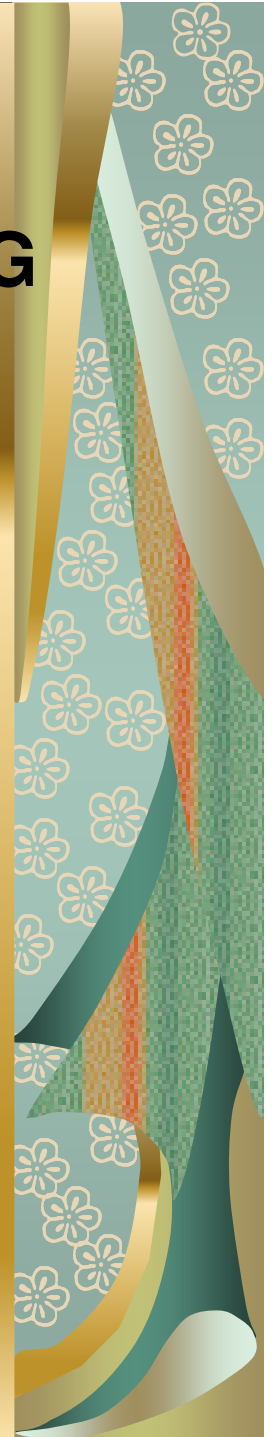


SEXUAL REPRODUCTION IN FLOWERING PLANTS

BY:-

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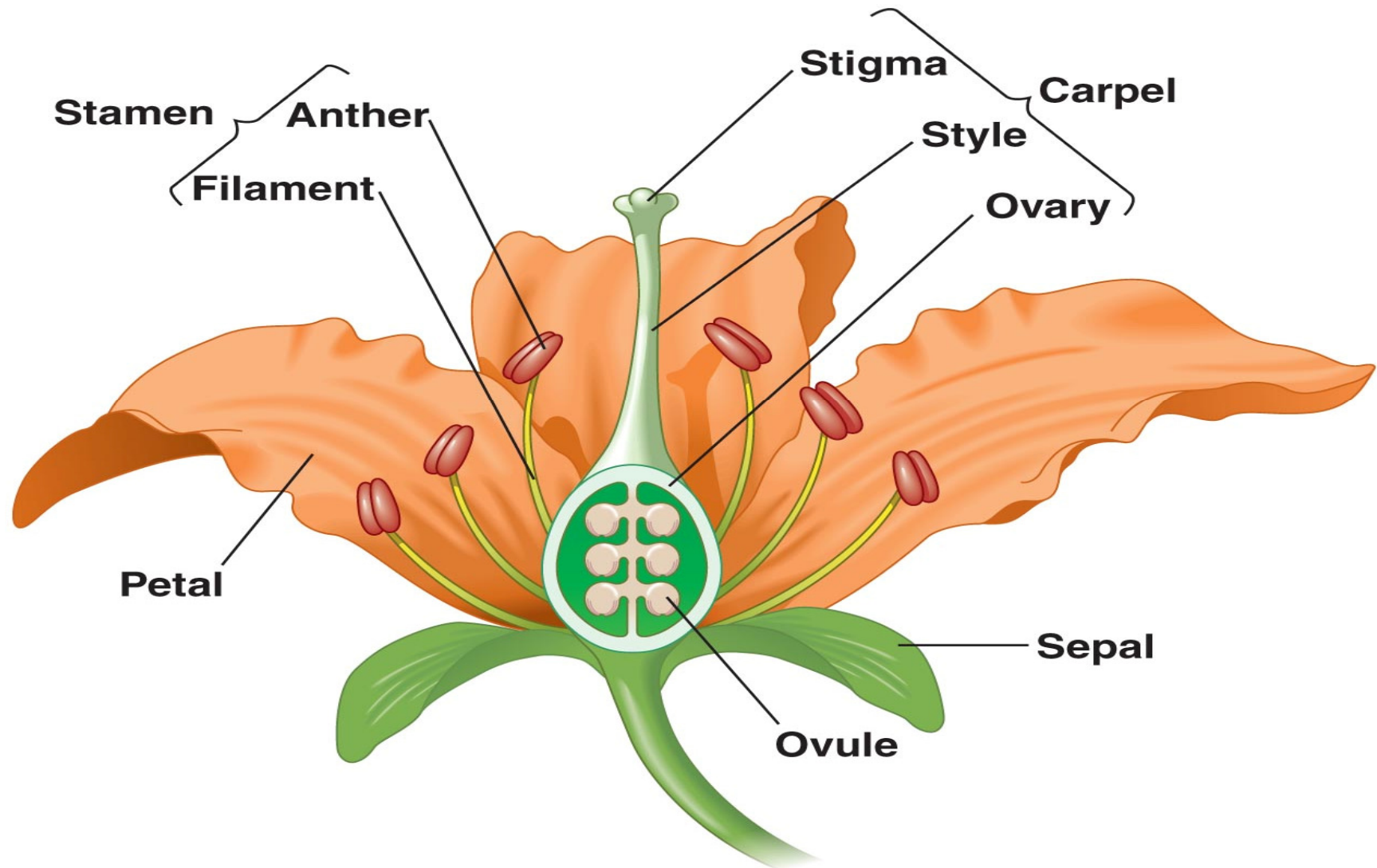


- **REPRODUCTION** : PROCESS BY WHICH EVERY LIVING ORGANISM PRODUCES OFFSPRINGS LIKE ITSELF.
- **SEXUAL REPRODUCTION:** TYPE OF REPRODUCTION IN WHICH FORMATION & FUSION OF GAMETES TAKE PLACE.
- **FLOWER** IS A MODIFIED SHOOT MEANT FOR SEXUAL REPRODUCTION OF PLANT.

PARTS OF FLOWER

- FOUR WHORL OF APPENDAGES PRESENT:
- **SEPALS OR CALYX**
- **PETALS OR COROLLA**
- **STAMEN OR ANDROECIUM**
- **CARPELS OR GYNOECIUM**

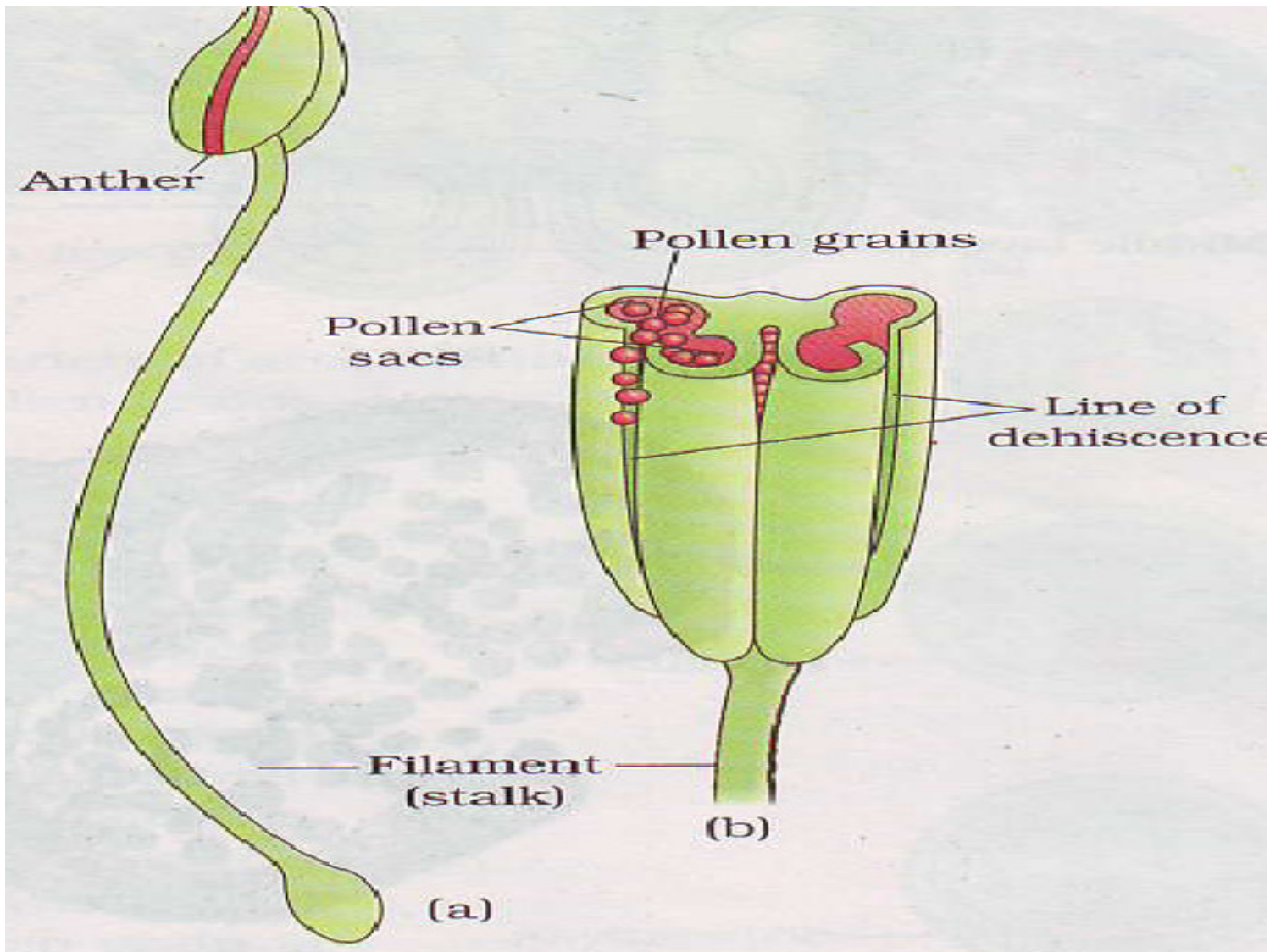
PARTS OF FLOWER



FORMATION & DEVELOPMENT OF POLLEN GRAIN

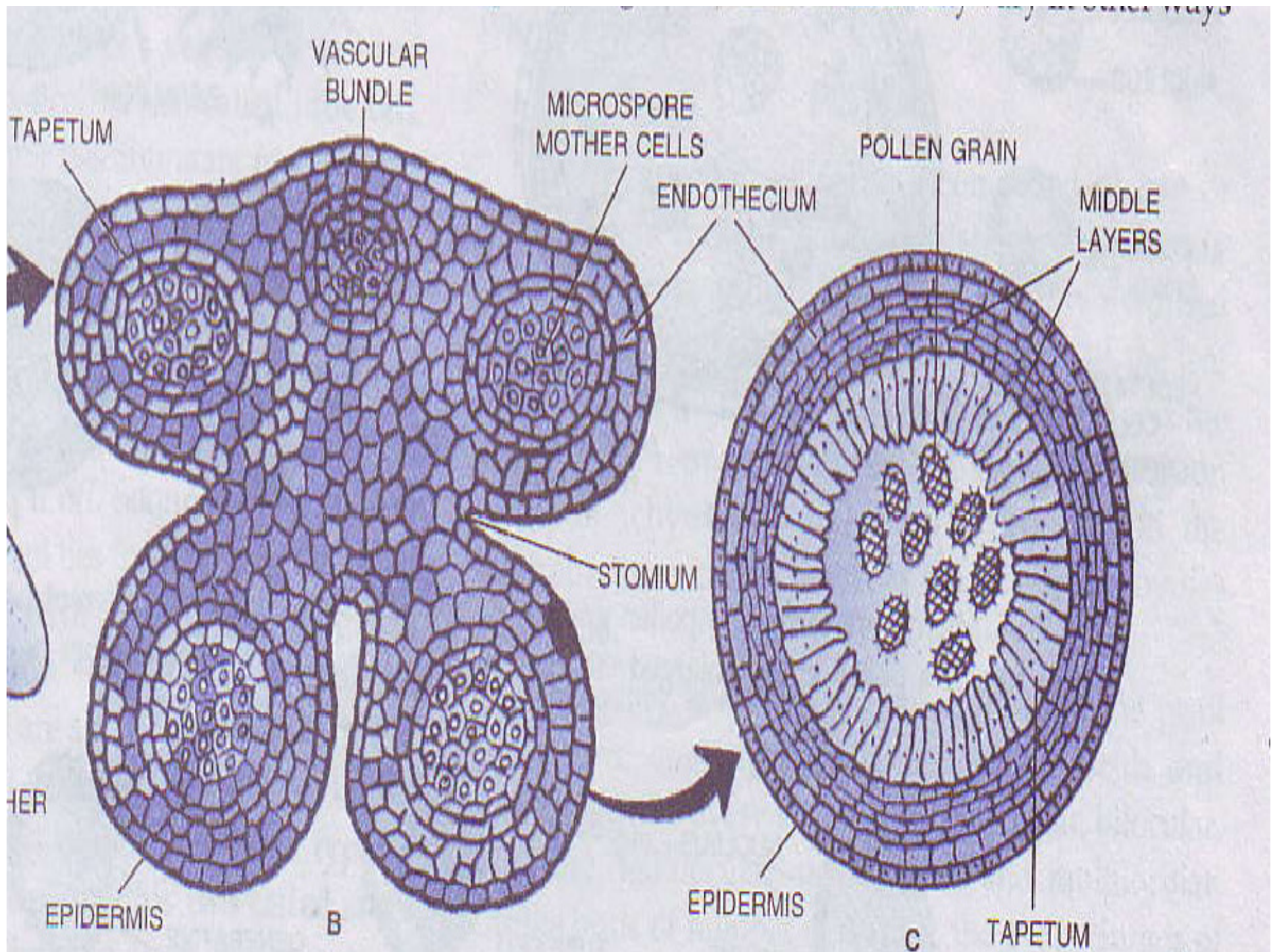
- **STAMEN:** CONSISTS OF LONG NARROW STALK CALLED FILAMENT & KNOB LIKE BILOBED ANTHER.
- **STRUCTURE OF ANTHER:** BITHECOUS ANTHER HAS TWO ANTHER LOBES CONNECTED BY STERILE PART CONNECTIVE HAS FOUR CAVITIES OR POLLEN SACS OR MICROSPORANGIA IN WHICH POLLEN GRAINS ARE PRODUCED.

POLLEN GRAIN

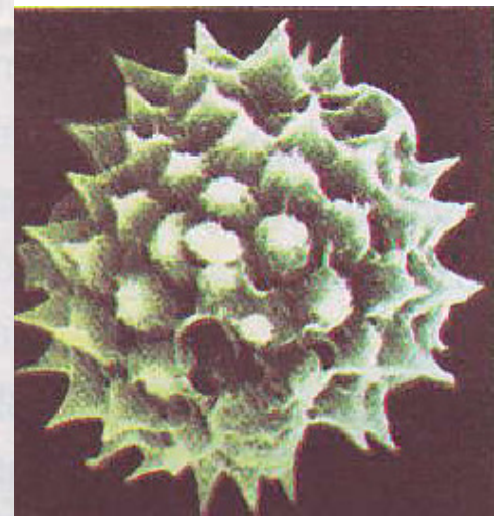
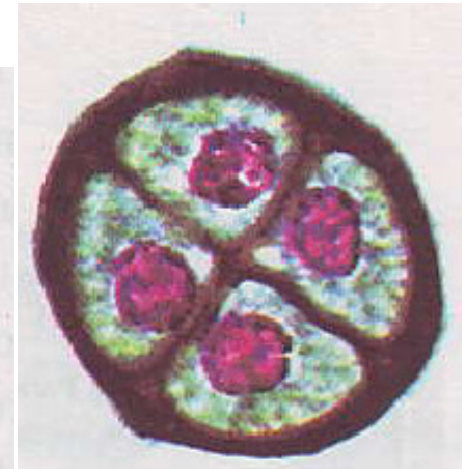
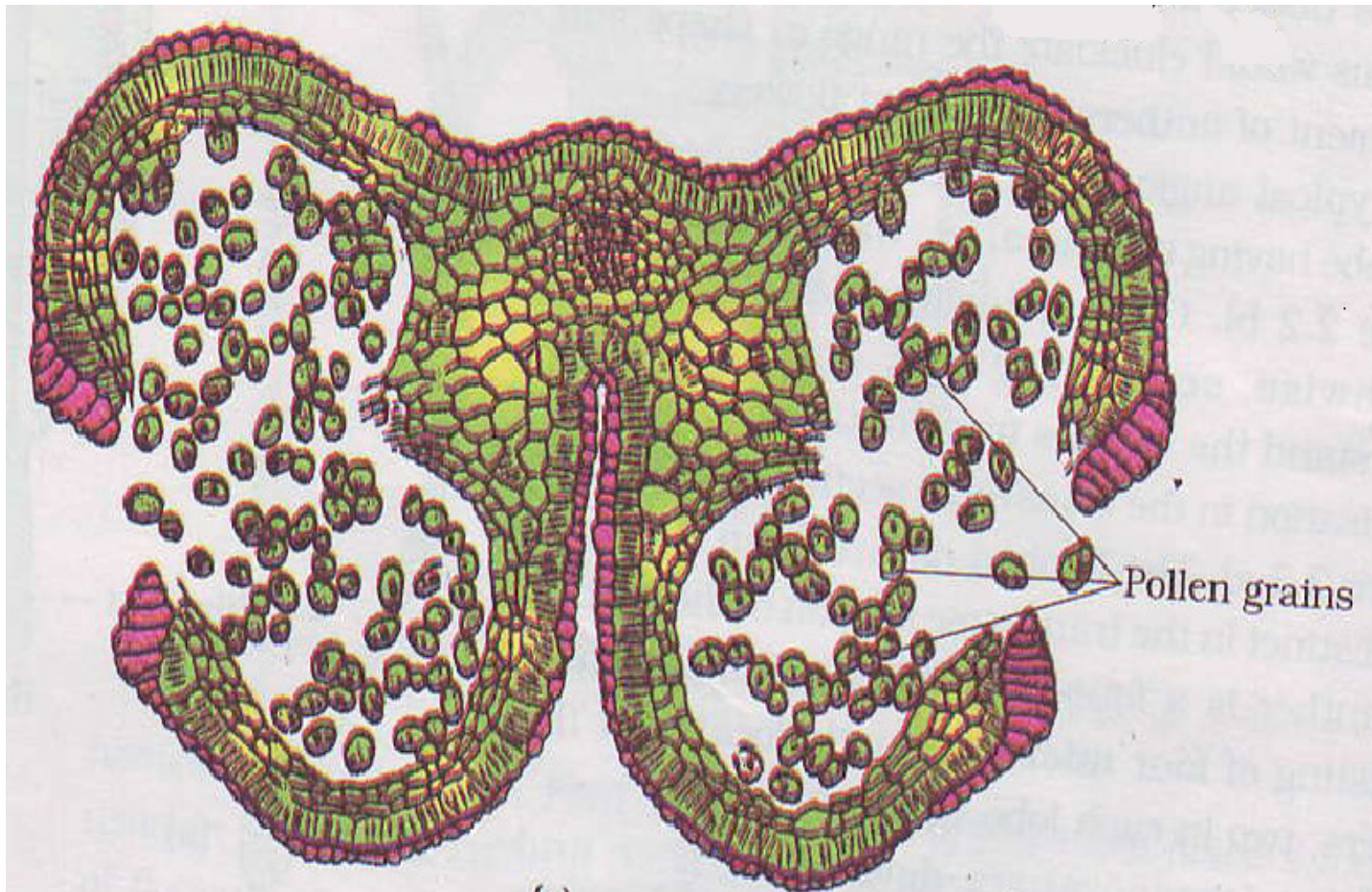


STRUCTURE OF MICROSPORANGIUM OR POLLENSAC

- ANTHOR IN T.S REVEALS PRESENCE OF OUTERMOST EPIDERMIS BELOW WHICH IS **ENDOTHECIUM**.
- BELOW ENDOTHECIUM, ARE 1-3 MIDDLE LAYERS OF PARENCHYMA CELLS.
- CELLS OF INNERMOST LAYER RADIALY ELONGATED & TERMED AS **TAPETUM** WHICH PROVIDE NOURISHMENT TO DEVELOPING MICROSPORE MOTHER CELLS.



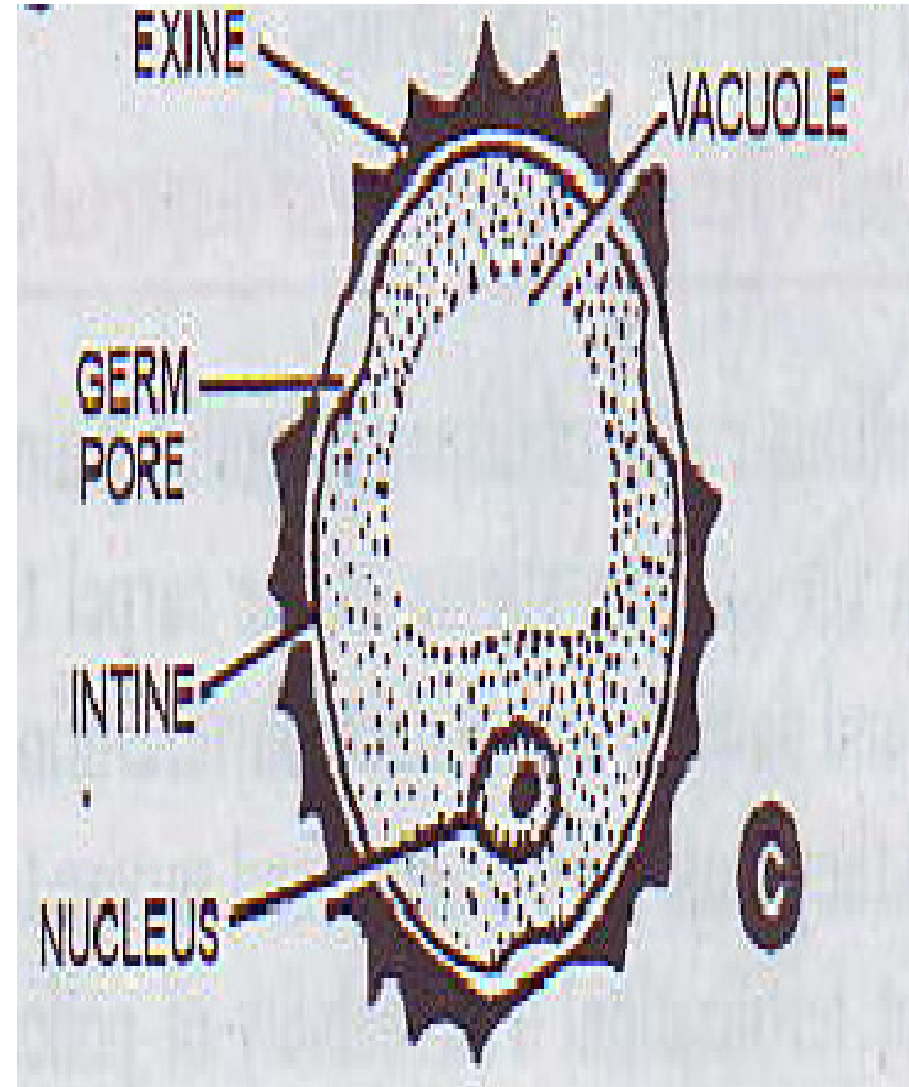
- **MICROSPOROGENESIS** :NUCLEUS OF EACH MICROSPORE MOTHER CELL UNDERGOES MEIOSIS & FORMS MICROSPORE TETRAD.
- FOUR MICROSPORES SEPARATE & ACQUIRE CHARACTERISTIC SHAPE.



STRUCTURE OF POLLEN GRAIN

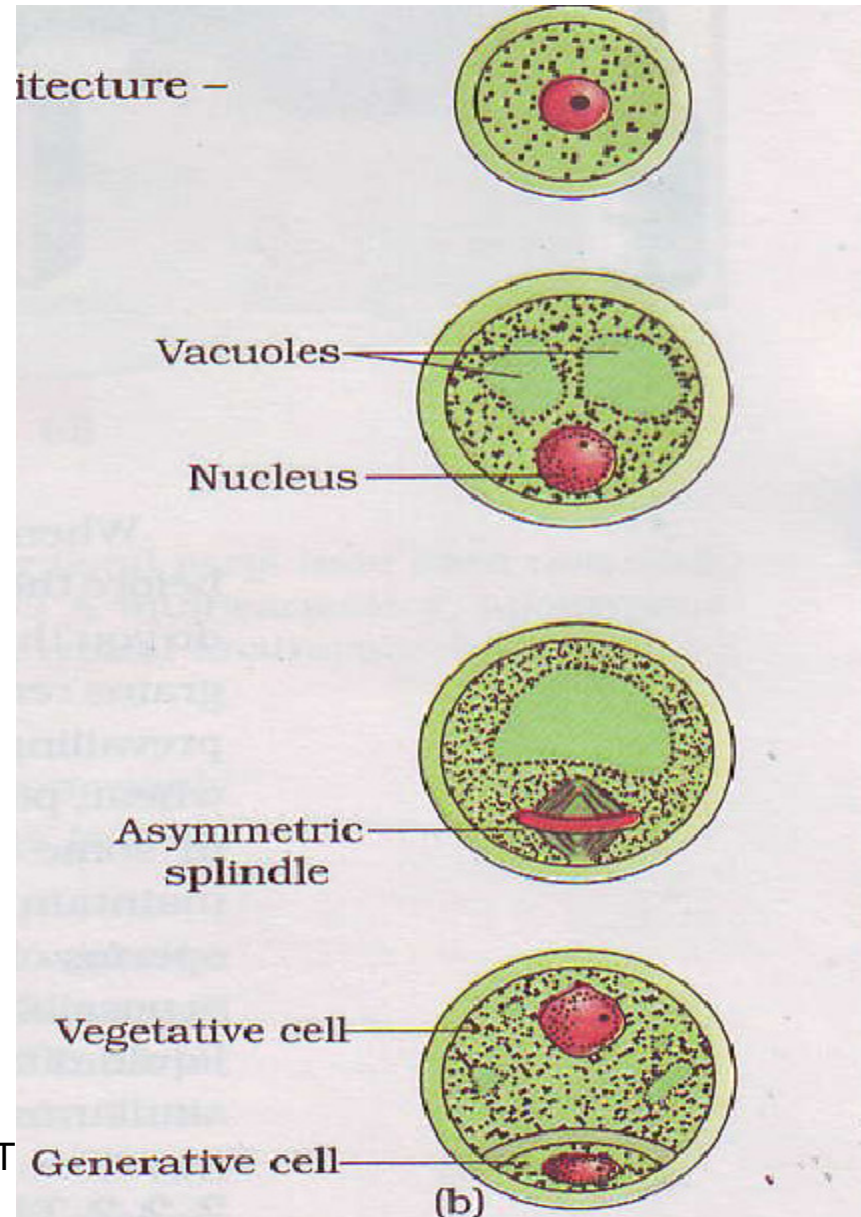
- HAPLOID ,UNINUCLEATE, MINUTE SPORES.
- GENERALLY SPHERICAL BUT CAN BE OVAL, ELLIPSOIDAL, TRIANGULAR etc
- CYTOPLASM COVERED BY OUTER THICK CUTICULARISED LAYER CALLED EXINE.CUTIN IS SPOROPOLLENIN RSISTANT TO CHEMICALS EXINE AT SOME PLACES THIN & TERMED AS **GERM PORES.**

- INTINE THIN
COMPOSED OF
PECTO-CELLULOSE
- CYTOPLASM RICH IN
STARCH &
UNSATURATED OILS.
- STUDY OF POLLEN
GRAINS-**PALYNOLOGY**



DEVELOPMENT OF MALE GAMETOPHYTE

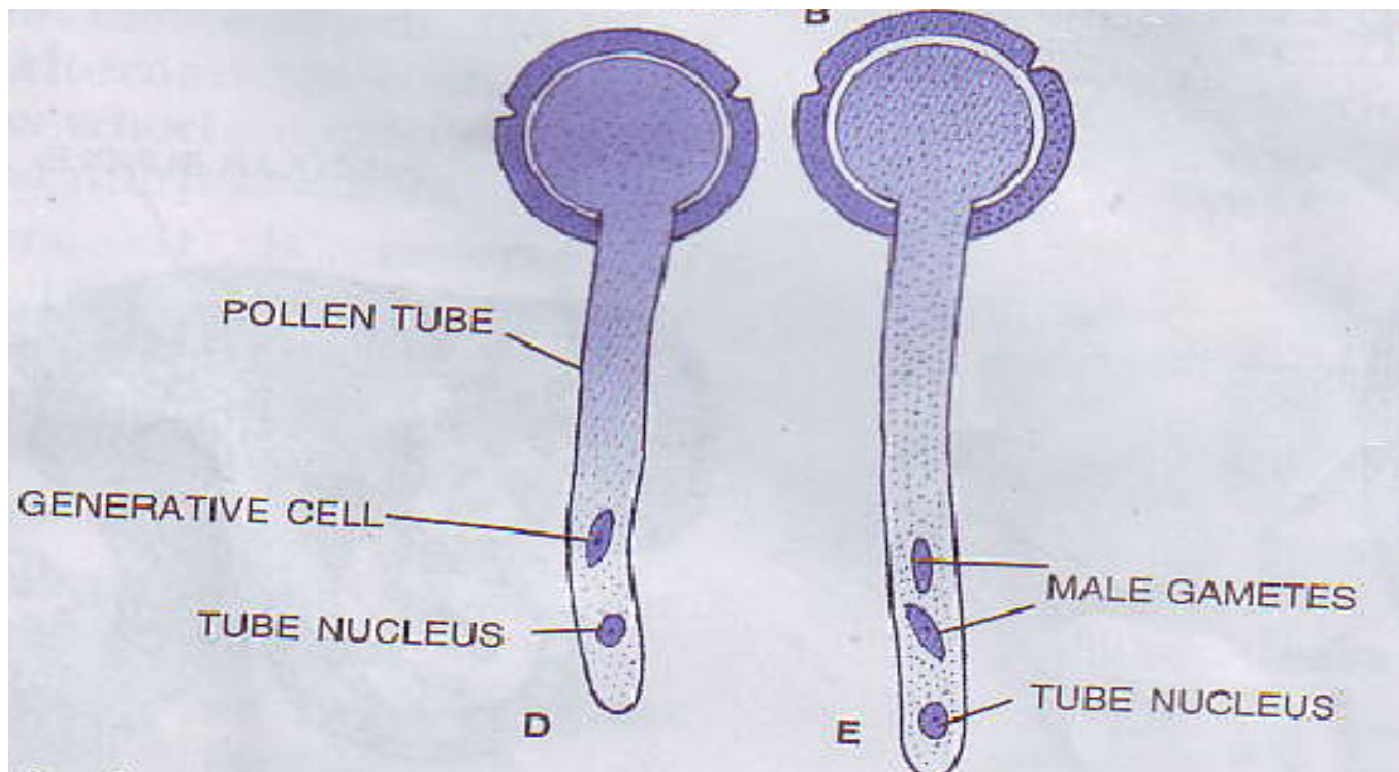
- **MICROSPORE FIRST CELL OF GAMETOPHYTIC GENERATION.**
- **DEV .OF MICROSPORE WHILE INSIDE THE MICROSPORANGIUM TERMED AS PRECOCIOUS DEV**
- **FIRST MITOTIC DIVISION PRODUCES LARGE VEGETATIVE CELL OR TUBE CELL& SMALL GENERATIVE CELL.**



- TEMPORARY **CALLOSE WALL** LAID BETWEEN TWO CELLS DISSOLVES & GENERATIVE CELL COMES TO LIE IN TUBE CELL.
- TWO CELLED POLLEN GRAIN IS READY TO LIBERATE FROM POLLEN SACS

POST-POLLINATION CHANGES

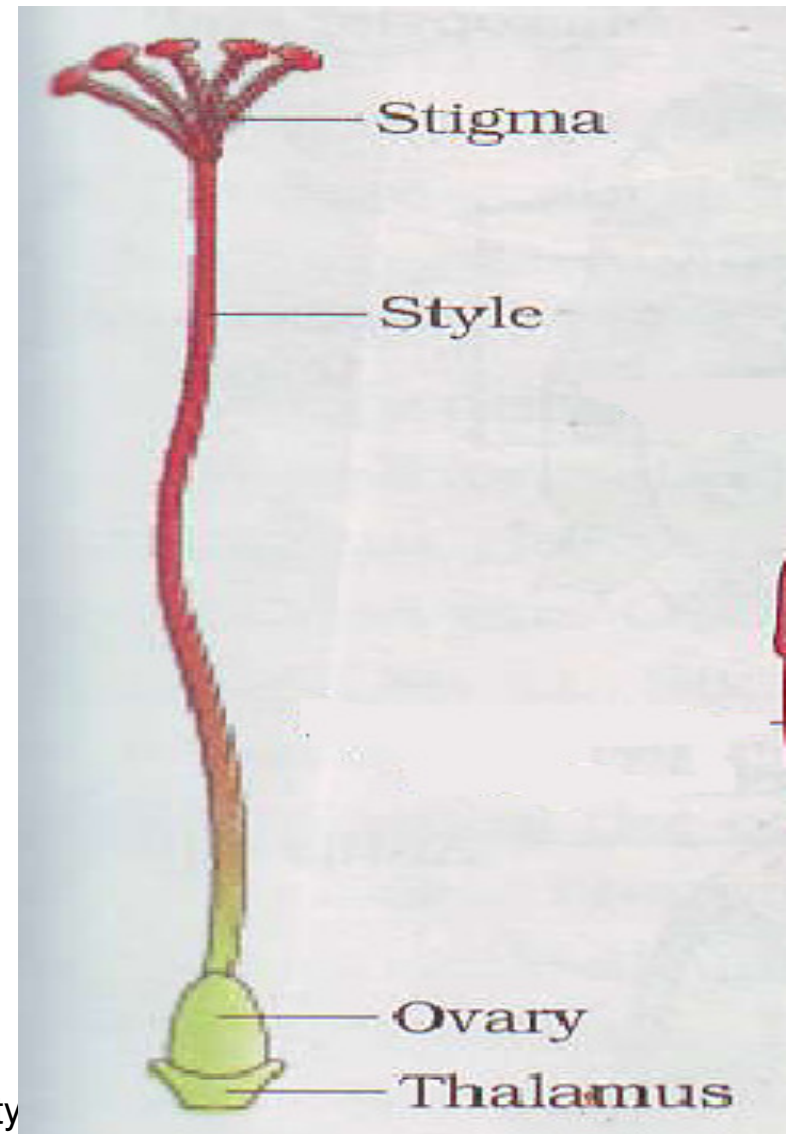
- LIBERATED POLLEN GRAIN FALLS ON STIGMA OF CARPEL.
- TUBE CELL COMES OUT OF GERM PORE IN FORM OF POLLEN TUBE.
- GENERATIVE NUCLEUS FORMS TWO MALE NUCLEI & LATER ON MALE GAMETES.
- TUBE NUCLEUS ALSO MIGRATES INTO POLLEN TUBE.



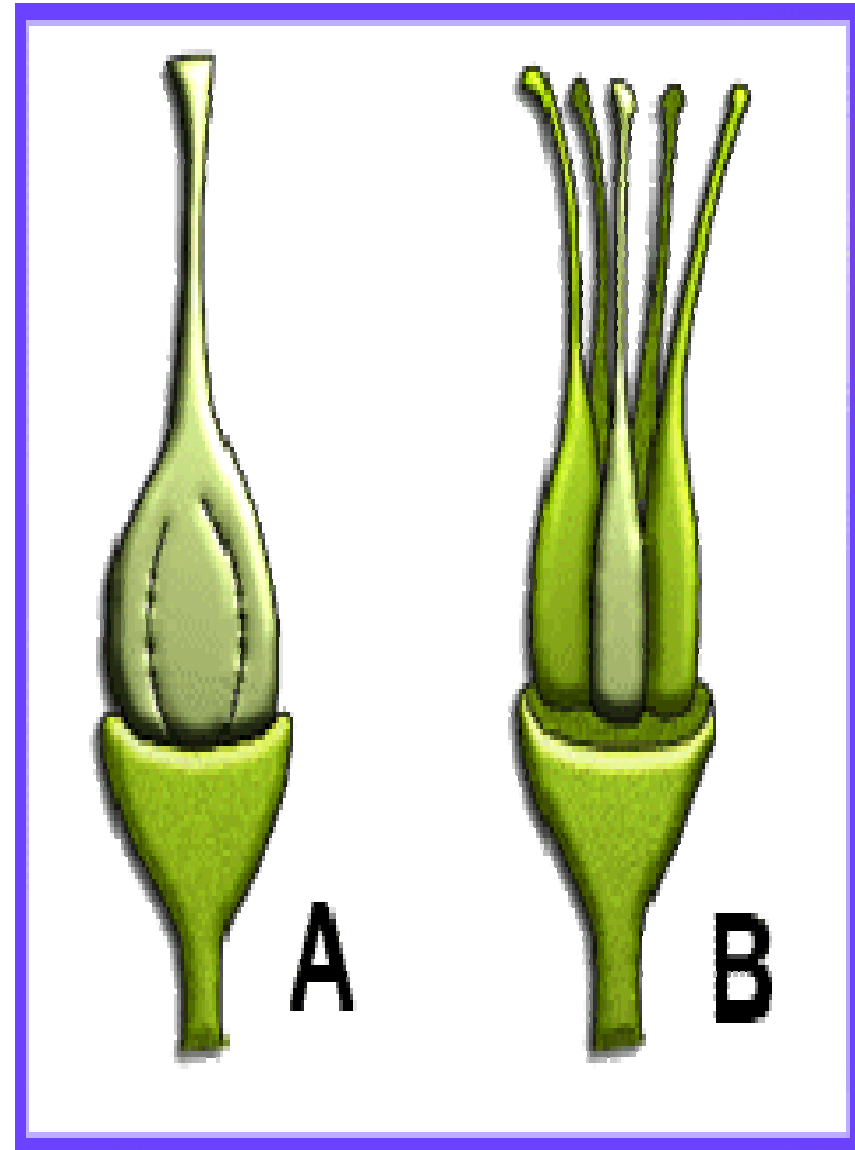
Punjab EDUSAT Society (PES)

DEVELOPMENT OF OVULE & FEMALE GAMETOPHYTE

- **PISTIL:** COMPOSED OF ONE OR MORE CARPELS.
- CARPEL HAS **OVARY, STYLE & STIGMA**
- CUSHION LIKE PARENCHYMATOUS OUTGROWTH DEVELOPS ON VENTRAL SUTURE CALLED **PLACENTA** ON WHICH **OVULES** ARE BORNE.



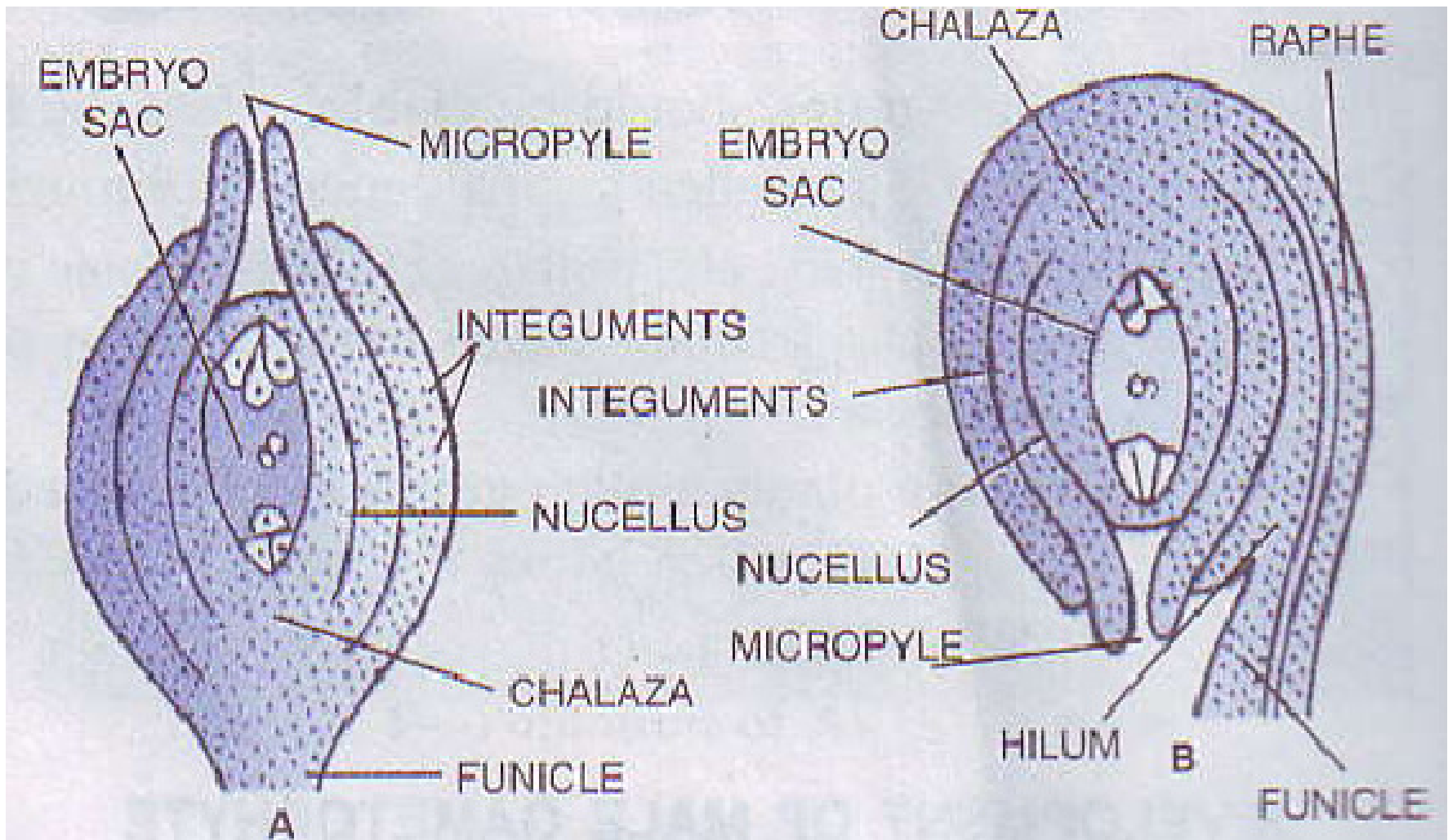
- **OVARY** IS BASAL SWOLLEN PORTION OF CARPEL CONTAINING ONE OR MANY CHAMBERS
- **STYLE** –ELONGATED PART OF CARPEL
- **STIGMA**- RECEPTIVE SPOT OF CARPEL WHERE POLLEN GRAINS GET LODGED AFTER POLLINATION.



STRUCTURE OF OVULE

- **OVULE**- AN INTEGUMENTED MEGASPORANGIUM. CONSISTS OF NUCELLUS INVESTED BY ONE OR TWO INTEGUMENTS
- **PARTS OF OVULE: FUNICULUS** –STALK OF OVULE.
- **HILUM**: POINT OF ATTACHMENT OF BODY OF OVULE WITH FUNICULUS
- **RAPHE**; LONGITUDINAL RIDGE FORMED BY LENGTHWISE FUSION OF FUNICULUS WITH BODY OF OVULE.

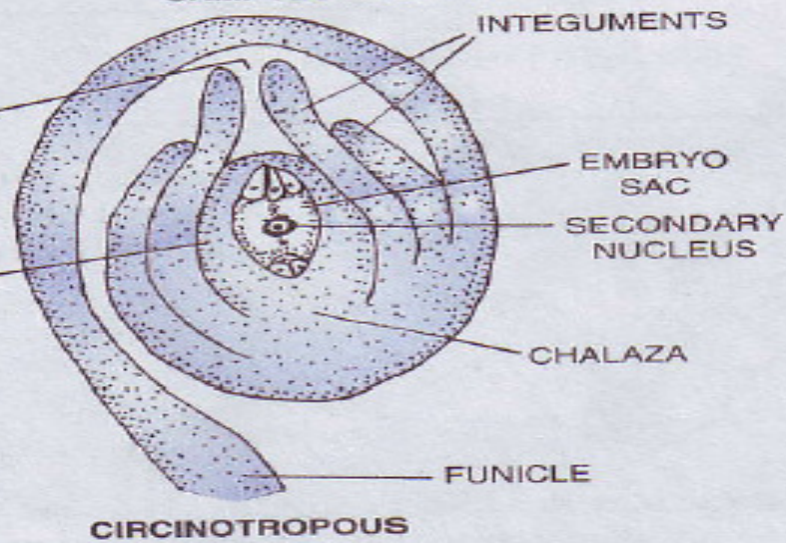
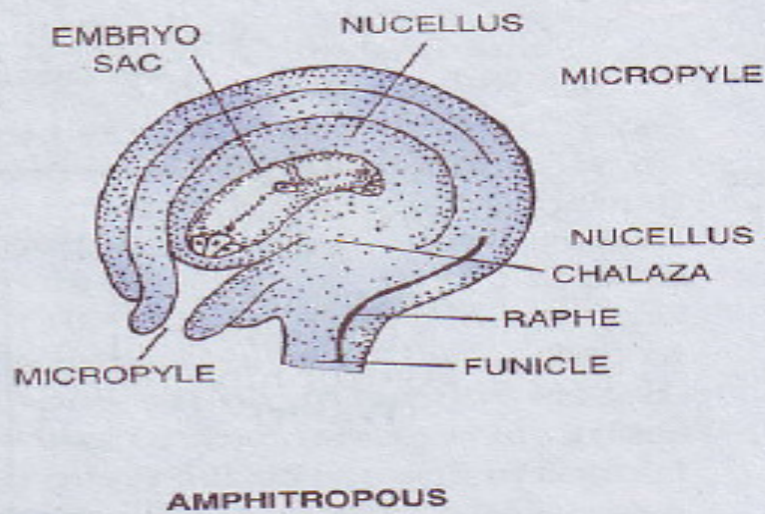
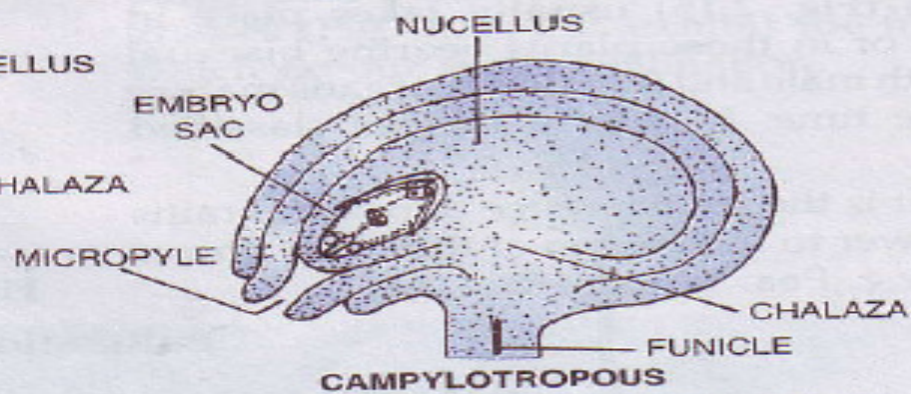
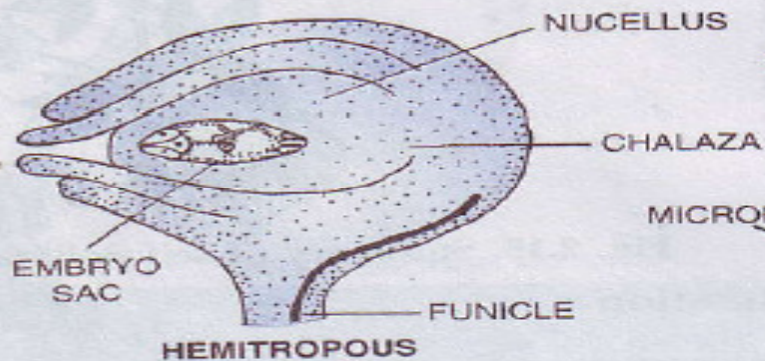
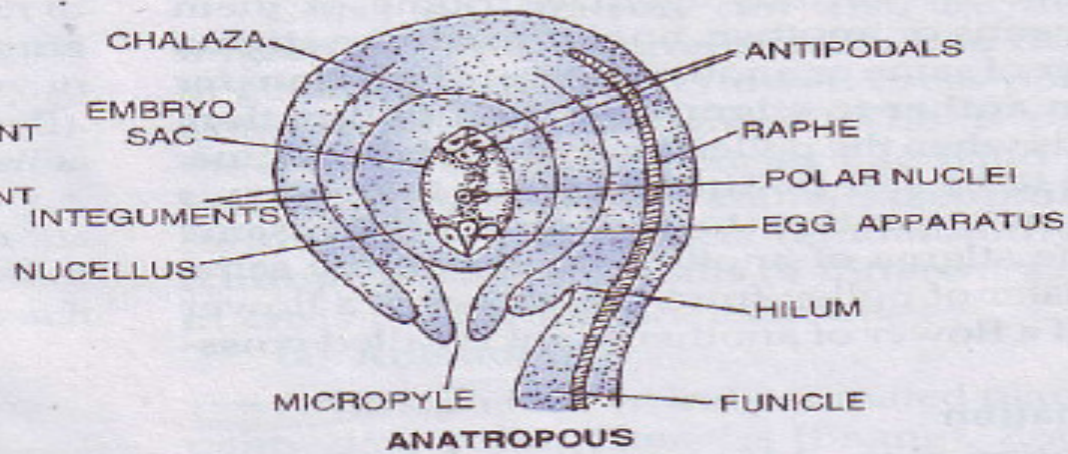
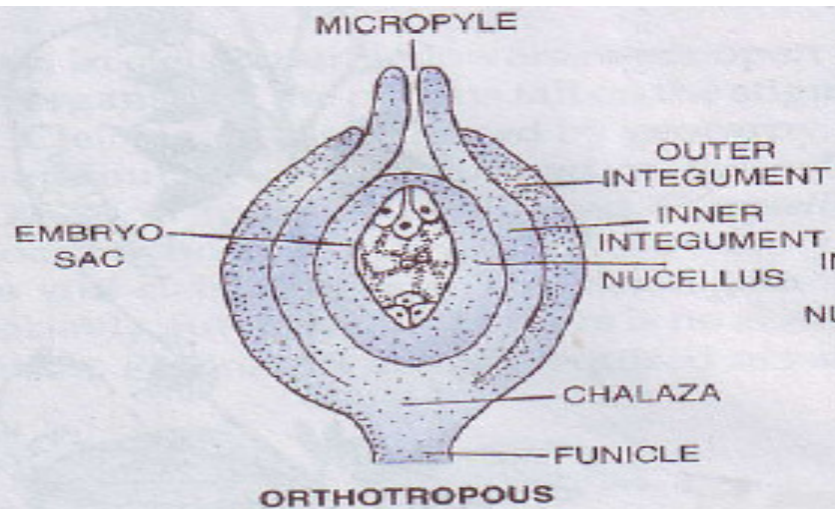
STRUCTURE OF OVULE



- **NUCELLUS:**PARENCHYMATOUS TISSUE SURROUNDED BY INTEGUMENTS.
- **EMBRYO-SAC:** FEMALE GAMETOPHYTE CONTAINING EGG APPARATUS
- **INTEGUMENTS:** OUTER COVERINGS OF OVULE PROVIDING PROTECTION TO DEVELOPING EMBRYO.
- **MICROPYLE:**PORE FORMED BY INTEGUMENTS.
- **CHALAZA:**PLACE OF ORIGIN OF INTEGUMENTS OR BASAL SWOLLEN PART OF OVARY.

TYPES OF OVULES

- **ORTHOTROPOUS OVULE:** UPRIGHT WITH MICROPYLE, EMBRYO SAC & FUNICLE IN SAME LINE.
- **ANATROPOUS OVULE :** OVULE COMPLETELY INVERTED.
- **HEMIANATROPOUS OVULE:** OVULE BODY HORIZONTALLY SITUATED ON FUNICLE.

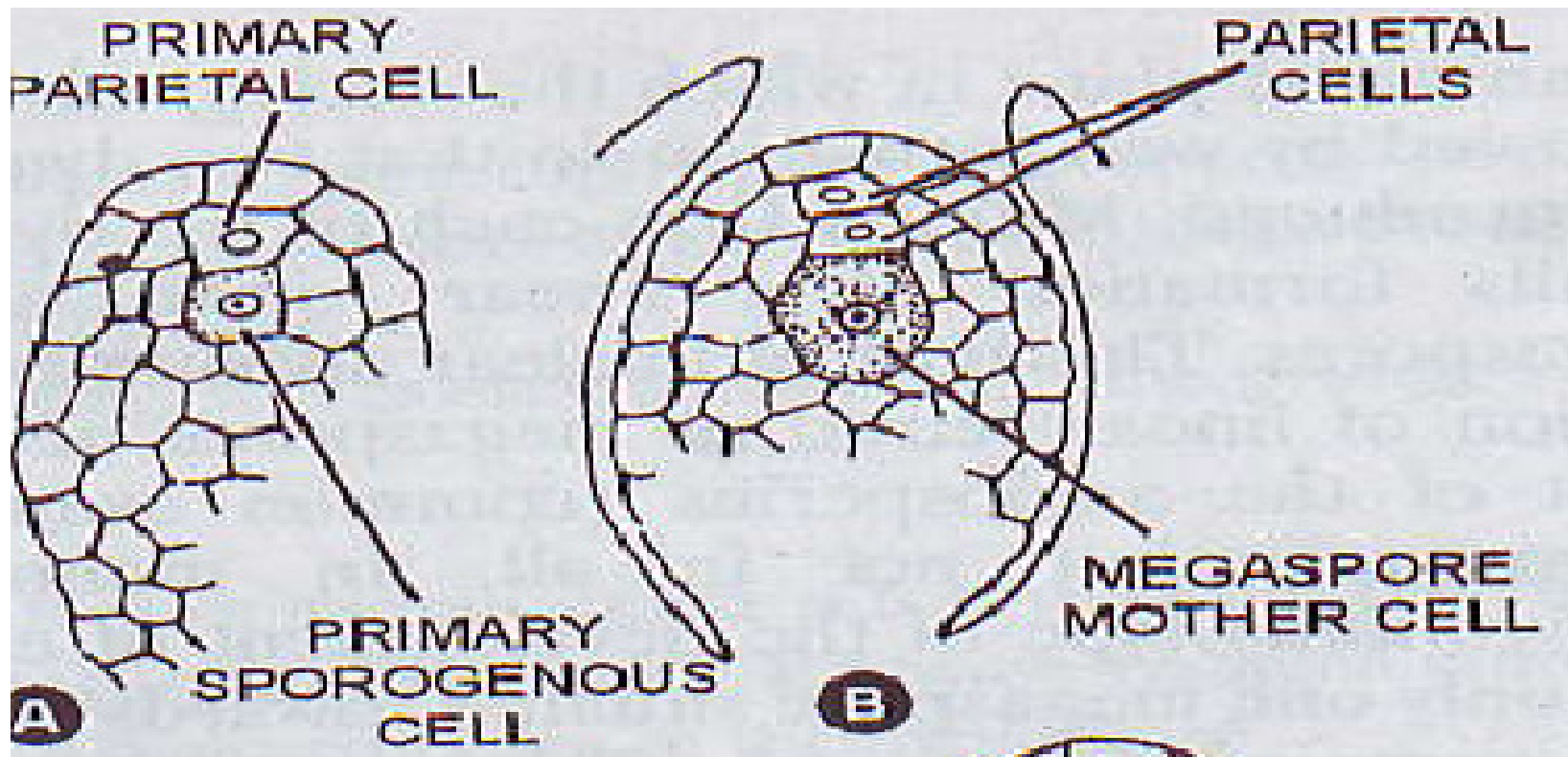


- **AMPHITROPOUS OVULE:** OVULE INVERTED WITH HORSE SHOE SHAPED EMBRYO SAC.
- **CAMPYLOTROPOUS OVULE:** OVULE INVERTED WITH MICROPYLE & CHALAZA ON EITHER SIDE OF MICROPYLE.
- **CIRCINOTROPOUS OVULE:**OVULE STRAIGHT WITH LONG FUNICLE COILED AROUND OVULE

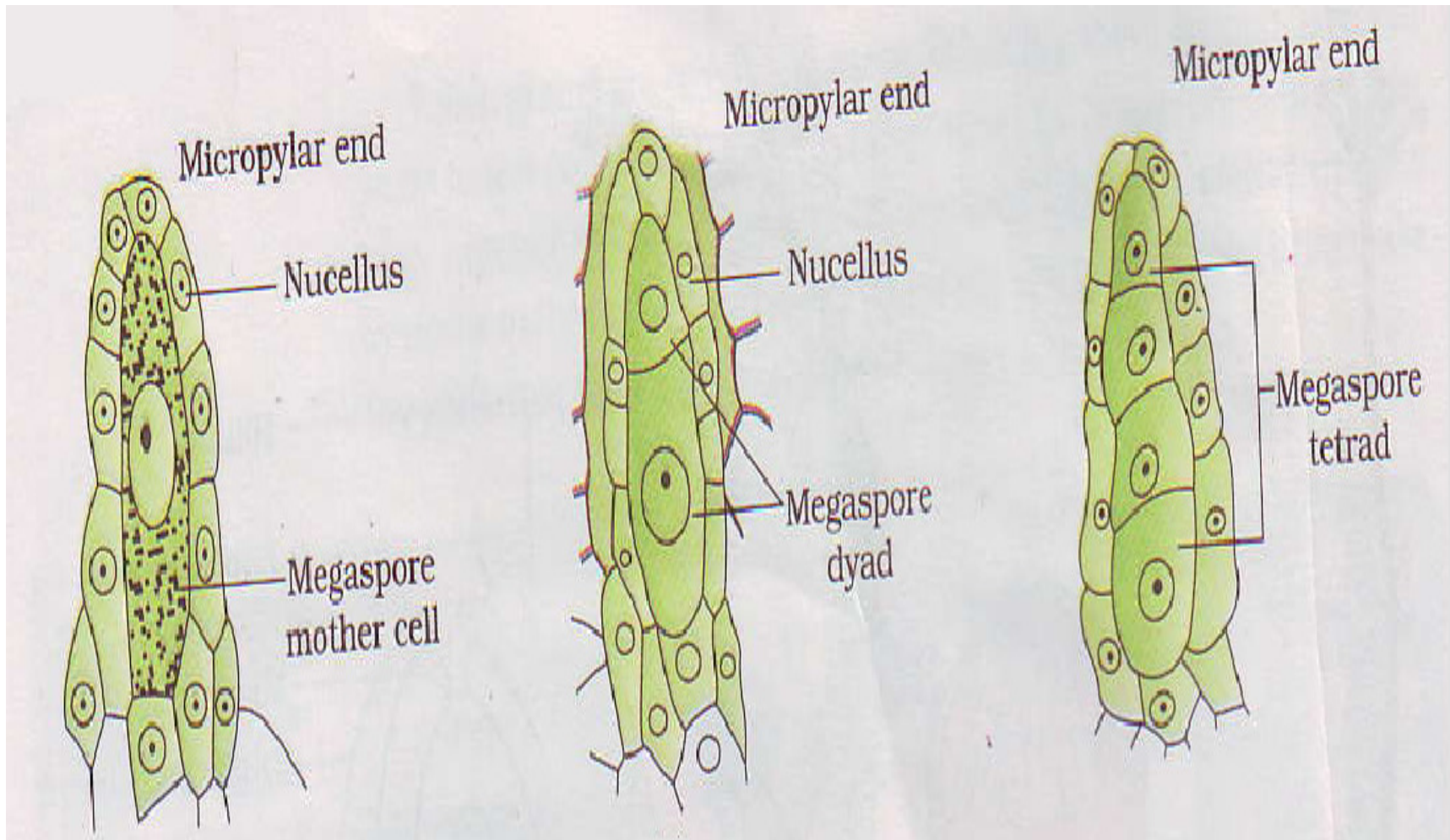
MEGASPOROGENESIS & DEVELOPMENT OF FEMALE GAMETOPHYTE

- **MEGASPOROGENESIS:** FORMATION OF MEGASPORE FROM MEGASPORE –MOTHER CELLS
- OCCURS INSIDE NUCELLUS OF DEVELOPING OVULE
- A SINGLE CELLED ARCHESPORIUM DIFFERENTIATES IN NUCELLUS NEAR MICROPYLAR END.

- ARCHESPORIAL CELL MAY DIRECTLY FUNCTION AS MEGASPORE MOTHER CELL OR DIVIDE INTO OUTER PARIETAL CELL & INNER SPOROGENOUS CELL.
- SPOROGENOUS CELL BEHAVES AS MEGASPORE MOTHER CELL



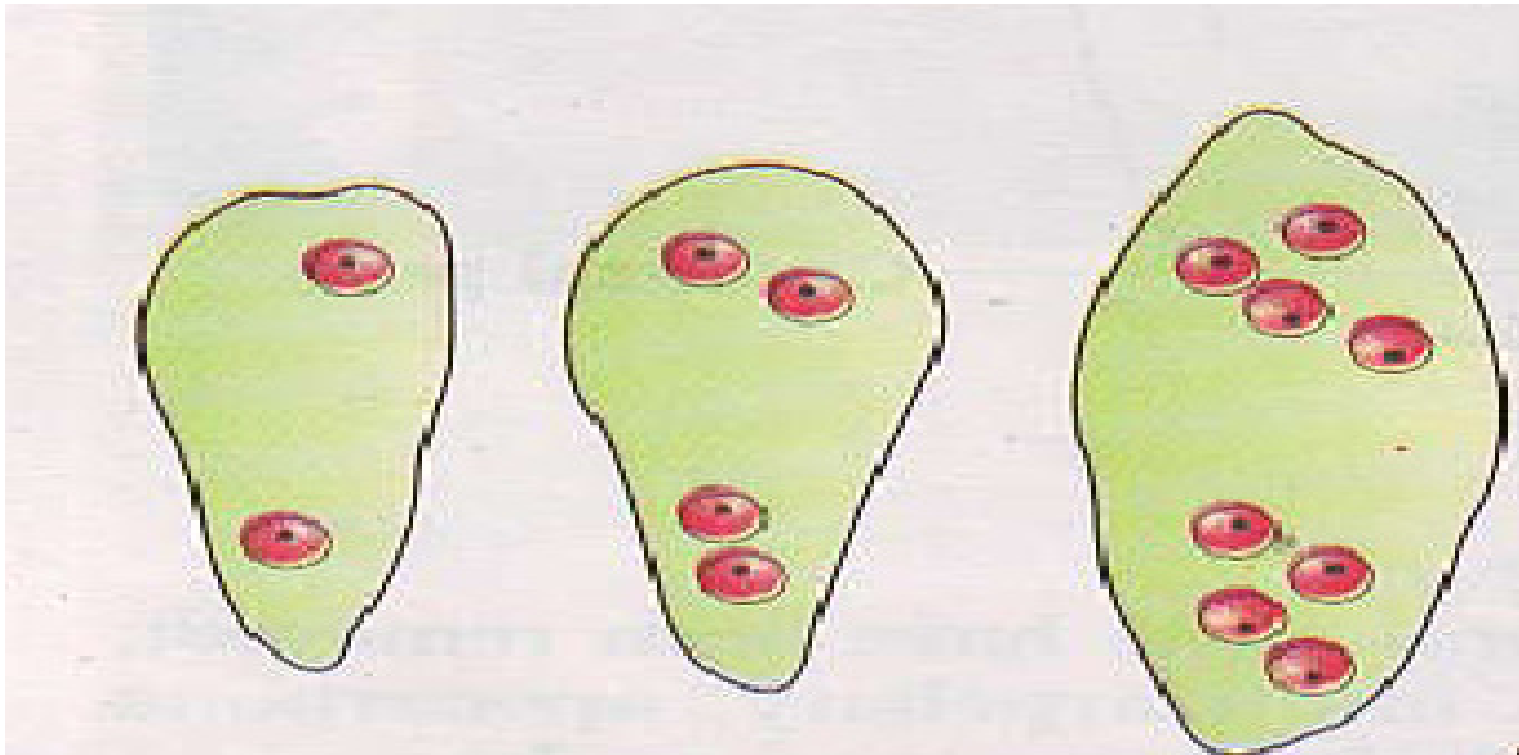
- MEGASPORE MOTHER CELL UNDERGOES MEIOTIC DIVISION TO FORM FOUR MEGASPORES.
- THREE MEGASPORES DEGENERATE & ONE REMAINS FUNCTIONAL.



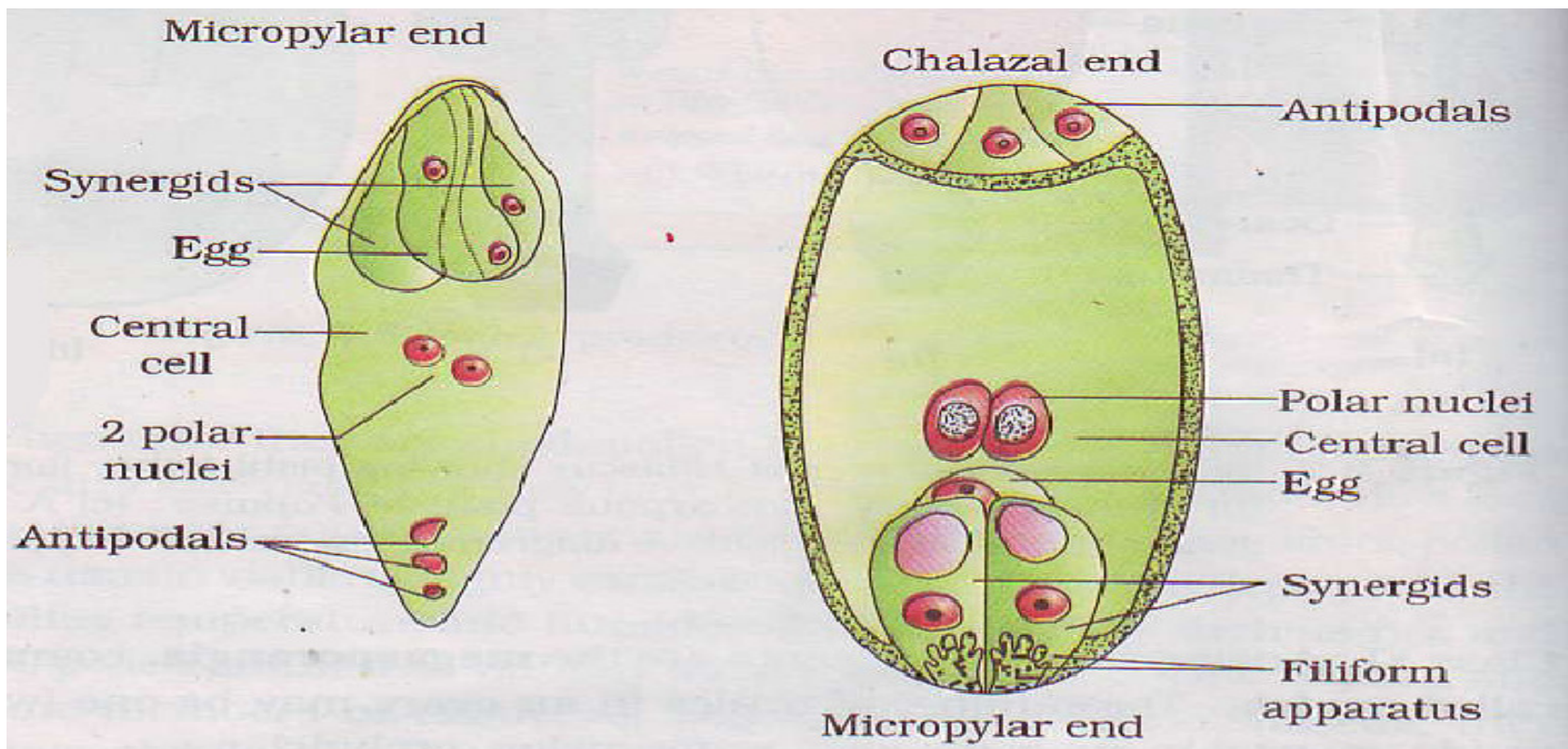
DEVELOPMENT OF FEMALE GAMETOPHYTE

- FUNCTIONAL MEGASPORE DEVELOPS INTO FEMALE GAMETOPHYTE.
- FIRST NUCLEUS OF FUNCTIONAL MEGASPORE DIVIDES MITOTICALLY TO FORM TWO NUCLEI MOVING TO OPPOSITE POLES.
- TWO MORE SEQUENTIAL MITOTIC DIVISIONS PRODUCE EIGHT NUCLEATE STAGE ,FOUR AT MICROPYLAR END &FOUR AT CHALAZAL END.

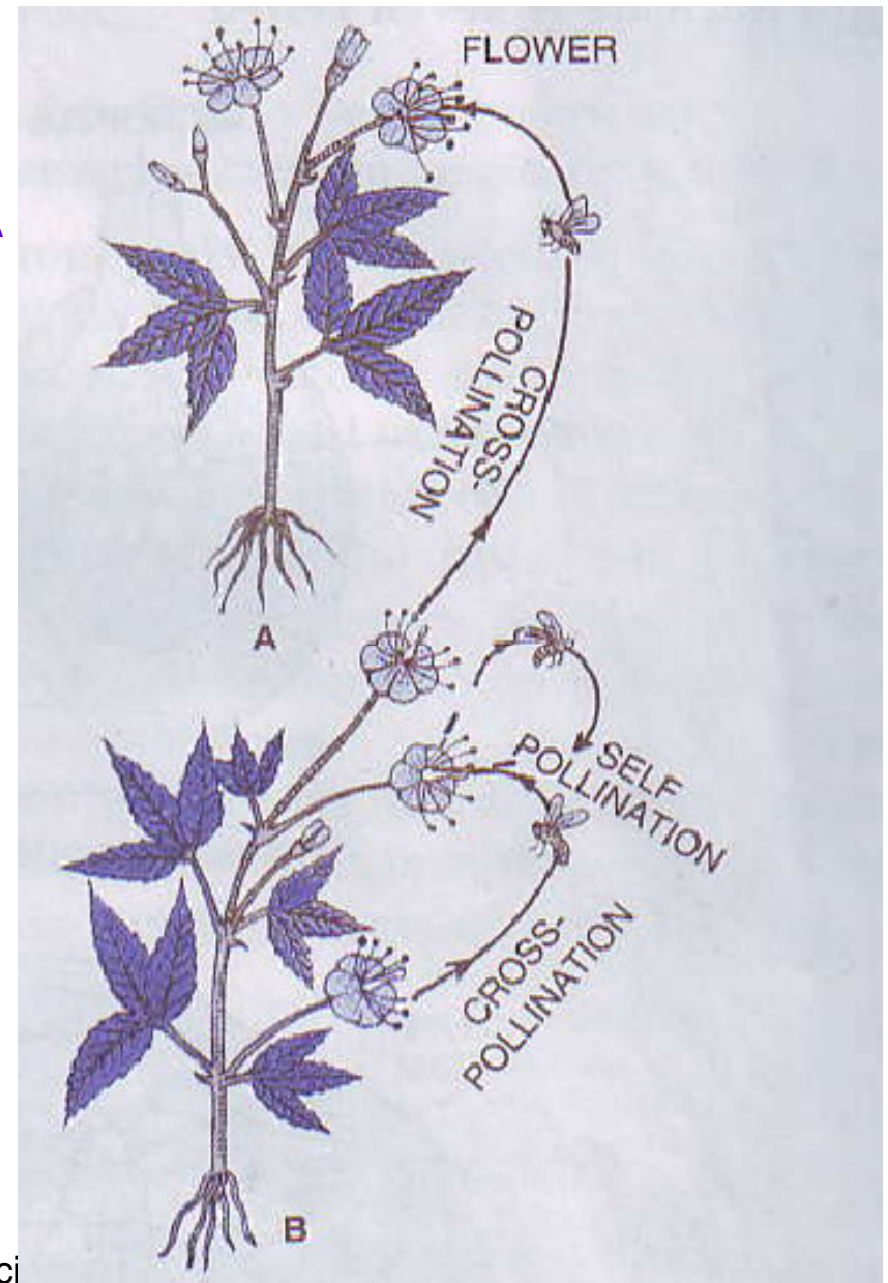
- **EGG APPARATUS CONSISTS OF EGG & TWO SYNERGIDS.**
- SYNERGIDS HAVE CELLULAR THICKENINGS AT MICROPYLAR END CALLED FILIFORM APPTT



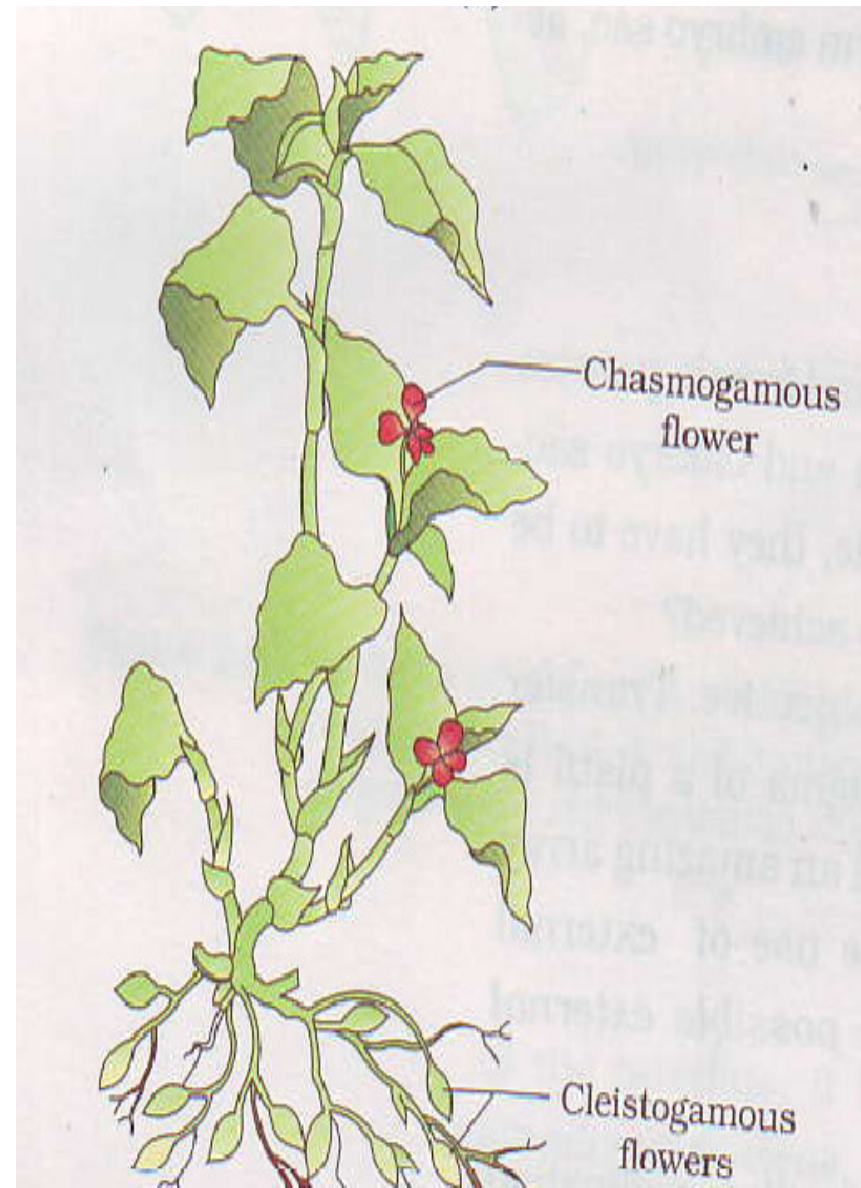
- FILIFORM APPARATUS HELPS IN ABSORPTION & TRANSPORTATION OF NUTRIENTS.
- THREE CELLS AT CHALAZAL END CALLED **ANTIPODAL CELLS**
- LARGE CENTRAL CELL HAS TWO **POLAR NUCLEI**.



- **POLLINATION:** TRANSFER OF POLLEN GRAINS FROM ANTHOR OF STAMEN TO STIGMA OF CARPEL .
- **TYPES:** 1.SELF-POLLINATION
2. CROSS-POLLINATION
- **SELF-POLLINATION:** TRANSFER OF POLLEN GRAINS FROM ANTHERS TO STIGMA OF SAME FLOWER.



- **TYPES OF SELF-POLLINATION:**
- **1]AUTOGAMY:**TRANSFER OF POLLEN FROM ANTHERS TO STIGMA OF SAME FLOWER. OCCURS BY THREE METHODS
- **CLEISTOGAMY:** OCCUR IN FLOWERS WHICH NEVER OPEN
e.g: OXALIS, VIOLA etc.



- **HOMOOGAMY:**

CONDITION IN WHICH ANTHERS & STIGMAS IN BISEXUAL FLOWER ATTAIN MATURITY AT SAME TIME

- **BUDPOLLINATION:** ANTHER & STIGMAS OF BISEXUAL FLOWERS MATURE BEFORE OPENING OF BUDS.

- **2]GEITONOGAMY:** TRANSFER OF POLLEN FROM ANTHERS OF ONE FLOWER TO STIGMA OF ANOTHER FLOWER BORNE ON SAME PLANT. OCCURS IN PLANTS SHOWING MONOECIOUS CONDITION.

- **ADVANTAGES OF SELF- POLLINATION:**
- CHANCES OF POLLINATION MORE.
- MAINTAINS PURITY OF RACE.
- NO NEED TO PRODUCE LARGE NUMBER OF POLLEN GRAINS
- NEED NOT TO POSSESS DEVICES TO ATTRACT POLLINATORS.
- **DISADVANTAGES OF SELF-POLLINATION:**
- PROGENY BECOMES WEAKER AFTER EVERY GENERATION
- LESS CHANCES OF PRODUCTION OF VARIETIES .

CROSS-POLLINATION OR ALLOGAMY

- TRANSFER OF POLLEN GRAINS FROM ONE FLOWER TO STIGMA OF GENETICALLY DIFFERENT FLOWER
- ALSO TERMED AS XENOLOGY
- FLORAL CHARACTERISTICS WHICH FACILITATE CROSS-POLLINATION ARE :
- **HERKOGAMY:** MECHANICAL BARRIER ON STIGMA TO AVOID SELF POLLINATION e.g. CALOTROPIS.

- **DICHOGAMY** :POLLEN AND STIGMA MATURE AT DIFFERENT TIMES.
- IT CAN BE PROTOGYNY OR PROTANDRY.

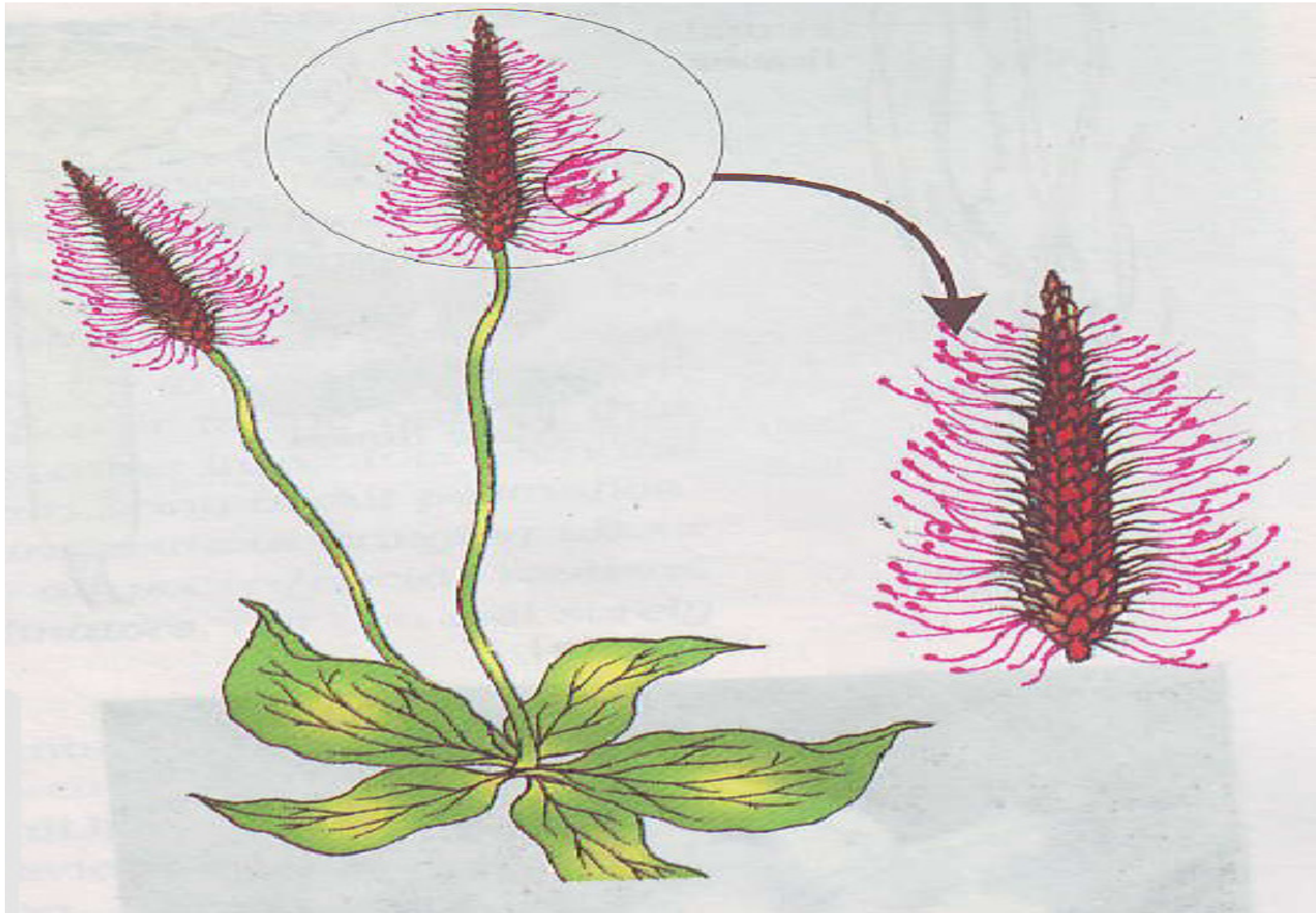
- **SELF INCOMPATIBILITY**: MATURE POLLEN FALLING ON STIGMA OF SAME FLOWER FAIL TO BRING ABOUT SELF-POLLINATION.

- **DIOECISM**: CROSS POLLINATION OCCURS IN DIOECIOUS PLANTS.

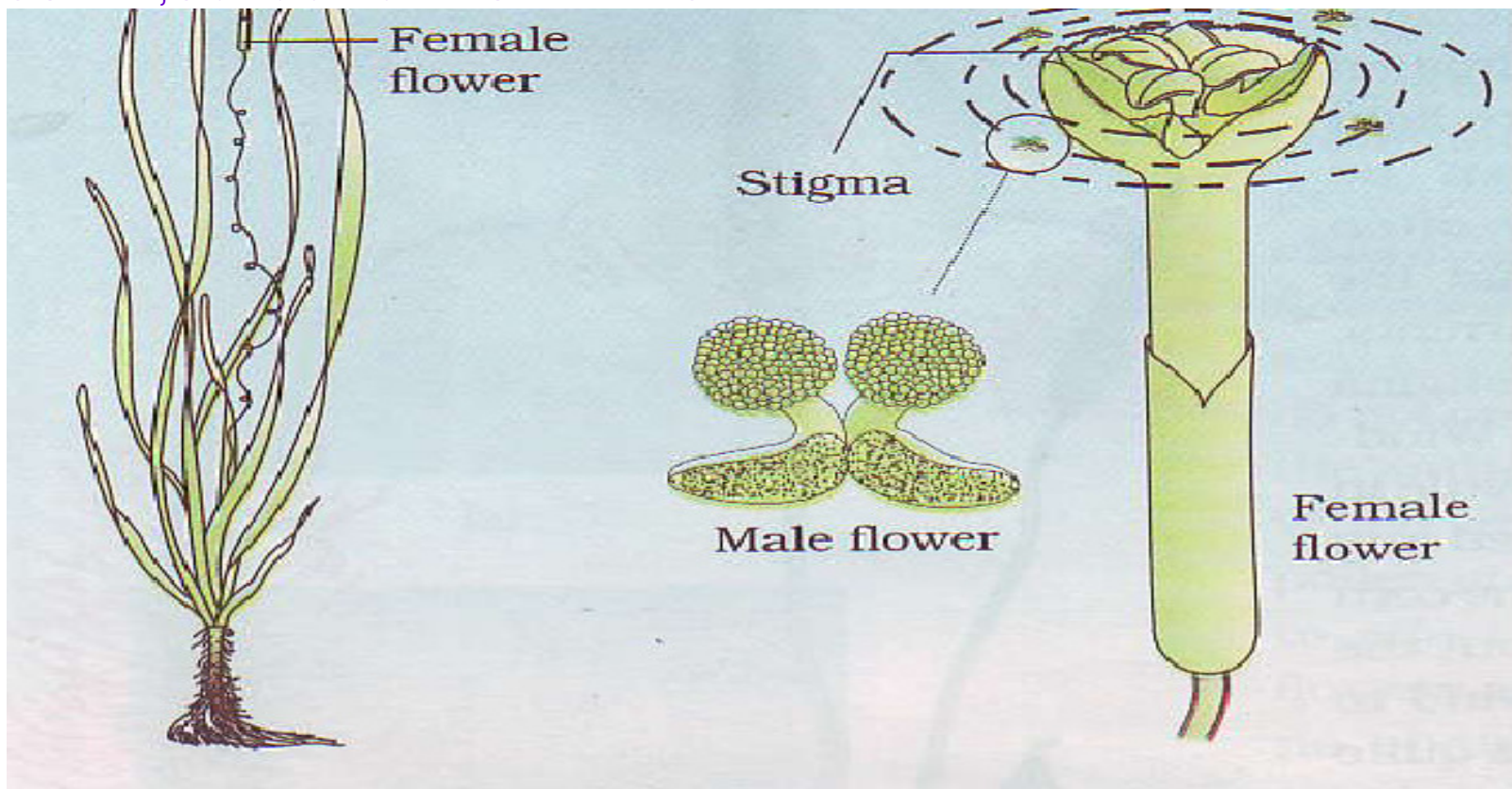
- **HETEROSTYLY**: DIFFERENT LENGTHS OF STAMENS & STYLES

- **CROSS-POLLINATION :**
- PERFORMED BY DIFFERENT AGENCIES LIKE WIND, WATER, BIRDS, INSECTS, BATS etc
- **ANEMOPHILY [POLLINATION BY WIND];** TRANSFER OF POLLEN FROM ANTHOR TO STIGMA BY AGENCY OF WIND
- FLOWERS INCONSPICUOUS, DEVOID OF NECTAR, & SCENT.
- LARGE NO. OF DRY & UNWETTABLE POLLEN GRAINS PRODUCED.
- STIGMAS STICKY, HAIRY, FEATHERY OR BRANCHED.

WIND POLLINATED FLOWERS



- **HYDROPHILY:** TRANSFER OF POLLEN GRAINS BY AGENCY OF WATER, E.g HYDRILLA,CERATOPHYLLUM etc.
- FLOWERS SMALL & INCONSPICUOUS,
- POLLEN GRAINS LIGHT COVERED WITH WAX.
- STIGMA STICKY & UNWETTABLE.
- SCENT, COLOUR & NECTAR ABSENT.



- **ENTOMOPHILY:**
TRANSFER OF POLLEN
GRAINS BY INSECTS.E.g:
JASMINE, ROSE,PANSY
etc
- FLOWERS FRAGRANT,
LARGE, BEAUTIFULLY
COLOURED & PRODUCE
NECTAR.
- SMALL FLOWERS BLOOM
IN BUNCHES.



- FLOWERS PRODUCE SPECIFIC ODOURS TO ATTRACT SPECIFIC INSECTS.
- POLLEN GRAINS ARE STICKY OR SPINY.
- STIGMAS ALSO STICKY TO CATCH POLLENS.

- **ORNITHOPHILY**

- POLLINATION BY BIRDS
E.g: BOMBAX,
BOTTLEBRUSH, BIGNONIA
etc.
- FLOWERS ARE
BEAUTIFULLY COLOURED
LARGE & SCENTLESS.
- PRODUCE MUCILAGINOUS
NECTAR, POLLENS STICKY.

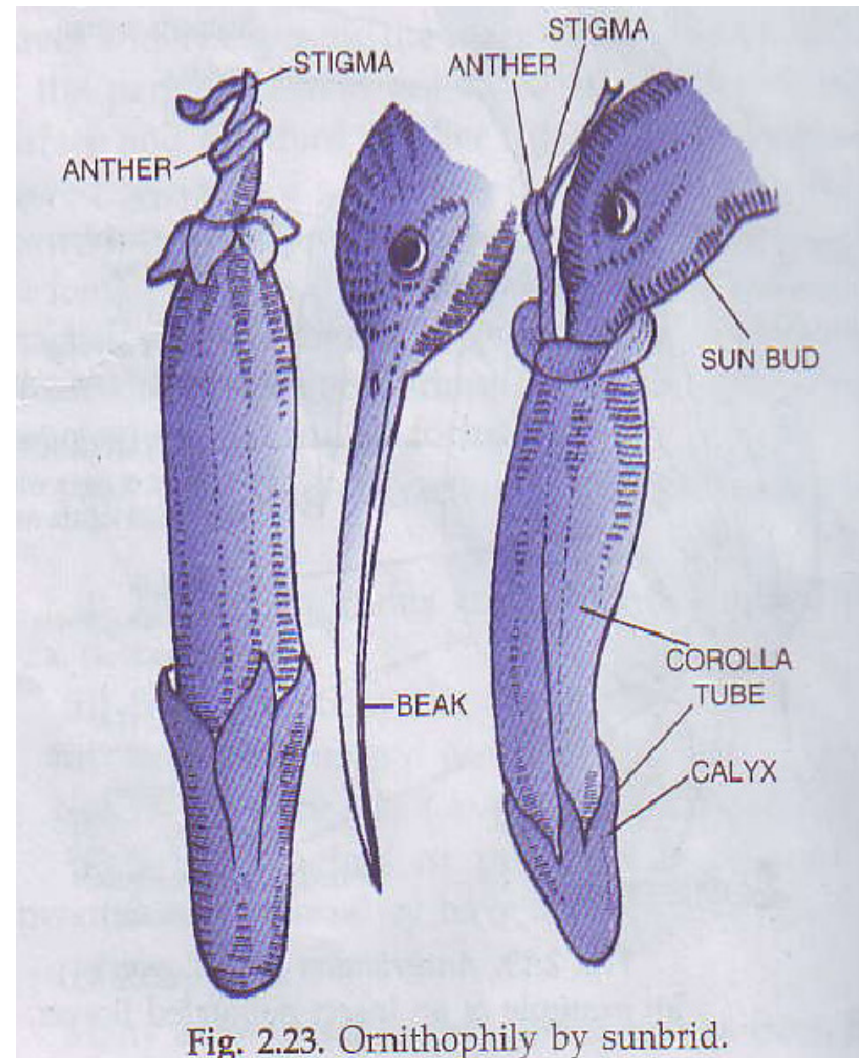


Fig. 2.23. Ornithophily by sunbird.

- **CHIROPTEROPHILY:**
- POLLINATION BY BATS.
- FLOWERS LARGE, DULL COLOURED & HAVE STRONG SCENT.
- PRODUCE ABUNDANT POLLEN GRAINS.

- **ADVANTAGES OF CROSS-POLLINATION :**

- PRODUCTION OF NEW VARIETIES.

- RESULTS IN HEALTHY OFFSPRINGS DUE TO HYBRID VIGOUR

- PRODUCTION OF DISEASE RESISTANT PLANTS .

- RESULTS IN PRODUCTION OF SEEDS IN SELF STERILE PLANTS.

- **DISADVANTAGES OF CROSS-POLLINATION :**
- NOT ECONOMICAL.
- IT IS UNCERTAIN BECAUSE CHANCE FACTOR IS INVOLVED
- INVOLVES ADDITION OF UNDESIRABLE OR LOSS OF IMPORTANT CHARACTER.

THANKS