Zeitschrift: Botanica Helvetica

Herausgeber: Schweizerische Botanische Gesellschaft

Band: 96 (1986)

Heft: 1

Artikel: Chromosome studies in the Greek flora. I, Karyotypes of some Aegean Angiosperms

Autor: Tzanoudakis, Dimitris

DOI: https://doi.org/10.5169/seals-67189

Botanica Helvetica 96/1, 1986

0253-1453/86/010027-10 $ 1.50+0.20/0

Chromosome studies in the Greek flora. I. Karyotypes of some Aegean Angiosperms

Dimitris Tzanoudakis

Botanical Institute, University of Patras, Patras-Greece

Manuscript accepted December 16, 1985

Abstract

Tzanoudakis, D. Chromosome studies in the Greek flora. 1986. I. Karyotypes of some Aegean Angiosperms. Bot. Helv. 96: 27–36.

Chromosome numbers and brief descriptions of the chromosome morphology are given for 19 Aegean taxa of the Greek flora. Most of the taxa studied are typical elements of the Aegean flora (16 endemics in the area, 13 chasmophytes), and the cytological study showed that at least 16 out of 19 are diploids.

Introduction

The purpose of this paper and others forthcoming in the same series, is to give information concerning the karyotypes of vascular taxa of the Greek flora. The interest of the Greek flora is well known and such information would be important in our attempts to understand the richness of the flora and the distribution pattern of the plant species in the area concerned.

The present study deals with 19 taxa of the Aegean flora which is one of the most interesting in Greece, mainly due to the geographical location (between Asia, Europe and Africa), and the topographic fragmentation of the area.

Material and methods

Cytological studies were made on material (rhizomes or seeds) collected by the present author and cultivated at the Botanical Institute of Patras University.

The taxonomy of the material and the sequence of the taxa in the list is in accordance with Flora Europaea (Tutin et al. 1964–1980). Voucher specimens of all the material studied are deposited in the Botanical Museum of the University of Patras (UPA).

Flora Europaea (Moore 1982) is also used as the main source of earlier chromosome number reports, and taxa for which the chromosome numbers were unknown are marked with an asterisk in table 1.

For the study of the karyotypes actively growing root tips were used. After a 3–4 hours pretreatment in colchicine (0.3%) or in α-bromonaphthalene solution the root-tips were fixed in Carnoy and stained according to the Feulgen technique.

Tab. 1. Chromosome numbers and origin of the material studied. An asterisk placed in front of the taxons' name means that the chromosome number given is a new record.

Taxon	Distribution	Origin of the material	2n
**Anemone hortensis* L.	C. Mediterr.	Crete: Rethymno, south of the village Mariou	16
**Ranunculus creticus* L.	Crete, Karpathos	Crete: Rethymno, gorge of Kourtalioti	16
Ranunculus asiaticus L.	Crete, Karpathos, W. Asia	Grete: Rethymno, gorge of Kourtalioti	16
Coronilla globosa L.	Crete	Crete: a) Rethymno, gorge of Kotsyfou b) Lassithion, NE of the village Monastiraki	12 12
**Eryngium ternatum* Poiret	Crete	Crete: Chania, gorge of Impros	14
**Convolvulus dorycnium* L.	Aegean region	Crete: Rethymno, south of the village Mariou	30
**Valeriana asarifolia* Dufresne	Crete, Karpathos	Crete: Rethymno, gorge of Kourtalioti	16
**Aster creticus* (Gand.), Rech. fil.	Crete, Karpathos	Crete: Lassithion, NE of the village Rousa Ekklisia	18
**Senecio gnaphalodes* Sieber	Crete, Karpathos	Crete: Lassithion, NE of the village Rousa Ekklisia	40
**Ptilostemon chamaepeuce* (L.) W. Greuter	Greece	Amorgos: Mt. Machos ca 700 m	32
Centaurea oliveriana DC.	C. Aegean	Amorgos: Above the village Potamos	22
Centaurea redempta Heldr.	Crete	Crete: Chania, Therisos gorge	20
**Wagenitzia lancifolia* (Sieber ex Sprengel) Dostal	Crete	Crete: Chania, Mt. Lefka Ori, above the village Kampi 1800	18
**Scorzonera cretica* Willd.	S. Aegean	Crete: Rethymno, gorge of Kourtalioti	12
**Lactuca viminea* (L.) J. C. Presl. ssp. *alpestris* (Grand.) Feráková	Crete	Crete: Chania, Lefka Ori above Omalos, 1500 m	18
Lactuca acanthifolia (Willd.) Boiss.	S. Aegean	Crete: a) Rethymno, gorge of Kourtalioti b) Lassithion, NE of the Village Monastiraki	18 18
**L. acanthifolia = L. amorgina* Heldr. & Orph. ex Halácsy	S. Aegean	Amorgos: Above the village Lagatha	18
Crepis auriculifolia Sieber ex Sprengel	Crete	Crete: a) Chania, Mt. Lefka Ori Gigilos ca. 1600 m. b) Rethymno, Mt. Idhi above to the village Anogia ca 1300 m	10 10
Crepis dioscoridis L.	Greece, Albania, Aegean region	Amorgos: a) Close to village Aegiali b) Above to the village Potamos	8 8

The nomenclature of the chromosomes is in accordance with Levan et al. (1965). In the drawings of karyotypes (karyograms), the chromosomes have been arranged according to decreasing size and only in very few cases, viz. caryotypes with large chromosomes they were also classified into groups by means of their centromeric position.

Results

In the present study material from 19 Aegean taxa has been investigated cytologically and the chromosome counts obtained are summarized in table 1. In the same table information concerning the total distribution of the studied taxa and the origin of the material is also given. Sixteen of the taxa studied are Aegean endemics and in twelve cases the chromosome numbers given are new records.

For the taxa studied karyotype information concerning the morphology of the chromosomes is given under independent sub-headings. *Convolvulus dorycnium* and *Senecio gnaphalodes* are excluded due to the very small size of their chromosomes.

Anemone hortensis L. (2n = 16)

The distribution of this taxon, as given in Flora Europaea, does not include the Greek area. The author, however, collected *A. hortensis* in the locality given in 1973, and one year later Greuter (1974) pointed out the presence of this taxon in Crete.

The karyotype consists of four metacentric and three strongly anisobrachial (subtelocentric to telocentric) chromosome pairs. Nucleolar organizers have been observed in the short arms of the individual submetacentric chromosomes (Fig. 1 A).

Ranunculus creticus L. (2n = 16)

The diploid chromosome number found in the population examined is very common among species of *Ranunculus.*

The karyotype consists of three metacentric, four subtelocentric, and one telocentric chromosome pair. The individual chromosomes of the latter pair possess a nucleolar organizer in the short arm (Fig. 1 C).

Ranunculus asiaticus L. (2n = 16)

In Crete this species shows a remarkable morphological variation and several varieties have been recognized (Rechinger 1943). The material investigated cytologically in the present study belongs to the white-flowered form (*R. asiaticus* var. *albus* Hayek).

The chromosome number 2n = 16 for *R. asiaticus* has been recently given by de Montmollin (1984). With regard to the chromosome morphology the karyotype of *R. asiaticus* looks very similar to that at *R. creticus* described above. The only karyotype difference worth mentioning is the lack of true telocentric chromosomes (Fig. 2 B).

Coronilla globosa Lam. (2n = 12)

The chromosome number of this species, 2n = 12, has been given recently by de Montmollin (1982) based on the study of material collected in Western Crete. In the present study material from both central and Eastern Crete has been studied and the same chromosome number was found.

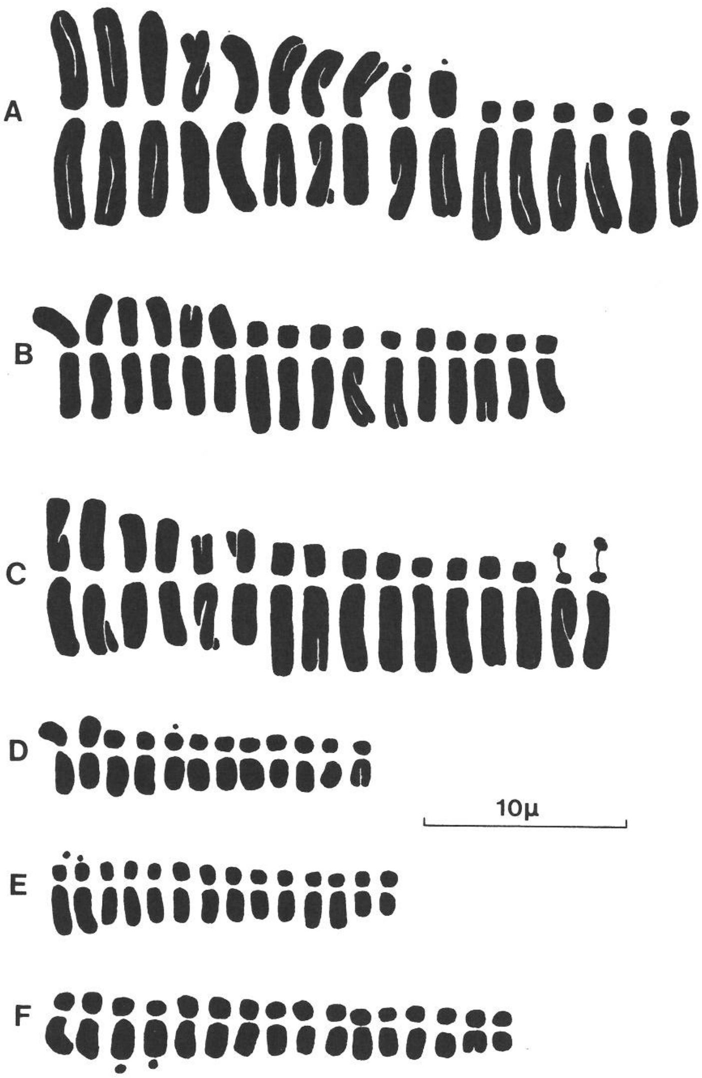

Fig. 1. Karyograms. A: *Anemone hortensis,* B: *Ranunculus asiaticus,* C: *R. creticus,* D: *Coronilla globosa,* E: *Eryngium ternatum,* F: *Valeriana asarifolia.*

The karyotype consists of one metacentric and five anisobrachial (submetacentric or subtelocentric) chromosome pairs. Satellites have been observed in the individual chromosomes of one of the anisobrachial chromosome pairs (Fig. 1 D).

Eryngium ternatum Poiret (2n = 14)

In the population studied, the diploid chromosome number 2n = 14 was found. The haploid complement consists of seven small anisobrachial chromosomes. Most of them are subtelocentric and only one or two seem to be submetacentric. Satellites have been observed in the short arms of the individual chromosomes of the larger subtelocentric chromosome pair (Fig. 1 E).

Convolvulus dorycnium L. (2n = 30)

In the material of *C. dorycnium* studied the chromosome number 2n = 30 was found but the small size of the chromosomes does not permit a detailed karyotype

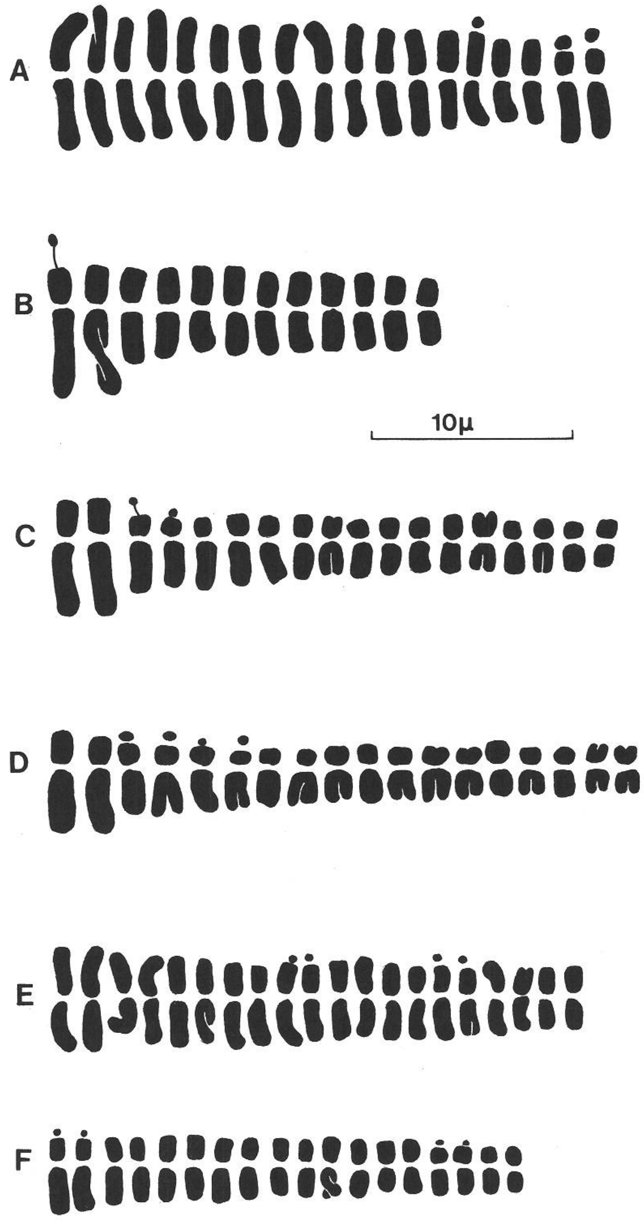

Fig. 2. Karyograms. A: *Aster creticus,* B: *Scorzonera cretica,* C: *Lactuca amorgina,* D: *L. acanthifolia,* E: *Centaurea redempta,* F: *Wagenitzia lancifolia.*

analysis. Consequently *C. dorycnium* could be a diploid (x = 15) or a triploid (x = 10) taxon. Up to the present chromosome numbers such as 20, 30, 40 and 50 have been reported for different *Convolvulus* species (Sa'ad 1967), which seems to favour the latter suggestion. It should be pointed out, however, that in the genus *Convolvulus* chromosome numbers of 22, 24, 26 and 28 have also been found (Sa'ad 1967, Moore 1982), and the possibility of x = 15 cannot be excluded.

Valeriana asarifolia Dufrense (2n = 16)

V. asarifolia is one of the most abundant and evenly distributed chasmophytes in Crete. A diploid chromosome number of 2n = 16 was found; the haploid complement consists of eight small chromosomes with the centromere in a ± submedian position. One of the larger chromosomes of the haploid complement is characterized by the presence of a nucleolar organizer in the longer arm (Fig. 1 F).

Aster creticus (Gand.) Rech. fil. (2n = 18)

The diploid chromosome number 2n = 18 was found in this taxonomically isolated species. The basic chromosome number x = 9 is the most common among the European species of *Aster*. In *A. creticus* the haploid complement consists of 8 metacentric and one submetacentric chromosome.

In the individual chromosomes of the single submetacentric and in one of the metacentric (one of the smaller ones) nucleolar organizers have been observed. (Fig. 2 A).

Senecio gnaphalodes Sieber (2n = 40)

Only one individual of this taxon has been studied and 40 chromosomes were counted in metaphase plates. Up to the present the chromosome numbers 20, 40, 60, 80, 100 have been reported for other European species of the genus *Senecio* (Moore 1982); therefore *S. gnaphalodes* should be considered as a tetraploid taxon.

Ptilostemon chamaepeuce (L.) W. Greuter (2n = 32)

The chromosome number 2n = 32 found in the material studied is one of those (24, 32, 34) already known for the genus *Ptilostemon* (Greuter 1972). Greuter also (l.c.) briefly discusses the cytology of the genus and mentions the contradictory aspects concerning the basic chromosome number(s) (x = 8 or x = 16).

The study of the chromosome morphology in the present material seems to favour the latter opinion: x = 16. This is because in all metaphase plates pairs rather than tetrads of homologous chromosomes were observed (arrowed chromosomes in figure 4 C).

Centaurea oliveriana DC. (2n = 22), *C. redempta* Heldr. (2n = 20)

Both these species were studied cytologically by Runemark (1967) and the chromosome numbers given here were also reported. In the karyotypes of both species two SAT-chromosome pairs were observed; the chromosomes are metacentric or submetacentric.

Wagenitzia lancifolia (Sieber ex Sprengel) Dostál (2n = 18)

This taxonomically isolated Cretan endemic is very rare on the island. As the cytological study showed, *W. lancifolia* is a diploid taxon, 2n = 18. Most of the chromosomes of the haploid complement are submetacentric and only a few ± metacentric. Two SAT-chromosome pairs have been observed; one of them is submetacentric and the larger of the complement (Fig. 2 F).

Scorzonera cretica Willd. (2n = 12)

In the Cretan material studied the diploid chromosome number 2n = 12 was found. The haploid complement consists of one large submetacentric and five, notably

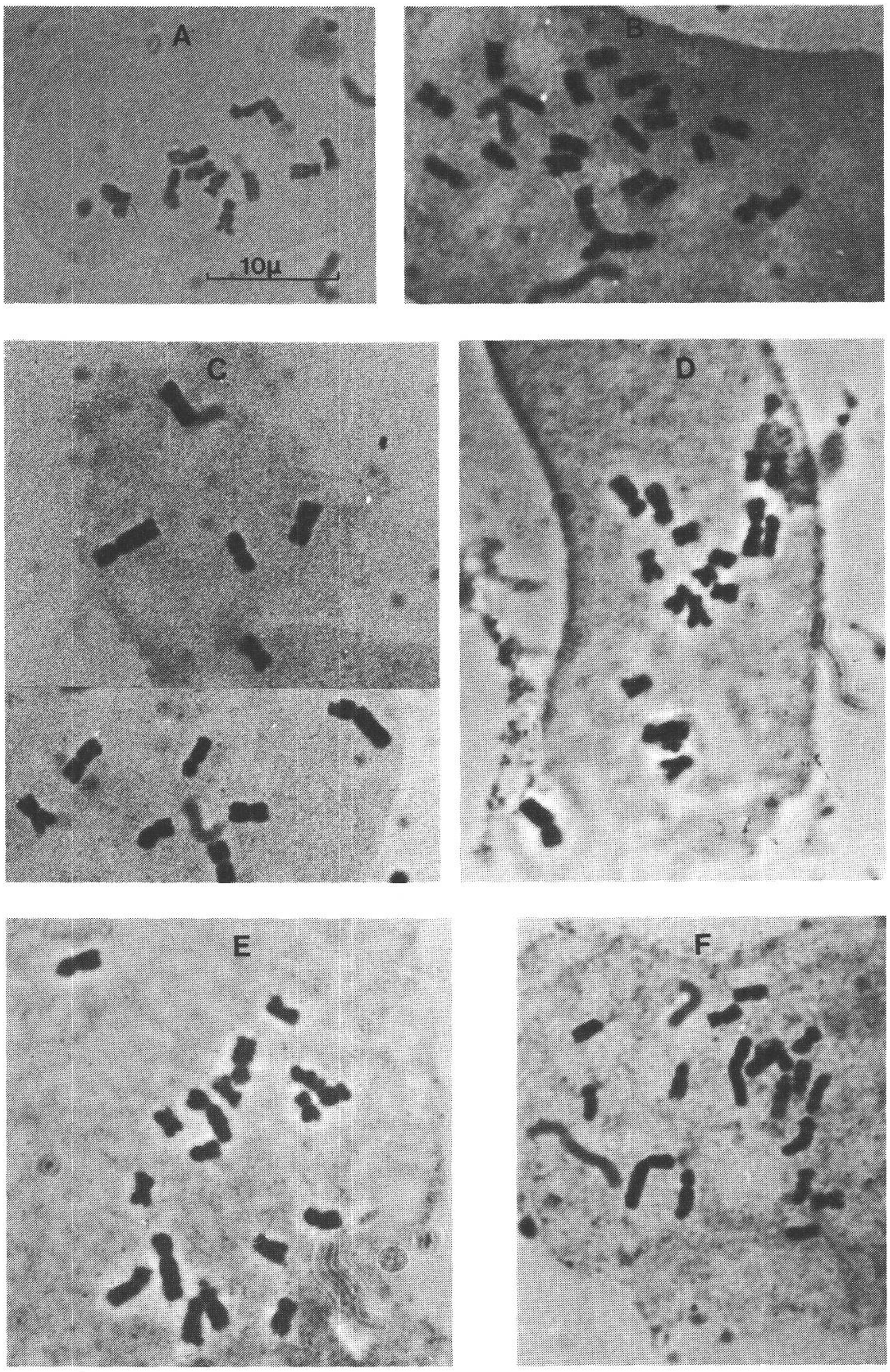

Fig. 3. Microphotographs of mitotic metaphase plates. A: *Coronilla globosa*, B: *Centaurea oliveriana*, C: *Scorzonera cretica*, D: *Lactuca viminea* ssp. *alpestris*, E: *L. acanthifolia*, F: *L. amorgina*

shorter, ± metacentric chromosomes. The cytologically investigated material seems to be heterozygous as far as the structure of the individual chromosomes of the large submetacentric chromosome pair is concerned. This is because in all cells examined only in one of the sm large chromosomes the nucleolar organizer was observed (Fig. 2B, 3C).

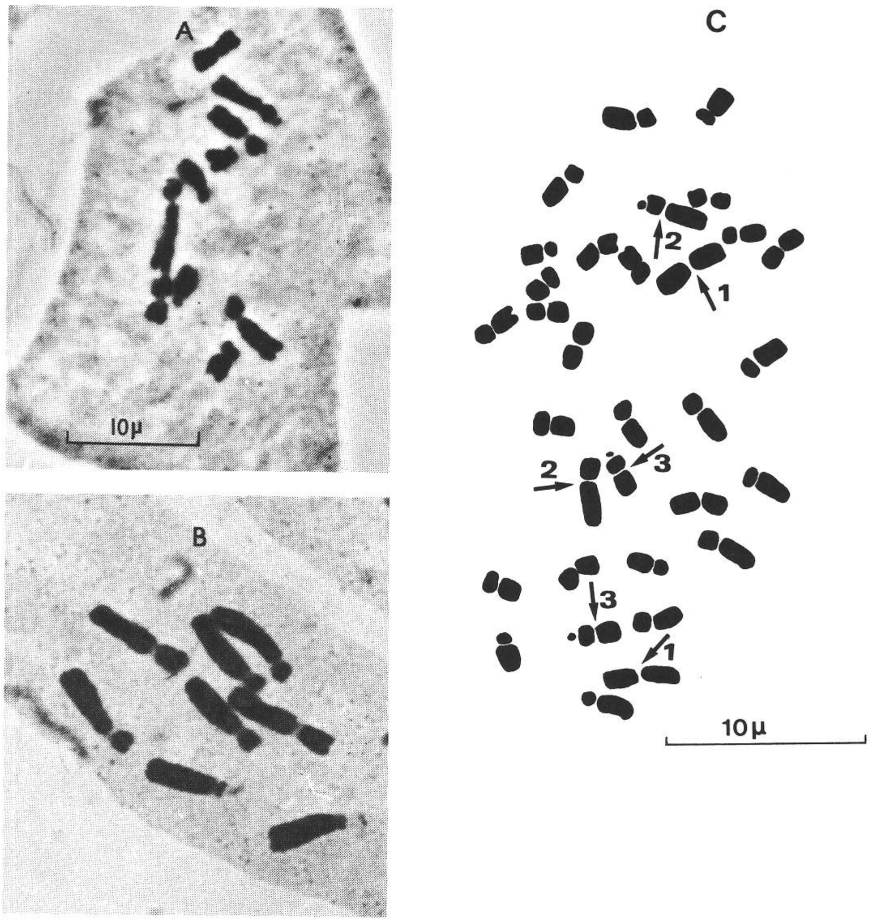

Fig. 4. Mitotic metaphase plates. A and B: microphotographs from *Crepis auriculifolia* and *C. dioscoridis* respectively, C: Drawing of karyotype of *Ptilostemon chamereuce*

Lactuca amorgina Heldr & Orph ex Halácsy (2n = 18), *L. acanthifolia* (Willd.) Boiss. (2n = 18), *L. viminea* (L) J. C. Presl ssp. *alpestris* (Gand.) Feráková (2n = 18)

Four endemic taxa of *Lactuca* have been described from the Southern Aegean area, viz. the three mentioned above, and *L. eburnea* Rech. fil. from Rhodos. In flora Europaea *L. amorgina* is included in *L. acanthifolia* but following Rechinger (1943) I consider it as a distinct species.

The present cytological study and that of Phitos and Kamari (1974) showed that all these taxa have the same diploid chromosome number, 2n = 18, and very similar chromosome complements. (Fig. 2C, 2D, 3D, 3E and 3F). These karyotypic similarities should be considered as one more taxonomical character supporting Jeffrey's (1975) opinion, that all these taxa should be placed in the distinct genus *Scariola.*

Crepis auriculifolia Sieber ex Sprengel (2n = 10)

Phitos and Kamari (1974) gave the chromosome number (2n = 10) and described the karyotype of the species based on the study of typical, low-altitude material of *C. auriculifolia.*

In the present study two mountain populations were studied and no karyotype differences were observed. The haploid complement consists of five ± anisobrachial chromosomes. In the larger chromosome and in one of the smaller ones of the haploid complement satellites were observed (Fig. 4 A).

One of the populations studied, that from the Lefka Ori, has been described as *C. raulinii* Boiss., and several botanists still prefer to consider these mountain populations as a distinct species.

Although the cytological data seems to favour Sell's (1976) opinion to unite both these taxa under the name *C. auriculifolia,* the Cretan material is very polymorphic and needs more detailed biosystematic study.

Crepis dioscoridis L. (2n = 8)

C. dioscoridis is very common in the Aegean area and very often a characteristic element of the littoral and sublittoral vegetation zones of the islands and islets.

In the populations studied the chromosome number 2n = 8 was found. The same chromosome number is also given by Babcock (1947), but his count was based on material of unknown origin.

The haploid complement consists of four large anisobrachial chromosomes. One of them is submetacentric and the remainder subtelocentric. The individual chromosomes of the smaller and more anisobrachial pair of the complement are satellited (Fig. 4 B).

Discussion

Without any doubt the rather small number of taxa studied here does not permit an extensive cytogeographical or cytotaxonomical discussion. It is worth mentioning, however, that in the majority of the taxa studied, diploid chromosome numbers were found.

This observation seems to be of special significance as most of the taxa studied are typical elements of the Aegean flora. Fifteen out of 19 are Aegean endemics and 13 are chasmophytes, i.e. members of the most characteristic of the Southern Aegean plant communities.

De Montmollin (1982, 1984) has already pointed out that polyploidy seems exceptional among the Cretan endemics. Our results are not only in agreement with de Montmollin's statement, but also suggest that perhaps this is true for the endemics in the whole Southern Aegean area. In a total of 19 taxa studied there, only three could be considered as polyploids, viz. *Senecio gnaphalodes* (2n = 40), *Convolvulus dorycnium* (2n = 30), and *Ptilostemon chamepeuce* (2n = 32). It should be pointed out, however, that not one of the three taxa mentioned above is endemic to a single island, and their distributions suggest that differentiation has taken place prior to the geographical fragmentation of the Aegean Land-mass.

References

Greuter W. 1973. Monographie der Gattung *Ptilostemon.* Boissiera 22: 1–215.
Greuter W. 1974. Floristic report on the Cretan area. Mem. Soc. Brot. 24: 131–171.
Jeffrey C. 1975. *Scariola* F. W. Schmidt. In Davis P. H. (ed.), Flora of Turkey, Vol. 5 Edinburgh.
Levan A., Fredga K. and Sandberg A. A. 1965. Nomenclature for centromeric position on chromosomes. Hederitas 52: 201–220.

Montmollin B. de 1982. Etude cytotaxonomique de la Flore endémique de la Crète. I. Bull. Soc. Neuchâtel. Sci Mat. 105: 65–77.
Montmollin B. de 1984. Etude cytotaxonomique de la flore de la Crète. II. Nombres chromosomiques. Bot. Helv. 94: 261–267.
Moore D. M. 1982. Flora Europaea, check-list and chromosome index. Cambridge Univ. Press, London.
Phitos D. und Kamari G. 1974. Zytotaxonomische Beiträge zur Flora von Kreta. I. Bot. Not. 127: 302–308.
Rechinger K. H. 1943. Flora Aegea. Denkschr. Akad. wiss. Wien Math.-Naturwiss. Kl. 105: 1.
Runemark H. 1967. Studies in the Aegean flora XII. Cytologic and morphologic investigations in Centaurea. Bot. Not. 120: 161–176.
Sa'ad F. 1967. The *Convolvulus* species of the Canary Isles, the Mediterranean Region and the Near and Middle East. Thesis Utrecht.
Sell P. D. 1976. *Crepis* L. In Tutin T. G. et al. (eds.), Flora Europaea 4: 344–357.
Tutin T. G. et al. (eds.) 1964–1976. Flora Europaea vol. 1–4 Cambridge.