



Full Length Article

Karyotype Analysis of two Species of Genus *Lathyrus* from Southeastern Anatolia, Turkey

EMINE AYAZ¹ AND A. SELCUK ERTEKIN

Faculty of Science and Art, Department of Biology, University of Dicle, 21280, Diyarbakır/Turkey

¹Corresponding author's e-mail: eyaz@dicle.edu.tr

ABSTRACT

The karyotypes of *Lathyrus chrysanthus* Boiss. and *L. trachycarpus* Boiss., native to Karacadağ (south-eastern Anatolia, Turkey) are described here for the first time. All species have $2n = 14$ chromosomes. The karyotypic formulae $10m+4sm$ is for *L. chrysanthus* and *L. trachycarpus*. A satellite was observed on the short arm of the second chromosome pair of *L. trachycarpus*. However, the total haploid complement was different: $48.27 \mu m$ in *L. chrysanthus* and $35.04 \mu m$ in *L. trachycarpus*.

Key Words: Chromosome; Karyotype; *Lathyrus*; Southeastern Anatolia

INTRODUCTION

The genus *Lathyrus* L. (*Papilionaceae*) comprises nearly 187 taxa (Allkin *et al.*, 1983). The main centers of diversity are the Mediterranean region, Asia Minor, East Africa and North and South America (Kupicha, 1977, 1981a & b; Simola, 1986). *Lathyrus* L. represent in Turkey by 73 taxa of which 22 taxa are endemic (Davis, 1970; Davis *et al.*, 1988; Güneş & Özhatay, 2000). From the point of view of the taxa *Lathyrus* species show the problem that in present. To obtain a better point of view regarding this subject, we will consider the chromosomal information, which gives us the possibility of classifying the species we are analyzing by family bounds. To make a taxonomic classification for the naturally occurring *Lathyrus* of Southeastern Anatolia, one has to analyze also the morphologic, chemical and karyologic information. Many Turkish species of the genus are well-known, but a little has been carried out on their cytogenetics (Yamamoto *et al.*, 1984; Şahin, 1993; Şahin *et al.*, 1998 & 2000; Ünal, 1999 & 2001). The present research reports the chromosome numbers, morphology and cytogenetic analyzes of naturally occurring *Lathyrus* of the Southeastern Anatolian region. A further aim was to take part in future cytogenetic research.

MATERIALS AND METHODS

Lathyrus seeds were collected from the natural habitats described below. Collected samples were described according to Davis (1970) and their seeds were analysed by using karyological techniques. *L. chrysanthus* is sturdy annual, stems, erect, winged, 15–45 cm; leaves with tendrils, leaflets 1-paired, elliptic; peduncles 2–4 flowered,

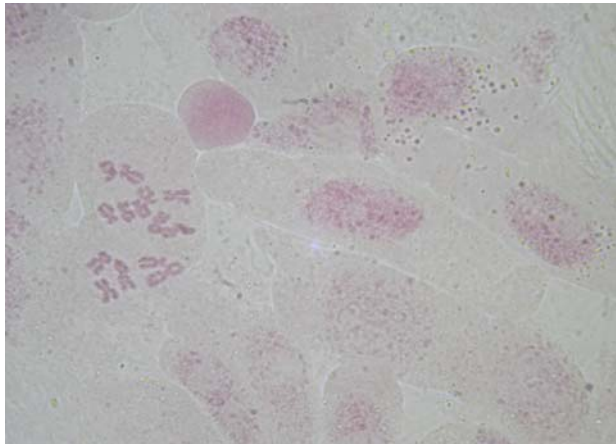
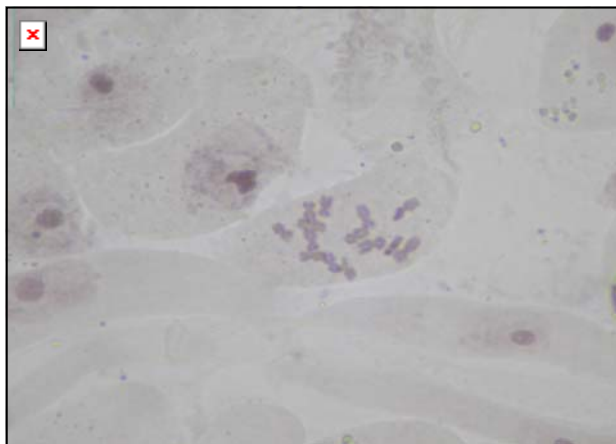
much longer than the leaves; corolla 18–25 mm, golden; legume linear oblong, densely tuberculate-pilose, 2–7 seeded. *L. chrysanthus*: Turkey C7 Şanlıurfa, Siverek, near of Karabahçe village, NW slopes of Karacadağ, 1250 m, steppe, 31.05.2001, A.S. Ertekin 2001–920 (DUF).

L. trachycarpus is sturdy annual, stems, erect, winged, 34–64 cm; leaves with aristate, leaflets 1-paired, elliptic; peduncles 3–8 flowered, much longer than the leaves; corolla 17–20 mm, standart purplish pink, wings paler and keel cream; legume elliptic-oblong, densely tuberculate-pilose, 1–3 seeded. *L. trachycarpus*: Turkey C7 Diyarbakır, Ergani, Besrek hill, N slopes of Karacadağ, 1100 m, steppe, 24.05.2001, A.S. Ertekin 2001–785 (DUF).

For cytological preparations, seeds were germinated in Petri dishes lined with moist filter paper at room temperature. When root tips reached 1–1.5 cm they have been detached and prethreated with paradichlorebenzene for 4 h, then fixed with aceticalcohol (1:3) for 24 h and stored in 70% alcohol at 4°C. Stored root tips washed and hydrolised in 1 N HCl for 5–12 min. at 60°C and stained with acetocarmine for 2 h (Elçi, 1982). To confirm staining quality root tips were kept in water for 15 min. and squashed for preparations. The karyotype analysis was according to the method developed by Levan *et al.* (Levan *et al.*, 1964) and the chromosome length was determined from the mean length value of the chromosomes in five cells.

RESULTS

Species *L. chrysanthus* (Fig. 1) had a karyotypic formula of $1 m+2 sm+3 m+4 m+5 m+6 m+7 sm$. According to the schematic representation the first and largest pair was a

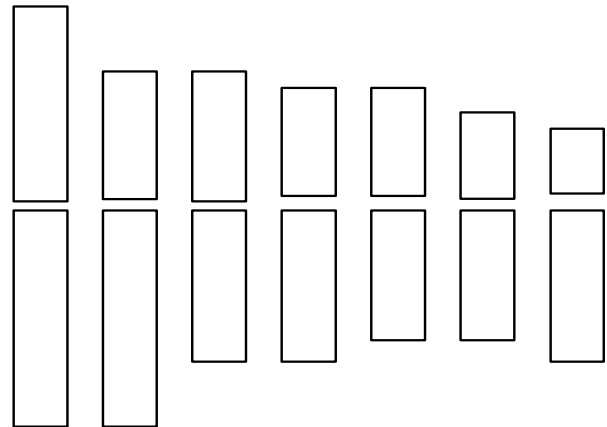
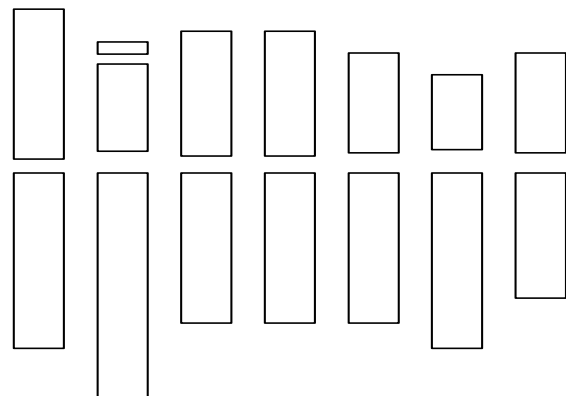
Fig. 1. Metaphase plates of *L. chrysanthus***Fig. 2. Metaphase plates of *L. trachycarpus***

metacentric centromed of the complement. The II and VII chromosomes were submetacentric centromed and the other chromosomes were metacentric centromed. Satellite have not been observed any chromosomes (Fig. 3). The total haploid length of the chromosomes is 48,27 μm Relative lengths of the chromosomes ranged between 20,71 and 11,00 μm (Table I).

L. trachycarpus Boiss: *L. trachycarpus* (Fig. 2) had a karyotypic formula of $1\text{ m}+2\text{ sm}^{\text{sat}}+3\text{ m}+4\text{ m}+5\text{ m}+6\text{ sm}+7\text{ m}$. According to the schematic representation the first and largest pair was a metacentric centromed of the complement. The II. and VI. chromosomes were submetacentric centromed and the other chromosome were metacentric centromed. A small satellite was connected to the short arm of the secondary largest chromosome (Fig. 4). The total haploid length of chromosomes is 35,04 μm . Relative lengths of chromosomes ranged between 17,00 and 11,75 μm (Table II).

DISCUSSION

No literature has been found on karyotypes for *L. trachycarpus* or *L. chrysanthus*. Karyotypic differences

Fig. 3. Idiogram of somatic chromosomes of *L. chrysanthus***Fig. 4. Idiogram of somatic chromosomes of *L. trachycarpus***

between *L. chrysanthus* and *L. trachycarpus* involved the satellite chromosome, the length and arm ratio of median and submedian chromosomes and the length of the individual chromosomes. The karyotypic studies showed that the somatic chromosome numbers in *L. chrysanthus* and *L. trachycarpus* were found to be $2n=14$. These two species are diploid. This findings agrees with previous studies of *Lathyrus* species (Şahin, 1993; Genç 1997; Klamt & Schifino-Wittmann, 2000; Şahin *et al.*, 2000; Ünal, 2001; Seijo & Fernandez, 2003). All chromosomes were found to be median centromered and submedian centromered. Yamamoto *et al.* (1984)'s study results on genus *Lathyrus* karyotypes morphology were divided into five types, A, B, C, D, E, 4X. In their study, karyotypes morphology on section. *Cicerula* were divided into three types, A, B, C according to the shape of the satellite chromosome. Type A was observed in *L. annuus*, *L. hierosolymitanus*, *L. pseudocicera*; the largest chromosome was found to be submedian and had a satellite connected to its short arm. The other six were found median or subterminal.

Type B was observed in *L. blepharicarpus*, *L. marmoratus*, *L. gorgonei*, *L. odoratus* and *L. hirsutus*; the

Table I. Measurements (µm) of somatic metaphase chromosomes of *L. chrysanthus*

Chromosome pair no	Total length	Long arm length (l)	Short arm length (s)	Satellite length	Arm ratio (l/s)	Relative length (%)	Centromere type
I	10.0	5.31	4.78	-	1.11	20.71	m
II	8.44	5.31	3.13	-	1.69	17.48	sm
III	6.91	3.72	3.19	-	1.16	14.31	m
IV	6.37	3.72	2.65	-	1.40	13.19	m
V	5.84	3.19	2.65	-	1.20	12.09	m
VI	5.31	3.19	2.12	-	1.50	11.00	m
VII	5.31	3.72	1.59	-	2.33	11.00	sm

Total length of haploid complements: 48.27

Table II. Measurements (µm) of somatic metaphase chromosomes of *L. trachycarpus*

Chromosome pair no	Total length	Long arm length (l)	Short arm length (s)	Satellite length	Arm ratio (l/s)	Relative length (%)	Centromere type
I	5.96	3.21	2.75	-	1.16	17.00	m
II	5.72	4.12	1.60	0.22	2.57	16.32	sm
III	5.04	2.75	2.29	-	1.20	14.38	m
IV	5.04	2.75	2.29	-	1.20	14.38	m
V	4.58	2.75	1.83	-	1.50	13.07	m
VI	4.58	3.21	1.37	-	2.34	13.07	sm
VII	4.12	2.29	1.83	-	1.25	11.75	m

Total length of haploid complements: 35.04

secondary largest submedian chromosome had a satellite connected to its short arm. The other six were found to be median, submedian or subterminal chromosomes. Type C was observed in *L. cicera* and *L. sativus*; the secondary largest chromosome had a satellite connected to its long arm. The other six were found to be median to subterminal. In this study *L. chrysanthus* had a karyotypic formula of 10 m+4 sm. No satellite was observed for this species. As a result of this and the number of median and submedian chromosomes, findings of Yamamoto *et al.* (1984) differ from our study. On the other hand, *L. trachycarpus* also had a karyotypic formula of 10 m+4 sm and involved a satellite on the secondary largest chromosome, this species was similar morphologically to type D in the studies by Yamamoto *et al.* (1984) study. Şahin (1993) showed in his study in parallel to our conclusions, that all the chromosomes for *L. rotundifolius* ssp *miniatus*, *L. cassius* and *L. cicera*, *L. aphaca* var. *modestus* are median and submedian ones. *L. cicera* is shows a correspondance with *L. trachycarpus* in having a satellite bound on the short arm and also in having the II and VI submetacentric. However having the III and IV chromosomes submetacentric be makes for a difference.

Ünal (2001) in three species of *Lathyrus* (*L. digitatus*; *L. gamelinii* & *L. laevegatus*) reported that the karyotype of all three species is formed by submetacentric chromosomes. *L. chrysanthus* shows a parallelism by having a satellite bound, but differs in not having submetacentric chromosomes. In their study on four *Lathyrus* species growing in the south of Brazilia (*L. nervosus*, *L. pubescences*, *L. pranensis* & *L. crassipes*), Klamt and Schifino-Wittmann (2000) showed that all four species had median and submedian chromosomes and all those had a satellite bound at the smallest chromosome pair on the long arm. This showed a resemblance just to *L. trachycarpus*

from the point of view of having a satellite bound.

In conclusion, somatic chromosome numbers in *L. chrysanthus* and *L. trachycarpus* were found to be 2n=14. *L. chrysanthus* Boiss. and *L. trachycarpus* Boiss. had karyotypic formulas of 1 m + 2 sm + 3 m + 4 m + 5 m + 6 m + 7 sm and 1 m + 2 sm^{sat} + 3 m + 4 m + 5 m + 6 sm + 7 m, respectively. This study can be a model method for the preliminary genetic improvement programmes for other *lathyrus* species. The method presented here can be useful for future cytogenetic research, revision and taxonomic studies.

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