



## Karyotype Analysis Of Fennel (*Foeniculum vulgare* Mill.) From Ankara Province

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### Abstract

Fennel (*Foeniculum vulgare* Mill.) belongs to Apiaceae family is medicinal and aromatic species with economic importance rich essential oils. In this research; we try to obtain cytological parameters on Fennel. Six chromosomal parameters were measured by Micro Measure 3.3 program; i.e., chromosome length (c), relative length (RL), the long arm (L) and short arm (S) lengths, arm ratio (AR: L/S), centromeric index (S/C). Maximum chromosome length was measured 1.71  $\mu\text{m}$  and max arm ratio was determined 2.79  $\mu\text{m}$ . It's been observed that the long arm lengths of fennel (*Foeniculum vulgare* Mill.) are within the range of 0.69-1.06  $\mu\text{m}$  and its short arm lengths are within range of 0.38-0.84  $\mu\text{m}$ . Relative length was ranged between 3.76-5.38%. Maximum centromeric index was measured in 1.81  $\mu\text{m}$ . Karyotype formula were obtained  $2n=22=18$  median + 4 submedian (18 m + 4sm).

**Keywords:** Medicinal plant, plant cytogenetic, caryological characterization, chromosome

### INTRODUCTION

The gene center of the genus *Foeniculum* is the Mediterranean basin and is represented in the world by three species. The species that have economic importance of the genus *Foeniculum vulgare* Mill. (Fennel). Fennel is a perennial, herbaceous plant, growing upright, reaching 2 m in length, with a filamentous piece of leaves and a yellow flowering plant. All parts of the plant can be evaluated, including seeds. It is a highly aromatic and flavourful herb with culinary and medicinal uses. Fennel seeds are anise (*Pimpinella anisum* L.) like in aroma and are used as flavour agents in baked goods, meat and fish dishes, ice cream, alcoholic beverages and herb mixtures [1, 2, 3].

Fennel (*Foeniculum vulgare* Mill.) is a widespread uses as medicinal plant because of various pharmacological activities. Also, it is believed to be one of the oldest medicinal plant in the World [4]. It is commonly used to treat amenorrhoea, angina, asthma, heartburn, high blood pressure a mild appetite suppressant and is used to improve the kidneys, spleen, liver and lungs. Fennel is also largely used for cattle condiments. It is one of the plants which is said to be disliked by fleas, and powdered Fennel has the effect of driving away fleas from kennels and stables. The plant gives off ozone most easily.

Fennel is well-recognized for its essential oil. The major components which are in fennel seed essential oils are trans-anethole, fenchone, estragol (methyl chavicol), and a-phellandrene and The relative concentration of these compounds varies considerably depending on the phonological stage and origin of the fennel [5]. Fennel has been reported to contain 6.3% of moisture, 9.5% protein, 10% fat, 13.4% minerals, 18.5% fibre and 42.3% carbohydrates. The minerals and vitamins in Fennel are calcium, potassium, sodium, iron, phosphorus, thiamine, riboflavin, niacin and vitamin C [6].

In general, there is a lack of cytogenetic report on Fennel in TURKEY. This paper provides cytogenetical knowledges

about Fennel (*Foeniculum vulgare* Mill.) from Ankara, TURKEY

### MATERIAL AND METHODS

Fennel (*Foeniculum vulgare* Mill.) seed were obtained from USDA (United States Department Of Agriculture). Also, it is presented in table 1.

**Table 1.** Knowledges about Fennel

Group	Plant Name	Taxonomy	Origin
PI 117336	113	<i>Foeniculum vulgare</i> Mill.	Ankara-TURKEY

All cytological observations were made from root tips. For visualizing somatic chromosomes, root tips were obtained from germinated fennel (*Foeniculum vulgare* Mill.) seeds germinated in petri dishes at room temperature (25 °C). 2-3 days old root tips were pre-treated in 0.002 M 8 hydroxyquinoline in +4 °C for 2.5 h and then fixed in glacial acetic acid for 30 minutes and transferred to 70% ethanol for long storage. When the root tips were analyzed, they hydrolyzed with 1 N HCl for 12 minutes in room temperature (25 °C). After hydrolyzing, root tips stained with 2% aceto orcein in darkness for 2.5 h. Then, finally squashed in 45% acetic acid. Slides were observed with Olympus BX-51 microscope and photographs were taken with Olympus BX-51 camera, magnification was 8000x. Six chromosomal parameters were measured by Micro Measure 3.3 program [7]; i.e., chromosome length (c), relative length (RL), the long arm (L) and short arm (S) lengths, arm ratio (AR: L/S), centromeric index (S/C). Ideograms were drawn based on long arm length/short arm length. Karyotype formulas and chromosome positions of fennel (*Foeniculum vulgare* Mill.) were determined by [8].

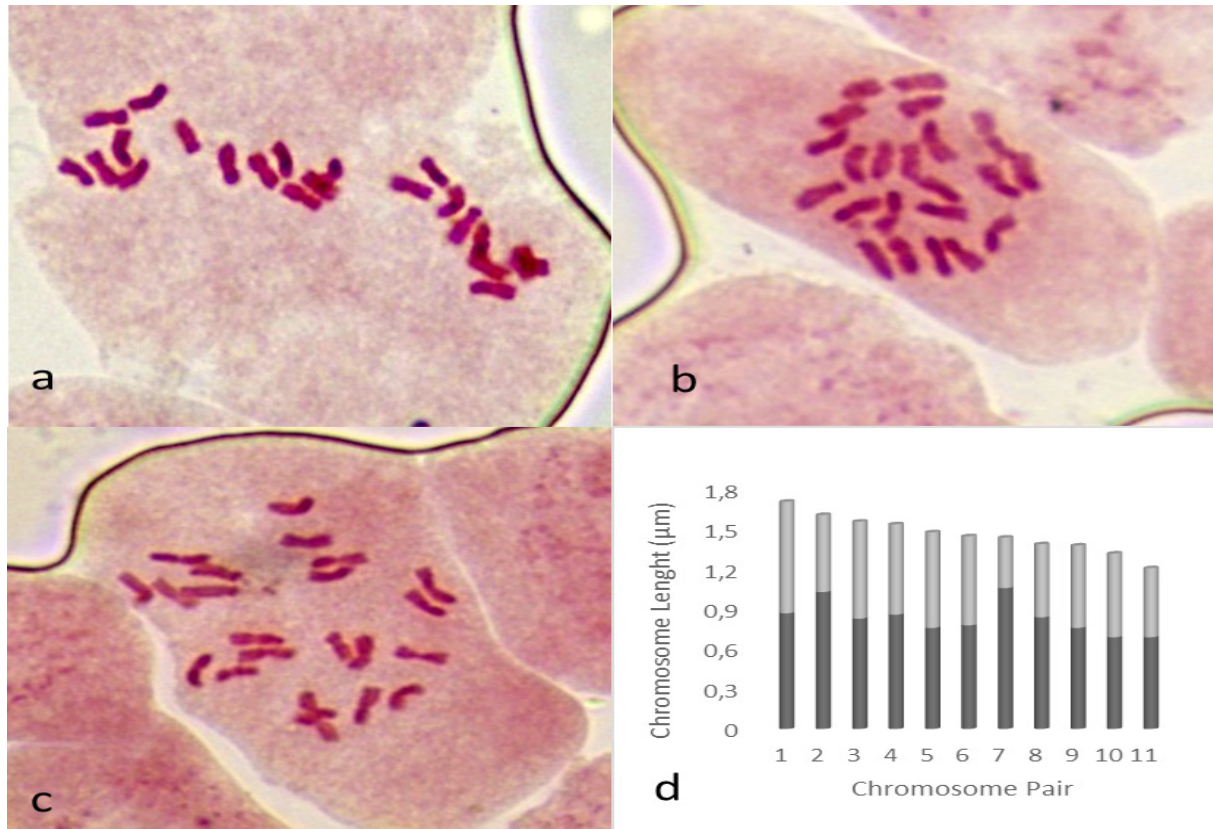


Figure 1. Somatic metaphase cells (a, b, c) and ideogram (d) of Fennel (*Foeniculum vulgare* Mill.)

## RESULTS and DISCUSSION

According to the cytologic studies that is carried out on the root tips of the fennel (*Foeniculum vulgare* Mill.) the number of somatic chromosome and the caryologic characteristics. It's found out that fennel (*Foeniculum vulgare* Mill.) has the number of chromosomes as  $2n=22$  and its caryotype formula has been measured as  $18m + 4sm$  (Figure 1). In reference to results, our findings are parallel the other researchers findings [9, 10, 11]. As it is presented in table 2, the species who has a total chromosome length of  $32.20 \mu\text{m}$ , the length of the chromosomes with haploid ( $n$ ) numbers are within the range of  $1.22\text{-}1.71 \mu\text{m}$  and the average of the chromosome length has been measured  $1.463 \mu\text{m}$ . It's been observed that the long arm lengths of fennel (*Foeniculum vulgare* Mill.) are within the range of  $0.69\text{-}1.06 \mu\text{m}$  and its short arm lengths are within range of  $0.38\text{-}0.84 \mu\text{m}$ . The arm ratio of the chromosomes have reached values between  $1.04\text{-}2.79 \mu\text{m}$ . Relative length has been measured for the maximum level as  $5.38\%$  and for the minimum level as  $3.76\%$ . When centromeric index has been observed, the chromosome number 1 had the highest value as  $1.81$  and the chromosome number 7 had the lowest value as  $0.74$ .

Table 2. Caryological features of Fennel

Chromosome Pair	C ( $\mu\text{m}$ )	L ( $\mu\text{m}$ )	S ( $\mu\text{m}$ )	R	RL (%)	CI	C. P
1	1.71	0.87	0.84	1.04	5.38	1.81	m
2	1.61	1.03	0.58	1.78	5.01	1.14	sm
3	1.56	0.83	0.73	1.14	4.82	1.61	m
4	1.54	0.86	0.68	1.26	4.71	1.47	m
5	1.48	0.76	0.72	1.06	4.60	1.67	m
6	1.45	0.78	0.67	1.16	4.52	1.53	m
7	1.44	1.06	0.38	2.79	4.48	0.74	sm
8	1.39	0.84	0.55	1.53	4.32	1.20	m
9	1.38	0.76	0.62	1.23	4.26	1.44	m
10	1.32	0.69	0.63	1.10	4.13	1.54	m
11	1.22	0.69	0.52	1.33	3.76	1.27	m

Abbreviations; C; total chromosome length, L; long arm length, S; short arm length, R; arm ratio =  $L/S$ , RL; relative length, CI; centromeric index =  $(S/C) \times 100$ , CP; centromeric position.

## REFERENCES

- [1] Anonymous, 2017. <http://www.theplantlist.org/1.1/browse/A/Apiaceae/Foeniculum/>. Access date: 25.10.2017.
- [2] Díaz-Maroto MC, Díaz-Maroto Hidalgo IJ, Sánchez-Palomo E and Pérez-Coello MS. 2005. Volatile components and key odorants of Fennel (*Foeniculum vulgare* Mill.) and Thyme (*Thymus vulgaris* L.) oil extracts obtained by simultaneous distillation-extraction and supercritical fluid extraction. Journal of agricultural and food chemistry, 53(13), 5385-5389. [3] Davis, PH. 1988. Flora of Turkey. Vol. 4. P:376-377. Edinburg.
- [4] Rahimi R and Ardekani MRS. 2013. Medicinal properties of *Foeniculum vulgare* Mill. in traditional Iranian medicine and modern phytotherapy. Chinese journal of integrative medicine, 19(1), 73-79.
- [5] Díaz-Maroto MC, Pérez-Coello MS, Esteban J and Sanz J. 2006. Comparison of the volatile composition of wild fennel samples (*Foeniculum vulgare* Mill.) from Central Spain. Journal of agricultural and food chemistry, 54(18), 6814-6818.
- [6] Rather MA, Dar BA, Sofi SN, Bhat BA and Qurishi MA. 2016. *Foeniculum vulgare*: A comprehensive review of its traditional use, phytochemistry, pharmacology, and safety. Arabian Journal of Chemistry, 9, S1574-S1583.
- [7] Reeves, A. 2001. MicroMeasure: A new computer program for the collection and analysis of cytogenetic data. Genome. 44: 439-443.
- [8] Levan A, Fredga K, Sandberg AA. 1964. Nomenclature for centromeric position on chromosomes. Hereditas. 52: 201-220.
- [9] Bing-bing DRNL, Da-cui, CMLH and Yan LRFL. 2006. Cytological Study on the Medical Plant *Foeniculum vulgare* Miller [J]. Journal of Huazhong Agricultural University (Natural Science Edition), 6, 003.
- [10] Safaei L, Zeynali H, Jaber Alansar Z. 2008. Cytogenetic Studies In 5 Native Fennel (*Foeniculum Vulgare* Mill.) Populations of Iran. Iranian Journal of Rangelands and Forests Plant Breeding and Genetic Research SPRING. Volume 16, Number 1 (31); Page(s) 117-125.
- [11] Dong Z, ZhiMing Y, ShuNing Z, JunXing L and HuiJi L. 2010. Karyotype analysis of main umbelliferous vegetables. Acta Botanica Boreali-Occidentalia Sinica, 30(10), 1978-1981.