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Anomalies in microsporogenesis in malformed mango flowers

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Malformation disease of mango *(Mangifera indica* L.) induced by *Fusarium moniliforme* Sheld (8) is a disease of international importance. The disease affects both floral and vegetative plant parts. Flowers borne on malformed inflorescence are mostly staminate, bear scanty pollens (10) and pollens exhibit poor viability (4). Information on cytogenetics of malformed tissue are not available so far, hence, it was thought worthwhile to find out the anomalies during microsporogenesis.

Suitable young flower buds collected between 9-11 A.M. from malformed panicles of the cultivar Ratna were fixed in Carnoy solution (ethanol-chloroform-acetic acid 6:3:1) for meiotic studies and stored in 70% alcohol (7). When the tissues became moderately soft, the pollen mother cells (PMC) were squashed and stained in acetocarmin solution. Thus, temporary slides were prepared and microsporogenesis was studied.

Along with the development of the flower buds the anthers grew in size and lead to the differentiation of the pollen mother cells with big nucleus (Fig. 1A). During cytological studies, various types of meiotic anomalies were observed. The spindle fibres were lightly stained. In normal metaphase homologous chromosomes are found as bivalents which are attached with the spindle fibres by their centromeres at the equator of the spindle (5). But in malformed buds, 2-4 chromosomes were found lying away from the metaphase plate (Fig. 1B). At anaphase, disjunction of homologous chromosomes is strikingly regular in normal buds (5). But in case of malformation bridges and laggards were of common occurrence both at anaphase (Figs. 1C-D) and telophase (Figs. 1E-F). In malformed buds gradual reduction in chromosome number was clearly observed from anaphase to telophase. During telophase further degeneration of chromosomes alongwith other organells like cell wall was seen (Fig. 1F).

Spindle anomalies were frequently noted at second meiotic division showing 3 separate parallel spindles (Fig. 1G). Subsequently, cytoplasm within the PMC was divided by cell plate formation leading to the formation of polyad (Fig. 1H) which finally resulted into abortive pollens (Fig. 2). Multipolar spindle formation as was reported in species of *Zea* (1),

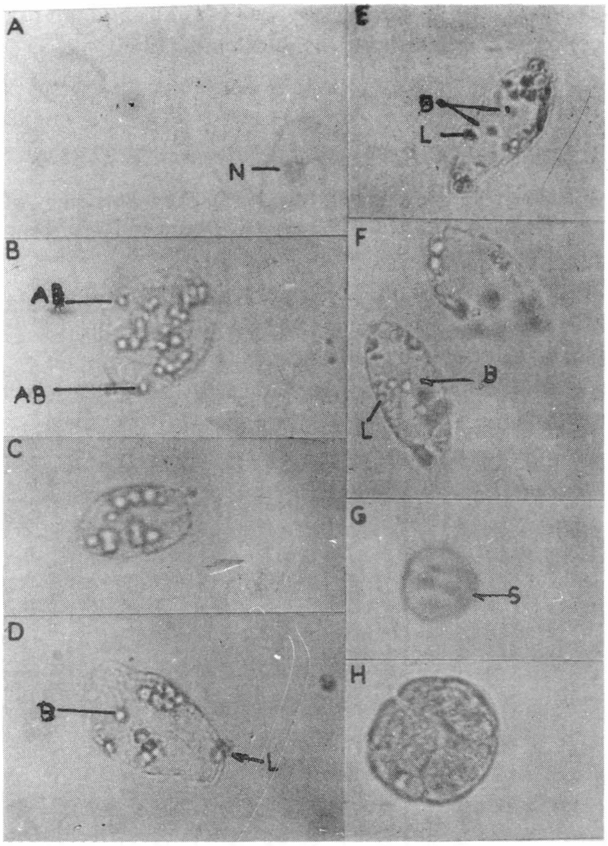

Fig. 1. Meiotic anomalies in *Mangifera indica L.* (A) PMC with big nucleus (N); (B) Metaphase showing bivalents (AB) lying away from the plate; (C) Anaphase with reduced number of chromosomes; (D) Anaphase with 2 laggards (L) and 1 bridge (B); (E-F) Telophase showing bridge (B) and laggards (L); (G) Cytokinesis showing 3 separate and parallel spindles (S); (H) Polyad

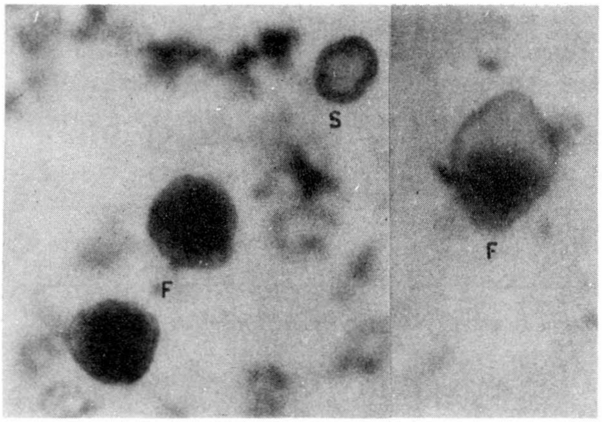

Fig. 2. Mango pollens sterile (S) and fertile (F) (stained).

Withania (7) and human cancer cells (9) may be spontaneous or may be induced by chemical agents (3). Nelson and Rossman (6) induced male sterility in maize with gibberellin treatment. It appears from the circumstantial evidence that specific gibberellic acid observed in malformed panicles (F), probably produced by the pathogen *F. moniliforme*, might be responsible to induce the chromosomal anomalies resulting in abortive pollens.

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