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Cytological study of medicinally important plant Fennel (*Foeniculum vulgare* Mill.)

Unnita Mahato* & Kamini Kumar
University Department of Botany, Ranchi University, Ranchi, Jharkhand, India

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ABSTRACT

Fennel is a member of the family Apiaceae. It is an aromatic, therapeutic plant with valuable essential oils. This communication aims to offer basic cytological parameters and chromosome counts for fennel. The chromosome length was ranged from 2.88 µm to 5.04 µm. The range of relative length was 6.98-12.20. A maximum centromeric index of 47.51 µm was recorded. The minimum arm ratio was determined as 1.10. Satellite was associated with the short arm.

Key Words - Fennel, Apiaceae, Chromosome count, Cytological parameter

***Corresponding author :** unnitamahato6@gmail.com

INTRODUCTION

In India, fennel (*Foeniculum vulgare* Mill.) is a very common seed spice belongs to the family Apiaceae. Europe and Mediterranean region are the centre of origin of this cross-pollinate crop. (Sharma *et al*., 2020). Due to its extensive pharmacological properties, fennel is used as a medicinal herb in many countries. It is also said to be among the world's earliest medicinal plants. (Rahimi and Ardekani, 2013). It is frequently used to treat high blood pressure, amenorrhea, angina, asthma, heartburn, and mild appetite suppression. It is also helps to support the health of liver, lungs, spleen, and kidneys. (Sheidai *et al*., 2007). Additionally, fennel is widely used as condiments for livestock. The plant is well known for the essential oil derived from its seeds. The principal constituents found in essential oils derived from fennel seeds are trans-anethole, estragol (methyl chavicol), fenchone, and a-phellandrene. (Özkan, 2017). The current study describes the karyology of fennel in order to collect cytological details for an effective evaluation of the spice for further study of cytogenetic issues, and crop improvement that follows.

MATERIALS & METHODS

The seeds of Fennel (*Foeniculum vulgare* Mill.) collected from ICAR- NRCSS, Ajmer, Rajasthan, India. From the tips of the roots, all chromosomal observations were made. Seeds were pre-soaked for eight hours in distilled water and let germinated (22°C ± 1°C) in petri plates on moist filter paper. 3 days old healthy root tips (2-3 mm in length) were cut and immediately transferred to 0.002 M 8-hydroxyquinoline for 3.5 hours at 16°C ± 1°C for pre-treatment, where initially it was kept at 0°C-4°C for 12 minutes. Samples were then fixed in glacial acetic acid for half an hour and moved to 70% ethanol for extended storage (Hore, 1976). Now, for making slides roots were hydrolyzed with 1N HCL for 10-12 minutes at 60°C, then stained in 2% aceto-orcein stain for 4 hours, finally squashed in 45% acetic acid, and done observations under light microscope and microphotographs were taken. The micrometry has done by stage and ocular micrometer. The nomenclature recommended by Levan *et al.* (1964) was adopted. (Levan and Sandberg, 1964).

RESULTS & DISCUSSION

Cytological analyses were performed on the fennel root tips, revealed the number of somatic chromosomes and the karyological features. The chromosomal count of Fennel was determined to be 2n=22, and its karyotype formula is, 8 median including 2 SAT chromosomes + 12 sub median+ 2 sub terminal {8m(2SAT) + 12sm + 2st}. The total chromosomal length of the species is 41.26 µm. It has found that the chromosome length ranges from 2.88 µm to 5.04 µm. Relative length is measured as follows: 12.20 at the maximum level and 6.98 at the minimum. The chromosomal arm ratios have measured and ranged from 2.60 to 1.60 µm. According to the centrometric index, chromosome number 7 had the highest value (47.51), while chromosome number 4 had the lowest value (15.88). Satellites were found associated to short arm of the chromosomes. In earlier report (Paul and Datta, 2003), this feature has also been confirmed.

Table 1- Cytological details of Fennel (*Foeniculum vulgare* Mill.)

Chrom. Pair.	TL	LA/SA	RL	Ci	Classification
1	5.04	1.60	12.20	38.49	median (m)
2	4.53	2.00	10.98	33.33	submedian (sm)
3	4.24	1.94	10.28	33.96	submedian (sm)
4	3.59	5.30	8.70	15.88	subterminal (st)
5	3.60	2.60	8.72	27.78	submedian (sm)
6	3.60	1.50	8.72	40.00	median (m)
7	3.62	1.10	8.77	47.51	median (m)
8	3.55	1.15	8.60	46.48	median (m)
9	3.38	1.94	8.19	34.02	submedian (sm)
10	3.23	1.81	7.82	35.60	submedian (sm)
11	2.88	2.60	6.98	27.78	submedian (sm)

Abbreviations: TL-total chromosome length; LA/SA-arm ratio; RL- relative length; Ci-centromeric index = (S/TL) × 100

According to previous research (Sharma and Ghosh, 1954), (Bell and Constanc, 1957) the number of chromosomes is consistent and confirmed. Maximum number of sub median chromosomes, presence of sub terminal chromosomes and chromosomes with secondary constriction has depicted very advance nature in aspect of karyotype according to the cytotaxonomical point of view. (Das and Mallick, 1989). Future studies on the cytogenetics of the species may benefit greatly from an exploration of the karyomorphological data found in these spices.

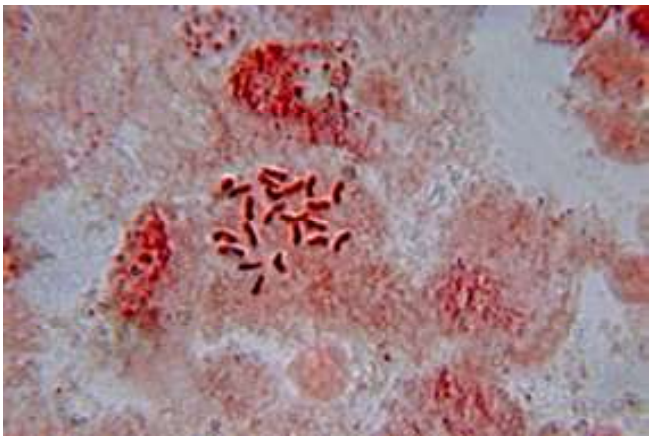

Fig.1- Cell showing metaphase chromosomes of *Foeniculum vulgare* Mill.

Fig. 2- Ideogram of *Foeniculum vulgare* Mill.

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