

**Karyological Studies on *Lotus strictus* Fisher and C.A. Mey. (Leguminosae),
Centaurea amanicola Hub.-mor. (Compositae) and *Teucrium lamiifolium*
D'urv. Subsp. *Lamiifolium* (Labiatae)**

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Abstract: In this study, the caryomorphological specialities of three taxa in Turkey were examined. The chromosome numbers in *Lotus strictus* Fisher and C.A.Mey. (Leguminosae) $2n = 14$, in *Centaurea amanicola* Hub.-Mor. (Compositae) $2n = 18$ and in *Teucrium lamiifolium* d'Urv. subsp. *lamiifolium* (Labiatae) $2n = 32$ were determined. The taxa karyotype analyses were made with Image Analyses System supported with computer. Also, karyograms of the taxa were prepared and their idiograms were drawn.

Key words: *Lotus* • *Centaurea* • *Teucrium* • chromosome number • karyotype

INTRODUCTION

Turkey occurring in warm climate zone is distinguished from many countries situating its environments by the plant diversity. The number of plants distributed in Turkey is nearly those in Europe. The plant taxa in Turkey have reached to 12.000 by recently discovered new taxa [1]. The richness of Turkish flora is based on geographical, climatical, topographical and edafic factors. These factors bring about the plant formation diversity and infraspecific variation [2]. Turkey is also one of the richest countries in world with respect to endemism. The number of endemic taxa is more than 3000 and endemism ratio is 34.4% [3].

In this study, *Lotus strictus* Fisher and C.A. Mey., *Centaurea amanicola* Hub.-Mor. and *Teucrium lamiifolium* d'Urv. subsp. *lamiifolium* taxa belonging to different families were determined in karyotypes. These genus are represented various numbers taxa of which *Centaurea* 189, *Teucrium* 41 and *Lotus* 21 taxa in Turkey. Endemism ratio of these genus is respectively as follows; about *Centaurea* 61.6%, *Teucrium* 29.6% and *Lotus* 11.1% [4-6]. Of the studied taxa, only *Centaurea amanicola* is endemic. The chromosome number of this species was $2n = 16$ according to the records in flora of Turkey [7]. However, it was recorded as $2n = 18$ in the supplement volume of Flora of Turkey [4]. Also, that of *Lotus strictus* as $2n = 14$ was given in flora of Turkey [8]. The somatic chromosome number of *Teucrium lamiifolium* subsp. *lamiifolium* was determined as $2n = 32$ for the first time in

this study. Also, the chromosome morphologies of these taxa were defined and their idiograms were drawn for the first time.

MATERIALS AND METHODS

In this research, the specimens which belong to the genus *Lotus*, *Centaurea* and *Teucrium* were collected and identified. Voucher specimens and their seeds are kept in Selçuk University, Education Faculty Herbarium. The localities and the collectors are as follows:

***Lotus strictus* B5 Aksaray:** Eskil, 950 m., 15.10.2005, salty steppe, M. Dınç 2522 and A. Duran.

***Centaurea amanicola* C6 osmaniye:** Amanos Mountains, Mitisin Yaylası, 1350 m., 19.08.2005, clearings *Pinus* forest, M. Dınç 2486.

***Teucrium lamiifolium* subsp. *lamiifolium* C4 Karaman:** Ermenek, Katranlı Yaylası, clearings *Cedrus* forest, rocky places, 1700 m., 24.10.2004, M. Dınç 2309a.

All cytological observations were made from root tips. In *Lotus strictus*, *Centaurea amanicola* and *Teucrium lamiifolium* subsp. *lamiifolium* taxa, they were germinated on wet filter paper in Petri dishes. Fresh root tips about 1cm long were cut, pretreated in α -monobromonaphthalene at 4°C for 16 h, then fixed with 1:3 (glacial acetic acid: absolute alcohol) at 4°C for 24 h. They were deposited in 70% ethanol at 4°C. Prior to

staining, the root tips were hydrolysed in 1 N HCl at room temperature for 10-12 min and squashed stained in 2% aceto-orcein. Permanent slides were made with the standard liquid nitrogen method. However in *Centaurea amanicola* root tips were hydrolysed in 1 N HCl at room temperature for 1 h and squashed stained in 2% aceto-orcein. Chromosome measurement and karyotypes were calculated with BsChromo karyotype analysis software. Chromosomes were classified with nomenclature of Levan *et al.* [9]. Idiograms of each taxa were arranged in order of decreasing length. Homolog chromosome pairs were determined through total length and relative length of each chromosome. However, centromers of the chromosomes could not be distinguished and the type of chromosomes could not be determined in *Teucrium lamiifolium* subsp. *lamiifolium* because of its very small chromosomes.

RESULTS

The chromosome number is $2n = 14$ in *Lotus strictus* (Figs. 1-3a). Total chromosome lengths of 2.40-0.85 μm .

Arm ratios are 1.85-1.15. According to these data, two chromosome pairs are submetacentric and the others are metacentric type. Total haploid chromosome length is 18.39 μm (Table 1).

The chromosome number is $2n = 18$ in *Centaurea amanicola* (Figs. 1-3b). Chromosomes are 1.75-1.10 μm in this species. Arm ratios are 1.32-1.23 and all chromosomes are metacentric type. Total haploid chromosome length is 19.04 μm (Table 2).

According to the results of the cytological studies, it was observed that the chromosome number is $2n = 32$ in *Teucrium lamiifolium* subsp. *lamiifolium* (Figs. 1-3c). The chromosome lengths are 1.97-0.86 μm . Because of its very small chromosomes, the centromers of the chromosomes could not be distinguished and the type of chromosomes could not be identified. Total haploid chromosome length is 20.51 μm in this taxon (Table 3).

DISCUSSION

It was reported in previous studies on *Lotus* that the chromosome numbers in the genus are $2n = 10, 12, 14, 24,$

Table 1: Detailed chromosome morphology in *Lotus strictus*

Chromosome pair no.	Chromosome arms (μm)		Total length (μm)	Arm ratio (L/S)	Relative length (%)	Chromosome type
	Long arm (L)	Short arm (S)				
I	2.40	1.30	3.70	1.85	19.15	sm
II	1.96	1.52	3.48	1.29	18.05	m
III	1.99	1.25	3.24	1.58	16.78	m
IV	1.83	1.00	2.83	1.83	14.66	sm
V	1.48	0.93	2.41	1.59	12.48	m
VI	1.10	0.96	2.06	1.14	10.64	m
VII	0.85	0.74	1.59	1.15	8.23	m

Total length of haploid complement: 19.31 μm

Table 2: Detailed chromosome morphology in *Centaurea amanicola*

Chromosome pair no.	Chromosome arms (μm)		Total length (μm)	Arm ratio (L/S)	Relative length (%)	Chromosome type
	Long arm (L)	Short arm (S)				
I	1.75	1.30	3.05	1.32	13.10	m
II	1.77	1.11	2.88	1.60	12.41	m
III	1.55	1.25	2.80	1.21	12.03	m
IV	1.60	1.20	2.80	1.32	12.04	m
V	1.35	1.20	2.55	1.15	11.01	m
VI	1.30	1.15	2.45	1.14	10.60	m
VII	1.25	1.15	2.40	1.06	10.30	m
VIII	1.25	1.10	2.35	1.13	9.98	m
IX	1.1	0.9	2	1.23	8.54	m

Total length of haploid complement: 22.25 μm

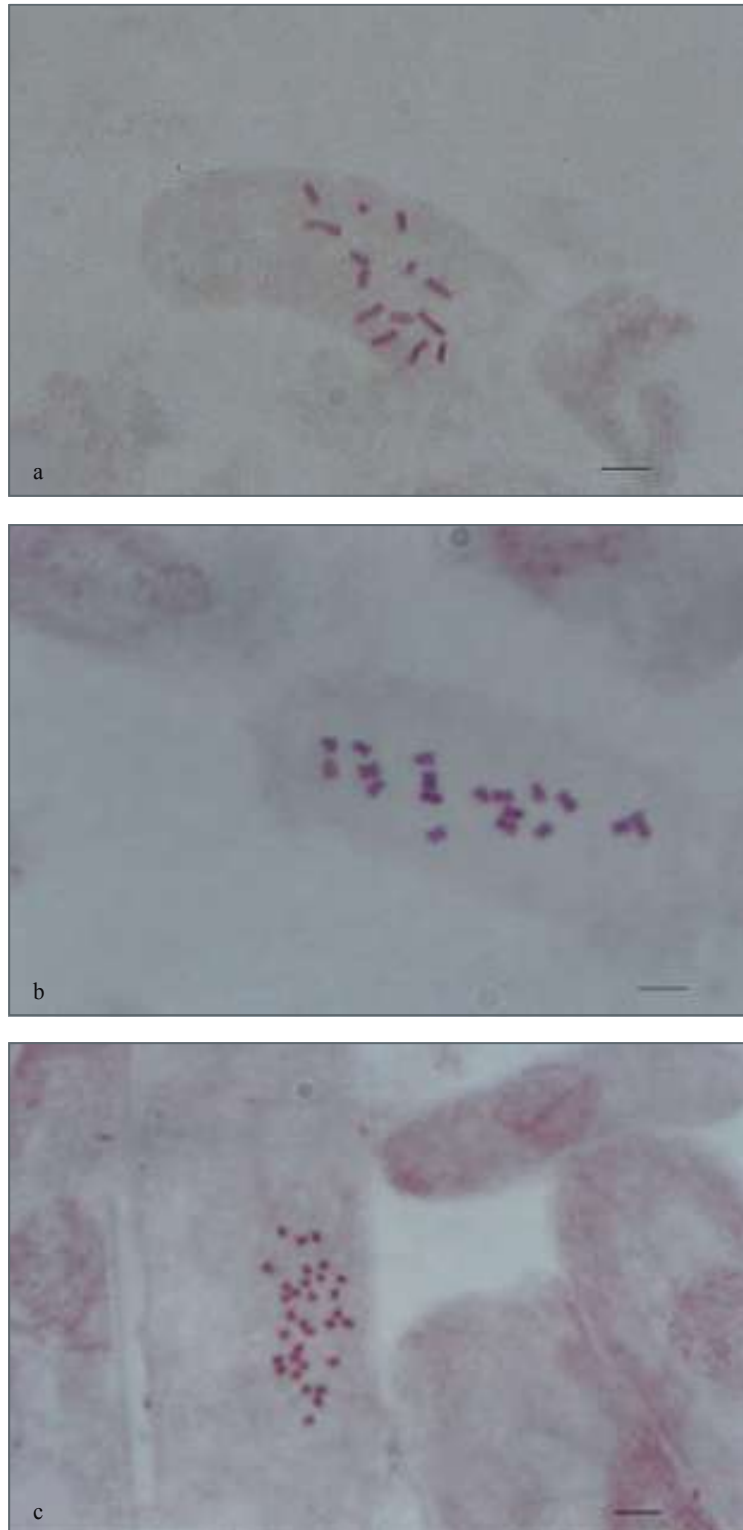


Fig. 1: Somatic chromosomes in taxa. (a) *Lotus strictus* $2n = 14$, (b) *Centaurea amanicola*, $2n = 18$, (c) *Teucrium lamiifolium* subsp. *lamiifolium* $2n = 32$, Bar = $10 \mu\text{m}$

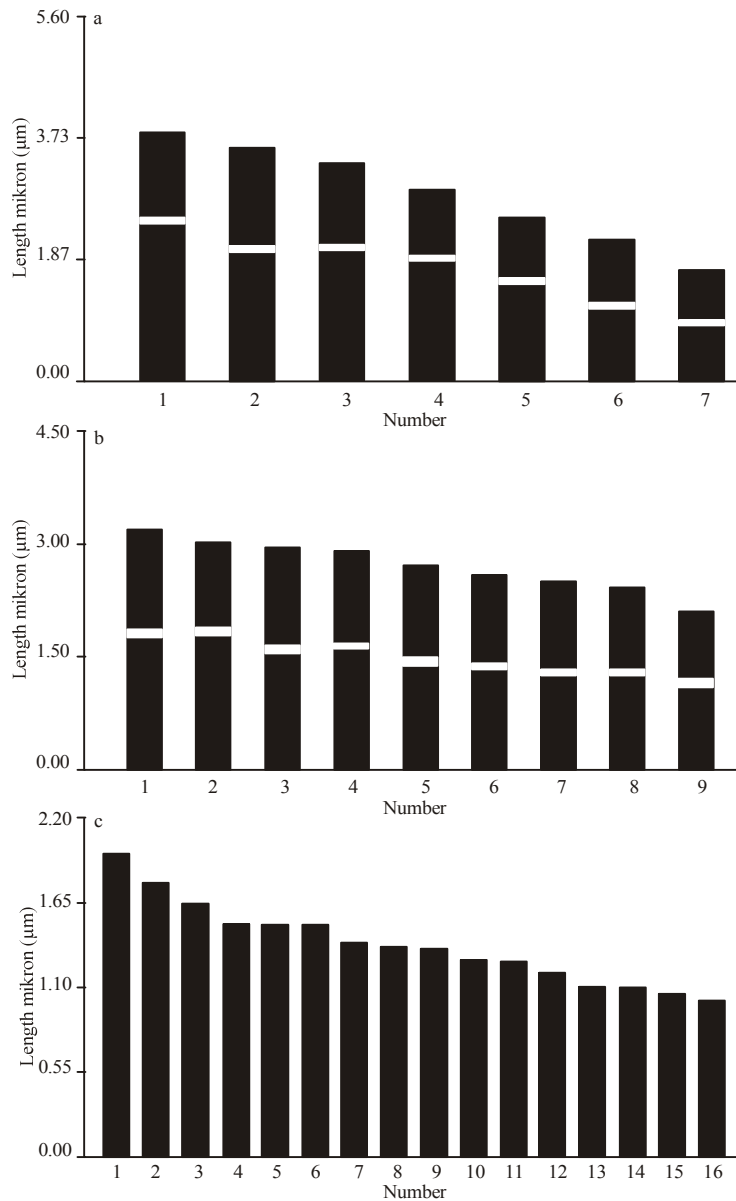


Fig. 2: Idiograms of taxa. (a) *Lotus strictus* 2n = 14, (b) *Centaurea amanicola* 2n = 18, (c) *Teucrium lamiifolium* subsp. *lamiifolium* 2n = 32. Bar = 1 µm

28 [7, 10-12]. Our results pointed out that the chromosome number is $2n = 14$ in *Lotus strictus* as given in Flora of Turkey [8]. The chromosome morphology of the species was also determined in this study. The karyotype formula is $5m+2sm$. *Lotus genistoides*, *L. spartioides* and *L. holosericeus* have $2n = 14$ somatic chromosome the same as in our study in the cytological studies previously carried out. According to these studies, their basic chromosome number are $n = 7$. But there is no data with

regard to chromosome morphologies of the taxa in the same studies [13, 14].

The basic chromosome numbers for the genus *Teucrium* has variation as $x = 5, 8, 13$ [15]. Valde's-Bermejo and Sanchez-Crespo [16] reported as $x = 16$ for the sect. *Scorodonia* (Hill) Schreb. Many researchers given the diploid chromosome number as $2n = 32$ in *Teucrium* [17-24]. The chromosome number and morphology firstly recorded in *T. lamiifolium* subsp.

Table 3: Detailed chromosome morphology in *Teucrium lamiifolium* subsp. *lamiifolium*

Chromosome pairs	Total length (µm)	Relative sizes (%)
I	1.97	9.59
II	1.68	8.18
III	1.55	7.57
IV	1.48	7.22
V	1.43	6.98
VI	1.40	6.83
VII	1.32	6.44
VIII	1.30	6.35
IX	1.22	5.98
X	1.18	5.73
XI	1.13	5.48
XII	1.06	5.19
XIII	1.01	4.94
XIV	0.98	4.76
XV	0.93	4.55
XVI	0.86	4.21

Haploid total length: 20.51 µm

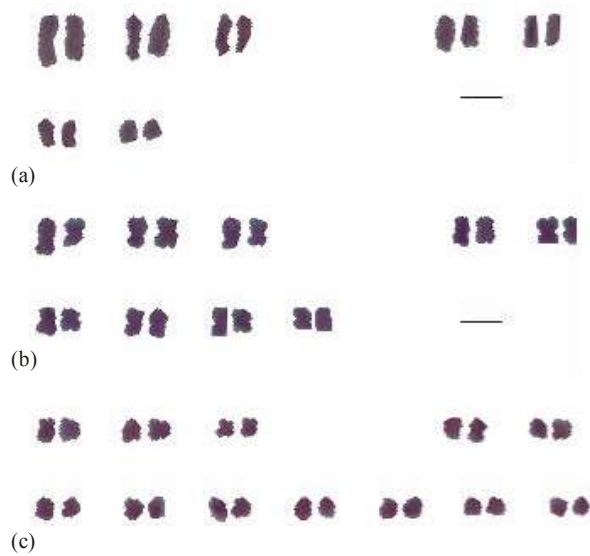


Fig. 3: Karyograms in taxa. (a) *Lotus strictus* $2n = 14$, (b) *Centaurea amanicola*, $2n = 18$, (c) *Teucrium lamiifolium* subsp. *lamiifolium* $2n = 32$ Bar = 10 µm

lamiifolium belongs to sect. *Stachybotrys* Benthham in this paper.

It was given that *Teucrium alyssifolium* in sect. *Teucrium* has $2n = 30$ and *T. divaricatum* subsp. *divaricatum* in sect. *Chamaedrys* has $2n = 64$ somatic chromosome number according to the records of Turkish Flora [4]. The sections including these taxa

are not morphologically related with sect. *Stachybotrys* including *T. lamiifolium* subsp. *lamiifolium*. This situation was confirmed by chromosomal data.

The mitotic metaphase chromosome number is $2n = 18$ in *Centaurea amanicola* as given in the Flora of Turkey [4]. The chromosome morphology of the species was also studied for the first time in our study.

The cytological researchs on taxa which belong to the genus *Centaurea* in the Flora of Turkey showed that the somatic chromosome numbers were $2n = 16, 18, 20, 22, 24, 36, 40$ [4, 7]. The chromosome numbers of some taxa in the *Centaurea Jacea* group were determined and the basic chromosome number was given as $n = 9$ [25]. The mitotic chromosome numbers of the group are $2n = 16, 18, 20, 30, 34, 36, 54$ [25]. The study also showed that different ploidy levels occur in the genus *Centaurea*. However, the species which belong to *Centaurea* sect. *Cynaroides* Boiss. ex Walp. does not show the chromosome number variation.

The species *Centaurea aladaghensis* Wagenitz, *C. cataonica* Boiss. and Hausskn. and *C. kurdica* Reichardt belong the sect. *Cynaroides* and they have the same somatic chromosome numbers as $2n = 18$. This situation shows that poliploidy does not occur in sect. *Cynaroides*. In this study, the chromosome morphology of *C. amanicola* in the sect. *Cynaroides* is firstly determined.

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