicciardii* 2*n* = 10x = 100; **C)** *Muscari comosum*, 2*n* = 2x = 18 (*E40*); **D)** *M. comosum*, 2*n* = 2x = 18 (*E31*); **E)** *M. spreitzenhoferi*, 2*n* = 4x = 36. – Scale bars = 10 μm.

The karyotype formula of the populations studied here is in accordance with previous reports and consists of 2*n* = 2x = 2t + 2sm + 4m/sm + 10m = 18 chromosomes, ranging in size between 8.00 and 1.11 μm.

2031. ***Muscari spreitzenhoferi*** (Heldr.) H.R. Wehrh. — 2*n* = 4x = 36 (Fig. 2E).

Gr: Kriti (KK), Nomos Hanion, Prov. Kissamos, Falasarna village, 35° 30' 00" N, 23° 34' 46" E, alt. 15 m, 18 Apr 2022, leg. *E. Kriemadi E34* (AUA).

A Greek endemic species, with a wide distribution on Kriti island and Gavdopoula islet, found in sandy and rocky places, scrub and mountain dolines, mainly on limestone at an altitude of 0-2200 m.

The tetraploid chromosome number of 2*n* = 4x = 36 found in the population studied here, has already been given by Montmollin (1986) from different localities. A microphotograph is given revealing an asymmetrical karyotype consisting of 8 long acrocentric chromosomes, 4 submetacentric and 28 small metacentric to submetacentric chromosomes. The karyotype formula is given as 2*n* = 8t + 4sm + 24m = 36, while chromosome size varies from 8.01 to 1.81 μm.

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Mediterranean plant karyological data – 33/4

Contribution to the karyological knowledge of some representatives of the family *Asteraceae* in the Pyrenean flora

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Abstract
Chromosome numbers, ploidy level, distribution, localities, and selected prior chromosome counts are detailed for eight taxa belonging to the *Asteraceae* family including the first count in *Hieracium hastile*. All of these species grow in the Pyrenees.

Keywords: Chromosome number, *Cirsium, Hieracium, Hypochaeris, Jacobea*, *Lactuca*, *Pilosella*, *Taraxacum*, *Tragopogon*, distribution, ploidy level.

Introduction

Within the context of various ongoing projects in alpine systems' plants, with a particular focus on the Pyrenees, acquiring information about chromosome numbers and ploidy levels is crucial. These data are indispensable for comprehending the processes that impact the species constituting the flora in these regions.

The objective of this study is to augment existing cytogenetic datasets by providing additional information about chromosome numbers and ploidy levels of these species, in one of them (*Hieracium hastile*) for the first time. All plants studied have been collected in the Catalan Pyrenees (Iberian Peninsula). The information provided about their general distribution area has been obtained in all cases from Plants of the World Online (POWO, https://powo.science.kew.org, accessed November 24, 2023).

2032. *Cirsium vulgare* (Savi) Ten. — 2*n* = 4x = 68 (Fig. 1A).

Hs: Catalonia, Setcases, La Serra, edges of the pine forest, alt. 1837 m, 42° 23' 11" N, 2° 18' 59" E, 18 Aug 2023, leg. *T. Garnatje (GR-900)*, *O. Hidalgo*, *J. de Montaigne de Poncins* & *I. Pérez-Lorenzo* (BC).

This species is native to Europe, Siberia, Arabian Peninsula and NW of Africa, and introduced into Australia, America and South of Africa.

It is a ruderal species that grows on the edges of forests in the Pyrenees (Bolòs & al. 2005).

The chromosome number established in this study agrees with most previous counts (e.g. Tonian 1982), and confirms the tetraploid status of this species, but a diploid 2*n* = 34 report exists from Bulgaria (Kuzmanov & al. 1991). This is the first count from the Pyrenean area studied (https://sites.google.com/view/cromocat/home, accessed November 25, 2023).

2033. *Hieracium hastile* Arv.-Touv. & Gaut. (syn.: *Hieracium phlomoides* subsp. *hastile* (Arv.-Touv. & Gaut.) Zahn) — $2n = 3x = 27$ (Fig. 1B).

Hs: Catalonia, Setcases, Camí de la Serra, meadows, alt. 1261 m, 42° 22' 33" N, 2° 18' 12" E. 11 Aug 2023, leg. *T. Garnatje (GR-862)* & *J. Luque* (BC).

This species is a perennial plant native to NE Pyrenees & E. Central Spain (POWO).

To our knowledge, the chromosome number established in this study is the first count for this species. It agrees with counts in other triploid species of the *Hieracium* gr. *laniferum* according to *Flora iberica* (Mateo & al. 2017), such as *H. spatulathum* Scheele (Castro & al. 2007).

2034. *Jacobaea leucophylla* (DC.) Pelser (syn.: *Senecio leucophyllus* DC.) — $2n = 4x = 40$ (Fig. 1C).

Hs: Catalonia, Setcases, Coma Ombriaga, open habitats of the screes, alt. 2315 m, 42° 25' 48" N, 2° 15' 33" E, 22 Aug 2023, leg. *T. Garnatje (GR-908)* & *J. Luque* (BC).

This species is native to Southern and Central France and Eastern Pyrenees. It thrives amidst the pebbles and screes within the alpine region.

The tetraploid chromosome number established in this study agrees with previous counts: Favarger & Küpfer (1968) indicated $n = 20$ for a Pyrenean population geographically very close to the one here reported.

2035. *Lactuca serriola* L. — $2n = 2x = 18$ (Fig. 1D).

Hs: Catalonia, Puigcerdà, near the railway track, 1-2 km from the urban nucleus, ruderal, alt. 1200 m. Coord.: 42º 41' 48" N, 1º 91' 99" E, 12 Aug 2023, leg. *J. Vallès* (BC).

Native to Europe to SW Siberia and Xinjiang and N Africa to Somalia, and introduced into Australia, America and South of Africa. It grows often in ruderal locations.

The chromosome number established in this study agrees with $n = 9$ and $2n = 18$ counts reported by Mejías (1993) from a low-altitude population located at ca. 150 km from the one here studied, and from $2n = 18$ recorded from an also non-far Southern French population (Garcia & al. 2013). The same $2n = 18$ number is recorded from many other provenances (Index to plant chromosome numbers, http://legacy.tropicos.org/NameSearch.aspx?projectid=9, accessed November 25, 2023).

2036. *Pilosella lactucella* (Wallr.) P.D.Sell & C.West (syn.: *Hieracium lactucella* Wallr.) — $2n = 2x = 18$ (Fig. 1E).

Hs: Catalonia, Setcases, La Serra, meadows, alt. 1781 m, 42° 23' 11" N, 2° 18' 58" E, 18

Aug 2023, leg. *T. Garnatje (GR-897)*, *O. Hidalgo*, *J. de Montaigne de Poncins & I. Pérez-Lorenzo* (BC).

This species is native to Europe and introduced into very restricted areas of America (New York, Nova Scotia).

The chromosome number established in this study agrees with the previous counts (e.g. Rotreklová & al. 2005). This is the first count in the Pyrenean area studied (https://sites.google.com/view/cromocat/home, accessed November 25, 2023).

2037. *Hypochaeris radicata* L. — 2*n* = 2x = 8 (Fig. 1F).

Hs: Catalonia, Setcases, camí de la Serra, meadows, alt. 1521 m, 42° 22' 52" N, 2° 18' 29" E, 12 Aug 2023, leg. *T. Garnatje (GR-870)* & J. *Luque* (BC).

This species is native to Europe and Northern Africa. In the Pyrenees, it grows in meadows, grazing lands and mountain trail edges.

The chromosome number established in this study agrees with the previous counts of *n* = 4 (Luque & al. 1984) and 2*n* = 8 (Izusquiza 1989) in low-altitude areas not far from the studied one, as well as in other places (e.g. in Morocco, Serra & al. 2001; in Italy, Barghi & al. 1988).

2038. *Taraxacum pyrenaicum* Reut. — 2*n* = 2x = 16 (Fig. 1G).

Hs: Catalonia, Setcases, on the trail to the Ulldeter refuge, alt. 2139 m, 42° 25' 14" N, 2° 15' 42" E, 18 Aug 2023, leg. *T. Garnatje (GR-887)*, *O. Hidalgo*, *J. de Montaigne de Poncins* & *I. Pérez-Lorenzo* (BC).

This species is native to Bulgaria, France and Spain. It grows in alpine meadows. Bolòs & al. (2005) included this taxon in *Taraxacum dissectum* (Ledeb.) Ledeb., whereas Galán de Mera (2017) disagrees with this structuration and considers both taxa separated, with only *T. pyrenaicum* present in the Iberian Peninsula.

The chromosome number here reported confirms the count published (under the name of *T. dissectum*) of a population extremely close to the present one (Garcia & al. 2013). It is also consistent with the number *n* = 8 observed by Küpfer (1969a, b) in a population under the name of *T.* aff. *pyrenaicum* (Col du Puymorens), not far from the present one, and with the number reported by Macháčková & al. (2022) for the Encamp population in Andorra, also in the same area. The report of a triploid lineage, with 2*n* = 3x = 24, in the Ordesa valley (Záveský & al. 2005) is remarkable, with the taxon recorded as *Taraxacum pyrenaicum* group. These chromosome numbers in Eastern Pyrenees' populations differ from 2*n* = 32 reported for *T. dissectum* from China (Zhai & al. 1997).

2039. *Tragopogon lamottei* Rouy (syn.: *Tragopogon pratensis* subsp. *lamottei* (Rouy) O.Bolòs & Vigo). — 2*n* = 2x = 12 (Fig. 1H).

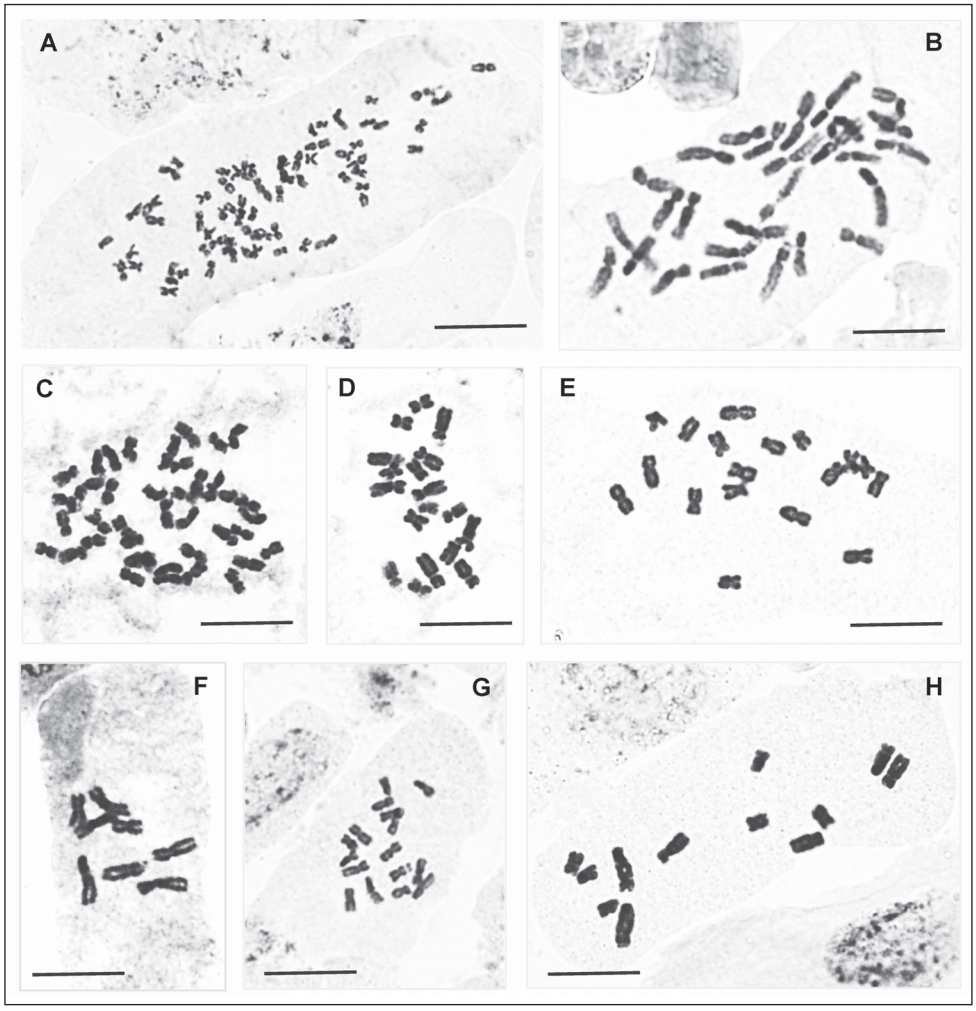

Fig. 1. Metaphase chromosome plates: A) *Cirsium vulgare*, 2*n* = 68; B) *Hieracium hastile*, 2*n* = 27; C) *Jacobaea leucophylla*, 2*n* = 40; D) *Lactuca serriola*, 2*n* = 18; E) *Pilosella lactucella*, 2*n* = 18; F) *Hypochaeris radicata*, 2*n* = 8; G) *Taraxacum pyrenaicum*, 2*n* = 16; H) *Tragopogon lamottei*, 2*n* = 12. – Scale bars = 10 μm.

Hs: Catalonia, Setcases, camí de la Serra, alt. 1365 m, 42° 22’ 40” N, 2° 18’ 25” E, 12 Aug 2023, leg. *T. Garnatje (GR-865)* & *J. Luque* (BC).

The native range of this species is limited to France and Spain. This species grows in the Pyrenean meadows.

The chromosome number here reported is coincidental with the one published by Díaz de la Guardia & Blanca (1988) for a Southern Iberian population. Garcia & al. (2013)

reported the same chromosome number for a *T. pratensis* -without subspecific assignation- population located not far from and at a similar altitude than the one studied in the present paper. In any case, $2n = 12$ is constant as chromosome number for all *T. pratensis* subspecies with such data available (Index to plant chromosome numbers, http://legacy.tropicos.org/NameSearch.aspx?projectid=9, accessed November 25, 2023).

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