Intraspecific Polyploidy in *Galinsoga parviflora* Ruiz and Pavon

Santosh Bala, Henna Goyal and Raghbir C. Gupta
Department of Botany, Punjabi University, Patiala-147002, Punjab, India

ABSTRACT

Detailed cytomorphological study has been made on ten populations of *Galinsoga parviflora* cav. (Asteraceae) from north and central India. Besides, diploid accessions, three tetraploid accessions were also reported from the study area. The tetraploid cytotype is reported for the first time from north India. Although, both diploids (2n=16) and tetraploids (2n=32) look alike but have some macro and micro differences. Among diploids, only Salli, Kangra accession shows some abnormality in the form of chromatin stickiness (60 %) at metaphase I. Further course of meiosis was normal leading to high pollen fertility (97-100 %). Meiosis in tetraploids was normal with relatively low pollen fertility (86%).

Key words: Asteraceae, *Galinsoga parviflora*, intraspecific polyploidy

INTRODUCTION

Asteraceae is recognized as the largest family of flowering plants and according to the Royal Botanical Gardens of Kew, the family is represented by 1600 genera and more than 23, 000 species all over the world. From India ca 900 species under 167 genera are reported (Hajra *et al.*, 1995). Polyploidy is a common phenomenon in plants with an estimated frequency between 30 and 80% (Masterson, 1994) and in members of Indian Asteraceae reports by Gupta and Gill (1984). Presence of plants of several ploidy levels within local populations is widespread (Stebbins, 1971). Polyploidy has had a fundamental role in plant evolution and offer unrivalled opportunities for investigation of evolutionary and ecological significance of polyploidy.

Galinsoga commonly known as Gallant Soldier or Quickweed has ca 16 species worldwide and only 2 in India. The genus is an annual herb found in moist temperate and subtropical regions of the world. It is native to South America,

but due to human activity has spread far from its original range to become "a cosmopolitan weed" (Gleason and Cronquist, 1991). It is distributed more or less throughout India, ascending up to 2,000 m. The present paper deals with the detailed comparison of cytomorphological characters of two cytotypes of *Galinsoga parviflora*.

MATERIAL AND METHODS

The species studied on accession basis from north and central India (Table 1). For meiotic studies appropriate sized capitula were fixed in Carnoy's fixative. Smears of pollen mother cells were prepared in acetocarmine using standard technique. Pollen fertility was estimated by mounting them in 50% glycero-acetocarmine. For stomata studies, mature leaves were treated with KOH, then epidermal peels stained with saffarnin.

Table 1. Data on locality, altitude, accession number, meiotic chromosome number, ploidy level, pollen size, pollen fertility and meiotic course of presently investigated accessions of *Galinsoga parviflora*

S.No.	Locality with altitude (m)	Accession number (PUN)*	Meiotic Chromosome	Ploidy level	Pollen size (µm)	pollen fertility (%age)	Meiotic course
A.	Himachal Pradesh						
	Manali: Kullu, 2100	49291	8	2x	22.50 x 22.50	97	Normal
	Mecleodganj, 1780	49375	16	4x	19.50 x 27.50	87	Normal
	Sali,1500	52609	8	2x	22.50 x 26.25	97	Abnormal
	Palampur, 1219	52610	8	2x	15.75 x 18.75	98	Normal
	Dharamsala, 1500	52611	16	4x	22.50 x 30.00	86	Normal
	Shimla, 2100	24564	8	2x	17.60 x 19.50	100	Normal
	Chhota Banghal, 2500	52612	8	2x	22.50 x 22.50	98	Normal
B.	Utrakhand						
	Mussoorie, 2000	24565	8	2x	18.75 x 19.50	98	Normal
		52613	16	4x	22.50 x 30.00	85	Normal
C.	Madhya Pradesh						
	Pachmarhi, 700	24492	8	2x	18.75 x 19.50	99	Normal

RESULTS AND DISCUSSION

Morphologically, the tetraploids do not show any robust and gigas effect due to polyploidy, excluding some characters like number of branches, number of capitula per plant and seeds per capitulum are relatively more in tetraploids. The tetraploid accessions have dominantly dark green colored leaves than diploids.

Morphological comparison of two cytotypes is given in Table 2 (Figs a and b).

Cytologically, seven populations are found to be diploid with 2n=16 and three populations are tetraploid with 2n=32. The diploid cytotype has normal 8 bivalents (Fig. c) in all the populations and the tetraploid one has 16 bivalents regularly constitutes at diakinesis/metaphase 1 (Fig. d). Thus, the tetraploid cytotype show the allopolyploid behaviour. Though in literature there are many reports of only bivalents formation in artificially produced autotetraploid also (Gottschalk, 1978). Meiotic course in all the accessions of species is normal except one. The Salli population shows the occurrence of stickiness at metaphase 1 in 60% PMCs. Further course of meiosis was normal with high percentage of pollen fertility in diploids (97-100) and relatively low in tetraploids (86). All diploid accessions show variation in pollen size ranging from 15.75 - 18.75 µm in Palampur population to maximum (22.50 - 26.25µm) in Salli population. Tetraploids show two ranges of size, small (17.60 - 22.50µm) and large (27.50 - 30µm).

Tetraploid cytotype in *Galinsoga parviflora* is a new report from North India.

Table 2. Comparison of some characters of diploid and tetraploid accessions of *Galinsoga parviflora*

Character	Diploid (2n=16)	Tetraploid (2n=32)
Plant height (cm)	35-40	20-25
Number of branches/plant	5-6	10-14
Petiole length (cm)	1.2-1.6	0.3-0.6
Leaf size (cm)	2.7-3.5 x1.1-2.2	1.2-2.9 x 0.4-1.2
Color of leaves	green	dark green
Number of capitula/plant	38-40	56-60
Peduncle length (cm)	2-2.2	1.2-1.3
Stomata size		
Upper epidermis	23.24-31.54 x 18.26-21.58	21.58-27.39 x 13.28-16.60
Lower epidermis	29.88-34.86 x 11.95-13.28	24.90-28.22 x 16.26-18.26
Frequency/mm²		
Upper epidermis	2.33	1.5
Lower epidermis	1.5	1.0
Stomatal Index		
Upper epidermis	32.54	16.67
Lower epidermis	25.06	14.28
Microsporogenesis	Abnormal	Normal
Pollen size (µm)	22.50-26.25	22.50-30.00
Pollen fertility	97	86
Number of seeds/capitulum	12-15	22-26

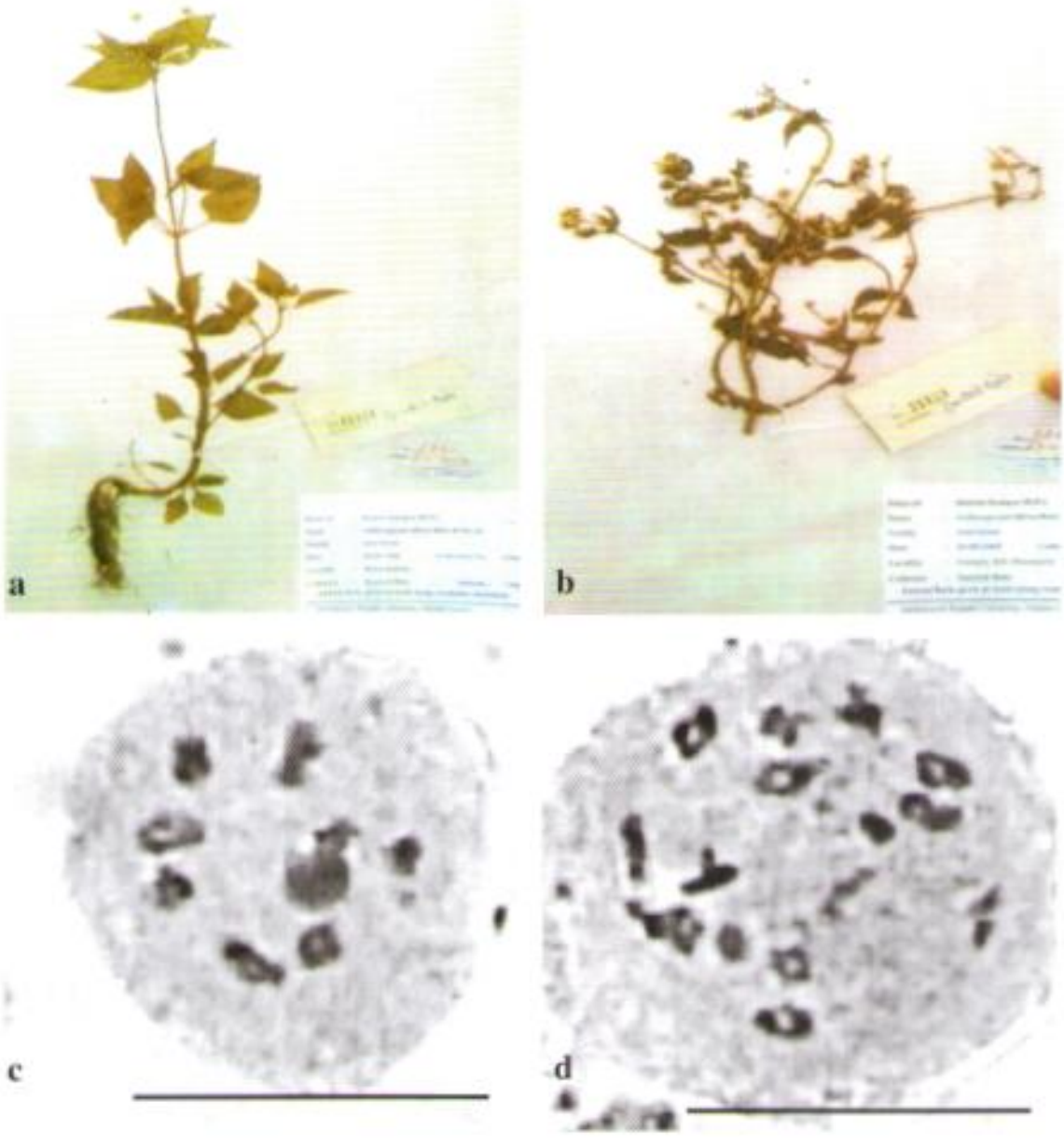

Fig. 1. *Galinsoga parviflora* (a) Diploid plant (2n=16), (b) Tetraploid plant (2n=32), (c) PMC with 8 II at diakinesis and (d) PMC with 16 II at metaphase I

although it is earliar reported from South India (Jose and Methew, 1995; Nirmala and Rao, 1981). The present investigation confirms the earliar findings with respect to the chromosomal counts made at diploid level (Banerjee, 1971; Gupta *et al.*, 1989). There are some reports of tetraploid cytotype from outside India (Canne, 1977; Weedin and Powell, 1978, Ward, 1983). Besides diploids and tetraploids, there is a report of triploid cytotype also from India by Gopinanthan and Babu (1981).

Polyploidy particularly autotetraploidy is generally associated with increased cell size and produces gigatism (Bali and Tondon, 1956). Tetraploids in the present report are less robust and show reduction in plant size as compared to diploid one. Though the number of capitula/ plant, number of branches/ plant, and number of seeds/ capitulum are found to be more in tetraploid cytotypes. Similarly the polyploid in *Chrysanthemum coronarium* (Gupta and Gill, 1985), tetraploids are found to be small sized as compared to diploids whereas many species of Asteraceae are polyploid and show gigatism as compared to diploids.

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