

KARYOTYPE ANALYSIS IN *CICER ARIETINUM* L.

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ABSTRACT

In this study, karyotype analysis was carried out on somatic root-tip metaphases of *Cicer arietinum* L. (chick-pea). $2n = 16$ chromosomes were observed during metaphase. These somatic chromosome numbers were found to be the same as reported by earlier researchers. Lengths of the chromosomes were found to vary from $1,52 \mu$ to $3,74 \mu$. A pair of satellited chromosomes was clearly distinguishable and these satellited chromosomes were the longest of the complement.

INTRODUCTION

The genus *Cicer* which belongs to the family of *leguminosae*, occupies a very important position among the food grain crops of the world and they are rich in proteins (% 18-31) (ESER and SORAN, 1978).

Karyotypic studies in *Cicer* have been undertaken by various researchers before but, there are still considerable gaps in our knowledge of the *Cicer*'s cytology. According to AHMAD and GODWARD (1980), some previous accounts of the cytology of *Cicer* are restricted to chromosome counts (RAO 1929; DIXIT 1932 a 1932 b; IYENGAR 1939; RAMANUJAM and JOSHI 1941; AHMAD 1952 b; MEENAKSHI and SUBRAMANIAN 1960, 1962, 1963 a, 1963 b, 1966; PNADNIS and NARKHEDE 1972; MERCY et al., 1974). However, the lengths of the chromosomes have been measured only in one of these publications (MERCY et al., 1974).

This study has contributed to the other studies with respect to its being a new report of the lengths of *Cicer*'s chromosomes which proposes the chromosome counts, $2n = 16$, and observes a pair of satellited chromosomes.

MATERIALS AND METHODS

It has been reported by various researchers that *Cicer*'s chromosomes were difficult to examine (AHMAD and GODWARD, 1980; MERCY et al., 1974). The first difficulty which we faced was to stain the chromosomes. The chromosomes became clearly distinguishable after having modified the method of ELÇİ (1966). The method which was followed in this study is mentioned below:

Karyotype analysis was carried out on somatic root-tip metaphases of *Cicer arietinum* L. Seeds were presoaked in water for 3-4 hours on moist filter paper in petri dishes at 25-30 C°. Healy root-tips (10-15 mm long) from fast growing germinating seeds were collected every hour between 8.00 a.m. and 18.00 p.m. during two months and examined to find out suitable metaphases. As a result of these investigations, a decision was made to collect the root tips between 9.45 a.m. and 12.00 noon. Fresh cut root tips pretreated in saturated aqueous solution of α -monobromonaphtalen in refrigerator for 16 hours. After the pretreatment of the roottips, they were fixed in glacial acetic acid for 30 minutes and washed in % 70 alcohol (three times, for five minutes) thoroughly. Then, they were washed in distilled water and hydrolysed in N HCl for 5 minutes at 60 C°. They were washed again in distilled water for 10 minutes and stained in acetocarmine for about 2 to 2,5 hours. Root-tips were cut (1,5-2 mm long) and squashed in a drop of acetocarmine and examined for suitable metaphases. Slides were mounted with Euporal. After the slides were made permanent, about ten metaphases with nicely separated chromosomes were microphotographed. Karl Zeiss Jena Light Microscope, IOX ocular and IOOX immersion oil objective, was used in this study.

RESULTS AND DISCUSSION

The chromosomes of *Cicer arietinum* L. are difficult to stain and examine, due to their condensation and small size (Fig. I).

$2n = 16$ chromosomes were observed during metaphases. These somatic chromosome numbers were found to be the same as reported by earlier researchers (PHADNIS and NARKHEDE 1972; MERCY et al. 1974; AHMAD and GODWARD 1980; LAVANIA and LAVANIA 1982, 1983; KUTAREKAR and WANJARI 1983; PUNDIR et al. 1983).

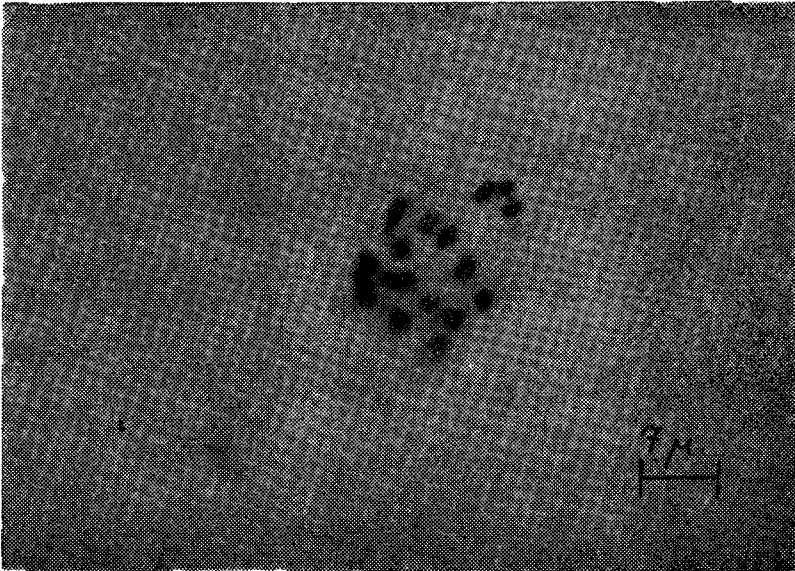


Fig. 1. Highly condensed chromosomes in *Cicer arietinum* L. ($2n = 16$).

In the present study, the lengths of the chromosomes were found to vary from $1,52\mu$ to $3,74\mu$, (Table I). A comparison between the chromosome measurements found by the authors (MERCY et al., 1974; LAVANIA and LAVANIA, 1983; AHMAD and GODWARD, 1980; KUTAREKAR and WANJARI, 1983) is given in table 2, in which chromosomes have been numbered I to 8 in the order of decreasing size. The longest chromosome pair has been reported as $6,52\mu$ by KUTAREKAR and WANJARI (1983). But in this study, it was observed to be $3,74\mu$. AHMAD and GODWARD's (1980) is the smallest measurement made for the longest chromosome pair in table 2 as it was estimated to be $3,28\mu$. But in the present work, this length was not measured in the cells investigated for pair I. For the length of pair 8, $1,52\mu$ was reported by us. $1,06\mu$ is the smallest chromosome length for pair 8 in table 2 in the study of KUTAREKAR and WANJARI (1983). $2,24\mu$ was reported for the pair 8 in the variety of D-8 and it is the longest chromosome length for pair 8 in table 2.

In this study, a pair of satellited chromosomes was clearly distinguishable and these satellited chromosomes were the longest of the complement in all the cells investigated (fig. 2). This is in agreement with the findings of MERCY et al., (1974); AHMAD and GODWARD

Table 1. Measurements of Somatic Chromosomes in Cicer.

| Pair of Chromosomes | Total Length (μ) (Means of Two Homologues) |
|----------------------------------|---|
| I | 3,74 (Satellited chromosomes) |
| II | 2,93 |
| III | 2,68 |
| IV | 2,48 |
| V | 2,24 |
| VI | 2,03 |
| VII | 1,76 |
| VIII | 1,52 |
| Total Length (μ) | 19,38 |
| Mean Chromosome Length (μ) | 2,42 |

(1980); LAVANIA and LAVANIA (1982); KUTAREKAR and WANJARI (1983).

Two pairs of satellited chromosomes have been reported by KUTAREKAR and WANJARI (1983) in the varieties of RS-II and N-59 among the varieties of Chaffa, Warangal, N-31, RS-II, B-98, Dacca, S-4, D-8, T-3, N-59, BG-I, NP-53. Bu in the other ten varieties, a pair of satellited chromosomes have been reported in agreement with our findings.

Chromosome morphology has been defined by AHMAD and GODWARD (1980); KUTAREKAR and WANJARI (1983). All the chromosomes were found to have either submedian or median centromeres by AHMAD and GODWARD (1980). According to KUTAREKAR and WANJARI (1983), the second chromosome pair of variety N-31 and the first chromosome pair of variety T-3 were found to be subterminal, but in the other varieties studied, the centromeres in all chromosome pairs were found to be either submedian or median. In the present study, the exact position of the centromeres could not be defined owing to the condensation of the chromosomes and their small size. The same conclusion can be seen in the reports of MERCY et al. (1974).

Table 2. A comparison Between The Chromosome Measurements Taken By The Other Authors.

| Species and Variety | Authors | Chromosome Lengths | | | | | | | |
|--------------------------------------|------------------------------|--------------------|------|------|------|------|------|------|------|
| | | Chromosome Pairs | | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| <i>C. arietinum</i> | Mercy et al. (1974) | 4.75 | 3.81 | 3.00 | 2.56 | 2.44 | 2.13 | 2.00 | 1.06 |
| <i>C. arietinum</i> | Lavana and Lavana (1983) | 3.40 | — | — | — | — | — | — | 1.60 |
| <i>C. arietinum</i> Varyete CSIMF | Ahmad and Godward (1980) | 3.28 | 3.16 | 2.89 | 2.63 | 2.37 | 1.84 | 1.84 | 1.32 |
| <i>C. arietinum</i> Varyete F-10 | " | 4.21 | 3.16 | 2.89 | 2.63 | 2.36 | 1.84 | 1.84 | 1.32 |
| <i>C. arietinum</i> Varyete C612 | " | 3.42 | 2.89 | 2.36 | 1.84 | 1.84 | 1.58 | 1.45 | 1.32 |
| <i>C. arietinum</i> Chaffa | Kutarekar and Wanjari (1983) | 5.05 | 4.43 | 4.43 | 2.97 | 2.88 | 2.88 | 2.35 | 2.00 |
| <i>C. arietinum</i> N-31 | " | 6.52 | 4.76 | 4.37 | 4.37 | 4.00 | 3.06 | 3.06 | 2.04 |
| <i>C. arietinum</i> Warangal | " | 5.20 | 4.39 | 3.07 | 3.07 | 3.07 | 2.42 | 2.42 | 2.01 |
| <i>C. arietinum</i> RS-11 | " | 6.43 | 5.83 | 5.20 | 5.20 | 5.14 | 4.39 | 3.39 | 2.08 |
| <i>C. arietinum</i> B-98 | " | 6.19 | 5.35 | 4.24 | 3.72 | 3.72 | 3.72 | 2.98 | 2.00 |
| <i>C. arietinum</i> Dacca | " | 5.60 | 5.11 | 4.18 | 4.18 | 3.72 | 2.63 | 2.63 | 2.00 |
| <i>C. arietinum</i> S-4 | " | 5.74 | 4.99 | 4.99 | 3.83 | 3.83 | 3.83 | 3.22 | 2.00 |
| <i>C. arietinum</i> D-8 | " | 5.76 | 5.02 | 4.56 | 4.56 | 3.48 | 3.48 | 2.84 | 2.24 |
| <i>C. arietinum</i> T-3 | " | 5.23 | 4.41 | 4.41 | 4.07 | 3.24 | 3.24 | 2.84 | 2.00 |
| <i>C. arietinum</i> N-59 | " | 5.15 | 4.69 | 4.35 | 3.74 | 3.74 | 3.18 | 3.18 | 2.22 |
| <i>C. arietinum</i> BG-1 | " | 5.72 | 4.42 | 4.42 | 4.26 | 3.04 | 3.04 | 3.04 | 2.10 |
| <i>C. arietinum</i> NP-53 | " | 4.72 | 3.78 | 3.78 | 3.10 | 3.10 | 2.72 | 2.34 | 2.00 |

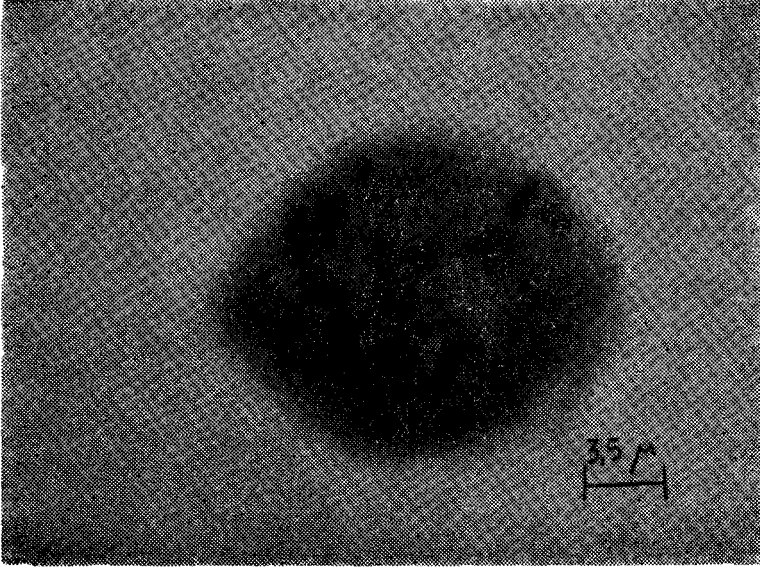


Fig. 2. Satellited chromosomes in *Cicer arietinum* L. (---), ($2n = 16$).

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