Mediterranean chromosome number reports — 15

edited by G. Kamari, C. Blanché & F. Garbari

Abstract

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This is the fifteenth of a series of reports of chromosomes numbers from Mediterranean area, peri-Alpine communities and the Atlantic Islands, in English or French language. It comprises contributions on 42 taxa: *Asarum*, *Carex*, *Hermodactylus*, *Leucojum*, *Ludwigia*, *Marsilea*, *Muscari*, *Ornithogalum*, *Pallenis*, *Ranunculus*, *Salvia*, *Xeranthemum* from Italy, by R. Marcucci, M. Brentan, S. Carlin, D. Patrese & N. Tornadore (Nos 1415-1427); *Ulex, Stauracanthus, Cytisus*, *Genista* from Morocco and Spain, by H. Tahiri, P. Cubas & C. Pardo (Nos 1428-1437); *Actinolema*, *Elaeosticta*, *Leiotulus*, *Szovitsia*, *Zosima* from Caucasus (Armenia), by J. V. Shner, M. G. Pimenov & E. V. Kljuykov (Nos 1438-1442); *Genista* from Spain and France, by T. Cusma Velari, L. Feoli Chiapella & V. Kosovel (1443-1444); *Acer*, *Chamaecytisus*, *Fagus*, *Fraxinus*, *Lonicera*, *Picea*, *Platanus*, *Rubus*, *Viburnum*, *Vitis* from Bulgaria, by D. Ivanova, V. Vladimirov & P. Stanimirova (Nos 1445-1456).

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Reports (1415-1427) by R. Marcucci, M. Brentan, S. Carlin, D. Patrese & N. Tornadore

1415. ***Asarum europaeum*** subsp. ***italicum*** I. Kukk. & P. Uotila — 2*n* = 2x = 26 (Figs 1a, b).

It: Mount Venda, Euganean Hills (Padua), 21° 5' N, 10° 94' E, 15 Mar 2004, *Brentan* (PAD).

This species has a Euro-Siberian distribution. The same diploid chromosome number 2*n* = 26 was reported by Skalinska & al. in Moore (1982), Ball (1964) and Fagioli & Fabbri (1971) who did not mention the karyotype formula, which -according to Levan & al. (1964)- is 2*n* = 2x = 4m + 2sm-SAT + 8m + 2m-SAT + 2m + 4sm + 4m = 26 chromosomes. The same formula is used in all the following reports.

1416. ***Carex depauperata*** Curtis ex With. — 2*n* = 44 (Figs 1c, d).

It: Mount della Croce, Euganean Hills (Padua), 19° 54' N, 17° 46' E, 14 Apr 2003, *Brentan* (PAD).

This species is rare in Italy (Pignatti 1982; Tornadore & Brentan 1999). Its chromosome number, 2*n* = 44, is in accordance with the report by Dietrich (in Moore 1982). Additionally, Strid & Franzen (1981) have also mentioned 2*n* = 74. The chromosome size ranges between 0.5 and 1 μm and they have a remarkable tendency to be sticky.

1417. ***Hermodactylus tuberosus*** (L.) Mill. — 2*n* = 2x = 20 (Figs 1e, f, g).

It: Mount Fasolo, Euganean Hills (Padua), 18° 72' N, 11° 52' E, 18 Mar 2003, *Brentan* (PAD).

H. tuberosum is a Mediterranean element very rare in the Euganean Hills (Todaro & al. 2003; Masin & Tietto 2005). The same chromosome number 2*n* = 20 is reported by Tornadore (1981) and Snogerup (1994). The karyotype consists of 2*n* = 2x = 2m + 2sm-SAT + 2st + 4sm + 4sm-SAT + 4st = 20. This karyotype is more asymmetrical than that of Apulian plants studied by Tornadore (1981).

1418. ***Leucojum vernum*** L. — 2*n* = 2x = 20 (Figs 2a, b).

It: Mount Rua, Euganean Hills (Padua), 22° 18' N, 12° 7' E, 20 Feb 1997, *Brentan* (PAD).

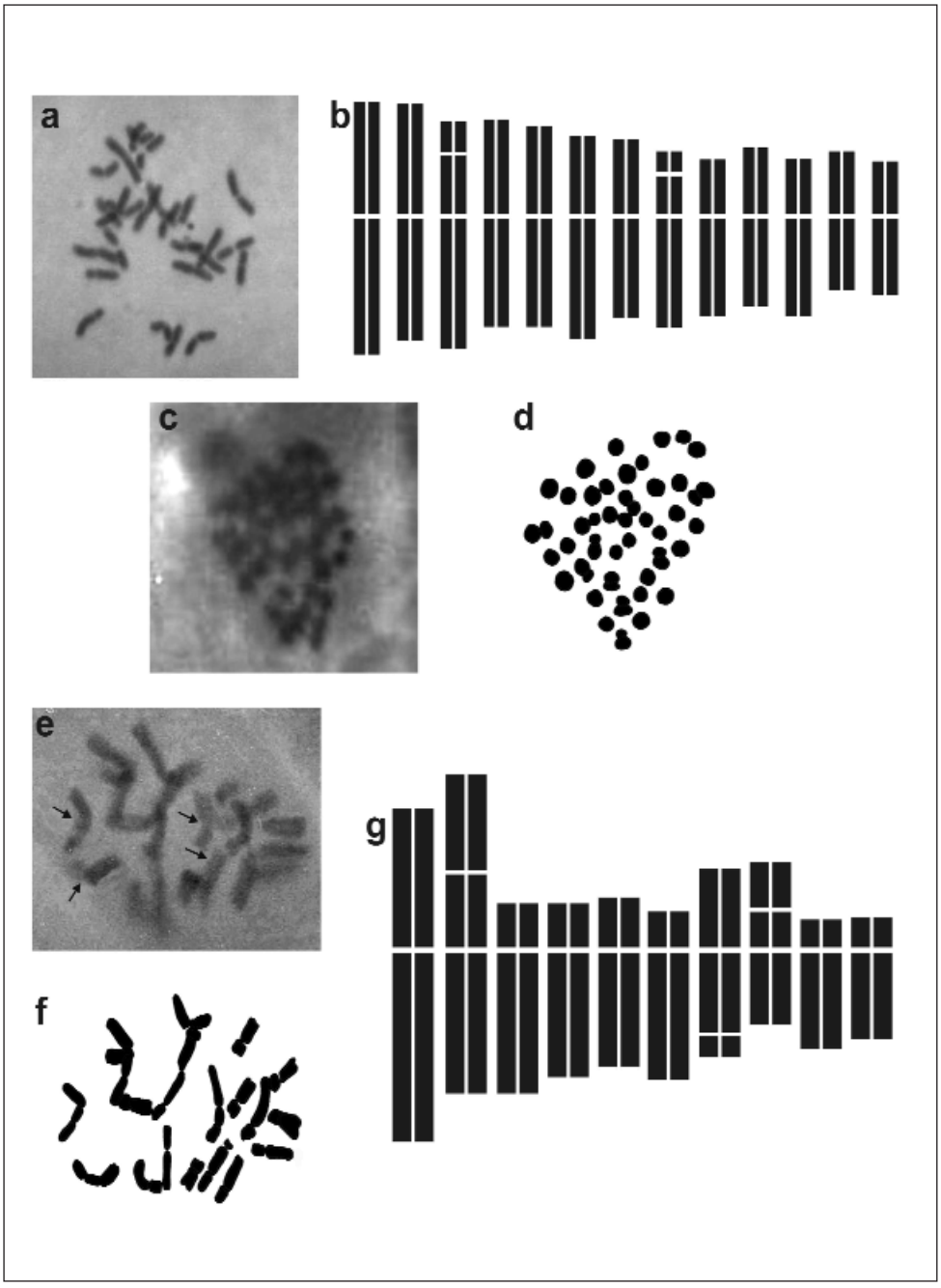

Fig.1. **a,** Microphotograph (x 1820) and **b,** idiogram of *Asarum europaeum* subsp. *italicum*, 2*n* = 26; **c,** microphotograph (x 2240) and **d,** drawing of *Carex depauperata*, 2*n* = 44; **e,** microphotograph (x 1820), **f,** drawing and **g,** idiogram of *Hermodactylus tuberosus*, 2*n* = 20.

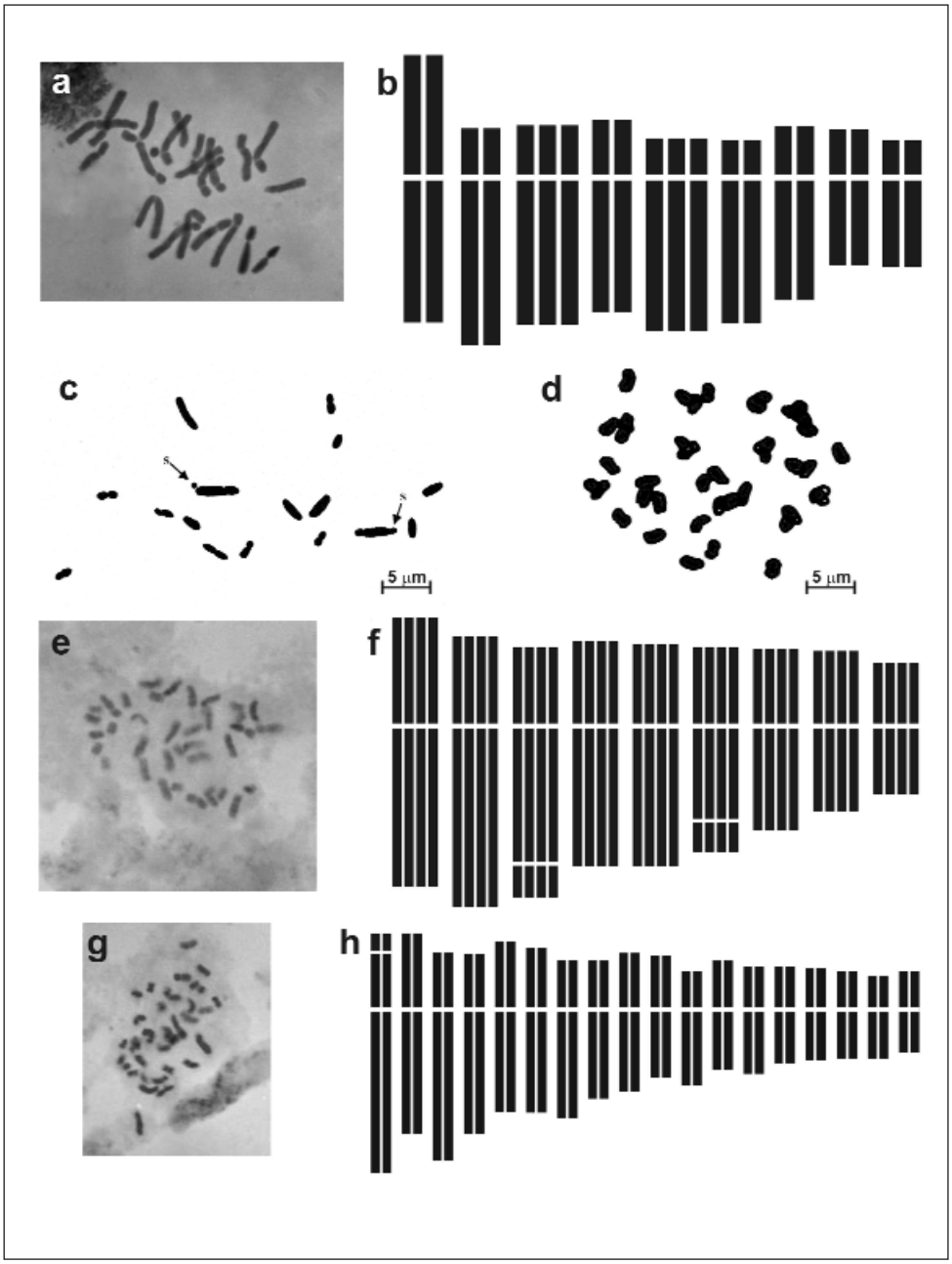

Fig. 2. **a,** Microphotograph (x 1820) and **b,** idiogram of *Leucojum vernum*, 2*n* = 20; **c,** drawing of *Ludwigia palustris*, 2*n* = 16; **d,** drawing of *Marsilea quadrifolia*, 2*n* = 40; **e,** microphotograph (x 1820) and **f,** idiogram of *Muscari neglectum*, 2*n* = 36; **g,** microphotograph (x 1820) and **h,** idiogram of *Muscari botryoides* × *M. neglectum*, 2*n* = 36.

This species is distributed in Southern Europe. The somatic number $2n = 20$ has already been reported by several authors (Webb 1984; Sveshnikova & Krichpahluschij 1985; Krichpahluschij 1989; Dobeš & al. 1997; Sveshnikova & Zemskova 1998). The chromosomes can be grouped as follows: $2n = 2x = 2m + 5st + 2sm + 5st + 6sm = 20$, with two trisomic groups in the third and fifth position.

1419. ***Ludwigia palustris*** (L.) Elliott — $2n = 2x = 16$ (Fig. 2c).

It: Toffanin Valley , Rovolon, Euganean Hills (Padua), 45° 22' N, 11° 40' E, 12 Jun 2003, *Brentan* (PAD).

This species occurs in Northern and Central America, in Western and Southern Europe and in North Africa. The diploid chromosome number, $2n = 16$, confirms previous reports (Queirós 1976; Löve & Löve in Majovsky & Murin 1987; Ficini & al. 1981).

1420. ***Marsilea quadrifolia*** L. — $2n = 2x = 40$ (Fig. 2d).

It: Lozzo Atestino, Euganean Hills (Padua), 18° 47' N, 6° 48' E, 13 Jun 2003, *Brentan* (PAD).

M. quadrifolia is quite rare in Italy because of destruction of wetlands. In the Euganean Hills, the species is present in only one place (Brentan & Tornadore 1999; Todaro & al. 2003). From the karyological points of view, this taxon is always diploid (Vasudeva & Bir 1983; Srivastava 1985; Buarque Marcon & al. 2001) with very small chromosomes.

1421. ***Muscari neglectum*** Guss. — $2n = 4x = 36$ (Figs 2e, f).

It: Mount Ricco, Euganean Hills (Padua), 13° 92' N, 14° 68' E, 22 Mar 2002, *Brentan* (PAD).

This bulbous plant is widespread in the European flora. The somatic number $2n = 36$ has been found in all specimens investigated. It agrees with previous data (see Garbari 2003 for references and other ploidy levels). The karyotype is symmetrical with two groups of SAT-chromosomes: $2n = 4x = 4sm + 4m + 4sm\text{-}SAT + 8sm + 4m\text{-}SAT + 12m = 36$.

1422. ***Muscari botryoides*** (L.) Mill. × ***M. neglectum*** Guss. — $2n = 2x = 36$ (Figs 2g, h).

It: Mount Venda, Euganean Hills (Padua), 21° 5' N, 10° 94' E, 10 Apr 2000, *Tietto* (PAD).

A population of *Muscari* with intermediate morphological characters between *M. botryoides* and *M. neglectum* was found on Mount Venda. It is our opinion that these specimens are hybrid of the mentioned taxa. The karyotype shows the following formula: $2n = 2x = 2sm\text{-}SAT + 2sm + 2m + 6sm + 4m + 2sm + 14m = 36$ chromosomes and the population behaves as a functional diploid. This situation is already knows in other members of *Hyacinthaceae* family (Tornadore & Orza 1987).

1423. ***Ornithogalum divergens*** Boreau — $2n = 5x = 45 + 5\text{-}8$ B (Figs 3a, b).

It: Arquà Petrarca, Euganean Hills (Padua), 16° 68' N, 12° 66' E, 14 Apr 2001, *Brentan* (PAD).

For this species, and for the allied species *O. umbellatum*, chromosome numbers ranging from $2n = 2x = 18$ to $2n = 12x = 108$ are reported (Chiappini & Scrugli in Moore 1982; Couderc & al. 1985). Aneuploid karyotypes are also known (Couderc & al. 1984; Speta 2000). In our specimens we have recorded the following karyotype formula: $2n = 5x = 10m + 5sm + 5m + 5st\text{-}SAT + 5sm + 15m = 45 + 5\text{-}8sm + B$, with SAT-chromosomes in the 5th position. Five to eight B-chromosomes were also detected.

1424. ***Pallenis spinosa*** (L.) Cass. — $2n = 2x = 10$ (Figs 3c, d).

It: Arquà Petrarca, Euganean Hills (Padua), 16° 68' N, 12° 66' E, 13 Apr 2001, *Brentan* (PAD).

P. spinosa is a Eurimediterranean element which is distributed mainly in Central and Southern Italy. This species is sporadic in the Euganean Hills and in the district of Brescia (Pignatti 1982). The somatic number $2n = 10$ has already been reported by several authors (e.g. Strid & Franzen 1981; Löve & Löve 1982; Galland 1988). Its karyotype formula is $2n = 2x = 6m + 4sm = 10$, without SAT-chromosomes.

1425. ***Ranunculus baudotii*** Godron — $2n = 16$ (Fig. 3e).

It: Cava Costa, Mount Ricco, Euganean Hills (Padua), 14° 61' N, 15° 65' E, 4 May 2003, *Villani* (PAD).

The diploid number $2n = 2x = 16$ reported here is the first count obtained from Italian plants whereas tetraploid data are available for some European countries (Cook in Dobeš & Vitek 2000; Arohonka 1982). Due to the small chromosome size (0.8-2.0 μm), karyotype characters cannot be represented.

1426. ***Salvia verticillata*** L. — $2n = 2x = 16$ (Figs 3f, g).

It: Vallon di Bastia, Euganean Hills (Padua), 45° 18' N, 11° 46' E, 25 Mar 2004, *Brentan* (PAD).

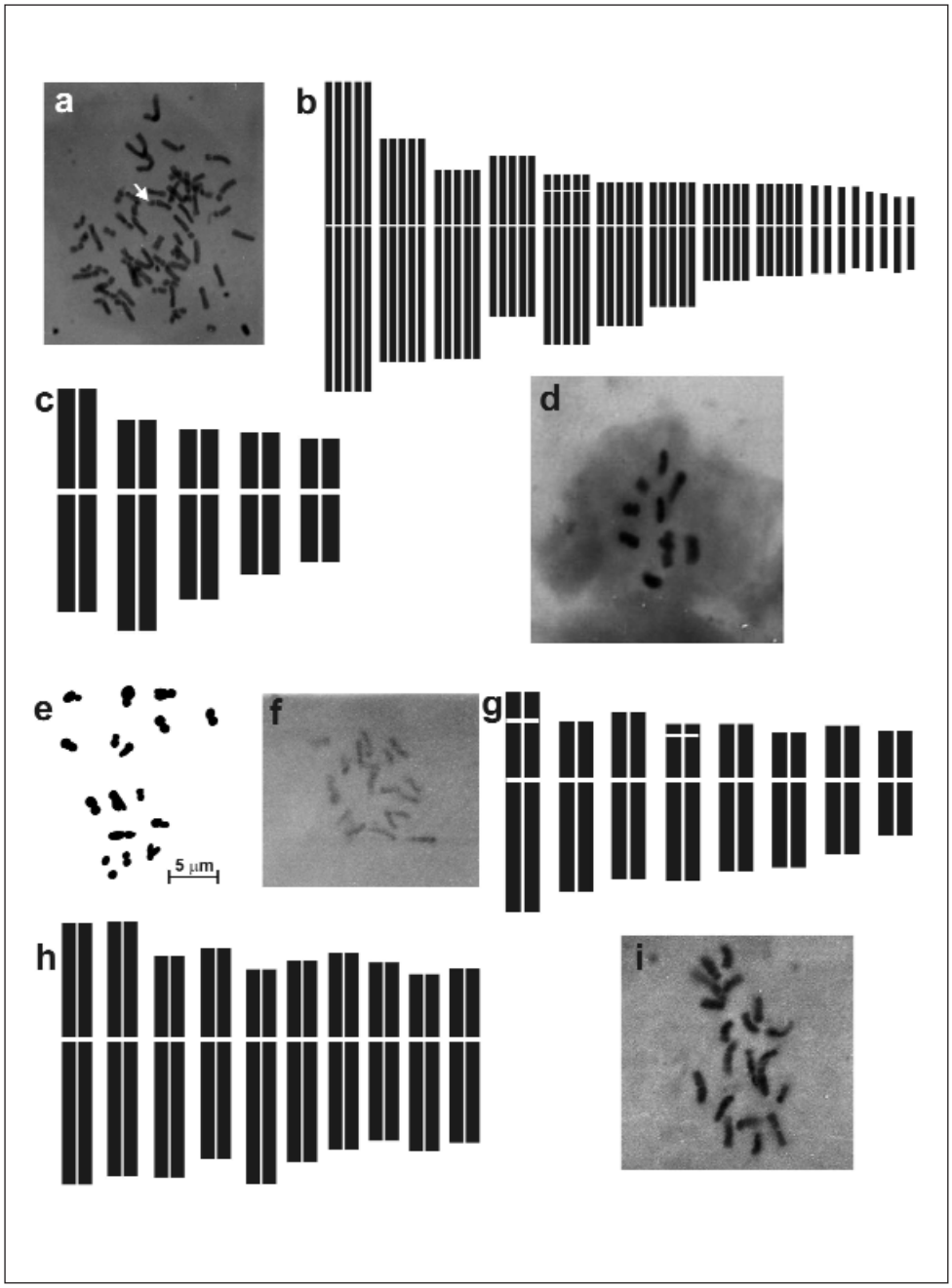

Fig. 3. **a,** Microphotograph (x 1820) and **b,** idiogram of *Ornithogalum divergens*, 2*n* = 45+5-8 B's; **c,** idiogram and **d,** microphotograph (x 1820) of *Pallenis spinosa*, 2*n* = 10; **e,** drawing of *Ranunculus baudotii*, 2*n* = 16; **f,** microphotograph (x 1820) and **g,** idiogram of *Salvia verticillata*, 2*n* = 16; **h,** idiogram and **i,** microphotograph (x 1820) of *Xeranthemum cylindraceum*, 2*n* = 20.

The species is distributed in Central and Southern Europe. Our record $2n = 16$ agrees with the chromosome number reported by Baltisberger (1991) and Dobeš & al. (1997). The karyotype is clearly symmetrical and consists of $2n = 2x = 2sm\text{-}SAT + 2sm + 2m + 2sm\text{-}SAT + 4sm + 4m = 16$ chromosomes. The SAT-chromosomes are in first and fourth position.

1427. ***Xeranthemum cylindraceum*** Sibth. & Sm. — $2n = 2x = 20$ (Figs 3h, i).

It: Mount Ceva, Euganean Hills (Padua), 21° 67' N, 17° 44' E, 9 Jun 2003, *Brentan* (PAD).

X. cylindraceum is a typical steppic element. It is quite common in Europe and it is also present in Italy as a rare species (Webb 1976; Pignatti 1982). To our knowledge no former records of the chromosome number or a karyotype analysis of this unit is known for Italian populations, but only for other European countries (Natarajan 1978; Baltisberger 1993). The species has $2n = 20$ chromosomes and the karyotype formula is given as: $2n = 2x = 8m + 2sm + 6m + 2sm + 2m = 20$. No SAT-chromosomes were observed.

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Reports (1428-1437) by H. Tahiri, P. Cubas & C. Pardo

1428. ***Ulex baeticus*** subsp**.** ***baeticus*** Boiss. — *n* = 16 (Figs 1, 7).

Hs: Cádiz, El Bosque, Grazalema, 36º 45' N, 5º 29' W, 7 Jan 1994, *Pardo & Ciruelos*, PC 9404 (MAF 143860).

This taxon is distributed in the Ronda sector of the Betic Mountains, where it grows in dolostones, limestones and peridotites. We counted *n* = 16 bivalents at meiosis. This number agrees with previous reports by Cubas (1986).

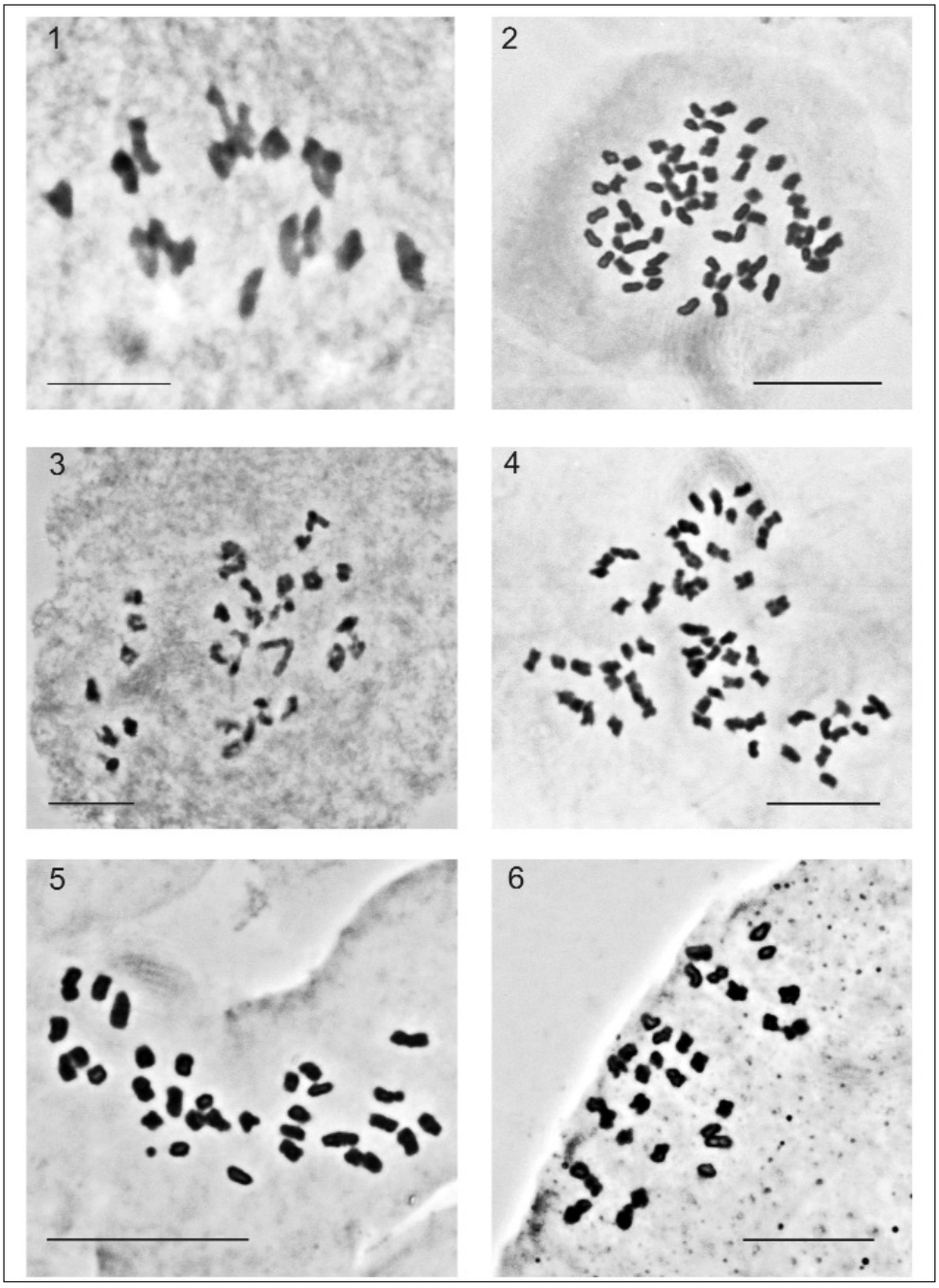
1429. ***Ulex borgiae*** Rivas Martínez — 2*n* = 64, *n* = 32 (Figs 2-3, 8-9).

Hs: Málaga, road to Refugio del Juanar, 36º 35' N, 4º 51' W, 510 m, 22 May 2003, *Cubas & Pardo*, UGJU (MAF 163922). - Figs 2, 8.
— Cádiz, Faro del Camarinal, 36º 05' N, 5º 48' W, 30 m, 2 Jan 1994, *Pardo & Ciruelos*, UGCA (MAF 143857). - Figs 3, 9.

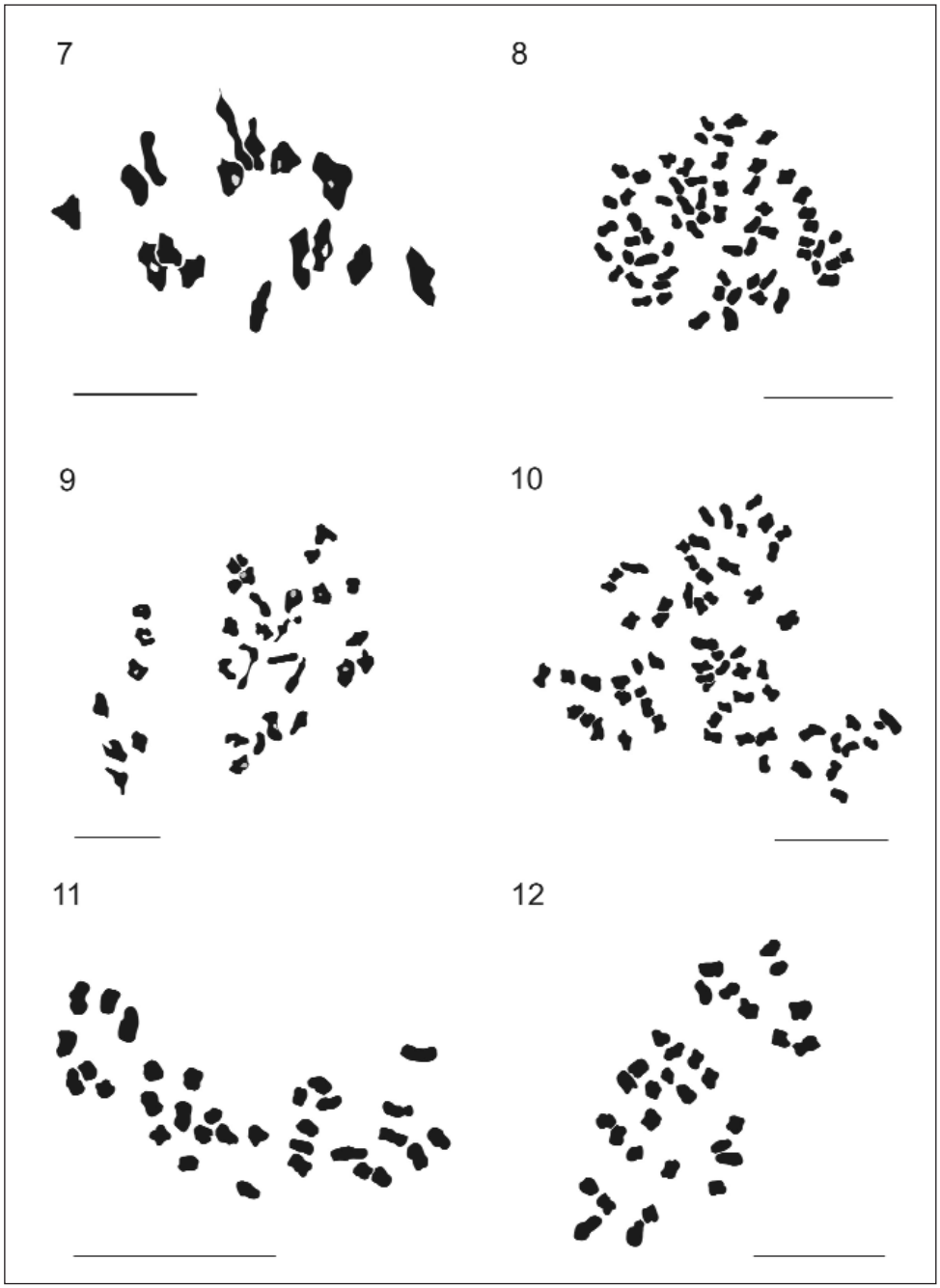
Ulex borgiae is widespread on the southeastern sector of the Cádiz Province, and can also be found in scattered localities in the Málaga Province (Spain). *U. borgiae* grows in sandstones and other acidic substrates. The sample from the Faro del Camarinal (MAF 143857) differs form other *U. borgiae* plants by a dense cover of hairs in the shoots and spines, which gives to the whole plant a greyish colour. No other character allows differentiation of those plants from other *U. borgiae* specimens.

Both samples are tetraploid with 2*n* = 64 chromosomes. Our results confirm previous data (Ruiz Rejón & Fernández Piqueras 1978; Cubas 1986).

1430. ***Ulex congestus*** (Webb) Pau [= *U. scaber* f. *congestus* (Webb) Maire] — 2*n* = 64 (Figs 4, 10).



Figs 1-6: Photomicrographs of: **1,** *Ulex baeticus* subsp. *baeticus*, *n* = 16 bivalents, (metaphase I); **2-3,** *U. borgiae*, 2*n* = 64 (2) and *n* = 32 bivalents (3, metaphase I); **4,** *U. congestus*, 2*n* = 64; **5-6,** *U. africanus*, 2*n* = 32. — Scale bars = 10 μm.



Figs 7-12: Explanatory diagrams of Figs 1-6: **7,** *Ulex baeticus* subsp. *baeticus*, $n = 16$ bivalents, metaphase I; **8-9,** *U. borgiae*, $2n = 64$ (8) and $n = 32$ bivalents (9, metaphase I); **10,** *U. congestus*, $2n = 64$; **11-12,** *U. africanus*, $2n = 32$. — Scale bars = 10 μm.

Ma: Rif, Bni Hosmar, jbel Ghorghis, 35° 33' N, 5° 21' W, 300 m, 27 May 2004, *Tahiri*, UCGG (RAB 65856).

Ulex congestus is restricted to an area extending from Tanger to Tetouan, where it grows in sandstones and dolostones. *U. congestus* is morphologically close to *U. borgiae*, and they also share the same ploidy level. Molecular studies are currently being carried out, to establish the genetic relationships between the taxa. No data on chromosome numbers for this taxon have been reported previously. We have counted $2n = 64$ chromosomes in root mitosis.

1431. *Ulex africanus* Webb [= *U. parviflorus* subsp. *africanus* (Webb) Greuter] — $2n = 32$ (Figs 5-6, 11-12).

Ma: Monts du Maroc oriental, jbel Taforalt, 34° 49' N, 2° 25' W, 750 m, 30 May 2004, *Tahiri,* UMTA (RAB 65849). - Figs 5, 11.
— Littoral de la Méditerranée, jbel KerKer, 34° 52' N, 3° 05' W, 600 m, 29 May 2004, *Tahiri*, UMKK (RAB 65851/MAF 163927). - Figs 6, 12.
— Littoral de la Méditerranée, road to Cap des Trois Fourches, 2 km from the cross with the road to Bni Chiker, 35° 18' N, 2° 59' W, 80 m, 29 May 2004, *Tahiri* (RAB 65848/MAF 163926).
— Littoral de la Méditerranée, Sidi Messaoud to Azzanene, 35° 16' N, 3° 05' W, 100 m, 29 May 2004, *Tahiri* (RAB 65859/MAF 163925).
— Rif, Chefchaouen, Talambote, 35° 14' N, 5° 11' W, 300 m, 27 May 2004, *Tahiri*, UMTT (RAB 65850/MAF 163928).

Ulex africanus is a north African species distributed from the western Rif mountains (Morocco) to Oran (Algeria), growing on different substrates, such as limestones, clays and marls. As indicated by Greuter & Raus (1986), the populations are morphologically variable. In our samples we found differences referred to the hairs and dimension of the calyx, and general indumentum of the plant, especially in the westernmost area.

U. africanus was considered as a subspecies of *U. parviflorus* (Greuter & Raus 1986), however, its morphology, as well as its geographical area of distribution, allows recognition of this taxon at the specific level. Our data indicate that is a diploid species with $2n = 32$ chromosomes. These results agree with the only report known to us obtained in a sample from Oran (Castro 1943).

1432. *Ulex parviflorus* Pourret subsp. ***parviflorus*** — $2n = 32$ (Figs 13, 19).

Hs: Almería, Tarambana to Dalias, 36º 45' N, 2º 52' W, 13 Mar 1980, *Cantó, Loidi & Laorga*, PC 9416.

This taxon has a wide distribution from southern France to eastern and southern Spain. Previous reports (Löve & Kjellqvist 1974, Fernández Piqueras & Ruiz Rejón 1976, Ruiz Rejón & Fernández Piqueras 1978, Cubas 1986) found the same chromosome number in samples obtained along the geographic range of the species.

1433. ***Ulex canescens*** Lange — 2*n* = 32 (Figs 14, 20).

Hs: Almería, Cabo de Gata, barranco del Sabinal, 36º 43' N, 2º 11' W, 10 Apr 1989, *Mira*, PC 9307 (MGC 30030).

Ulex canescens is an endemism restricted to southeastern Spain (Cabo de Gata), and characterised by the persistent, appressed hairs that cover young twigs and spines. The area of *U. canescens* and *U. parviflorus* contact, however, *U. parviflorus* grows on carbonate rocks whereas *U. canescens* is restricted to the coastal volcanic mountains of Cabo de Gata. We have counted 2*n* = 32 chromosomes in root mitosis of germinated seeds.

The only previous data (*n* = 16) was obtained by Fernández Piqueras & Ruiz Rejón (1976) from a plant of this area, although named as *U. argenteus* subsp. *erinaceus*.

1434. ***Stauracanthus boivinii*** (Webb) Sampaio — 2*n* = 48, *n* = 24 (Figs 15-16, 21-22).

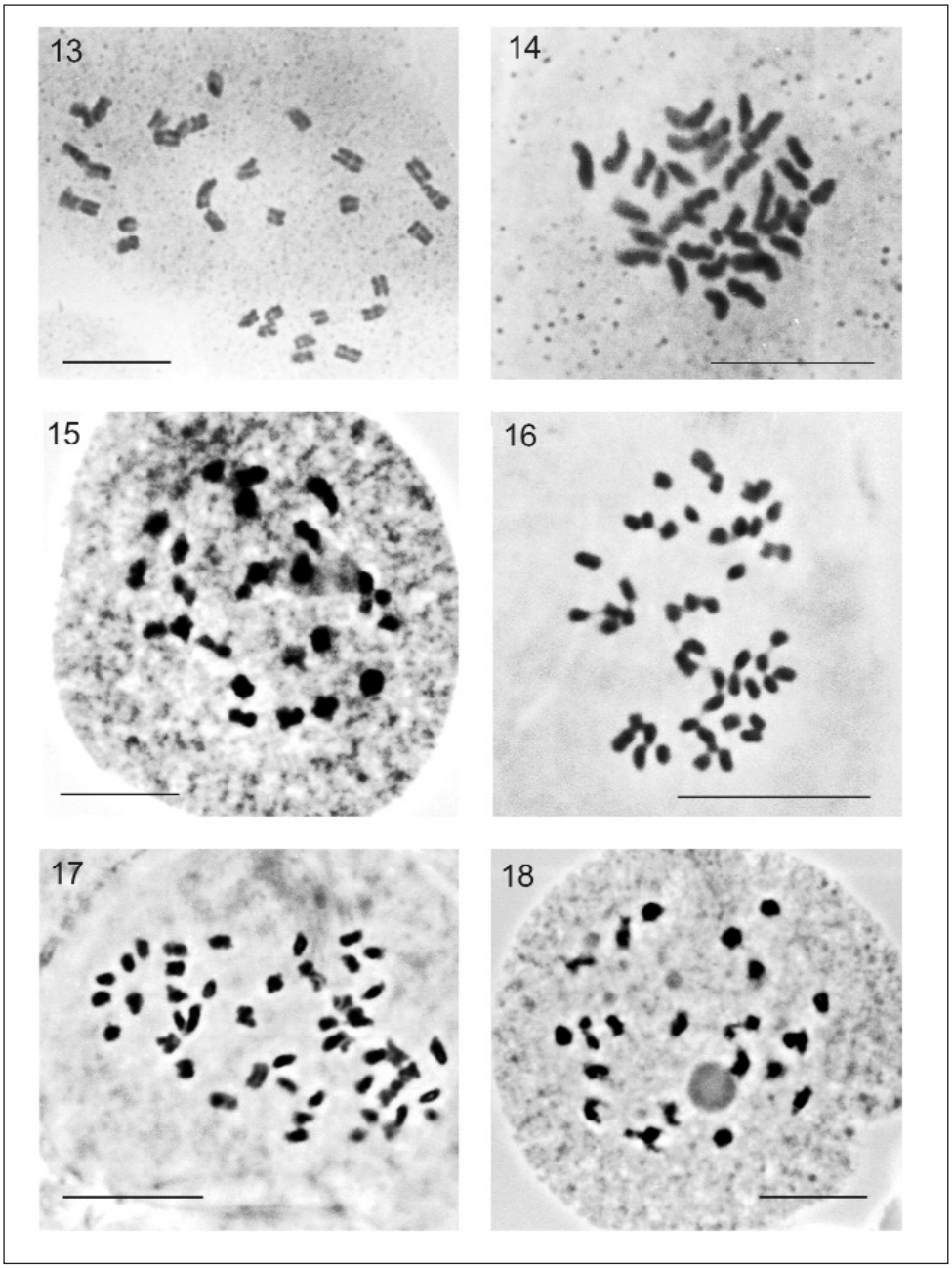
Ma: Moyen Atlas, Taza, Parc National de Tazekka, 34° 09' N, 4° 01' W, 1050 m, 14 Feb 2003, *Tahiri* (RAB 65855). - Figs 9, 15.
— Rif, Bab Berred to Ketama, 8 km from Bab Berred, 35° 00' N, 4° 53' W, 1350 m, 28 May 2004, *Tahiri* (RAB 65861/MAF 163923).
— Rif, Tafira, jbel Timzorene, 34° 59' N, 4° 47' W, 1600 m, 28 May 2004, *Tahiri* (RAB 65860/MAF 163924).
— Rif, Targuist to Bni Hadifa, 23 km from Targuist, 35° 01' N, 4° 11' W, 28 May 2004, *Tahiri* 15-04. - Figs 10, 16.

Stauracanthus boivinii is restricted to the southwest of the Iberian Peninsula and northern Morocco. Numerous taxa have been described based on variation of morphological characters, although not a clear geographical or ecological pattern has been found. There are also different ploidy levels. Plants with 2*n* = 96, ± 128 and 144 chromosomes (Castro 1941; Cubas 1986) have been found in the Iberian Peninsula while all the studied plants from Morocco have 2*n* = 48 chromosomes. Our data agree with the only previous report on Moroccan samples (Talavera & Arista 1995).

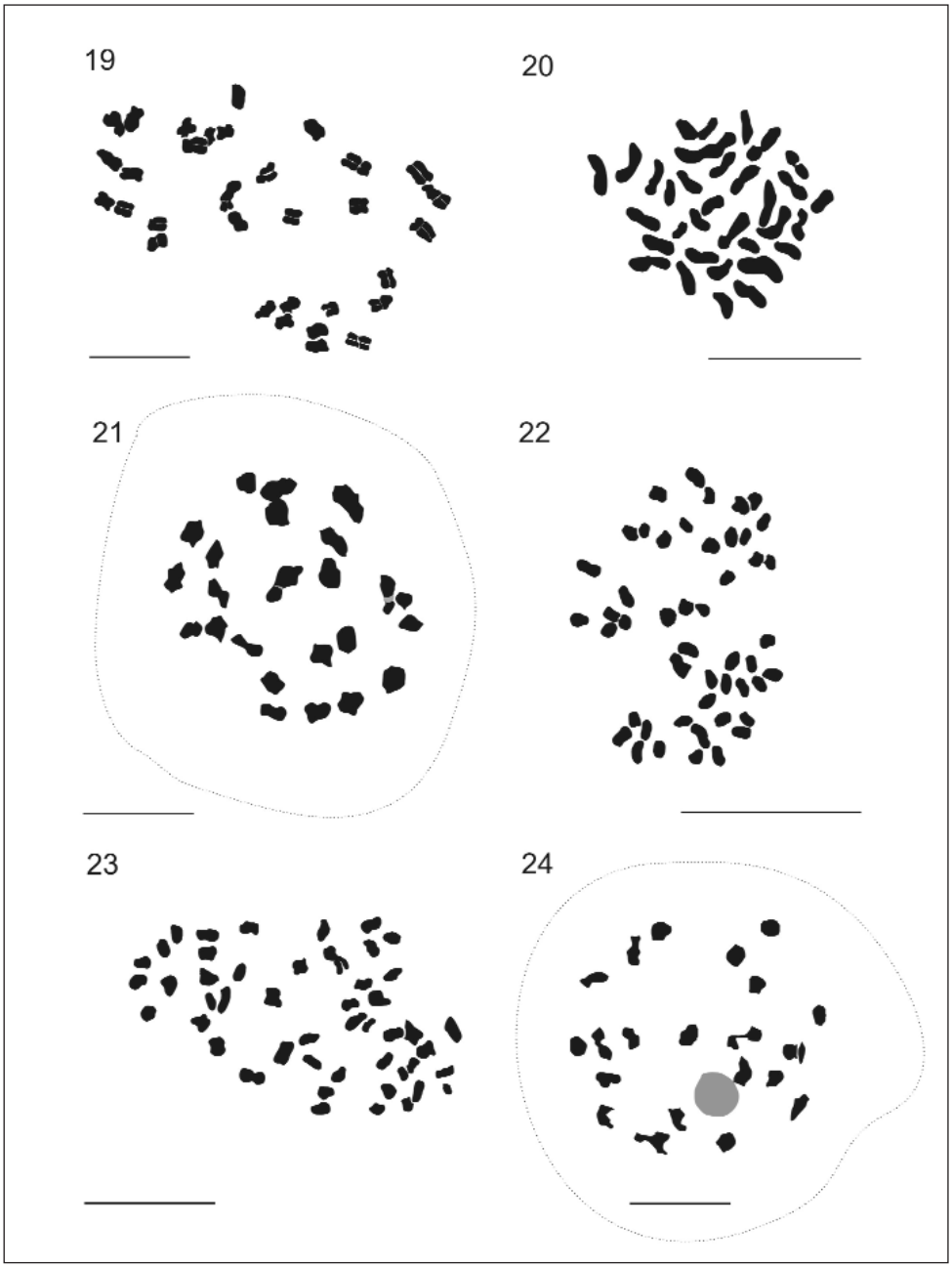
1435. ***Cytisus transiens*** (Maire) Talavera (= *C. arboreus* subsp. *transiens* Maire) — 2*n* = 50.

Ma: Maroc atlantique nord, J. Tirmah, 33° 15' N, 6° 30' W, 750 m, 9 Mar 2000, *Tahiri* (RAB 62171).

Cytisus transiens is endemic of the North Atlantic area of Morocco where it grows on quartzitic rocks between 500 and 1100 m of altitude. This taxon is undoubtfully close to *C. arboreus*, but differs by morphological characteristics, such as the number of stem ribs, legume and indument (Tahiri 2002). It has been considered either as a variety, subspecies (*C. arboreus* subsp. *transiens*; Maire 1987), or as a separate species (Talavera & Salgueiro 1999). Molecular phylogenetic analysis indicates that *C. transiens* is sister to *C. arboreus*



Figs 13-18: Photomicrographs of: **13,** *Ulex parviflorus* subsp. *parviflorus*, 2*n* = 32; **14,** *U. canescens*, 2*n* = 32; **15-16,** *Stauracanthus boivinii*, *n* = 24 bivalents (15, metaphase I) and 2*n* = 48 (16); **17,** *Genista clavata*, 2*n* = 48; **18,** *G. spartioides* subsp. *pseudoretamoides*, *n* = 22 bivalents (diakinesis). — Scale bars = 10 μm.



Figs 19-24: Explanatory diagrams of Figs 19-24: **19,** *Ulex parviflorus* subsp. *parviflorus*, 2*n* = 32; **20,** *U. canescens*, 2*n* = 32; **21-22,** *Stauracanthus boivinii*, *n* = 24 bivalents (21, metaphase I) and 2*n* = 48 (22); **23,** *Genista clavata*, 2*n* = 48; **24,** *G. spartioides* subsp. *pseudoretamoides*, *n* = 22 bivalents (diakinesis). — Scale bars = 10 μm.

and *C. malacitanus* (Cubas & al. 2002).

We have counted 2*n* = 50 chromosomes in root mitosis. No previous information on the chromosome number of this taxon has been reported.

1436. *Genista clavata* Poiret — 2*n* = 48 (Figs 17, 23).

Ma: Rif, Tanger, Dar Zhirou, 35° 40' N, 5° 53' W, 15 Mar 2003, *Tahiri* (RAB65857/MAF 163919).

Genista clavata is an endemic species restricted to the northwest of Morocco. This species is included into sect. *Cephalospartum* (Gibbs 1966) which is characterised by capitate inflorescences and partly opposite branching. In molecular phylogenetic analysis (Pardo & al. 2004) this section splits into two groups. One of those, which includes *G. clavata* and *G. umbellata,* is sister to a clade formed by *Ulex* and *Stauracanthus*.

We have counted 2*n* = 48 chromosomes in root mitosis. This is the first record of the chromosome number for this taxon.

1437. *Genista spartioides* subsp. ***pseudoretamoides*** Maire — *n* = 22 (Figs 18, 24).

Ma: Moyen Atlas, 10 km to Boulmane in the road from Ifrane, 33° 27' N, 4° 47' W, 1600 m, 1 May 2004, *Tahiri* (RAB 65854/MAF 163920).

Genista spartioides is a western Mediterranean species, restricted to North Africa (Algeria and Morocco) and Spain. Maire (1987) recognises three subspecies: subsp. *spartioides*, growing in coastal areas around Oran (Algeria) and northeastern Morocco; subsp. *retamoides* (Spach) Maire, restricted to southeastern Spain, and subsp. *pseudoretamoides* with a wider geographic range from the Tlemcen Mountains (Algeria) to Morocco (eastern Morocco, Rif Mountains and Middle Atlas). The North African subspecies can be differentiated by the ovary and legume: with numerous hairs in subsp. *pseudoretamoides*, and glabrous to glabrescent in subsp. *spartioides*.

We have counted *n* = 22 bivalents in metaphase of meiosis. This is the first count for North African plants and differs from previous records of 2*n* = 40 + 0-2B chromosomes in samples from southern Spain (Sañudo 1971; Cusma Velari & al. 2003).

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Reports (1438-1442) by J. V. Shner, M. G. Pimenov & E. V. Kljuykov

1438. ***Actinolema macrolema*** Boiss. — $n = 5$ (Figs 1a, b).

Cc: Armenia, vicinity of Erevan, Vokhchaberd, 40° 10' N, 44° 31' E, 28 May 2001, *Pimenov & Kljuykov* 12 (MW).

Actinolema, a very special genus of the Umbelliferae-Saniculoideae, contains only two annual species, distributed in SW Asia. None of them was investigated in terms of chromosome numbers. So $n = 5$ is the first determination for the genus.

The genus was regarded as close relative of *Astrantia*. Koso-Poljansky (1916) even proposed for *A. macrolema* and *A. eryngioides* Fenzl the nomenclatural combinations under *Astrantia*. Molecular data (nrDNA ITS1-2 sequencing) show a close, but separate position of *Actinolema* near *Astrantia* (Valiejo-Roman & al. 2002).

These genera differ, however, in chromosome numbers. In *Astrantia* (eight species have been investigated) x = 7 prevails, and x = 8 has been determined for *A. minor* L. and *A. pauciflora* Bertol., both belonging to the section *Astrantiella*. The chromosome number x = 5 has never been determined for *Astrantia*, marking cytological difference between this genus and *Actinolema*, in addition to their known morphological differences. In *Saniculoideae* x = 5 is known only for some *Eryngium* L. species (Pimenov & al. 2002).

1439. *Elaeosticta glaucescens* (DC.) Boiss. — $n = 11$ (Figs 1c, d).

Cc: Armenia, vicinity of Erevan, Vokhchaberd, 40° 10’ N, 44° 31’ E, 28 May 2001, *Pimenov & Kljuykov* 1 (MW).

Our new determination confirms the only one made before, also on the basis of Armenian material (Vasil’eva & al. 1981). The chromosome number x = 11 is the most common chromosome number in the genus, although some species have x = 10.

1440. *Leiotulus dasyanthus* (Fisch. & C. A. Mey. ex K. Koch) Pimenov & Ostroumova [Malabaila dasyantha (Fisch. & C. A. Mey. ex K. Koch) Schischk.] — $n = 11$ (Figs 2a, b).

Cc: Armenia, vicinity of Erevan, Vokhchaberd, 40° 10’ N, 44° 31’ E, 28 May 2001, *Pimenov & Kljuykov* 2 (MW).

Our new determination corresponds to three previous ones, made for this species (Vasil’eva & al. 1981; Nazarova 1997), collected in Nakhichevan, Georgia and Arcach (Karabakh).

Being widely spread in the Umbelliferae-Apioideae, the same number x = 11 was found not only for other three diploid *Leiotulus* species, but also in closely related genera *Pastinaca* L. and *Trigonosciadium* Boiss. (Pimenov & al. 2002; Shner & al. 2004). The chromosome number x = 10 is known, however, in some *Leiotulus* species too - *L. aureus* (Sm.) Pimenov & Ostroumova (Baltisberger 1991; Constantinidis & al. 1997) and *L. pastinacifolius* (Boiss. & Balansa ex Boiss.) Pimenov & Ostroumova (Shner & al. 2004).

Diploids prevail in the whole this group, which could be regarded as *Pastinaca* s.l., although *Pastinaca pimpinellifolia* M. Bieb. was be found to be tetraploid (Pimenov & al. 1996).

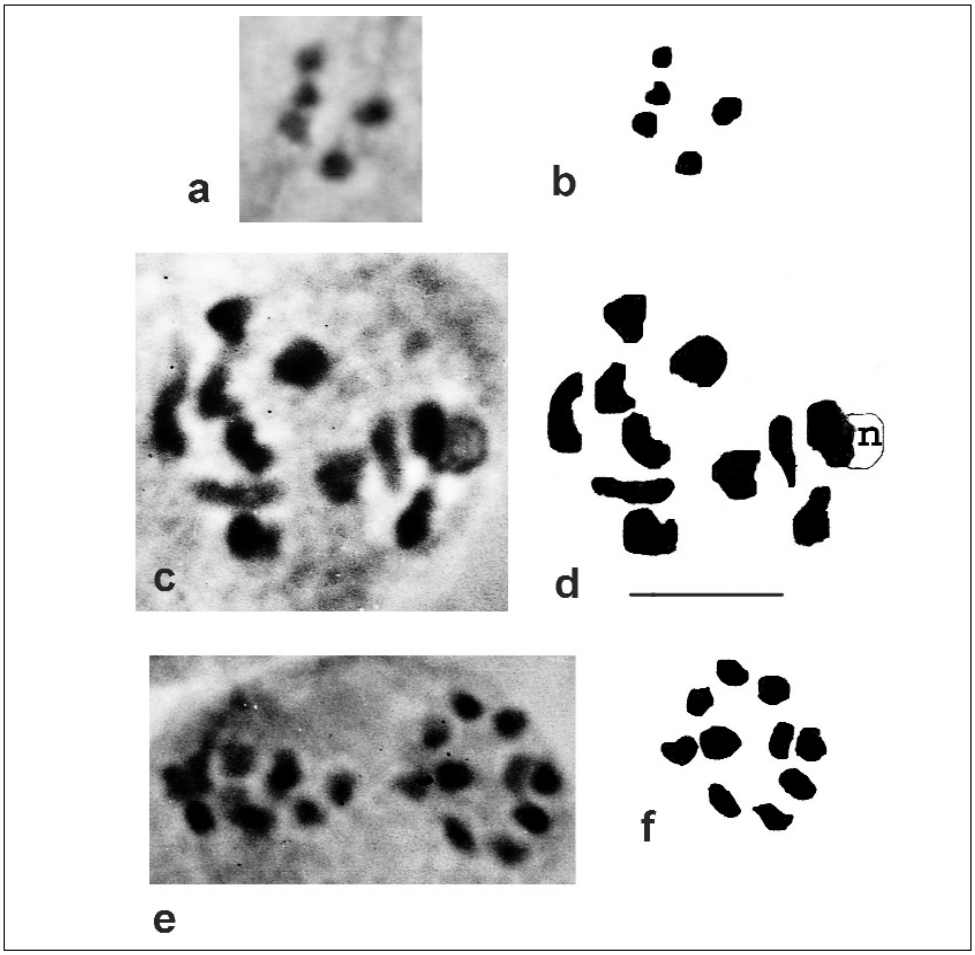

Fig. 1. Microphotographs (**a, c, e**) and drawings (**b, d, f**) of meiotic chromosomes of: **a, b,** *Actinolema macrolema*, *n* = 5 (metaphase II); **c, d,** *Elaeosticta glaucescens*, *n* = 11 (diakinesis, n - nucleolus); **e, f,** *Szovitsia callicarpa*, *n* = 10 (metaphase II). — Scale bar = 10 μm.

1441. ***Szovitsia callicarpa*** Fisch. & C. A. Mey. — *n* = 10 (Figs 1e, f).

Cc: Armenia, vicinity of Erevan, Vokhchaberd, 40° 10’ N, 44° 31’ E, 28 May 2001, *Pimenov & Kljuykov* 13 (MW).

This is the first chromosome number determination for the species and the genus (monotypic).

The species has a rather limited area, including Western Iran (W & E Azerbaijan), Armenia, Azerbaijan and E Anatolia (Turkish vilajets Kars and Van).

The affinity of *Szovitsia* in not clear. The genus was included into *Apioideae* tribes Apieae (“*Ammineae*”) (Boissier 1872; Drude 1897-98; Schischkin 1950) or *Caucalideae* (Heywood 1978; Leute 1987). Molecular data (Lee & Downie 1999, 2000; Downie & al.

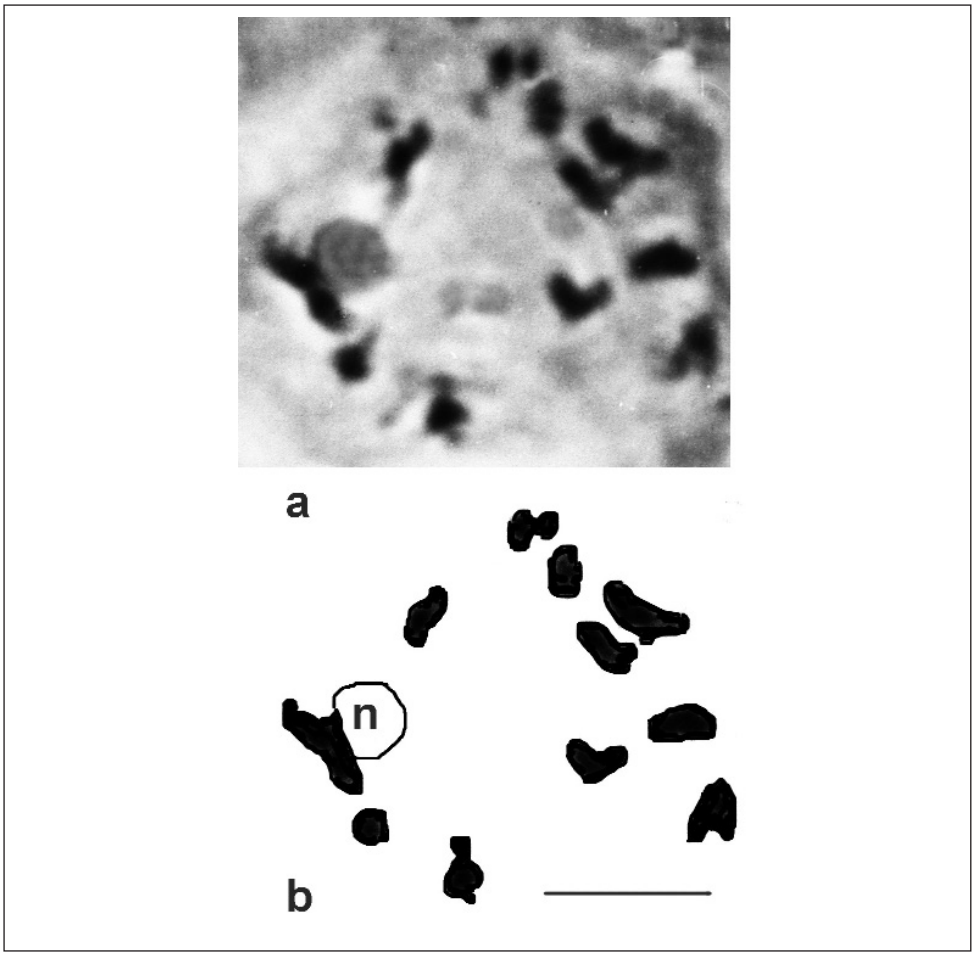

Fig. 2. Microphotograph (**a**) and drawing (**b**) of meiotic chromosomes of *Leiotulus dasyanthus*, *n* = 11 (diakinesis, n - nucleolus). — Scale bar = 10 μm.

2000) showed the affinity between *Szovitsia* and *Caucalideae* (the closest genera - *Astrodaucus* Drude and *Glochidotheca* Fenzl). The count of *n* = 10 was found in both tribes, so this information is of little value in resolving the issue.

1442. ***Zosima absinthiifolia*** (Vent.) Link — *n* = 10 (Figs 3a, b).

Cc: Armenia, vicinity of Erevan, Vokhchaberd, 40° 10’ N, 44° 31’ E, 28 May 2001, *Pimenov & Kljuykov* 8 (MW).

The species is rather widely distributed in the Eastern Mediterranean and adjacent territories. It is known for the Russian North Caucasus, Transcaucasia, Kazakhstan, Middle

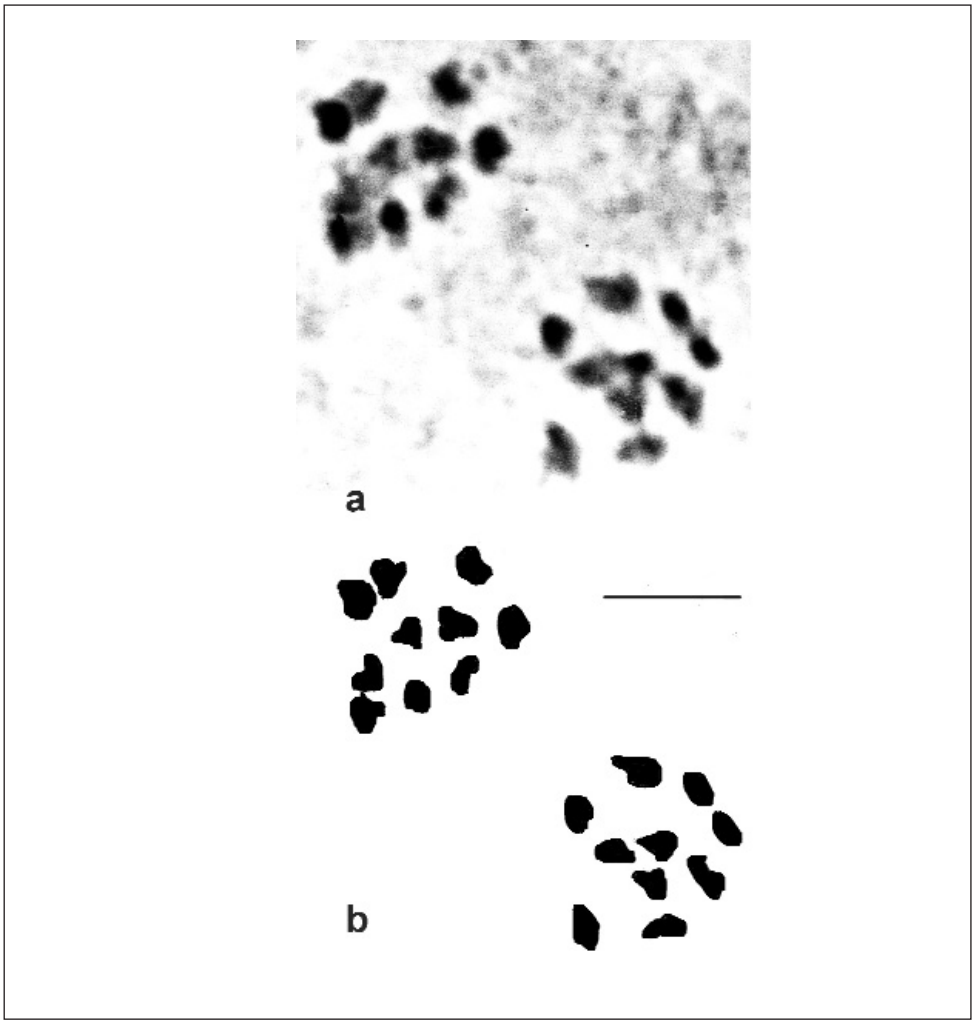

Fig. 3. Microphotograph (**a**) and drawing (**b**) of meiotic chromosomes of *Zozima absinthiifolia*, *n* = 10 (metaphase II). — Scale bar = 10 µm.

Asia, Afghanistan, Pakistan, India, Iran, Turkey, Iraq, Saudi Arabia, Syria, Jordan, Egypt, and Cyprus.

Chromosome numbers were determined at least eight times, and showed considerable intraspecific variability: *n* = 10 (from Iraq: Constance & al. 1971, 1976), 2*n* = 12 (from Armenia, Daghestan and Nakhichevan: Retina & Pimenov 1981), 2*n* = 10, 10 + 4B (from Turkmenistan: Geldykhanov 1986) and *n* = 5 (from Turkmenistan: Alexeeva & al. 1994; from Cyprus: Vogt & Aparicio 1999). Our determination corresponds to the earlier data by Constance & al. (1971, 1976) from Iraq and does not correspond to the previous determination from Armenia, 2*n* = 12. Taking into account the later data by Geldykhanov, who

showed $2n = 10$ and $2n = 10 + 4B$ for Turkmenian material, i.e. the presence of supplementary chromosomes in karyotype, this count could be interpreted as $2n = 10 + 2B$.

In this case, the species *Z. absinthiifolia* (incl. *Z. orientalis* Hoffm.) has two races of polyploid series with x = 5, namely $n = 5$ and $n = 10$. No clear geographical localization is traced in available data.

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Reports (1443-1444) by T. Cusma Velari, L. Feoli Chiapella &V. Kosovel

1443. ***Genista hispanica*** subsp. ***occidentalis*** Rouy — 2*n* = 36 (Fig. 1a).

Hs: Leon, Cordillera Cantabrica, 43° N, 5° 40' W, seeds obtained from Botanical Garden, Berlin (s.n., s.coll., s.exsicc.).

Genista hispanica ssp. *occidentalis* occurs in southwestern France and in northern and central Spain (Gibbs 1966; Talavera 1999).

The chromosome number 2*n* = 36 confirms the only reference for this taxon, reported by Sañudo (1972) concerning a Spanish population from Espinosa de los Monteros (Burgos). The same number was reported for *Genista hispanica* ssp. *hispanica*, distributed in south-eastern France and in eastern and central Spain, by Sañudo (1972, Abentosa, Teruel) and Verlaque & al. (1987b, Cabriès, Bouches-du-Rhône; Forêt domaniale de la Gardiole de Rians, Var; Petit Luberon, la Font de l'Orme, Vaucluse). Data generically concerning *G. hispanica* were reported by Forissier (1973), who found *n* = 18 in two French populations (Gréolières; Tartère, Massif du Coronat). Chromosome size ranges between 1.43 and 2.64 µm.

The number 2*n* = 36 may be traced back to the secondary basic number x = 9 (Sañudo 1979; Cusma Velari & al. 1999, 2003b). *Genista hispanica* belongs to sect. *Voglera* (Gaertn., Mey. & Schreb.) Spach; other western taxa of this section present numbers deriving from x = 9: *G. micrantha* Gómez Ortega (endemic to the northern Iberian Peninsula) has *n* = 18 / 2*n* = 36 (Sañudo 1972; Gallego Martín & al. 1985; Cubas & al. 1998; Cusma Velari & al. 2004) and *G. tridens* (Cav.) DC. (southern Spain, northwestern Morocco) has *n* = 36 / 2*n* = 72 (Sañudo 1972).

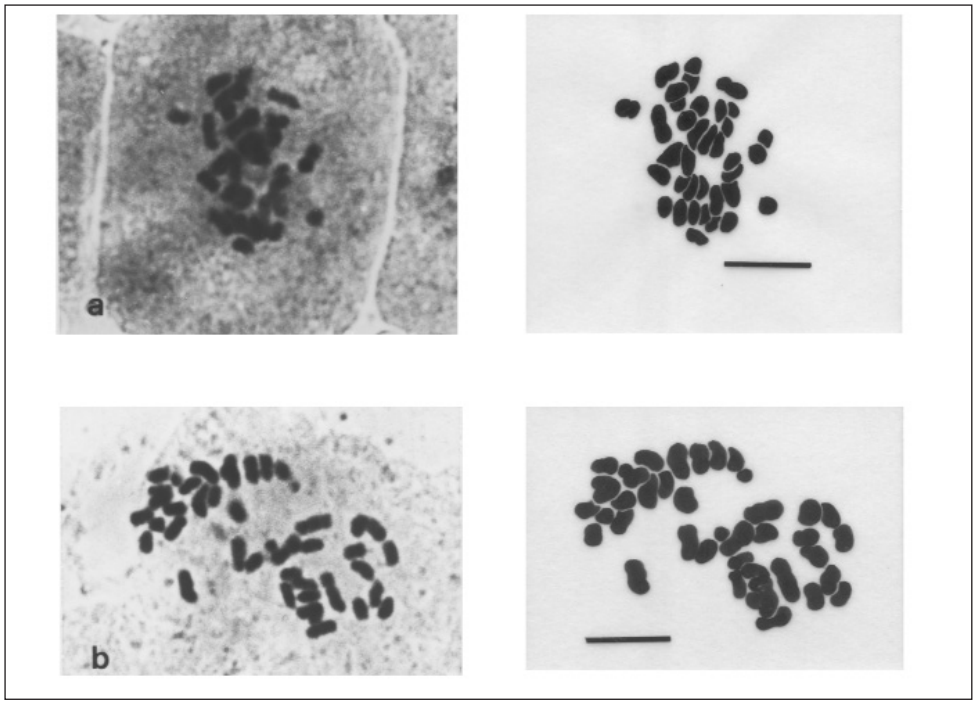

Fig. 1. Photomicrograph and relative drawing of somatic metaphase plate of: **a,** *Genista hispanica* ssp. *occidentalis,* 2*n* =36; **b,** *Genista scorpius* ssp. *scorpius,* 2*n* = 40. — Scale bars = 5 μm.

1444. *Genista scorpius* (L.) DC. subsp. ***scorpius*** — 2*n* = 40 (Fig. 1b).

Hs: Cataluña, Prades, 41° 18' N, 0° 52' E, seeds obtained from Botanical Garden, Barcelona (s.n., s.coll., s.exsicc.).

Ga: Lozère, M. Lozère, on schists, 44° 26' N, 3° 44' E, Jul 1992, seeds obtained from Botanical Garden, Bordeaux (s.n., s.coll., s.exsicc.).

Genista scorpius ssp. *scorpius* is distributed in southern France, in central and eastern Spain and in northern Morocco (Tetuán area) (Gibbs 1966; Greuter & al. 1989; Talavera 1999).

The chromosome number 2*n* = 40 confirms most of the data reported in literature: Lorenzo Andreu & Garcia-Sanz (1950), Sañudo (1971) and Gallego Martín & al. (1986) for Spanish populations (respectively from Aragona, Granada, Zamora), Verlaque & al. (1987a) for French populations (from Hérault, Bouches-du-Rhône, Alpes-de-Haute-Provence). Chromosome size ranges between 0.99 and 2.86 μm.

This number may be traced back to the secondary basic number x = 10 (Sañudo 1971; Cusma Velari & al. 1999, 2003a). For this species also other numbers were found in populations from southern France: lower (down to 2*n* =36, Natarajan 1978; Seidenbinder & Verlaque 1985) and higher (up to 2*n* = 44, Verlaque & al. 1987a). These numbers might be considered as deriving from x = 10 by descending and ascending aneuploidy. A trend

towards polyploidization may be detected in the easternmost part of the distributional range of *G. scorpius* ssp. *scorpius*; in fact a race with 2*n* = 82-84 was found in southeastern France (Var) by Verlaque & al (1987a).

The numbers *n* = 20 / 2*n* = 40 were counted also for *Genista carpetana* Lange ssp. *carpetana*, a Spanish endemic (Gibbs 1966), by Sañudo (1971, 1973) and Cubas & al. (1998). *G. scorpius* and *G. carpetana* are the only two species belonging to sect. *Scorpioides* Spach, present in the Iberian Peninsula.

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Reports (1445 - 1456) by D. Ivanova, V. Vladimirov & P. Stanimirova

1445. ***Acer pseudoplatanus*** L. — 2*n* = 52 (Fig. 1).

Bu: Central Rhodopi Mts, Trigrad gorge, 41° 38’ N, 24° 21’ E, 1000-1050 m, 30 May 2004, *Vladimirov* 04-157 (SOM).

This is the first report of the chromosome number for the species from a Bulgarian accession. It confirms earlier counts from elsewhere (Santamour 1988; Měsíček 1992; Druskovic & Lovka 1995; Dobeš & al. 1997; see also Fedorov 1969: 10; Goldblatt 1981: 28-29, 1984: 33).

1446. ***Chamaecytisus kovacevii*** **(Velen.) Rothm.** — 2*n* = 48 (Fig. 2).

Bu: Western Forebalkan, pasture south of Golyama veriga peak, NW of Petrevene village, 43° 10’ N, 24° 06’ E, c. 320 m, 7 Jun 2004, *Vladimirov* 04-169 (SOM).

This is the first report of the chromosome number for this Bulgarian endemic species.

1447. ***Fagus sylvatica*** L. — 2*n* = 24 (Fig. 3).

Bu: Mt. Vitosha, forest margin along the road from Prostor hotel to Sofia, 42° 35' N, 23° 18' E, 1450 m, 26 Oct 2003, *Petrova, Ivanova & Vladimirov* 203-113 (SOM).

— Rila Mts, Parangalitsa reserve, hills near the resort complex "Bedros", by Bistritsa river, 42° 03' N, 23° 11' E, 1450 m, 8 Aug 2004, *Stanimirova & Goranova* 3908 (SOM).

This is the first karyological record of *F. sylvatica* from Bulgaria. Previous counts from elsewhere also yielded 2*n* = 24 chromosomes (Jaretzky 1930; Tischler 1934; Johnsson 1946; Murín 1974; Uhriková & Schwarzová 1978; Pogan & al. 1980; Králik 1986; Kammacher & Sliai 1987; Morawetz & Samuel 1989; Ohri & Ahuja 1991; Druskovic & Lovka 1995).

Our count, however, does not confirm the chromosome number 2*n* = 22 given by Wetzel (1928, 1929).

1448. ***Fraxinus ornus*** L. — 2*n* = 46 (Fig. 4).

Bu: Western Forebalkan, Belogradchik town, Venetsa locality, above the TV tower, 43° 38' N, 22° 41' E, 850 m, 24 Mar 2004, *Stanimirova* 3907 (SOM).

The chromosome number presented here confirms previous reports of 2*n* = 46 made by Taylor (1945), Wright (1957), Mehra (1976), Aboucaya & Verlaque (1990), Druskovic & Lovka (1995). No former record of a chromosome number of this taxon is known from Bulgaria.

1449. ***Lonicera xylosteum*** L. — 2*n* = 18 (Fig. 5).

Bu: Central Rhodopi Mts, Trigrad gorge, 41° 38' N, 24° 21' E, 1000-1050 m, 30 May 2004, *Vladimirov* 04-143 (SOM).

This chromosome number confirms earlier counts by Arohonka (1982), Verlaque & al. (1987), Krasnikov (1991), and others (see Fedorov 1969: 198; Goldblatt 1984: 133). The same number has already been reported from Rila Mts, Pirin Mts and Central Rhodopi Mts in Bulgaria by Čheshmedziev (1994).

1450. ***Picea abies*** (L.) Karsten — 2*n* = 24 (Fig. 6).

Bu: Mt. Vitosha, Norway spruce forest near Mecha Polyana locality, 42° 34' N, 23° 17' E, c. 1770 m, 26 Oct 2003, *Petrova, Ivanova & Vladimirov* 203-104(2) (SOM).

Our report of $2n = 24$ chromosomes is in agreement with indications given by Váchová (1974), Terasmaa (1975), Arohonka (1982), Pashuk (1987), Hizume & al. (1988), Müller & al. (1991), Druskovic & Lovka (1995), Fuchs & al. (1995), Guttenberger & Müller (1996) and Nkongolo (1999). This is the first record on Bulgarian material.

1451. ***Platanus orientalis*** L. — $2n = 42$ (Figs 7, 8).

Bu: Strouma valley floristic region, dry places west of Kolarovo village, 41° 22' N, 22° 57' E, c. 300 m, 20 Oct 2003, *Ivanova & Vladimirov* 03-40 (SOM).

The established chromosome number $2n = 42$ is the first count on Bulgarian materials and confirms previous counts of $2n = 42$ or $n = 21$ reported by Sax (1933), Pizzolongo (1958), Ernst (1963), Koul & Gohil (1973), Mehra (1976), Todua (1976), and Oberprieler & Vogt (1994).

Different chromosome numbers, $2n = 14$, 16 (see Fedorov 1969: 491) and $2n = 35$ (Todua l.c.) have also been published.

1452. ***Rubus caesius*** L. — $2n = 28$ (Fig. 9).

Bu: Strouma valley floristic region, dry places west of Kolarovo village, 41° 22' N, 22° 57' E, c. 300 m, 20 Oct 2003, *Ivanova & Vladimirov* 03-41 (SOM).

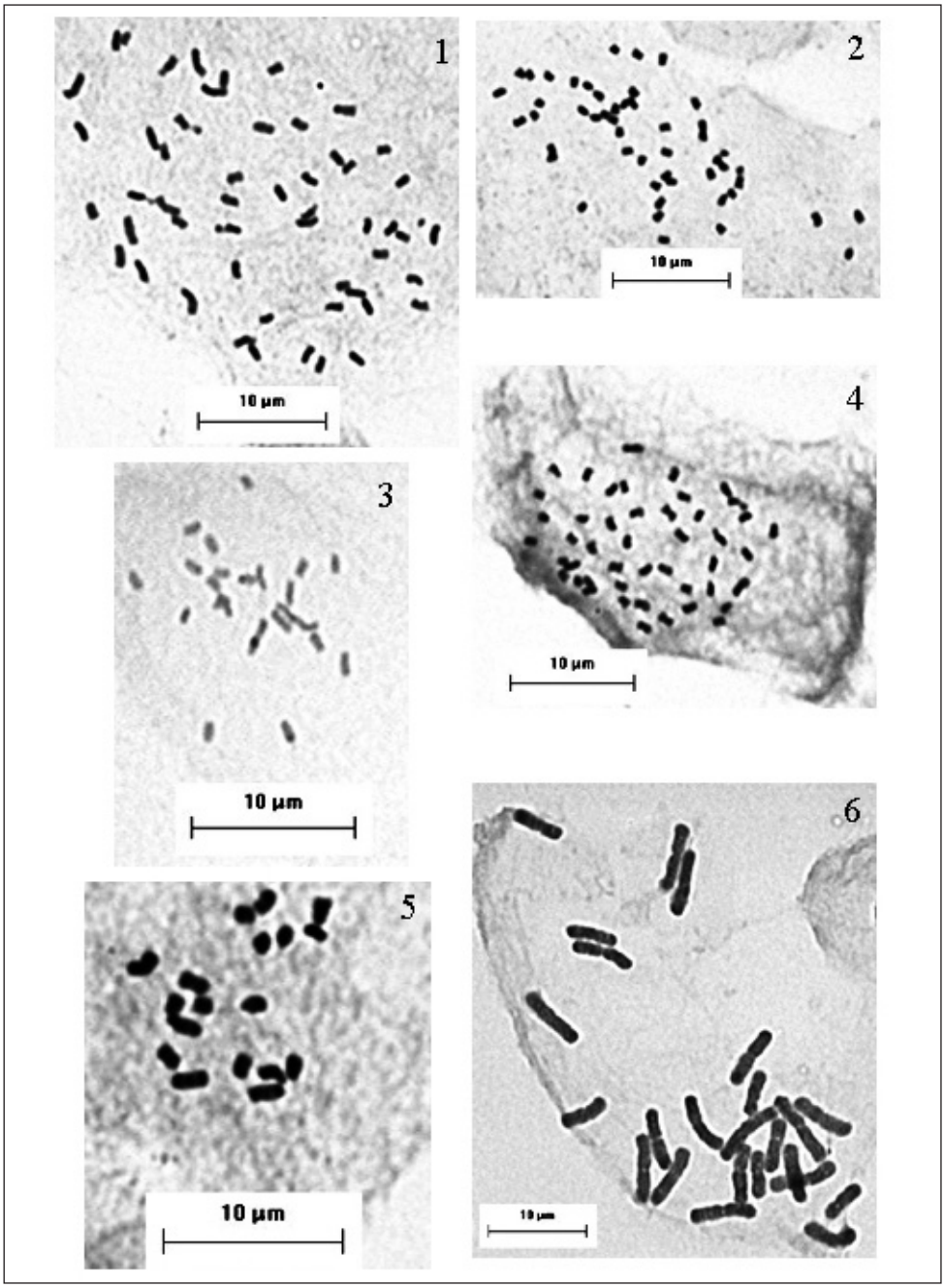
The established chromosome number $2n = 28$ is reported for the first time from a Bulgarian accession. The same number is also reported by Longley (1924), Longley & Darrow (1924), Datta (1932), Gustafsson (1933, 1939, 1942, 1947), Rozanova (1934, 1940), Tischler (1934), Rohweder (1937), Vaarama (1939), Heslop-Harrison (1953), Engelskjøn (1979), Krahulcová & Holub (1997). Heslop-Harrison (l.c.) gave $2n = 35$ as well.

1453. ***Rubus idaeus*** L. — $2n = 14$ (Fig. 10).

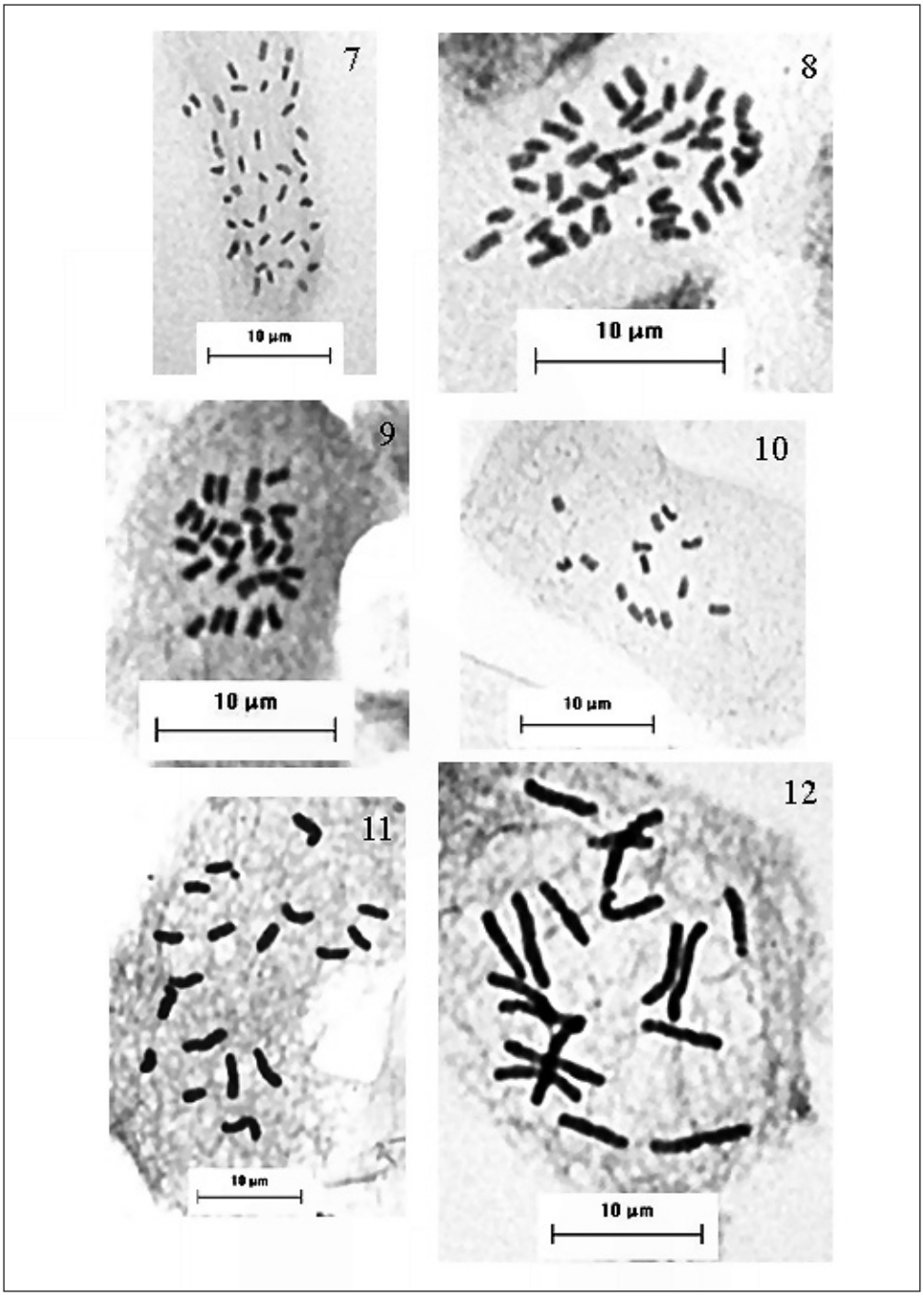
Bu: Mt. Vitosha, Mecha Polyana locality, 42° 34' N, 23° 17' E, 1770 m, 26 Oct 2003, *Petrova, Ivanova & Vladimirov* 203-97(1) (SOM).

No former record of a chromosome number of *R. idaeus* is known from Bulgaria. The number $2n = 14$ agrees well with the reports of many authors - Váchová (1974), Skalińska & al. (1978), Engelskjøn (1979), Pool & al. (1981), Arohonka (1982), Dmitrieva & Parfenov (1985), Parfenov & Dmitrieva (1987), Měsíček (1992), Chen (1993), Li & al. (1993), Krahulcová & Holub (1997a), Lövkvist & Hultgård (1999), and others (see Fedorov 1969: 637-638). Chen (l.c.) reported $2n = 21$ as well.

Other chromosome numbers ($2n = 21$, 28, 35, 42) are indicated in Fedorov (1969: 637-638).



Figs 1-6. Microphotographs of: **1,** *Acer pseudoplatanus*, 2*n* = 52; **2,** *Chamaecytisus kovacevii*, 2*n* = 48; **3,** *Fagus sylvatica*, 2*n* = 24; **4,** *Fraxinus ornus*, 2*n* = 46; **5,** *Lonicera xylosteum*, 2*n* = 18; **6,** *Picea abies*, 2*n* = 24.



Figs 7-12. Microphotographs of: **7-8,** *Platanus orientalis*, 2*n* = 42; **9,** *Rubus caesius*, 2*n* = 28; **10,** *Rubus idaeus*, 2*n* = 14; **11,** *Viburnum lantana*, 2*n* = 18; **12,** *Viburnum opulus*, 2*n* = 18.

1454. ***Viburnum lantana*** L. — 2*n* = 18 (Fig. 11).

Bu: Central Rhodopi Mts, Trigrad village, Trigradsko zhdrelo, 41° 39’ N, 24° 21’ E, 1000-1100 m, 29 May 2004, *Stojanov* 3911 (SOM) & 30 May 2004, *Vladimirov* 04-152 (SOM).

The chromosome number found confirms previous counts (see Fedorov 1969: 199; Goldblatt 1981: 173, 1988: 81; Goldblatt & Johnson 1991: 81, 1994: 73, 1996: 89, 2000: 51, 2003: 96). It is the second report from Bulgaria as Čheshmedziev (1994) established the same chromosome number for a population from Golo Burdo Mt.

1455. ***Viburnum opulus*** L. — 2*n* = 18 (Fig. 12).

Bu: Central Rhodopi Mts, Trigrad gorge, 41° 38’ N, 24° 21’ E, 1000-1050 m, 30 May 2004, *Vladimirov* 04-151 (SOM).

This count agrees with earlier reports by Ma & al. (1990), Semerenko (1990), Kiehn & al. (1991), Lavrenko & Serditov (1991), Benko-Iseppon & Morawetz (1993), Montgomery & al. (1997) and others (see Fedorov 1969: 199; Goldblatt 1981: 173, 1984: 133). The same number has already been reported from Rila Mts in Bulgaria by Čheshmedziev (1994).

1456. ***Vitis sylvestris*** C. C. Gmel. — 2*n* = 38.

Bu: Strouma valley floristic region, rock near the bridge above Strouma river on the road from Petrich to Sandanski towns, 41° 29'N, 23° 14'E , 20 Oct 2003, *Ivanova & Vladimirov* 03-44 (SOM).

— Strouma valley floristic region, damp places in open *Alnus glutinosa* forest west of Kolarovo village, 41° 22’ N, 22° 57’ E, c. 280 m, 26 Apr 2004, *Ivanova & Vladimirov* 04-56 (SOM).

Baranov & Rajkova (1930) published 2*n* = 28, and later Magulaev (1979) reported 2*n* = 38 for this species. Our count showing 2*n* = 38 chromosomes is the first report from Bulgaria.

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