Karyomorphology of the Genus *Eleiotis* (Fabaceae) from India

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Summary The genus *Eleiotis* DC. (Fabaceae) is distributed from Burma to Sri Lanka and represented by only two species. The genus has not been screened for its cytological characters. In the present investigation, the mitotic chromosome counts ($2n=20+2b$) and basic karyomorphology in *Eleiotis rottleri* are reported for the first time and chromosome counts ($2n=20+2b$) in *E. monophyllos* are reported as a new cytotype. Generic cytotaxonomical characters of the genus *Eleiotis* viz. mitotic chromosome counts $2n=20+2b$, two B-chromosomes and 1B category as per Stebbin asymmetry classes are also reported.

Key words B-Chromosome, Chromosome count ($2n$), *Eleiotis monophyllos*, *E. rottleri*, Karyomorphology, India.

The genus *Eleiotis* DC belongs to the tribe Desmodieae of the sub-family Faboideae (Fabaceae) and comprises just two species (Mabberley 2008), *E. monophyllos* (Burm.f.) DC. and *E. rottleri* Wight & Arn. *Eleiotis monophyllos* is distributed in Myanmar, India, and Sri Lanka (Nemotoa *et al.* 2010) while, *E. rottleri* is endemic to India and so far, reported from Karnataka state of India (Singh *et al.* 2015). *Eleiotis monophyllos* and *E. rottleri* can be easily distinguished by their leaf characteristics (unifoliolate and trifoliolate leaf, respectively). Both species of the genus grow in dry to arid areas. Chromosome counts and karyotype of *E. monophyllos* are reported by Bir and Kumari (1977, 1978) and Kumari and Bir (1990). So far no detailed investigations have been made on chromosome counts and karyomorphology of *E. rottleri* and karyomorphological features at a generic level. Present communication provided chromosome counts ($2n$) and karyomorphology of *E. rottleri* for the first time and cytotaxonomical features of the genus *Eleiotis*.

Materials and methods

Seeds of *E. monophyllos* were collected from cultivated fields around Badami city of Bagalkot dist. in Karnataka state while that of *E. rottleri* were collected from the Sutkatti region in Belgam dist. of Karnataka state. The voucher specimens are deposited in the Herbarium,

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Mitosis was studied from the root tips of germinated seeds. Seeds were germinated between two moist blotting papers in glass petri plates. Root tips of 6–10 mm length were pre-treated with saturated solution of *Para*-dichlorobenzene (pDB) at $8\pm 10^\circ\text{C}$ for 3–4 h. The root tips were squashed in 2% propionic orcein. Ten well-spread somatic chromosomes plates of each species were analyzed for karyotype analysis. The well-spread somatic plates were photographed with Leica EC3 camera at 1000x magnification under Leica DM 2000 microscope. Types of chromosomes were evaluated by using centromeric index (i) (Levan *et al.* 1964) and categories were determined by following classes of Stebbins (1971).

Results

The basic karyotypic analyses of *Eleiotis monophyllos* and *E. rottleri* are given in Tables 1 and 2, respectively. Different karyotypic parameters such as total chromosome length of haploid complement (THCL), total chromosome length percent (TCL %), total form percent (TF %), symmetric index (SI), gradient index (GI), Coefficient of Variation indices (CVcl and CVci) (Paszko 2006), and asymmetry indices (Ai, A1, A2) (Zarco 1986), were examined for both species of *Eleiotis*. These parameters are given in Table 3.

Eleiotis monophyllos and *E. rottleri* showed same somatic chromosome counts *i.e.*, $2n=20$ with two B-chromosomes ($20+2bs$) (Fig. 1b, 1c and Fig. 1e, 1f,

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Table 1. Karyomorphological analysis of *Eleiotis monophyllos* (Burm. f.) DC.

Chromosome pair	Long arm (l) (μm)	Short arm (s) (μm)	Total length C=l+s (μm)	'd' value l-s (μm)	'r' value l/s (μm)	'i' value s/c $\times$ 100	Centromeric position
I	0.86 $\pm$ 0.25	0.66 $\pm$ 0.08	1.52 $\pm$ 0.29	0.20	1.31	43.99	m
II	0.81 $\pm$ 0.25	0.56 $\pm$ 0.12	1.37 $\pm$ 0.26	0.25	1.54	41.26	m
III	0.77 $\pm$ 0.26	0.49 $\pm$ 0.09	1.26 $\pm$ 0.26	0.28	1.62	39.86	m
IV	0.72 $\pm$ 0.19	0.43 $\pm$ 0.08	1.15 $\pm$ 0.24	0.29	1.69	37.6	m
V	0.65 $\pm$ 0.21	0.42 $\pm$ 0.07	1.07 $\pm$ 0.24	0.23	1.57	40.07	m
VI	0.58 $\pm$ 0.17	0.39 $\pm$ 0.07	0.97 $\pm$ 0.2	0.19	1.53	40.52	m
VII	0.55 $\pm$ 0.17	0.35 $\pm$ 0.06	0.9 $\pm$ 0.19	0.2	1.63	39.49	m
VIII	0.54 $\pm$ 0.14	0.3 $\pm$ 0.04	0.84 $\pm$ 0.16	0.23	1.77	36.77	sm
IX	0.49 $\pm$ 0.16	0.3 $\pm$ 0.06	0.79 $\pm$ 0.18	0.19	1.74	38.76	m
X	0.44 $\pm$ 0.14	0.28 $\pm$ 0.05	0.72 $\pm$ 0.15	0.16	1.59	39.96	m

Table 2. Karyomorphological analysis of *Eleiotis rottleri* Wight & Arn.

Chromosome pair	Long arm (l) (μm)	Short arm (s) (μm)	Total length C=l+s (μm)	'd' value l-s (μm)	'r' value l/s (μm)	'i' value s/c $\times$ 100	Centromeric position
I	1.47 $\pm$ 0.63	1.12 $\pm$ 0.53	2.59 $\pm$ 1.13	0.35	1.35	42.83	m
II	1.33 $\pm$ 0.62	0.98 $\pm$ 0.46	2.31 $\pm$ 1.06	0.35	1.37	42.55	m
III	1.3 $\pm$ 0.58	0.89 $\pm$ 0.37	2.18 $\pm$ 0.92	0.41	1.48	41.06	m
IV	1.29 $\pm$ 0.59	0.83 $\pm$ 0.39	2.12 $\pm$ 0.94	0.46	1.59	39.68	m
V	1.04 $\pm$ 0.4	0.77 $\pm$ 0.31	1.81 $\pm$ 0.69	0.27	1.37	42.49	m
VI	0.92 $\pm$ 0.34	0.7 $\pm$ 0.27	1.63 $\pm$ 0.6	0.22	1.34	42.98	m
VII	0.87 $\pm$ 0.33	0.69 $\pm$ 0.28	1.56 $\pm$ 0.59	0.19	1.32	43.57	m
VIII	0.83 $\pm$ 0.36	0.57 $\pm$ 0.21	1.4 $\pm$ 0.54	0.26	1.46	41.33	m
IX	0.85 $\pm$ 0.63	0.52 $\pm$ 0.19	1.37 $\pm$ 0.78	0.33	1.54	40.95	m
X	0.54 $\pm$ 0.19	0.45 $\pm$ 0.14	0.99 $\pm$ 0.32	0.1	1.21	45.53	m

Table 3. Different karyotypic parameters of *Eleiotis monophyllos* and *E. rottleri*.

Sr. No.	Parameters	<i>E. monophyllos</i>	<i>E. rottleri</i>
1	THCL	10.59	17.96
2	Range of TCL%	6.7–14.3	5.5–14.4
3	TF%	39.4	41.8
4	SI	65.21	72
5	GI	47.36	38.2
6	R	2.1	2.6
7	CVcl	24.9	27.6
8	CVci	4.9	3.8
9	AI	1.2	1
10	A1	0.60	0.67
11	A2	0.25	0.28
12	Karyotype formula (K)	18m+2sm+2bs	20m+2bs
13	Classification as per Stebbin (1971)	1B	1B

respectively). Mean chromosome length was 1.06 μm in *E. monophyllos* while it was 1.79 μm in *E. rottleri*. Chromosome length ranged between 1.52 to 0.72 μm in *E. monophyllos* while 2.59 to 0.99 μm in *E. rottleri*. The intrachromosomal difference in long arm and short arm ('d' value) ranged between 0.16 to 0.29 in *E. monophyllos* while it was 0.1 to 0.46 in *E. rottleri*. Arm ratio ('r' value) ranged between 1.31 to 1.77 in *E. monophyllos* while it was 1.21 to 1.59 in *E. rottleri*. Centromeric index ('i' value) ranged between 36.77 to 43.99 in *E. monophyllos* while it was 49.68 to 45.53 in *E. rottleri*. In *E. monophyllos* median to sub median types of chromosomes were observed with a karyotype formula K: 18m+2sm+2bs while, only median types chromosomes

were observed in *E. rottleri* with a karyotype formula K: 20m+2bs.

Discussion

Somatic chromosome counts $2n=20$ with two B-chromosomes were observed in *Eleiotis monophyllos* and *E. rottleri*. Two B-chromosomes, somatic chromosome counts, and basic karyotype of *E. rottleri* were reported for the first time and new cytotype in *E. monophyllos*.

Earlier workers reported $2n=22$ in *E. monophyllos* (Bir and Kumari 1977, 1978, Kumari and Bir 1990) but we found $2n=20+2b$. Kumari and Bir (1990) reported somatic chromosome counts $2n=22$, average chromosome size=1.35 μm , chromosome size range=1.11–2.22 μm , total haploid chromatin length=14.94 μm , highly symmetrical symmetric index (SI)=81.11, slightly asymmetrical gradient index (GI)=50 in *Eleiotis monophyllos*; however, we found somatic counts $2n=20+2b$, average chromosome size=1.06 μm , chromosome size range=1.52–0.72 μm , total haploid chromatin length=10.59 μm , moderately symmetrical symmetric index (SI)=65.21 and slightly asymmetrical gradient index (GI)=47.36. Kumari and Bir (1990) reported 16 metacentric, 6 submetacentric chromosomes, and 2B category of Stebbins classification in *E. s* while we found 18 metacentric, 2 submetacentric, 2 B-chromosomes, and 1B category of Stebbins classification. The reason of variability in karyomorphological analysis of *E. monophyllos* between previous and present work is

Fig. 1. *Eleiotis* DC.: *Eleiotis monophyllos* (Burm. f.) DC: **a** leaf and flowers; **b** Somatic chromosome plate; **c** Idiograph; *Eleiotis rottleri* Wight & Arn.: **d** leaf and flower; **e** Somatic chromosome plate; **f** Idiograph.

unknown but population wise karyomorphological study on *E. monophyllos* will solve this problem.

Reduction of leaflet from trifoliolate to unifoliolate is observed in Fabaceae, the phenomenon is reported in the genus *Ononis* L. (Turini *et al.* 2010). *Eleiotis monophyllos* having unifoliolate leaf and karyotypic formula $K=18m+2sm+2bs$ with two submetacentric chromosome showing more asymmetric (advanced) nature (Fig. 1a) as compared to *E. rottleri* having trifoliolate leaf and karyotypic formula $K=20m+2bs$ (Fig. 1d). As we consider the karyotypic formula is an important cytological parameter, *E. monophyllos* showed an advanced nature compared to *E. rottleri*. Thus, it supported Turini *et al.* (2010) reduction view of leaflet from trifoliolate to unifoliolate.

Eleiotis monophyllos and *E. rottleri* showed common karyomorphological characters such as somatic chromosome counts $2n=20+2b$, two B-chromosomes and 1B category as per Stebbins (1971) classification. These characters can be recognized as cytomorphological distinguishing characters at a generic level. Both the species of *Eleiotis* can be distinguished by karyotypic formula i.e., *E. monophyllos* $K=18m+2sm+2bs$ while *E. rottleri* $K=20m+2bs$.

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