

KARYOTYPIC STUDIES IN *LENS CULINARIS* MEDIC, S.SP. *MACROSPERMA* cv. LAIRD X PRECOZ

SHAFIQUE-UR-REHMAN AND CH. MUHAMMAD ALTAF

Department of Botany,
University of Azad Jammu & Kashmir, Muzaffarabad, Pakistan.

Abstract

Karyotypic analysis of *Lens culinaris* Medic., s.sp. *Macrosperma* Laird x Precoz was carried out to determine the chromosomal positions. The diploid chromosome number was 14. The Karyotype characterized its seven pairs of chromosomes into 3 metacentric and 4 sub-metacentric pairs. No chromosome with secondary constriction was observed. The total chromosomal length of the diploid complement was 45.74 μm whereas, the average chromosomal length observed was 3.67 μm . The Karyotypic formula was $K(n=7) = 3M+4Sm$. A Karyogram and an idiogram was prepared for further cytogenetic studies.

Introduction

Lens culinaris Medic., i.e. lentil is one of the oldest domesticated crops which has been highly exploited by man both as food and feed. The plant is rather poorly studied. Its detailed genetic, cytologic and cytogenetic studies started 30 years ago (Slinkard, 1985). The Karyotype for *L. culinaris* was first reported by Bhattacharjee (1951) and since then a number of researchers have published the Karyotypes for various species and subspecies (Slinkard, 1985).

Among lentils *Lens culinaris* ssp. *Macrosperma* is poorly studied from the Karyotypic stand point. A number of scientists (William *et al.*, 1974; Eser, 1976; and Sinha & Keswani, 1983) have analysed Karyotypes in various lines of the subspecies but their results have not been confirmed. Karyotypic studies in a very promising advanced line *Laird X Precoz* of *L. culinaris* ssp. *Macrosperma* is described.

Materials and Methods

The material used in this study was an advanced line of *L. culinaris* ssp. *Macrosperma* cv. *Laird x Precoz*. Seeds were germinated in Petri dishes on moist filter paper at 26-28°C for 72h in laboratory seed germinator. About 2-3 mm long root tips were excised, treated with saturated aqueous solution of paradichlorobenzene (PDB) for 6 h, fixed for 24 h in a mixture of glacial acetic acid-ethanol (3:1) and root-tips were then stored in 70% ethyl alcohol in a refrigerator.

Slides were prepared by squashing the root-tips in 1.0% acetocarmine. Slides with best chromosomal preparations were waxed with Canada balsum and analysed under the Nikon Optiphot research microscope. Photomicrography was done with the same microscope simultaneously using an oil immersion objective (100x). The individual chromosomal length was measured with an ocular micrometer. The calculation was (1986) reported 2 metacentric and 5 submetacentric chromosome pairs.

Table 1. Morphology of Somatic Chromosomes in *Lens culinaris* cv. Laird x Precoz.

Chromo- some pair	Position of Pri- mary Constriction	Long arm (q) μm	Short arm (P) μm	Total length (P+q) μm	Relative chromosomal length (p+qx1000/ length of haploid set)	Arm ratio	Centromeric index P/q+p
1	SM	2.23	1.25	3.48	152.16	1.78	0.35
2	M	1.74	1.63	3.37	147.35	1.06	0.48
3	M	1.853	1.417	3.27	142.98	1.30	0.43
4	SM	2.071	1.199	3.27	142.98	1.72	0.36
5	SM	2.18	1.09	3.27	142.98	2.00	0.35
6	M	1.962	1.199	3.16	138.17	1.63	0.37
7	SM	1.96	1.09	3.05	133.36	1.79	0.35

Chromatin length of the haploid complement = 22.87 μm . Average length of chromosome.

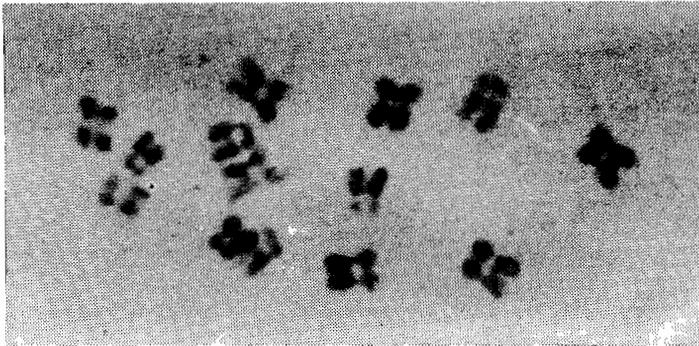


Fig. 1. Somatic metaphase of *Lens culinaris* cv. Laird x Precoz.

then done for standard factor (on $100\times = 1.09$) by the method suggested by Urban (1977). The centromeric position were characterized by Arm Ratio. The nomenclature for centromeric position on chromosomes was done as given by Levan *et al.*, (1984).

The Karyological data of chromosomal length was taken from four flattened cells with best chromosomal spreading (Table 1). For compensating differences in the degree of contraction of the chromosomes for different cells, each of the arms in a given cell was expressed as percentage of the total sum of the lengths of all the measured chromosomes in that cell.

Results

The diploid chromosome complement was $2n = 14$ (Fig.1) in *Lens culinaris* Medic., cultivar Laird x Precoz. Results presented in Table 1 show that the actual total chromatin length of the chromosomes in the cultivar studied ranged from 3.05 to 3.48 microns. Based on the arm ratio and total length, chromosome pairs were arranged from 1 to 7 in order of descending length. Data on the location of primary constriction showed that there are three metacentric and four sub-metacentric chromosomes. Arranging on the total length, as the arm ratio show, chromosomes 1,4,5 and 7 have sub-metacentric position of the primary constriction whereas the position on chromosomes 2,3 and 8 are some what median and are metacentric. The Karyotypic formula as derived from the chromosomal data can be written as $K(n=7) = 3M + 4Sm$, where K represents the haploid complement, M used for metacentric and Sm for sub-metacentric. The total chromatin length of the haploid set is 22.87 microns where as the average length for individual chromosome is 3.267 microns. As no secondary constriction is observed in the material under study therefore no satellited pair exist there.

Discussion

Chromosomal data for Karyotypic investigation (Table 1), the Karyotype and the idiogram (Fig.2,3) confirms the Karyotypic formula ($K(n=7) = 3M + 4Sm$). In the culti-

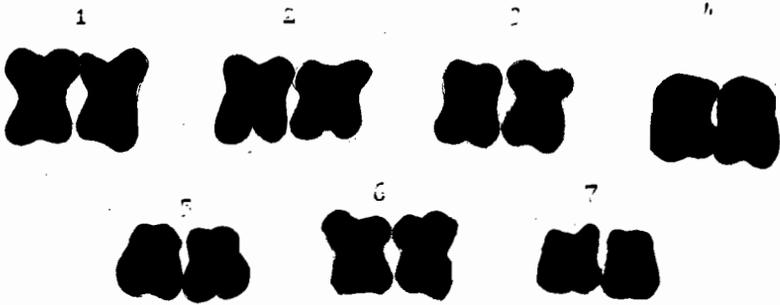


Fig. 2. Karyotype of *Lens culinaris* cv. Laird x Precoz.

var under investigation the chromosome number is $2n=14$. Three chromosomes are metacentric and 4 sub-metacentric. No secondary constriction is observed and thus there is no satellited chromosomal pair in the diploid chromosomal complement of the cultivar studied.

The Karyotype concept, originated by Russian School of cytogenetics (Levitzky, 1931) has been extensively used in characterizing and distinguishing chromosomes of different species. The first Karyotypic studies on lentil were reported by Bhattacharjee (1951); Sen & Ghosh (1955); Sharma & Mukhopadhyaya (1963) and Prasad & Jama (1976). Sinha & Acharya (1972) reported 4 metacentric and 3 submetacentric chromosomes in Indian and 4 sub-metacentric and 3 metacentric in Russian varieties. The result obtained from Russian varieties are in conformity with the results of the present studies. Gupta & Singh (1981a) found 4 metacentric and 3 sub-metacentric chromosomes in lentil type L-639, while Sindhu *et al.*, (1983a) found 1 metacentric, 3 sub-metacentric and 3 acrocentric chromosomes. Lavania & Lavania (1983) found that all 7 chromosomes pair in Var. L-3847 were sub-metacentric, whereas, Dixit & Dubey (1986) reported 2 metacentric and 5 submetacentric chromosome pairs.

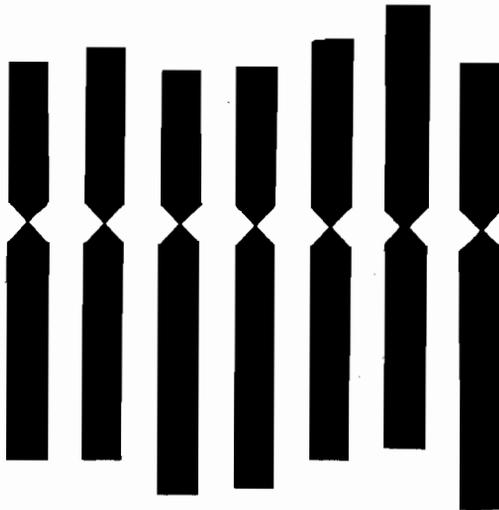


Fig. 3. Idiogram of somatic chromosomes of lentil cv. Laird x Precoz.

During the present investigation no secondary constriction was observed in the whole complement. The result though are in conformity with some of the earlier works (Sinha & Acharya 1972; Dixit & Dubey, 1986) but does not confirm the results of Prasad & Jama (1976); who reported two pairs of chromosomes with secondary constriction near the centromere in *L. culinaris* Medic. Similarly Mehra *et al.*, (1986) also reported 3 metacentric, 3 submetacentric and one with satellited chromosome pair.

The present results showed that the total chromatin length of the diploid complement for this particular cultivar was 45.74 μm whereas, the results reported by Dixit & Dubey (1986) showed that the total chromatin length of the haploid complement was 31.77 μm in lentil Var. T.36. Sinha & Acharya (1972) found that in different varieties, total chromatin length ranged between 28.2-72.3 μm whereas, Gupta & Singh (1981a) reported as 39.31 μm in lentil type L-639. Sindhu *et al.*, (1983a) found the total chromatin length in *L. culinaris* to be 27.43 μm while Lavania & Lavania (1983) reported 16.9 μm in L-3847. The average length of the individual chromosome observed during the present investigation was 3.26 μm , while Sharma & Mukhopadhyay (1963) reported 3.8-9.8 μm ; Nsithani & Sarbhoy (1973) 3.05 μm ; Gupta & Singh (1981a) 4.0-7.36 μm ; Dixit & Dubey (1986) 4.54 μm and Lavania & Lavania (1983) that the average chromosome length of individual pair was 1.9-3.4 μm .

It would suggest that there are variations in the Karyotypes of different lentil varieties and it is difficult to clearly identify a single standard Karyotype of lentil.

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