

CHROMOSOME NUMBERS OF SOME ANGIOSPERMS FROM THE SOUTH OF FRANCE

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SUMMARY

The chromosome number of 42 plant species collected in the wild in the South of France has been determined. Notes on some species are given.

1. INTRODUCTION

The flora of the Mediterranean region has been much less investigated in cytological respect than that of North-Western Europe.

For a good understanding of the cyto geography of a given species it is necessary to carry out extensive investigations throughout its entire area. Recent studies have often revealed the occurrence of different chromosome numbers within one species, and sometimes it appeared to be difficult to find a clear correlation between differences in morphology and/or ecological preferences. The only way to solve these problems is to study a very large number of plants taken from as many localities as possible. This is the background against which investigations on a number of plants from the Mediterranean region were carried out, the results of which are given below.

In such investigations only counts are valuable for which there is well-documented voucher material. Therefore, in nature both plants for the herbarium and seeds were collected. The herbarium specimens collected in the wild by the junior author have been deposited in the herbarium of the Laboratorium voor Experimentele Plantensystematiek at Leiden. The seeds were germinated in the experimental garden of the University of Utrecht. The plants thus obtained were examined cytologically and subsequently preserved in the herbarium of Utrecht (U) where the microscopical slides are also kept.

2. MATERIAL AND METHODS

The seeds collected were sown in the experimental field of the Botanical Garden of the State University of Utrecht. The seedlings were potted and from this material roottips were fixed in Karpechenko's fixative, embedded in paraffine-wax, sectioned at 15 μ , and stained according to Heidenhain's haematoxylin method.

In two cases (*Galeopsis reuteri* Reichenb. and *Lamium maculatum* L.) the chromosome number was determined from material fixed in the field. For this purpose flowerbuds were fixed in Carnoy's fixative, squashed, and stained with aceto-carmin.

3. RESULTS

The results of the chromosome counts are given in the following table. This table gives a survey of the species investigated, the source of the material, and the collection number. The first number listed represents the herbarium material collected in the wild (L.E.P.), the second the material cultivated in the experimental garden. Notes on some species, marked with a plus sign (+), are added.

4. NOTES ON SOME SPECIES

1+ *Amaranthus deflexus* L.

The chromosome number $2n = 34$ for this species is also known from the studies in the Amaranthaceae by GRANT (1959). Three out of the four counts given by him are from plants cultivated from seeds received from botanical gardens. The origin of this material is unknown. The fourth count refers to material collected in the wild in Oklahoma, U.S.A. In the chromosome portraits of *Amaranthus deflexus* as given by Grant two satellites are present. Such satellites could not be observed in our material.

4+ *Silene nutans* L. subsp. *dubia* (Herbich) Zapal.

In Flora Europaea *Silene nutans* is subdivided into two subspecies. Subspecies *dubia* is characterized by: inflorescence branches usually 1- to 3-flowered, calyx teeth usually unequal, petal claw 2,4-4,5 mm, with a well-developed auricle, and capsule 4-5 times as long as the carpophore. These characters completely agree with our material. The chromosome number of this subspecies was not known; it turned out to be $2n = 24$, the most common chromosome number in European *Silenes*.

6+ *Cneorum tricoccum* L.

This is the first count of a representative of the family Cneoraceae. This family consists of two genera with three species in the Mediterranean region, the Canaries, and Cuba (LANJOUW 1968). Its taxonomic position is not clear. On the basis of anatomical characters WETTSTEIN (1935) assumed a close relationship with the Zygophyllaceae. It differs from this family by the presence of oil containing cells in bark and leaves, the absence of stipules and staminal appendices and by the arrangement of the stamens in a single whorl (HEGI 1965). Furthermore, the spectrum of the phenoles of the Cneoraceae does not support the incorporation of this family in the Geraniales as advocated by Wettstein (HEGNAUER 1964). HUTCHINSON (1959) assumed relationship with the Celastrales, whereas TAKHTAJAN (1959) placed the family near the Rutales. Takhtajan's view is supported by the chromosome number $2n = 36$.

Table. Results of chromosome counts

Amaranthaceae						
1* <i>Amaranthus deflexus</i> L.	L.E.P. 17123-10426	St. Laurent du Var, c. 50 m (A.M.)			2n = 34	
Campanulaceae						
2. <i>Jasione montana</i> L.	L.E.P. 17043-10425	Near Port-Vendres, c. 210 m (Pyr. Or.)			2n = 12	
Caryophyllaceae						
3. <i>Polygonum polycarpoides</i> (Biv.) Zodda	L.E.P. 17300-10380	Cap Ferrat (A.M.)			2n = 54	
4* <i>Silene nutans</i> L. subsp. <i>dubia</i> (Herbich) Zapal.	L.E.P. 17426-10381	Col de Bleine, c. 1450 m (A.M.)			2n = 24	
Chenopodiaceae						
5. <i>Chenopodium murale</i> L.	L.E.P. 17302-10422	Cap Ferrat, 10-15 m (A.M.)			2n = 18	
Cneoraceae						
6* <i>Cheorum tricoccum</i> L.	L.E.P. 17265-10400	Mont Boron, c. 200 m (A.M.)			2n = 36	
Compositae						
7. <i>Andryala integrifolia</i> L.	L.E.P. 17042-10404	Near Port-Vendres, c. 210 m (Pyr. Or.)			2n = 18	
8. <i>Carduus collinus</i> Waldst. et Kit.	L.E.P. 17435-10427	Col de Bleine, c. 1350 m. (A.M.)			2n = 32	
9. <i>Crepis foetida</i> L.	L.E.P. 17271-10416	St. Laurent du Var, c. 50 m (A.M.)			2n = 10	
10. <i>Erigeron karwinskianus</i> DC. var. <i>mucronatus</i> (DC.) Aschers.	L.E.P. 17298-10405	Cap Ferrat, 10-15 m (A.M.)			2n = 36	
11. <i>Lactuca virosa</i> L.	L.E.P. 17006-10413	Thuir, sealevel (Pyr. Or.)			2n = 18	
12. <i>Senecio vulgaris</i> L.	L.E.P. 17277-10414	St. Laurent du Var. c. 50 m (A.M.)			2n = 40	
13. <i>Seriola aetnensis</i> L.	L.E.P. 17151-10408	St. Jeannet, c. 200 m (A.M.)			2n = 12	
14. <i>Urospermum dalechampii</i> (L.) Desf.	L.E.P. 17094-10412	Grand Corniche, near Nice, c. 450 m (A.M.)			2n = 14	
Cruciferae						
15. <i>Lobularia maritima</i> (L.) Desv.	L.E.P. 17146-10382	St. Jeannet, c. 200 m (A.M.)			2n = 24	
Cyperaceae						
16* <i>Carex flacca</i> Schreb.	L.E.P. 17099-10392	Grand Corniche, near Nice, c. 450 m (A.M.)			2n = 76	
17* <i>Cyperus vegetus</i> Willd.	L.E.P. 17315-10393	Esterel, c. 180 m (Var)			2n = 42	
Euphorbiaceae						
18* <i>Euphorbia cyparissias</i> L.	L.E.P. 17054-10401, 10423	Col de Jou, c. 1100 m (Pyr. Or.)			2n = 20	
Globulariaceae						
19* <i>Globularia cordifolia</i> L. subsp. <i>cordifolia</i>	L.E.P. 17398-10383	Coussols near Gourdon, c. 1400 m (A.M.)			2n = 16	
20* <i>Globularia elongata</i> Hegetschw.	L.E.P. 17162-10384	Col de Vence, c. 950 m (A.M.)			2n = 16	
	L.E.P. 17246-10385	Colomars, c. 200 m (A.M.)			2n = 16	

Gramineae									
21.	<i>Aegilops ovata</i> L.	L.E.P. 17176-10428	Between Vence and Col de Vence, c. 750 m (A.M.)	2n = 28					
22.	<i>Agrostis semiverticillata</i> (Forsk.) C. Chr.	L.E.P. 17312-10429	Esterel, c. 180 m (Var)	2n = 28					
23.	<i>Avena barbata</i> Pott ex Link	L.E.P. 17013-10436	Thuir, sealevel (Pyr. Or.)	2n = 28					
24.	<i>Brachypodium distachyon</i> (L.) Pal. Beauv.	L.E.P. 17307-10418	Cap Ferrat, c. 10-15 m (A.M.)	2n = 28					
25.	<i>Dactylis glomerata</i> L.	L.E.P. 17014-10435	Thuir, sealevel (Pyr. Or.)	2n = 14					
		L.E.P. 17283-10443	Mont Boron (A.M.)	2n = 28					
		L.E.P. 17186-10433	St. Dalmas le Vésubie, c. 1450 m (A.M.)	2n = 18					
Juncaceae									
27.	<i>Luzula multiflora</i> (Retz.) Lej.	L.E.P. 17413-10395	Col de Bleine, c. 1450 m. (A.M.)	2n = 24					
Labiatae									
28.	<i>Galeopsis reuteri</i> Reichenb.	L.E.P. 17217	Morignole, c. 900 m (A.M.)	2n = 16					
		L.E.P. 17220	Morignole, c. 900 m (A.M.)	n = 9					
Leguminosae									
30*	<i>Calicotome spinosa</i> (L.) Link	L.E.P. 17291-10439	Mont Boron, c. 1100 m (A.M.)	2n = 48					
31.	<i>Dorycnium pentaphyllum</i> Scop. subsp. <i>pentaphyllum</i>	L.E.P. 17074-10438	Vinca, c. 250 m (Pyr. Or.)	2n = 14					
32.	<i>Ononis natrix</i> L. subsp. <i>natrix</i>	L.E.P. 17245A-10437	Colomars, c. 200 m (A.M.)	2n = 32					
Linaceae									
33.	<i>Linum strictum</i> L. subsp. <i>strictum</i>	L.E.P. 17016-10377	Etang de St. Nazaire et de St. Cyprien, sealevel (Pyr. Or.)	2n = 18					
Plantaginaceae									
34*	<i>Plantago fuscescens</i> Jord.	L.E.P. 17359-10376	Mont L'Aution, c. 1850 m (A.M.)	2n = 36					
Polygonaceae									
35.	<i>Rumex scutatus</i> L.	L.E.P. 17190-10473	St. Dalmas le Vésubie, c. 1450 m (A.M.)	2n = 20					
Primulaceae									
36.	<i>Anagallis arvensis</i> L. subsp. <i>arvensis</i>	L.E.P. 17116-10371	St. Laurent du Var, c. 50 m (A.M.)	2n = 40					
Scrophulariaceae									
37.	<i>Antirrhinum orontinum</i> L.	L.E.P. 17122-10367	St. Laurent du Var, c. 50 m (A.M.)	2n = 16					
38.	<i>Verbascum thapsus</i> L.	L.E.P. 17434-10363	Col de Bleine, c. 1350 m (A.M.)	2n = 36					
39.	<i>Veronica officinalis</i> L.	L.E.P. 17322-10365	Esterel, c. 180 m (Var)	2n = 34					
Solanaceae									
40*	<i>Solanum nigrum</i> L. subsp. <i>nigrum</i>	L.E.P. 17310-10398	Cap Ferrat, 10-50 m (A.M.)	2n = 72					
Urticaceae									
41.	<i>Parietaria diffusa</i> Mert. et Koch	L.E.P. 17113-10411	St. Laurent du Var, c. 50 m (A.M.)	2n = 26					
Violaceae									
42*	<i>Viola riviniana</i> Reichenb.	L.E.P. 17324-10391	Esterel, c. 180 m (Var)	2n = 40					

16⁺ *Carex flacca* Schreb.

The chromosome number $2n = 76$ was also found in material from Scandinavia studied by HEILBORN (1924, 1932), from Iceland by LÖVE & LÖVE (1956), and from Britain by DAVIES (1956 a, b). KJELLQVIST & LÖVE (1963) reported $2n = 90$ from plants from Spain 10 km South of Tagacete. It is of interest to notice that our material in cytological respect matches the plants from northern Europe.

17⁺ *Cyperus vegetus* Willd.

This species was introduced from South America and is now common in the South of France. It had not been studied cytologically before. The material investigated showed the number $2n = 42$.

18⁺ *Euphorbia cyparissias* L.

In this species diploids ($2n = 20$) and tetraploids ($2n = 40$) are known. The distribution of the two cytotypes seems to be of interest at least in Europe (in America this species was introduced as a weed). The number $2n = 20$ found in our plants seems to support the opinion that tetraploids have a more eastern distribution as suggested by BAUER (1971), though PRITCHARD (1959) claimed the occurrence of tetraploids in England.

19⁺ *Globularia cordifolia* L. subsp. *cordifolia*

The specimen from Caussols near Gourdon (Alpes-Maritimes) has spatulate leaves with a tridentate apex. This is a character of the subspecies *cordifolia* (LARSEN 1957). Our plant is a diploid with $2n = 16$ chromosomes. Larsen (l.c.) reported $2n = 32$ for plants from France and Switzerland. Later SCHWARZ (1963) in a study of the entire genus *Globularia* confirmed the number $2n = 32$ and besides also counted $2n = 48$. Further cytotaxonomic investigation within this polymorphic species complex seems to be worthwhile.

20⁺ *Globularia elongata* Hegetschw.

The number $2n = 16$ has also been reported by SCHWARZ (1963) from material of unknown origin and by LÖVE & LÖVE (1944) in plants from the neighbourhood of Lund in Sweden. However, the origin of these plants is uncertain because in Sweden *Globularia elongata* is only known from the islands Öland and Gotland and plants from Öland turned out to be tetraploids ($2n = 32$) (LARSEN 1957). In the same paper the latter author reported also tetraploids from Spain. The distribution of the two cytotypes is unknown and needs further investigation.

30⁺ *Calicotome spinosa* (L.) Link

Our material proved to be a tetraploid with $2n = 48$ chromosomes. Up till now only diploids were known (GILOT 1965). The chromosome number $2n = 48$ is the same as in the other European species, *C. villosa* (Poiret) Link, which is morphologically clearly distinct from *C. spinosa* Link.

34⁺ *Plantago fuscescens* Jord.

In a study of the chromosomes and their morphology in the Plantaginaceae MCCULLAGH (1934) reported $2n = 24$ for *P. fuscescens* Jord. The number $2n =$

36 found in our study is in agreement with the observation of RESENDE (1937). According to LÖVE & LÖVE (1961) the Plantaginaceae show the basic numbers $x = 5$ and $x = 6$. The species investigated belongs to the series with $x = 6$ and polyploidy obviously occurs. No correlation between cytotype and morphology has been established. This needs further investigation.

40+ *Solanum nigrum* L.

In this cosmopolitan species a large series of polyploids occurs. Up till now the chromosome numbers $2n = 24, 48, 72, 96,$ and 144 are known. The hexaploid is the most common and in Europa the normal representative. According to LÖVE & LÖVE (1961) this cytotype is to be regarded as subspecies *nigrum*.

42+ *Viola riviniana* Reichenb.

Viola riviniana Reichenb. is a polymorphic species characterized by intraspecific aneuploidy [$2n = 35, 40, 46,$ and 47 (VALENTINE 1949; GADELLA 1963; GADELLA & KLIPHUIS 1963)]. There is, however, no correlation between the differences in morphology and the differences in chromosome number (Gadella l.c.). *V. riviniana* Reichenb. and *V. reichenbachiana* Jord. ex Bor. were formerly considered to be varieties of *V. silvatica* Fr., but several morphological characters permit to distinguish two separate species. Apart from the diagnostic differences, *V. riviniana* and *V. reichenbachiana* have also different levels of polyploidy, *V. reichenbachiana* being diploid ($2n = 20$) and *V. riviniana* tetraploid ($2n = 40$).

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