

## CYTOLOGICAL STUDIES IN *CYPERUS* LINN. SECTION *CYPERUS* LINN. FROM PUNJAB, NW INDIA

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Out of nine presently studied species of *Cyperus* two species namely *C. alulatus* (n=57) and *C. bulbosus* (n = 46,59) are studied for the first time. In the remaining species the known reports are confirmed as well as new chromosome numbers are recorded. As many as 91% of these species are polyploids, of these 54.5% are aneuploids. The cytological data do not support hierarchal systematic status of the section *Cyperus*.

**Key Words :** Cytotypes, Aneuploidy recurrence, Euploidy preference, Polyploidy prevalence.

In continuation of our earlier studies (Bir & Cheema 1994, Bir *et al.*, 1992, Cheema *et al.*, 1992, 1993 a,b), chromosome numbers of more species of *Cyperus* Linn. have been recorded and thus are reported in the present paper.

### MATERIALS AND METHODS

The plants with young inflorescences were collected in different localities of Punjab. For meiotic counts usual procedure was followed. Voucher specimens with detailed information about localities and collection data were deposited in the Herbarium, Department of Botany, Punjabi University, Patiala.

### RESULTS AND DISCUSSION

*Cyperus alulatus* (n=57) and *C. bulbosus* (n=46, 59) have been analysed for the first time on world wide basis. New chromosome numbers are recorded in *C. compressus* (n = 56), *C. digitatus* (n = 42, 52), *C. eleusinoides* (n = 32), *C. iria* (n = 52, 54, 58), *C. niveus* (n = 34) and *C. rotundus* (n = 52, 55, 56, 58, 66, 80).

Information about recorded chromosome numbers, some interesting observations and earlier reports, is provided in Table 1.

#### Phenotypic Variations

Various cytotypes show easily discernible morphological characteristics as reflected in Table 2 for *C. bulbosus* (n = 46, 59), *C. compressus* (n = 56, 64) and *C. digitatus* (42, 52, 54) and in Table 3 *C. difformis* (n = 9, 17, 18).

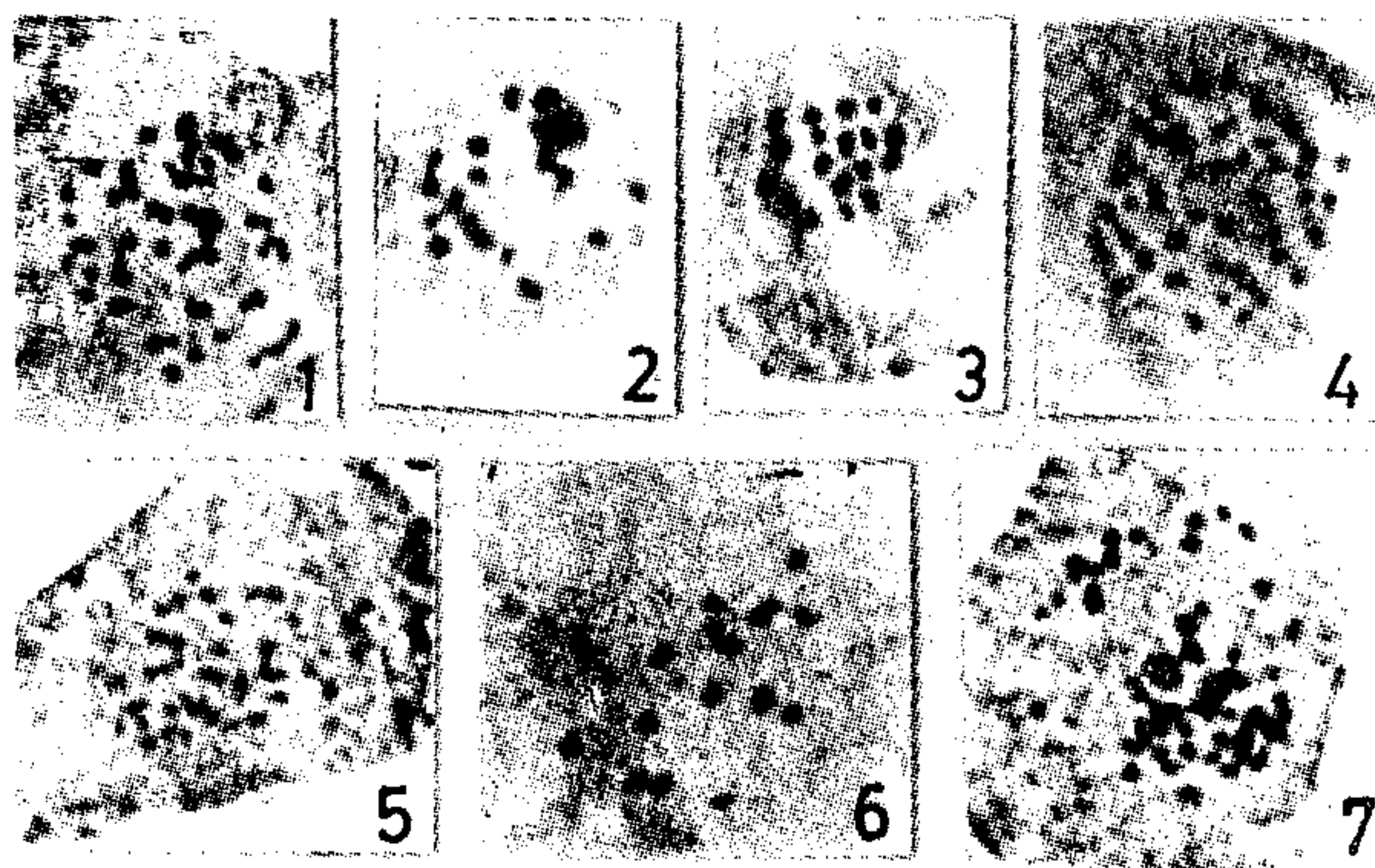
Earlier two cytotypes with n = 57 and 64 have been recorded in *C. compressus* from this laboratory (cf. Bir

*et al.*, 1988). cytotypes with n = 57 (PUN 26158) have medium-sized (8.7 - 17.2 cm) plants and low (7.-27%) pollen fertility as compared to rest for the populations. Medium-sized leaf sheaths (1.5-2.3 cm) and longer leaves (7.1-9.1 cm) are characteristic of Pop. ii with n = 64 (PUN 26156, 26157).

#### Polyploidy

Based on X=8 and 9 the basic chromosome numbers for *Cyperus* all the species (except 2 populations of *C. difformis* are polyploids varying from 2X to 16X.

No specific base numbers can be attributed to different sections of genus *Cyperus* (Kumar & Subramaniam 1987, Bir & Cheema 1994, Bir *et al.*, 1992, Cheema *et al.*, 1992, 1993 a,b) since the genus is characterised by the preponderance of both euploid and aneuploid chromosome numbers as the present studies



Figures 1-7. PMC's of 1. *Cyperus bulbosus* Pop. i showing n=46 2 & 3. *C. difformis* Pop. ii (n=17) & Pop. Vii (n=18) respectively, 4. *C. digitatus* Pop. ii (n=54), 5. *C. eleusinoides* (n=32), 6. *C. flabelliformis* (n=16), 7. *C. iria* var. *Parviflorus* (n=52).

Table 1. Chromosome numbers in members of *Cyperus* Linn. section *Cyperus* Linn. from Punjab State, NW India.

Name of the Species	Chromosome number	
	Present reports	Earlier reports and authors
<i>CYPERUS</i> LINN. X = 8,9		
<i>Cyperus alulatus</i> Kern*	n = 57, 14, X, aneu.	-
<i>C. bulbosus</i> vahl*		
Population i	n=46, 10 X, aneu., Fig. 1	-
Population ii	n = 59, 14 X, aneu.	
<i>C. compressus</i> Linn.		n = 57 (Bir <i>et al.</i> , 1988)
Population i	n = 56**, 14 X n = 64	n = C. 49 (Rath & Patnaik, 1978) (Sharma & Sarkar 1967-68; Sanyal 1972; Bir <i>et al.</i> , 1982, 1983)
<i>C. difformis</i> Linn.		
Population iv, v	n=9, 2X	n=9 (Mehra & Sachdeva 1971, 1975; Nijalingappa <i>et al.</i> , 1978; Rath & Patnaik 1978 a)
Population i,ii,vi	n=17, 4X, aneu. Fig.2	n-17 (Sanyal 1972; Baquar 1978)
Population iii, vii	n=18, 4X, Fig. 3	n-18 (Nijalingappa <i>et al.</i> , 1978) n-18 (Mehra & Sachdeva 1971 n-13(Rath <i>et al.</i> , 1973)
<i>C. digitatus</i> Roxb.		
Population i	n=52**, 12X, aneu.	2n=108 (Sharma & Sarkar 1967-68; Mehra & Sachdeva 1971; Sanyal 1972)
Population ii	n=54, 12 X Fig. 4	
Population iii	n=42**, 10X, aneu.	
<i>C. eleusinoides</i> Haines	n=32**, 8X	n=36 (Rath <i>et al.</i> , 1973)
Kunth (=C. <i>nutans</i> Vahl var. <i>eleusinoides</i> Haines	Fig. 5	2n=104 (Mehra & Sachdeva 1975, 1976) 2n - 56 (Nijalingappa 1978)
<i>C. flabelliformis</i> Rottb. (=C. <i>alternifolius</i> Linn. subsp. <i>flabelliformis</i> Kuek	n=16, 4X Fig. 6	2n =30 (Sharma & Bal 1956)
<i>C. iria</i> Linn.		
Population i	n=54* &, 12X	n=36 (Baquar 1967-68; Rath <i>et al.</i> , 1973)
Population ii	n=58**, 14X, aneu.	
<i>C. iria</i> var. <i>parviflorus</i> (Nees) Miq.	n=52**, aneu. Fig. 7	n = 64 (Mehra & Sachdeva 1971 Bir <i>et al.</i> , 1988) n-56 (Bir <i>et al.</i> , 1982, 1988) 2n = 16 (Hsu 1967)
<i>C. niveus</i> Retz+		
Population i	n=34**, 8X aneu.	n=36 (Mehra & Sachdeva 1971 1975)
Population ii	n-34**, 2\8X aneu.	n-32, 37 (Bir <i>et al.</i> , 1982, 1988)

\* Species studied for the first time.

\*\* New Chromosome number recorded for the first time in Case of the species.

+ Loose associations of two bivalents apparently looking as quadrivalents often noticed, course fo meiosis is normal.

and cumulative chromosomal data have indicated. This reaffirms our earlier view that under the genus *Cyperus* various sections are recognised purely on the basis of morphological characters. No support, how so

ever little is provided by cummulative cytological data.

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Table 2. Morphological differentiation of Cytotypes of *Cyperus compressus*, *C. bulbosus* and *C. digitatus*.

Character	<i>Cyperus compressus</i>		<i>Cyperus bulbosus</i>		<i>Cyperus digitatus</i>		
	Cytotype A (n=56)	Cytotype B (n=64)	Cytotype A (n=46)	Cytotype B (n=59)	Cytotype A (n=52)	Cytotype B (n=54)	Cytotype C (n=42)
	Population i	Population ii	Population i	Population ii	Population i	Population ii	Population iii
Locality	University campus (Patiala)	University campus (Patiala)	University campus (Patiala)	Chhoti Daun (Patiala)	Thermal plant (Bhatinda)	beas (Jalandhar)	Zirakpur (Patiala)
Plant height	20.0-29.0 cm	6.0-10.0 cm	30.0-38.0 cm	21.0-25.0 cm	151.0-163.0 cm	170.0-190.0 cm	170.0-196.0 cm
Stem Perimeter	0.2-0.3 cm	0.3-0.4 cm	0.2-0.3 cm	0.15-0.2 cm	3.4-4.5 cm	2.2 cm	2.2-2.5 cm
Leaf							
A Leaf sheath length	2.5-3.5 cm	0.5-0.7 cm	3.2-4.0 cm	2.0-2.5 cm	29.0-36.5 cm	30.0-34.0 cm	17.5-22.0 cm
B Leaf lamina length	7.0-10.0 cm	1.0-2.5 cm	19.0-25.0 cm	10.0-12.5 cm	60.76.0 cm	79.0-85.0 cm	91.0-101.0 cm
C Leaf lamina breadth	0.1-0.15 cm	0.06-0.12 cm	0.1-0.2 cm	0.1-0.15 cm	1.0-cm	0.6 cm	0.5 cm
D. Epidermal cell length	56.0 µm	59.0 µm	118.80 µm	83.16 µm	79.20 µm	59.40 µm	99.0 µm
E Stomata							
(a) Average stomata length	35.0 µm	31.0 µm	27.72 µm	27.72 µm	27.72 µm	31.68 µm	23.76 µm
(b) Average stomata breadth*	11.0 µm	12.0 µm	11.85 µm	15.84 µm	19.80 µm	19.80 µm	19.80 µm
(c) Stomatal Index	15	16	29.4	19.5	22.50	25.0	24.6
(d) Stomatal frequency/unit area	2-3	3-4	5	3	3-4	4-5	4
Spike Length	1.7-2.2 cm	1.7-2.1 cm	3.0-4.0 cm	1.7-2.0 cm	10.0-14.0 cm	9.0-14.0 cm	14.0-18.0 cm
Spikelet							
(a) Length	0.6-0.7 cm	0.5-1.2 cm	1.0-1.2 cm	1.0-1.1 cm	0.15-0.2 cm	0.15-0.2 cm	0.4-0.5 cm
(b) Breadth	0.15-0.25	0.2-0.3	0.2 cm	0.15 cm	0.1 cm	0.1 cm	0.1 cm
Pollen							
(a) Size	23.28 X 23-25 µm	20-28 X 19-23µm	25-31 X 20-23µm	26-32 X 20-24µm	20-24 X 16-22µm	20-23 X 16-21µm	20-24 X 12-22µm
(b) Fertility	29%	23%	75%	92%	87%	88%	93%

\* Based on average of 10 readings.

\*\* Based on average of 50 readings.

Table 3. Morphological differentiation of various biotypes in *Cyperus difformis*.

Character	Tetraploid aneu. (n=17)			Tetraploid (n=18)		Diploid (n=9)	
	Population i	Population ii	Population vi	Population iii	Population vii	Population iv	Population V
Locality	nadampur (Patiala)	Sangrur	Boharpur (Patiala)	Sangrur	Beas (Jalandhar)	nangal (Ropar)	nangal (Ropar)
Plant height	35.0-39.0 cm	38.5-42.0 cm	36.5 cm	9.0 cm	50.0-54.0 cm	9.5-15.0 cm	20.9-23.5 cm
Stem Perimeter	0.3-0.5 cm	0.6-0.9 cm	0.3-0.5 cm	0.4 cm	0.5 cm	0.5 cm	0.6 cm
Leaf							
A Leaf sheath length	5.4-6.9 cm	1.9-4.3 cm	2.0-4.0 cm	1.2-2.0 cm	2.2-4.0 cm	1.0-3.5 cm	1.5-3.5 cm
B Leaf lamina length	9.0-14.2 cm	4.5-22.0 cm	13.0-17.5 cm	1.7-7.2 cm	16.0-19.5 cm	3.5-13.0 cm	3.0-16.0 cm
C Leaf lamina breadth	0.1-0.3 cm	0.2 cm	0.1-0.2 cm	0.1 cm	0.3 cm	0.3 cm	0.2 cm
D Epidermal cell length	79.02 µm	95.04µm	79.20 µm	95.04µm	79.20 µm	150.48µm	142.56 µm
E Stomata							
(a) Average stomata length*	48.0 µm	39.60µm	35.64µm	35.64µm	39.60µm	39.60µm	43.56µm
(b) Average stomata breadth*	18.0 µm	19.80µm	19.80µm	9.9µm	23.76µm	31.68µm	
(c) Stomatal Index	20	22.7	32.94	16.6	33.33	42.1	35
(d) Stomatal frequency/unit area	3-4	5	5-6	1-2	5-6	8-9	6-7
Spikelet							
(a) Length	0.2-0.4 cm	0.5-0.9 cm	0.1-0.2 cm	0.2 cm	0.25 cm	0.2 cm	0.2 cm
(b) Breadth	0.1 cm	0.5 cm	0.1 cm	0.1 cm	0.1 cm	0.1 cm	0.1 cm
Pollen							
(a) Size**	22-26 X 20-24 µm	22-28 X 18-24 µm	18-20 X 16-20 µm	20-24 X 16-18 µm	18-22 X 16-20µm	20-24 X 20 µm	24-28 X 16-24µm
(b) Fertility	51%	86%	83%	89%	86%	61%	51%

\* Based on average of 10 readings.

\*\* Based on average of 50 readings.

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