

# CHROMOSOME NUMBERS OF FLOWERING PLANTS IN THE NETHERLANDS. VI

BY

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## ABSTRACT

The chromosome numbers of 67 species of Dutch Angiosperms were determined. Notes on 11 species are added.

## INTRODUCTION

The present paper, the sixth<sup>1)</sup> in this series, is a continuation of the documented list of chromosome numbers of *Angiospermae* occurring in the Netherlands. In this paper 67 species will be treated. The results obtained are compared with those of other authors, using the reference works by FEDOROV *et al.* (1969), MOORE (1970, 1971, 1972) and SOLBRIG and GADELLA (1970). From this comparison it appeared that some of the species treated show variation in chromosome number within their range. Some notes on these species are given under the heading "notes on some species".

## MATERIAL AND METHODS

The material was collected in nature. Some plants were transferred from their natural habitats to the experimental plot, but in many other cases the plants were grown from seeds. The chromosome counts were made from roottip mitoses of material fixed in Karpechenko's fixative, embedded in paraffin-wax, sectioned at 15  $\mu$  and stained according to Heidenhain's haematoxylin method. Herbarium vouchers of the plants that served for the counts were prepared and preserved in the collection of the Utrecht Herbarium.

## RESULTS

Most counts turned out to be confirmations of previous ones. Others are discussed in the next chapter. The results obtained are summarized

<sup>1)</sup> Continued from: Chromosome numbers of flowering plants in the Netherlands I. *Acta Bot. Neerl.* 12: 195-230, 1963; idem II. *Proc. Kon. Ned. Acad. Wet. ser. C* 69: 541-556, 1966; idem III. *Proc. Kon. Ned. Acad. Wet. ser. C* 70: 7-20, 1967; idem IV. *Proc. Kon. Ned. Acad. Wet. ser. C* 71: 168-183, 1968; idem V. *Proc. Kon. Ned. Acad. Wet. ser. C* 74: 335-343, 1971.

TABLE I

	Coll. no.	Provenience	2n
<b>Araceae</b>			
1. <i>Acorus calamus</i> L.	s.n.	Vuntus near Loosdrecht (prov. Utrecht)	36
2. <i>Calla palustris</i> L.	s.n.	Vuntus near Loosdrecht (prov. Utrecht)	72
<b>Boraginaceae</b>			
3. <i>Symphytum officinale</i> L.	10.734-10.735 11.885	Molenpolder near Westbroek (prov. Utrecht) Genneger Buitenland near Hasselt (prov. Overijssel)	40 48
<b>Caryophyllaceae</b>			
4. <i>Lychnis flos-cuculi</i> L.	10.823	near Terziet (prov. Limburg)	24
5. <i>Melandrium album</i> (Mill.) Gareke	12.560	Island of Schiermonnikoog (prov. Friesland)	24
6. <i>Myosoton aquaticum</i> (L.) Moench	12.572	near Rookanje, Quackjeswater (prov. Zd. Holland)	28
7. <i>Sagina nodosa</i> (L.) Fenzl	12.551	Island of Schiermonnikoog (prov. Friesland)	56
8. <i>Spergula arvensis</i> L.	12.555-12.562 12.867-12.875	Island of Schiermonnikoog (prov. Friesland) Island of Terschelling, near West-Terschelling (prov. Friesland)	18 18
<b>Chenopodiaceae</b>			
9. <i>Atriplex hastata</i> L.	12.573	near Hellevoetsluis (prov. Zd. Holland)	18
10. <i>Atriplex patula</i> L.	12.567	Island of Schiermonnikoog (prov. Friesland)	18
11. <i>Chenopodium rubrum</i> L.	12.574-12.575	near Hellevoetsluis (prov. Zd. Holland)	36
<b>Compositae</b>			
12. <i>Achillea millefolium</i> L.	12.846-12.847	Island of Terschelling, near Oosterend (prov. Friesland)	54
13. <i>Eupatorium cannabinum</i> L.	12.588	Oostvoorne, Heveringen (prov. Zd. Holland)	20
14. <i>Hieracium umbellatum</i> L.	11.531 12.593	near Hollum, Island of Ameland (prov. Friesland)	18 18
15. <i>Matricaria recutita</i> L.	12.570 12.576 12.571	Oostvoorne, Heveringen (prov. Zd. Holland) Oostvoorne (prov. Zd. Holland) Hellevoetsluis (prov. Zd. Holland)	18 18 18
16. <i>Pulicaria dysenterica</i> (L.) Bernh.	11.889-11.890	near Rookanje, Quackjeswater (prov. Zd. Holland)	18
17. <i>Senecio fluviatilis</i> Walp.		Genneger Buitenland near Hasselt (prov. Overijssel)	40

TABLE I (continued)

	Coll. no.	Provenience	2n
18. <i>Senecio jacobaea</i> L.	12.554	Oostvoorne, Heveringen (prov. Zd. Holland)	40
19. <i>Senecio sylvaticus</i> L.	11.529	near Ballum, Island of Ameland (prov. Friesland)	40
20. <i>Sonchus arvensis</i> L.	12.561	Island of Schiermonnikoog (prov. Friesland)	40
Crassulaceae	10.119	Island of Schiermonnikoog (prov. Friesland)	54
21. <i>Sedum telephium</i> L.	11.463	Vogelenzang (prov. N. Holland)	36
Cruciferae			
22. <i>Alliaria petiolata</i> (Bieb.) Cavara et Grande	12.853-12.855	near West-Terschelling, island of Terschelling (prov. Friesland)	42
23. <i>Cakile maritima</i> Scop.	12.578	near Oostvoorne (prov. Zd. Holland)	18
24. <i>Coronopus didymus</i> (L.) Sm.	12.579	near Sloterdijk (prov. N. Holland)	18
25. <i>Descurainia sophia</i> (L.) Webb ex Prantl	13.646	near Utrecht (prov. Utrecht)	32
Gramineae	11.522	near Hollum, Island of Ameland (prov. Friesland)	28
26. <i>Agrostis stolonifera</i> L.	10.120	Island of Schiermonnikoog (prov. Friesland)	28
27. <i>Calamagrostis epigejos</i> (L.) Roth	12.563	Island of Schiermonnikoog (prov. Friesland)	28
28. <i>Festuca ovina</i> L.	11.532	near Hollum, Island of Ameland (prov. Friesland)	14
Hydrocharitaceae			
29. <i>Hydrocharis morsus-ranae</i> L.	s.n.	Vuntus near Loosdrecht (prov. Utrecht)	28
30. <i>Stratiotes aloides</i> L.	s.n.	Vuntus near Loosdrecht (prov. Utrecht)	48
Labiatae			
31. <i>Lamium maculatum</i> L.	11.862	Zalkerbos near Zalk (prov. Overijssel)	18
32. <i>Thymus pulegioides</i> L.	12.584	Oostvoorne, Heveringen (prov. Zd. Holland)	28
Liliaceae			
33. <i>Allium scorodoprasum</i> L.	11.864-11.866	Zalkerbos near Zalk (prov. Overijssel)	32
34. <i>Allium ursinum</i> L.	10.798	near Bergen (prov. Nd. Holland)	14
35. <i>Allium vineale</i> L.	11.858-11.861	near Hasselt (prov. Overijssel)	32
	11.871	Zijtkolk near Hasselt (prov. Overijssel)	32

TABLE I (continued)

	Coll. no.	Provenience	2n
36. <i>Fritillaria meleagris</i> L.	11.873-11.875	Zijkolk near Hasselt (prov. Overijssel)	24
37. <i>Ornithogalum umbellatum</i> L.	11.863	Zalkerbos near Zalk (prov. Overijssel)	27
Malvaceae	11.886	Genneger Buitenland near Hasselt (prov. Overijssel)	27
38. <i>Malva neglecta</i> Wallr.	12.564	Island of Schiermonnikoog (prov. Friesland)	42
Papilionaceae			
39. <i>Lotus corniculatus</i> L.	10.327	Island of Schiermonnikoog (prov. Friesland)	24
40. <i>Tetragonolobus maritimus</i> (L.) Roth	11.282	Kunderberg near Voerendaal (prov. Limburg)	14
Plantaginaceae			
41. <i>Littorella uniflora</i> (L.) Asehrs.	12.838	near Hoorn, Island of Terschelling (prov. Friesland)	24
42. <i>Plantago major</i> L.	12.550	Island of Schiermonnikoog (prov. Friesland)	12
43. <i>Plantago maritima</i> L.	10.326	Island of Schiermonnikoog (prov. Friesland)	12
Plumbaginaceae			
44. <i>Armeria maritima</i> (Mill.) Willd.	10.115	Island of Schiermonnikoog (prov. Friesland)	18
Primulaceae			
45. <i>Lysimachia vulgaris</i> L.	12.864	Koobosjes near West-Terschelling (prov. Friesland)	70
	12.865	idem	84
	13.446-13.447	near Vlagtwedde (prov. Groningen)	84
46. <i>Samolus valerandi</i> L.	12.543	Island of Schiermonnikoog (prov. Friesland)	26
Ranunculaceae			
47. <i>Ranunculus auricomus</i> L.	11.856-11.857	near Hasselt (prov. Overijssel)	32
48. <i>Ranunculus flammula</i> L.	10.729-10.730	near Durgerdam (prov. Nd. Holland)	32
	10.821-10.822	near Terziet (prov. Limburg)	32
49. <i>Thalictrum minus</i> L.	10.116	Island of Schiermonnikoog (prov. Friesland)	42
Rhamnaceae			
50. <i>Rhamnus catharticus</i> L.	12.587	near Rockanje, Quackjeswater (prov. Zd. Holland)	24

TABLE I (continued)

	Coll. no.	Provenience	2n
<b>Rosaceae</b>			
51. <i>Potentilla anglica</i> Leitch.	12.542	Island of Schiermonnikoog (prov. Friesland)	56
52. <i>Potentilla palustris</i> (L.) Scop.	12.782	near Lage Vuursche (prov. Utrecht)	56
53. <i>Potentilla tabernaemontani</i> Aschrs.	11.528-11.530	near Ballum, Island of Ameland (prov. Friesland)	42
54. <i>Sanguisorba officinalis</i> L.	11.868	near Wilsom, Koppelerwaard (prov. Overijssel)	42
	11.883	near Hasselt (prov. Overijssel)	56
<b>Salicaceae</b>			
55. <i>Salix repens</i> L.	12.565	Island of Schiermonnikoog (prov. Friesland)	38
<b>Scheuchzeriaceae</b>			
56. <i>Triglochin maritima</i> L.	10.114	Island of Schiermonnikoog (prov. Friesland)	48
<b>Scrophulariaceae</b>			
57. <i>Veronica catenata</i> Pennell	11.432	near Werkendam (prov. Zd. Holland)	36
58. <i>Veronica filiformis</i> Sm.	11.853-11.854	near Hasselt (prov. Overijssel)	14
59. <i>Veronica longifolia</i> L.	11.880-11.881	Zijkolk near Hasselt (prov. Overijssel)	68
60. <i>Veronica officinalis</i> L.	12.844	near Gritjeplak, Island of Terschelling (prov. Friesland)	36
<b>Sparganiaceae</b>			
61. <i>Sparganium erectum</i> L.	s.n.	Vuntus near Loosdrecht (prov. Utrecht)	30
<b>Typhaceae</b>			
62. <i>Typha latifolia</i> L.	s.n.	Vuntus near Loosdrecht (prov. Utrecht)	30
<b>Umbelliferae</b>			
63. <i>Cicuta virosa</i> L.	s.n.	Vuntus near Loosdrecht (prov. Utrecht)	22
64. <i>Conium maculatum</i> L.	11.525	W. of Hollum, Island of Ameland (prov. Friesland)	22
65. <i>Eryngium maritimum</i> L.	10.799-10.800	near Bergen aan Zee (prov. Nd. Holland)	16
66. <i>Sium erectum</i> Huds.	10.701	near Eemnes, Eempolder (prov. Utrecht)	18
	10.835-10.836	Loosdrecht, Vuntus (prov. Utrecht)	18
<b>Violaceae</b>			
67. <i>Viola canina</i> L.	11.527	near Ballum, Roosduinen Island of Ameland (prov. Friesland)	40

in the table, together with the provenience of the material and the collection number under which the plants are preserved.

#### NOTES ON SOME SPECIES

The following species show intraspecific cytological variation within their range (the numbers of the species correspond to their number in the table):

#### 2. *Calla palustris* L.

The chromosome number of this species,  $2n=72$ , agrees with that previously established by LÖVE and LÖVE (1944) in plants from Northern Europe, by TARNAVSCHI (1948) in S. Europe and by WCISLO (1970) in Poland. Another cytotype,  $2n=36$ , was reported by WULFF (1939) from W. Germany, by MALESVIN-FABRÉ (1945, cited by LÖVE and LÖVE, 1961) from France, and, finally, from N. America by DUDLEY (1937) and LÖVE and LÖVE (1965). Since plants with  $2n=36$  have been found in neighbouring countries, it does not seem impossible that this cytotype is also represented in the Netherlands. For that reason, further research is required.

#### 8. *Spergula arvensis* L.

In a previous paper (GADELLA and KLIPHUIS, 1971) we were able to demonstrate the occurrence of tetraploid ( $2n=36$ ) plants near Oosterend, Island of Terschelling. All other authors (see FEDOROV *et al.*, l.c.) counted  $2n=18$ . For that reason some more populations from the Dutch Wadden area were studied cytologically. All plants, collected in two localities on the island of Schiermonnikoog and in two localities on the Island of Terschelling, turned out to be diploid ( $2n=18$ ).

#### 9. *Atriplex hastata* L. and 10. *Atriplex patula* L.

In these species the chromosome number  $2n=18$  could be demonstrated. The majority of the cells of the roottips had this number, but also endoploidy could be found in both species. This phenomenon was also met with in plants of *Atriplex hastata* L. from the Island of Schiermonnikoog (GADELLA and KLIPHUIS, 1968).

#### 16. *Pulicaria dysenterica* (L.) Bernh.

The plants studied proved to have  $2n=18$ . The same number could be established in material from the Island of Goeree and from the environment of Houten (near Utrecht), GADELLA and KLIPHUIS (1967). Other authors report  $2n=20$  [RODOLICO (1933) for material from Italy, and MAJOVSKY *et al.* (1970), for plants from Slovakia].

Also in the Netherlands plants with  $2n=20$  occur (near Schalkwijk, prov. of Utrecht, GADELLA and KLIPHUIS, 1967). As far as our material is concerned, we were unable to find morphological differences between plants with  $2n=18$  and  $2n=20$ .

18. *Senecio jacobaea* L.

In this genus the basic chromosome number is  $X=10$ . The Dutch material of *S. jacobaea* studied turned out to be tetraploid, which agrees with the number found in most other plants studied sofar (see FEDOROV *et al.*, l.c.). Only in Eastern Europe octoploids ( $2n=80$ ) were found: MAJOVSKY *et al.* (1970): Slovakia; MURIN and VACHOVA, in FEDOROV *et al.*, (l.c.): Slovenia. In the authors' opinion a close comparison of the Western and Eastern European populations is clearly needed.

30. *Stratiotes aloides* L.

Our results differ from those obtained by SCHÜRHOFF (1926), the only author who studied the cytology of *Stratiotes aloides*. He found  $2n=24$ , whereas our material from Loosdrecht turned out to have  $2n=48$ . From these data it is not possible to draw conclusions concerning the basic number of this monotypic genus:  $X=6$  or  $X=12$ .

33. *Allium scorodoprasum* L.

All authors (see FEDOROV *et al.*, l.c.) mention the occurrence of diploids ( $2n=16$ ), originating from Hungary, Slovakia and E. Alps. TSCHERMAK-WOESS (1947) found plants with  $2n=24$  in the Eastern Alps. The plants collected near Zalk were all tetraploid ( $2n=32$ ), an hitherto unreported number for this species.

42. *Plantago major* L.

This species was studied by many authors in many parts of the distribution area (see FEDOROV *et al.*, l.c.). In all cases the somatic number appeared to be  $2n=12$ , except in material from the Western Himalays, which turned out to be hexaploid ( $2n=36$ ), FAVARGER and KUNJAH NARAYANAN VASUDEVAN (1972). These authors were unable to demonstrate the occurrence of clear-cut morphological differences between these cytotypes.

45. *Lysimachia vulgaris* L.

In the Netherlands the most common chromosome number of *L. vulgaris* is  $2n=84$  (GADELLA and KLIPHUIS, 1968), but also the numbers  $2n=42$  (GADELLA and KLIPHUIS, 1971) and  $2n=56$  (GADELLA and KLIPHUIS, 1963, 1966) were found. LAANE (1969) confirmed the number  $2n=56$  in Norwegian plants. ROHWEDER (1937) reported plants with the number  $2n=28$ , but, unfortunately, the exact place of origin of his material is unknown. These data indicate that the basic number of this species is either  $X=7$  or  $X=14$ . In this paper the results obtained on two other Dutch populations are reported. The number  $2n=84$  was found again, but in one plant, originating from the island of Terschelling ("kooibosjes"), the number  $2n=70$  could be demonstrated without any doubt. In this

locality, however, also a plant with  $2n=84$  was found. From these data it becomes clear that combined morphological and cytological studies in the entire range of the species are necessary for unraveling its complexity.

#### 56. *Triglochin maritima* L.

In this species a very large polyploid series occurs, ranging from the diploid to the 24-ploid level (LÖVE and LÖVE, 1958). The Dutch material proved to be tetraploid. This highly intricate complex should be studied in its entire range, both from the morphological, and from the cytological point of view, before we can arrive at more definite conclusions with regard to the taxonomic position of the various cytotypes, including the Dutch material.

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