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Research Article

Karyotypic Analysis of four Species of Genus Blumea (Asteraceae) from Nepal

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Abstract

In this study chromosome number determination and karyotype analysis of four species of genus *Blumea* from the family asteraceae was carried out. The specimen plants were collected from central parts of Nepal, namely *Blumea fistulosa* (Roxb.) Kurz, *Blumea lacera* var. *glandulosa* (DC.) Hook, *Blumea lacera* (Buem f.) DC. and *Blumea laciniata* DC were observed. The chromosome number in somatic cells were recorded to be 2n= 22 in *Blumea fistulosa;* 2n= 32 in *Blumea lacera* var.*glandulosa; 2n*=18 in *Blumea lacera* and *Blumea laciniata.* The range of chromosome length found to be 0.6 to 1.6 µm in *Blumea fistulosa*, 0.6 to 1.6µm in *Blumea lacera* var.*glandulosa,* 0.6 to 1.7 µm in *Blumea lacera* and 0.8 to 1.6 µm in *Blumea laciniata*. Karyotype formula for *Blumea fistulosa* is M_{12}+ $sm_{10,\ for}$ *Blumea lacera* var. *glandulosa* is M_{14}+sm_{14}+ $st_{4,}$ for *Blumea lacera* is M_{14}+ st_2 and for *Blumea laciniata* is M_{12}+ sm_6 in *Blumea laciniata*. In this investigation a pair of satellite chromosome found in only one species *Blumea fistulosa* at the end of shot arm of chromosome. Mainly three types of chromosomes observed in this study having centromere at middle point, at sub-median region and at sub-terminal region. Numerical and structural variation in chromosome are evolutionary significance. Similarity in size of chromosomes and karyomorphology indicates the homogeneity of the taxa within this tribe.

Keywords: Karyotype; chromosome number; Asteraceae; chromosome length.

Introduction

In the present study four species of the genus Blumea , namely *Blumea fistulosa*, *Blumea lacera* var.*glandulosa* and *Blumea laciniata* from the asteraecea family collected from Central Nepal was Cytologically carried out. The genus Blumea is a flowering plants belonging to the family Asteraceae. The plants of this genus Blumea are mostly small weeds.Many species of this genus are used in traditional Chinese medicine and also used in ornamental plants. The genus Blumea locally called Kukur ghaans in Nepal. Most of the species of *Blumea* are used in bodyache (Kirtikar & Basu, 1987). Somatic chromosome number determination and karyotypic analysis of the studied taxa are the objective of this study.

Materials and Methods

The plants were collected from Central parts of Nepal, brought to Kathmandu and transplanted in earthen pots at my home garden. Somatic chromosomes were observed in the meristamatic cells of root tips for karyotypic analysis. To ensure full turgidity, plants were sufficiently watered for

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two hours before the excision of the root tips for pretreatment. Healthy root tips were pretreated in aqueous solution of 0.002M 8-hydroxyquinoline for three hours. They were then fixed in a mixture of absolute ethanol and glacial acetic acid (3:1) for one day or more. In the laboratory root tip materials were hydrolyzed and stained in a mixture of 2% aceto-orcein and 1N HCl (9:1) contained in watch glass and warmed for few seconds and left for 30 minutes to 1 hour. Squashes were made in 45% acetic acid. The observations were done from this preparation to select the plates for photomicrography. The drawings were made at table level using opcolite-1366 Camera Lucida apparatus. Photomicrographs were taken with the help of digital camera of 12.1 megapixel using 10 x eye pieces and 100x objective of trinocular compound microscope. The methodology was followed according to Levan et *al.* (1965).

Results and Discussion

Blumea fistulosa (Roxb.) Kurz (2n=22)

The plant is herb, annual, erect, 15-100 cm tall, shaggily pubescent above. Leaves simple oblanceolate to obovate, pubescent on both surfaces (Fig. 1), base narrowly long attenuate, margin bidentate apex acute. Capitula in small sessile clusters arranged in interrupted spike like terminal racemes or sparsely branched panicles. Involucres 4- or 5-seriate, phyllaries purplish adaxially. pubescent, sparsely glandular, outer series lanceolate, remainder linear. Receptacle sparsely shortly pubescent. Corollas yellow, lobes of central florets with glandular and few glandular hairs. Pappus white. Flowering period October to April.

Chromosome number determined for this taxon is 2n=22. The somatic chromosome number determined from the root tip cell is shown in (Fig. 1B) and camera lucida drawing in (Fig. 1C) 3. Its ideogram is represented in (Fig.1D). The chromosome measurements are given in Table 1,

The karyotype consists of two different types of chromosomes with centromere at median point and sub-median region. The chromosome length ranged from 0.6 to 1.6 µm with mean length 1.0 µm and absolute length 12.0 µmTF % is 45.0. Karyotype formula is M_{12}+ sm_{10}.

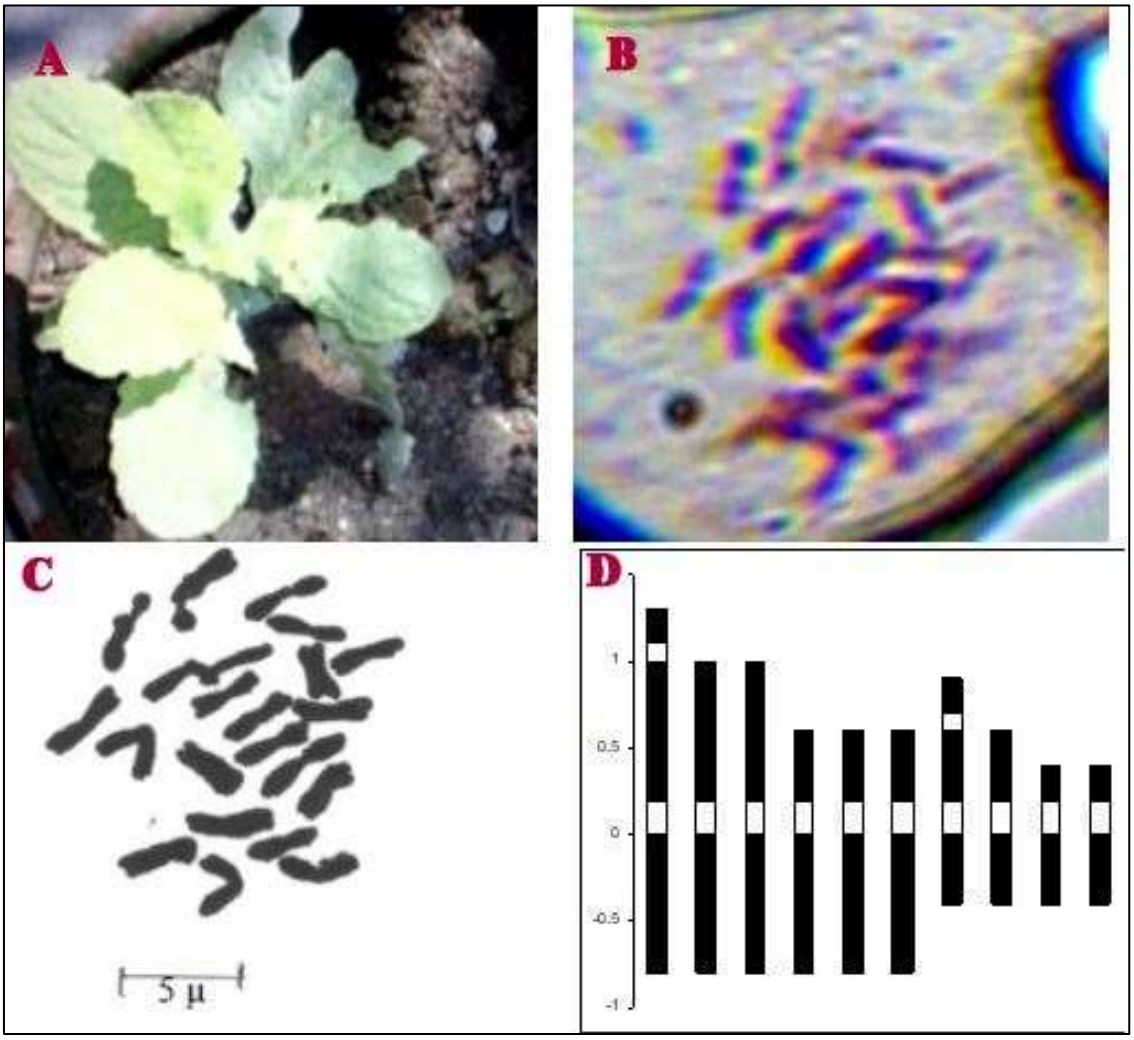

Fig.1: *Blumea fistulosa* (Roxb**.)** Kurz A. Photograph of living plant; B. Photomicrograph of somatic metaphase plate; C. Camera lucida drawing of the same; D. Ideogram

Table 1: Chromosome measurement in *Blumea fistulosa* (Roxb.) Kurz

Chrom. Pairs	Long Arm (µm)	Short Arm (µm)	Total Length (µm)	r-value	Relative Length (µm)	Position of Centromere
I	0.8	0.8+0.2	1.6+0.2	1	8.8	M
II	0.8	0.8	1.6	1	8.8	M
III	0.8	0.8	1.6	1	8.8	M
IV	0.8	0.4	1.2	2	6.6	sm
V	0.8	0.4	1.2	2	6.6	sm
VI	0.8	0.4	1.2	2	6.6	sm
VII	0.4	0.4+0.2	0.8+0.2	1	4.4	M
VIII	0.4	0.4	0.8	1	4.2	M
IX	0.4	0.2	0.6	2	3.3	sm
X	0.4	0.2	0.6	2	3.3	sm
XI	0.2	0.2	0.4	1	2.2	M

Table 2: Chromosome measurement in *Blumea lacera* var. *glandulosa* (DC.) Hook

Chrom. Pairs	Long Arm (µm)	Short Arm (µm)	Total Length (µm)	r-value	Relative Length (µm)	Position of Centromere
I	0.8	0.8	1.6	1	10.6	M
II	0.8	0.8	1.6	1	10.6	M
III	0.8	0.4	1.2	2	8.0	sm
IV	0.8	0.4	1.2	2	8.0	sm
V	0.8	0.4	1.2	2	8.0	sm
VI	0.8	0.4	1.2	2	8.0	sm
VII	0.8	0.2	1.0	4	6.6	st
VIII	0.8	0.2	1.0	4	6.6	st
IX	0.4	0.4	0.8	1	5.3	M
X	0.4	0.4	0.8	1	5.3	M
XI	0.4	0.4	0.8	1	5.3	M
XII	0.4	0.2	0.6	2	4.0	sm
XIII	0.4	0.2	0.6	2	4.0	sm
XIV	0.4	0.2	0.6	2	4.0	sm
XV	0.2	0.2	0.8	1	5.3	M
XVI	0.2	0.2	0.8	1	5.3	M

Blumea lacera var.glandulosa (DC.) Hook (2n=32)

The plant is an annual herb, slender, very variable weed with a strong turpentine or camphor odour, 45-60 cm high. Stem erect, simple or branched, covered with hairs and glands (Fig. 2A) often grey in more silky forms. Leaves alternate, petiolate, obovate, margin toothed; heads in short axillary cymes and collected into terminal panicles, involucre of bracts narrow, covered with hairs, florets female and bisexual, yellow, achenes nearly tetragonous and not ribbed.

Chromosome number presently determined for this taxon is 2n=32. The somatic chromosome number determined from the root tip cell is shown in (Fig. 2B) and camera lucida

drawing is in (Fig. 2C). Its ideogram is represented in (Fig. 2D).The chromosome measurements are given in Table 2.

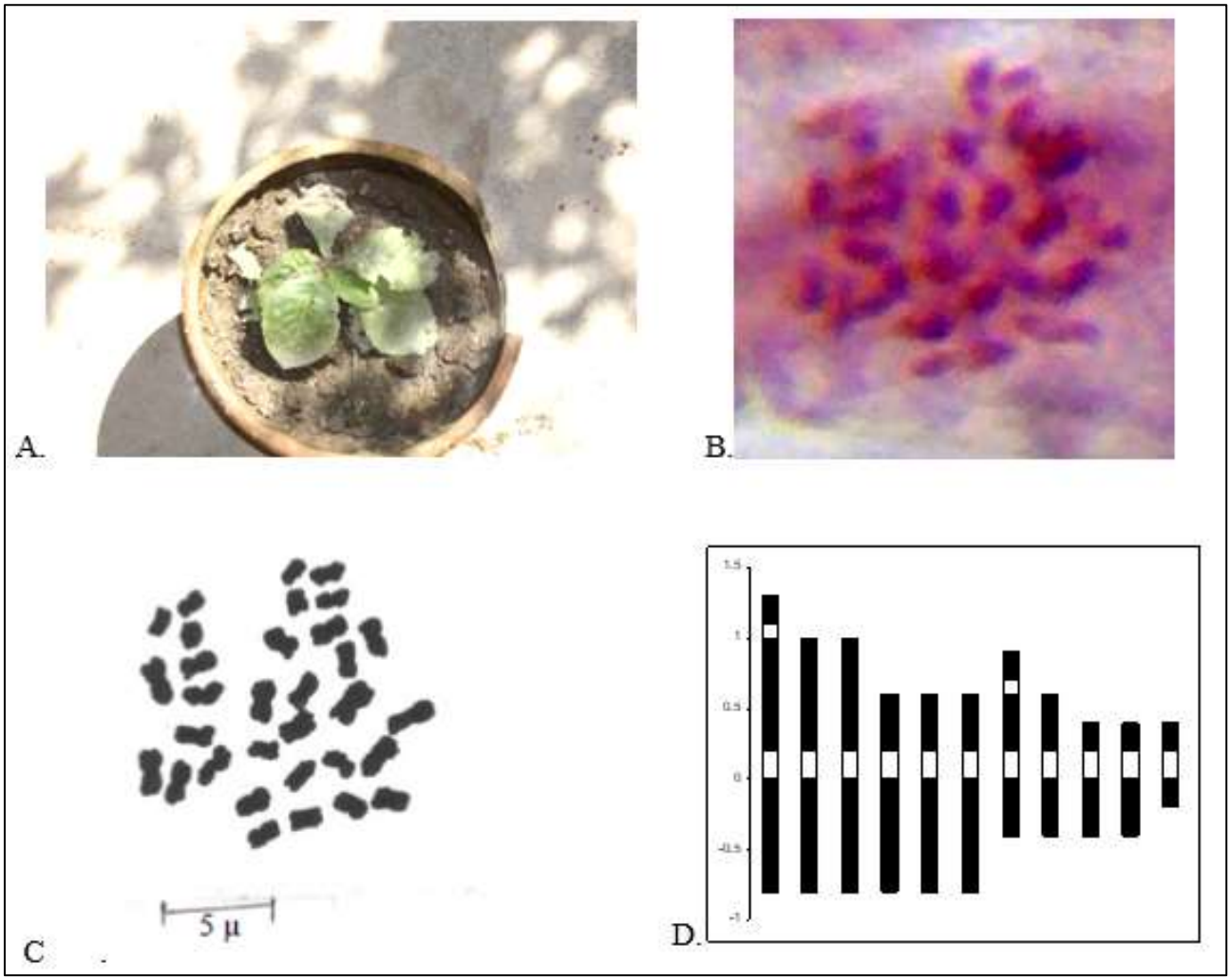

Fig 2. *Blumea lacera* var.*glandulosa* (DC.) Hook A. Photograph of living plant; B. Photomicrograph of somatic metaphase plate; C. Camera lucida drawing of the same; D. Ideogram

The karyotype consists of three different types of chromosome with centromere at median point, sub-median region and sub-terminal region. The chromosome length ranged from 0.6 to 1.6µm with mean length 0.9 µm and absolute length 8.4µm. TF % is 39.2. Karyotype formula is M_{14}+sm_{14}+ st_4.

Blumea lacera (Buem f.) DC. (2n=18)

The plant is annual herb, with a strong ordour of turpentine, stem erect, 30 cm tall, ash colored, densely glandular, pubescent (Fig. 3A) . Leaves are often incised or lyrate, the lower leaves petioled, often incised or lyrate, the upper sub-sessile, elliptic oblong or ovovate, obtuse, finely silky on both sides, sharply serrate, dentate, base much tapered. Heads many flowered, arranged in axillary cymes or terminal panicle, flower yellow. Corolla lobes of hermaphrodite flowers nearly glabrous. Involucral bracts densely silky-villous, the outer bracts somewhat herbaceous, linear-lanceolate the inner linear, scarious with green midrib. Pappus white. Fruit an achene, oblong and not ribbed.

Chromosome number determined for this taxon is 2n=18. The somatic chromosome number determined from the root tip cell is shown in (Fig. 3B) and camera lucida drawing is in (Fig. 3C). Its ideogram is represented in (Fig. 3D). The chromosome measurements are given in Table 3.

The karyotype consists of two different types of chromosomes with centromere at median point and sub-terminal region. The chromosome length ranged from 0.6 to 1.7 µm with mean length 0.9 µm. and absolute length 8.4 µm TF% was 39.2. Karyotype formula is M_{14}+ st_2.

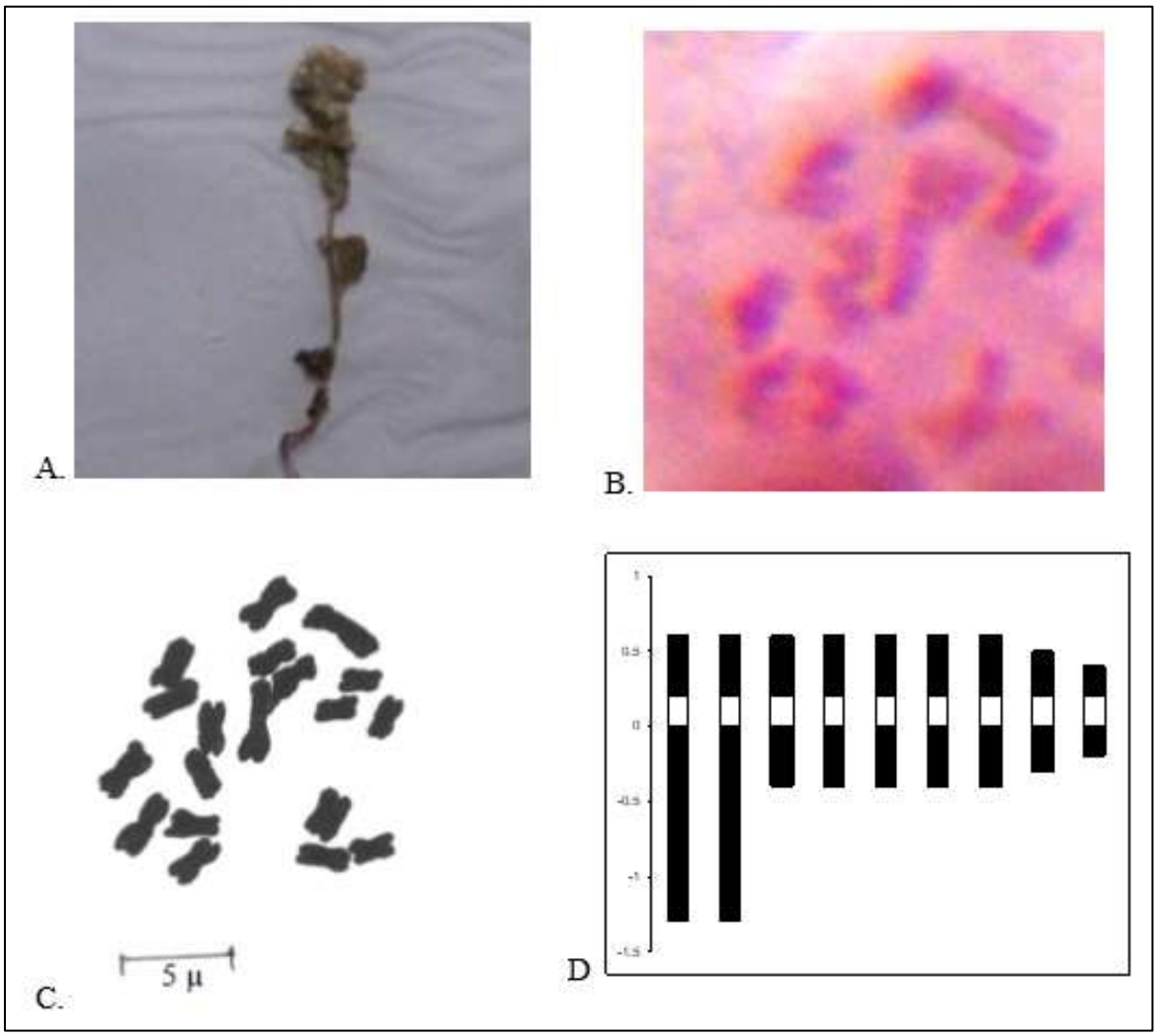

Fig **3**. *Blumea lacera* (Buem f.) DC. (2n=18) A. Photograph of living plant; B. Photomicrograph of somatic metaphase plate; C. Camera lucida drawing of the same; D. Ideogram

Table 3: Chromosome measurement in *Blumea lacera* (Buem f.) DC.

Chrom. Pairs	Long Arm (µm)	Short Arm (µm)	Total Length (µm)	r-value	Relative Length (µm)	Position of Centromere
I	1.3	0.4	1.7	3.2	20.2	st
II	1.3	0.4	1.7	3.2	20.2	st
III	0.4	0.4	0.8	1	9.5	M
IV	0.4	0.4	0.8	1	9.5	M
V	0.4	0.4	0.8	1	9.5	M
VI	0.4	0.4	0.8	1	9.5	M
VII	0.4	0.4	0.8	1	9.5	M
VIII	0.3	0.3	0.6	1	7.1	M
IX	0.2	0.2	0.4	1	4.7	M

Blumea laciniata DC. (2n=18)

The plant is annual, herb, erect, aromatic. Stems with many branches, arising from a woody base, short hairy (Fig. 4A) with stalked gland. Lower leaves lyrately lobed, petioled, upper ones sessile obovate, base tapering, entire to coarsely dentate apiculate. Heads yellow combined into large, lax terminal panicle, glandular, pubescent. Outer bracts acicular, long glandular, hairy on dorsal surface.

Chromosome number determined here for this taxon is 2n=18. The somatic chromosome number determined from the root tip cell is shown in Fig. 4B and camera lucida drawing in Fig. 4C. Its ideogram is represented in Fig. 4D. The chromosome measurements are given in Table 4.

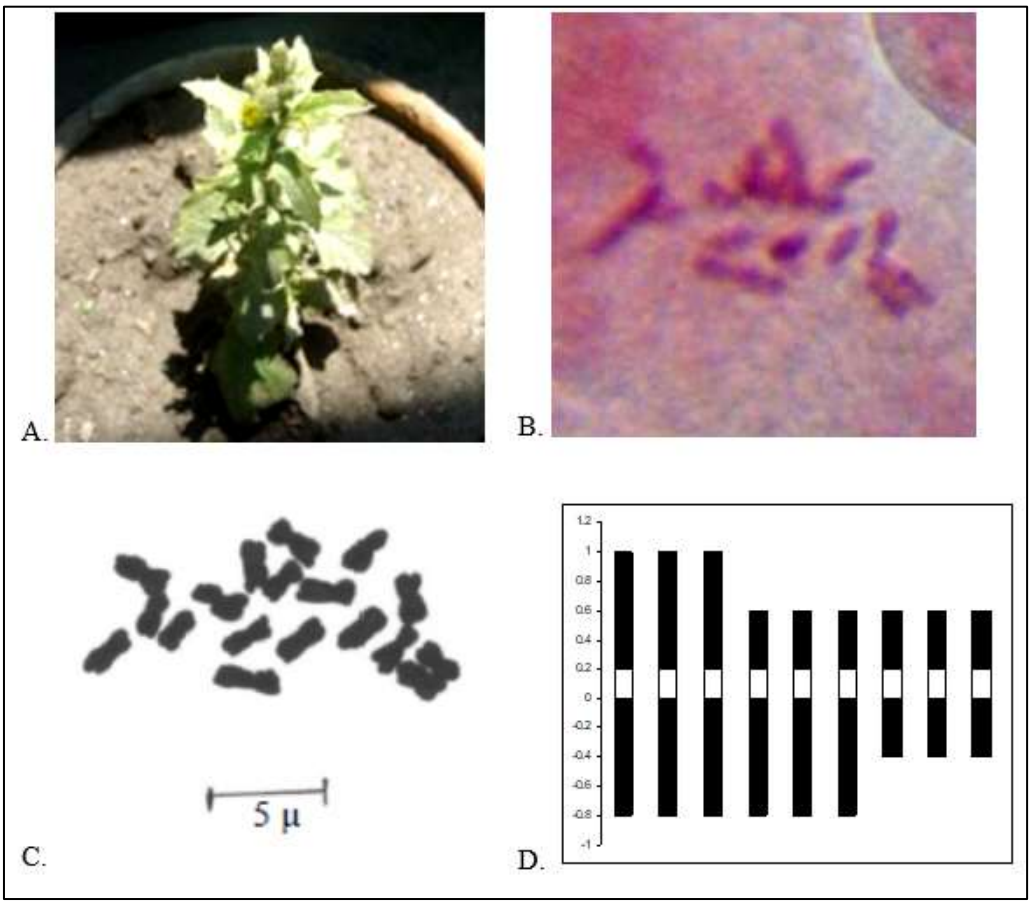

Fig **4**: *Blumea laciniata* DC. (2n=18) A. Photograph of living plant; B. Photomicrograph of somatic metaphase plate; C. Camera lucida drawing of the same; D. Ideogram

Table 4: Chromosome measurement in *Blumea laciniata* DC.

Chrom. Pairs	Long Arm (µm	Short Arm (µm)	Total Length (µm)	r-value	Relative Length (µm)	Position of Centromere
I	0.8	0.8	1.6	1	14.8	M
II	0.8	0.8	1.6	1	14.8	M
III	0.8	0.8	1.6	1	14.8	M
IV	0.8	0.4	1.2	2	11.1	sm
V	0.8	0.4	1.2	2	11.1	sm
VI	0.8	0.4	1.2	2	11.1	sm
VII	0.4	0.4	0.8	1	7.4	M
VIII	0.4	0.4	0.8	1	7.4	M
IX	0.4	0.4	0.8	1	7.4	M

The karyotype consists of two different types of chromosomes with centromere at median point and sub-median region. The chromosome length ranged from 0.8 to 1.6 µm with mean length 1.2 µm and absolute length 10.8 µm TF% was 44.4. Karyotype formula is M_{12}+ sm_6

Among the four species of genera *Blumea* from the tribe Inulae, the length of chromosomes ranged from 0.6 to 1.6 µm in *B. fistulosa*, *B. lacera* var. *glandulosa*, *B. laciniata*, *B. lacera*. Karyoype is different among all of them. Among *B. laciniata* (2n=18) and *B. lacera* (2n=16) the former is primitive than latter which is indicated by ratio differentiation and T.F. percentage. *B. lacera* var. *glandulosa* (2n=32) also seems to be advanced being polyploidy nature and presence of sub-terminal chromosomes when compared to other species of the genus *Blumea*.

Present chromosome count for *Blumea lacera* var. *glandulosa* (2n=32) is different from previous reports (2n=18, 22) by Verma and Vijayavalli (1998) and (2n=36) by Mathew and Mathew (1975). This is the case of intraspecies variations among the taxa. Chromosome number for *Blumea laciniata* 2n=18 tallies with Peng and Hsu (1977) and Sharma (1970). The various numbers found for this species are due to the existence of different cytotypes. In present investigation chromosome bearing satellite is observed in only one species *Blumea fistulosa* of the tribe Inuleae. A pairs of satellite observed in short arms of the chromosomes in this taxa. Satellite, play a significant role in the study of karyotypes (Sakya, 1991). All four species of *Blumea* studied presently from the tribe Inuleae found to be polyploid forms. *B. lacera* var. *glandulosa* (2n=32) has been found to be descending pentaploid form of base number x=7. *B. lacera* (2n=18) and *B. laciniata* (2n=18) have been found to be descending triploid forms of base number x=7 in present study. Basic numbers x= 8, 9, 10, 11 are observed by Peng and Hsu (1978) for this genus. Similarity in size of chromosomes and karyomorphology indicates the homogeneity of the taxa within this tribe.

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