Zeitschrift: Candollea : journal international de botanique systématique = international journal of systematic botany

Herausgeber: Conservatoire et Jardin botaniques de la Ville de Genève

Band: 49 (1994)

Heft: 2

Artikel: Chromosome numbers of North African phanerogams : IV

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DOI: https://doi.org/10.5169/seals-879556

Chromosome numbers of North African phanerogams. IV.

Part III was published in *Willdenowia* 24 (1994)

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ABSTRACT

VOGT, R. & C. OBERPRIELER (1994). Chromosome numbers of North African phanerogams. IV. *Candollea* 49: 549-570. In English, English and French abstracts.

Chromosome numbers for 45 Moroccan phanerogams out of 17 plant families are given. Eight reported taxa have not previously been studied cytologically or have chromosome numbers differing from previous reports. Counts for 14 additional taxa are the first reports for Morocco or North Africa.

RÉSUMÉ

VOGT, R. & C. OBERPRIELER (1994). Nombres chromosomiques de phanérogames d'Afrique du Nord. IV. *Candollea* 49: 549-570. En anglais, résumés anglais et français.

Nombres chromosomiques pour 45 phanérogames marocains de 17 familles. Huit des taxons étudiés ne l'avaient pas été auparavant ou ont des nombres chromosomiques différents de ceux cités jusqu'ici. En outre, 14 comptages sont les premiers pour le Maroc ou l'Afrique du Nord.

KEY-WORDS: Chromosome numbers — Phanerogams — North Africa.

Introduction

The fourth contribution of this series dealing with cytological investigations in the North African flora provides 57 counts in 45 species out of 17 phanerogam families.

Materials and methods

The seed material used for this study was collected during two field trips to Morocco organized by the Institute of Systematic Botany, Munich University, in 1987 and 1989. The collection sites are listed below and their approximate position is indicated in Fig. 1.

Locality 1: Prov. de Tetouan; 3 km SW of Ceuta along the road (P 28) to Tetouan, ca. 10 m, 5°21'W — 35°52'N, 22.6.1989.

Locality 2: Prov. de Tetouan; 7 km S of Ceuta, along the road to Tetouan (P 28), ca. 10 m, swamp, 5°21'W — 35°50'N, 22.6.1989.

CODEN: CNDLAR
ISSN: 0373-2967
49(2) 549 (1994)

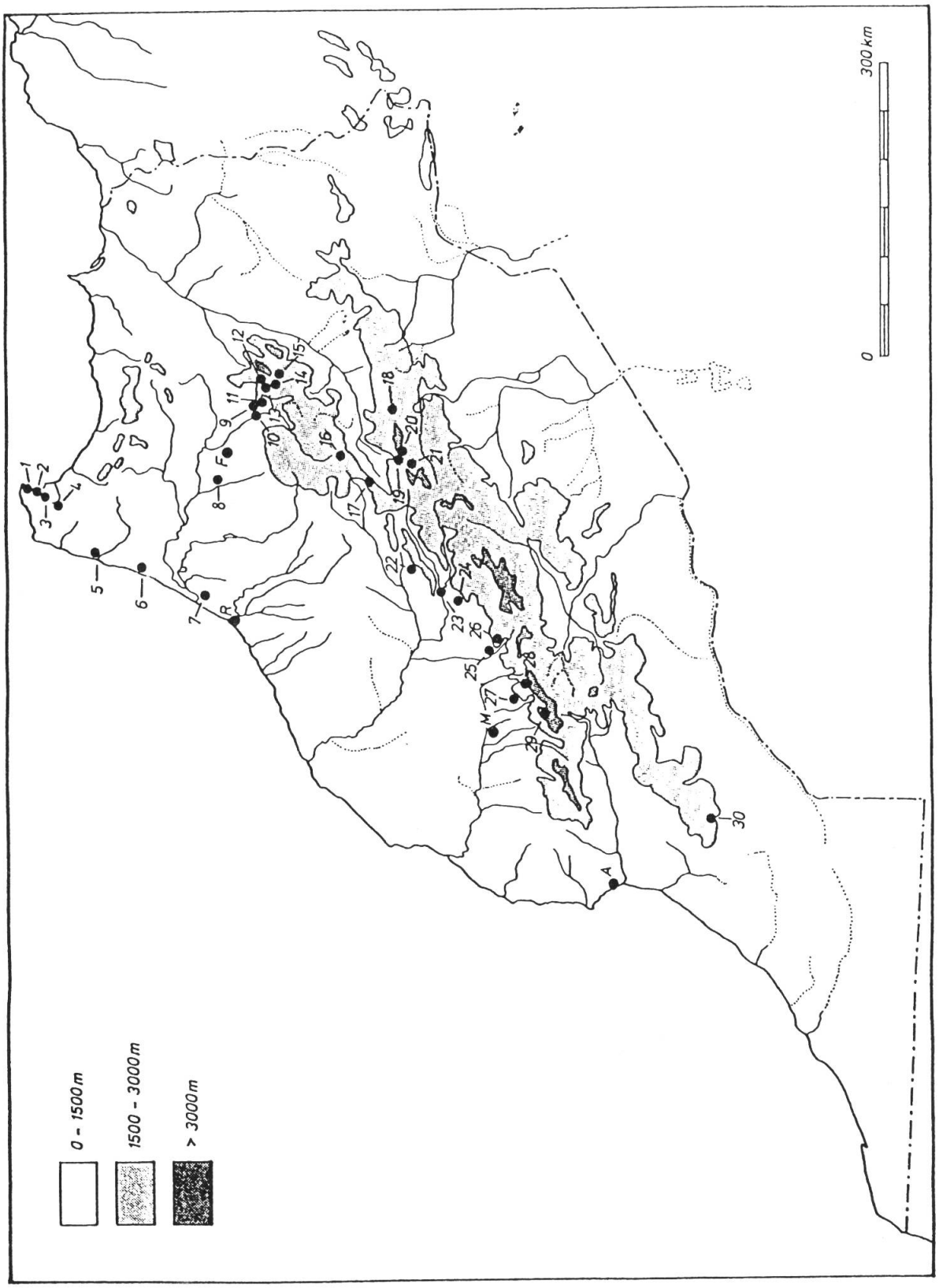

Fig. 1. — Map of Morocco showing the 30 localities cited in this paper.

Locality 3: Prov. de Tetouan; 7 km N of Mdiq along the road from Tetouan to Ceuta (P 28), moist hollow, 5°21'W — 35°44'N, 22.6.1989.

Locality 4: Prov. de Tetouan; southern shore of Barrage Ajras along the road between Tetouan and Tanger (P 37), cultivated fields, 5°31'W — 35°34'N, 22.6.1989.

Locality 5: Prov. de Tetouan; northern shore of Oued Loukos (N of Larache), ca. 10 m, dunes ca. 2 km inland, 6°08'W — 35°13'N, 23.6.1989.

Locality 6: Prov. de Kenitra; 4 km SW of Lalla-Mimouna along the road between Arbaoua and Moulay-Bousselham (S 216), 6°07'W — 34°51'N, 23.6.1989.

Locality 7: Prov. Kenitra; Kenitra — Allal Tazi (S 206), 25 km N of Kenitra, cultivated fields and stony slopes, sand, 10 m, 6°30'W — 34°27'N, 3.5.1987.

Locality 8: Prov. Fès; near Moulay-Yakoub, W of Fès, stony slopes and fields, 400 m, 30.4.1987.

Locality 9: Prov. de Taza; ca. 25 km SE of Ahermoumou (Ribat-el-Kheyr) on road to Jebel Bou Iblane (4803), N slopes of Tizi n'Tiskrine, 1430-1550 m, 4°15'W — 33°42'N, 25.06.1989.

Locality 10: Prov. de Taza; ca. 19 km SE of Ahermoumou (Ribat-el-Khear) on track (4803) to Jebel Bou-Iblane, 1100 m, 4°16'W — 33°44'N, 25.6.1989.

Locality 11: Prov. de Taza; environs of Taffert on road (4803) from Ahermoumou (Ribat-el-Kheyr) to Jebel Bou-Iblane, 1400-1680 m, limestone cliffs, 4°15'W — 33°40'N, 25.6.1989.

Locality 12: Prov. de Taza; Moyen Atlas, ca. 10 km E of Taffert along the road from Ahermoumou (Ribat-el-Kheyr) to Jebel Bou Iblane (4803), 1680m, 4°12'W — 33°39'N, 25.6.1989.

Locality 13: Prov. de Taza; Moyen Atlas, Jebel Bou Iblane, surroundings of the Refuge de Taffert near the road 4803, cedar-forest, 1830-1930 m, 4°10'W — 33°39'N, 25.6.1989.

Locality 14: Prov. de Taza; Moyen Atlas, Jebel Bou Iblane, N facing slopes, road of Tizi Bouzabel, 2 km above the forest station at 2040 m, stony slopes, 4°10'W — 33°39'N, 26.6.1989.

Locality 15: Prov. de Fès; Moyen Atlas, Jebel Bou Iblane, 14 km S of Tizi Bouzabel on road (4656) to Boulmane, N of Talzent, 1790 m, cultivated fields and fallow land, 4°11'W — 33°37'N, 27.6.1989.

Locality 16: Prov. d'Er-Rachidia; Moyen Atlas, Col du Zad on road (P 21) from Azrou to Midelt, 2150 m, roadside and rocks, 5°04'W — 33°01'N, 29.6.1989.

Locality 17: Prov. de Khenifra; Moyen Atlas, Tizi n'Tahhout-ou-Fillali on the road (P 33) between Zeida and Khenifra, oak-forest, 2070 m, 5°27'W - 32°41'N, 4.7.1989.

Locality 18: Prov. d'Er-Rachidia; Grand Atlas, Tizi-n-Talrhemt on road (P21) from Midelt to Er-Rachidia, 1820-1900 m, roadside and rocks, 4°32'W — 32°37'N, 30.6.1989.

Locality 19: Prov. d'Er-Rachidia; Grand Atlas, 13 km W of Tounfite along the road (3422) to Arhbala, near the turn-off to Sidi Yahia ou Youssef, 2000 m, river-bed, 5°21'W — 32°29'N, 1.7.1989.

Locality 20: Prov. d'Er-Rachidia; Grand Atlas, ca. 8 km W of Tounfite on track to Arhbala (3422), fields and roadsides, 2100 m, 5°19'W — 32°28'N, 4.7.1989.

Locality 21: Prov. d'Er-Rachidia; Grand Atlas, gorge "Arhbalou n'Oussaka" between Jebel Masker and Jebel Bou Ijallabene, S of Assaka, limestone, 1950-2000 m, 5°22'W — 32°22'N, 2.7.1989.

Locality 22: Prov. de Beni-Mellal; S of the village Foum el Ancer (NE of Beni-Mellal), 700 m, limestone, 6°15'W — 32°23'N, 5.7.1989.

Locality 23: Prov. de Beni-Mellal; Moyen Atlas, S of Afourer along the road to Azilal, S facing slopes of the pass, limestone, 1320 m, 6°32'W - 32°09'N, 5.7.1989.

Locality 24: Prov. de Beni-Mellal; Moyen Atlas, Cascades d'Ouzoud, 960-1060 m, 6°43'W — 32°02'N, 6.7.1989.

Locality 25: Prov. de Marrakech; Grand Atlas, Imi-n-Ifri (Pont naturel), 6 km SE of Demnate, limestone, 1020 m, 6°58'W — 31°43'N, 7.7.1989.

Locality 26: Prov. de Marrakech; Grand Atlas, 11 km S of Imi-n-Ifri (Pont naturel) along the road to Toufrine, 1600 m, stony slopes, 6°57'W - 31°35'N, 6.7.1989.

Locality 27: Prov. de Marrakech; Grand Atlas, 2 km N of Ait Bakra on the road (P 31) between Marrakech and Ouarzazate, 1340 m, 7°25'W — 31°28'N, 8.7.1989.

Locality 28: Prov. de Marrakech; Grand Atlas, 8 km N of Tizi-n-Tichka on the road from Marrakech to Ouarzazate (P 31), 1900 m, 7°22'W — 31°20'N, 8.7.1989.

Locality 29: Prov. de Marrakech; Grand Atlas, surroundings of Oukaimeden and mountains SE of the village, 2600-3000 m, silicate rocks, 7°51'W — 31°11'N, 14.-15.7.1989.

Locality 30: Prov. d'Agadir, Anti Atlas, 11 km S of Tafraout, pass on the road to Timkyet (7075), 1650 m, granit, 21.4.1987.

Plants were raised at the Botanic Garden Berlin-Dahlem and voucher specimens are deposited in the herbaria of the Botanic Museum Berlin-Dahlem (B) and in the private collections of the authors.

Chromosome numbers were obtained from somatic mitoses of root tips of plants raised from seed. A detailed description of the cytological techniques used is given in VOGT & OBERPRIELER (1993).

Table 1. — Chromosome counts of phanerogames from Morocco. — An asterisk (*) indicates new or deviating counts.

Taxon	*2n*	*Fig.*	*Locality (Fig. 1)*
ALISMATACEAE			
Baldellia ranunculoides (L.) Parl.	*20	2A	3
APIACEAE			
Daucus muricatus (L.) L.	22	2B	2
Pseudorlaya minuscula (Pau & Font Quer) Laínz	*16	2C	3
Stoibrax involucratum (Maire) B. L. Burtt	22	2D	23
BORAGINACEAE			
Cynoglossum creticum Miller	24	2E	10
BRASSICACEAE			
Alyssum serpyllifolium Desf.	16		19
Lobularia maritima (L.) Desv.	24		5
CAMPANULACEAE			
Campanula filicaulis Durieu	48	2F	26
Jasione montana subsp. *corymbosa* (Poiret) Greuter & Burdet	12	3A	3
CARYOPHYLLACEAE			
Cerastium gibraltaricum Boiss.	72		14
Silene boryi Boiss.	24	3B	21
Silene obtusifolia Willd.	24	3C	1
COMPOSITAE			
Andryala integrifolia L.	18	3D	17, 22, 28
Calendula cf. *stellata* Cav.	14	3E	30
Chrysanthemum segetum L.	18	3F	8
Crepis vesicaria L. subsp. *taraxacifolia* (Thuill.) Thell.	8		11
Crepis vesicaria L. subsp. *taraxacifolia* (Thuill.) Thell.	16	4A	18
Crepis vesicaria L. subsp. *stellata* (Ball) Babcock	*15	4B	26
Filago pyramidata L.	28		*27*
Hieracium amplexicaule L. cf. subsp. *olivicolor* Jahand. & Zahn	27	4C	21
Hieracium pseudopilosella Ten. subsp. *tenuicauliforme* Jahand. & Zahn	*36		20
Hieracium pseudopilosella Ten. subsp. *timincariense* Zahn	*36	4D	29
Lactuca tenerrima Pourret	16	4E	13, 13, 28
Leontodon longirostris (Finch & P. D. Sell) Talavera	8	4F	4, 10, 24, 25
Nivellea nivellei (Br-Bl. & Maire) Wilcox, Bremer & Humphries	18	5A	22, 24, 25
Otospermum glabrum (Lag.) Willk.	18		7, 8
Phagnalon saxatile (L.) Coss. subsp. *saxatile*	18	5B	12
Pseudognaphalium luteo-album (L.) Hilliard & Burtt	14	5C	15
Scorzonera laciniata L.	14	5D	9, 10, 12, 15
Tolpis barbata (L.) Gaertn.	18	5E	5
Tragopogon porrifolius L. subsp. *australis* (Jordan) Nyman	12	5F	16
EUPHORBIACEAE			
Euphorbia terracina L.	18	6A	5
FABACEAE			
Lotus creticus L.	14		3
GENTIANACEAE			
Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch	40	6B	3
LAMIACEAE			
Micromeria fontanesii Pomel	*60		27
Teucrium resupinatum Desf.	14	6C	6
PAPAVERACEAE			
Papaver atlanticum (Ball) Cosson	14	6D	16
PORTULACACEAE			
Portulaca oleracea L. subsp. *nitida* Danin & H. G. Baker	ca. 45		1
PRIMULACEAE			
Anagallis arvensis L.	40	6E	4
Samolus valerandi L.	26	6F	1
RANUNCULACEAE			
Delphinium ambiguum L. (= *D. nanum* DC.)	16		3

Table 1 (cont.).

Taxon	*2n*	*Fig.*	*Locality (Fig. 1)*
Ranunculus spicatus Desf. subsp. *fontqueri* Romo	*16	7A	13
SCROPHULARIACEAE			
Chaenorrhinum villosum (L.) Lange	14	7B	25
Linaria pedunculata (L.) Chaz.	12	7C	3
Linaria tristis (L.) Miller	12	7D	12
VALERIANACEAE			
Centranthus calcitrapa (L.) Durf.	32		18

Results

ALISMATACEAE

Baldellia ranunculoides (L.) Parl. — Fig. 2A — $2n = 20$

Locality 3, *Oberprieler 1760.*

This first count based on North African plant material yielded the fourth chromosome number for *Baldellia ranunculoides*. Previously this species has been studied by LÖVE & LÖVE (1944, sub *Echinodorus ranunculoides* (L.) Engelm.), Packer *in* LÖVE & LÖVE (1961a), BJÖRKQVIST (1968), BJÖRKQVIST & al. (1969), PASTOR (1983), FERNÁNDEZ CASAS (1978), SCHOTSMAN (1970) and UCHIYAMA (1989) with the result of $2n = 16$ or $n = 8$ respectively. $2n = 22$ chromosomes have been reported by Clavier (see DARLINGTON & WYLIE 1955) and $2n = 14$ by PALMGREN (1943, sub *Echinodorus ranunculoides*).

APIACEAE

Daucus muricatus (L.) L. — Fig. 2B — $2n = 22$

Locality 2, *Oberprieler 1750.*

Our count of $2n = 22$ is the first one reported for Morocco and corresponds with previous counts of BELL & CONSTANCE (1960) and QUEIRÓS (1972, 1978a) who studied Portuguese, and BRULLO & al. (1979) who used Sicilian plant material. One differing count of $2n = 16$ based on plant material from unknown origin was published by WANSCHER (1933, sub *Orlaya muricata*).

Pseudorlaya minuscula (Pau ex Font Quer) Laínz — Fig. 2C — $2n = 16$

Locality 3, *Oberprieler 1764.*

Previous reports for this taxon confined to the western part of the mediterranean area are not known. Our result of $2n = 16$ agrees with the indications for the circum mediterranean *Pseudorlaya pumila* (L.) Grande given by SILVESTRE (1978), GARCÍA MARTIN & SILVESTRE (1985), LARIBI & al. (1987), HUMPHRIES & al. (1978), and QUÉZEL (1957).

Stoibrax involucratum (Maire) B. L. Burtt (= *Brachyapium involucratum* Maire) — Fig. 2D — $2n = 22$

Locality 23, *Oberprieler 3503.*

Our count appears to be the second for this Moroccan endemic and corroborates the former report of $n = 11$ published by SILVESTRE (1991) who also studied plant material from the Middle Atlas mountains.

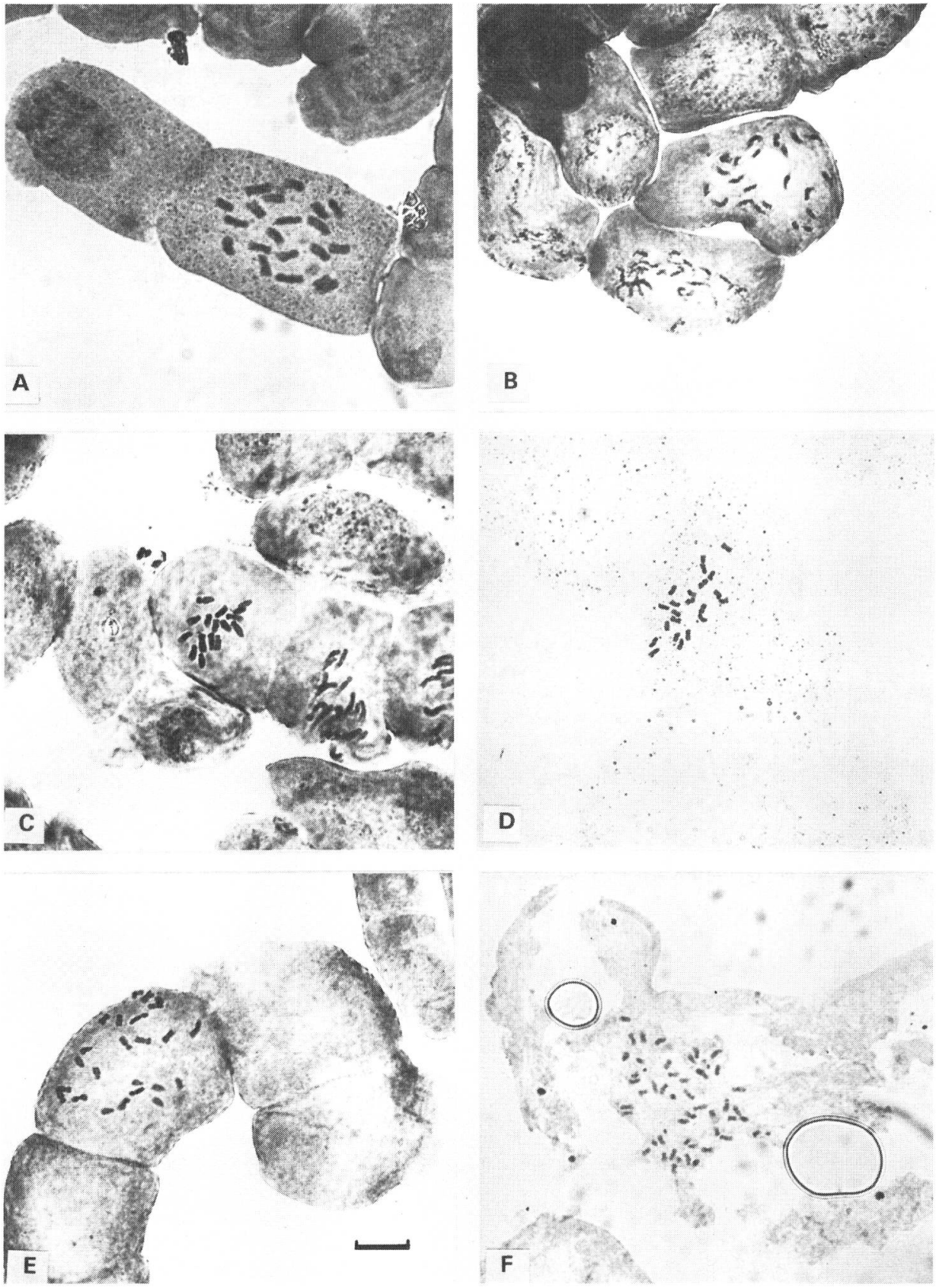

Fig. 2. — Metaphases of root-tip mitoses.
A: *Baldellia ranunculoides*, $2n = 20$. **B:** *Daucus muricatus*, $2n = 22$. **C:** *Pseudorlaya minuscula*, $2n = 16$. **D:** *Stoibrax involucratum*, $2n = 22$. **E:** *Cynoglossum creticum*, $2n = 24$. **F:** *Campanula filicaulis*, $2n = 48$. (Scale: 10 µm).

BORAGINACEAE

Cynoglossum creticum Miller — Fig. 2E — $2n = 24$

Locality 10, *Oberprieler 1865*.

This first count based on Moroccan plant material of this widespread weed agrees with the previous reports by LUQUE & VALDÉS (1986, Spain), DALGAARD (1986b, Madeira), ALTAMURA & al. (1984, Italy), DEVESA & al. (1984), MARKOVA (1983, Bulgaria), VALDÉS & al. (1978, Spain), FERNÁNDEZ CASAS & RUIZ REJÓN (1974, Spain), LÖVE & KJELLQVIST (1974b, Spain), STRID (1971, Albania), FERNANDES & LEITAO (1972, Portugal), and DELAY (1970a, France). One tetraploid number ($2n = 48$) is reported from Syria by KLIPHUIS & BARKOUDAH (1977).

BRASSICACEAE

Alyssum serpyllifolium Desf. — $2n =$ ca. 16

Locality 19, *Oberprieler 3374*.

According to previous studies this species seems to be represented by at least two ploidy levels. Our count of $2n = 16$ is in accordance with the report of $n = 8$ or $2n = 16$ respectively made by GALLAND (1984 & 1990) who studied Moroccan plant material and QUEIRÓS (1973b, sub *A. serpyllifolium* subsp. *lusitanicum* Dudley & P. Silva) and KÜPFER (1974) who studied European plants of Portuguese and French provenance. $2n = 32$ chromosomes have been reported by PUECH (1968) from the Moroccan Rif mountains and by PUECH (1963, sub *A. alpestre* subsp. *serpyllifolium*) from France. $n = 16$ chromosomes have been cited by APARICIO (1987, sub *A. serpyllifolium* subsp. *malacitanum* Rivas-Goday) and BONNET (1963, sub *A. alpestre* subsp. *serpyllifolium*) who counted plant material from Spain and France respectively.

Lobularia maritima (L.) Desv. — $2n = 24$

Locality 5, *Oberprieler 1808*.

Our count agrees with all former indications from Morocco (HUMPHRIES & al., 1978; GALLAND, 1990) and other Mediterranean countries e.g. Italy (LARSEN, 1955), France (BONNET, 1963; KLIPHUIS & WIEFFERING, 1972), Spain (GADELLA & al., 1966; BJÖRKQVIST & al., 1969), and Portugal (CATARINO, 1965).

CAMPANULACEAE

Campanula filicaulis Durieu — Fig. 2F — $2n = 48$

Locality 26, *Oberprieler 3519*.

Extensive investigations carried out on *Campanula filicaulis* in Morocco by CONTANDRIOPOULOS (1980, 1981) and CONTANDRIOPOULOS & al. (1984) have yielded a huge series of euploid as well as aneuploid chromosome numbers for this species ranging between diploid and hexaploid levels. There seem to be only week correlations between the cytotypes indicated and the taxonomic subdivision of *C. filicaulis*; var. *filicaulis* from the High Atlas mountains was found to have $2n = 24, 26, 48, 50, 52, 53$; var. *gomarica* Font Quer from the Rif mountains $2n = 48, 50$; var. *gattefossii* (Maire & Weiller) Quézel from the High Atlas $2n = 48, 52, 72$; and var. *pseudoradiocosa* Litard. & Maire from the High Atlas $2n = 24/n = 12$ chromosomes. A chromosome number of $n = 13$ for *C. filicaulis* found by HUMPHRIES & al. (1978) in plant material from the Tanger Peninsula gives further evidence for the assumption of two basic chromosome numbers ($n = 12$ and $n = 13$) in this species which could be responsible for the aneuploid chromosome numbers.

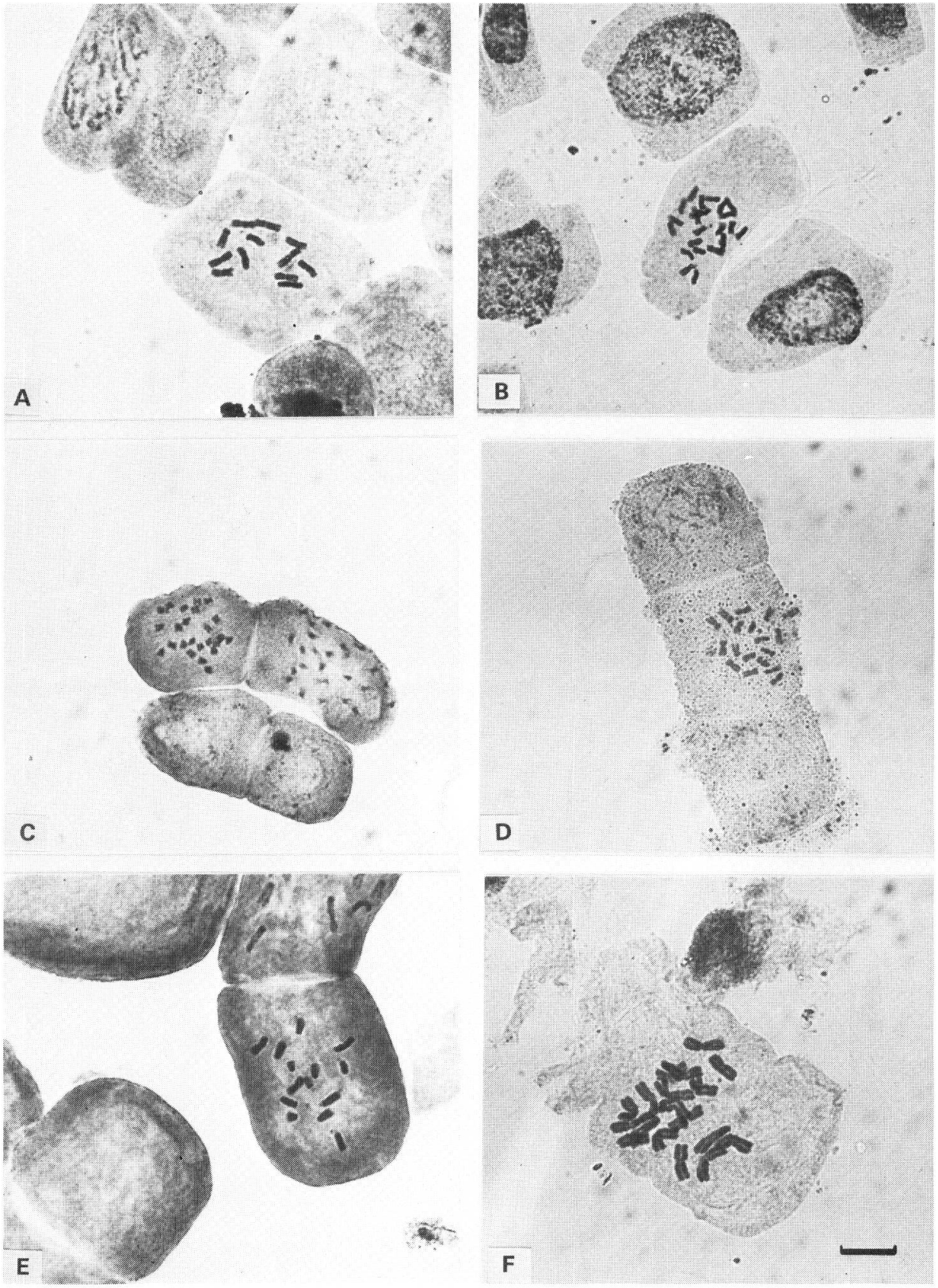

Fig. 3. — Metaphases of root-tip mitoses.
A: *Jasione montana* subsp. *corymbosa*, $2n = 12$. **B:** *Silene boryi*, $2n = 24$. **C:** *Silene obtusifolia*, $2n = 24$. **D:** *Andryala integrifolia*, $2n = 18$. **E:** *Calendula* cf. *stellata*, $2n = 14$. **F:** *Chrysanthemum segetum*, $2n = 18$. (Scale: 10 µm).

Jasione montana subsp. **corymbosa** (Poiret) Greuter & Burdet — Fig. 3A — $2n = 12$

Locality 3, *Oberprieler 1756.*

Jasione montana subsp. *corymbosa* has been studied previously in Morocco by HUMPHRIES & al. (1978 sub *Jasione corymbosa* Poiret) with the corresponding result of $2n = 12$.

CARYOPHYLLACEAE

Cerastium gibraltaricum Boiss. — $2n = 72$

Locality 14, *Oberprieler 1969.*

Cerastium gibraltaricum seems to be represented by a polyploid series with $2n = 36$, 54, and 72. It has been studied cytologically in Morocco by FAVARGER & al. (1980) and GALLAND (1990) with the result of $n = 18$, 36, and $2n = 36$, 36 + 1, 54, 72 [FAVARGER & al. (1980) also found $2n = 36$, and $2n = 72$ in Spanish plant material] considering $2n = 36$ to represent the diploid level of the species. Tetraploids, occurring in the Middle Atlas mountains of Morocco (FAVARGER & al., 1980) as well as in southern Spain (Sierra de Cazorla, Sierra Nevada) (see GALLAND, 1990) and in Corsica (SÖLLNER, 1953), are in our opinion more likely to have evolved independently from each other than to be the result of a single polyploidisation step.

Silene boryi Boiss. — Fig. 3B — $2n = 24$

Locality 21, *Oberprieler 3395.*

Our count is in accordance with the previous indication from Morocco given by Küpfer *in* FAVARGER & al. (1980) and GALLAND (1990).

Silene obtusifolia Willd. — Fig. 3C — $2n = 24$

Locality 1, *Oberprieler 1734.*

Our first count based on North African plant material agrees with the former indication of $n = 12$ from Cádiz province, Spain, published by TALAVERA & BOCQUET (1975).

COMPOSITAE

Andryala integrifolia L. — Fig. 3D — $2n = 18$

Locality 17, *Oberprieler 3455.*

Locality 22, *Oberprieler 3489* (Fig. 3D).

Locality 28, *Oberprieler 3568.*

For discussion see VOGT & OBERPRIELER (1993).

Calendula cf. **stellata** Cav. — Fig. 3E — $2n = 14$

Locality 30, *Vogt 5714 & al.*

For discussion see OBERPRIELER & VOGT (1993).

Chrysanthemum segetum L. — Fig. 3F — $2n = 18$

Locality 8, *Vogt 5988 & al.*

For discussion see VOGT & OBERPRIELER (1993).

Crepis vesicaria L.

In addition to our report of a tetraploid chromosome number in North African material of *Crepis vesicaria* subsp. *taraxacoides* in VOGT & OBERPRIELER (1993 sub *C. vesicaria* subsp. *haenseleri*) we found this species also to be represented by diploid plants. This is in accordance with indications made by HUMPHRIES & al. (1978) and by BABCOCK (1947).

BABCOCK (1947: 840) pointed out that *Crepis vesicaria* subsp. *stellata* is supposed to be of hybrid origin between *C. vesicaria* subsp. *taraxacifolia* and subsp. *myriocephala*, the areal differentiation of *C. vesicaria* subsp. *stellata* warranting the recognition as a distinct subspecies. As supposed by BABCOCK (1947) the hybrid origin of *C. vesicaria* subsp. *stellata* may cause intermediate chromosome numbers. Our report of $2n = 15$ together with his findings of $2n = 9$ and $2n = 12$ chromosomes in Moroccan plant material may add another hint for this assumption.

Crepis vesicaria subsp. **taraxacifolia** (Thuill.) Thell. — Fig. 4A — $2n = 8$

Locality 11, *Oberprieler 1906*.

$2n = 16$

Locality 18, *Oberprieler 3315* (Fig. 4A).

Crepis vesicaria L. subsp. **stellata** (Ball) Babcock — Fig. 4B — $2n = 15$

Locality 26, *Oberprieler 3515*.

Filago pyramidata L. — $2n = 28$

Locality 27, *Oberprieler 3558*.

Our indication is in accordance with reports from LOON & KIEFT (1980, Yugoslavia), QUEIRÓS (1973a, Portugal), DAHLGREN & al. (1971, Balearic Islands), and BJÖRKQVIST & al. (1969, Spain). *Filago desertorum* Pomel, a species near to *F. pyramidata*, was studied in three Egyptian populations by NORDENSTAM (1972) with the same result of $2n = 28$ chromosomes.

Hieracium amplexicaule cf. subsp. **olivicolor** Jahand. & Zahn — Fig. 4C — $2n = 27$

Locality 21, *Oberprieler 3387*.

This species was studied cytologically in North Africa twice before. QUÉZEL (1957) found $n = 18$ chromosomes in plants from Djebel M'Goun, GALLAND (1990) reports the triploid chromosome number of $2n = 27$ from the Toubkal region in the western part of the High Atlas mountains. The latter is in accordance with our finding of triploid numbers for subsp. *olivicolor* from the eastern part of the High Atlas.

Hieracium pseudopilosella Ten.

In addition to our three reports of chromosome numbers in *Hieracium pseudopilosella* (VOGT & OBERPRIELER, 1993) we were able to count chromosomes in two further populations yielding tetraploid numbers in both cases. Correlation between ploidy level and subspecific classification as proposed by ZAHN (1923) and JAHANDIEZ & MAIRE (1934) seem to lack completely, *H. pseudopilosella* subsp. *tenuicauliforme* and subsp. *timinkariense* which were reported to be diploid in our earlier paper (VOGT & OBERPRIELER, 1993) turned out to be tetraploid in both populations of the present study.

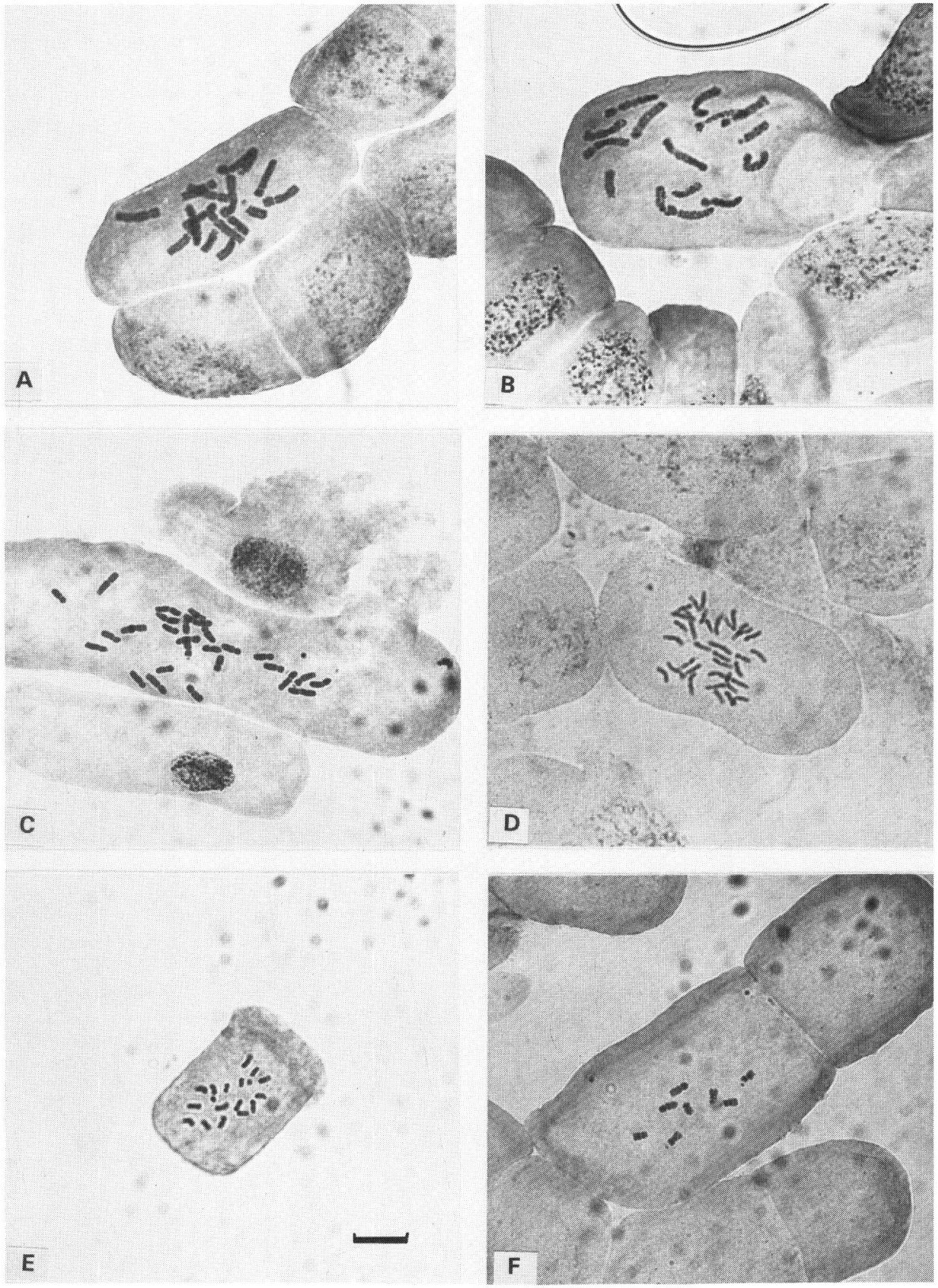

Fig. 4. — Metaphases of root-tip mitoses.
A: *Crepis vesicaria* subsp. *taraxacifolia*, $2n = 16$. **B:** *Crepis vesicaria* subsp. *stellata*, $2n = 15$. **C:** *Hieracium amplexicaule* cf. subsp. *olivicolor*, $2n = 27$. **D:** *Hieracium pseudopilosella* subsp. *timinkariense*, $2n = 36$. **E:** *Lactuca tenerrima*, $2n = 16$. **F:** *Leontodon longirostris*, $2n = 8$. (Scale: 10 µm).

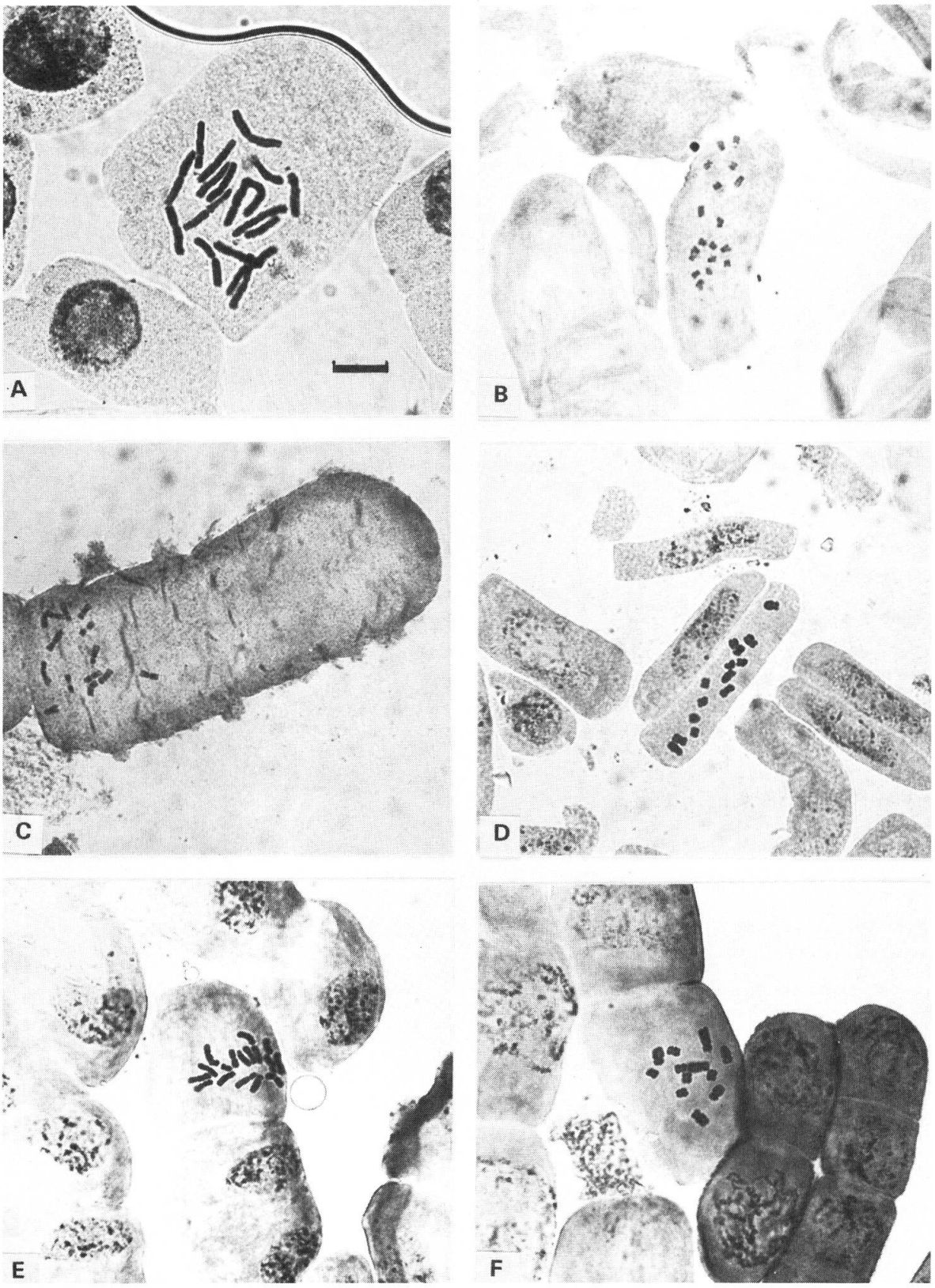

Fig. 5. — Metaphases of root-tip mitoses.
A: *Nivellea nivellei*, $2n = 18$. **B:** *Phagnalon saxatile* subsp. *saxatile*, $2n = 18$. **C:** *Pseudognaphalium luteo-album*, $2n = 14$. **D:** *Scorzonera laciniata*, $2n = 14$. **E:** *Tolpis barbata*, $2n = 18$. **F:** *Tragopogon porrifolius* subsp. *australis*, $2n = 12$. (Scale: 10 μm).

Hieracium pseudopilosella subsp. **tenuicauliforme** Jahand. & Zahn — $2n = 36$

Locality 20, *Oberprieler 3454*.

Hieracium pseudopilosella subsp. **timinkariense** Zahn — Fig. 4D — $2n = 36$

Locality 29, *Lippert 25493*.

Lactuca tenerrima Pourret — Fig. 4E — $2n = 16$

Locality 13, *Oberprieler 1935*.

Locality 13, *Oberprieler 1949* (Fig. 4E).

Locality 28, *Oberprieler 3574*.

For discussion see VOGT & OBERPRIELER (1993).

Leontodon longirostris (Finch & P. D. Sell) Talavera — Fig. 4F — $2n = 8$

Locality 4, *Oberprieler 1785*.

Locality 10, *Oberprieler 1862*.

Locality 24, *Oberprieler 3513* (Fig. 4F).

Locality 25, *Oberprieler 3538*.

For discussion see VOGT & OBERPRIELER (1993).

Nivellea nivellei (Br.-Bl. & Maire) Wilcox, Bremer & Humphries — Fig. 5A — $2n = 18$

Locality 22, *Oberprieler 3490* (Fig. 5A).

Locality 24, *Podlech 41484*.

Locality 25, *Oberprieler 3553*.

For discussion see VOGT & OBERPRIELER (1993).

Otospermum glabrum (Lag.) Willk. — $2n = 18$

Locality 7, *Vogt 6123 & al.*

Locality 8, *Vogt 5984 & al.*

For discussion see VOGT & OBERPRIELER (1993).

Phagnalon saxatile (L.) Coss. subsp. **saxatile** — Fig. 5B — $2n = 18$

Locality 12, *Oberprieler 1920*.

For discussion see VOGT & OBERPRIELER (1993).

Pseudognaphalium luteo-album (L.) Hilliard & Burtt — Fig. 5C — $2n = 14$

Locality 15, *Oberprieler 1993*.

For discussion see VOGT & OBERPRIELER (1993).

Scorzonera laciniata L. — Fig. 5D — $2n = 14$

Locality 9, *Oberprieler 1882.*

Locality 10, *Oberprieler 1863.*

Locality 12, *Oberprieler 1917* (Fig. 5D).

Locality 15, *Oberprieler 1991.*

For discussion see VOGT & OBERPRIELER (1993).

Tolpis barbata (L.) Gaertner — Fig. 5E — $2n = 18$

Locality 5, *Oberprieler 1810.*

For discussion see VOGT & OBERPRIELER (1993).

Tragopogon porrifolius subsp. **australis** (Jordan) Nyman — Fig. 5F — $2n = 12$

Locality 16, *Oberprieler 3297.*

For discussion see VOGT & OBERPRIELER (1993).

EUPHORBIACEAE

Euphorbia terracina L. — Fig 6A — $2n = 18$

Locality 5, *Oberprieler 1805.*

This first count based on North African plant material agrees with the reports of DALGAARD (1986b) from the Canary Islands, DALGAARD (1986a) from Madeira, PAVONE & al. (1981) from Italy, GARCIA & VALDÉS (1981) and DAHLGREN & al. (1971) from Spain, and QUEIRÓS (1975a) from Portugal. DALGAARD (1986a) reported $2n = 36$ from Lanzarote, Canary Islands.

FABACEAE

Lotus creticus L. — $2n = 14$

Locality 3, *Oberprieler 1758.*

Our count agrees with the reports of LARSEN (1958a, sub *Lotus corniculatus* var. *cytisoides*) from Spain and Croatia, DELAY & PETIT (1971) and HUMPHRIES & al. (1978) from Morocco, and CARDONA (1973, sub *L. cytisoides*) from the Balearic Islands. $2n = 28$ chromosomes are reported by FERNANDES & QUEIRÓS (1978) and FERNANDES & SANTOS (1971) from Portugal, VALDES-BERMEJO (1980) from Spain, and HEYN & HERRNSTADT (1967) from Israel.

GENTIANACEAE

Centaurium tenuiflorum (Hoffmanns. & Link) Fritsch — Fig. 6B — $2n = 40$

Locality 3, *Oberprieler 1757.*

This species seems to be represented by two ploidy levels. ZELTNER (1966 & 1980) found $2n = 40 / n = 20$ in plants from Greece and (ZELTNER, 1963 & 1966) $2n = 20 / n = 10$ in plants from France, Corsica, and Greece. Our count seems to be the first made with North African plant material.

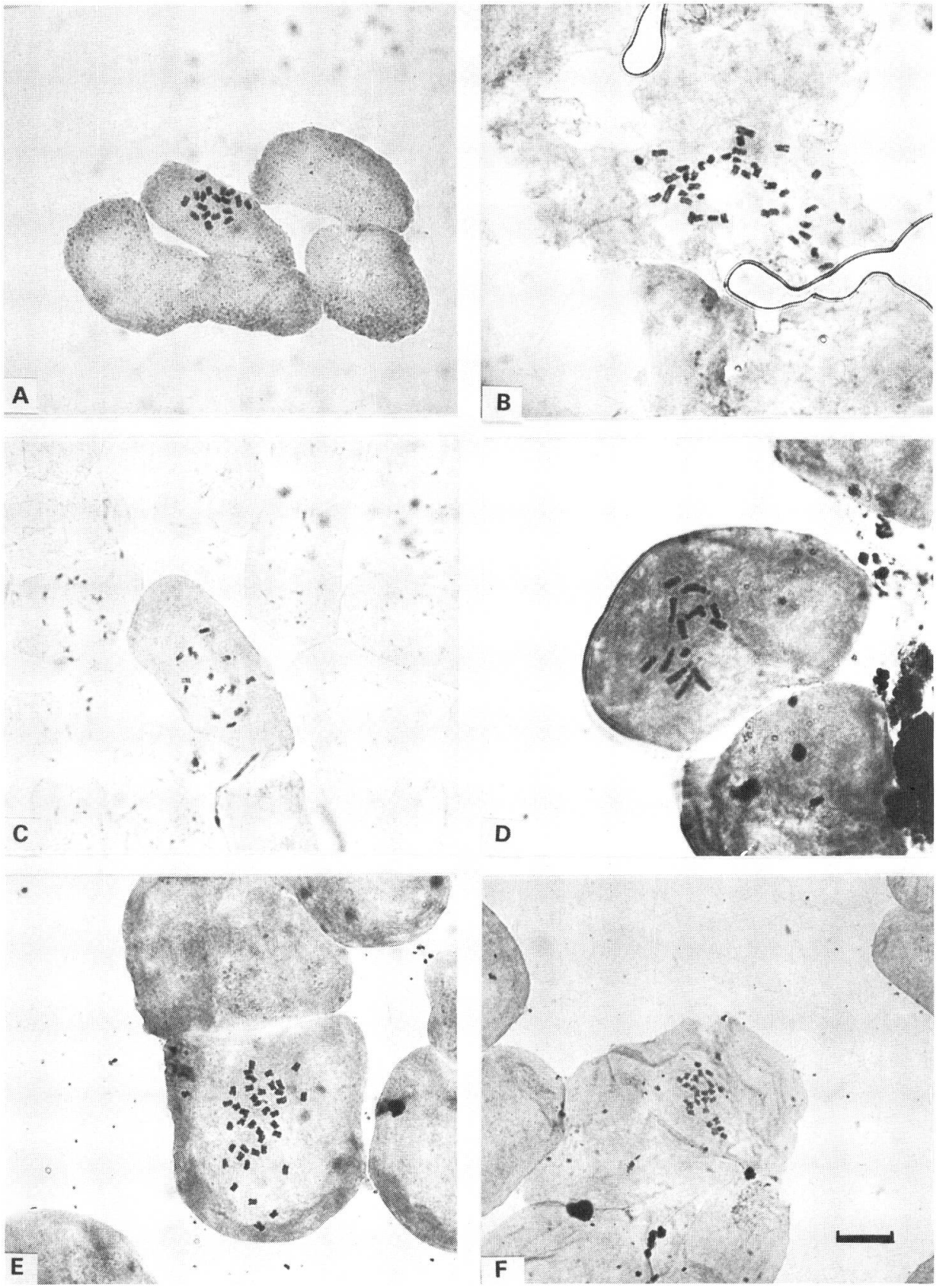

Fig. 6. — Metaphases of root-tip mitoses.
A: *Euphorbia terracina*, $2n = 18$. **B:** *Centaurium tenuiflorum*, $2n = 40$. **C:** *Teucrium resupinatum*, $2n = 14$. **D:** *Papaver atlanticum*, $2n = 14$. **E:** *Anagallis arvensis*, $2n = 40$. **F:** *Samolus valerandi*, $2n = 26$. (Scale: 10 µm).

LAMIACEAE

Micromeria fontanesii Pomel [= *Micromeria hochreutineri* (Briq.) Maire] - $2n = 60$

Locality 27, *Oberprieler 3557.*

It seems to be the first report of a chromosome number for this North African endemic.

Teucrium resupinatum Desf. — Fig. 6C — $2n = 14$

Locality 6, *Oberprieler 1823.*

Our count agrees with the only former reported chromosome number of this species given by Bayón (1989) who studied plants of Spanish origin.

PAPAVERACEAE

Papaver atlanticum (Ball) Cosson — Fig. 6D — $2n = 14$

Locality 16, *Oberprieler 3288.*

Our count agrees with the former reports for this Moroccan endemic published by QUÉZEL (1957) and GALLAND (1990).

PORTULACACEAE

Portulaca oleracea subsp. **nitida** Danin & H. G. Baker — $2n =$ ca. 45

Locality 1, *Oberprieler 1733.*

This seems to be the first report for North Africa of *Portulaca oleracea* subsp. *nitida* which differs from the typical subspecies by its smaller and smoother seeds (DANIN & al., 1978). The distribution of *P. oleracea* subsp. *nitida* ranges from N and S America to the Azores, England, Egypt, Israel, Tanzania, and to the Aldabra Island in the Indian Ocean. Populations from California and Israel yielded tetraploid chromosome numbers of $2n = 36$, giving rise to the assumption that our finding represents the pentaploid level. Since the other subspecies reported for Morocco — *P. oleracea* subsp. *oleracea* — shows hexaploid chromosome numbers ($2n = 54$) we believe the pentaploid chromosome number to be due to hybridisation of *P. oleracea* subsp. *oleracea* and *P. oleracea* subsp. *nitida*. The only further indication of $2n = 45$ in *P. oleracea* was found to be SHARMA & BHATTACHARYYA (1956).

PRIMULACEAE

Anagallis arvensis L. — Fig. 6E — $2n = 40$

Locality 4, *Oberprieler 1781.*

This is the first count based on Moroccan plant material of this weed widespread in temperate regions. It is in accordance with the indications from Mediterranean countries published by PEEV (1976a), STRID & FRANZEN (1981), LOON & KIEFT (1980), LÖVE & LÖVE (1982b), LOON & SETTEN (1982), and REESE (1957). Only the count of $n = 11$ reported by AMIN (1973) from Egypt is distinct.

Samolus valerandi L. — Fig. 6F — $2n = 26$

Locality 1, *Oberprieler 1738.*

Our count of $2n = 26$ for this cosmopolitan species is in accordance with the previous reports from the Mediterranean area published by LÖVE & KJELLQVIST (1974b), STRID (1971), VAN DEN BRAND & al. (1979), FICINI & al. (1981), and APARICIO (1989).

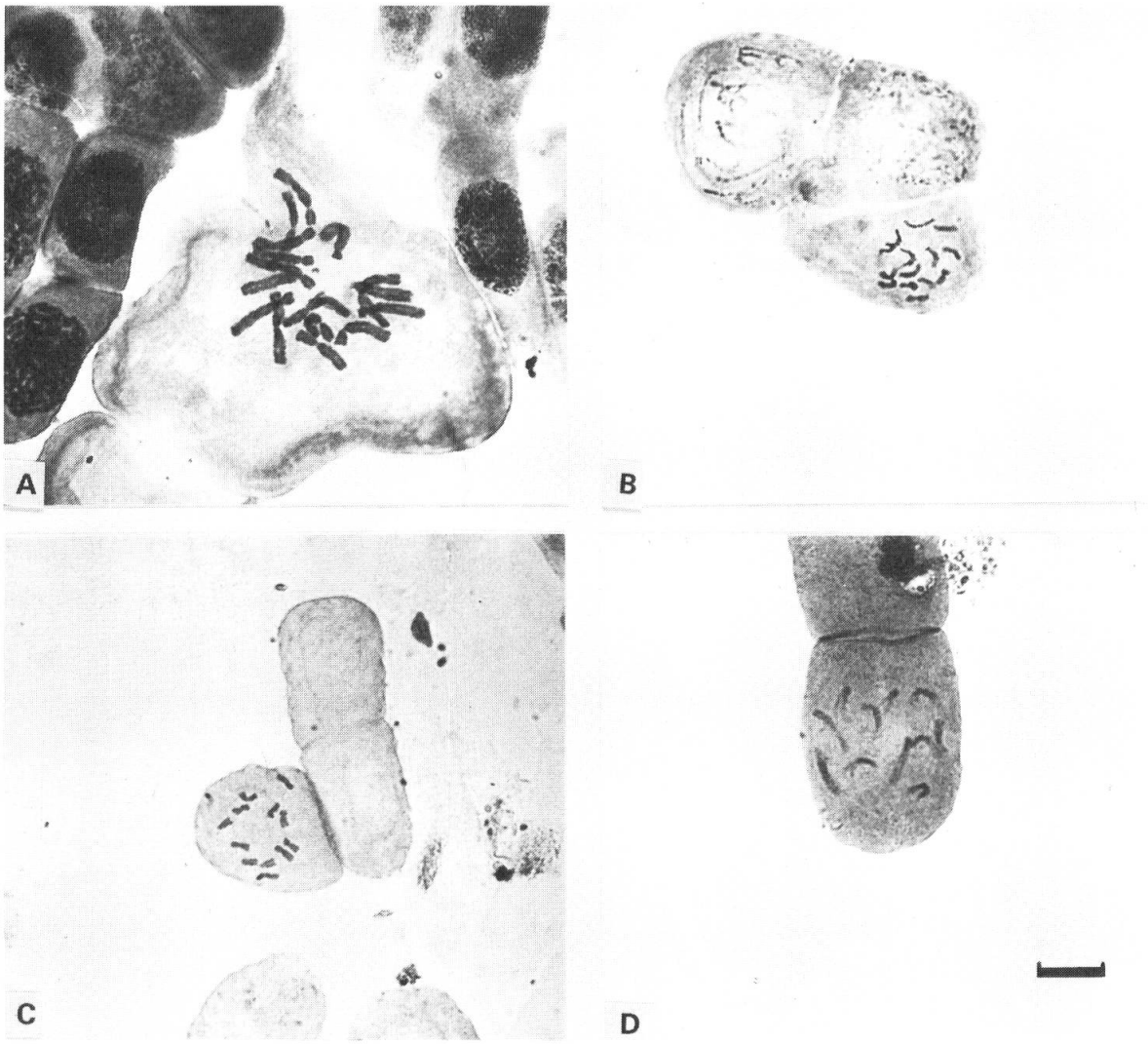

Fig. 7. — Metaphases of root-tip mitoses.
A: *Ranunculus spicatus* subsp. *fontqueri*, $2n = 16$. **B:** *Chaenorrhinum villosum*, $2n = 14$. **C:** *Linaria pedunculata*, $2n = 12$. **D:** *Linaria tristis*, $2n = 12$. (Scale: 10 µm).

RANUNCULACEAE

Delphinium ambiguum L. (= *D. nanum* DC.) $2n = 16$

Locality 3, *Oberprieler 1763*.

Our first count based on Moroccan plant material agrees with the only previous report of $n = 8$ by BLANCHÉ & al. (1985, sub *D. nanum* DC.) who studied plants of Spanish origin.

Ranunculus spicatus subsp. **fontqueri** Romo — Fig. 7A — $2n = 16$

Locality 13, *Oberprieler 1927*.

This taxon was described by ROMO (1992) from the Djebel Tazzeka area of Morocco and is supposed to grow also in the Rif and Middle Atlas mountains where we were able to study plants from Djebel Bou Iblane cytologically. The subspecies is characterized by wider fruiting spikes and bigger achenes compared to the typical subspecies from Algeria and Eastern Morocco and *R. spica-*

tus subsp. *blepharicarpus* (Boiss.) Grau from southern Spain and Morocco. The latter taxon was studied in Spanish populations by DIOSDADA & PASTOR DÍAZ (1990) who found diploid and tetraploid representatives with $2n = 16$ and $2n = 32$ chromosomes, respectively. The indication of $2n = 28$ chromosomes in Flora iberica I (CASTROVIEJO & al. 1986) seems to be rather questionable. Our count of *R. spicatus* subsp. *fontqueri* yielded a diploid chromosome number of $2n = 16$.

SCROPHULARIACEAE

Chaenorrhinum villosum (L.) Lange — Fig. 7B — $2n = 14$

Locality 25, *Oberprieler 3546*.

This species was studied cytologically only twice before by VIANO (1974) and LÖVE & KJELLQVIST (1974b, *C. villosum* var. *granatense* (Willk.) Lange) using plants of Spanish provenance.

Linaria pedunculata (L.) Chaz. — Fig. 7C — $2n = 12$

Locality 3, *Oberprieler 1766*.

Our first count based on North African plants corroborates the reports of VIANO (1975, 1979) who studied plants of Iberian provenance.

Linaria tristis (L.) Miller — Fig. 7D — $2n = 12$

Locality 12, *Oberprieler 1921*.

Our count is in accordance with the former results based on Moroccan plant material published by FAVARGER & al. (1980), QUÉZEL (1957), and GALLAND (1990). VALDÉS (1970) studied this species in Spain and FERNANDES & al. (1977) used plants of unknown origin.

VALERIANACEAE

Centranthus calcitrapa (L.) Durf. — $2n = 32$

Locality 18, *Oberprieler 3325*.

This first count based on plant material of North African origin agrees with the previous reports from the Balearic Islands (DAHLGREN & al., 1971), Italy (TUCCI & RICCIARDI, 1978), Corsica (CONTANDRIOPOULOS & al., 1987), and Crete (MONTMOLLIN, 1986).

ACKNOWLEDGEMENTS

We would like to thank Dr. W. Lippert (Munich) for the determination of our *Hieracium* collections and Dr. B. Zimmer for valuable comments in the final draft of this paper. The skillful cultivation of the plants by Mr. Ch. Schiers and the excellent technical assistance of Mrs. M. Lüchow are gratefully acknowledged.

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