

DEVELOPMENT OF SEED AND FRUIT IN *GERBERA JAMISONII* BOLUS

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ABSTRACT

The ovary is bicarpellary, syncarpous and unilocular. It contains a single anatropous, unitegmic and tenuinucellate ovule. The integument is distinguishable into three zones. Outer consists of compactly arranged densely cytoplasmic cells, the middle constitutes the periendothelial zone and endothelium forms the third zone. Some cells of the integument lining the micropyle elongate and function as obturator. In mature seeds only one or two cell-layers of endosperm persists. Hypocotyl-root-axis of the embryo is much shorter than the cotyledons. Seed-coat is formed of 3 to 4 layers of cells and radial walls of epidermal cells are characteristically thickened. Pericarp of mature cypsela shows a layer of epidermis whose cells contain resin-like droplets. Below the epidermis is a zone of parenchymatous cells which also include fibrous strands. Fruit is ribbed and hairy, and the appus nearly equals the length of the fruit.

INTRODUCTION

Literature on seed and fruit anatomy of the family Compositae has been reviewed by NETOLITZKY (1926) and more recently by CORNER (1976). KAPIL AND SETHI (1962) made observations on the embryology, seed and fruit structure of *Ainsliaea aptera*, a member of tribe Mutiseae to which *Gerbera jamisonii* also belongs. MAHESWARI DEVI (1957) investigated this species embryologically but did not study the development and structure of seed-coat and fruit wall in this taxon. The present paper, therefore, deals with the development of seed and fruit in this species of ornamental importance.

MATERIAL AND METHOD

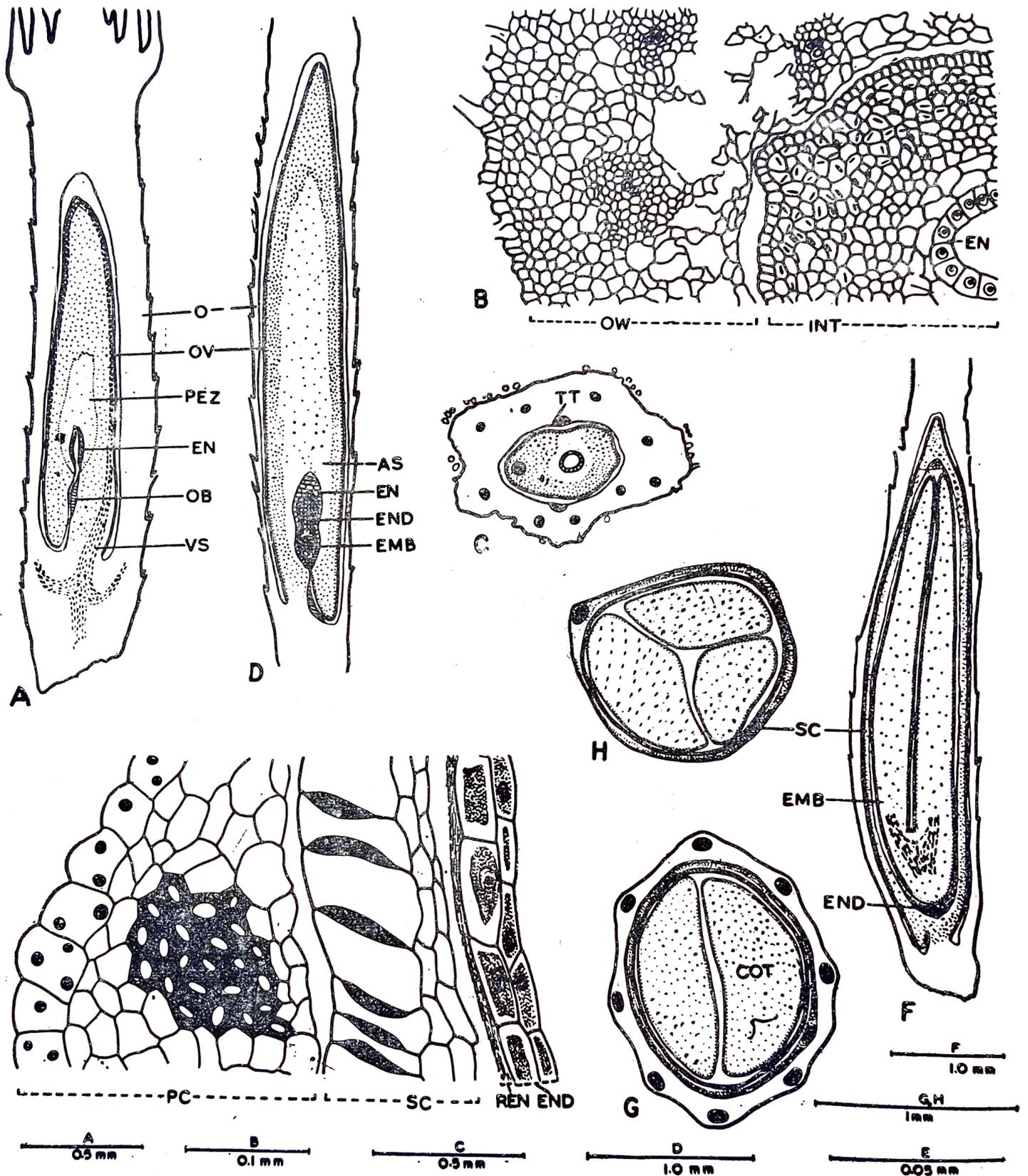
Flowers and fruits at different stages of development collected locally were fixed in formalin-acetic - alcohol and stored in 70% ethanol. Customary methods of dehydration and embedding were followed. Microtome sections cut between 8-12 μ m thickness were stained in safranin-fast green combination.

OBSERVATION AND CONCLUSION

Ovary and ovule—The ovary is bicarpellary, syncarpous and unilocular. It contains a single anatropous, unitegmic and tenuinucellate ovule (Fig. 1 A). The vascular supply to the ovule enters the funicle, overarches the chalaza and ends on the antiraphe side near the lower limit of the endothelium. KAPIL AND SETHI (1962) reported a similar pattern of vascular supply in *Ainsliaea aptera*.

Integument—The integument at the organised female gametophyte stage is 14 to 16 cell-layers thick at the level of the embryo sac (Fig. 1 B). It is distinguishable into four distinct zones. The outermost is formed of a layer of epidermis. The second zone is composed of compactly arranged cells having dense cytoplasmic contents and many of these cells contain needle-shaped calcium oxalate crystals. The third zone consists of enlarged cells with depleted contents and forms the periendothelial zone and this appears to be a

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Gerbera jamisonii—Fig. 1 (Text-figs.) A. L. s. ovary and ovule at organized female gametophyte stage, B. C. s. part of ovary and ovule at the same stage, C. C. s. ovary and ovule at organised female gametophyte stage, D. L. s. ovary and ovule at globular embryo stage, E. C. s. part of mature cypselas. Note thickening in radial walls of the outer epidermal cells of seed-coat, F, G. L. s. and c. s. of mature cypselas, H. C. s. of mature seed showing tricotyledonous embryo.

characteristic feature of the ovules of Compositae (PANDEY, 1977). The fourth zone is made up of the endothelium. Some cells of the integument lining the micropylar canal on the raphe side elongate radially and function as obturator (Figs. 1A ; 2 A). Similar outgrowths have also been reported in micropylar canal of *Mutisia candolleana* (DAHLGREN, 1920) and *Ainsliaea aptera* (KAPIL & SETHI, 1962).

Endosperm and embryo—The cells of the endosperm fill the embryo sac completely at the globular embryo stage (Fig. 1 D). Disintegration of the endosperm cells begins by the time embryo reaches heart-shaped stage, and simultaneously the outermost layer of the endosperm lying next to the endothelium differentiated as a prominent layer. In the mature seed the endosperm remains as one or two-layered structure (Fig. 1 E), while rest of this tissue is consumed. The cells of the endosperm are uniformly thickened and show dense contents.

Contrary to the observations of MAHESWARI DEVI (1957) who reported that endosperm is completely absorbed in the mature seeds of *Gerbera jamisonii*, the present study clearly shows one or two layers of endosperm in the seed. Two layers of endosperm in the mature seed has also been reported in *Ainsliaea aptera* (KAPIL & SETHI, 1962).

Embryo fills the seed completely when fully mature (Fig. 1 F). The hypocotyl-root-axis is much shorter than the cotyledons. Average length of embryo, hypocotyl-root-axis and cotyledons is given in Table I. The cotyledons are more or less hemispherical in cross-section (Fig. 1 G). In one seed a tricotyledonous embryo has been seen (Fig. 1 H).

Seed-coat—After fertilization, the cells of the periendothelial zone are gradually digested with the result that a lysigenous space is formed around the endothelium by the time embryo reaches globular stage (Fig. 1 D). The cells of the endothelium towards the antipodal side divide anti- and periclinally and become massive (Figs. 1 D ; 2 C).

By the time cotyledons are well-differentiated, the cells of the outer epidermis of the integument show much radial elongation (Fig. 2 B). The cells of endothelium at this stage also divide periclinally on the micropylar side making the endothelium many layered as is the case on the antipodal side. In a mature seed, the seed-coat is formed of 3 to 4 layers of cells, and the radial walls of the epidermal cells are characteristically thickened (Fig. 1 E). The other cell-layers of the seed-coat remain parenchymatous and do not show any type of thickening. Calcium oxalate crystals so commonly seen earlier are not present at this stage. The endothelium remains as a noncellular pellicle over the endosperm. In *Ainsliaea aptera* (KAPIL & SETHI, 1962), on the other hand, the seed-coat is represented by a few degenerated darkly stained, thickened cell-layers.

Ovary wall and pericarp—Cross-section of an ovary at the organised female gametophyte stage shows a layer of epidermis followed by a broad zone of aerenchymatous tissue. Vascular bundles of the ovary wall are embedded in this region (Fig. 1 B). Epidermis shows a good number of unicellular hairs. Two strands of transmitting tissue are also seen in the ovary wall (Fig. 1 C). These strands extend from the base of the locule upto the styler region. Such strands of transmitting tissue has also been observed in *Vernonia altissima*, *Helianthus annuus* (PANDEY, 1977) and *Vernonia anthelmintica* (MISRA, 1972). MISRA (1972) designated these strands as cord of transmitting tissue. The significance of these strands is difficult to interpret at present.

After fertilization, degeneration of aerenchymatous cells proceeds quickly and by the time cotyledons are well-differentiated the pericarp shows the outer epidermis and strands of fibrovascular bundles. Around the fibrovascular bundles more parenchymatous cells persist but at other places their number remains less (Fig. 2 B).

In a fully mature fruit, the fibrovascular bundles become sclerenchymatous but rest of the cells of the pericarp remain thin-walled. The cells of epidermis contain resin-like droplets (Fig. 1E). At the base of the fruit the epidermal cells become lignified and probably help in the abscission of the fruit.

Fruit—The fruit is ribbed and hairy (Fig. 2 D). The body of the fruit is broad at the base and narrow above. The pappus is composed of bristles which nearly equals the length of the fruit. Size of the fruit is given in Table 1.

Table-1—Size of cypsela, length of embryo, hypocotyl-root-axis and cotyledons (measurements in mm)

Name of the species	Cypsela l × b	Embryo	Hypocotyl- root-axis	Cotyledons
<i>Gerbera jamisonii</i>	6—7 × 1—1.5	5.85	0.85	5.00

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Gerbera jamisonii.—Fig. 2. (Plate 1). A. L.s. part of ovule at organised female gametophyte stage showing obturator × 420. (es : embryo sac, ob : obturator). B. C.s. part of seed and fruit at half mature embryo stage × 280. (fs : fibrous strand, sc : seed-coat).

C. L. s. part of ovule at globular embryo stage showing many layered endothelium towards antipodal side × 330. (en : endothelium, end : endosperm).

D. Mature cypsela × 8.

