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ORIGINAL RESEARCH ARTICLE

Cytotaxonomical Studies on Some Members of Solanaceae

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ABSTRACT

In the present study, the Cytotaxonomical features of the family Solanaceae were studied. The present observation shows that six species of Solanaceae members namely *Datura stramonium* L, *Datura fastuosa* L, *Solanum xanthocarpum* Schrad and Wendl, *Solanum trilobatum* L, *Solanum nigrum* L and *Withania somnifera* (L) Dunal., medium, short and shorter in size in most of the species of Solanaceae studied. This shows the more evolved nature of the species.

Key words: Cytotaxonomy, Solanaceae, Chromosome number, Cytological features, Solanaceae members.

INTRODUCTION

The Solanaceae has about 90 genera and 2,800-3,000 species. The largest genus, by far, is *Solanum*. It has around 1,400 species.

Distribution

The Solanaceae is a cosmopolitan family, occurring in tropical and temperate regions throughout the world. Its greatest center of diversity is in central and northern South America, but there is a secondary center in Australia.

Importance

If you like eating, the Solanaceae is an important family. Solanaceous foods that can be found in our stores include potatoes, tomatoes, peppers of the red, green, yellow, and chili varieties, eggplant, and tomatillos. Many other members of the family are important foods in South America but, so far as I am aware, the family was not particularly exploited by native peoples in Australia. This could be my ignorance, or possibly Australian species do not produce edible fruits Many species of Solanaceae produce tropane alkaloids that have valuable medicinal properties Examples include *Solanum trilobatum, Solanum xanthocarpum* and *Datura* species. Nicotine is a tropane alkaloid. It makes a great insecticide.

The center of diversity of the Solanaceae is near the equator and thus species were disturbed by the ice ages and have had time to accumulate adaptive genetic variation for extreme ecological niches. The Solanaceae are also the third most important plant taxon economically and the most valuable in terms of vegetable crops, and are the most variable of crops species in terms of agricultural utility, as it includes the tuber-bearing potato, a number of fruit-bearing vegetables (Tomato, Eggplant, Peppers), ornamental plants (*Petunias, Nicotiana*), plants with edible leaves (*Solanum nigrum, Solanum trilobatum*) and medicinal plants (eg. *Datura* species).

Morphology

Most members of the Solanaceae are erect or climbing, annual or perennial herbs, but shrubs are not uncommon and there are a few trees. The leaves vary greatly in shape but are usually simple, although sometimes highly lobed. They are alternate and never have stipules. The inflorescence is generally cymose and axillary, but may be reduced to a single flower. The flowers are bisexual, usually radially symmetric, and usually 5-merous. The calyx is united, at least at the base, and sometimes becomes inflated in fruit. The corolla is also united but its shape varies from long and tubular to rotate or campanulate. It is usually radially symmetric, but there are some bilaterally symmetric genera. There are 5 (rarely 4-8) epipetalous stamens that alternate with the corolla lobes. The anthers are sometimes touching but are never fused. The gynoecium consists of a single pistil, usually with 2 locules and numerous

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ovules. The fruit is a usually a berry (think of sweet peppers and tomatoes) but quite frequently a dry capsule.

MATERIALS AND METHODS

Collection

Fruits of *Solanum* species were collected during field trips to different parts of Southern Tamilnadu. The root tips for mitotic studies were obtained from healthy seedlings.

Mitotic studies:

Seeds were germinated on moistened absorbent paper in Petri dishes kept in the dark at temperatu-C. Primary roots measuring about 5 to 10 mm long were harvested during late afternoon for slide preparation. Seedlings of plants could not yield enough roots for this protocol. To enhance root production, therefore, their root systems were completely excised just below the soil level and the stems dipped in 10 ppm iodole butyric acid for up to 6 h. They were later transferred to dilute nutrient solution for about 168 h to yield a good crop of roots. Pretreatment in all the species was with 0.002 M aqueous solution of 8-hydroxyquinoline (W/V) for at least 3 h. The root tips were then fixed in 1 part glacial acetic acid and 3 parts ethanol (V/V) for a minimum of 24 h. The roots that were not required immediately for slide preparation were stored in 70% ethanol in a refrigerator. The root tips were hydrolyzed in 9% hydrochloric acid for a minimum of 5 minutes and squashed in formic-lactic-propionic acid-orcein (FLP-orcein) stain. Chromosomes were examined at x400 magnification using Leitz Labolux microscope fitted with photographic equipment. Good plates with well spread chromosomes were photomicrographed while measurement of chromosomes was done with an ocular micrometer. Chromosomes were studied under oil immersion on a phase contract microscope at a magnification of 1000x. All slides were made permanent by the venetian turpentine Subils (1979). Nomenclature adopted by Shekhar and Vij (1985) was followed for recognizing chromosome types. For the previous chromosome counts, we used the following references: Mehra and Vij (1972); Hallier (1912).

OBSERVATION

***Datura stramonium* 2n = 24**

The length of the chromosomes ranges from 2.5 to 3.9 µm. The chromosomes are medium and short sized.

***Datura fastrosa* 2n = 24**

The size of the chromosomes ranges from 3.0 to 5.0 µm. The chromosomes are large and medium sized.

***Solanum trilobatum* 2n = 24**

The length of chromosomes ranges from 1.8 to 2.4 µm. The chromosomes are short sized.

***Solanum xanthocarpum* 2n = 24**

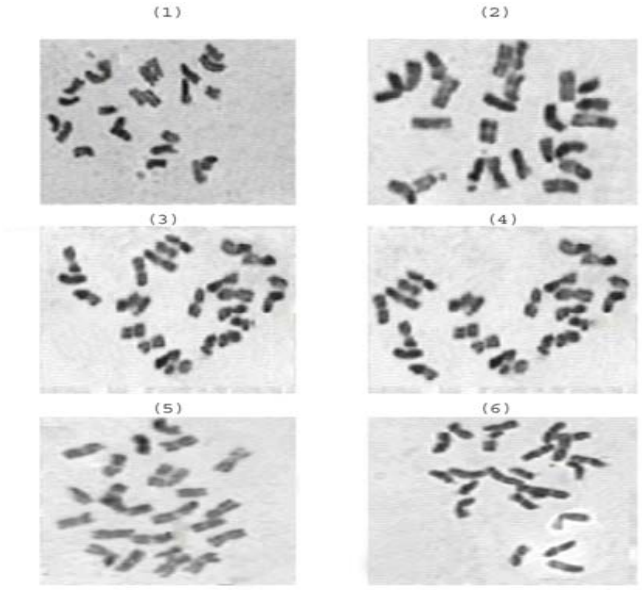
The length of chromosomes ranges from 1.4 µm to 2.0 µm. The chromosomes are short in size.

***Solanum nigrum* 2n = 24**

The chromosomes are larger and medium sized. The chromosomes vary in length from 1.8 m to 3.5 µm.

***Withania somnifera* 2n = 24**

The chromosomes are longer and medium sized. The size of the chromosomes ranges from 1.5 to 4.0 µm.



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Metaphase of mitosis 2n = 24 chromosomes in six species (1) *Datura stramonium*, (2) *Datura fastuosa*, (3) *Solanum trilobatum*, (4) *Solanum xanthocarpum*, (5) *Solanum nigrum*, (6) *Withania somnifera*.

RESULTS AND DISCUSSION

Solanum species chromosomes are small to medium sized D'Arcy (1991), with a range of 0.80 – 14 µm e.g. Ogg., (1981); Badr *et al*.(1997) most taxa within 1 - 3 µm. Solanoideae displays the smallest chromosomes of the family e.g. species of *Solanum* species, clades of *Solanum;* Park (1994), as well as the longest ones (e.g. in *Withania* clad ; Sonia *et al*., (2001). It should be mentioned that clad cestreae is characterized by having chromosomes of about 6-7 µm Pathak and Jorapur (1983); Dos santos and Thorman (1994), pointed out an association between habit and chromosome size, with perennial species having

small chromosomes. However, within woody solanoideae, chromosomes are either small e.g. *S.trilobatum*, Dweikat (1993); Erdtman (1952), or medium-sized (e.g. *Datura stramonium* and *Datura fastuosa).*

After the available literature, in solanaceae the number of satellite chromosome pairs per complement is variable. In solanoideae, for instance, *Solanum nigrum* showed one to four pairs Sonia *et al*., (2001), *S.xanthocarpum* and *Withania* one to three pairs Chiarini (2008), where as *Solanum* species either no satellites or one pair Vij and Mehra (1974). In fact, the solanoideae here examined presented one, none, or exceptionally two satellite pairs. Considering our data and the available literature, there is no relationship between habit and karyotype features in Solanaceae, as suggested by several authors Ferguson (1924); Goodspeed (1933). Symmetrical karyotypes may be found in woody species (e.g. *S.trilobatum* species). as well as in herbs (e.g. *Solanum xanthocarpum*, *Solanum nigrum*, Chiarini (2008), and there are asymmetrical karyotypes in herbs (*Withania somnifera*).

The systematic position of the *Datura stramonium* has been controversial for a long time Badr *et al*.(1997); Dos santos and Thorman (1994). Molecular phylogenies include it in clad Physalinae, suggesting it is a distinct genus though closely related to *Datura fastuosa* Dweikat (1993). Our data on karyotypes of one species of each genus indicate that morphological diversification was accompanied by chromosomal changes, such as chromosome size, presence of satellite and karyotype formula.

The studies on the morphology of chromosomes indicate that mostly asymmetrical karyotypes of chromosome have been observed. This shows the more evolved cytological character of the species of Solanaceae. The primary basic chromosome number of the species of the family may be n = 8 and the derived basic chromosome number is n = 12, as evidenced by the present and earlier cytological studies of the members of Solanaceae. A large number of species of *Solanum* genera studied have 2n = 24 chromosomes and they may be considered as diploids.

The present investigation showed that the investigated genotypes in eight species of Solanaceae, all had 24 chromosomes and there was a significant chromosomal diversity between the genotypes which could be used to develop breeding programs for these plants.

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