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HYBRIDIZATION IN *ACACIA NILOTICA* COMPLEX IN INDO-PAKISTAN SUBCONTINENT: CYTOLOGICAL EVIDENCE

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Abstract

Acacia nilotica complex comprises 9 subspecies of which 5 occur in Pakistan. Hybridization among subspecies is reported in some previous works on the basis of morphological and chemical data. The present work provides the first cytological evidence (disturbed meiosis) for hybridization between subsp. *indica* (Benth.) Brenan and subsp. *hemispherica* Ali & Faruqi. The frequent abnormalities found in pollen mother cells meiosis of putative hybrids were pairing disturbance and precocity at metaphase-I; and lagging chromosomes at anaphase-I.

Introduction

Acacia nilotica (L.) Willd. ex Delile is widely distributed in Africa, Arabia and the Indo-Pakistan subcontinent. It is very variable and currently 9 subspecies are recognized. Of these 5 occur in the Indo-Pakistan subcontinent (Ali & Faruqi, 1969a, b). The subspecies can be identified using the shape of the plant, the shape and indumentum of fruit and the indumentum of the branches (Brenan, 1959; Ali & Qaiser, 1980).

Hybridization in *Acacia nilotica* complex was for the first time demonstrated by Ali & Faruqi (1969). Morphological studies of the members indicated that the variation pattern observed in Pakistan was genoclinal in nature near the coast and the vast amount of variability encountered is the result of hybridization between *A. nilotica* subsp. *hemispherica* Ali & Faruqi and *A. nilotica* subsp. *indica* (Benth.) Brenan. The hybrid populations may backcross either with the first or the second parent producing *A. nilotica* subsp. *adstrigens* (Schumach. & Thonn.) Roxb., and subsp. *subalata* (Vatke) Brenan type plants. This was later substantiated by the study of phenolic constituents, pollen fertility and intra-plant fruit variability also (Ali & Qaiser, 1980). The hybridization between *Acacia nilotica* subsp. *indica* and *A. nilotica* subsp. *cupressiformis* is also substantiated by the study of phenolic constituents (Ali & Qaiser, 1992).

In the present paper the cytological evidences confirming the hybridization in this complex are being presented for the first time.

Material and Methods

Collection of cytological material was made from the hybrid swarm present in the Karachi University Campus. Young capitula were fixed in Carnoy's Solution (Absolute alcohol – Glacial Acetic Acid in 3:1 ratio) and stored in a refrigerator. Slides were prepared by squashing young anthers in 1% propionic carmine. Photographs were taken from temporary mounts by a Zeiss photomicroscope with 8x eye piece and 100x oil immersion objective lens in most cases, some photographs were taken with 40x objective lens as well.

Fig. 1. a. A group of four PMCs, each on metaphase-I. b_1-b_3. Precocious chromosomes at metaphase-I. (b_1) A group of four PMCs showing a high degree of precocity in one of the cells separated from the group (b_2) A group of four PMCs showing varying degrees of precocity in all the cells. (b_3) One cell from "b_2", photographed at higher magnification.

Results and Discussion

Generally the number of pollen grains per polyad is considered constant for each species (Cookson, 1953), though Leach & Wahiffin (1978) have reported the two parental types of the polyads in the taxon of hybrid origin. In this species the pollen mother cells occur in groups of 4 which ultimately give rise to poyads with 8, 12 and 16 monads. The 16 cell polyad being most common.

On the basis of biochemical evidence it has been demonstrated (Ali & Qaiser, 1980) that the Indian populations of *A. nilotica* subsp. *indica* are much purer than the Pakistani populations where the genes from the hybrid swarms have infiltrated. Hence our samples of *A. nilotica* subsp. *indica* in Sindh represent the hybrid version of *A. nilotica* subsp. *indica*. The hybrids analyzed by us cytologically are the products of hybridization between *A. nilotica* subsp. *hemispherica* and the hybrid version of *A. nilotica* subsp. *indica.*

c. A group of four PMCs at Anaphase-I. Two lagging chromosomes visible in one cell. d_1-d_2. Two cells from a group of four at anaphase-I, one with bridge formation (d_1) and the other with lagging chromosomes (d_2) visible at different focuses. e. A group of four PMCs at anaphase-I, showing almost all chromosomes coalesced to form bridges in two cells.

Frequent cytological disturbances were observed in the pollen mother cell (PMC) meiosis. In this taxon, the PMCs occur in groups of four which ultimately give rise to 16-grain polyads. The four PMCs of a group undergo synchronized meiosis (Fig. 1a). Usually similar type of meiotic disturbance was found in all the four PMCs, though with varying intensity. The common abnormalities were pairing disturbance in meiosis-I and presence of precocious chromosomes at metaphase-I (Fig. $1b_1$, b_2, b_3), lagging chromosomes at Anaphase-I (Fig. 1c, d_2), presence of bridge at Anaphase-I (Fig. $1d_1$); and occasional coalescence of almost all chromosomes stretching like a bridge at Anaphase-I (Fig. 1e). Both precocity and lagging of chromosomes occur due to the differences in characteristics of the parental genomes in case of hybrids. This study further strengthens the presence of hybridization between subspecies of *Acacia nilotica*, demonstrated earlier on the basis of morphological and chemical evidences (Ali & Faruqi, 1969b; Ali & Qaiser, 1980, 1992).

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