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Karyomorphological Work in Two Endemic Species of *Tricholepis* (Asteraceae) in India

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Summary Genus *Tricholepis* DC. comprises about 18 species worldwide, of which India represents 10 species and one variety. Among the 10 species, 3 are endemic to the region, *viz. Tricholepis amplexicaulis* C. B. Clarke, *T. glaberrima* DC. and *T. radicans* DC. Somatic chromosome counts of *T. amplexicaulis* and karyotypic analysis of *T. amplexicaulis* and *T. glaberrima* have been reported for the first time in the present communication.

Key words Asteraceae, India, Karyomorphology, *Tricholepis amplexicaulis*, *T. glaberrima*.

With more than 1,600 genera and 23,000 species, Asteraceae forms the largest family of the flowering plants (Funk *et al.* 2009). In India, Asteraceae are represented by *ca.* 900 species under 167 genera (Hajra *et al.* 1995). The family Asteraceae is of great economic importance with a special status in floriculture, medicine, source of oil, insecticide, dye, ornamentals, *etc.* Due to the wide morphological as well as ecological diversity and the existence of many evolutionary trends in different floral parts, the Asteraceae family offers a suitable material for detailed cytological studies. It shows interesting features like polyploidy, hybridization, apomixis, *etc.*, which are important from the evolution point of the species.

Cytological studies, particularly on Asteraceae, were made by many workers (Raven *et al.* 1960, Moore and Frankton 1962, Ornduff *et al.* 1963, Solbrig *et al.* 1969, Strother 1976, *etc.*). The cytology of Indian Asteraceae have been carried out by Sobti and Singh (1961); Mehra *et al.* (1965); Mehra and Remanandan (1974, 1975, 1976); Gupta and Gill (1983, 1989); Gupta *et al.* (1989); Sharma and Sarkar (1967–1968); Subramanyam and Kamble (1967); Mathew and Mathew (1978, 1983, 1988) and Shukur *et al.* (1977). Gupta *et al.* (1989) made cytological analyses on 40 wild species of West Himalayan Compositae and gave notes on the presence of B-chromosomes, intra- and inter-specific polyploidy, meiotic abnormalities, incidence of polyploidy, apomixis, hybridization and polyploidy. Hill (1983) studied the chromosome number and morphology of chromosomes for 12 species of *Aster* which helped in revising the classification of the genus into several subgenera and sections. Love (1979) reported chromosome numbers in some indigenous taxa of Asteraceae, *viz. Blumea lanceolaria* (Roxb.) Druce n=10; *Conyza leucantha* (D. Don) Ludlow & Raven. n=9; *Picris hieracioides* L. 2n=10; *Sonchus asper* (L.) Hill. 2n=18; and *Tricholepis glaberrima* DC. n=16.

Tricholepis is a Greek word meaning *thrix*, *trichos* "hair" and *lepis*, *lepidos* "scale." The genus was established by de Candolle (1838) with five species. Afterwards there were several additions by Dalzell and Gibson (1861), Kurz (1872), Clarke (1876), Dunn (1927), Linczevski (1954), Kitamura (1964), Rechinger (1980) and Dittrich (1993), raising the total number of species to 18

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distributed in Afganistan, India, Pakistan, Nepal, Bhutan, Myanmar, Thailand, Iran and Tadjikistan (Bremer 1994). Chaudhary and Pandey (2001) described 10 species and one variety within the political boundaries of present day India falling under three sections of *Tricholepis*, *viz.*, sect. *Tricholepis*, sect. *Ochanoppapus* and sect. *Stictophyllum* concentrated in the North West Himalayas and Peninsular India. *T. amplexicaulis* C. B. Clarke, *T. glaberrima* DC. and *T. radicans* DC. are endemic to India. The cytological studies in the genus were neglected. In present investigation somatic chromosome counts of *T. amplexicaulis* and karyotypic analysis of *T. amplexicaulis* and *T. glaberrima* have been reported for the first time.

Materials and methods

The plant material for the present investigation (achenes) was collected from Western Ghats. Mitosis was studied from healthy root tips. The root tips of 6–10 mm length were pretreated with saturated solution of *para*-dichlorobezene (PDB) for 3 to 4 h at 9±3°C. The root tips were squashed in 2% propionic orcein. The well-spread somatic plates were photographed with a Leica EC3 camera at 1000× magnification under a Leica DM 2000 microscope. Ten well-spread somatic chromosome plates were analyzed for karyotype analysis. For analysis and comparison of the karyotype, the chromosomes were categorized on the basis of their length and centromeric position (Levan *et al.* 1964). The degree of karyotype asymmetry has been determined as per the categories of Stebbins (1971).

The voucher specimens are deposited in Herbarium, Department of Botany, Shivaji University, Kolhapur (SUK).

Results

Both *Tricholepis amplexicaulis* and *T. glaberrima* showed somatic chromosome counts of (2*n*)=32. Chromosomes ranged from 0.63 to 1.41 μm in *T. amplexicaulis* and 0.52 to 1.19 μm in *T. glaberrima* in length. The arm ratio ranged from 1.39 to 1.33 in *T. amplexicaulis* and 1.38 to 1.17 in *T. glaberrima*. Both species showed only m-type of chromosomes. On the basis of chromosome length both species showed the same karyotypic formula (2*n*)=32=$2A^m+8B^m+18C^m+2D^m+2E^m$ and 1A category as per Stebbins (1971) classification.

Table 1. Karyomorphological analysis of *Tricholepis amplexicaulis* DC.

Chromosome pairs	Long arm (l) (μm)	Short arm (s) (μm)	Total (c=l+s) (μm)	*d* Value (l–s)	*r* Value (l/s)	*i* Value (s/c×100)	Centromeric position
1	0.82±0.15	0.59±0.1	1.41±0.25	0.23	1.39	41.84	m
2	0.71±0.12	0.53±0.09	1.24±0.21	0.18	1.34	42.74	m
3	0.66±0.04	0.49±0.11	1.15±0.15	0.17	1.35	42.61	m
4	0.66±0.09	0.44±0.08	1.1±0.17	0.22	1.5	40	m
5	0.64±0.12	0.43±0.08	1.07±0.2	0.21	1.49	40.19	m
6	0.57±0.09	0.43±0.07	1±0.16	0.14	1.33	43	m
7	0.54±0.08	0.43±0.06	0.97± 0.14	0.11	1.26	44.33	m
8	0.52±0.09	0.41±0.07	0.93±0.16	0.11	1.27	44.09	m
9	0.52±0.08	0.38±0.09	0.9±0.17	0.14	1.37	42.22	m
10	0.52±0.1	0.36±0.06	0.88±0.16	0.16	1.44	40.91	m
11	0.49±0.06	0.37±0.09	0.86±0.15	0.12	1.32	43.02	m
12	0.46±0.1	0.36±0.07	0.82±0.17	0.1	1.28	43.90	m
13	0.47±0.09	0.32±0.07	0.79±0.16	0.15	1.47	40.51	m
14	0.42±0.08	0.33±0.07	0.75±0.15	0.09	1.27	44	m
15	0.38±0.07	0.31±0.06	0.69±0.13	0.07	1.23	44.93	m
16	0.36±0.05	0.27±0.05	0.63±0.1	0.09	1.33	42.86	m

Table 2. Karyomorphological analysis of *Tricholepis glaberrima* DC.

Chromosome pairs	Long arm (l) (μm)	Short arm (s) (μm)	Total (c=l+s) (μm)	*d* Value (l–s)	*r* Value (l/s)	*i* Value (s/c×100)	Centromeric position
1	0.69±0.07	0.5±0.07	1.19±0.14	0.19	1.38	42.02	m
2	0.64±0.07	0.44±0.06	1.08±0.13	0.2	1.45	40.74	m
3	0.61±0.08	0.39±0.07	1±0.15	0.22	1.56	39	m
4	0.56±0.08	0.41±0.05	0.97±0.13	0.15	1.37	42.27	m
5	0.54±0.07	0.4±0.04	0.94±0.11	0.14	1.35	42.55	m
6	0.51±0.05	0.38±0.04	0.89±0.09	0.13	1.34	42.7	m
7	0.5±0.05	0.35±0.05	0.85±0.1	0.15	1.43	41.18	m
8	0.46±0.05	0.36±0.02	0.82±0.07	0.1	1.28	43.90	m
9	0.46±0.05	0.33±0.04	0.79±0.09	0.13	1.39	41.77	m
10	0.42±0.04	0.34±0.02	0.76±0.06	0.08	1.24	44.74	m
11	0.42±0.04	0.32±0.02	0.74±0.06	0.1	1.31	43.24	m
12	0.41±0.04	0.32±0.03	0.73±0.07	0.09	1.28	43.84	m
13	0.38±0.04	0.32±0.03	0.7±0.07	0.06	1.19	45.71	m
14	0.4±0.04	0.27±0.03	0.67±0.07	0.13	1.48	40.30	m
15	0.36±0.04	0.25±0.04	0.61±0.08	0.11	1.44	40.98	m
16	0.28±0.06	0.24±0.02	0.52±0.08	0.04	1.17	46.15	m

Table 3. Comparative karyotypic parameters of *Tricholepis amplexicaulis* and *T. glaberrima*.

Sr. No.	Parameters	*T. amplexicaulis*	*T. glaberrima*
1.	THCL	15.19	13.26
2.	Range of TCL%	4.15–9.28	3.92–8.97
3.	TF%	42.46	42.38
4.	SI	73.80	73.56
5.	GI	44.68	43.70
6.	R	0.45	0.44
7.	CVcl	21.82	21.32
8.	Cvci	3.60	4.62
9.	Ai	0.79	0.99
10.	A1	0.68	0.67
11.	A2	0.22	0.21
12.	Karyotypic formulae	$2n=32=2A^m+8B^m+18C^m+2D^m+2E^m$	$2n=32=2A^m+8B^m+18C^m+2D^m+2E^m$
13.	Classification as per Stebbins (1971)	1A	1A

Table 4. *Tricholepis* species and their chromosome counts.

Sr. No.	Species	Chromosome counts	Author
1.	*Tricholepis radicans* (Roxb.) DC.	*n*=16	Gupta and Gill (1989)
2.	*Tricholepis glaberrima* DC.	*n*=16	Gupta and Gill (1979)
3.	*Tricholepis stewartei* Clarke	2*n*=16	Mehra *et al.* (1965); Mehra and Remanandan (1976)
		n=8	Mehra *et al.* (1965)
4.	*Tricholepis elongata* DC.	2*n*=32	Mehra and Remanandan (1976)
		n=16	Mehra *et al.* (1965)

Karyotypic analyses of *T. amplexicaulis* and *T. glaberrima* are given in Tables 1 and 2, respectively. Comparative karyotypic parameters of both species are summarized in Table 3.

Discussion

Earlier workers reported somatic counts of 2*n*=16 and 32 and meiotic counts of *n*=8 and 16 in different species of *Tricholepis* (Table 4). Somatic chromosome counts of (2*n*)=32 of *Tricholepis*

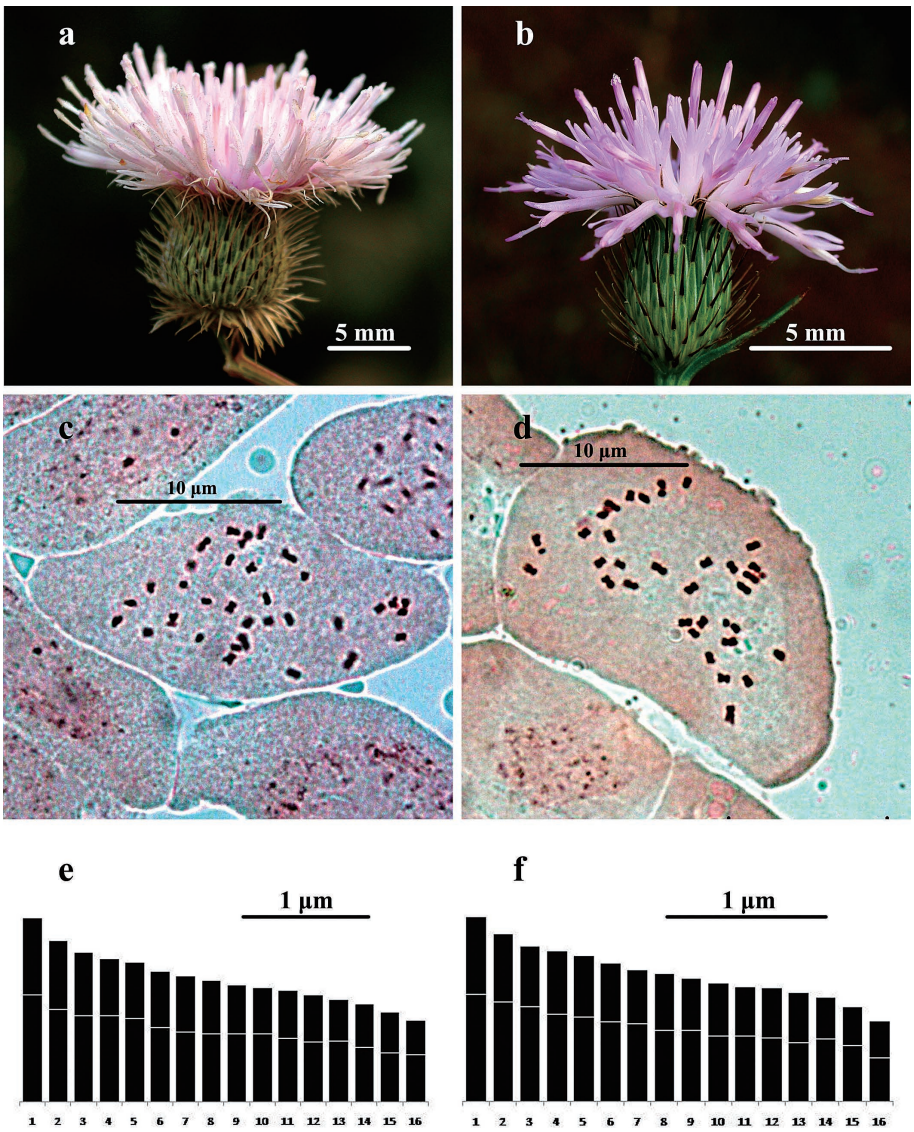

Fig. 1. *Tricholepis amplexicaulis* C. B. Clarke and *Tricholepis glaberrima* DC., (a) head of *T. amplexicaulis*, (b) head of *T. glaberrima*, (c) somatic plate of *T. amplexicaulis* showing 2*n*=32, (d) somatic plate of *T. glaberrima* showing 2*n*=32, (e) ideograph of *T. amplexicaulis*, (f) ideograph of *T. glaberrima*.

amplexicaulis (Fig. 1c) have been reported for the first time while somatic chromosome counts of (2*n*)=32 of *T. glaberrima* have been reconfirmed (Fig. 1d). Both the species have m-type of chromosome (Levan *et al.* 1964) with karyotype formula $2n=32=2A^m+8B^m+18C^m+2D^m+2E^m$ and 1A Category (Stebbins 1971).

T. amplexicaulis and *T. glaberrima* are quite distinct in their morphology but cytologically both have similar chromosome number as well as chromosome morphology.

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