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THE STRUCTURE AND DEVELOPMENT OF MALE GAMETOPHYTE OF *ARUDINELLA PUMILA* (HOCHST.EX.A. RICH).

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ABSTRACT: The paper deals with embryological investigation of male gametophyte of *Arundinella pumila.*(Voucher specimen: N-7). The anther wall development conforms to the Monocot type. The epidermis shows echinate out growth on the outer tangential wall and persist till anthesis.The hypodermal layer differentiates into endothecium. Tapetum remains uninuclear throughout development. The pollen grains degenerate at uninucleate stage.

Key words: - Poaceae, Poodeae, Echinate outgrowth on epidermis, Endothecial cell,Ubisch granule ,Uninucleate tapetum , Pollen grain, Degenerating pollen, Male gametes.

INTRODUCTION:

The division of the Poaceae into two subfamilies viz; Pooideae & Panicoideae as proposed by Brown (1814) is being maintained even today. This taxon also follows uniform pattern at sub family level regarding the development of male gametophyte (Narayanswami 1955 a,b,c 1956; Koul 1997 a,b; Raju 1980; Bhanwara et al., 1991; Deshpande and Makde 1994; Nikhade and Makde 1997). In many anthers abortive non-viable pollen grains are formed.Mature pollen grains are 3-celled.

MATERIALS AND METHODS:

The material of *Arundinella pumila* was collected from Totaladoh localities of Nagpur (M.S.) India. The voucher specimens submitted to the herbarium. Spikelets at various stages of development were fixed in 70% F.A.A. Customary methods of dehydration, infiltration and embedding followed. Sections were cut 8-12µ thick & stained with Delafields hematoxylin. Erythrosin and light green stain was used as counter stain.The sections were mounted in Canada balsam.Diagrams were drawn with the help of camera lucida.

Microsporangium, Microsporogenesis and Male gametophyte :

The anthers are bithecous and tetra locular in transection consist of a homogeneous mass of parenchymatous cell surrounded by a single layer epidermis (Fig.1A). The male archesporeium differentiate at the four corners of a young anther. A fully develop anther consist fours wall layer viz. the outer most epidermis, a hypodermal layer constituting an endothecium, a single middle layer and the inner most tapetum that surrounds a central sporogenious cell (Fig.1B). The development of anther wall thus, correspond to monocotyledonous type (Davis,1966). The epidermal cell is rectangular and on the outer tangential wall peculiar echinate outgrowth develop these projections are probably silicious in nature. (Figure 1 B, C, K). The hypodermal layer of endothecium has a finger like fibrous bands

arise from the inner tangential wall. A distinct 'Ubisch' granules are notice on the inner tangential wall. (Fig.1 K,L). The ephemeral middle layer start degenerating prior to the onset of meiosis in PMCs. The tapetum is the innermost parietal layer that completely surrounds the central sporogeneses tissue. The tapetum remain uninuclear through the anther development. (Fig.1B). The pollen mother cell is very prominent and polygonal in shape the primary sporogeneous cell directly function as microspore mother cell.Thus pollen output is very low. The meiotic division are normal at close of meiosis-I wall is laid which result dyad. (Fig. 1 D). Meiosis-II in both dyad cell are synchronous result isobilateral microspore tetrads (Fig 1 E).The male sterility is common in this taxon. However, adjoining locules from the same theca become confluent due to dissolution of septum prior to anthesis.

The epidermal cell has somewhat less flattened and on the outer tangential wall peculiar echinate out growth develop that remains persistent at anthesis. (Fig.1B). The finger like fibrous bands is observed on the endothelial cells. The fibrous bands arise along the inner tangential walls, extend outwards and upward terminating near the outer tangential wall. These bands are distinctly "V" or "U" shaped (Fig. 1K,L).The fibrous bands are not developed in the endothecial cells of sterial anthers.(Fig.1C) . The ephemeral middle layers degenerate before to start the meiosis in pollen mother cells (Fig. 1B).

The tapetum is the innermost parietal layer that completely surrounds the central sporogenous tissue (Fig. 1B). Tapetum remains uninucleate during development finally degenerate *in situ*. Thus, tapetum are secretory or glandular type. A fully developed anther consists of four wall layer. The development of anther wall thus, corresponds to monocotyledon type (Davis, 1966). The primary sporogenous cells functions directly as microspore mother cells. This indicate the pollen output is very low. The pollen mother cells are polygonal in outline, densely cytoplasmic with a centrally placed nucleus. PMCs under goes meiosis I&II and results into microspore tetrads of the isobilateral type (Fig. 1E). Male sterility is common and the degeneration observed at the uninucleate or binucleate stage of pollen grains.

Pollen Grains :-

The young microspore is spherical with dense cytoplasm and a centrally placed prominent nucleus. The uninucleate microspore are spherical or ovoid well develop exine and intine and content a granular cytoplasm. (Fig.1 F). The first mitotic division of the microspore nucleus results in smaller generative nucleus and larger vegetative nucleus. The two nuclei lie side by side & cytoplasm becomes alveolar in which few starch grains are deposited (Fig. 1G, H). The generative cell soon divides & forms two male gametes. The shape of male gametes are lenticular (Fig1. H,I).

RESULT & DISCUSSION:

The present study on structure and development of male gametophyte of *Arundinella pumila* which belongs to subfamily, Pooideae resembles in most of the feature of male gametophyte work out by earlier worker. The anther wall is four layered & its development conforms to the Monocotyledons type of Davis (1966). Epidermis is single layered & an echinate minute projection appear on epidermis which was earlier reported by Batygina (1974), Diwanji (1976) & Harigopal & Mansi Ram (1981), The fibrous thickenings develop along the inner tangential wall of endothecium. This is the normal appearance of fibrous endothecium in most members of Poaceae. However, in the sterile anther do not show such thickenings. The single middle layer is ephemeral and become completely crushed before the microsporangium is fully mature and ready to dehisce Swamy & Krishnamurthy (1980). The cells of glandular tapetum are uninucleate. This is also reported by Narayanswami, 1955a; Christensen et al., 1972; Chikkannaiah & Mahalingappa, 1976a; Bhuskute, 1990; Ghaisas, 1991. In this taxon

sporogenous cells are less which speaks of low output of pollen grains (Bhanwra, 1988, Bhanwra et al., 1991). Male sterility is common in this taxon.

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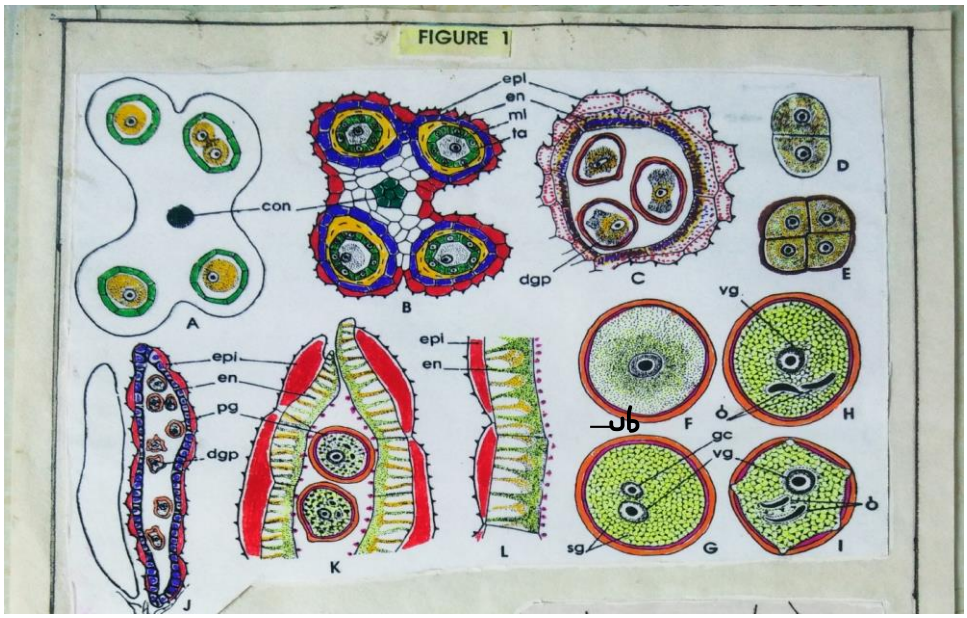

Fig, 1A-S.*Arundinella pumila*, A. Tetrasporangiate anther (Diagramatic); B.T.S anther (4-Layered anther wall); C. Part of anther showing degenerating pollen grain; D. Dyad; E. Tetrad ; F-I, Uninucleate, Binucleate pollen grain with male gametes; K-L: L.S. anther(Part magnified).

Abbreviations:

(con, connective ; dgp, degenerating pollen grain; epi, epidermis; en, endothecium; ; gc, generative cell ; ii, ml, middle layer ; ta,Tapetum; ub, ubiscsh granule ; pg, pollen grain ; vg, vegetative cell.)