



Investigation of cytogenetical in *Citrullus* and *Cucurbita* species of family-cucurbitaceae of Mainpuri district of Uttar Pradesh (India)

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Abstract

Citrullus species (Cucurbitaceae) were carried out cytogenetically formed 22 chromosomes in *Citrullus vulgaris* while 24 chromosomes were observed in *Citrullus fistulosus*. Seeds and fruits are intermediates in shape and size, monoecious or andromonoecious and shows genetic in nature. They are differ in size, only one pair of chromosome is more in *Citrullus fistulosus*. The category of genotypic factors, structure and numeral changes are responsible for variations in chromosome behaviour and structure. Heterotypic one pair of chromosome was clearly established both in mitotic and meiotic study of male diploid plant. Cytogenetically the *Cucurbita* species can be divided into mesophytic and xerophytic species as *Cucurbita pepo*, *Cucurbita moschatia* and *Cucurbita maxima*. They reported 20 small rod shaped chromosomes in all *Cucurbita* species. *Cucurbita* species are numerous and show wide variations in fruit characters. Small size of mitotic chromosome makes them troublesome to count accurately while long chromosomes have pronounced centromere region.

Keywords: cytogenesis of *Citrullus* and *Cucurbita* species, chromosomes in fruit

Introduction

Cytogenetically the family-cucurbitaceae has been reviewed by several workers for differentiation and evolution of *Citrullus* and *Cucurbita* species. *Citrullus vulgaris*, *Citrullus colocynthis*, *Citrullus lanatus*, *Citrullus ecirrhosus* and *Citrullus fistulosus* are a xerophytic and monotypic species Cytogenetic investigatins support the segregation of *Praecitrullus* from *Citrullus*. The base chromosome number of *Citrullus colocynthis* and *Citrullus lanatus* is $x=11$ [1, 2, 3] and that of *Citrullus fistulosus* is $x=12$, In addition to a different base number, *Citrullus fistulosus* has chromatin 1-5 time longer than that of *Citrullus* species has a distinct karyomorphology and is cross incompatable with *Citrullus* species. *Citrullus colocynthis* and *Citrullus lanatus*, each $2n=22$ chromosome, have strong karyomorphological affinities. These species have not been crossed successfully and also been observed to cross in nature to produce partially fertile hybrid. *Citrullus vulgaris* var. *fistulosus* have $2n=22$ chromosomes. Species of *Citrullus* cultivated in India confirmed the diploid chromosome number, $2n=22$ for *Citrullus vulgaris* and *Citrullus colocynthis*. However in *Tinda*, a common vegetable in India which is treated taxonomically as *Citrullus vulgaris* var. *fistulosus*. Study of hybrid from this interspecific cross [4] has confirmed and extended previous investigations. Observations shows that there are 11 bivalents in 50% of cells at meiosis. The remaining cells had irregular chromosome association such as multivalent and univalents, about 50% of pollen in the hybrids was fertile. Leaves of the hybrids were intermediate in shape, seeds and fruits were intermediate in size and weight. In the fruits of hybrids, the exocarp and taste of seeds colour was dominant in *Citrullus coloynthis* and *Citrullus vulgaris*. Cultivars of *Citrullus vulgaris* are either

monoecious or andromonoecious [5] and showed genetic in nature. Monoecious condition is dependent upon a single dominant gene for expression. The use of pressure tester have some preliminary histological data of the rinds of tough and tender fruits [6]. Dark green colour of the fruit is dominant over yellowish white skin [7] but in crossess with yellow green.

The evidences to Showed that the genes determining ovary and fruit shape are identical [8]. The differences between elongate and spherical fruits is determined by a single pair of genes are dominance, heterozygotes produce fruits are intermediate in shape. Present evidence suggests that flesh colour is polygenetically determined while single pair of gene might produce the major effect are surely some that of modify. Cucurbitaceae are among more important plant families. It supported man with edible products and useful fibres. It is an annual occasionally perennial long running or climbing herbs usually monoecious or dioecious forms. Stem mostly globrous or angled with hairy tendrils. Leaves lobed or deeply cut and simple. Fruits is indehiscent and fleshy with hard durable pericarp and classified as berry or pepo, seeds usually flattened.

Cytogenetically the Cucurbitaceae family has not been well investigated because of terminal constraints. Cytogenetic methods have provided valuable information. Investigations have revealed the main cytogenetic mechanism responsible for differentiation and evolution of the species. Cytological study of *Cucurbita* species have been described, *Cucurbita* species can be divided into mesophytic and xerophytic species, This genus cytologically and reported 20 small rod shaped chromosomes and suggested the species are secondary polyploids with base number $x = 10$ and annually cultivated, *Citrullus pepo*, *Citrullus moschata* and *Citrullus*

maxima have resulted from rearrangement through translocations [9].

It provides a comprehensive account of relationship and evolution [10]. On the basis of cross compatibility and pollen fertility of hybrids, *Cucurbita lundelliana* crosses with all cultivated species. It produces partially fertile hybrids with *Citrullus moschata*, *Citrullus maxima* and *Citrullus ficifolius* with *Citrullus pepo* and *Citrullus moschata* xerophytic species crosses only with *Citrullus moschata* to produce vigorous sterile hybrids. Cultivated *Citrullus moschata* which crosses with both mesophytic and xerophytic groups, connecting link between wild and cultivation taxa. It has also been considered as the main axis of genetic diversity affecting the cultivated species.

Cucurbita species have 20 chromosomes [11, 12] which showed the small size of mitotic chromosome makes them trouble some to count accurately, even though tend to be well separated, Main difficulty has been in mitotic figures of at least of the shorter ones. Long chromosomes have pronounced centromeric regions, one chromosome may give the appearance of two short ones connecting. The cytogenetics study and its uses of *Cucumis* species have already been studied [13].

Materials and Methods

In cytological study of *Citrullus* species of Family Cucurbitaceae, the meiosis was studied in dividing the pollen mother cells. Young flower buds were fixed in acetic acid-alcohol in 1:2 molar ratio between 10-11 a.m., then added few drops of ferric chloride for fixative purposes. The anthers were stained by the aceto - carmine squash method, for mitotic study more than 50 meristematic cells were scored 10 slides of root tips Slides were thoroughly screened to determine the frequency of mitotic division, abnormalities and other related nuclear aberrations The cytological studies of family Cucurbitaceae has been described in *Citrullus* species are as follows:

1. ***Citrullus vulgaris* (Tarbooj):** The root tip cells of *Citrullus vulgaris* have 22 chromosomes. There are secondary constriction not seen in these chromosomes.

The length were also varies from 1.24 μ to 2.88 μ and chromosomes pairs are represented in the ideogram.

2. ***Citrullus vulgaris* var *fistulosus* (Tinda):** There are 24 chromosomes were observed in *Citrullus fistulosus* Three pairs of chromosomes have secondary constriction and chromosomes pairs are not represented in the idiogram.

Observations of cytological studies of *Cucurbita* species has been described as follows: It can be divided into two mesophytic and xerophytic species. In all species the chromosomes number are 20. Chromosomes are rod shaped in *Cucurbita pepo* (*Kashiphal*, *Kaddu*), *Cucurbita moschata* (*Setaphal*, *Kaddu*) and *Cucurbita maxima* (*Lauk*, *Kaddu*).

Results and Discussion

The cytogenetically study on genus *Citrullus* the species *Citrullus vulgaris* and *Citrullus fistulosus* have been investigated. They have almost the same number of median and sub-median chromosomes. *Citrullus fistulosus* have 3 pairs of chromosomes with secondary constriction, which is not in *Citrullus vulgaris* and are not related to *Citrullus*

fistulosus. In both the taxa, the shape of individual pairs of chromosomes are very similar. They are only differ in size, only one pair of chromosomes is more in *Citrullus fistulosus*, one pair of medium sized chromosomes cannot make so much difference in the total chromatin matter. The category of factors, genotypic structure, numeral changes, responsible for all variations in chromosome structure and behaviour, one more has to be added, the polynemy. Polynemy may be best considered as the fourth dimension of variation.

Variation between *Citrullus vulgaris* and *Citrullus fistulosus*, its phylogenetic relationship remain debatable. These two taxa of *Citrullus* also show differences in their range and frequency of ring and rod bivalents, consequently they differ in chiasma frequency per nucleus also. The remote relationship between the two taxa as revealed by their karyotype meiotic data. A pair of heteromorphic chromosomes was clearly established both in mitotic as well as meiotic studies of diploid male plant. The diploid chromosomes number was confirmed to be 24. One of the chromosome in the male plants was longer than the rest was identified as X chromosomes, thus giving the diploid male plant a chromosome constitution of XY^{+2M}, The Y chromosome was lacking in female plants as revealed in a study of somatic chromosomes, thus giving the diploid female plants a chromosome constitution of XY^{+2A}. It was confirmed cytologically that the male was heterogametic in which anthers were formed in bisexual, flower but pollen grain formation was impeded resulting in sterility of plant.

However, in *Citrullus vulgaris* observed 22 chromosomes while *Citrullus fistulosus* (Tinda) were observed 24 chromosomes. In *Cucurbita*, the xerophytic species cross only with the cultivated *Cucurbita moschata* to produce vigorous, sterile hybrids [14]. Cytological studies of the hybrids suggests that among the xerophytic species *Cucurbita foetidissima* is closer to *Cucurbita moschata*, although the hybrid species of *Cucurbita foetidissima* and *Cucurbita moschata* [10]. The cultivated *Cucurbita vulgaris* are so numerous and they show wide variation in fruit characters specially with respect to shape, size, skin colour and texture.

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