

CYTOGENETICS OF *CAJANUS CAJAN* (L.) MILLSP. × *ATYLOSIA* SPECIES

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The cross between *Cajanus cajan* and *Atylosia* spp. was successful and viable hybrids were obtained. The genomic affinities between *Cajanus cajan* and *Atylosia* spp. were determined following hybridization through studies on chromosomal pairing and pollen fertility. The present investigation revealed the existence of considerable degree of homology between the chromosomal complements of these species. The partial pollen sterility and occurrence of unpaired chromosomes can possibly be attributed to the structural differences in the parental genomes to some extent or to the action of different genetic factors which inhibit chromosome pairing. The hybrids of *C. cajan* and *Atylosia* species manifest forage potentiality.

Key words : *Cajanus cajan*, *Atylosia* spp., cytogenetics

Cajanus cajan is a pantropical species and is most adopted and productive in the semi-arid tropics. Species of *Atylosia* constitute the wild germplasm of *Cajanus cajan*. Of the thirty species or so in *Atylosia*, most of them occur in Asia. But about 1/3 are found in Australia (Raynolds and Pedly 1981). *Atylosia cajanifolia* and *Atylosia lanceolata* are drought hardy and well adapted to fertile soil (De, 1974; Pedly, 1980). *Atylosia scarabaeoides* and *Atylosia albicans* are considered to be the sources of high protein (Reddy *et al.*, 1979). The present investigation reports the cytogenetics of hybrids between *C. cajan* and *Atylosia* species.

MATERIALS AND METHODS

Materials comprised *Cajanus cajan* (2n=22), *Atylosia cajanifolia* (2n=22), *Atylosia scarabaeoides* (2n=22), *Atylosia albicans* (2n=22) and *Atylosia lanceolata* (2n=22). For the intergeneric crosses, *C. cajan* was used as female parent and F₁ hybrids of *Atylosia* spp. as pollen parent. Meiotic studies were done following propionocarmine staining technique and the pollen grains were stained in 1 per cent acetocarmine.

RESULTS AND DISCUSSION

A. Intergeneric hybrids

1. *Cajanus cajan* × *Atylosia cajanifolia*

In the F₁ hybrid the homoeologous chromosomes participating in pairing were identified. The synopsis in these bivalents was complete. This has indicated close homology between the parents. However one bivalent exhibited heteromorphism in the hybrid. Pollen fertility was near normal. The hybrid showed high leafiness.

2. *Cajanus cajan* × *Atylosia lanceolata*

During meiosis, bivalent chromosomal association was the most common at metaphase I in the hybrid. The low occurrence of univalents at metaphase I in the hybrid indicated considerable chiasma formation and hence crossing over between *C.cajan* and *Alanceolata*. Partial pollen sterility was noticed in the hybrid.

B. Trispecific hybrids

3. *Cajanus cajan* × (*Atylosia albicans* × *Atylosia scarabaeoides*)

Meiosis in the trispecific hybrid revealed formation of 7 bivalents and 8 univalents. Most of the bivalents showed loose pairing. Also, precocious separation in one of the bivalents could be seen. Partial pollen sterility was observed in the hybrid. The shattering nature of the mature pods of the trispecific hybrid revealed greater possibility of increased seed harvest.

4. *Cajanus cajan* × (*Atylosia cajanifolia* × *Atylosia scarabaeoides*)

In this trispecific hybrid, one heteromorphic bivalent was invariably present. Pollen sterility was seen to be higher in the trispecific hybrid as compared to those of the parents. The F₁ hybrid showed very high leafiness. The trispecific F₁ hybrid was erect with branch end drooping as compared to erect and semi erect growth habits of female and male parents respectively. In the segregating progeny of the hybrid, different plant types viz., erect, semi erect, semi erect with branch end drooping and spreading were scored. The fertility percentage in such plants ranged from 48.5-66.0 and days to flowering from 115-170. These new plant types were invariably associated with high leafiness and smooth leaf surface, which are important characteristics from the forage point of view.

Species of *Atylosia* with diverse growth habits (Table 1) and *C. cajan* (an erect shrub) have hermaphrodite flowers which require hand emasculation and pollination for hybridization. The possibility of hybridization between *Atylosia* species and *C.cajan* was first pointed out by Deodikar and Thakar

Table 1. Growth habits of *Atylosia* species used in crosses with *Cajanus cajan*

Species	Growth habit
<i>A. cajanifolia</i> Haines	Erect shrub
<i>A. scarabaeoides</i>	Herbaceous creeper
<i>A. albicans</i>	Perennial climber
<i>A. lanceolata</i>	Erect shrub

(1956). They have suggested that it may be possible to transfer wilt resistant character of *Atylosia* and combine it with the desirable agronomic characters of *C.cajan*. Both, the wild *Atylosia* spp. and cultivated crop, *Cajanus cajan* have chromosome number $n = 11$. Thus, it is clear that the development of crop took place without alteration in the chromosome number.

The high cross compatibility of *C.cajan* and *A.cajanifolia* indicate that they have diverged from each other in the recent past or both have originated from a common ancestral stock. This further supports the contention of vander Maesen (1980) that *A.cajanifolia* is the putative progenitor of *C.cajan*. The affinities of *C. cajan* and *A.lanceolata* was determined following hybridization through studies of pollen and chromosomal pairing. Trispecific cross between *C.cajan* and F_1 of *A.albicans* × *A.scarabaeoides* were successfully attempted. Parental plants having different morphological traits have shown close affinity in their chromosome complements as evident by the formation of high degree of bivalents during meiosis.

The present studies and the earlier works (Reddy *et al.*, 1980; Pundir and Singh, 1985) on the cytogenetics of *C.cajan* × *Atylosia* spp. revealed an important fact about the existence of considerable degree of homology between the chromosome complements of these species. The partial pollen sterility and the occurrence of unpaired chromosomes can possibly be attributed to the structural differences in the parental genomes to some extent or to the action of different genetic factors which inhibit chromosome pairing. In some cases, the heteromorphism exhibited by single bivalent indicated that the genomes involved in hybridization have attained some degree of non-homology in their chromosomes.

The hybrids of *C. cajan* and *Atylosia* species manifest forage potentiality. It is emphasized that *Atylosia* spp. can very well be utilized in breeding superior strains of *Cajanus cajan*.

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