Ontogenetic Basis of Polyad Symmetry in *Samanea saman* (Jacq.) Merr.

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Abstract

Samanea saman (Jacq.) Merr. bears more or less radially symmetric polyad. The polyad is formed by eight equal sized, decussate tetrads, thus consisting of 32 pollen grains in total. In the present work, the ontogeny of the polyad is studied and the results show that the symmetry of the polyad is effected by the fact that the premeiotic nuclear divisions in the sporogenous cell precede cell-wall formation.

Introduction

Compound pollen grains, i.e. tetras and polyads, occur in almost all tribes of Mimosaceae (Leguminosae-Mimosoideae) with high frequency (Guinet 1981). The number of pollen grains per polyad ranges from eight to 64 in various members of the family (Maheshwari 1950). Dnyansagar (1951) has described and illustrated the morphology of the mature polyad of *Samanea saman* (as *Pithecolobium saman* Benth.) He also described the microsporogenesis, but did not study the premeiotic events. Kenrick and Knox (1982) for the first time suggested that the pollen mother cells which give rise to a polyad, descend froin single sporogenous cell in *Acacia*. On the basis of their studies on Australian species of *Acacia*, Knox and Kenrick (1983) concluded that the number of premeiotic mitoses determined the number of pollen grains per polyad. The mature polyad is generally highly symmetric, whatever the grain number may be (Guinet 1983). According to him, this symmetry is related to the ontogenctic sequence which, however, has not been worked out. In the present work, premeiotic events are investigated in *Samanea saman* with a view to determine the ontogenetic sequence that leads to the symmetry of polyad.

Materials and Methods

Young floral heads of *Samanea saman* were fixed in Carnoy's solution (ethanol-glacial acetic acid in a ratio of 3:1) and stored, at 5°C. The slides were prepared by squashing the anthers in 1% propionic carmine. Photographs were taken from temporary mounts.

Results and Discussion

The study of polyad ontogeny in *Samanea saman* revealed that three rounds of premeiotic mitosis occur in the sporogenous cell, giving rise to eight nuclei. However, these nuclear divisions are not immediately followed by cytokinesis and well-wall formation, thus all these nuclei remain within the same cell. The eight nuclei are arranged in a circle near the periphery of the cell at almost equal distances from one another (Fig. 1A); then radial walls are laid down and a group of eight pollen mother cells is formed (Fig. 1B). This group of radially arranged pollen mother cells undergoes meiosis and gives rise to the polyad, which consists of eight radially arranged decussate tetrads (Fig. 2A & 2B). Dnyansagar (1951) has described these tetrads as tetrahedral, but according to the terminology of Maheshwari (1950), these tetrads are decussate rather than tetrahedral since each tetrad has two pollen grains arranged in one plane and the other two are in the plane perpendicular to the first.

Knox and Kenrick, (1983) suggested that the sporogenous cell in *Acacia* divides once to form two pollen mother cells in the case of the polyad comprising eight pollen grains, and that there are two rounds of premeiotic mitosis in the case of the polyad comprising 12 or 16 pollen grains. All the polyad comprising 8, 12 or 16 pollen grains were symmetric, containing equal sized tetrads. However, Knox and Kenrick (1983) did not study how the polyad composed of 12 pollen grains was formed. Guinet (1983) discussed that the symmetry of the polyad implies the symmetric arrangement of pollen mother cells which form the polyad. However, it has not been explained how the pollen mother cells achieve this symmetry. Their symmetry seems logical in cases where the pollen mother cells are in even number, such as 2, 4 or 8; but in those where the pollen mother cells are in odd numbers (such as 3 or 7, i.e. in the instances of polyad composed of 12 or 28 pollen grains), it is obvious that one of the daughter cells of the original sporogenous cell remains undivided, and is therefore larger than other cells. This may result in unequal sizes of the pollen grains thus disturbing the symmetry of the polyad (cf. Knox and Kenrik 1983, Fig. 1c). The ontogenetic sequence described here for *Samanea saman* ensures the formation of equal sized pollen mother cells, as the nuclear divisions without cell-wall formation allow the nuclei to be arranged at equal distances from one another, followed by the formation of cell-wall. This mechanism would also allow the formation of equal sized pollen mother cells in those instances where the pollen mother cells are in odd numbers. Further studies in other polyad bearing members of Mimosaceae would reveal if such a mechanism exists in them also.

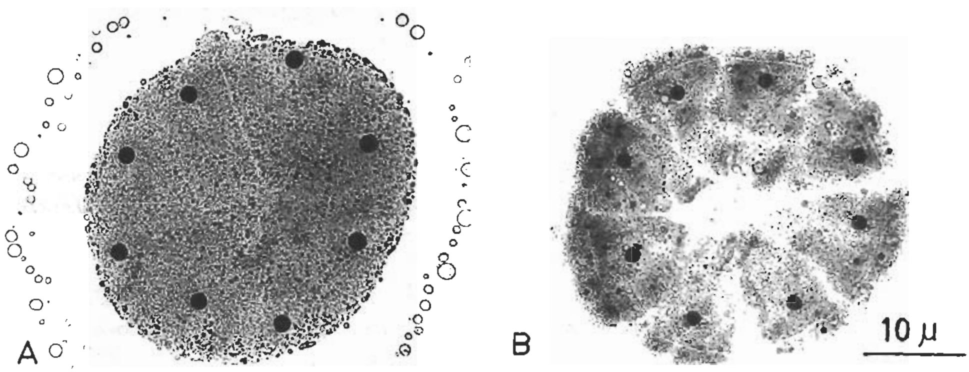

Fig. 1. Premeiotic developmental stages of the polyad of *Samanea saman* (Jacq.) Merr.:
A. Sprogenous cell with eight nuclei arranged near periphery.
B. Group of eight young pollen mother cells formed by laying down of radial walls in the 8-nucleate sprogenous cell.

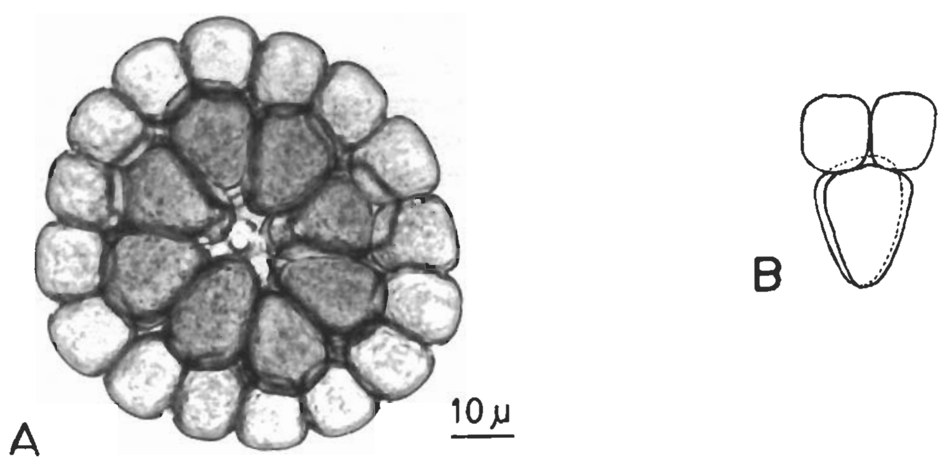

Fig. 2. A. Mature of polyad of *Samanea saman* (Jacq.) Merr. (unacetolysed).
B. One of the component tetrads drawn separately to show the decussate arrangement of the pollen grains.

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