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CYTOTAXONOMICAL STUDIES ON SOME VARIETIES OF *MORUS* L. (MORACEAE)

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ABSTRACT
Morus commonly called mulberry belonging to the family Moraceae mulberry has been received many attentions because of its economic and medicinal values. Mulberry has a worldwide distribution. Five varieties of mulberry namely *Morus alba* L. varieties Kanva-2, English black, China white and *Morus indica*, varieties MS-2 and MS-5 were selected for cytotaxonomical studies Stomatal studies, Somatic chromosomal number and ploidy level studies. All varieties having diploid with 2n=28 except MS-2 which is an aneuploidy 2n=30. Various chromosomal abnormalities such as clumping of chromosomal, precocious movement of chromosome, unequal separation of chromosomes were also observed.

KEYWORDS: *Morus* sp. Stomatal frequency, Diploid, Aneuploid, Chromosomal aberrations.

INTRODUCTION
Mulberry belongs to the genus *Morus* L. of the family Moraceae which consists of 73 genera and 1000 species (Chopra, 1954). It is an economically important foliage crop, the staple food of silkworms (L.) outstanding bio energy plant belonging to the old world. Mulberry is cultivated mainly in Japan, France, Thailand, Burma, Srilanka etc. Mulberry used fodder, Paper making medicine social forestry, sports goods making manufacture of boats, furniture's, ago-forestry and drought prone area development programmers (Dandin *et al.*, 1992; Munirajppa *et al.*, 1995). Indian sericulture presents the picture of a well knit agro-based cottage industry. India is the second largest producer of mulberry in the world next only to china (Anonymous, 1992). It is very important to select varieties of mulberry with best quality leaves. Five varieties were selected among this 3 varieties such as Kanva-2, English black and China white belongs to *M. alba* and 2 varieties is MS-2 and MS-5 belongs to *Morus indica* L. all varieties are diploid 2n=30 triploid, tetraploid, polyploid varieties in Mulberry also reported (Venkatesh, 2007, Rajalakshmi, 2005; Kondu and Sharma, 1976) carried out the cytogenetically investigation in Mulberry but cytotaxonomy of mulberry indicates lacunae in the present study an attempt has been made to understand the stomatal index, stomatal frequency, somatic chromosome and chromosomal aberrations of five varieties of mulberry have been discussed.

MATERIAL AND METHODS
Five varieties of mulberry were used in the present investigation and the mulberry stem cutting were collected form silkworm and mulberry germplasm station, Hosur, Tamil Nadu the collected cutting were planted in garden after growth, roots were fixed in Carnoy's fluid for mitotic studies and root tip squashes were made by using iron-A 10m Haematoxylin squash method of Marimuthu and Subramanian (1960) for detailed chromosomal and Karotype analysis. For meiotic study, Bellings Iron- acetocarmine smear technique (Darlington and La Cour, 1962) was found more suitable for this study stomatal studies, nail polish impression method was followed. stomatal index, stomatal frequency were calculated by using the following formula.

$$\text{Stomatal index} = = \frac{No\ of\ stomata}{\text{No of stomata+no of epidermal}} X\,100$$

$$\text{Stomatal frequency} = \frac{No\ of\ stomata}{\text{no of epidermal cells}} X\,100$$

OBSERVATION
Morus alba L. Var. Kanva-2
It is an indigenous, popular, improved medium sized tree with erect branches and cylindrical bole variety leaves are cordate, thick, glossy, pale grey with crenate margin and acute open. Female spikes are avoid, glabrous, short style and fruits are purplish blade in colour the somatic chromosome of this variety was determined to be 2n=28. The chromosome range in length from 2.00-3.00 µm. the details of chromosome measurements are given in the table Plate – 1, Fig. -1 (Table-3).

***Morus alba* (L.) Var. English black**
This is an exotic variety of medium sized tree with erect branches bark deep pinkish and dull green in colour. Petiole medium in thickness spikes glabrous with long style, fruits chromosome member of this variety was found to be 2n=28. The length of chromosome range from 2.00=3.00µm. Plate – 1, Fig. – 2.

***Morus alba* (L.) Var. China white**
It is an exotic variety of china orgin, medium sized fast growing tree. Leaves are very large, drooping, ovate, light green in colour with slightly rough surface. Margin crenate and cordate leaf base young shoots are plat and it produces made and female catkins. The diploid chromosome number of this variety was determined to be 2n=28 the length of the chromosome range from 1.50-3.00 µm. Plate – 1, Fig. – 3.

***Morus alba* (L.) Var. MS-2**
This variety was evolved through clonal selection. It is an exotic variety medium sized free with erect branching habit. Leaves are medium sized, lobed, green, smooth and ovule margin serrate, acuminate tip, cordate leaf base. It is a male plant, producing male catkins. The somatic chromosome number of this variety was found to be 2n=30. It is an aneuploidy variety. The length of the chromosomes ranges from 2.00-300µm. Plate – 1, Fig. – 4.

***Morus alba* L. Var. MS-5**
It is an exotic cultivar, evolved through clonal selection of major variety it is a medium sized tree with spreading branches leaves are unlobed, green, ovate, smooth surfaced. Leaf tip. It is a female plant, with female catkins ovary. The normal diploid chromosome complement of this variety was found to be 2n=28. The length of the chromosome ranges from 1.50-3.00µm. Plate – 1, Fig. – 5.

Stomatal studies
The leaves of mulberry are hypostomatic and the stomatal type happens to be anomocytic. The maximum stomatal length (15.50 µm) was observed in Var. MS-2 and minimum length (13.50 µm) was recorded in Ms-5.

The breadth stomatal was maximum (5.50µm) was reported in Kanva-2 and minimum (3.50µm) in *Morus indica* var. MS-5. The maximum (35.56) stomatal index was observed in MS-2 and minimum (11.11) in *Morus indica* var. MS - 5. The stomatal frequency was maximum (55.17) in MS-2 and minimum (12.50) in MS-5.

Meiotic Studies
Various chromosomal abnormalities such as precocious movement of chromosomes, laggard formation, clumping of chromosomes and cytomixis of chromosomes. Plate – 3.

RESULT AND DISCUSSION
Morus species chromosomes are small to medium sized. The chromosome number has been determined based on a number of root tip squash preparations for each variety of the five variety studied, 4 verities are diploids (2n=28) and one variety (MS-2) coming under hyperdiploids (Aneuploid, 2n=30) so the majority of the mulberry varieties possess n=14 the basic chromosome number for the genus *Morus* L. may be considered to be X=14 (Osawa, 1920, Janaki-Ammal, 1948; Kundu and Sharma, 1976).

Of the five varieties of mulberry studied, aneuploid number like 2n=30 suggested the inconsistency of chromosome number and the probable reason cited for the same is high degree of vegetative propagation by stem cuttings or by grafting which invariably results in polysomaty is of frequent occurrence in the vegetative propagated plants and this potential character can be fully exported for the crop improvement.

Stebbins (1971) suggested that alternations in chromosome number involve either differences in gene arrangement or gene duplication. In MS-2, aneuploidy character reflected differences in morphological automatically characters. The varieties in chromosomes generally reflect distinction in the quality of genes in that variety the maximum stomatal index in MS-2.

Cultivars Kanva-2, English black, China white, MS-5 have significantly in their adaptations in Karyological studies but there a slight changes occur in MS-2 cultivar. Somatal index and stomatal frequency are important parameter in selecting drought resistant genotype and also it industry leaf field in mulberry. Basavaiah and Murthy (2001) reported that less stomatal frequency and index parameters play an important role in drought resistance. These parameters are significantly less in aneuploidy and more in diploid varieties. The moistures retention capacity and drought resistant capacity are will be higher in diploid cultivations which is suitable for dry lands. Maximum stomatal frequency and index reported in MS-2, aneuploidy cultivar, exploits low moisture retention and it is highly suitable for rain fed region. The present investigation is also in agreement with the report of Vijan *et al.,* (1998), Hatalli *et al.,* 1993; Nautoyal *et al.,* 1994**.**

In meiosis many chromosomal aberrations have been reported in MS-2 aneuploidy cultivar. Chromosomal aberrations as laggard's precocioous movement and clumping of chromosomes were observed and this is due to unequal separation on chromosomes (Tikedar and Dandin 2007). Such as aberrations cause less fertility of pollengrains, less micro-macro nutrient components and less adaptations for environmental factors. The present investigation will be very useful in plant breeding techniques during selection of parietal traits, evolving better off spring's production of high quality cultivars

and also establish phytogenetic relationship between the cultivars.

Table – 1: Chromosomal numbers of experimental cultivars.

Sr. No.	Morus species	Cultivar name	Chromosome no.
1	*Morus alba* L.	Kanva - 2	Diploid 2n = 28
2		English black	Diploid 2n = 28
3		China white	Diploid 2n = 28
4	*Morus indica* L.	MS - 2	Diploid 2n = 30 Aneuploid
5		MS - 5	Diploid 2n = 28

Table – 2: Stomatal measurements and chromosome length of five cultivars.

Sr. No.	Morus cultivars	Stomatal length (um)	Stomatal breadth(um)	Stomatal index	Stomatal frequency	Chromosome length (um)
1	Kanva - 2	18.00	5.50	36.17	56.67	2.00 – 3.00
2	English black	14.50	4.25	27.66	38.24	2.00 – 3.00
3	China white	15.25	4.00	27.78	38.46	1.50 – 3.00
4	MS - 2	15.50	4.25	35.56	55.17	2.00 – 3.00
5	MS - 5	13.50	3.50	11.11	12.50	1.50 – 3.00

Plate – 1
Morphology of the taxa

1. *Morus alba* L. var. Kanva – 2
2. *Morus alba* L. var. English black
3. *Morus alba* L. var. China white
4. *Morus indica* L. var. MS – 2
5. *Morus indica* L. var. MS – 5

Plate – 2
Mitosis
Microphotographs (x 1250)

1. *Morus alba* L. var. Kanva – 2 2n = 28
2. *Morus alba* L. var. English black 2n = 28
3. *Morus alba* L. var. China white 2n = 28
4. *Morus indica* L. var. MS – 2 2n = 30
5. *Morus indica* L. var. MS – 5 2n = 28

Plate – 3
Meiosis – chromosomal aberrations
Microphotographs

1. *Morus alba* L. var. Kanva – 2 Fragmentation of chromosomes
2. *Morus alba* L. var. English black Clumping of chromosomes
3. *Morus alba* L. var. China white Laggard formation
4. *Morus indica* L. var. MS – 2 Metaphasic chromosomes
5. *Morus indica* L. var. MS – 5 I Telophasic chromosomes
6. *Morus indica* L. var. MS – 5 Cytomixis of chromosomes

Plate – 4
Microphotographs of Epidermis

1. *Morus alba* L. var. Kanva – 2 Lower epidermis
2. *Morus alba* L. var. English black Lower epidermis
3. *Morus alba* L. var. China white Lower epidermis
4. *Morus indica* L. var. MS – 2 Lower epidermis
5. *Morus indica* L. var. MS – 5 Lower epidermis

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