Embryological studies in *Eleutherine plicata* Herb. and *Belamcanda chinensis* Lem.

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Abstract. Embryology of *Eleutherine plicata* Herb. and *Belamanda chinensis* Lem. has been studied. Anther wall shows epidermis, fibrous endothecium, 3–4 middle layers and secretory tapetum. Pollen mother cells divide successively or simultaneously. Tetrahedral, isobilateral, decussate, linear and T-shaped tetrads are present. Embryo sac development is of polygonum type. Fertilisation is porogamous. An obturator is present. Embryo development in *E. plicata* confines to Muscari Variation of Asterad type. Occurrence of polyembryony is also recorded.

Keywords. *Eleutherine plicata*; *Belamcanda chinensis*; embryology; Iridaceae.

1. Introduction

Iridaceae is a monocotyledonous family with 60 genera and 800 species (Willis and Airy Shaw 1973) comprising of ornamentals like *Gladiolus, Belamcanda, Iris, Crocus, Eleutherine*, etc. and also plants of commercial value like *Crocus sativa* and *Iris* spp. Embryological work on the family Iridaceae was summarised by Schnarf (1931) and later made up to date by Davis (1966). In the present work embryological study of two ornamental plants, *Eleutherine plicata* Herb. and *Belamcanda chinensis* Lem. is made.

2. Materials and methods

The materials of *E. plicata* and *B. chinensis* were cultivated from the Andhra University Botanical Gardens, Waltair and fixed in Formalin-aceto-alcohol. Customary methods of dehydration, infiltration and embedding were followed and sections were cut at 6–25 μm depending upon the stage of flower buds and fruits. Sections were stained with Delafield’s haematoxylin and also safranin and fast green.

3. Observations

A plate of hypodermal archesporial cells in each of the anther lobe divides periclinally to form a layer of outer primary parietal cells and an inner primary
Figures 1–7. (Captions in p, 366)
sporogenous cells. The former divides further periolinally forming four layers of cells in *E. plicata* (figure 3) and three in *B. chinensis*. The innermost layer forms the secretory type of tapetum. The cells of subepidermal layer develop into fibrous endothecium. In the anthers of *B. chinensis* at the stage of the formation of pollen mother cells, it has been observed in a few cases that the tapetum and the sporogenous tissue degenerate in one (figure 6) or all the lobes of an anther. The microspore mother cells usually divide successively but sometimes simultaneous divisions are also encountered.

Pollen tetrads of tetrahedral, isobilateral, decussate, linear and T-shaped types have been observed. The pollen grains are two-celled and circular. The exine is smooth and unsculptured in *E. plicata* and shows ridges with a reticulate pattern of thickening on the surface (figure 7a). Pollen grains of *B. chinensis* have conical pillar-like thickenings in the exine at the ridges (figure 7b).

The ovules are anatropous, bitegmic and tenuinucellate in *E. plicata* and erassinucellate in *B. chinensis*. In *B. chinensis* abnormal ovules with two nucelli, each having its own vascular supply are encountered occasionally (figure 15). The archesporium consists of a single hypodermal cell (figure 9). Occasionally two archesporial cells are also differentiated in *E. plicata* and three in *B. chinensis* (figure 16). After meiosis a linear tetrad of megaspores is formed, the chalazal of which is functional (figure 11). The embryo sac is of polygonum type. The egg is centrally placed but sometimes lateral in position in *E. plicata*. The synergids are pyriform. Polar nuclei are larger in size. Three well-formed uninucleate oblong or rectangular antipodal cells occur arranged in a linear or triangular fashion. In *E. plicata* the antipodals persist even after endosperm formation (figure 14). A few cases are met with in *E. plicata* in which two of these simulate the appearance of the synergids while the third remains unaltered (figure 13). Sometimes they resemble the egg apparatus. But no embryos have been encountered at the antipodal end.

Fertilisation in *E. plicata* is of porogamous type. An obturator is present (figure 8). Primary endosperm nucleus divides earlier to the division of the zygote and the formation of endosperm is of nuclear type.

Embryogeny is studied in *E. plicata* (figures 18 to 30) which conforms to Asterad type with Muscari Variation. After a prolonged period of rest the zygote divides transversely to form a terminal and a lower cell namely, *ca* and *cb*. Both the cells of the proembryo contribute to the formation of the embryo proper. Occasionally two to three embryos are met with in *E. plicata* in the micropylar region (figures 32a and b). Their position in the embryo sac cavity in close proximity with fertilized egg (figure 31) suggests their origin from the proliferated cells of the integument.

### 4. Discussion

The anther wall shows uniformity in the presently investigated species, *E. plicata* and *B. chinensis* and comprises of epidermis, fibrous endothecium, two to three middle layers and secretory tapetum. Lakshmanan and Philip (1971) also reported a similar structure of anther wall in *Sisyrinchium striatum* and *Sisyrinchium californicum* but with one to two middle layers.
Figures 8–14. (Captions in p. 367)
In *S. striatum* and *S. californicum* (Lakshmanan and Philip 1971) the microspore mother cells divide only simultaneously whereas successive or simultaneous type of divisions have been recorded in microspore mother cells of *E. plicata* and *B. chinensis*. Tetrads of tetrahedral, isobilateral, decussate, linear and T-shaped types have been encountered in *E. plicata* and *B. chinensis*. Only isobilateral and tetrahedral types are reported in *S. striatum* and *S. californicum* (Lakshmanan and Philip 1971).
Pollen grains are shed at two-celled stage in *S. striatum* and *S. californicum* (Lakshmanan and Philip 1971) and also in the presently investigated species *E. plicata* and *B. chinensis*.

Nuclear type of endosperm formation has been reported in *S. striatum* and *S. californicum* (Lakshmanan and Philip 1971). In the present study of *E. plicata* and *B. chinensis* also Nuclear type of endosperm has been recorded which accords with the observations in *Sisyrinchium* spp.

Persistent antipodals upto endosperm formation have been observed in *E. plicata*, a feature also reported in *S. striatum* and *S. californicum* (Lakshmanan and Philip 1971).

Karagyozova (1963) has reported in *Iris pseudacorus* occasional functioning of synergids as egg cells. A similar feature has also been observed in *E. plicata* of present study.

Embryogeny is confined to Muscari variation of Asterad type in *E. plicata* of the present study. Asterad type of embryogeny has also been reported in *S. striatum* and *S. californicum* (Lakshmanan and Philip 1971) and in *Iris pseudacorus* by Guignard (1962).

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### References

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Figures 1–7. 1 to 5. *E. plicata*. 1. T.s. of an anther lobe in early stage of development showing hypodermal archesporium (× 533). 2. T.s. of an anther lobe showing the sporogenous tissue surrounded by three middle layers under the epidermis. The innermost enlarged cells form the tapetum (× 533). 3. T.s. of an anther lobe showing the well-developed sporogenous tissue surrounded by the one nucleate tapetum and two wall layers below the epidermis (× 400). 4. T.s. of a dehiscing anther lobe showing well-developed fibrous endothecium and two nucleate pollen grains. Some pollen grains are in degenerated state. The tapetal cells have disappeared already (× 160). 5 a, b, c and d. Isobilateral, linear, decussate and T-shaped pollen tetrads respectively (× 833). 6. *B. chinensis*. T.s. of anther lobe showing degenerating sporogenous cells and tapetum (× 333). 7a, b. Pollen grain of *E. plicata* and *B. chinensis* respectively (× 333).
Figures 8 to 14. *E. plicata*. 8. L.s. of ovule showing the obturator formed from the apical part of the funicle (× 133). 9. L.s. of young ovule showing single hypodermal archesporial cell (× 533). 10. L.s. of young ovule with two hypodermal archesporial cells adjacent to each other (× 833). 11. L.s. of a nucellus showing a linear tetrad of megaspores, with chalazal functioning and three micropylar degenerating (× 833). 12. L.s. of nucellus of an ovule with an 8-nucleate embryo sac in which the egg apparatus cells and the antipodal cells are organised and the polar nuclei have not fused (× 533). 13. An embryo sac in which the antipodals are assuming a synergid shape (egg not shown) (× 533). 14. Chalazal end of an embryo sac with well-developed nuclear endosperm showing the persistent antipodals (× 333).