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Mediterranean plant karyological data – 26

edited by G. Kamari, C. Blanché & S. Siljak-Yakovlev

Abstract

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This is the twenty-six of a series of karyological data from Mediterranean area, peri-Alpine communities and the Atlantic Islands, in English or French language. It comprises contributions on 25 taxa: *Cyclamen*, *Matthiola*, *Ornithogalum* and *Scilla* from Cyprus by P. Bareka, E. Christou & G. Kamari (Nos 1868-1871); *Lilium* from Turkey by B. Gürdal, S. Demirci, N. Özhatay & E. Kaya (Nos 1872-1880); *Centaurea*, *Campanula*, *Clinopodium* and *Silene* from Greece by Ch. Kyriakopoulos, P. Bareka & G. Kamari (Nos 1881-1884); *Aconitum* from France, Morocco and Spain by J. Molero, A. M. Rovira, M. Bosch, J. Simon & C. Blanché (Nos 1885-1902).

During the OPTIMA Meeting held in Montpellier (6-11 June 2016), the Commission of Karyosystematics agreed to change the current name of the column "Mediterranean Chromosome Number Reports" in Flora Mediterranea for a most comprehensive title recognizing the true scope of the contributions usually published (which include, karyotype analysis, evolutionary consequences, bibliographic critical review, as well as biogeographical considerations, taxonomic remarks etc., derived from chromosome studies). The new title for the series is: "Mediterranea plant karyological data" (MPKD) and thus the next issues will be named accordingly. The Commission also decided the addition of the titles of single contributions to valorize the work of the contributors.

Addresses of the editors:

Prof. Georgia Kamari, Botanical Institute, Section of Plant Biology, Department of Biology, University of Patras, GR-265 00 Patras, Greece. E-mail: kamari@upatras.gr

Prof. Cesar Blanché, IRBio-GReB, Laboratori de Botànica, Facultat de Farmàcia, Universitat de Barcelona, Av. Joan XXIII s/n, E-08028 Barcelona, Catalonia, Spain. E-mail: cesarblanche@ub.edu

Dr. Sonja Siljak-Yakovlev, CNRS, Unité Ecologie, Systématique, Evolution, UMR 8079 UPS-CNRS-AgroParisTech, Département "Biodiversité, Systématique et Evolution, Université Paris-Sud 11, Bat. 360, 91405 ORSAY CEDEX, France. E-mail: sonia.yakovlev@u-psud.fr

P. Bareka, E. Christou & G. Kamari

Karyology of some plant taxa from Cyprus

Abstract

Bareka, P., Christou, E. & Kamari, G. 2016: Karyology of some plant taxa from Cyprus [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 216-219. doi: 10.7320/FlMedit26.216

The chromosome number, karyotype morphology and geographical distribution of some plant taxa from the indigenous flora of Cyprus are presented, along with comments concerning their IUCN status, whenever appropriate. Karyotype microphotographs for all taxa are provided and their karyotype morphology is discussed.

1868. ***Cyclamen cyprium*** Unger & Kotschy **—** 2*n* = 30 (Fig. 1A).

Cy: Close to the monastery of Agia Moni, 34° 90' N, 32° 62' E, alt. ca 1000 m, 17 Feb 2009, *E. Christou & P. Christou E67CY* (UPA).

Cyclamen cyprium is an endemic species of Cyprus that grows in rocky places, near lakes, streams and woodlands of pine and cedar, at an altitude of 300-1200 m.

The chromosome number 2*n* = 30 found here, agrees with previous reports by Vogt & Aparicio (1999) from a population derived from the region of Paphos. Earlier studies (Haan & Doorenbos 1951; Legro 1959 and Lepper 1964) also report the same chromosome number from cultivated material of unknown origin.

The karyotype is symmetrical consisting of mostly metacentric and submetacentric chromosomes, varying in size from 5.07 to 3.04 μm. In the present study, we observed the presence of at least two chromosomes pairs bearing satellites.

1869. ***Matthiola tricuspidata*** (L.) R. Br. **—** 2*n* = 14 (Fig. 1B).

Cy: Limassol, Akrotiri Bay, 34° 70′ N, 33° 09′ E, alt. 0-3 m, 4 Apr 2009, *E. Christou & P. Christou, E63CY* (UPA).

Matthiola tricuspidata, is a mediterranean ammophilus species that is located on sandy beaches and primary dunes near the sea level.

The somatic chromosome number of 2*n* = 14, counted here is in accordance with previous reports from Italy (Cela Renzoni 1969; Brullo & Pavone 1977) and Greece (Miège & Greuter 1973; Runemark 2000). However, Vogt & Aparicio (1999) report the chromosome number 2*n* = 16 in material derived from a Cypriot population close to Larnaca.

The karyotype studied here consists of mostly metacentric (m) chromosomes, which vary in size between 2.90 and 1.61 μm.

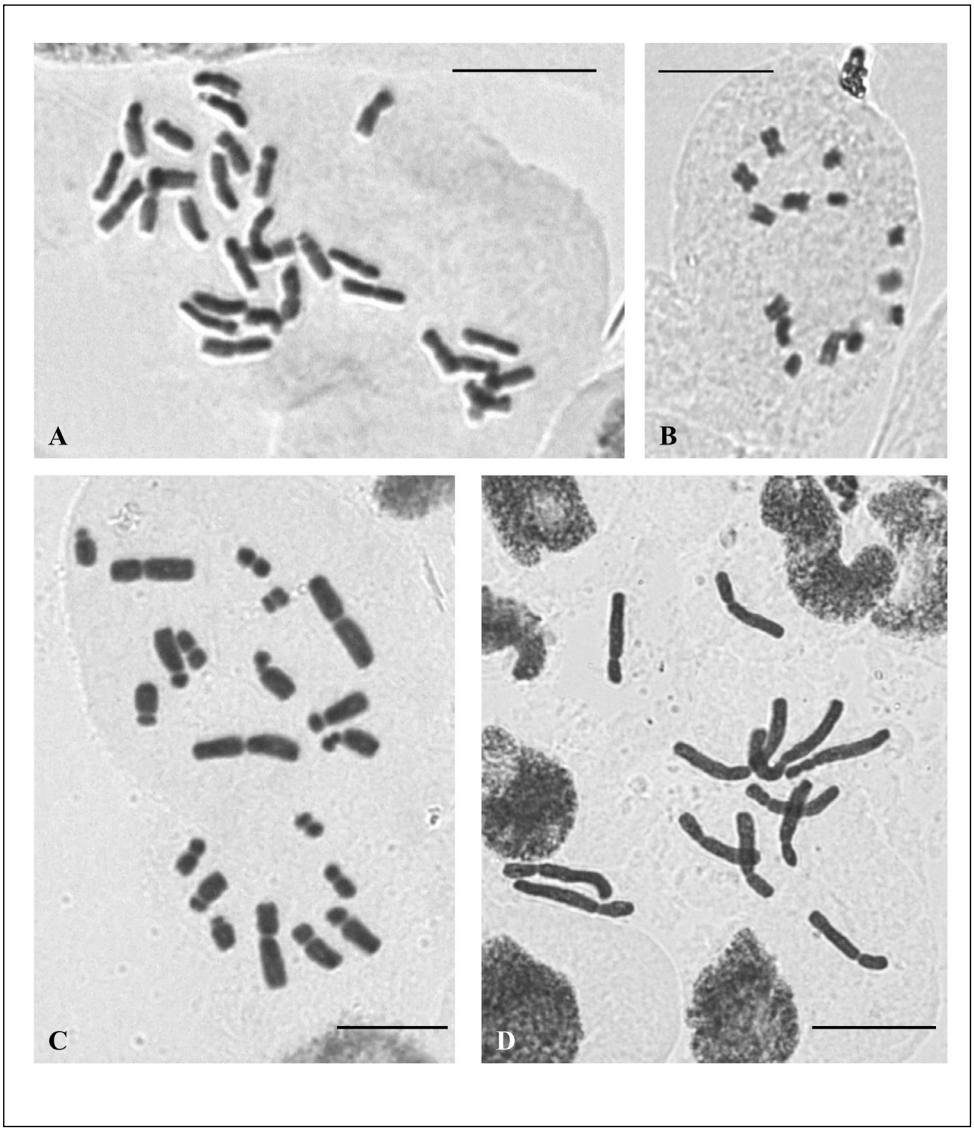

Fig. 1. Microphotographs of somatic metaphase plates of: **A,** *Cyclamen cyprium*, 2*n* = 30; **B,** *Matthiola tricuspidata*, 2*n* = 14; **C,** *Ornithogalum chionophylum,* 2*n* = 20 and **D,** *Scilla morrisii*, 2*n* = 12. – Scale bars = 10 μm.

1870. *Ornithogalum chionophilum* Holmboe **—** 2*n* = 20 (Fig. 1C).

Cy: Agios Nikolaos forest, 35° 05' N, 32° 02' E, alt. ca 700 m, 6 Apr 2008, *E. Christou & P. Christou*, *E4CY* (UPA).

Ornithogalum chionophylum is an endemic species of Cyprus distributed in Akamas area, at the forest of Agios Nikolaos as well as the Troodos mountains. It prefers moist soil, usually near streams, riverbanks or in shaded areas of *Pinus nigra* J.F. Arnold forests.

The chromosome number $2n = 20$ of the population studied is in accordance with previous reports by Garbari & al. (1988) and Stedje & Ovstedal (1991). Additionally, the chromosome number of $2n = 24$ is also reported for this taxon by Gennaiou-Della (2000) in material from another population of Cyprus.

The karyotype is asymmetrical consisting of $2n = 10m + 2sm + 2sm/st + 6st = 20$ chromosomes. The fourth in size chromosome pair is characterized by the presence of a secondary constriction on the short arm of the homologues, while the size of the chromosomes ranges from 10.25 to 2.21 μm.

1871. *Scilla morrisii* Meikle **—** $2n = 12$ (Fig. 1D).

Cy: Close to the monastery of Agia Moni, 34° 90' N, 32° 62' E, 6 Apr 2008, *E. Christou & P. Christou*, *E4CY* (UPA).

Scilla morrisii is an endemic species of Cyprus found in moist, shaded crevices and banks, often under *Quercus infectoria* subsp. *veneris* (A. Kern.) Meikle and *Pistacia terebinthus* L. The species has been characterized as Endangered (EN), according to the *Red Data Book of the flora of Cyprus*, since it is threatened by habitat loss caused by the expansion of agricultural areas, road construction, internal factors (inbreeding and low densities) and by predators, while its total population on the island amounts to 1000 individuals (Della & al. 2007).

The chromosome number $2n = 12$ is in accordance with previous reports by Greilhuber & Speta (1989); Gennaiou-Della (2000) and Speta (2011), under *Othocallis morrisiii* (Meikle) Speta from other localities of the island.

The symmetrical karyotype consists of $2n = 2m + 8sm + 2sm\text{-}SAT = 12$ large chromosomes ranging in size from 22.96 to 11.94 μm. The shortest in size chromosome pair bears small spherical satellites. Additionally, secondary constrictions are observed in the middle of the shorter arms of the third in size chromosome pair.

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Addresses of the authors:
Pepy Bareka[1], E. Christou[2] & G. Kamari[2],
[1]Laboratory of Systematic Botany, Faculty of Crop Science, Agricultural University of Athens, Iera Odos 75, 118 55 Athens, Greece. E-mail: bareka@aua.gr
[2]Botanical Institute, Section of Plant Biology, Department of Biology, University of Patras, 265 00 Patras, Greece. E-mail: kamari@upatras.gr

B. Gürdal, S. Demirci, N. Özhatay & E. Kaya

Chromosome numbers of 9 taxa of *Lilium* (*Liliaceae*) from Turkey

Abstract

Gürdal, B., Demirci, S., Özhatay, N. & Kaya, E. 2016: Chromosome numbers of 9 taxa of *Lilium* (*Liliaceae*) from Turkey [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 220-223. doi: 10.7320/FlMedit26.220

In the present study the chromosome number of 9 *Lilium* taxa from Tukish populations is given. For three of them the somatic number is given for the first time. Additionally, the presence of B chromosomes has been observed for *Lilium kesselringianum, Lilium ponticum* var. *artvinense* and *Lilium szovitsianum*, while a new chromosome number for *Lilium candidum* is reported.

Introduction

This report is based on the specimens collected during the Geophyte Project (110G007), carried out in the Atatürk Horticultural Central Research Institute (Yalova). Plant specimens were collected from nature and planted in the geophytes research garden in Yalova. Actively growing root tips used for the chromosome counts were collected from the garden. The methods followed standard chromosome counting procedure in ISTE (Koçyiğit & Bona 2013). As a result, chromosome number of 9 taxa are counted, 3 of them are reported for the first time in this study.

1872. *Lilium akkusianum* R. Gämperle — 2*n* = 24 + 0-1B.

Tu: Tokat; Erbaa, Madenli Köyü, Armudun altı mevkii, 1147 m, 15 Apr 2008 (Hort. coll. no: L6001).
— Tokat; Erbaa, Gökal Köyü, Çermik Mahallesi, orman açıklıkları, 1358 m, 02 Jul 2008 (ISTE 93709).

Lilium akkussianum is an endemic species described from N Anatolia (Gamperle 1998). The chromosome number is reported for the first time.

1873. *Lilium armenum* Grossh. — 2*n* = 24.

Tu: Ardahan; Damaldan Arap Mezarlarına, Üçdere ağaçlandırma, 1800-1900 m, 15 Jul 2009 (Hort. coll. no: L7506).

Lilium armenum was reported as 2*n* = 24 in the literature (Kudriashova 1969). Our result is in accordance to the previous study.

1874. *Lilium candidum* L. — 2*n* = 24, 32.

Tu: Muğla; Marmaris, İçmeler-Bayırköy yolu, İçmeler üstü, 241 m, 14 Mar 2008 (Hort. coll. no: L4805).

The somatic number of *Lilium candidum* 2*n* = 24 has been previously reported (Smyth & al. 1989; Agnieszka & al. 2005). In the present study 2*n* = 24, as well as 2*n* = 32 chromosomes are counted.

1875. *Lilium ciliatum* P.H. Davis — 2*n* = 24.

Tu: Trabzon; Maçka, Bekçiler Köyü civarı eski yol üzeri, 1657 m, 13 Jul 2007 (Hort. coll. no: L6107).

Lilium ciliatum is an endemic species from Turkey. The chromosome number reported here, 2*n* = 24, is in accordance with a previous report (Özdemir 2003).

1876. *Lilium kesselringianum* Miscz. — 2*n* = 24 + 0-2B

Tu: Artvin; Sahara, Yalnızçam dağı, Şavşat, 2185 m, 12 Sept 2006 (Hort. coll. no: L0801).

In the literature, the chromosome number of *Lilium kesselringianum* is reported as 2*n* = 24 (Kudriashova 1969; Zakharyeva & Makushenko 1969). In this study, the somatic number is the same, while 0-2B chromosomes are observed.

1877. *Lilium martagon* L. — 2*n* = 24.

Tu: İstanbul; Belgrat Ormanları, Atatürk Arboretumu, 100 m, 05 Jun 2005 (Hort. coll. no: L3401).

The chromosome number of 2*n* = 24 + 0-2B for *Lilium martagon* is also reported in the literature (Holub & al. 1972; Murin & al. 1980; Strid & Franzen 1981; Malakhova & Markova 1994).

1878. *Lilium ponticum* K. Koch — 2*n* = 24.

Tu: Trabzon; Çaykara, Karaçamdan Soğanlıya çıkış yolu, 1959 m, 15 Apr 2006 (Hort. coll. no: L6101).

The chromosome number of *Lilium ponticum* is reported for the first time in this study.

1879. *Lilium ponticum* var. *artvinense* (Miscz.) P.H. Davis & D.M. Hend. — $2n = 24 + 0\text{-}3B$.

Tu: Artvin; Kafkasordan-Madene giderken yol üzeri, 1701 m, 13 Apr 2006 (Hort. coll. no: L0803).

The chromosome number reported here is counted for the first time and B chromosomes are observed.

1880. *Lilium szovitsianum* Fisch. & Avé-Lall. — $2n = 24 + 0\text{-}1B$.

Tu: Ardahan; Çıldır, Kenarbel Köyü, Aktaş Gölü, Ercan mevkii, 1975 m, 30 Aug 2007 (Hort. coll. no: L7505).

The chromosome number $2n = 24$ for *Lilium szovitsianum* has already been given (Kudriashova 1969). In this study, we observed the presence of a B chromosome in some metaphase plates.

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Addresses of the authors:
Bahar Gürdal[1], Serpil Demirci[2], Neriman Özhatay[1] & Erdal Kaya[3],
[1]Department of Pharmaceutical Botany, Faculty of Pharmacy, İstanbul University, 34116, Fatih/İstanbul, Turkey. E-mail: bahar_ps@yahoo.com
[2]Department of Pharmaceutical Botany, Faculty of Pharmacy, Çukurova University, 01330, Adana, Turkey.
[3]Ornamental Plants Department, Atatürk Horticultural Central Research Institute, 77102, Yalova, Turkey.

Ch. Kyriakopoulos, P. Bareka & G. Kamari

Karyological data of some endemic taxa from Mt Taigetos, Greece

Abstract

Kyriakopoulos, Ch., Bareka, P. & Kamari, G. 2016: Karyological data of some endemic taxa from Mt Taigetos, Greece [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 224-228. doi: 10.7320/FlMedit26.224

In the present study, the chromosome number and the karyotype of 4 endemic taxa from populations of Mt Taigetos are given. For *Campanula papillosa* and *Clinopodium taygeteum* the somatic number is given to our knowledge for the first time. The geographical distribution and the conservation status of the threatened taxa are also discussed.

1881. *Centaurea athoa* subsp. *parnonia* (Halácsy) E. Gamal-Eldin & Wagenitz — $2n = 2x = 20$ (Fig. 1A).

Gr: Peloponnisos, Nomos Lakonias, Mt Taigetos, at the way from Maganiari to EOS refuge, limestone, open place between *Pinus nigra-Abies cephalonica* forest, 36° 57' N, 22° 23' E, alt. 1300 m, 5 Jul 2014, *Ch. Kyriakopoulos& G. Kofinas 2052* (UPA).

Centaurea athoa belongs to sect. *Acrocentron* (Cass.) DC. (Wagenitz & Gamal-Eldin 1985) and it is divided into two subspecies. The typical one occurs at Athos peninsula and in W & S Anatolia (Gamal-Eldin & Wagenitz 1991), while subsp. *parnonia* (≡ *Centaurea parnonia* Halácsy) is an endemic taxon occurring in S & SE Peloponnisos, mostly at the middle-upper altitudinal range of Mts Taigetos and Parnon respectively (Gamal-Eldin & Wagenitz 1991).

The chromosome number of the population studied is $2n = 2x = 20$ and agrees with previous reports by Routsi (1993) and Routsi & Georgiadis (1994, 1999), under the name *C. rupestris* subsp. *parnonia*. The same chromosome number is also given for the typical subspecies in material from Greece (Strid 1986; Routsi & Georgiadis 1994, 1999) and Turkey (Uysal & al. 2009).

1882. *Campanula papillosa* Halácsy — $2n = 32$ (Fig. 1B).

Gr: Peloponnisos, Nomos Lakonias, Mt Taigetos, at the summit area of Profitis Ilias called Megala Zonaria, limestone slopes, 37° 57' N, 22° 21' E, alt. 1900 m, 22 Jun 2008, *Ch. Kyriakopoulos & N. Turland 755a* (UPA).

Campanula papillosa is a local endemic species of S Peloponnisos, which occurs on the higher altitudes of Mt Taigetos. It was found for the first time by Maire & Petitmengin

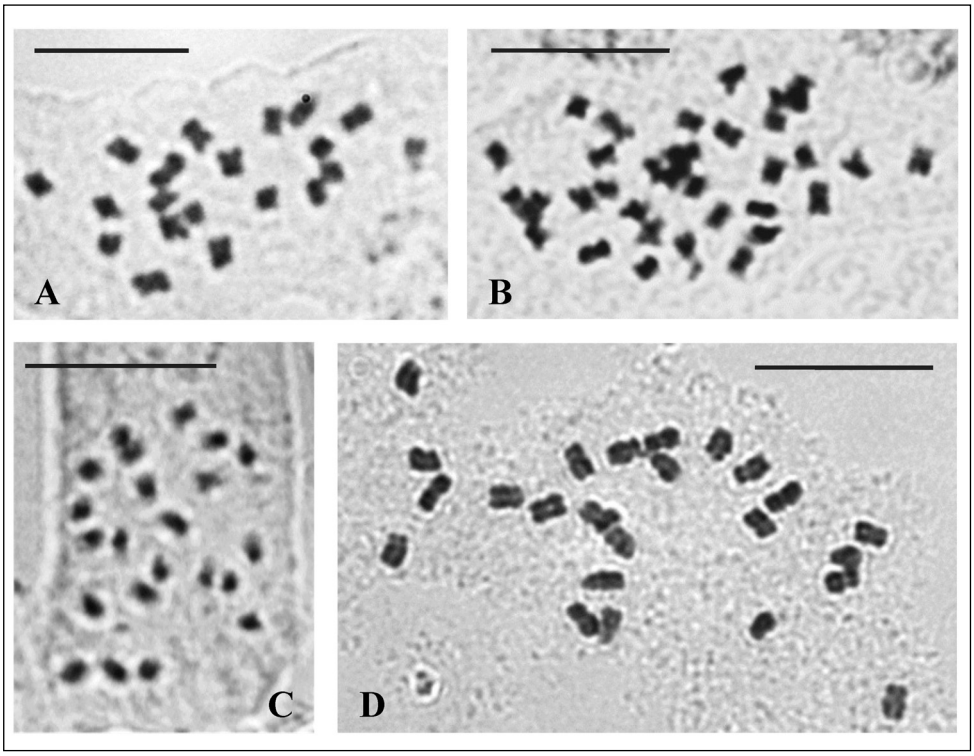

Fig. 1. Microphotograph of mitotic metaphase plates of: **A.** *Centaurea athoa* subsp. *parnonia*, 2*n* = 20; **B.** *Campanula papillosa*, 2*n* = 32; **C.** *Clinopodium taygeteum*, 2*n* = 22; **D.** *Silene gigantea* subsp. *hellenica*, 2*n* = 24. – Scale bars = 10 μm.

(1906) and described by Halácsy (1908). It is a little-known and rarely collected species of the genus *Campanula* with few references (Hartving 1991; Tan & Iatroú 2001) and to our knowledge its collection by the first author in 2008, is its rediscovery after 102 years. It is a relict species, categorized as Critically Endangered (CR) by Kyriakopoulos & al. 2009, because of its limited distribution area and very small population size, which was considered not to exceed 100 individuals.

To our knowledge, the chromosome number 2*n* = 32 and the karyotype of *Campanula papillosa* are given here for the first time.

1883. *Clinopodium taygeteum* (P.H. Davis) Bräuchler — 2*n* = 22 (Fig. 1C).

Gr: Peloponnisos, Nomos Messinias, Mt Taigetos, on the vertical NE slopes of Tsuga summit of Mt Xerovouna, in the north part of Taigetos ridge, 37° 06’ N, 22° 18’ E, alt. 1750 m, 1 Jul 2007, *Ch. Kyriakopoulos 561*(UPA). – Fig. 1C.

— Peloponnisos, Nomos Messinias, Mt Taigetos, place called Neraidovrahos, on the vertical slopes of Pirgaki summit of Mt Xerovouna, in the north part of Taigetos ridge, 37° 07' N, 22° 17' E, alt. 1650 m, 5 Aug 2007, *Ch. Kyriakopoulos 673* (UPA).
— Peloponnisos, Nomos Lakonias, Mt Taigetos, at the E slopes between the summits Sidirokastro and Anonimi, Pentadactilos ridge, 37° 02.554' N, 22° 19.036' E, alt. 1950 m, 17 Jun 2015, *Ch. Kyriakopoulos 2233* (UPA).

Clinopodium taygeteum (P.H. Davis) Bräuchler (≡ *Micromeria taygetea* P. H. Davis) is an endemic species of S Peloponnisos, which grows exclusively on limestone rock crevices and stony slopes, at the higher altitudes of the main summits Tsuga (1782 m) and Pirgaki (1731 m) of Mt Xerovouna, in the north part of Taigetos ridge. The species is included in the *Red Data Book of Rare and Threatened Plants of Greece* (Phitos & al. 2009) as Endangered (EN) by Kyriakopoulos & Kamari (2009).

The closest relative of this isolated taxon is *Clinopodium caricum* (P.H. Davis) Bräuchler & Heubl (≡ *Micromeria carica* P. H. Davis), which occurs in SW Anatolia (Τουρκία) (Burtt & Davis 1949). Davis collected *C. taygeteum* for first time in 1938 at the place above Tripi in Mt Xerovouna in Northern Taigetos. Recently, the first author also found *C. taygeteum* (*Kyriakopoulos 2233*, UPA) in the main ridge of Mt Taigetos called Pentadactilos, c. 15 km southern of its *locus classicus*.

To our knowledge, the chromosome number $2n = 22$ and the karyotype of *Clinopodium taygeteum* are given here for the first time.

1884. *Silene gigantea* subsp. *hellenica* Greuter — $2n = 24$ (Fig. 1D).

Gr: Peloponnisos, Nomos Lakonias, Mt Taigetos, at the gorge Langada, 37° 05' N, 22° 19' E, alt. 600 m, 23 Jun 2013, *Ch. Kyriakopoulos 1528* (UPA).

Silene gigantea (L) L. is a perennial species endemic to the Balkan Peninsula, western Asia and Cyprus. It is divided into three subspecies; subsp. *gigantea*, subsp. *rhodopea* (Janka) Greuter and subsp. *helllenica* Greuter (Greuter 1995, 1997).

Silene gigantea subsp. *hellenica* is growing from central to west Sterea Ellas (Parnassos and Giona), NW Evia, Peloponnisos (Mts Taigetos, Parnonas, Chelmos, Kyllini and Gerania) on the low-mid altitudes of them (Greuter 1997). Recently, Du Pasquier & al. (2015) mentioned that the distribution of *S. gigantea* subsp. *hellenica* can be extended to Turkey, however, according to the authors a more detailed study is necessary in order to clarify the taxonomic status of the Turkish populations.

The chromosome number found here is $2n = 24$. The same chromosome number is given for *Silene gigantea* s.l. by Degraeve (1980); Ghazanfar (1983); Strid & Andersson (1985); Montmollin (1986) and Runemark (1996).

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Adresses of the authors:
Charalambos Kyriakopoulos[1], Pepy Bareka[2] & Georgia Kamari[1],
[1]Botanical Institute, Section of Plant Biology, Department of Biology, University of Patras, 265 00, Patras, Hellas (Greece). E-mails: hakyri@yahoo.gr; kamari@upatras.gr
[2]Laboratory of Systematic Botany, Faculty of Crop Science, Agricultural University of Athens, Iera Odos 75, 118 55 Athens, Greece. E-mail: bareka@aua.gr

J. Molero, A. M. Rovira, M. Bosch, J. Simon & C. Blanché

Karyological study of the genus *Aconitum* (*Ranunculacae*) in the W Mediterranean Area

Abstract
Molero, J., Rovira, A. M., Bosch, M., Simon, J. & Blanché, C. 2016: Karyological study of the genus *Aconitum* (*Ranunculacae*) in the W Mediterranean Area [In Kamari, G., Blanché, C. & Siljak-Yakovlev, S. (eds), Mediterranean plant karyological data - 26]. – Fl. Medit. 26: 229-239. doi: 10.7320/FlMedit26.229

A karyological study of 38 populations belonging to 8 taxa of the genus *Aconitum* (*Ranunculaceae*) from the W Mediterranean Area is presented here. Karyotype microphotographs and corresponding idiograms for all taxa are provided and their karyotype morphology is discussed.

1885. *Aconitum anthora* L. — 2*n* = 32.

Ga: Pyrénées Orientales, Vall d'Eina, meadow, 42° 26' 39'' N 2° 06' 55'' E, alt. 2000 m, 20 Aug 1994, *M. Bosch* (BCN 4712).
Hs: Girona, Alta Garrotxa, Bassegoda peak, rocky scree, 42° 18' 46'' N 2° 37' 51'' E, alt. 1370 m, 22 Aug 1985, *J. Molero & A. Rovira* (BCN 4718).
— Huesca, Lanuza, dam in the gorge of Portet, 42° 45' 32'' N 0° 17' 42'' W, alt. 1900 m, 28 Jul 1994, *A. Salvador & J. Vicens* (BCN 4711) – Figs 1A & 3A.
— Lleida, Llebreta Lake, Aigües Tortes-Sant Maurici, 42° 33' 02'' N 0° 53' 27'' E, alt. 1750 m, 30 Aug 1994, *J. Simon & M. Bosch* (BCN 4714). – Figs 1B & 3B.
— Lleida, Vall d'Aran, above Arrós, ravine of Varradós, cottage of les Artiguetes to Salt del Pish, grasslands and wet meadows, 42° 46' 36'' N 0° 50' 05'' E, alt. 1500 m, 3 Sept 1992, *J. Molero & A. Rovira* (BCN 14360).

The five surveyed populations (Central & E Pyrenees) share the same chromosome number 2*n* = 4x = 32 (Figs 1A-1B), as previously reported in the few studies available from the Iberian Peninsula (Picos de Europa, Díez & al. 1984) and French Pyrenees (Küpfer 1974; Baltisberger & Utelli 2001) and in accordance with the previous counts known from European origin (Bosch & al. 2016).

The haploid idiograms (Pyrenean populations, Figs 3A-3B) are quite similar, with the formula 2*n* = 13 sm + 3st = 16 chromosomes, slightly differing (length of long arm of pair II) from those reported by Seitz & al. (1972) from the Jura massif (Ch). Some variation in number and position of satellites is detected: pair XIV (Pyrenees, present paper), pair V (Slovenia, Seitz & al. 1972), pairs XIV and XV (Jura, Seitz & al. 1972), as also observed in *A. lycoctonum* and particularly in the *A. napellus*-group (Figs. 3 & 4). Chromosome size and total karyotype length in *A. anthora* are clearly shorter than in the remaining groups, even considering the tetraploid condition (and thus losses and deletions), also detected by

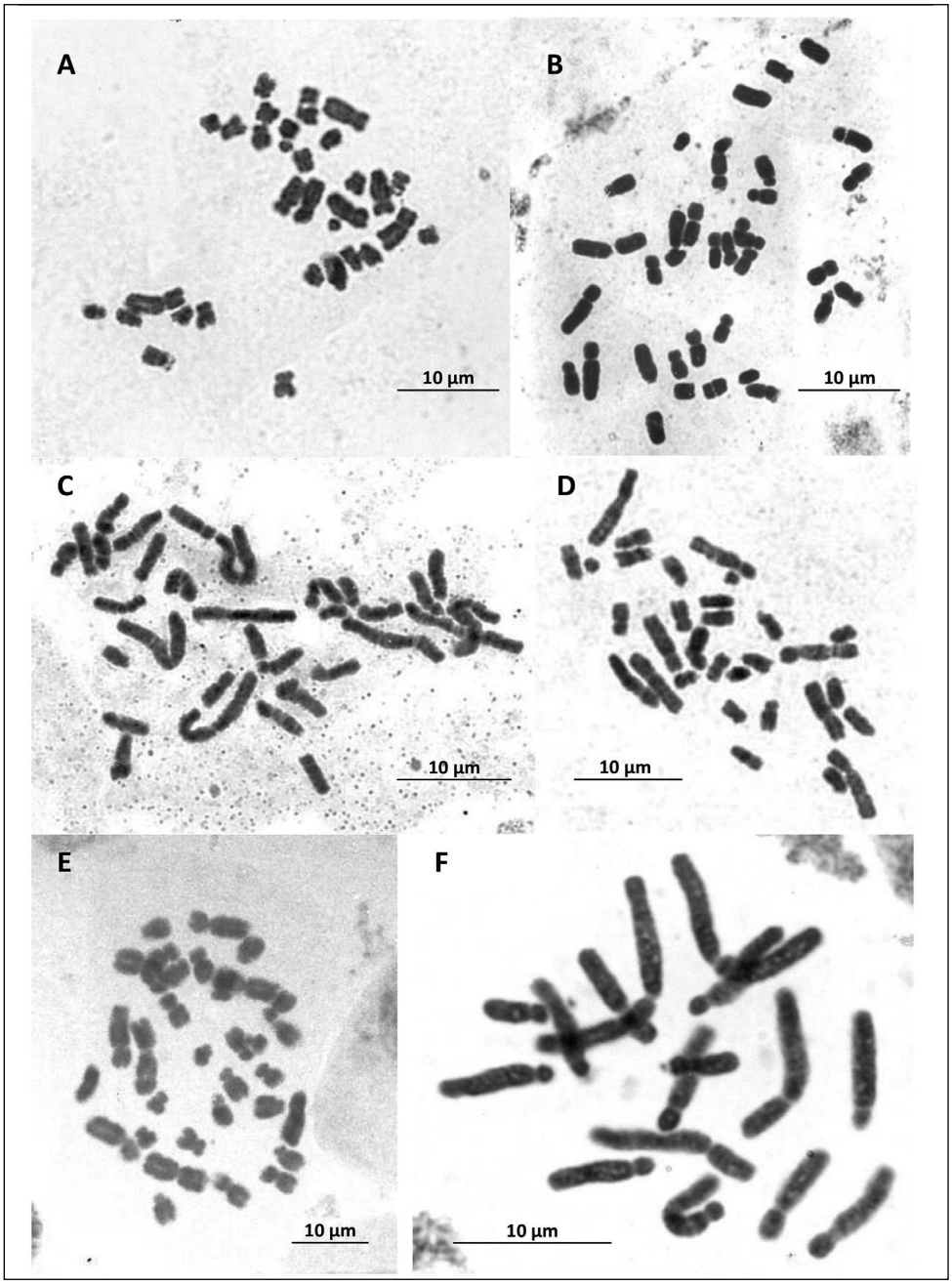

Fig. 1. Microphotographs of somatic metaphase plates of: A-B, *A. antora*, 2*n* = 32: A, Lanuza (Hs: Huesca) & B, Llebreta Lake (Hs: Lleida); C-E, *A. burnatii*, 2*n* = 32: C, Authion (Ga: Alpes Maritimes), D, La Hoya de la Mora (Hs: Granada) & E, Peña Oroel (Hs: Huesca); F, *A. lycoctonum*, 2*n* = 16, Sierra Nevada (Hs: Granada).

Schafer & La Cour (1934) and Kočková (2012), this last one from DNA values. Seitz & al. (*l.c.*) considered *A. anthora* as an old taxon originated by autopoliploidy from a diploid Asiatic ancestor; it has been placed by Jabbour & Jenner (2012) in a clade of relatively old divergence.

1886. *Aconitum burnatii* Gáyer subsp. *burnatii* — 2*n* = 32.

Ga: Alpes Maritimes, Madone de Fenestre, meadow near a stream, 44° 05' 41'' N 7° 21' 30'' E, alt. 1910 m, 17 Sept 1993, *M. Bosch, J. Simon & J. Vicens* (BCN 14362). – Fig. 3C.
— Alpes Maritimes, Circuit d'Authion, gaunt ravine, 44° 00' 07'' N 7° 25' 49'' E, alt. 1900 m, 17 Sept 1993, *M. Bosch, J. Simon & J. Vicens* (BCN 14361). – Figs 1C & 3D.
Hs: Granada, Sierra Nevada, Laguna de las Yeguas, source of a creek, 37° 03' 32'' N 3° 22' 50'' W, alt. 2800 m, 27 Jun 1983, *C. Benedí, C. Blanché, J. Molero, J. Molero-Mesa & J. Vallès* (BCN). – Fig. 3E.
— Granada, Sierra Nevada, Hoya de la Mora, under the university refugee, 37° 05' 34'' N 3° 23' 09'' W, alt. 2500 m, 14 May 1986, *J. Molero* (BCN 4725). – Figs 1D & 3F.
— Huesca, Jaca, Peña Oroel, under "Faixa Paco", 42° 31' 12'' N 0° 31' 47'' W, alt. 1630 m, 1 Oct 1992, *J. Molero & A. Rovira* (BCN 14359). – Figs 1E & 3G.

Our results included the first reports for W Mediterranean populations (Pyrenees, Sierra Nevada) of this taxon, with 2*n* = 4x = 32 chromosomes (Figs 1C to 1F). The only previously known European references come from Maritime Alps populations (Ga, It) under the name *A. divergens* subsp. *burnatii* (Gáyer) W. Seitz with indications of 2*n* = 32 (Seitz 1969).

Also for the first time, five haploid idiograms belonging to *A. burnatii* subsp. *burnatii* are presented (Figs 3C to 3G), with karyotype structure corresponding to the *A. napellus* s.l.- type defined by Seitz (1969). These idiograms show minor differences in several pair ratios, whereas it seems relevant that the Iberian populations of *A. burnatii* (and also of the *A. napellus* grex) constantly bear the pair II shorter than pair I. The significance of variation in the II pair of chromosomes in tribe *Delphinieae* has been discussed in Blanché & al. (1997). Satellite positions are shared by Maritime Alps and Pre-Pyrenees populations (pair XI), whereas in Sierra Nevada karyotypes they appear in pair XIII.

1887. *Aconitum lycoctonum* L. subsp. *lycoctonum* — 2*n* = 16.

Hs: Ávila, Puerto de Mijares, near the edge of a stream, 40° 19' 52'' N 4° 48' 48'' W, alt. 1570 m, 11 Oct 1986, *J. Molero* (BCN).
— Granada, Sierra Nevada, near Parador Nacional to Veleta peak, 37° 05' 11'' N 3° 22' 25'' W, alt. 2500 m, 14 May 1986, *J. Molero* (BCN). – Figs 1F & 3H.
— Guadalajara, Montejo de la Sierra, 41° 04' 01'' N 3° 31' 50'' W, alt. 1200 m, 3 Aug 1985, *C. Benedí & J. Molero* (BCN). – Fig. 3I.
— Huesca, Benasque, near Llosás, meadow, 42° 36' 34'' N 0° 30' 21'' E, 1 Aug 1993, alt. 2200 m, *M. Bosch & J. Simon* (BCN 14358).

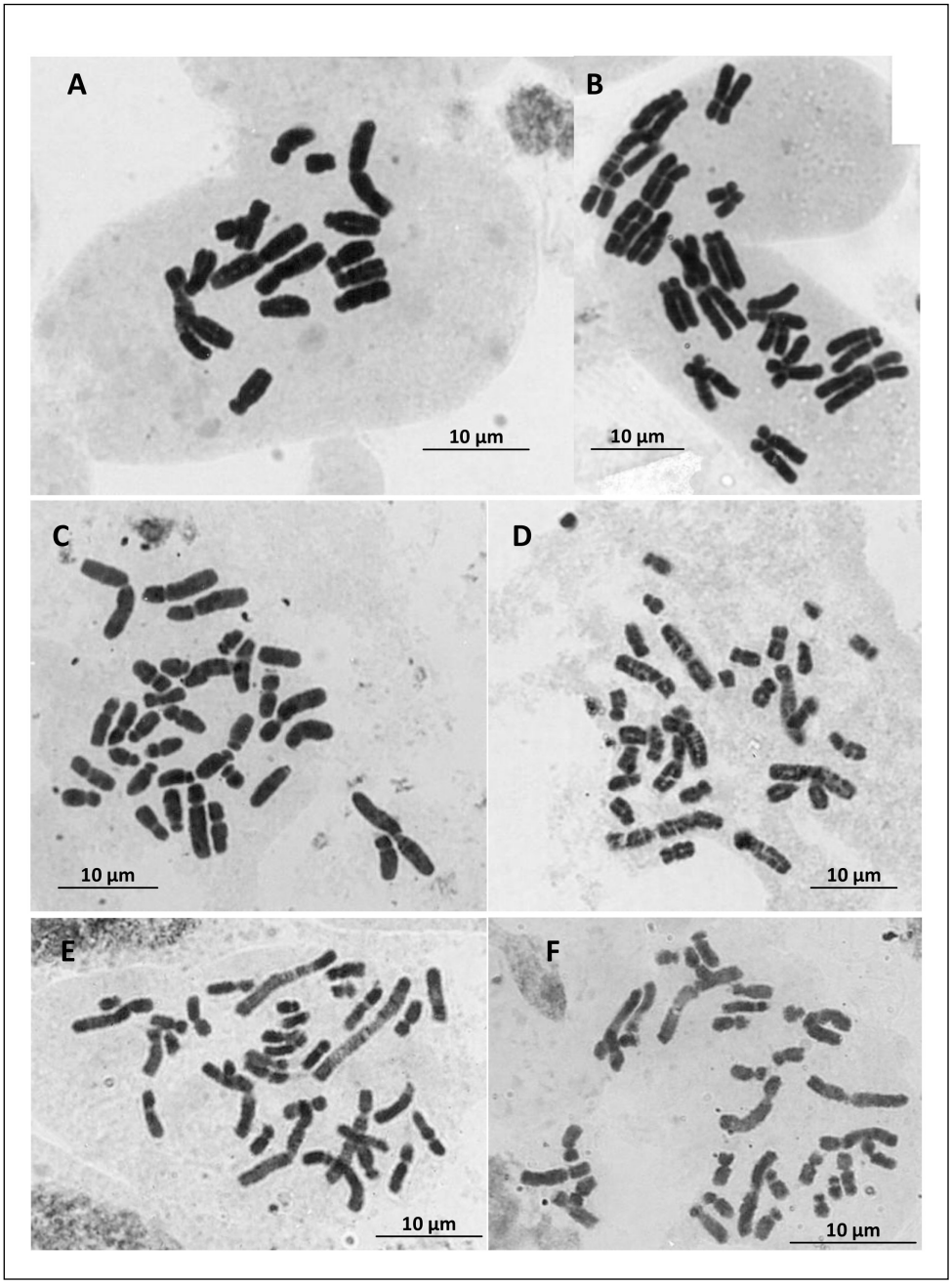

Fig. 2. Microphotographs of somatic metaphase plates of: A-B, *A. lycoctonum* subsp. *lycoctonum*, 2*n* = 16: A, Moncayo (Hs: Huesca) & B, Oukaimeden (Ma: Haut Atlas); C-D, *A. napellus* subsp. *castellanum*, 2*n* = 32: C, Laguna del Marquesado (Hs: Cuenca) & D, Las Honfrias (Hs: Salamanca); E-F, *A. napellus* subsp. *vulgare*, 2*n* = 32: E, Lago Enol (Hs: Oviedo) & F, Moncayo (Hs: Huesca).

— León, Cofiñal, 43° 01' 48" N 5° 15' 58" W, alt. 1200 m, 19 Jul 1984, *F. Llamas* (BCN 4874).
— Oviedo, Puerto de Veguerada, between calcareous rocks, 43° 02' 38" N 5° 29' 41" W, alt. 1500 m, 1 Jun 1994, *C. Blanché & J. Simon* (BCN). – Fig. 3J.
— Soria, Sierra Cebollera, forest trail over Molinos de Razón, granitic scree in birch clearings, 41° 58' 23" N 2° 35' 15" W, alt. 1300 m, 16 Aug 1983, *J. Molero & A. Rovira* (BCN 4863).
— Zaragoza, Moncayo, Beratón, ravine slope, on stony and rich in humus ground near to *A. napellus*, 41° 43' 17" N 1° 48' 18" W, alt. 1480 m, 2 Jul 1995, *J. Molero* & *A. Rovira* (BCN 4766). – Figs 2A & 3K.
Ma: Haut Atlas, Oukaimeden peak, margin of a stream, 31° 11' 48" N 7° 50' 02" W, alt. 2700 m, 20 Jun 1994, *J. Molero, A. Rovira, C. Blanché, M. Bosch & J. Simon* (BCN). – Figs 2B & 3L.

The nine studied populations from Spain and Morocco presented $2n = 2x = 16$ chromosomes (Fig. 1F and Figs 2A-2B), as reported from many sources (Bosch & al. 2016). The previously known numbers from *A. lycoctonum* Iberian populations –although published under several alternative nomenclatural combinations– are also $2n = 16$ (Küpfer 1974; Löve & Kjellquist 1974; Baltisberger & Charpin 1989; Baltisberger & Utelli 2001 and Castroviejo & al. 2003) as well as the North African ones (Galland 1988).

Only diploid cytotypes have been reported for *A. lycoctonum*, apart from a rare and old report of a triploid ($2n = 24$, Delay 1947). However, poliploidy has been documented in tetraploid and hexaploid Chinese species of *Aconitum* subgen. *Lycoctonum* (Yuan & Yang 2006; Hong & al. 2016): $2n = 32$ in *A. angustius* W.T. Wang, *A. brevicalcaratum* (Finet & Gagnep) Diels, *A. crassifolium* Hand.-Mazz., *A. chrysotrihum* W.T. Wang, and *A. rilongense* Kadota, and $2n = 48$ in *A. apetalum* (Huth) B. Fedtsch ex Stein. The most deviant chromosome count in subgen. *Lycoctonum* is the very recently published $2n = 12$ from *A. fletcherianum* G.Taylor, with a karyotype showing deep and significant chromosome rearrangements (Hong & al. 2016), representing the first report of this chromosome number in the genus *Aconitum*.

We obtained the haploid idiogram for four Iberian populations and one from Morocco (Figs 3H to 3L). This taxon shows a very stable karyotype structure in its whole southern distribution area, from Romania to the Moroccan Atlas, in coincidence with that published by Seitz & al. (1972), exhibiting a common chromosome formula ($2n = 2m + 6sm + 8st = 16$ chromosomes). Minor differences in arm lengths of pairs II and VI should be noted, as well as the number of satellite pairs (one, VII or mainly VIII in Iberian and Moroccan populations, *vs* two, VII and VIII in the Romanian one). The characteristic relatively longer short arm of pair V found in *A. lycoctonum* (both subsp. *lycoctonum* Figs 3H to 3L and subsp. *ranunculifolium*, Figs 4A-4B) has been also reported from Chinese diploid species of this subgenus (Yuan & Yang 2006; Hong & al. 2016).

1888. *Aconitum lycoctonum* subsp. *ranunculifolium* (Rchb.) Schinz & R. Keller — $2n = 16$.

Hs Girona, Vallter, over Setcases, megaphorbic communities on the bed of the valley, 42° 44' 21" N 2° 16' 30" E, alt. 1800 m, 22 Aug 1985, *J. Molero* (BCN 4762).
— Huesca, Peña Montañesa, 42° 30' 00" N 0° 12' 20" E, alt. 1500 m, 12 Aug 1985, *J.*

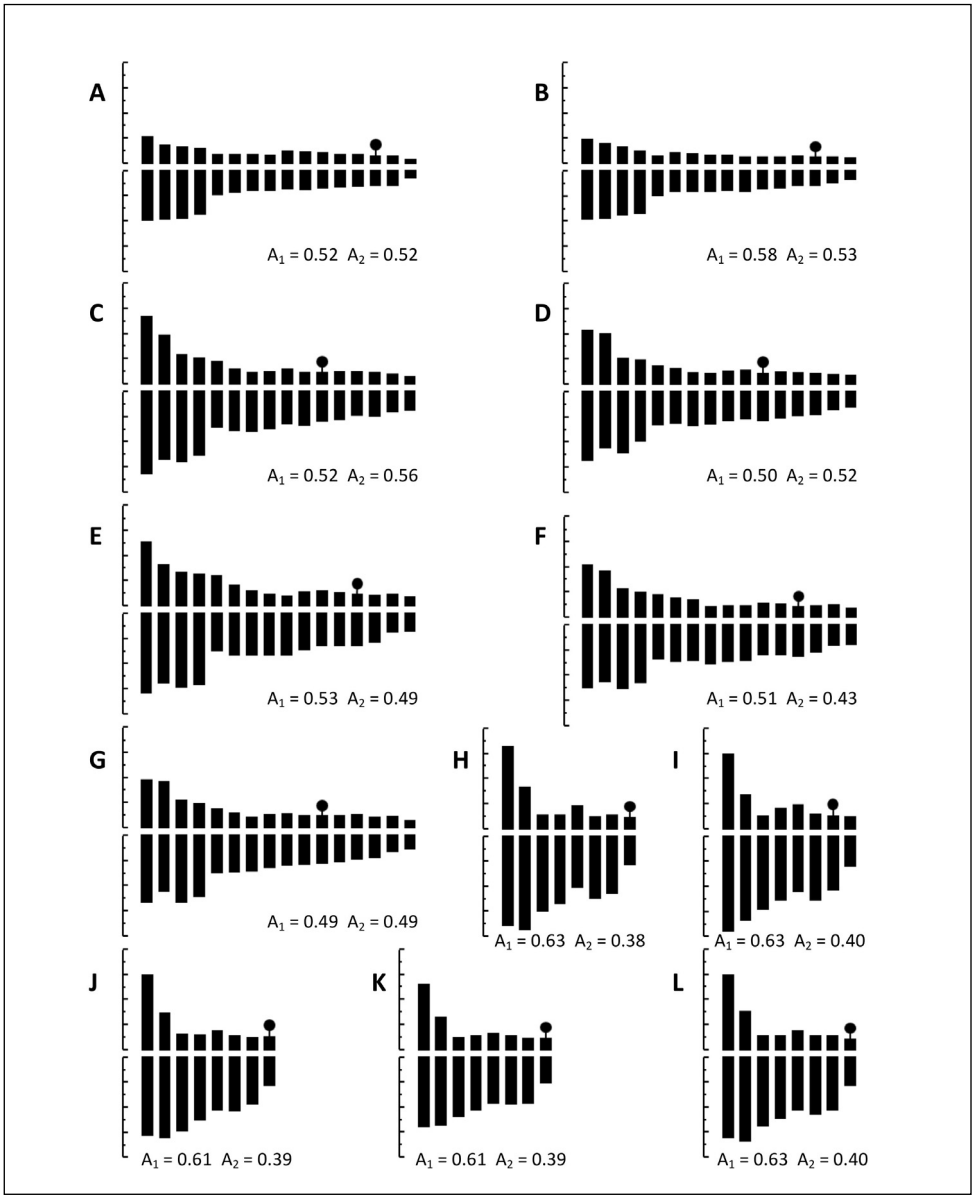

Fig. 3. Haploid idiograms obtained by measuring at least 5 good mitotic metaphases, 3 hours after pretreatment with colchicine 0.05 %. Asymmetry indices A1 and A2 are calculated following Romero (1986). A-B, *A. antora*: A, Lanuza (Hs: Huesca) & B, Llebreta Lake (Hs: Lleida); C-G, *A. burnatii*: C, Madone de Fenestre (Ga: Alpes Maritimes), D, Authion (Ga: Alpes Maritimes), E, Laguna de las Yeguas (Hs: Granada), F, La Hoya de la Mora (Hs: Granada) & G, Peña Oroel (Hs: Huesca); H-L, *A. lycoctonum* subsp. *lycoctonum*: H, Sierra Nevada (Hs: Granada), I, Montejo de la Sierra (Hs: Guadalajara), J, Puerto de Veguerada (Hs: Oviedo), K, Moncayo (Hs: Soria) & L, Oukaimeden (Ma: Haut Atlas). – Scale bars = 8+8 µm.

Molero (BCN). – Fig. 4B.
— Lleida, Vall d'Aran, Viella tunnel, Vall del Nere, 42° 39' 20'' N 0° 44' 47'' E, alt. 1600 m, 27 Jul 1994, *J. Simon & M. Bosch* (BCN 4759). – Fig. 4A.

Three Iberian populations (from Catalonia and Aragon) are reported here for the first time, showing diploid cytotypes of $2n = 2x = 16$. Only few and old chromosome data, coincident, are available for this taxon in Europe: Lovka & al. (1971) from Slovenia and Seitz & al. (1972) from Italy (S Tyrol). Some authors (Akeroyd & Chater 1993) place this taxon under the synonymy of *A. lycoctonum*; we follow the criteria of Seitz & al. (1972), confirmed by Molero & Blanché (1986).

Two haploid idiograms (from Central Pyrenees and Pre-Pyrenees) are presented (Figs 4A-4B). Karyotype structure is nearly identical between the two studied populations and the Iberian populations of subsp. *lycoctonum* ($2n = 2m + 6sm + 8st = 16$ chromosomes). Minor variation in subsp. *ranunculifolium* refers to arms ratios (at the border of sm and st limits) and satellites presence: in pair VIII in Vall de Nera population, absent in Peña Montañesa.

1899. *Aconitum napellus* subsp. *castellanum* Molero & C. Blanché — $2n = 32$.

Hs: Cuenca, Laguna del Marquesado, peaty soil, 40° 10' 40'' N 1° 40' 17'' W, alt. 1400 m, 12 Oct 1986, *J. Molero* (BCN 4682). – Figs 2C & 4D.
— Salamanca, Linares de Riofrío, Las Honfrias, in *castanetis* with *Pteridium aquilinum-Quercus pyrenaica*, near river, 40° 34' 59'' N 5° 58' 03'' W, alt. 1200 m, 19 Aug 1985, *C. Blanché & R. Ferrer* (BCN 4685). – Figs 2D & 4E.

The somatic number of $2n = 4x = 32$ chromosomes (Figs 2C-2D), is given here for the first time for this endemism of the Centre of the Iberian Peninsula (Molero & Blanché 1986), not differing from the remaining subspecies of the polymorphic complex of *A. napellus* s.l. (Bosch & al. 2016).

The karyotype structure of the two studied populations (Figs 4D-4E) is analogous to the basic model described by Seitz (1969) for the subspecies of *Aconitum* grex. *napellus* found in Europe (Akeroyd & Chater 1993), with some polymorphism at population level in subsp. *castellanum*: in arm ratio (pairs VI, XII, XV) and number of sat-chromosomes: two in Cuenca (VII and XII) *vs.* a single one (VII) in Salamanca.

1900. *Aconitum napellus* subsp. *lusitanicum* Rouy — $2n = 32$.

Hs: Ávila, Puerto Mijares, near the edge of a stream, 40° 19' 58'' N 4° 48' 44'' W, alt. 1680 m, 11 Oct 1986, *J. Molero* (BCN 4691).
— Guadalajara, Montejo de la Sierra, 41° 04' 01'' N 3° 31' 50'' W, alt. 1200 m, 3 Aug 1985, *C. Benedí & J. Molero* (BCN 4690).
— León, La Uña, margin river near Lario, 43° 03' 26'' N 5° 07' 57'' W, alt. 1200 m, 17 Aug 1985, *C. Blanché & R. Ferrer* (BCN 4735).

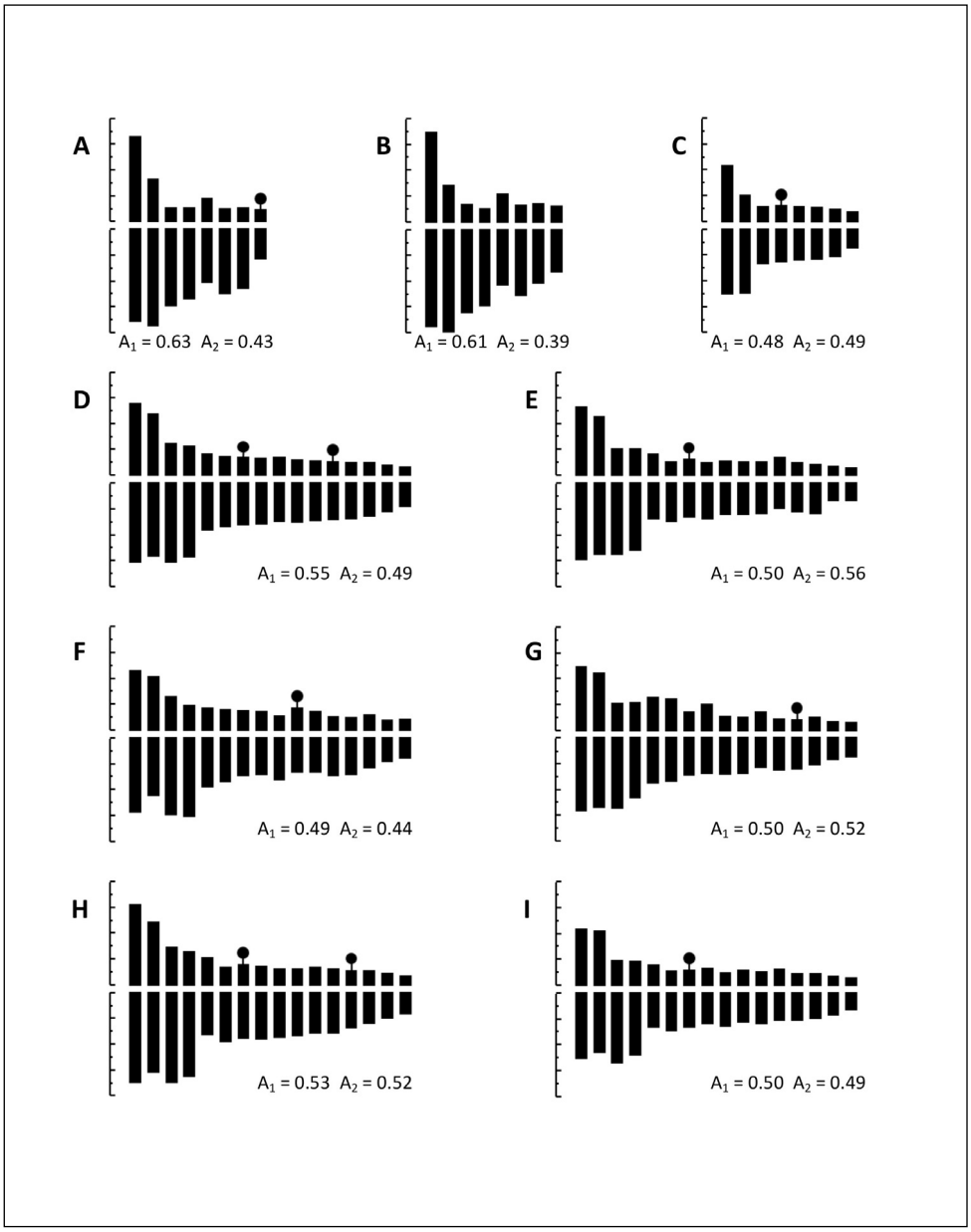

Fig.4. Haploid idiograms obtained by measuring at least 5 good mitotic metaphases, 3 hours after pre-treatment with colchicine 0.05 %. Asymmetry indices A1 and A2 are calculated following Romero (1986). A-B, *A. lycoctonum* subsp. *ranunculifolium*: A, Vall del Nere (Hs: Lleida) & B, Peña Montañesa (Hs: Huesca); C, *A. variegatum* subsp. *pyrenaicum*, Espelunguère (Ga: Pyrénées Atlantiques); D-E, *A. napellus* subsp. *castellanum*: D, Laguna del Marquesado (Hs: Cuenca) & E, Las Honfrias (Hs: Salamanca); F-I, *A. napellus* subsp. *vulgare*: F, Valdegobia (HS: Álava), G, Valle de Ordesa (Hs: Huesca), H, Lago Enol (Hs: Oviedo) & I, Moncayo (Hs: Soria). – Scale bars = 8+8 µm.

— León, Villasecino, meadow near a creek, 42° 57’ 03’’ N 6° 01’ 36’’ W, alt. 1200 m, 17 Jul 1984, *J. Molero & C. Blanché* (BCN 4736).
— Palencia, a creek near Areños, 42° 59’ 57’’ N 4° 29’ 34’’ W, alt. 1130 m, 15 Aug 1985, *C. Blanché & R. Ferrer* (BCN 4741).
— Zamora, Alcorcillo, near Alcañices, alder forest, 41° 42’ 39’’ N 6° 22’ 10’’ W, alt. 600 m, 31 May 1994, *C. Blanché & J. Simon* (BCN).

First absolute records for the six Iberian populations of this taxon, where we obtained the somatic number $2n = 4x = 32$. This result agrees with the counts reported by Seitz (1969) from several populations coming from Germany, Austria and N. France identified as *A. napellus* subsp. *neomontanum* (Wulfen) Gáyer, a non-priority synonym of the same taxon.

1901. *Aconitum napellus* subsp. *vulgare* (DC.) Rouy & Fouc. — $2n = 32$.

Ga: Pyrénées Orientales, Vall d’Eina, orri de baix, grassland near a creek, 42° 26’ 38’’ N 2° 06’ 56’’ E, alt. 1980 m, 18 Jul 1994, *M. Bosch & J. Simon* (BCN 4732).
Hs: Álava, Valdegovia, 42° 50’ 55’’ N 3° 04’ 24’’ W, alt. 600 m, 13 Oct 1985, *B. Fdez. de Betoño* & *J. A. Alejandre* (Alejandre Personal Herbarium). – Fig. 4F.
— Barcelona, Pedraforca, scree, 42° 14’ 13’’ N 1° 42’ 16’’ E, alt. 2300 m, 22 Sept 1985, *C. Blanché* (BCN 4740).
— Girona, Vallter, over Setcases, near ski station, 42° 25’ 30’’ N 2° 15’ 50’’ E, alt. 2000 m, 14 Sept 1983, *J. Molero & A. Rovira* (BCN 4752).
— Huesca, Valle de Ordesa, 42° 38’ 06’’ N 0° 00’ 48’’ W, alt. 1700 m, 23 Jul 1992, *J. Vicens, M. Bosch & J. Simon* (BCN). – Fig. 4G.
— Oviedo, Picos de Europa, Covadonga, Lago Enol, to Mirador del Rey, slits and meadows, 43° 16’ 19’’ N 4° 59’ 15’’ W, alt.1100 m, 2 Jun 1994, *C. Blanché & J. Simon* (BCN). – Figs 2E & 4H.
— Zaragoza, Moncayo, Beratón, ravine slope, on stony and rich in humus ground near to *A. lycoctonum*, 41° 43’ 17’’ N 1° 48’ 18’’ W, alt. 1400 m, 2 Jul 1995, *J. Molero* (BCN). – Figs 2F & 4I.

The obtained number for the seven studied populations is $2n = 4x = 32$ chromosomes (Figs 2E- 2F), in agreement with the numerous previous counts (Bosch & al. 2016). They are the first ones from the Iberian Peninsula. Some reports for *A. napellus* s.l. gave the somatic number $2n = 24$ for this taxon, coming from very old reports (Bosch & al. 2016) or obtained from plants growing in botanical gardens; they probably belong to hybrids, as the example of *A. napellus* x *A. variegatum* cited by Seitz (1969).

We are also giving the haploid idiograms from four Iberian populations (Cantabric Mts, Pyrenees and Iberian System) (Figs 4F to 4I). The idiograms mainly match with the general model of *A. napellus* s.l. karyotypes proposed by Seitz (1969), with slight divergences in arm ratios (particularly pairs IV, V and VI) and distribution of satellites (either in pairs VII, X o XIII). The basic chromosome formula is $2n = 3m + 13m (2m + 14sm) = 16$ chromosomes.

1902. *Aconitum variegatum* L. subsp. *pyrenaicum* Vivant in **Vivant & Delay** — 2*n* = 16.

Ga: Pyrénées Atlantiques, Vallée d'Aspe, Espelunguère, near Ibón de Estanés, megaphorbic communities in limestone foot cliff, 42° 48' 21'' N 0° 35' 15'' W, alt. 1650 m, 6 Oct 1995, *J. Molero, P. Montserrat & L. Villar* (BCN 4754). – Fig. 4C.

Poorly known E Pyrenean endemic, we studied a population located very close to that published by Vivant & Delay (1980), with the same result, 2*n* = 2x = 16 chromosomes.

Chromosome formula is 2*n* = 2m + 14sm = 16 chromosomes. The Fig. 4C shows the idiogram of *A. variegatum* subsp. *pyrenaicum*, with karyotype structure (except for the absence of satellite in pair III of the Pyrenean population) mainly sharing the data given by Seitz (1969) and Seitz & al. (1972) from alpine German and Austrian populations of *A. variegatum* subsp. *variegatum*. All the reports belonging to subsp. *variegatum* (from Central Europe, Alps and Balkans) give 2*n* = 16 (Bosch & al. 2016), although some old counts indicate 2*n* = 24 (Langlet 1927, Delay 1947).

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Address of the authors:
Julià Molero, Ana M. Rovira, Maria Bosch, Joan Simon & Cèsar Blanché,
BioC (GReB) & IRBio, Laboratori de Botànica, Facultat de Farmàcia, Universitat de Barcelona, Av. Joan XXIII s/n, 08028-Barcelona, Catalonia (Spain). E-mail: maria-bosch@ub.edu