

## Karyological Studies on Mediterranean Sage (*Salvia aethiopsis* L.)

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### Abstract:

Mediterranean sage (*Salvia aethiopsis* L.) is a species being part of *Lamiaceae* family and important in terms of economic aspect. Caryological studies are important in developing this species and determining the hybridization process of this species with other ones. In this study, the root tips obtained after the germination with mature seeds have been pre-treated in the  $\alpha$ -monobromonaphthalene solution and stained by aceto-orcein. According to the karyotype analysis applied, it has been observed that this species has a chromosome number equivalent of  $2n=2x=22$  ( $14m + 8 sm$ ). It has been measured that the average length of chromosome regarding to this species is  $2.043 \mu m$ , the longest arm length was  $1.994 \mu m$ , the shortest arm length was  $0.604 \mu m$ . Relative lengths of chromosomes ranged between 3.22-6.73%. Arm ratios and centromeric index were changed between 1.140-2.120 and 0.320-0.468, respectively.

**Key words:** Medicinal plant, Karyotype, Caryological characterization, Chromosome

### INTRODUCTION

Lamiaceae is generally a relishing family and is a flowering plant that could have one year old or longer. It's one of the families of flowering plants who have a huge number of varieties comprising 236 genus and approximately 7500 species [1]. In Turkey's flora, it exists 99 species of which 57 are endemic and 113 taxa [2]. Also, *Salvia* is the largest genus with 986 species and 1037 taxa [3]. *Salvia aethiopsis* L. is economically important for being used in pharmacology, perfumery, as a decoration and herbal plant. In local usage, *Salvia aethiopsis* L. also known as "Mediterranean Sage" has an antioxidant effect [3] and it's reported that it has an effect on *Bacillus subtilis*, *Bordotella bronchiseptica*, *Staphylococcus aureus* and *Staphylococcus epidermidis* [4].

In cytological studies carried out on *Salvia* species, it's been revealed that the species have different numbers of chromosome and this difference in chromosome number is relevant to the locations where they grow [5]. According to the studies conducted, it's observed that in *Salvia* species, the chromosome numbers are as  $2n=14-18$  by [6],  $2n=14-16-20-22$  by [7],  $2n=14-20-22-32$  by [5],  $2n=14-18-22-28-32-60$  by [8] and there are large variations in ploidy levels. In most species of *Salvia*, root tips can not be obtained from the seeds due to the fact that the seeds can not be germinated in most cases and it makes it hard to conduct cytological studies in these species.

The aim of this study is to determine the number of chromosome and caryomorphological characteristics of Mediterranean sage (*Salvia aethiopsis* L.) commonly found in Turkey's flora.

### MATERIAL AND METHOD

For the visualizing of somatic chromosomes, Mediterranean sage (*Salvia aethiopsis* L.) seeds germinated in petri dishes in room temperature ( $25^\circ C$ ). 4-5 days old

root tips were pre-treated in 6%  $\alpha$ -monobromonaphthalene in  $+4^\circ C$  for 7.5 h, then fixed in glacial acetic acid for 30 minutes and transferred to 70% ethanol for long storage [9]. When the root tips were analyzed, they were hydrolyzed with 1 N HCl for 12 minutes in room temperature ( $25^\circ C$ ). Then, stained with 2% aceto orcein in darkness for 2.5 h and finally squashed in 45% acetic acid. Slides were analyzed with Olympus BX-51 microscope and photographs were taken with Olympus BX-51, magnification was 8000x. Six chromosomal parameters were determined by Micro Measure 3.3 [10]; 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 formula of Mediterranean sage (*Salvia aethiopsis* L.) was determined by [11].

### RESULT AND DISCUSSION

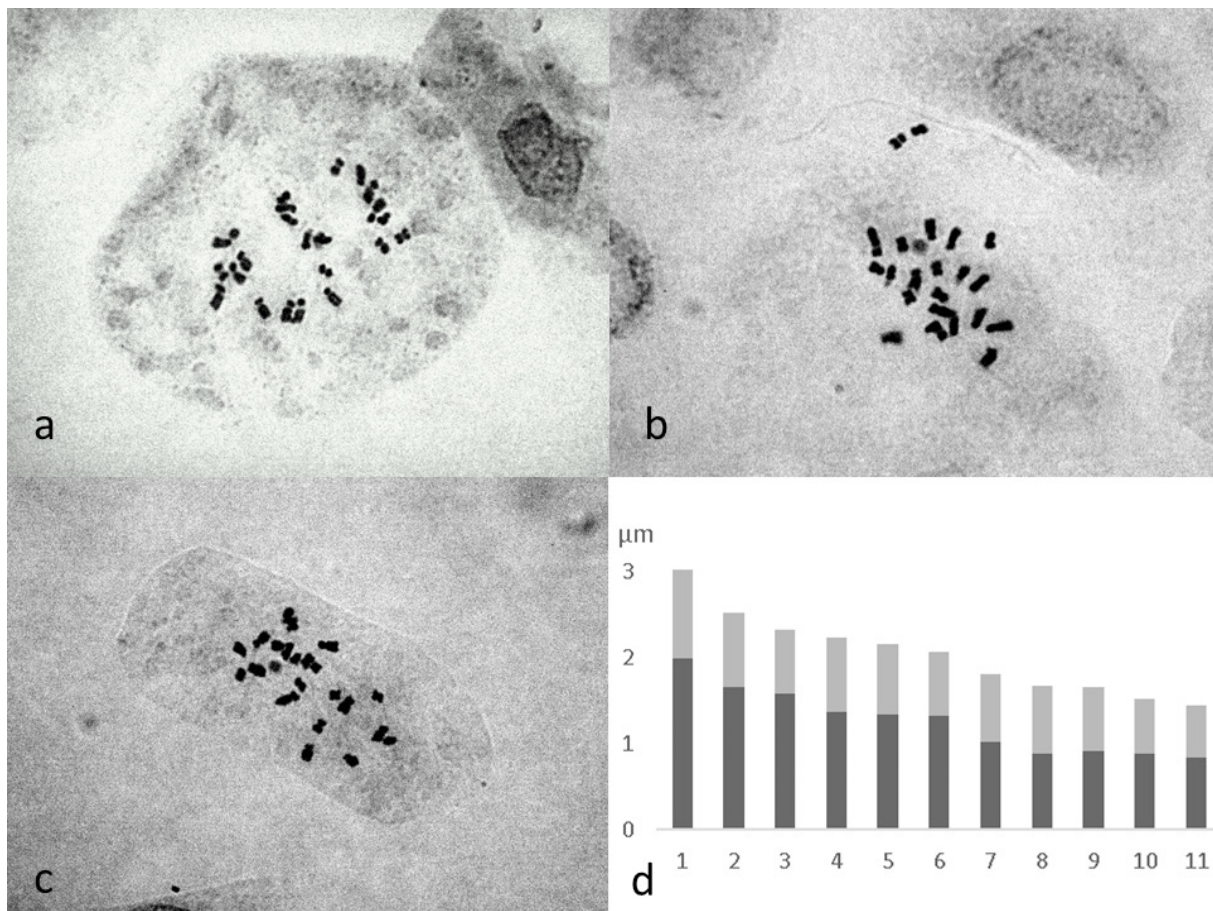
According to the cytologic studies carried out on the root tips of the Mediterranean sage (*Salvia aethiopsis* L.) the number of somatic chromosome ve the caryologic characteristics. It's found out that *Salvia aethiopsis* L. has the number of chromosomes as  $2n=22$  (Figure 1) [12]; [13] [14]; [15]; [16] and its karyotype formula has been measured as  $2n=22=14 \text{ median} + 8 \text{ submedian}$ . As it is presented in table 1, the species who has total chromosome length of  $44.95 \mu m$ , the length of the chromosomes with haploid (n) numbers were within the range of  $1.445-3.025 \mu m$  and the average of the chromosome length has been measured  $2.043 \mu m$ . Relative length has been measured for the maximum level as 6.73% and for the minimum level as 3.22%. It's been observed that the longest arm lengths of *Salvia aethiopsis* L. were within the range of  $0.841-1.994 \mu m$  and its shortest arm lengths were within range of  $0.604-1.031 \mu m$ . The arm ratio of the chromosomes have reached values between 1.140-

2.120. When centromeric index has been observed, the chromosome number 8 had the highest value as 0.468 and the chromosome number 3 had the lowest value as 0.320.

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.

**Table 1.** Caryological features of Mediterranean sage

Number	Type	Chromosome Length ( $\mu\text{m}$ )	Relative Length (%)	Long Arm Length ( $\mu\text{m}$ )	Short Arm Length ( $\mu\text{m}$ )	Arm Ratio	Centromeric Index
1	sm	3.025	6.73	1.994	1.031	1.930	0.341
2	sm	2.527	5.62	1.654	0.873	1.900	0.345
3	sm	2.328	5.18	1.582	0.745	2.120	0.320
4	m	2.246	5.00	1.368	0.878	1.560	0.391
5	m	2.162	4.81	1.345	0.816	1.650	0.378
6	sm	2.066	4.60	1.325	0.741	1.790	0.359
7	m	1.816	4.04	1.017	0.799	1.270	0.440
8	m	1.673	3.72	0.890	0.783	1.140	0.468
9	m	1.659	3.69	0.915	0.744	1.230	0.448
10	m	1.528	3.40	0.893	0.634	1.410	0.415
11	m	1.445	3.22	0.841	0.604	1.390	0.418
Total		22.475					



**Figure 1.** Somatic metaphase cells (a, b, c) and ideogram (d) of Mediterranean sage

## REFERENCES

- [1] Harley RM, Atkins S, Budantsev AL, Cantino PD, Conn BJ, Grayer R and Upson T. 2004. Labiatae. In *Flowering Plants: Dicotyledons* (pp. 167-275).
- [2] Anonymous, 2017a. <http://www.bizimbitkiler.org.tr/v2/hiyerarsi.php?c=Salvia>. Access date:24.10.2017
- [3] Anonymous, 2017b. <http://www.theplantlist.org/1.1/browse/A/Lamiaceae/Salvia/>. Access date:22.10.2017
- [4] Hernandez-Perez M, Rabanal RM, Arias A, De La Torre MC and Rodriguez B. 1999. Athiopi-none an Antibacterial and Cytotoxic Agent from *Salvia aethiopsis* Roots, *Pharmaceutical Biology*, 37:1, 7-21.
- [5] Sheidai M and Alijanpoo B. 2011. Karyotype analysis in some *Salvia* species (*Lamiaceae*) of Iran. *Cytologia*, 76(4), 425-429.
- [6] Özkan M. 2006. Karyotype analysis on two endemic *Salvia* L.(*Lamiaceae*) species in Turkey. *International Journal of Botany*, 2(3), 333-335.
- [7] Kharazian N. 2011. Karyotypic study of some *Salvia* (*Lamiaceae*) species from Iran. *Journal of Applied Biological Sciences*, 5(3), 21-25.
- [8] Martin E, Cetin O, Kahraman A, Celep F and Dogan M. 2011. A cytomorphological study in some taxa of the genus *Salvia* L.(*Lamiaceae*).*Caryologia*, 64(3), 272-287
- [9] Benlioglu B and Özgen M. 2014. The Effect Of Different 2,4-Dichlorophenoxyacetic Acid Doses On Chromosomal Structure Of Regenerants In Barley (*Hordeum vulgare* L.) Embryo Culture. *International Journal of Advanced Biotechnology and Research (IJBR)*, Vol5, Issue3, 2014, p533-538.
- [10] Reeves, A. 2001. MicroMeasure: A new computer program for the collection and analysis of cytogenetic data. *Genome*. 44: 439-443.
- [11] Levan A, Fredga K, Sandberg AA. 1964. Nomenclature for centromeric position on chromosomes. *Hereditas*. 52: 201-220.
- [12] Afzal-Rafii, Z. 1980. Chromosome number reports LXVII. *Taxon*. 29:365-366.
- [13] Markova ML, Ivanova PS. 1982. Karyological study of the genus *Salvia* L. in Bulgaria. *Filologija*.
- [14] Sekovski Z, Jovanovska M. 1983. Chromosome atlas of some Macedonian angiosperms. IV. *Ann Fac Biol Univ Skopje*. 6:73-86.
- [15] Dobeá, C, Hahn B and Morawetz W. 1997. Chromosomenzahlen zur Gefäßpflanzen-Flora Österreichs. *Linzer Biol. Beitr.* 29(1): 5-43.
- [16] Kiehn M, Vitek E, Dobeá C. 2000. Documented chromosome number checklist of Austrian vascular plants. Vienna: Verlag des Naturhistorischen Museums.