CHROMOSOME STUDIES IN FLOWERING PLANTS FROM MACARONESIA

por

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Resumen

DALGAARD, V. (1986). Estudios cromosomáticos sobre fanerógamas de Macaronesia. *Anales Jard. Bot. Madrid* 43(1): 83-111 (en inglés).

Se presentan 85 números cromosomáticos de 65 especies de fanerógamas de las islas Canarias. Los cuatro recuentos siguientes son nuevos o difieren de los hallados anteriormente: *Calendula tripterocarpa* ($2n = 54$), *Rumex bipinnata* ($2n = 20$), *Oligomeris linifolia* ($2n = 30$) y *Lophochloa pumila* ($2n = 12$). Los recuentos de otras 22 especies son los primeros que se realizan sobre material de Macaronesia o difieren de los hallados anteriormente. Para muchas de las especies se añaden comentarios sobre su taxonomía, distribución y morfología de los cromosomas.

Palabras clave: *Spermatophyta*, número de cromosomas, Macaronesia.

Abstract

DALGAARD, V. (1986). Chromosome studies in flowering plants from Macaronesia. *Anales Jard. Bot. Madrid* 43(1): 83-111.

85 chromosome numbers for 65 species of flowering plants from the Canary Islands are reported. The following four chromosome numbers are new or deviate from earlier reports: *Calendula tripterocarpa* ($2n=54$), *Rumex bipinnata* ($2n=20$), *Oligomeris linifolia* ($2n=30$) and *Lophochloa pumila* ($2n = 12$). Chromosome numbers of 22 additional species are reported for the first time from Macaronesia or deviate from earlier reports. Notes on taxonomy, distribution and chromosome morphology are provided for many of the species.

Key words: *Spermatophyta*, cromosome numbers, Macaronesia.

INTRODUCTION

This paper is the third in a series dealing with cytotaxonomic problems of the Macaronesian flora (DALGAARD, 1979, 1985), and is confined to chromosome studies in flowering plants from the Canary Islands.

MATERIAL AND METHODS

Seed samples and transplants were collected in the field and cultivated in the Copenhagen Botanical Garden. All data on the material are listed in table 1

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TABLE 1

Chromosome counts of flowering plants from the Canary Islands. The status Canarian endemic (E) or Macaronesian endemic (M) is given for each taxon (species, subspecies, variety). New or deviating counts are marked with two asterisks; and taxa not previously counted in the Canary Islands or deviating counts are marked with one asterisk

Taxon	Endemic status	2n	Fig.	Cult. no.	Origin
DICOTYLEDONS					
Amaranthaceae					
* *Amaranthus viridis* L.		34	23	10397	Gran Canaria: San Agustín, 1-II-80, L & VD.
Apiaceae					
* *Bupleurum semicompositum* L.		16	1	7266	Lanzarote: Punta de las Mujeres, 20 m, 1-IV-76, L & VD.
Asteraceae					
Asteriscus intermedius (DC.) Pit. & Pr.	E	14	2	7230	Lanzarote: Montañas del Fuego, 300 m, 1-IV-76, L & VD.
A. stenophyllus (Link in Buch) O. Kuntze	E	14		7221	Gran Canaria: Barranco de Mogán, 210 m, 31-III-76, L & VD.
		14	3	10309	Gran Canaria: W Isleta, 30-I-80, L & VD.
** *Calendula tripterocarpa* Rupr.		54	24	7026	Gran Canaria: SW Isleta, 75 m, 26-III-76, L & VD.
Hedypnois cretica (L.) Dum.-Cours.		11	25	10034	Lanzarote: Puerto del Carmen, 7-III-78, AH 66.
* *Ifloga spicata* (Forsskål) Schultz Bip.		14	4	7227	Lanzarote: Uga, 200 m, 1-IV-76, L & VD.
Launaea arborescens (Batt.) Murb.		14	5	7008	Gran Canaria: SW Isleta, 60 m, 26-III-76, L & VD.
Pericallis steetzii (Bolle) Nordenstam	E	60	6	8003	Gomera: Pico Agando, c. 600 m, 25-III-76, J. Vivant.
Phagnalon purpurascens Schultz Bip.		18	7	7180	Gran Canaria: W of Agüimes, 610 m, 30-III-76, L & VD.
			18	10036	Lanzarote: Masdache W of Arrecife, 8-III-78, AH 117.
P. saxatile (L.) Cass.		18	8	10037	Lanzarote: Masdache W of Arrecife, 8-III-78, AH 120.
Prenanthes pendula Schultz Bip.	E	18	9	10222	Gran Canaria: Barranco de Arguineguin, Cercado Espino, 200 m, 27-I-80, L & VD.
Reichardia tingitana (L.) Roth		16	10	7246	Lanzarote: Yaiza, 160 m, 1-IV-76, L & VD.
Schizogyne glaberrima DC.	E	18	11	10209	Gran Canaria: San Agustín, 26-I-80, L & VD.
S. sericea (L. fil.) DC.	M	18	12	10258	Gran Canaria: Punta de Arinaga, 26-I-80, L & VD.
* *Senecio massaicus* (Maire) Maire		40	26	7238	Lanzarote: Montañas del Fuego, 300 m, 1-IV-76, L & VD.
Sonchus oleraceus L.		32	27	10263	Gran Canaria: Punta de Arinaga, 26-I-80, L & VD.

* *Tolpis barbata* (L.) Gaertner		18	28	7207	Gran Canaria: Barranco de Fataga, c. 400 m, 31-III-76, L & VD.
* *Volutaria lippii* (L.) Maire		32	13	7157	Gran Canaria: W of Agüimes, 380 m, 30-III-76, L & VD.
Brassicaceae					
Descurainia preauxiana (Webb) O. E. Schulz	E	14	14	7198	Gran Canaria: Barranco de Fataga, c. 400 m, 31-III-76, L & VD.
Erucastrum canariense Webb & Berth.	E	18	15	10044	Lanzarote: Haria, 10-III-78, AH 19.
		18		10048	Lanzarote: Los Valles, 10-III-78, AH 235.
E. cardaminoides (Webb ex Christ) O. E. Schulz		18	29	6059	Tenerife: Ladera de Güimar, 470 m, 24-III-75, L & VD.
Lobularia intermedia Webb in Webb & Berth.	M	22	30	6003	Tenerife: Ladera de Güimar, 390 m, 24-III-75, L & VD.
* *Moricandia arvensis* (L.) DC.		28	31	10203	Gran Canaria: San Agustín, 26-I-80, L & VD.
Sisymbrium irio L.		14	32	10378	Gran Canaria: San Agustín, 1-II-80, L & VD.
Campanulaceae					
Wahlenbergia lobelioides (L. fil.) A. DC. subsp. *lobelioides*	M	18	16	7236	Lanzarote: Montañas del Fuego, 300 m, 1-IV-76, L & VD.
		18		7269	Lanzarote: Punta de las Mujeres, 20 m, 1-IV-76, L & VD.
Caryophyllaceae					
Silene gallica L.		24	17	10050	Lanzarote: Mirador del Río, 10-III-78, AH 219.
Spergularia fimbriata Boiss. & Reut.		18	35	10307	Gran Canaria: W Isleta, 30-I-80, L & VD.
Chenopodiaceae					
* *Atriplex semibaccata* R. Br.		18		10243	Gran Canaria: Punta de Arinaga, 28-I-80, L & VD.
		18	33	10375	Gran Canaria: San Agustín, 1-II-80, L & VD.
* *Chenopodium murale* L.		18	18	6282	Tenerife: Puerto de la Cruz, 30-III-75, L & VD.
* *Patellifolia patellaris* (Moq.) S., F.-L. & W.		36		7004	Gran Canaria: Aeropuerto de Gando, 26-III-76, L & VD.
		36	34	10260	Gran Canaria: Punta de Arinaga, 28-I-80, L & VD.
Cistaceae					
Helianthemum canariense (Jacq.) Pers.		20		7020	Gran Canaria: SW Isleta, 75 m, 26-III-76, L & VD.
		20	36	7225	Lanzarote: Uga, 200 m, 1-IV-76, L & VD.
		20		10059	Lanzarote: S of Yaiza, 7-III-78, AH 27.
Convolvulaceae					
Convolvulus caput-medusae Lowe	E	30	37	10259	Gran Canaria: Punta de Arinaga, 28-I-80, L & VD.
Euphorbiaceae					
* *Euphorbia exigua* L.		24	38	7175	Gran Canaria: W of Agüimes, 380 m, 30-III-76, L & VD.

Taxon	Endemic status	2n	Fig.	Cult. no.	Origin
* *E. peplus* L.		16	19	7121	Gran Canaria: Los Tilos de Moya, 670 m, 28-III-76, L & VD.
* *E. pubescens* Vahl		14	20	10316	Gran Canaria: Barranco Guayadeque, 290 m, 30-I-80, L & VD.
* *E. segetalis* L.		16	39	10061	Lanzarote: Above Haria, 10-III-87, AH 196.
* *E. terracina* L.		18	21	10060	Lanzarote: SW of Yaiza, 7-III-78, AH 25.
		18,36	22	10062	Lanzarote: W of Tias, 7-III-78, AH 53.
Fabaceae					
Lotus glinoides Delarb.		14	40	7229	Lanzarote: Montañas del Fuego, 300 m, 1-IV-76, L & VD.
		14		10310	Gran Canaria: W Isleta, 30-I-80, L & VD.
L. holosericeus Webb & Berth.	E	14	41	7218	Gran Canaria: W of Puerto Rico, c. 30 m, 31-III-76, L & VD.
Geraniaceae					
Geranium purpureum Vill.		32	54	6010	Tenerife: Ladera de Güimar, 390 m, 24-III-75, L & VD.
Hypericaceae					
Hypericum canariense L. var. *canariense*	E	40	42	10235	Gran Canaria: Barranco de Arguineguin, 280 m, 27-I-80, L & VD.
Lamiaceae					
Lavandula multifida L. subsp. *canariensis* (Mill.) Pit. & Pr.	E	22	55	10313	Gran Canaria: Barranco Guayadeque, 290 m, 30-I-80, L & VD.
* *Salvia aegyptiaca* L.		26	43	10075	Lanzarote: Playa del Carmen, 8-III-78, AH 106.
S. canariensis L.	E	22	56	10236	Gran Canaria: Barranco de Arguineguin, 120 m, 27-I-80, L & VD.
Malvaceae					
Malva parviflora L.		42		10077	Lanzarote: Playa del Carmen, 8-III-78, AH 108.
		42	57	10377	Gran Canaria: San Agustín, 1-II-80, L & VD.
Polygonaceae					
* *Emex spinosa* (L.) Campd.		20	58	6296	Tenerife: Puerto de la Cruz, 30-III-75, L & VD.
* *Polygonum maritimum* L.		20	45	10352	Gran Canaria: San Agustín, 31-I-80, L & VD.
** *Rumex bipinnatus* L. fil.		20	44	10078	Lanzarote: El Jable N of Teguise, 9-III-78, AH 166.
R. vesicarius L. var. *rhodophysa* Ball		18		7177	Gran Canaria: W of Agüimes, 610 m, 30-III-76, L & VD.
		18	50	10079	Lanzarote: W of Tias, 7-III-78, AH 47.

Resedaceae					
***Oligomeris linifolia* (Vahl) Macbride		30	46	7015	Gran Canaria: SW Isleta, 75 m, 26-III-76, L & VD.
		30		7255	Lanzarote: Yaiza, 180 m, 1-IV-76, L & VD.
Reseda lancerotae Webb & Berth. ex Del.	E	24	59	7250	Lanzarote: Yaiza, 180 m, 1-IV-76, L & Vd.
R. luteola L.		26	60	6204	Tenerife: The road from Aguamansa to El Portillo, 1650 m, 27-III-75, L & VD.
Rubiaceae					
**Galium setaceum* Lam.		44	47	7166	Gran Canaria: W of Agüimes, 380 m, 30-III-76, l & VD.
**G. spurium* L.		20	61	10083	Lanzarote: Masdache W of Arrecife, 8-III-78, AH 116.
Scrophulariaceae					
Kickxia sagittata (Poir.) Rothm. var. *sagittata*		18	48	10084	Lanzarote: Between Yaiza and El Golfo, 7-III-78, AH 59.
		18		10085	Lanzarote: N of Playa Blanca, 11-III-78, AH 271.
***K. sagittata* (Poir.) Rothm. var. *urbanii* (Pit.) Sund.	E		18	7021	Gran Canaria: SW Isleta, 75 m, 26-III-76, L & VD.
		18		10265	Gran Canaria: Punta de Arinaga, 28-I-80, L & VD.
K. scoparia (Brouss. ex Sprengel) Kunk. & Sund.	E	18	49	7199	Gran Canaria: Barranco de Fataga, c. 400 m, 31-III-76, L & VD.
		18		10214	Gran Canaria: San Agustín, 26-I-80, L & VD.
MONOCOTYLEDONS					
Amaryllidaceae					
Pancratium canariense Ker-Gawler	E	22		10335	Gran Canaria: Barranco Guayadeque, 650 m, 30-I-80, L & VD.
		22	52	10366	Gran Canaria: Barranco de Fataga, 450 m, 1-II-80, L & VD.
Juncaceae					
Juncus acutus L.		46	63	10345	Gran Canaria: E of Faro de Maspalomas, 31-I-80, L & VD.
Liliaceae					
Scilla haemorrhoidalis Webb & Berth.	E	28	53	6099	Tenerife: Punta Hidalgo, 90 m, 25-III75, L & VD.
Poaceae					
Avena canariensis Baum, Rajh. & Samps.	E	14		10093	Lanzarote: Femés, 8-III-78, AH 141
		14	62	10094	Lanzarote: La Caleta, 9-III-78, AH 181.
Bromus madritensis L.		28+2B	51	10095	Lanzarote: Between Yaiza and El Golfo, 7-III-78, AH 69.
**Lolium parabolicae* Sennen ex Samp.		14	64	10098	Lanzarote: Between Tinajo and Tiagua, 8-III-78, AH 96.
***Lophochloa pumila* (Desf.) Bor.		12	65	10101	Lanzarote: Between Yaiza and El Golfo, 7-III-78, AH 81.
**Phalaris minor* Retz.		28	66	10099	Lanzarote: Rubicon N of Playa Blanca, 11-III-78, AH 260.

where the following abbreviations of collectors' names are used: AH Alfred Hansen, L & VD Lotte & Vilhelm Dalgaard. For the greater part the nomenclature and author abbreviations are in accordance with HANSEN & SUNDING (1985).

Root tips were pretreated in 2mM 8-hydroxyquinoline for 4 hours, usually at a temperature of 18 °C (sometimes a preteatment in α-monobromonaphtalene or colchicine was used), subsequently fixed according to JACOBSEN (1957) in lactic acid/etanol (1 part lactic acid: 99 parts 30% alcohol)at 0 °C for at least 15 minutes, squashed in 45% acetic acid, and stained in Pyronine G. Some material was pretreated for about 12 hours at 2-4 °C, fixed in Navashin-Karpechenko, embedded in paraffin, cut with a microtome, and stained with gentian violet.

Concerning chromosomal terminology according to centromere position, the definition devised by LEVAN & *al.* (1964) is followed.

Voucher specimens are deposited at C.

RESULTS AND DISCUSSION

Amaranthaceae

Amaranthus viridis L.
A. gracilis Desf.
$2n=34$, $2x$ (fig. 23)

This naturalized species is a native of S America. The present count of $2n=34$ is the first on material from Macaronesia and is widely reported from other areas (cf. FEDOROV, 1969; MOORE, 1973, 1977; GOLDBLATT, 1981, 1984).

Apiaceae

Bupleurum semicompositum L.
B. glaucum Robill. & Cast. ex DC.
$2n=16$, $2x$ (fig. 1)

The present count coincides with four previous ones from S Europe and Morocco (cf. FEDOROV, 1969; GOLDBLATT, 1981; HUMPHRIES & *al.*, 1978).

Asteraceae

Asteriscus intermedius (DC.) Pit. & Pr.
Odontospermum intermedium (DC.) Schultz Bip.
$2n=14$, $2x$ (fig. 2)

This species is endemic to Lanzarote and Fuerteventura. The present diploid count of $2n=14$ is in accordance with a previous record (Halvorsen, ined., see BORGEN, 1984).

Asteriscus stenophyllus (Link in Buch) O. Kuntze
Odontospermum stenophyllum (Link in Buch) Schultz Bip.
$2n= 14$, $2x$ (fig. 3)

The present report is a confirmation of previous counts from Gran Canaria (BORGEN, 1970; BRAMWELL & *al.*, 1972).

The collection from Barranco de Morgan (Cult. no 7221) refers to var. *filifolius* (Kunk.) A. Hans. & Sund.

Calendula tripterocarpa Rupr.
C. aegyptiaca auct. p.p., *C. aegyptiaca* Desf. subsp. *tripterocarpa* (Rupr.) Lanza
$2n=54$, $6x$ (fig. 24)

The present annual plant from Gran Canaria is characterized by its fruiting heads with four different achene types: an outer row of broadly 3-winged, beakless and dorsally spineless achenes alternating with spiny, beaked achenes; cymbiform and annulate achenes are present too. On account of the broadly 3-winged and spineless outer achenes the collection belongs to *Calendula tripterocarpa* (cf. MEIKLE, 1976). In their revision of the annual *Calendula* species HEYN & *al.* (1974) found that all achenes in *C. tripterocarpa* are beakless, which together with the cytology shows that the Canarian *Calendula* species need further investigations.

All previous counts for *C. tripterocarpa* give $2n=30$ (see HEYN & *al.*, 1974 for review). The present new count of $2n=54$ represents a previously unrecorded number for the genus. However, the basic chromosome number $x=9$ is known from the *C. maroccana* group which have $2n=18$ (OHLE, 1975; HEYN & JOEL, 1983). Previously reported chromosome numbers for *Calendula* are $2n=14$, 18, 30, 32, 44, c.85. Considering information from crossing experiments HEYN & JOEL *(l. c.)* proposed a scheme of species relationships based on hybridization and subsequent chromosome doubling. The present hexaploid number adds a new interesting line to the scheme and emphasizes that detailed cytotaxonomic investigations in material from the Canary Islands are required before the relationships of the species can be resolved.

Hedypnois cretica (L.) Dum.-Courset
H. rhagadioloides (L.) Willd.
$2n=11$, $2x$ (fig. 25)

Numerous chromosome counts have been made in this very variable species which demonstrate an apparent aneuploid series: $2n=6$, 8, 10, 10 +1B, 11, 12, 12+B, 13, 14, 15, 16, 18, 54 (cf. FEDOROV, 1969; MOORE, 1973, 1974, 1977; GOLDBLATT, 1981, 1984). Previous reports from the Canary Islands are $2n=10$ (BORGEN, 1970) and $2n=11$, 12 (LOON, 1974) for plants also from Lanzarote.

BORGEN *(l. c.)* reported one satellite chromosome and in the present material three satellites have been observed.

Ifloga spicata (Forskål) Schultz Bip.
I. fontanesii Cass.
$2n=14$, $2x$ (fig. 4)

This widespread species is, according to HILLIARD (1981), separated from the Canarian endemic species *I. obovata* Bolle by its normally heterogamous heads where each outer bract is subtending a female flower. In *I. obovata* the heads are always homogamous and the outer bracts are empty.

The present diploid number $2n=14$ is previously reported from N India (cf. FEDOROV, 1969 under the name *I. fontanesii)* and Egypt (cf. MOORE, 1977).

Satellites were observed on two chromosomes.

Launaea arborescens (Batt.) Murb.
L. spinosa (Forskål) Schultz Bip., *Zollikoferia spinosa* (Forskål) Boiss.
$2n=14$, $2x$ (fig. 5)

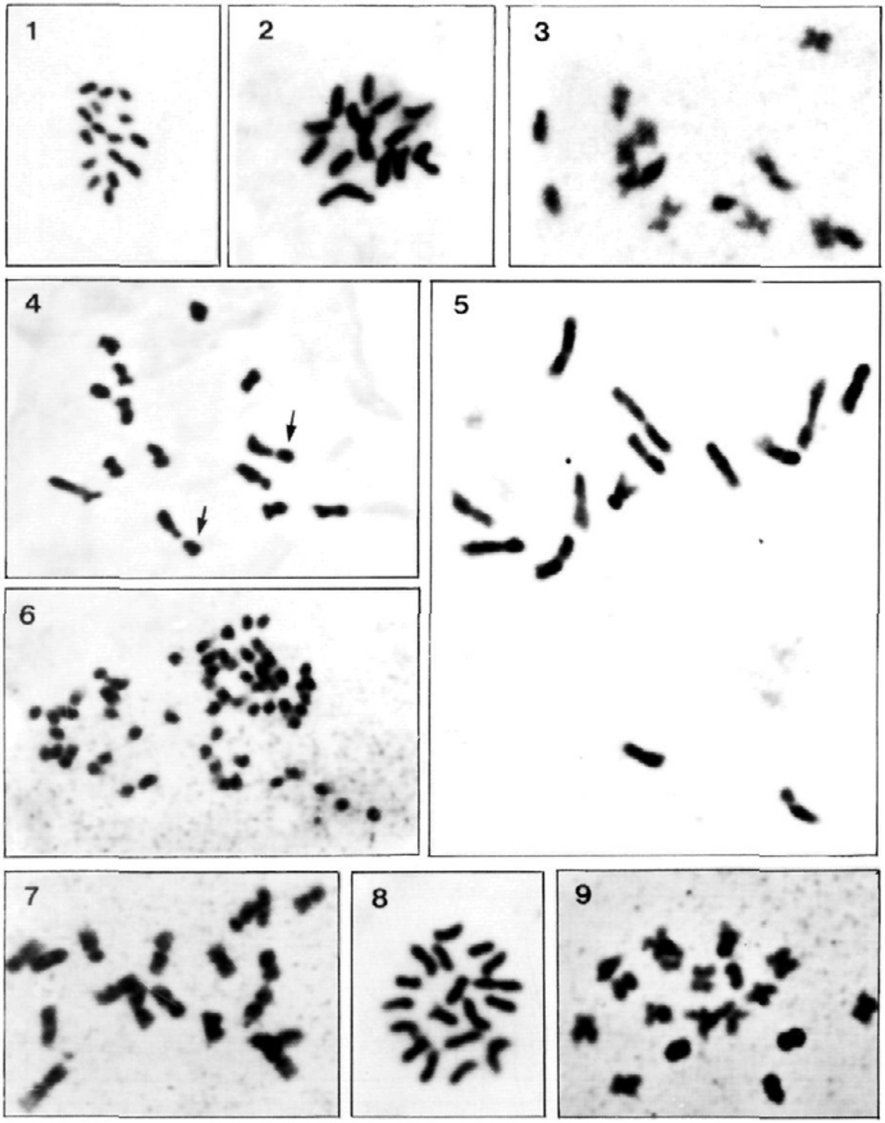

Fig. 1.—*Bupleurum semicompositum*, $2n=16$. Fig. 2.—*Asteriscus intermedius*, $2n=14$. Fig. 3.—*Asteriscus stenophyllus*, $2n=14$. Fig. 4.—*Ifloga spicata*, $2n=14$ (arrows refer to satellites). Fig. 5.—*Launaea arborescens*, $2n=14$. Fig. 6.—*Pericallis steetizii*, $2n=60$. Fig. 7.—*Phagnalon purpurascens*, $2n=18$. Fig. 8.—*Phagnalon saxatile*, $2n=18$. Fig. 9.—*Prenanthes pendula*, $2n=18$. (× 2.500)

The same chromosome number is reported six times from the Canary Islands and N Africa (cf. FEDOROV, 1969; BORGEN, 1977; GOLDBLATT, 1981).

Pericallis steetzii (Bolle) Nordenstam
Senecio steetzii Bolle
$2n=60$, $12x$ (fig. 6)

This report confirms previous chromosome counts of this Gomeran endemic by LARSEN (1960) and AFZELIUS (1967).

Phagnalon purpurascens Schultz Bip.
$2n=18$, $2x$ (fig. 7)

This species is known from each of the Canary Islands and possibly also from the so-called Macaronesian enclave on the coast of Africa. The chromosome number $2n=18$ was previously counted by BORGEN (1969) in material from Gran Canaria.

The chromosomes in *P. purpurascens* are metacentric or submetacentric; one pair of satellite chromosomes is present in the material from both Gran Canaria and Lanzarote. The karyotype morphology of this genus is worthy of detailed investigation.

Phagnalon saxatile (L.) Cass.
$2n=18$, $2x$ (fig. 8)

The same chromosome number is reported several times from S Europe and N Africa (cf. FEDOROV, 1969; MOORE; 1973, 1977; GOLDBLATT, 1981), and also from the Canary Islands (LARSEN, 1960; BORGEN, 1969).

Prenanthes pendula Schultz Bip.
$2n=18$, $2x$ (fig. 9)

This report confirms a previous count of the chromosome number of this Gran Canarian endemic by MICHAELIS (1964).

The chromosomes in *P. pendula* are all metacentric.

Reichardia tingitana (L.) Roth
Picridium tingitanum (L.) Desf.
$2n=16$, $2x$ (fig. 10)

This species is found in the Canary Islands, the Mediterranean region to W India and in SE Africa (GALLEGO & *al.*, 1980).

The chromosome number agrees with that of previous finds also from the Canary Islands (LARSEN, 1960; BORGEN, 1970; LOON, 1974).

Schizogyne glaberrima DC.
S. sericea (L. fil.) DC. var. *glaberrima* (DC.) Schultz Bip.
$2n=18$, $2x$ (fig. 11)

This species is endemic to Gran Canaria and Tenerife. MICHAELIS (1964), BORGEN (1970), and ORTEGA & NAVARRO (1977) reported the same chromosome number on material also from Gran Canaria.

In culture in the experimental field the plants still remained vegetative after five years of cultivation.

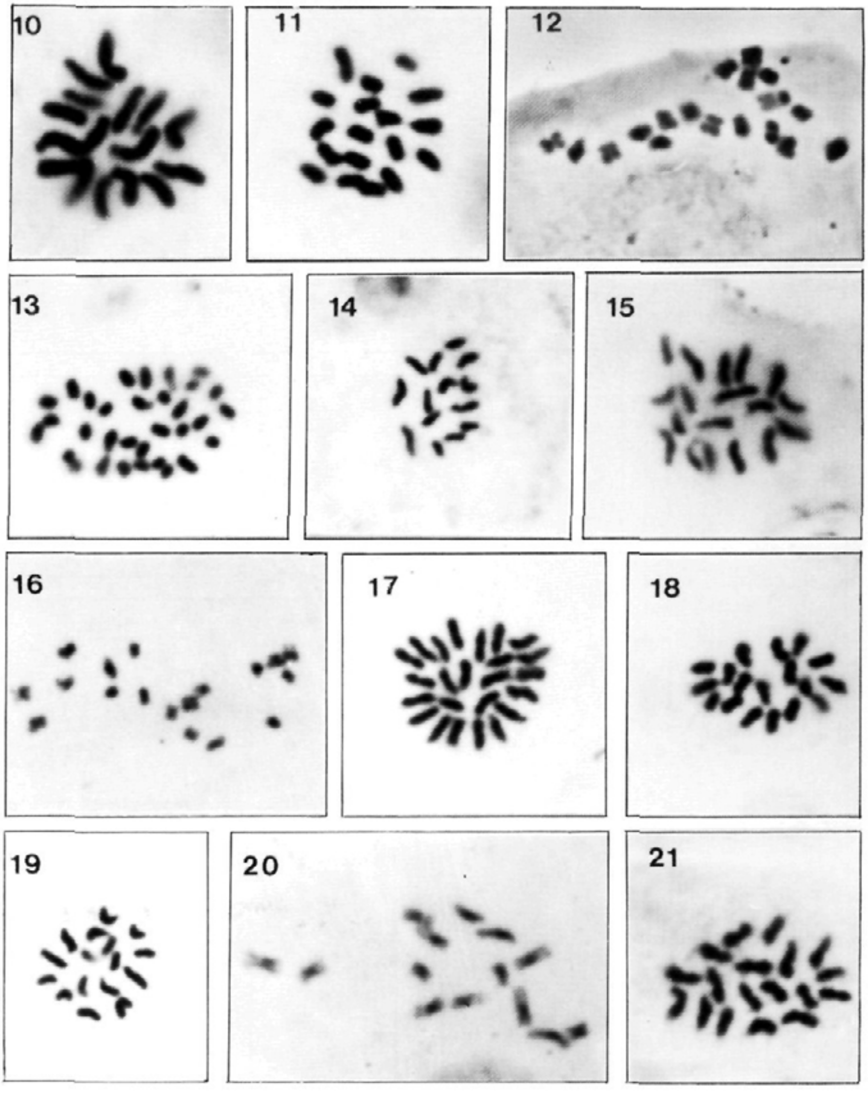

Fig. 10.—*Reichardia tingitana*, $2n=16$. Fig. 11.—*Schizogyne glaberrima*, $2n=18$. Fig. 12.—*Schizogyne sericea*, $2n=18$. Fig. 13.—*Volutaria lippii*, $2n=32$. Fig. 14.—*Descurainia preauxiana*, $2n=14$. Fig. 15.—*Erucastrum canariense*, $2n=18$. Fig. 16.—*Wahlenbergia lobelioides* subsp. *lobelioides*, $2n=18$. Fig. 17.—*Silene gallica*, $2n=24$. Fig. 18.—*Chenopodium murale*, $2n=18$. Fig. 19.—*Euphorbia peplus*, $2n=16$. Fig. 20.—*Euphorbia pubescens*, $2n=14$. Fig. 21.—*Euphorbia terracina*, $2n=18$. (×2.500)

Schizogyne sericea (L. fil.) DC.
Conyza sericea Aiton, *Inula schizogyne* Masf., *Chrysocoma sericea* L. fil.
$2n=18$, $2x$ (fig. 12)

This Macaronesian endemic species is known from all the Canarian Islands and the Salvage Islands. LARSEN (1960) reported $2n=18$ in material from Gomera; GAGNIEU & *al.* (1973) in material from Tenerife.

In culture *S. sericea*, like *S. glaberrima*, remained vegetative during five years of cultivation (see also LARSEN, 1960).

The chromosomes in the present material of *Schizogyne sericea* are all metacentric.

Senecio massaicus (Maire) Maire
S. coronopifolius Desf. subsp. *massaicus* Maire
$2n=40$, $4x$ (fig. 26)

This tetraploid annual is found on the Canary Islands (Lanzarote and Fuerteventura) and on the atlantic coast of Morocco (KADEREIT, 1984). It is related to the more widespread diploid *S. glaucus* L.

AFZELUIS (1949) and ALEXANDER (1979) reported the same chromosome number in plants from Morocco.

Sonchus oleraceus L.
$2n=32$, $4x$ (fig. 27)

Most previous counts for this widespread weed give $2n=32$. From the Canary Islands LARSEN (1960) and BORGEN (1970) reported the same number.

In the present material two satellite chromosomes were observed.

S. oleraceus is often difficult to distinguish from *S. tenerrimus* L. and is possibly an amphidiploid derived from *S. asper* (L.) Hill ($2n=18$) and *S. tenerrimus* ($2n=14$) (STEBBINS & *al.*, 1953).

Tolpis barbata (L.) Gaertner
T. crinita Lowe, *T. umbellata* Bertol.
$2n=18$, $2x$ (fig. 28)

The present chromosome count coincides with previous counts from S Europe (cf. FEDOROV, 1969; MOORE, 1973, 1974, 1977; GOLDBLATT, 1984; BARTOLO & *al.*, 1981).

Satellites were observed on three chromosomes.

Volutaria lippii (L.) Maire
Centaurea lippii L., *Volutarella lippii* (L.) Cass.
$2n=32$, $2x$ (fig. 13)

This annual species is also found in N Africa, SE Spain, Linosa S of Sicilia, and SW Asia.

REESE (1957) reported the same diploid chromosome number $n=16$ in material from N Africa and BRULLO & *al.* (1978) reported the tetraploid number $2n=64$ in material from Linosa; the report of $2n=36$ from Russia (cf. FEDOROV, 1969 under the name *Centaurea lippii)* is in contrast.

Bassicaceae

Descurainia preauxiana (Webb) O. E. Schulz
Sisymbrium preauxianum Webb
$2n=14, 2x$ (fig. 14)

BORGEN (1969) and Bramwell (ined., see BRAMWELL, 1977) also found $2n=14$ in this polymorphic, perennial shrub.

Erucastrum C. Presl
$2n=18, 2x$ (figs. 15, 29)

Previous counts are: $2n=18$ (LARSEN, 1960, 1963; HARBERD, 1972; LOON, 1974) in *E. canariense; 2n* = 18 (LARSEN, 1963; HARBERD, *l. c.*) in *E. cardaminoides*. The two species are, according to HARBERD *(l. c.)*, fully interfertile. The basic chromosome number $x=9$ is also found in two species from Morocco: *E. brevirostre* (Maire) Gómez-Campo *(E. varium* Durieu subsp. *brevirostre* Maire) and *E. ifniense* Gómez-Campo (Harberd in GÓMEZ-CAMPO, 1984). By contrast the basic numbers $x=7$, 8, and 15 have been reported in other Mediterranean and Tropical African species.

GÓMEZ CAMPO *(l. c.)* considers *E. ifniense* as a continental vicariant of the insular *E. canariense* or *E. cardaminoides* and suggests that both species are confined to the Canary Islands.

Lobularia intermedia Webb in Webb & Berth.
$2n=22, 2x$ (fig. 30)

The present report is in accordance with previous counts (cf. BORGEN, 1977, 1984).

Moricandia arvensis (L.) DC.
Brassica arvensis L.
$2n= 28, 2x$ (fig. 31)

The same chromosome number has been counted previously in plants from the Mediterranean region and N Africa. Numbers for other species in the genus include $2n=28, 56, 84$, $2n=28$ being the most common, and demonstrate an apparent polyploid series based on $x=14$ (SOBRINO VESPERINAS, 1978).

Sisymbrium irio L.
Descurainia irio (L.) Webb & Berth.
$2n=14, 2x$ (fig. 32)

Chromosome counts in this widely distributed Mediterranean annual show a polyploid series: $2n=14, 21, 28, 42, 56$ (cf. FEDOROV, 1969), $2n=14$ and 28 being the most common numbers. The present diploid count from Gran Canaria coincides with a previous count from Lanzarote (LOON, 1974).

Campanulaceae

Wahlenbergia lobelioides (L. fil.) A. DC. subsp. **lobelioides**
$2n=18, 2x$ (fig. 16)

The two collections represent two different races not treated by THULIN (1975) in his revision of *Wahlenbergia.* The plants from the volcanic peak of Montañas del Fuego, Timanfaya (cult. no. 7236) are characterized by the glabrous stem, the linear to narrowly elliptic, dentate leaves, and the red flowers. The plants from the *Euphorbia* community on Punta de las Mujeres (cult. no. 7269) differ by having sparsely hairy stem, broader leaves, and pale blue flowers. The characteristics remain constant in cultivation. Specimens from Madeira and Tenerife collected by the present author resemble the bluish flowered race.

LARSEN (1960) and LOON (1974) recorded the same chromosome number from this Macaronesian endemic subspecies.

Caryophyllaceae

Silene gallica L.
$2n=24, 2x$ (fig. 17)

The number $2n=24$ corroborates previous countings also in plants from the Canary Islands (LARSEN, 1960).

Spergularia fimbriata Boiss. & Reuter
$2n=18, 2x$ (fig. 35)

The present diploid report from Gran Canaria agrees with counts from S Europe (cf. FEDOROV, 1969) and from Lanzarote and Tenerife (BORGEN, 1970; LOON, 1974).

Chenopodiaceae

Atriplex semibaccata R. Br.
$2n=18, 2x$ (fig. 33)

This naturalized species is a native of Australia. The present counts of $2n=18$ are in accordance with four counts from other areas (cf. FEDOROV, 1969; MOORE; 1973).

Chenopodium murale L.
$2n=18, 2x$ (fig. 18)

Widely distributed annual weed, in wich the number $2n=18$ has previously been found by several authors.

Patellifolia patellaris (Moq.) S., F.-L. & W.
Beta patellaris Moq., *Patellaria cordata* S., F.-L. & W.
$2n=36, 4x$ (fig. 34)

The genus *Patellifolia* (section *Patellares* of the genus *Beta* sensu lato) includes three species. *P. procumbens* (Chr. Sm. ex Hornem.) S., F.-L. & W. and *P. webbiana* (Moq.) S., F.-L. & W. are endemic to Macaronesia; *P. patellaris* is known from Cape Verde Islands, Canary Islands, Salvage Islands, Madeira, SE Spain and NW Africa.

Most previous counts for *P. patellaris* give $2n=18$ (cf. FEDOROV, 1969) including the count of LARSEN (1962) in material from Tenerife. BAROCKA (1959), BANDLOW (1961) and CURTIS (1968) reported $2n=36$ in plants of unspecified origin and suppose that *P. patellaris* is always tetraploid, whereas *P. procumbens* and *P. webbiana* are always diploid. The present report is the first tetraploid report on authentic Macaronesian material of *P. patellaris*.

The *Patellifolia* species possess many important genetic characters. They are the only *Beta* sensu lato species which are more or less completely resistant to the sugarbeet nematode *Heterodera schachtii*. They also are resistant to the powdery mildew *Erysiphe polygoni*, *Cercospora* leaf spot and curly top virus. In addition they are monocarpous, a character much desired in the sugarbeet as an aid in mechanizing the operations in growing the crop. After many years of experimental work there is hope that desirable traits of *Patellifolia* species can be transferred to sugarbeet. This work is still in need of wild collections because the material exchanged between research institutes is possibly from a narrow genetic base (see STEWART, 1950; CURTIS, 1968; COONS, 1975, for review).

Cistaceae

Helianthemum canariense (Jacq.) Pers.
$2n=20$, $4x$ (fig. 36)

This species is known from all the islands of the Canaries group and from the so-called Macaronesian enclave on the atlantic coast of Morocco (PELTIER, 1973).

The same chromosome number, $2n=20$, was recorded by BORGEN (1970) and LOON (1974).

Convolvulaceae

Convolvulus caput-medusae Lowe
$2n=30$, $2x$ (fig. 37)

This Canarian endemic species is confined to a few localities on Gran Canaria (KUNKEL, 1977) and Fuerteventura (SANTOS & FERNÁNDEZ, 1984). It is related to *C. trabutianus* Schweinf. & Muschler from Sahara and Morocco (MENDOZA-HEUER, 1971). *C. trabutianus* has not been studied cytologically yet.

The present chromosome number for *C. caput-medusae*, $2n=30$, was previously recorded by ALDRIDGE & ORTEGA (1976) in material also from Arinaga, Gran Canaria. Basic chromosome numbers for the genus are $x=10, 11, 12$ and 15 (see BORGEN, 1969).

Euphorbiaceae

Euphorbia exigua L.
Tithymalus exiguus (L.) Hill
$2n=24$, $4x$ (fig. 38)

$2n=24$ is by far the most common chromosome number for this rather widespread weed. Other numbers are $2n=12, 16, 20, (24+1), 28, 56, 64$ (cf. QUEIRÓS, 1975; MOORE, 1977; GOLDBLATT, 1981, 1984) and suggest an aneuploid series in this species.

Euphorbia peplus L.
$2n=16$, $2x$ (fig. 19)

Widely distributed annual weed, the chromosome number of which agrees with that of several previous counts.

Euphorbia pubescens Vahl
E. platyphylla L. var. *pubescens* (Vahl) Roep.
$2n=14$, $2x$ (fig. 20)

Mediterranean perennial, in which $2n=14$ has been found by several authors and $2n=16$ by one author (cf. GOLDBLATT, 1981, 1984; QUEIRÓS, 1975).

Euphorbia segetalis L.
$2n=16$, $2x$ (fig. 39)

Several previous counts from S Europe and Morocco give the same chromosome number $2n=16$, and one diverging count from France gives $2n=18$ (cf. QUEIRÓS, 1975; GOLDBLATT, 1981).

Euphorbia terracina L.
$2n=18$ and 36, $2x$ and $4x$ (figs. 21, 22)

The diploid chromosome report, $2n=18$, in this Mediterranean species confirms six previous counts from Portugal, Spain, Mallorca and Italy (cf. FEDOROV, 1969; MOORE; 1977; GOLDBLATT, 1981, 1984; OLIVA, 1978). In cult. no. 10062 tetraploid cells were found scattered singly amongst the diploid cells of the same root tip (fig. 22). The same interesting feature was observed by HARRISON (1930), who also found other peculiarities in the mitotic processes of *E. terracina.* Based on these peculiarities and the very variable external morphology she suggests that this species may be of hybrid origin.

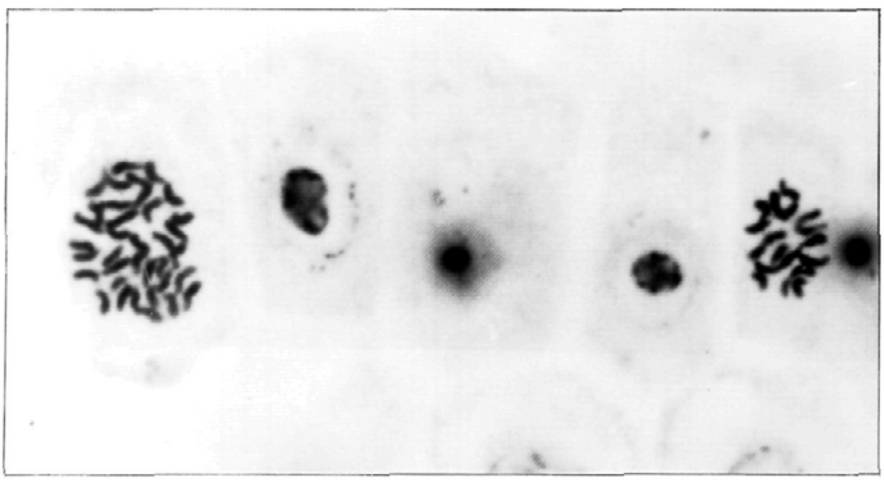

Fig. 22.—*Euphorbia terracina*, $2n=18$ and 36 (× 2.000).

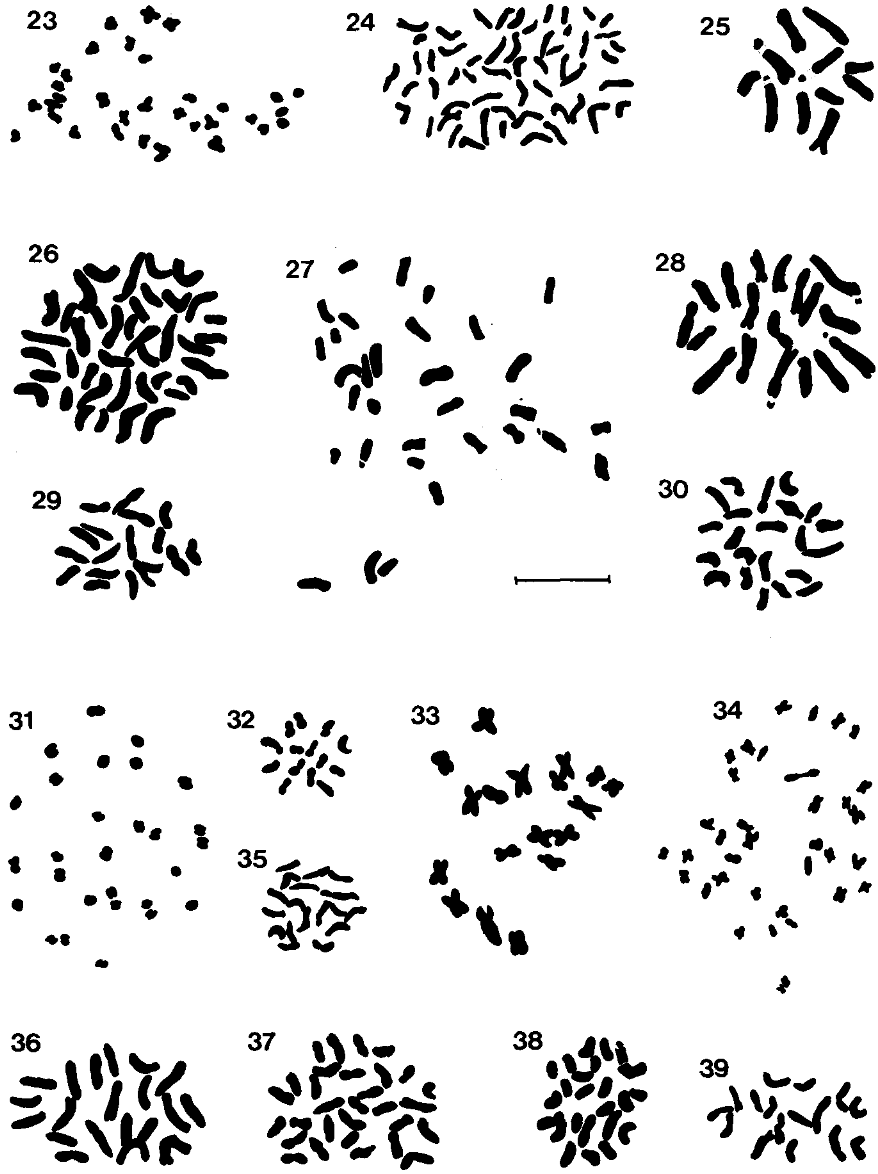

Fig. 23.—*Amaranthus viridis*, $2n=34$. Fig. 24.—*Calendula tripterocarpa*, $2n=54$. Fig. 25.—*Hedypnois cretica*, $2n=11$. Fig. 26.—*Senecio massaicus*, $2n=40$. Fig. 27.—*Sonchus oleraceus*, $2n=32$. Fig. 28.—*Tolpis barbata*, $2n=18$. Fig. 29.—*Erucastrum cardaminoides*, $2n=18$. Fig. 30.—*Lobularia intermedia*, $2n=22$. Fig. 31.—*Moricandia arvensis*, $2n=28$. Fig. 32.—*Sisymbrium irio*, $2n=14$. Fig. 33.—*Atriplex semibaccata*, $2n=18$. Fig. 34.—*Patellifolia patellaris*, $2n=36$. Fig. 35.—*Spergularia fimbriata*, $2n=18$. Fig. 36.—*Helianthemum canariense*, $2n=20$. Fig. 37.—*Convolvulus caput-medusae*, $2n=30$. Fig. 38.—*Euphorbia exigua*, $2n=24$. Fig. 39.—*Euphorbia segetalis*, $2n=16$. (Scale 5 µm).

Fabaceae

Lotus glinoides Delarb.
L. trigonelloides Webb & Berth., *L. arabicus* L. var. *trigonelloides* (Webb & Berth.) Pit. & Pr.
$2n=14$, $2x$ (fig. 40)

This species is known from the Canary Islands, S Morocco to Arabia and Ethiopia and perhaps the Cape Verde Islands (MONOD, 1980).

The present chromosome report is in accordance with previous records from the Canaries (LARSEN, 1956, 1960; BORGEN, 1970; LOON, 1974).

Lotus holosericeus Webb & Berth.
$2n=14$, $2x$ (fig. 41)

BRAMWELL & *al.* (1972) and ORTEGA (1976) report the same chromosome number from this species which is confined to Gran Canaria.

Geraniaceae

Geranium purpureum Vill.
$2n=32$, $2x$ (fig. 54)

Previous counts for this short-lived annual give $2n=32$ (see LOON, 1984a for review; LOON, 1984b) also in material from the Canaries (LARSEN, 1960; LOON, 1984b).

According to LOON (1984a, b) *G. purpureum* and *G. robertianum* are sibling species, representing the diploid ($2n=32$) and tetraploid ($2n=64$) cytotypes of a single polyploid series. They are reproductively isolated because their triploid hybrid is completely sterile.

Hypericaceae

Hypericum canariense L.
$2n=40$, $4x$ (fig. 42)

The present tetraploid report refers to var. *canariense,* which is endemic to the Canary Islands. The collection was characterized by its small and narrow leaves up to 25 mm long and 6 mm broad.

LARSEN (1962), BORGEN (1969) and GAGNIEU & *al.* (1973) also counted $2n=40$ in material of this species from Tenerife.

Lamiaceae

Lavandula multifida L. subsp. **canariensis** (Mill.) Pit. & Pr.
L. abrotanoides Lam.
$2n=22$, $2x$ (fig. 55)

LARSEN (1960) and BORGEN (1970) reported the same chromosome number.

Salvia aegyptiaca L.
$2n=26$, $2x$ (fig. 43)

Salvia aegyptiaca is a remarkably oligomorphic species known from Cape

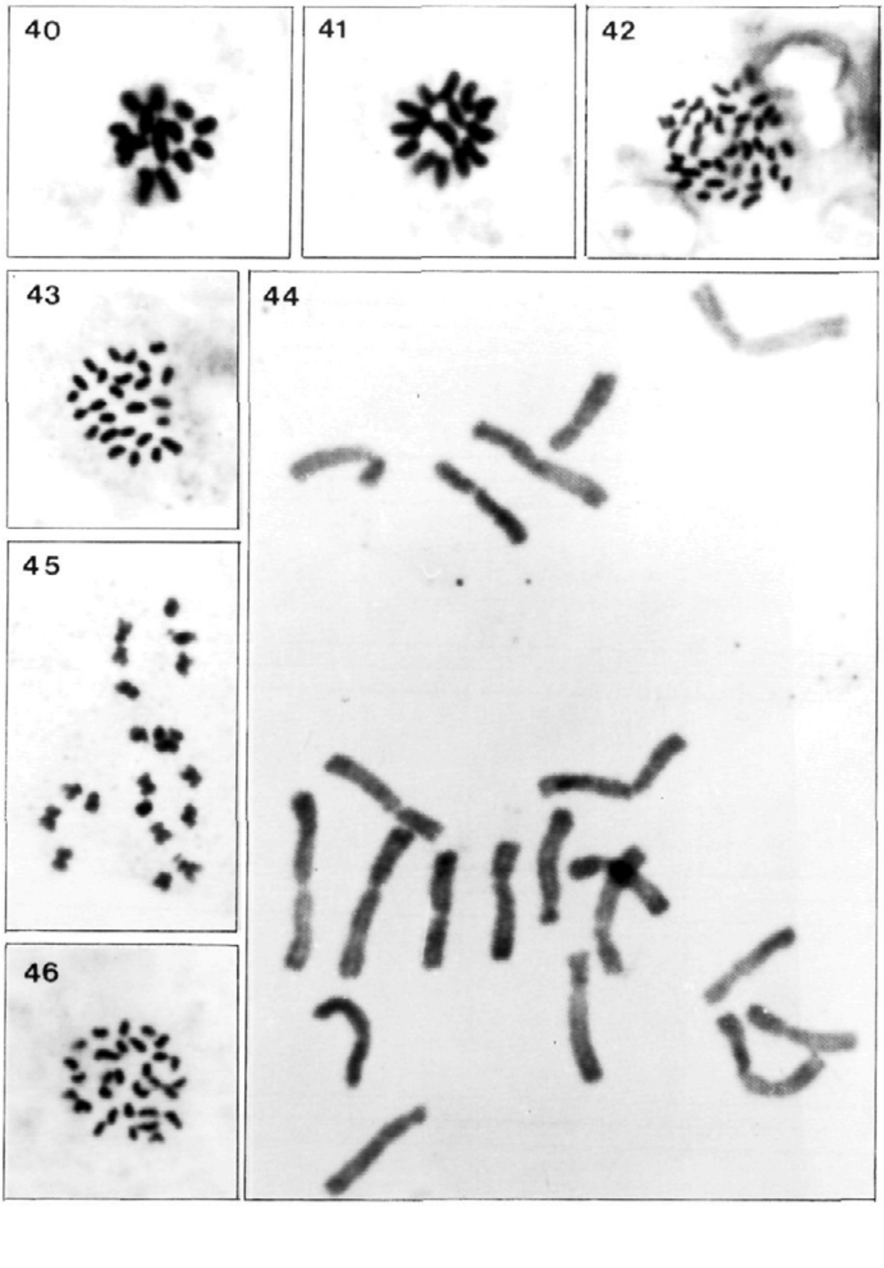

Fig. 40.—*Lotus glinoides*, $2n = 14$. Fig. 41.—*Lotus holosericeus*, $2n = 14$. Fig. 42.—*Hypericum canariense* var. *canariense*, $2n = 40$. Fig. 43.—*Salvia aegyptiaca*, $2n = 26$. Fig. 44.—*Rumex bipinnatus*, $2n = 20$. Fig. 45.—*Polygonum maritimum*, $2n = 20$. Fig. 46.—*Oligomeris linifolia*, $2n = 30$. (× 2.500)

Verde Islands, Canary Islands, NW and N Africa, Sudan, Ethiopia eastwards to W Pakistan and India (HEDGE, 1974).

The present count confirms the reports by HAQUE & GHOSHAL (1980) and HAQUE (1981) from unlocalised Botanic Garden material but is in striking contrast to counts from Libya ($2n=38$; BHATTACHARYA & *al.*, 1971), Morocco ($2n=42$; HUMPHRIES & *al.*, 1978), Cape Verde Islands ($2n=28$; BORGEN, 1981) and from unknown origin ($2n=28$; DELESTAING, 1954). The different chromosome numbers indicate that aneuploidy occurs in this widespread weed. This is further confirmed by the extensive series of aneuploid chromosome numbers found in the genus *Salvia* (see FERNANDES & LEITÃO, 1984).

The chromosomes are metacentric or submetacentric.

Salvia canariensis L.
$2n=22$, $2x$ (fig. 56)

This report confirms previous counts of this Canarian endemic by LARSEN (1960), LINDER & LAMBERT (1965) and GAGNIEU & *al.*, (1973) all from Tenerife.

HEDGE (1974) in his revision of *Salvia* in Africa placed *S. canariensis* in a monotypic species-group H but connected it with a species-group G from southwestern Africa. It thus demostrates an interesting long-range link between the Canary Islands and southwestern Africa. The only chromosome count in species belonging to species-group G shows the deviating number $2n=16$ for *S. aurea* L. (HEDGE, *l. c.*).

One pair of satellite chromosomes was seen in *S. canariensis*.

Malvaceae

Malva parviflora L.
$2n=42$, $6x$ (fig. 57)

The same chromosome number is reported several times in this widely distributed annual (cf. FEDOROV, 1969; MOORE, 1977; GOLDBLATT, 1981, 1984), also in plants from the Canary Islands (LOON, 1974).

Polygonaceae

Emex spinosa (L.) Campd.
Rumex spinosus L., *Vibo spinosa* (L.) Moench
$2n=20$, $2x$ (fig. 58)

The present chromosome count of this Mediterranean annual is in accordance with previous counts from S Europe, N Africa and Australia (cf. FEDOROV, 1969; MOORE; 1974; GOLDBLATT, 1984; QUEIRÓS, 1983).

Polygonum maritimum L.
$2n=20$, $2x$ (fig. 45)

The diploid number $2n=20$ is previously reported from Britain, Portugal and Spain (cf. FEDOROV, 1969; BJÖRKQVIST & *al.*, 1969; OLIVA; 1978).

Two satellite chromosomes were observed.

Rumex bipinnatus L. fil.
$2n=20$, $2x$ (fig. 44)

This annual species is recorded from Lanzarote (LID, 1967), Fuerteventura (SANTOS & FERNÁNDEZ, 1977), and from western Morocco and Tunis (RECHIN-

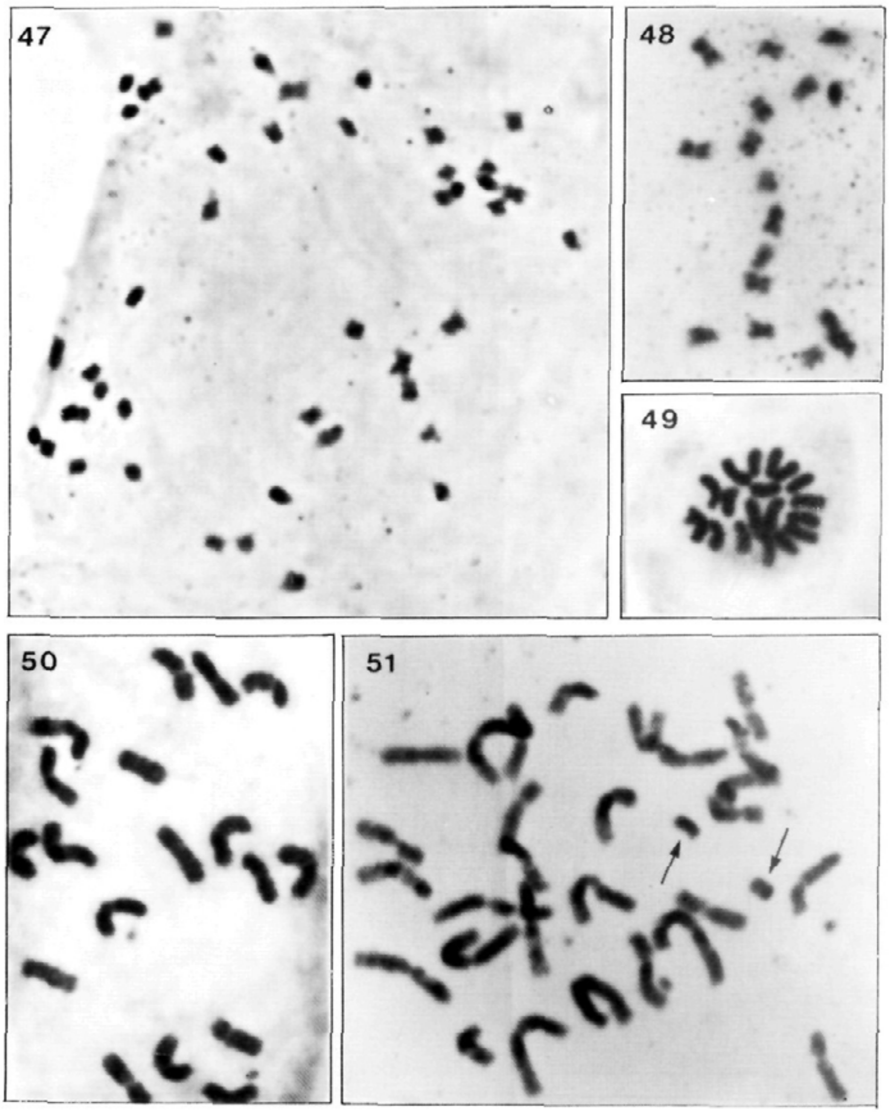

Fig. 47.—*Galium setaceum*, $2n=44$. Fig. 48.—*Kickxia sagittata* var. *sagittata*, $2n=18$. Fig. 49.—*Kickxia scoparia* $2n=18$. Fig. 50.—*Rumex vesicarius* var. *rhodophysa*, $2n=18$. Fig. 51.—*Bromus madritensis*, $2n=28+2B$ (arrows refer to B-chromosomes). (×2.500).

GER, 1954). It is closely related to *R. pictus* Forskål from Egypt, Palestine and Transjordania (RECHINGER, *l. c.*). *R. pictus* has not been studied cytologically yet.

The present count of $2n=20$ is a first report for *R. bipinnatus*. The karyotype shows one subacrocentric, four submetacentric and five metacentric chromosome pairs.

Rumex vesicarius L. var. **rhodophysa** Ball
$2n=18$, $2x$ (fig. 50)

Rumex vesicarius is a N African and SW Asian species. The var. *rhodophysa* is known from Cape Verde Islands, Canary Islands and NW Africa.

The same chromosome number, $2n=18$, was previously recorded from India and Morocco (cf. FEDOROV, 1969; HUMPHRIES & *al.*, 1978) and from Lanzarote (LOON, 1974).

Resedaceae

Oligomeris linifolia (Vahl) Macbride
Reseda linifolia Vahl in Hornem., *Resedella subulata* (Del.) Webb & Berth., *O. subulata* (Del.) Webb, *O. glaucescens* Camb.
$2n=30$, $2x$? (fig. 46)

Oligomeris linifolia is known from India to N Africa, SW United States and Mexico (ABDALLAH, 1967).

The present new counts of $2n=30$ differ from the two previous counts for this species, $n=24$ and $2n=28$ (cf. FEDOROV, 1969 under the name *O. glaucescens*).

Reseda lancerotae Webb & Berth. ex Del.
R. crystallina Webb & Berth.
$2n=24$, $4x$ (fig. 59)

Most previous counts for this Canarian endemic species give $2n=24$ (cf. FEDOROV, 1969; BORGEN, 1974; LOON, 1974). BRAMWELL & *al.* (1972) found the octoploid number, $2n=48$.

R. lancerotae is closely related to the widespread *R. lutea* L. and may be seen as an island population belonging in this species in its widest circumscription (ABDALLAH & WIT, 1978). Also *R. lutea* shows intra-specific polyploidy: most counts for *R. lutea* give the octoploid number, $2n=48$, but the tetrapoid cytotype is also found (cf. FEDOROV, 1969; MOORE, 1973, 1977; GOLDBLATT, 1981, 1984).

Reseda luteola L.
$2n=26$, $2x$ (fig. 60)

Previous chromosome counts in this widespread European and Mediterranean biennial give $2n=24$, 26, 28 (cf. FEDOROV, 1969; MOORE, 1977; GOLDBLATT, 1981, 1984). Reports based on material from the Canary Islands give $n=12$ (LARSEN, 1960) and $n=12$ and 13 within one individual (LINDER & LAMBERT, 1965).

FERNÁNDEZ PERALTA & GONZÁLEZ AGUILERA (1982) found two cytotypes,

$n=12$ and $n=13$, in *R. luteola,* and they consider that the $n=13$ level has been derived through aneuploidy from $n=12$ and that this species has not reached stabilization yet.

Rubiaceae

Galium setaceum Lam.
$2n=44$, $4x$ (fig. 47)

Chromosome counts in this Mediterranean annual show intra-specific polyploidy. Two cytotypes, $2n=22$ and $2n=44$, were previously found in material of unspecified origin (cf. FEDOROV, 1969). The tetraploid level was found in material from Greece (cf. MOORE, 1973) and the diploid cytotype was found in material from Mallorca (cf. MOORE, 1977).

Galium spurium L.
G. vaillantii DC.
$2n=20$, $2x$ (fig. 61)

Galium spurium is a widespread weed in most of Europe, Asia and Africa. The present diploid chromosome report coincides with 8 previous counts from outside the Canaries. A tetraploid cytotype, $2n=40$, is recorded in subsp. *africanum* Verdcourt for material from S Africa (cf. GOLDBLATT, 1981, 1984).

Scrophulariaceae

Kickxia sagittata (Poir.) Rothm.
Linaria sagittata (Poir.) Steud., *K. heterophylla* (Schousboe) Dandy, *Linaria heterophylla* (Schousboe) Sprengel, non Desf.
$2n=18$, $2x$ (fig. 48)

The type variety is known from the eastern Canary Islands and Sahara. The present chromosome record is in accordance with previous records from Fuerteventura (ALDRIDGE & ORTEGA, 1976, under the name *K. heterophylla)* and N Sahara (REESE, 1957; VIANO, 1971, both under the name *Linaria sagittata).*

The var. *urbanii* is often considered as a distinct endemic species, *K. urbanii* (Pit.) K. Larsen, and the chromosome number has not previously been reported.

Kickxia scoparia (Brouss. ex Sprengel) Kunk. & Sund.
K. spartioides (Brouss.) Janchen
$2n=18$, $2x$ (fig. 49)

The same chromosome number was reported by LARSEN (1963) and BORGEN (1970) under the name *K. spartioides.*

Amaryllidaceae

Pancratium canariense Ker-Gawler
$2n=22$, $2x$ (fig. 52)

This geophyte is endemic to the Canary Islands and the chromosome number has also been recorded by BORGEN (1969), BRAMWELL & *al.* (1971), GAGNIEU & *al.* (1973), and ALDRIDGE & ORTEGA (1976).

The karyotype shows a pattern of five acrocentric or subacrocentric, one submetacentric and five metacentric chromosome pairs. The largest chromosome is about two and a half time as long as the smallest one. *P. canariense* is therefore, with respect to karyotype asymmetry, classified in category 2B (see STEBBINS, 1971: 88).

Juncaceae

Juncus acutus L.
$2n=46$, $2x$ (fig. 63)

The present chromosome report agrees with counts made on material from Italy (SNOGERUP, 1958), the Canaries (BORGEN, 1969) and France (cf. GOLDBLATT, 1981) but is in contrast to several counts of $2n=48$ made by SNOGERUP (1963) for material from France, Italy and Greece. SNOGERUP (1963) suggests that chromosome reports deviating from $2n=48$ may be explained by the special difficulties in counting extremely small chromosomes and proposes the secondary basic number, $x=24$, for this species. The present count together with previous counts of $2n=46$ suggest that two secundary basic numbers of $x=23$ and $x=24$ occur.

The chromosomes are small sphaeric bodies, but there are two larger ones. SNOGERUP (1958) found 2-6 larger ones, and BORGEN (1969) found two larger chromosomes with satellites.

Liliaceae

Scilla haemorrhoidalis Webb & Berth.
$2n=28$, $4x$ (fig. 53)

This Canarian endemic species is closely related to *S. latifolia* Willd., known from the Canary Islands and Morocco.

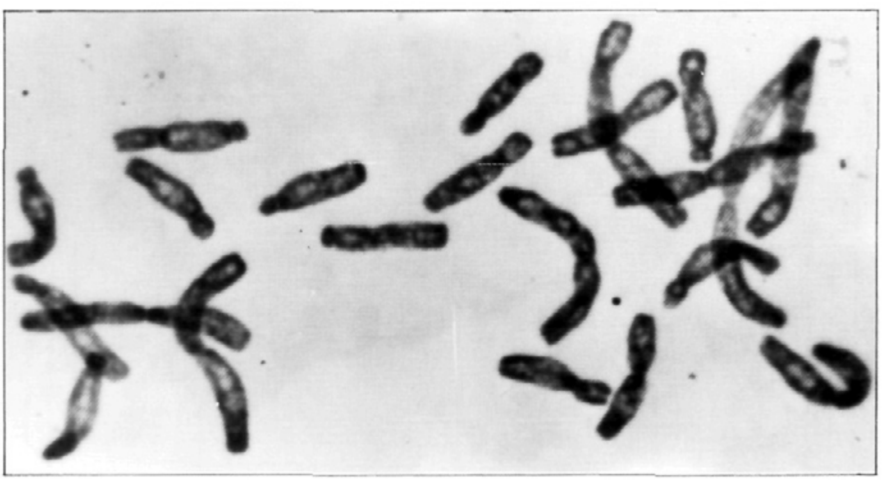

Fig. 52.—*Pancratium canariense*, $2n=22$ (× 1.900).

The chromosome number, $2n=28$, is in accordance with two previous reports (cf. FEDOROV, 1969; BORGEN, 1969) but differs from the report of $2n=32$ by GAGNIEU & *al.* (1973).

BORGEN (1969, 1970) found that two pairs of chromosomes are much longer than the others in *S. haemorrhoidalis* as well as in *S. latifolia.* In the present material of *S. haemorrhoidalis* there are three pairs of chromosomes which are much longer than the others and the karyotype shows five subacrocentric, three submetacentric and six metacentric chromosome pairs. The largest chromosome is six times as long as the smallest one. In the classification of karyotypes according to their degree of asymmetry (see STEBBINS, 1971: 88) *S. haemorrhoidalis* belongs to the category 2C. The same karyotype morphology was found in five Canarian populations of *S. latifolia* (ASCENSIÓN VIERA, 1984).

Poaceae

Avena canariensis Baum, Rajh. & Samps.
$2n=14$, $2x$ (fig. 62)

The present diploid record in this Canarian endemic is in accordance with those of BAUM & *al.* (1973).

Based on information from morphology and karyotype BAUM & *al. (l. c.)* suggest the evolutionary sequence: *A. canariensis* ($2x$) ⟶ *A magna* Murphy & Terrell ($4x$) ⟶ *A. sterilis* L. ($6x$) so that *A. canariensis* is a putative ancestor of the hexaploid cultivated oats.

Fig. 53.—*Scilla haemorrohodalis*, $2n=28$ ($\times$ 2.500).

Bromus madritensis L.
$2n=28+2B$, $4x$ (fig. 51)

Two subspecies are known from the Canary Islands. Whereas subsp. *kunkelii* H. Scholz is a Canarian endemic, the type subspecies is a native of the Mediterranean Region, now widespread in Europe and introduced into N and S America, S Africa and Australia.

The present chromosome report refers to subsp. *madritensis*. The somatic number, $2n=28$, has already been reported by LOON (1974) for material from Lanzarote and is in accordance with several reports from other localities in its distribution area.

Two B-chromosomes were observed. Accessory chromosomes were previously not found in *B. madritensis* but are found in a few other *Bromus* species e.g. the closely related *B. rubens* L. from Moroccan material (HUMPHRIES & *al.*, 1978).

Satellites were observed on two chromosomes.

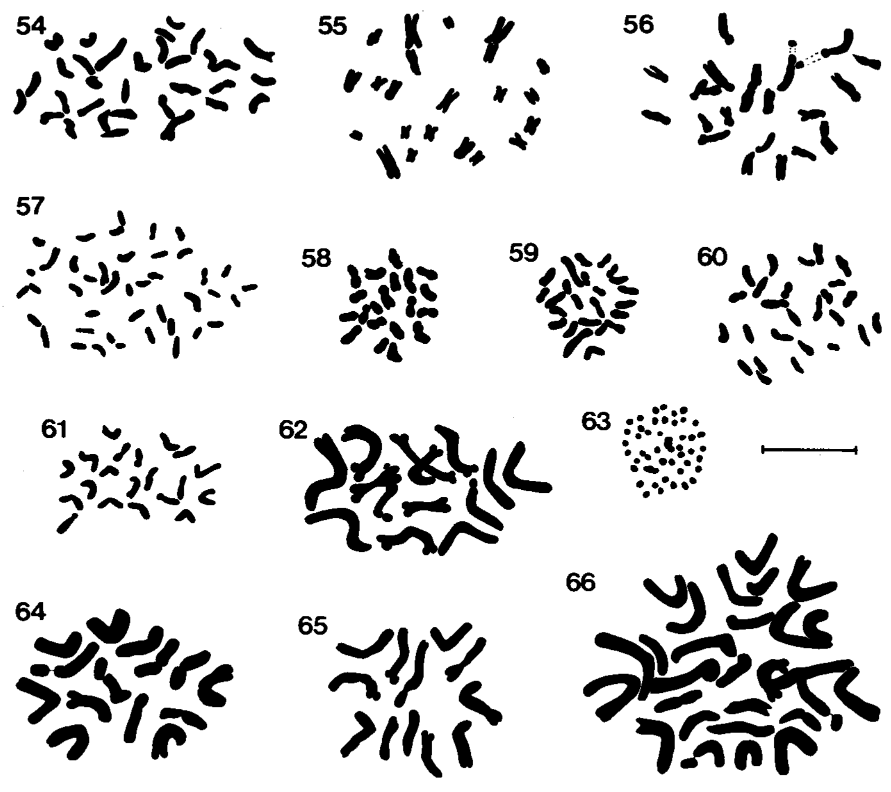

Fig. 54.—*Geranium purpureum*, $2n=32$. Fig. 55.—*Lavandula multifida* subsp. *canariensis*, $2n=22$. Fig. 56.—*Salvia canariensis*, $2n=22$. Fig. 57.—*Malva parviflora*, $2n=22$. Fig. 58.—*Emex spinosa*, $2n=20$. Fig. 59.—*Reseda lancerotae*, $2n=24$. Fig. 60.—*Reseda luteola*, $2n=26$. Fig. 61.—*Galium spurium*, $2n=20$. Fig. 62.—*Avena canariensis*, $2n=14$. Fig. 63.—*Juncus acutus*, $2n=46$. Fig. 64.—*Lolium parabolicae*, $2n=14$. Fig. 65.—*Lophochloa pumila*, $2n=12$. Fig. 66.—*Phalaris minor*, $2n=28$. (Scale 5 μm).

Lolium parabolicae Sennen ex Samp.
$2n=14$, $2x$ (fig. 64)

Lolium parabolicae is an atlantic species known from France, Spain, Portugal, Morocco, Madeira and the Canaries (KERGUÉLEN, 1983).

The present diploid report from Lanzarote agrees with two counts from Europe (KERGUÉLEN, 1972; QUEIRÓS, 1973).

One pair of satellite chromosomes was seen. QUEIRÓS (1973) reports two pairs of satellite chromosomes for material from Portugal.

Lophochloa pumila (Desf.) Bor
Avena pumila Desf., *Koeleria pumila* (Desf.) Domin, *Trisetaria pumila* (Desf.) Maire, *Trisetum pumilum* (Desf.) Kunth
$2n=12$, $2x$ (fig. 65)

The present new count of $2n=12$ for this species differs from the only previous count of $n=13$ made by DEVESA & ROMERO ZARCO (1984) for material from Spain. $2n=26$ has been recorded in *Lophochloa cristata* (L.) Hyl. [*Koeleria phleoides* (Vill.) Pers., *K. gerardi* (Vill.) Schinners] (cf. MOORE, 1973; GOLDBLATT; 1981). $2n=12$ has been recorded in *Lophochloa pubescens* (Lam.) H. Scholz [*Koeleria pubescens* (Lam.) Beauv., *Trisetaria pubescens* (Lam.) Kerguélen] (cf. FEDOROV, 1969; MOORE, 1973, 1977; GOLDBLATT, 1984). The basic number, $x=7$, is the prevailing number in the related genera: *Avena, Koeleria* and *Trisetum*.

Phalaris minor Retz.
$2n=28$, $4x$ (fig. 66)

Mediterranean annual, in which $2n=28$ has been found by several authors.
One pair of satellite chromosomes was seen.

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