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Reproductive Morphology of *Laggera aurita*

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The anther of *Laggera aurita* is tetrasporangiate and its wall development is dicotyledonous type. Endothecium is non-fibrous. Tapetum is periplasmodial. Microspore tetrads are both tetrahedral and isobilateral. Pollen is shed at three/celled stage. The ovule is anatrospous unitegmic and tenuinucellate. The development of the embryo sac is of Polygonum type. Endosperm is cellular and the embryo development conforms to *Senacio* variation of Asterad type.

Key Words - Anther Endothecium Ovule Tapetum Wall

Of the four species of Laggera occuring in India (Gamble, 1957) Pullaiah (1979), studied the embryology of L pterodonta. In the present study the reproductive morphology of Laggera aurita is reported.

MATERIALS & METHODS The material at different stages of development was collected at Nandi Hills and Central College Campus Bangalore, was prefixed in Carnoy's fluid for 10 minutes, fixed in Nawashin's fluid and preserved in 70% ethanol. The capitual were infiltrated and embedded in paraffin. Serial transactions and longisections were cut at 8-14 μm and stained in Heidenhain's iron alum haematoxylin with Orange G as counter stain.

RESULTS *Microsporogenesis and male gametophyte* The anther is tetrasporangiate and its wall development conforms to dicotyledenous type (Davis 1966). The archesporium is hypodermal (Fig. 1) and consists of 4 to 6 cells. The anther wall comprises of epidermis, non-fibrous endothecium, middle layer and tapetum (Fig. 2).The middle layer is ephemeral. The taperal cells are uninucleate (Fig. 2). The periplasmodium is formed at microspore tetradal stage (Fig. 3). Simultaneously, with the changes in anther wall of the primary sporogenous cell which functions directly as the microspore mother cell, undergoes meiosis. Simultaneous cycokinesis by furrowing results in the formation of tetrahedral and isobilateral tetrads of microspores (Fig. 3,4). The microspores soon after liberation undergo a division, resulting into a large vegetative nucleus and two small male gametes. The pollen grain is shed at this stage and has a thick echinate exine (Fig.5).

Ovary and Ovule The bicarpellary syncarpous gynoecium has inferior unilocular ovary with a single basal anatropous, unitegmic and tenuinucellate ovule. The nucellar epidermis degenerates and disappears completely at mature embryo sac stage (Fig. 11). The endothelium remains uniseriate throughout the development though at some places it becomes biseriate (Fig . 12,15). The endothelium persists as a thin non-cellular pellicle in the mature seed.

Megasporogenesis and Female Gametophyte. A single hypodermal archesporial cell functions directly as the megaspore mother cell (Fig.6) which undergoes meiosis to result in a linear tetrad of megaspores (Fig.7). The two middle megaspores degenerate first and both micropylar and chalazal megaspores appear to be functional, but finally it is the chalazal one which functions (Figs. 8,9) and by three successive mitotic divisions gives rise to eight nucleate polygonum type of embryo sac (Figs. 10,11).

The synergids are hooked (Figs. 11,17-19). After fertilization the persistent synergid elongates further up to globular stage of the embryo behaving as a haustorium. The two polar nuclei fuse before

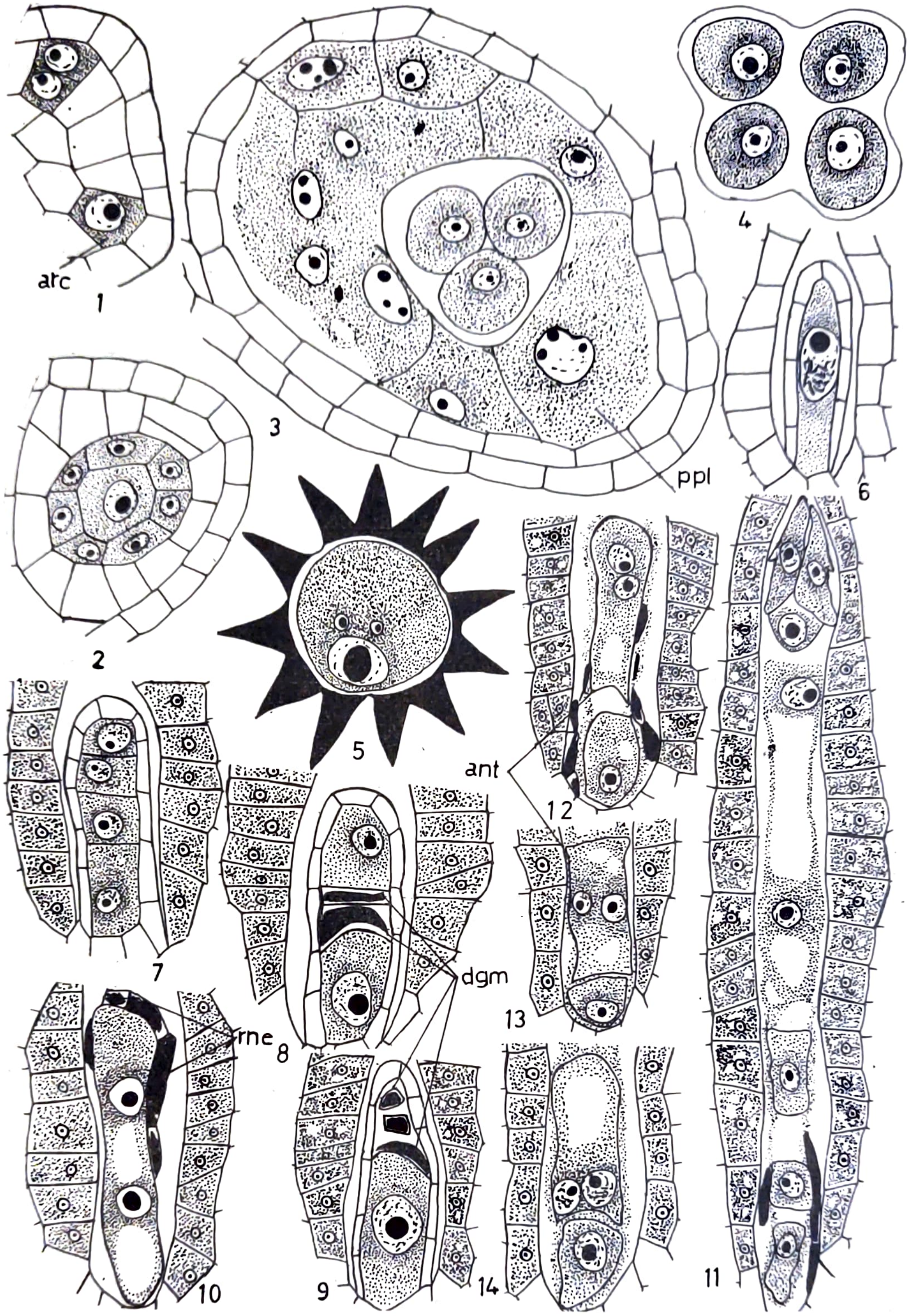

PLATE-1

Figs. 1-5 Microsporogenesis and male gametophyte. Fig. 1. T.S. of part of anther lobe. showing archesporial cell, primary sporogenous cell. Fig.2. T.S. of anther lobe showing wall layers and sporogenous cell. Fig.3 : T.S. of anther lobe showing periplasmodium and tetrahedral microspore tetrad. Fig.4 Isobilateral microspore tetrad Fig.5 Three celled pollen grain. Figs. 6-11 Megasporogenesis and female gametophyte Fig.6 L.S. of ovule showing megaspore mother cell. Figs, 7-8 Linear tetrad of megaspores along with endothelium. Fig.9 Chalazal functional megaspore Fig.10. Two nucleate embryo sac. Fig.11 Eight nucleate embryo sac. Figs. 12-14 Antipodals

(ant, antipodals. arc- archesporial cell; dgm-degenerating megaspores; ppl-periplasmodium; rne- remnants of nucellar epidermis) All figures × 1000.

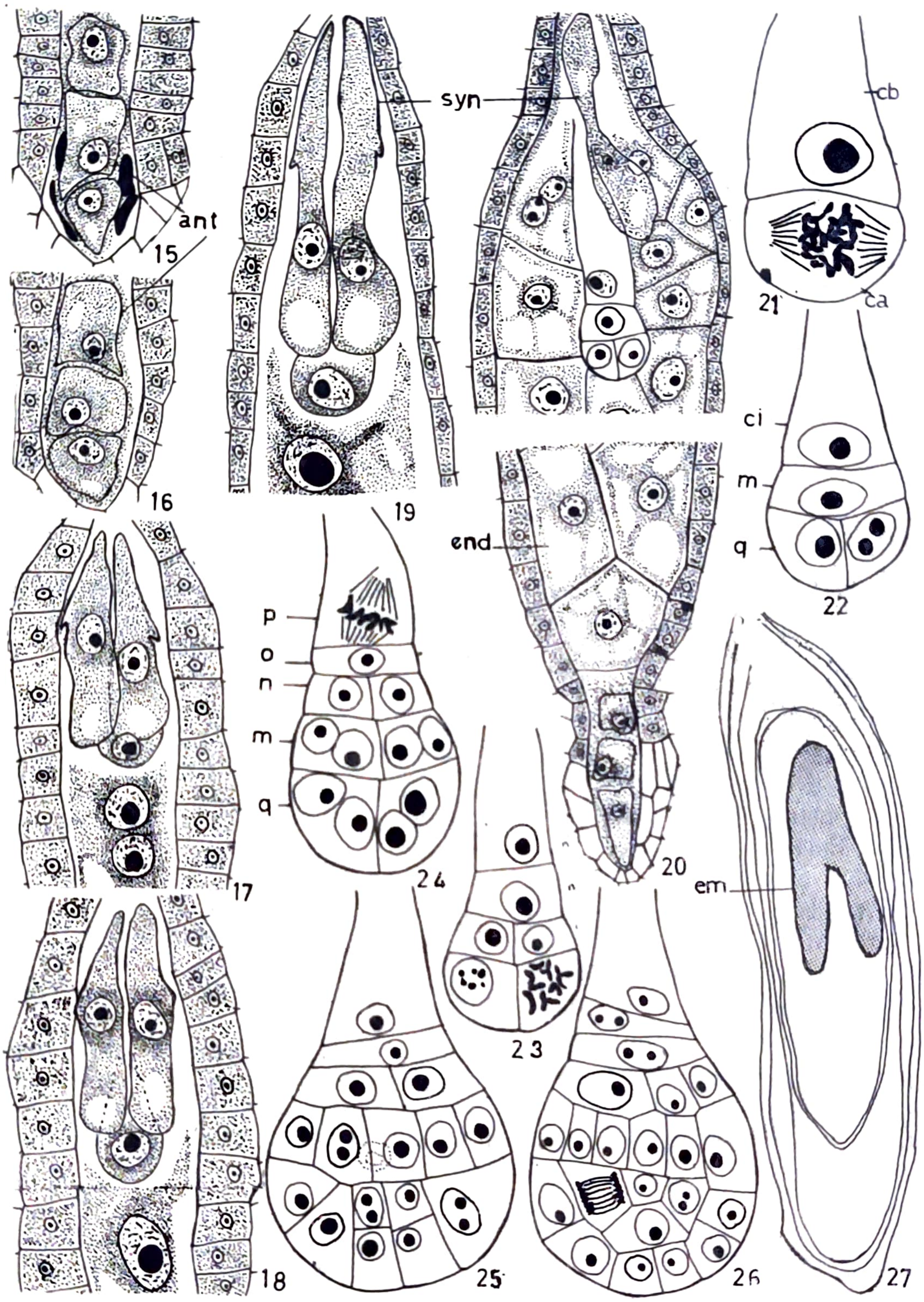

PLATE-2

Figs. 15-16 Antipodals, Figs. 17-19 L.S. of part of embryo sac showing synergid haustoria. Fig. 20 L.S. of ovule showing cellular endosperm four-celled proembryo, persistent synergid and antipodals. Fig. 21-27 Stage in the development of embryo. Figs. 21-22 Two and four-celled proembryos. Figs. 23-26. Advanced stages in embryo development. All figures × 1000. Fig. 27 L.S. of mature fruit × 450. (ant-antipodals; em- embryo; end- endosperm; syn- synergids) fertilisation forming the secondary nucleus (Figs. 11,17,19). When 2, usually the one towards the micropyle is larger and binucleate (Fig. 12-14). The lower most antipodal cell usually tapers towards the chalazal tissue serving as a weak haustorium (Figs. 11,14,16,20). The antipodals persists upto proembryonal stages (Fig 10) of the embryo.

Fertilization, Endosperm and Embryo Fertilization is porogamous. The synergid which receives the pollen tube degenerates after fertilization. Syngamy and triple fusion takes place almost simultaneously. The development of endosperm is cellular. The primary endosperm nucleus divides transversely repeated transverse and vertical divisions followed by cytokinesis result in the formation of endosperm tissue around the growing embryo (Fig.20) . Few layers of endosperm persist around the mature seed.

Transverse division in the zygote results in terminal cell *ca* and the basal cell *cb* (Fig.21) ca undergoes two vertical divisions at right angles to each other resulting in quadrant *q* (Fig.22) which, by oblique divisions gives rise to an octant (Figs.22,24) *cb* undergoes a transverse division giving rise to cells m and *ci* (Fig.22) *ci* divides transversely and cells *n* and *n'* are formed (Fig.23). A transverse division in the cells *n'* gives rise to cells *o* and *p* (Figs 24-26). The cell *p* may undergo one or two divisions resulting in a uniseriate suspensor (Figs 24,26).

The derivatives of *q* give rise to the cotyledons and stem tip, *m* to the hypocotyledonary region and plerome initials of the root, *n* and *o* to the initial of root cortex; root cap and dermatogen and *p* to the suspensor. Thus the development of the embryo conforms to the *Senecio* variation of asterad type (Johansen. 1950.)

DISCUSSION The development of anther and the male gametophyte is similar to that in L. pterodonta (Pullaiah 1979) except that the primary sporogenous cell directly functions as pollen mother cell instead of undergoing divisions to produce sporogenous tissue. The development of the embryo sac is of polygonum type. Although both micropylar and chalazal megaspores appear to be functional it is the chalazal one which finally functions. The elongated hooked haustorial synergids have also been reported in species of Compositae.

The antipodal cells in the tribe Inuleae vary in number. In *L. pterodonta* , the three antipodals simulate the egg apparatus and very rarely remain in linear row (Pullaiah 1979). The antipodals increase in number due to secondary multiplication forming antipodal complex (Davis.1966). The multiplication and persistence of antipodals suggest their haustorial nature. The development of the endosperm is cellular and the development of embryo follows the astrad type as in *L. pterodonta* (Pullaiah.1979).

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