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CHROMOSOME MORPHOLOGY IN *CYMBOPOGON DISTANS* (NEES) WATSON

A. K. DHAR* AND KANTI REKHA*

Regional Research Laboratory, Sanat Nagar, Srinagar, Kashmir

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ABSTRACT

Pachytene analysis of bivalents of *Cymbopogon distans* (2n = 20) was attempted to establish an idiogram of the species. The chromosomes were marked from 1 to 10 in descending order of their length which varied from 45µ to 15µ. The short arm of chromosome 5 is associated with nucleolus. With the combination of characters like total length, arm ratio and distribution of heterochromatin, all the 10 chromosomes can be identified.

Key words : *Cymbopogon distans*, Poaceae, pachytene analysis, idiogram.

The genus *Cymbopogon* Spreng. is characterised by its ability to produce a variety of aroma chemicals of great use to industry. The well known oils of commerce viz. lemongrass oil, citronella oil, palmarosa oil etc. are produced from different species of *Cymbopogon*. Interest in certain terpene blocks in the recent years prompted us to explore commercial feasibility of another native species viz. *Cymbopogon distans* (Nees) Wats. growing wild in the hills of Kashmir, Himachal Pradesh and Uttar Pradesh. Except for its chromosome number and regular meiosis, morphological details of chromosomes are unknown [1,2]. A great deal of variation was observed in oil content and its constituents (Dhar, unpublished data). In the present study an effort was made to establish an idiogram of the species for use in detection of cytological variations, if any, in different chemotypes.

MATERIALS AND METHODS

Leaf meristem from a high oil yielding genotype SL-83105 were prefixed in para-dichlorobenzene at 4°C for 2 h and later fixed in 1:3 acetic alcohol and stored in 70% alcohol until use. Young spikes were also fixed in 1:3 acetic alcohol and stored in 70% alcohol until use. The material was squashed in 2% aceto-carmine saturated with ferric acetate. 10 cells with excellent spreading and differentiation of of chromosomes and pachytene bivalents were used for further analysis. Slides were

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* Present address : Botanical Sciences Division, Regional Research Laboratory, Canal Road, Jammu 180 001, (J&K) India.

made permanent in usual butyl alcohol schedule and mounted in Euparol. The chromosome measurements were made from camera lucida drawings with the use of divider and fine thread. Total length (actual length in microns), relative length (absolute length expressed as percentage of total chromatin length), location of centromere and arm ratio (length of short arm : long arm) were recorded. The chromosomes after identification were numbered from 1-10 in descending order of their length. A standard karyotype was prepared in the form of an idiogram on the basis of mean values. In describing centromere position nomenclature of Levan *et al.* [3] was followed.

RESULTS AND DISCUSSION

The somatic chromosomes studied from squashes of meristem are too small, 1.8 - 2.5 μ to reveal any details which could be exploited for chromosome identification. In all pachytene preparations, chromosome pairing was perfect. One bivalent is always associated with nucleolus in all pachytene figures observed (Fig. 1). The centromere appears as unstained area flanked by deep stained segments on either side. The bivalents vary in total length, relative length, position of centromeres, arm ratio and nucleolar attachment. The mean values of these features are listed in Table 1. and represented by an idiogram in Fig. 2. The total length of haploid chromosome

Table 1. Measurement of pachytene chromosomes of *C.distans* (Mean length in microns)

Chromosome No.	Short arm (s)	Long arm (l)	Total length+	Relative total length (%)	Arm ratio (s/I)	Centromere position
1.	16.26 ± 1.27	26.26K ± 2.84	45.33 ± 3.72	18.10	0.62	sm
2.	12.79K ± 1.40	24.13 ± 2.00	38.27 ± 3.25	15.27	0.53	sm
3.	11.46 ± 1.15	14.53 ± 1.38	27.32 ± 2.75	10.90	0.79	m
4.	8.93 ± 1.02	14.67K ± 0.75	24.93 ± 1.31	9.95	0.57	sm
5*.	8.13 ± 0.68	12.93 ± 1.04	22.40 ± 1.40	8.94	0.63	sm
6.	7.73K ± 0.54	11.73 ± 1.39	20.80 ± 1.74	8.31	0.66	sm
7.	7.86 ± 0.79	10.93 ± 0.54	19.87 ± 1.16	7.93	0.72	m
8.	7.06 ± 0.26	10.39 ± 0.54	18.79 ± 0.68	7.50	0.73	m
9.	6.93 ± 0.34	9.59 ± 1.00	17.86 ± 1.28	7.13	0.72	m
10.	5.73 ± 0.26	7.99 ± 0.47	15.06 ± 0.02	6.01	0.72	m

± Standard error; *Nucleous organising chromosome; + Total length including length of long arm, short arm and centromere region; K represents terminal knob; sm: sub median; m: median.

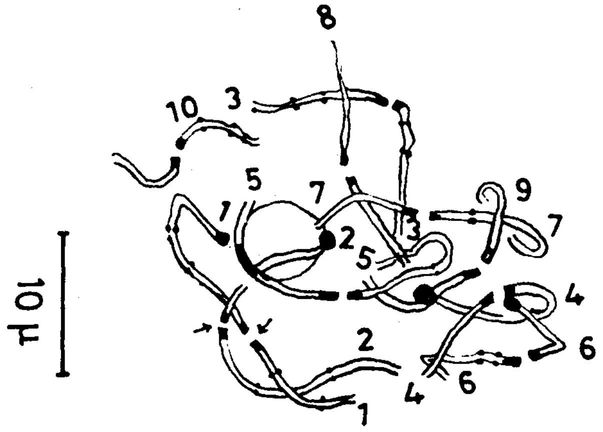

Fig. 1. pachytene chromosomes of *C. distans*: An interpretive drawing of microsporocyte

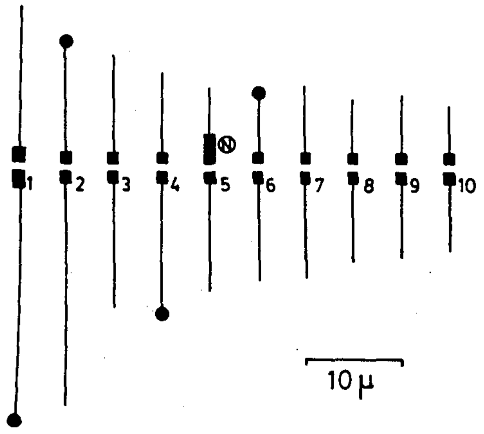

Fig. 2. Idiogram of the pachytene bivalents of *C. distans*. Circles indicate terminal knobs. Thin line represent euchromatic regions and thickened portion of the lines represent heterochromatic regions

complement (TCL) is measured as 250.63 μ. The chromosomes are numbered 1-10 in descending order of their total length. The longest bivalent (45μ) is three times the size of shortest bivalent (15μ).

Pachytene chromosomes have an edge over mitotic chromosomes for the purpose of identification on account of their size and linear differentiation. In tomato, pachytene chromosomes vary in size [4]. In maize and *Beta vulgaris,* they vary with respect to number and position of knobs [5, 6]. However, in diploid *Medicago sativa* [7, 8] mean length, arm ratio, number and distribution of chromomeres have been used to identify chromosomes, where as heterochromatin distribution is helpful in *Lycopersicon esculentum* [9, 10], *Solanum ochranthum* [11], *Cajanus cajan* [12], *Artemisia annua* [13], *Cymbopogon jwarancusa* [14] and other plant species. In the case of *C. distans* chromosome identification is not possible on the basis of single character, however, when total length, arm ratio and distribution of heterochromatin are considered together, it is possible to identify all 10 chromosomes individually.

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