Cassia fistula: A Source of Sennoside B (Chromosome Morphology and Sennoside Content)

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Keywords: *Cassia angustifolia*, senna, rhein, laxative, purgative

Abstract

***Cassia fistula* (Leguminosae) grows wild and as a roadside tree in India. The leaves and pods of this plant contain the commercially important laxative sennoside B rhein. Both sennoside and rhein contents in the leaves and the pods show seasonal variation. Plants growing at different localities of India have also been found to contain different amount of sennoside B in leaves and pods and also differ in chromosome morphology. No relation between chromosome morphology and sennoside content, however could be established. Although sennoside content in this species is lower than in the official drug senna (*C. angustifolia*), this plant may be considered as an alternate source of sennoside B.**

INTRODUCTION

Cassia fistula L., related to those species considered as sources of purgative drugs (*Cassia acutifolia* Del. and *C. angustifolia* Vahl.), is a source of sennoside A and B (Evans, 1996). Seasonal variation of sennoside and rhein content in this plant, which grows wild throughout India, has previously been reported (Cano Asseleih et al., 1990, Dutta and De, 1998). Although sennoside content in the plant is lower than in the official drug (*C. angustifolia*), *C. fistula* may be considered as an alternate source of sennoside B.

The present state of knowledge of medicinal plants clearly indicates that a species may have different cytogenetical and chemical races and that genetic make-up of a plant affects quality and quantity of secondary metabolites (Evans, 1996). There are numerous reports on the presence of chromosomal biotypes in medicinal plants, such as *Adhatoda vasica* Nees (Datta and Maiti, 1968a), *Centella asiatica* L. (Datta and Maiti, 1968b), and *Ocimum sanctum* L. (Singh and Sharma, 1981). Similarly the intraspecific differences in accumulation of secondary metabolites are well known for some plants such as *Thevetia nerifolia* Juss., *Nerium odorum* Soland., *Piper* spp. (Jose and Sharma, 1983), and *Andrographis paniculata* (Roy and Datta, 1988a, 1988b). The aim of present investigation was to study the chromosome number and cytotypes of *C. fistula* plants collected from different localities in India and to study if there was any relation between morphology of chromosomes and anthraquinone content of the drugs.

MATERIAL AND METHODS

Pods of *C. fistula* were collected from indigenous populations of different localities of India (Table 1.) in the month of March/April. For germinating, the seeds were soaked in concentrated sulphuric acid for 10-15 minutes, washed in running water for 30 minutes, and placed on two sheets of filter paper soaked in distilled water in Petri dishes. For study of mitotic metaphase, root tips from germinated seedlings were squashed by usual aceto-orcein technique (Sharma and Sharma, 1965). Idiograms were prepared on the average mean value of five selected cells of five plants of each population. The positions of centromere in each pair of chromosomes were evaluated following the centromeric index as prepared by Sikka and Sharma (1979). Seedlings and pods collected from different localities of India were extracted following the method of Habib and El-Sebakhy (1980) for determination of sennoside content in the seedlings and the content of sennoside and glycosidic rhein in the pods.

RESULTS

Mitotic metaphase plates showed the presence of 24 (2n) chromosomes in each of the plants. On the basis of sizes of the chromosomes and position of centromere, eight cytotypes were found (Fig. 1). The chromosomes, in general, were small and differed in size and morphology from plant to plant. The total diploid chromosome length varied from 13.5 μm to 30.0 μm in different cytotypes. In cases of cytotypes 1, 2, 3, and 4, the largest chromosome homologous pair had a sub median centromere and the rest have median centromere. In the cytotypes 5 and 6 all the chromosome homologous pairs had a median position of centromere.

In pods, the highest sennoside content was found in cytotype 5 and the lowest sennoside content was in cytotype 2. The sennoside content varied from 0.103 $\pm$ 0.003 to 0.448 $\pm$ 0.002 %. The glycosidic rhein content showed no major variation. TLC and HPLC analysis could detect the presence of sennoside in 20-day old seedlings. The content of sennoside in 20-day old seedlings of different cytotypes varied from 0.218 $\pm$ 0.01 to 0.926 %. Cytotype 5 contained highest amount of sennoside in both seedlings and pods (Table 1).

DISCUSSION

Chromosome number 2n=24 for *C. fistula* was previously reported by Datta (1933). Pantulu (1946) reported 2n=28 chromosomes in *C. fistula*. During the present investigations, all the plants were found to have 2n=24 chromosomes.

Although cytotypes differed in their anthraquinone content, no relationship between morphology of the chromosomes and anthraquinone content could be established.

ACKNOWLEDGEMENT

We thank Council of Scientific and Industrial Research, New Delhi for financial assistance and SANDOZ PHARMA AG., Switzerland for providing us with sennoside.

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Tables

Table 1. Variations in the percentage of sennoside (in pods and plantlets) and glycosiodic rhein (in pods) in different cytotypes of *C. fistula*

Cyto-type	Locality	Total diploid chromosome length (μm)	Sennoside content in pod (%)	Glycosidic rhein content in pod (%)	Sennoside content in seedlings (%)
1.	Calcutta	26.0	0.200 ± 0.005	--	0.491 ± 0.017
2.	Diamond Harbour	27.5	0.103 ± 0.003	0.052 ± 0.003	0.321 ± 0.01
3.	Agartala	30.0	0.121 ± 0.008	0.062 ± 0.002	0.565 ± 0.015
4.	Mogra	22.2	0.138± 0.003	0.089±0.002	0.834 ± 0.02
5.	Delhi	20.4	0.248 ± 0.002	0.044 ± 0.125	0.926 ± 0
6.	Chander-nagore	18.4	0.152 ± 0.002	0.004 ± 0.003	0.800 ± 0.01
7.	Haldia	13.5	0.155 ± 0.002	0.03 ± 0.003	0.238 ± 0
8.	Nilgiri	18.9	Pods could not be collected		0.218 ± 0.01

-- = Not present ; Results expressed as mean (percentage dry weight) ± SD, n=2

Figures

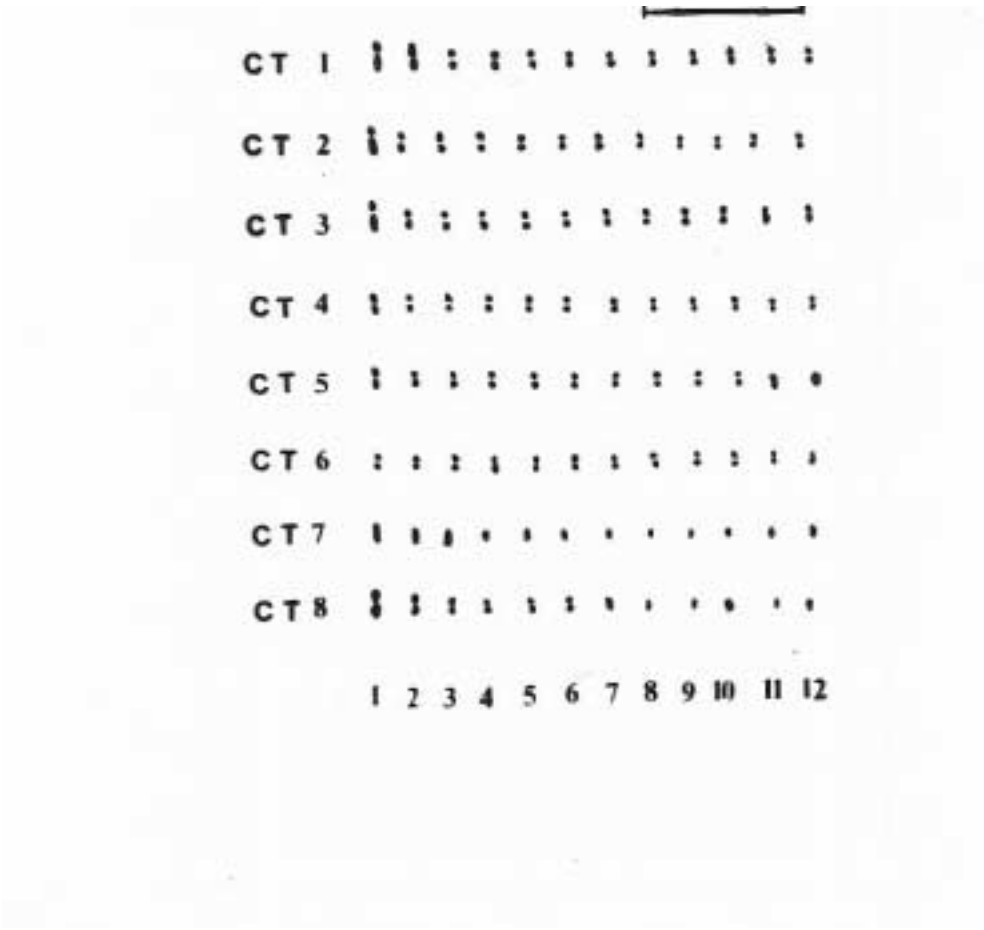

Fig.1. Idiograms of different cytotypes of *C. fistula* L. (Bar=10µ: CT=Cytotype: 1-12 Chromosome homologous pairs)