Botanica Orientalis – Journal of Plant Science (2009) **6:** 111–113 ISSN 1726-6858

http://www.cdbtu.edu.np/botanica-orientalis

Short communication

Cytotaxonomy of *Smithia ciliata* Royle (Fabaceae)

Laxmi Manandhar and Shyam R. Sakya

Central Department of Botany, Tribhuvan University, Kirtipur, Kathmandu, Nepal

Abstract

Cytotaxonomy of *Smithia ciliata* Royle, collected from Panighat (1700 msl), Kathmandu valley, is reported. The somatic chromosome number was found to be 2n = 38 with the basic number being n = 19. Karyotype structure is predominated with medium sized chromosomes and with median constrictions.

Key-words: chromosome count, karyotype, meiosis.

Introduction

Smithia ciliata Royle belongs to the family Fabaceae. It grows on the sloppy areas of hills during rainy season. It is an annual herb with diffused and spreading branches. Leaves are echinulate and even pinnate with axillary as well as terminal peduncles that bear small white or bluish white flowers. Studies on the genus *Smithia* have not been well undertaken. In this paper, cytotaxonomy of *Smithia ciliata* is reported. A perusal of the literature (Darlington and Ammal 1945; Darlington and Wylie 1955; Fedorov 1969; Kuzmanov 1993; Khatoon and Ali 1993; Chen *et al*. 1993, 2003; Dawson 2007) provided information that cytotaxonomical research in *Smithia ciliata* is the first record.

Materials and methods

Plant species, collected from Panighat (1700 msl), Kathmandu valley, were established in home garden for investigation. Morphological and cytogenetical studies were done with the help of stereo– and compound– microscopes. The mitotic studies were made with excised healthy root tips or anther wall cells (Sakya and Joshi 1990). The meiotic behaviors were recorded in pollen mother cells (Darlington and La Cour 1976). Pollen viability was estimated by staining pollen grains in Müntzing solution (Müntzing 1941).

The karyotype formula was developed following the nomenclature of chromosomes proposed by Levan *et al*. (1965). The symmetry of the karyotypes was determined from the value of the total form percentage (TF%). The latter was calculated as a percentage of total sum of short arm length over total sum of chromosome length as given by Huziwara (1962). All the photomicrographs were taken under the uniform magnification of 1000 ×.

Results

TAXONOMY

Annual diffused and spreading herb. Stem terete. Leaves even pinnate, echinulate, petiole 2.0 cm, petiolule 5.0 mm, rachis ending in a bristle, leaflets up to 7 pairs, small up to 1.0 cm long, narrowly oblong, sensitive, entire margin, ventral mid- rib and rachis with straight and hooked hairs, stipules scarious, persistent. Flowers small, groups of 5, second on small and short peduncles of axillary or terminal racemes or panicles up to 1.5 cm, bracts small, caduceus, racteoles paired as long as calyx, papillose, ciliated. Calyx 5 mm × 4 mm, bi-labiate, lips entire, upper lip truncate or shortly toothed, margins stiff ciliated, grooved in the middle, veins anastomosing, not closely parallel, sheathing base of the calyx persistent. Corolla white or blue, exerted, clawed, standered orbicular 7 mm × 5 mm with notched tip, keel and wing *c*. 7 mm. Stamens 10 in two bundles, 5 each, 5 stamens joined together up to 2/3 length, *c*. 5 mm long, anthers uniform, dorsifixed. Gynoecium *c*. 4 mm long, ovary linear, 2.5 mm long, ovules very often 7-9, style 1.5 mm, curved, stigma simple. Pod compressed consisting of several rounded one seeded segments folded on top of one another within persistent accrescent calyx, indehiscent.

Distribution: WCE of Nepal (1200-2800 m asl).

CYTOGENETICAL STUDY

The measurement of somatic chromosomes is given in Table 1. Camera lucida drawing and Ideogram are given in Fig. 1. The somatic chromosome number was found to be 2n = 38 with the basic number n = 19. The present study distinguished two different types of chromosomes with centromere at median point and median regions. The medium sized chromosomes predominated. The meiotic studies have revealed regular divisions with bivalents and tetravalents in early metaphase (Fig. 1c). In some meiocytes exclusion of chromosomes and shifting of a group of chromosomes towards periphery were observed in some cells. Anaphase and telophase were mostly normal. Normal structures as well as non-synchronous divisions, stickiness and agglutination of chromosomes were also noticed in some cells. Chromatin bridges were observed occasionally. Cytomixis have been evidenced at different stages (Fig. 1d). Normal

metaphase II is shown in Fig. 1e. The abortive meiocytes were observed in certain cases. Tetrads were observed normal. Pollens were circular, triporate and large. Sometimes dimorphic pollens were observed.

Table 1. Measurement of somatic chromosomes.

Shortest chromosome	Longest chromosome	Mean length	Absolute length	T F %	Karyotype formula	Fig
0.8	2.7	1.54	29.3	48. 8	M30+ m8	1a,b

Discussion

The present determination of the chromosome number in *Smithia ciliata* (n = 19 and 2n = 38) is the first report. These results tallies with the earlier works in S *bigemina, S. conferta* with 2n =38 and n = 19 in *S. recemosa* by Kumar and Kuriachan (1990). Similarly, Kumari and Bir (1990) have also reported 2n = 38 median and submedian chromosomes in S *bigemina* and *S. conferta*. It suggests that the basic number in *S. ciliata* is × =19. Meiosis is mostly normal. The findings of present study have indicated that cytomixis occurred mostly during early stages of meiosis. Cytomixis is considered as one of the factors contributing to pollen sterility (Verma *et al*. 1986). Maheswori (1950) believes that cytomixis is favorable during early stages of microsporogenesis. High percentage of pollen stainability suggests that abnormal cells did not reach maturity. The interpretations from the total form percentage with symmetrical chromosomes indicate that *S. ciliata* is less advanced among the herbaceous groups (Stebbins 1950; Sinha and Kumar 1979; Manandhar and Sakya 2003a, b).

Acknowledgments

The paper is based on Ph.D. thesis submitted by LM. We wish to thank all those who have supported us during the laboratory work.

References

Chen R.Y., Lin S.H. and Song Chen W.Q. 1993. *Chromosome Atlas of Chinese Principal Economic Plants. Tomus I: Chromosome Atlas of Chinese Fruit*. International Academic Publishers, Beijing, China.

Chen R.Y., Song W.Q., Li X.L. 2003. *Chromosome Atlas of Major Economic Plants Genome in China*. Science Press, Beijing, China.

Darlington C.D. and Amal J. E.K. 1945. *Chromosome Atlas of Cultivated Plants*. George Allen and Unwin Ltd., London, UK.

Darlington C.D. and La Cour F.L. 1976. *The Handling of Chromosomes*. George Allen and Unwin Ltd., London, UK.

Darlington C.D. and Wylie A.P. 1955. *Chromosome Atlas of Flowering Plants*. George Allen and Unwin Ltd., London, UK.

Dawson M.L. 2007. Contributions to a chromosome atlas of the New Zealand flora – 39. Orchidaceae. *New Zealand Journal of Botany* 45: 611–684.

Fedorov A.A., ed. 1969. *Chromosome Numbers of Flowering Plants*. Science Press, V.L. Academy of Science of USSR, Komarov Botanical Institute, Russia.

Huziwara Y. 1962. Karyotype analysis in some genera of Compositae VIII. Further studies on the chromosomes of *Aster*. *American Journal of Botany* 49: 116–119.

Khatoon S. and Ali S.L. 1993. *Chromosome Atlas of the Angiosperms of Pakistan*. University of Karachi, Karachi, Pakistan.

Kumar M.G.V. and Kuriachan P.I. 1990. SOCGI plant chromosome number reports-IX. *Journal of Cytology and Genetics* 25: 145–147.

Kumari S. and Bir S.S. 1990. Karyomorphological evolution in Papilionaceae. *Journal of Cytology and Genetics* 25: 173–219.

Kuzmanov B.1993. Chromosome numbers of Bulgarian angiosperms: an introduction to a chromosome atlas of the Bulgarian flora. *Flora Medit*. 3: 19–163.

Levan A., Fredge K. and Sandgerg A.A. 1965. Nomenclature for centromeric position of chromosomes. *Hereditas* 52: 201–220.

Maheswori P. 1950. *An Introduction to the Embryology of Angiosperm*. McGraw-Hill Book Company, Inc., New York, USA.

Manandhar L. and Sakya S.R. 2003a. Biological significance of *Desmodium* Desv. in Nepal Himalayas. In: *Proceedings of International Conference on Woman, Science and Technology for Poverty Alleviation* (S.L. Maskey, J.L. Shrestha and R.B. Pradhan, eds.), pp. 168–171. Women in Science and Technology (WIST), Kathmandu, Nepal.

Manandhar L. and Sakya S.R. 2003b. Karyomorphological observations in *Desmodium* Desv. and its related taxa of Nepal. *Cytologia* 68: 121–126.

Muntzing A. 1941. Differential response to x-ray treatment of diploid and tetraploid barley. *K. Fysiong. Sallisk. Forh* 11: 1–10.

Press J.R., Shrestha K.K. and Sutton D.A. 2000. *Annotated Checklist of the Flowering Plants of Nepal*. The Natural History Museum, London, UK.

Sakya S.R. and Joshi K.K. 1990. Karyomorphological studies in some *Primula* species of Nepal Himalaya. *Cytologia* 55: 571–579.

Sinha S.S.N. and Kumar P. 1979. Mitotic analysis in thirteen varieties of *Cajanus cajan* (L.) Mill. *Cytologia* 44: 571–580.

Stebbins G.J. Jr. 1950. *Variation and Evolution in Plants*. Columbia University Press, New York, USA.

Verma R.C., Sarkar A. and Das B.C. 1986. Cytoplasmic channels and chromatin migration in mulberry. *Cytologia* 51: 731–736.

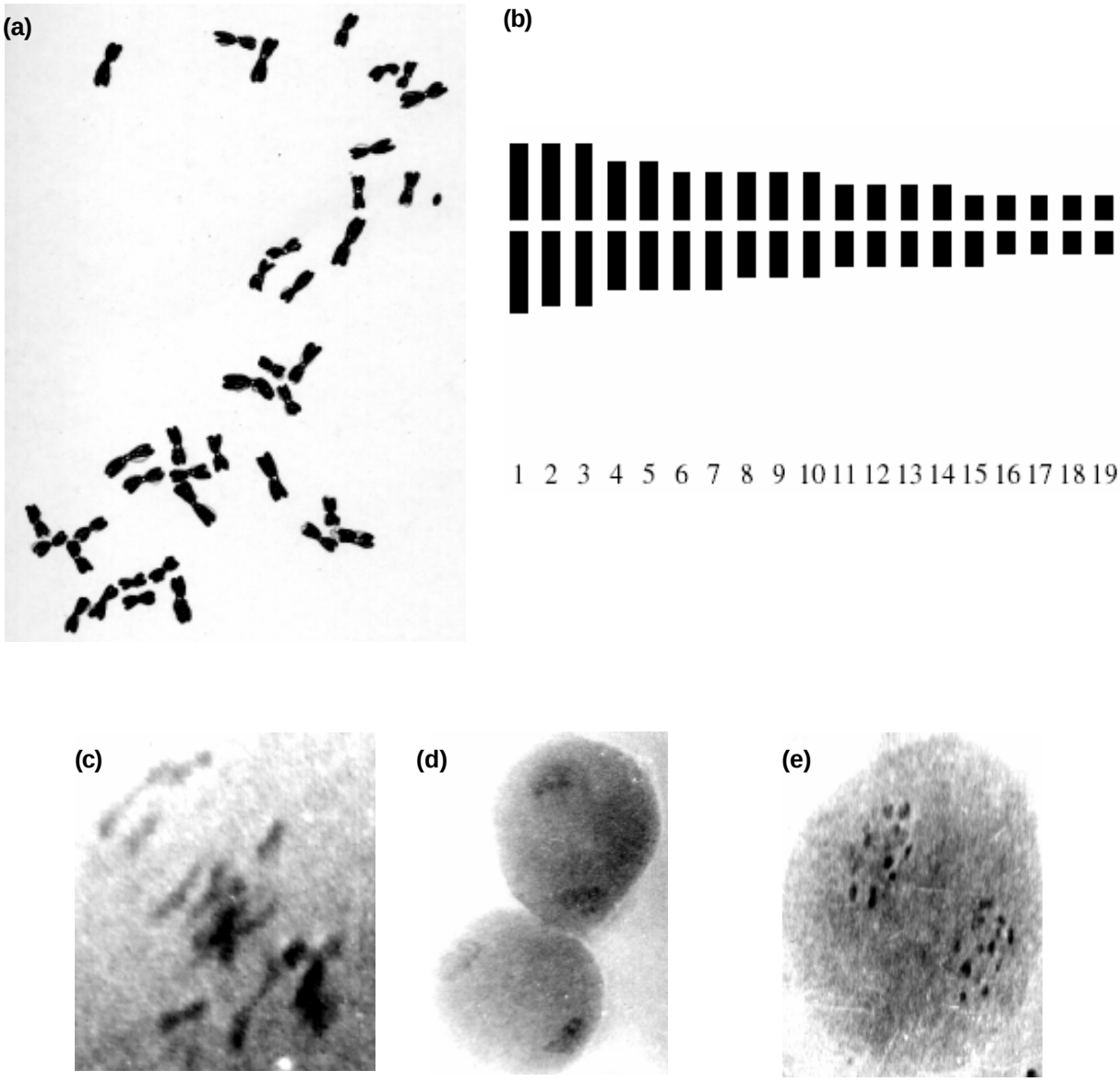

Fig. **1**. Cytotaxonomy of *Smithia ciliata* Royle: (a) karyotype (camera lucida drawing); (b) karyotype (ideogram); (c) meiosis: metaphase I (bivalents and tetravalents); (d) meiosis: telophase I (cytomixis); (e) meiosis: Metaphase II