Embryological studies in the family Meliaceae Fertilisation, Endosperm and Embryogeny in *Walsura trifoliata* (A. Juss) Harms[1]

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ABSTRACT

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The process of fertilisation and post-fertilisation stages have been decribed in *Walsura trifoliata* (A. Juss.) Harms, a member of Meliaceae. Fertilisation is porogamous. Syngamy and triple fusion are simultaneous. Synergids and antipodals are ephemeral. Endosperm is free nuclear and endosperm module is present at the chalazal end of the embryo sac. Embryo development follows VI Megarchetype of the series A of the group I in Soueges system of classification.

INTRODUCTION

The genus Walsura Roxb., belonging to the family Meliaceae comprises 10 species in India (HOOKER, 1875) but WILLIS (1955) reports the occurrence of 15 Indo-Malayan species of the genus. The embryological literature on the family under study has been reviewed by SCHNARF (1931) which has been further corroborated by PAETOW (1931), JULIANO (1934) and WIGER (1935). MAURITZON

(1) The work described in the paper is a portion of the thesis approved for D. Phil. in Botany of the Calcutta University.

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(1935) worked out 40 species of the family representing 13 genera on the basis of which he adversely criticised WIGER'S (1935) accounts. In India, GARUDAMA (1956, 1957), NAIR (1959), NARAYANA (1958) and NAIR & KUSUM KANTA (1961) have recorded embryological features of some more taxa of the family. Recently, GHOSH (1966a, b) has recorded the process of gametogenesis and development of the female gametophyte in *Walsura piscidia* Roxb., now known as *W. trifoliata* (A. Juss). Harms and *Aphanamixis polystachya* (Wall.) Parker respectively. Very recently (1972), the same author has worked out the post-fertilisation stages in the latter species.

In the present investigation an attempt has been made to work out the remaining embryological features, such as, fertilisation, endosperm and embryo development of the ovule in the taxon.

MATERIAL AND METHODS

The material for study was collected from the plants growing in the Indian Botanic Garden, Calcutta, during the months of March-June, 1965. Formalin-acetic alcohol was used as a fixative and after the usual procedures of dehydration and embedding, the material was sectioned at a thickness of 12-18 μ. Heidenhain's iron-alum haematoxylin and erythrosin were used for staining the sections.

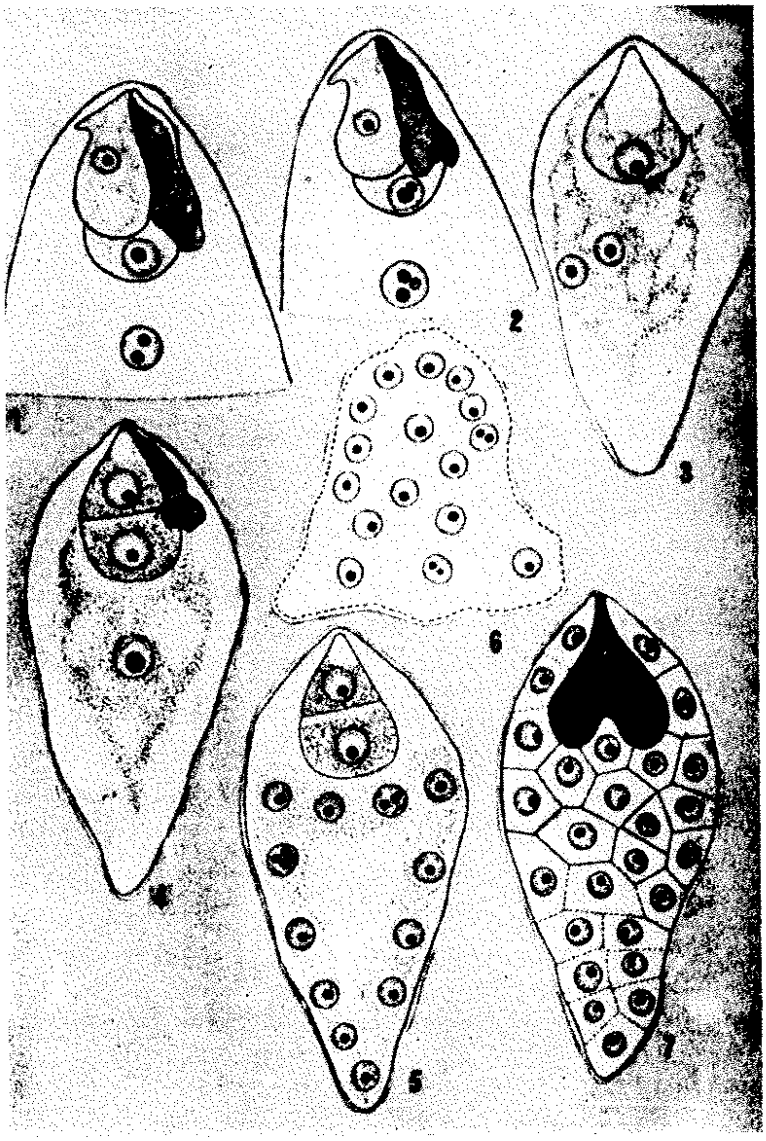
OBSERVATIONS

Fertilisation

Fertilisation is porogamous. The pollen tube enters the embryo-sac by way of the micropyle disorganising one of the synergids (fig. 1) Syngamy and triple fusion are quite evident in the ovule (fig. 2). Ultimately both the synergids and the antipodals are ephemeral (fig. 3). The remnant pollen tube is persistent upto 2-celled stage of the embryo (fig. 4). The disorganised pollen tube shows the presence of X-bodies (figs. 2, 4).

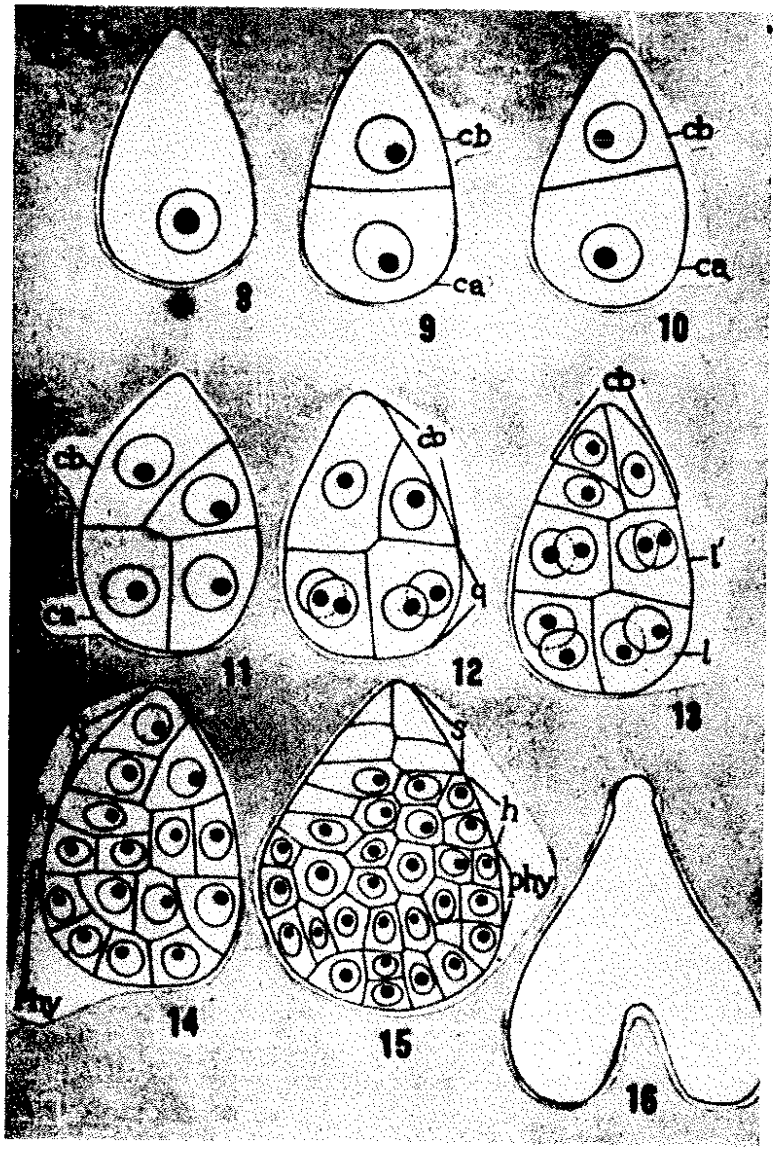
Endosperm

The primary endosperm nucleus divides earlier than the fertilised egg and produces two free nuclei (fig. 3). The two nuclei thus formed are separated and soon undergo repeated division mitoti-



Walsura piscidia (*A. Juss.*) *Harms.* FIGS. 1-7. Portion of mature embryosac showing process of fertilisation, × 1400. FIG. 2. Same showing syngamy and triple fusion as well as remnant pollen —tube with ×— bodies, × 1400. FIG. 3. Mature embryo— sac showing ephemeral synergids, antipodals and two free nuclei derived from primary endosperm nucleus, × 1400. FIG. 4. Same showing remnant pollen-tube with 2-celled pro-embryo and primary endosperm nucleus, × 1400. FIG. 5. Same showing uni-, bi and trinucleate free endosperm nuclei and 2-celled proembryo, × 1400. FIG. 6. A portion chalazal end showing endosperm nodules, × 1400. FIG. 7. A mature embryo-sac showing wall formation around endosperm nuclei and a heart - shaped embryo, × 1400.

cally giving rise to a large number of free nuclei (fig. 5). Ultimately those nuclei are arranged peripherally in the cytoplasm of the embryo-sac (fig. 5). Evidently, there is an aggregation of nuclei in the chalazal region (fig. 6). The wall formation initiates during heart-shaped configuration of the embryo (fig. 7). The endosperm cells become uninucleate but sometimes they show the presence of 2 or 3 nucleoli (fig. 5).



Walsura piscidia (*A. Juss.*) *Harms*. FIGS. 8-16. Showing different developmental stages in the formation of embryo, × 1400.

Embryo

After fertilisation the zygote undergoes a period of rest for sometime (fig. 8). Then it divides transversely into two cells, giving rise to 'ca' and 'cb' (fig. 9). In a few cases, an oblique wall is laid down in the fertilised egg to form two-celled pro-embryo (fig. 10). The apical cell 'ca' divides vertically while the basal cell 'cb' by an oblique wall (fig. 11). The tetrad pro-embryo thus derived falls to the category A_1 of Soueges system of embryonal classification. The two juxtaposed daughter cells of the apical cell 'ca', by a vertical division, gives rise to the quadrant (fig. 12). The quadrant 'q' of the previous stage is now followed by Octant (fig. 13). Differentiation of 1 and 1' being superior an inferior Octant respectively is soon noticeable in the quadrant 'q' (fig. 13). Some later stages leading to the separation of the hypocotyledonary and hypophyseal parts are shown accordingly (figs. 14-16).

DISCUSSION

The embryological stages of the taxon represented herewith reveal that the process of fertilisation simulates with other members of Meliaceae (WIGER, 1935; MAURITZON, 1935; NAIR, 1959; NAIR & KUSUM KANTA, 1961). WIGER (1935) asserts that the development of endosperm in some members of Meliaceae is independent of fertilisation and triple fusion. In *Walsura trifoliata*, it is quite evident that endosperm development is normally initiated after triple fusion as also reported in *Melia azedarach, Cedrela toona* and *Azadirachta indica* (NAIR, 1959b, c; NAIR & KUSUM KANTA, 1961). The division of the zygote in the taxon under study starts after the formation of a large number of free endosperm nuclei as is also the case with *Sandoricum koetjape, S. indicum, Naregamia alata* and *Azadirachta indica* (JULIANO, 1934; NAIR, 1959; NAIR and KUSUM KANTA, 1961). Cell wall formation of the free nuclei of the endosperm commences at the heart-shaped stage of the embryo as has been observed in other taxa of Meliaceae (JULIANO, 1934; NAIR, 1969; NAIR & KUSUM KATA, 1961). The occurrence of endosperm nodules in the chalazal end of the embryo-

sac is an interesting feature as also recorded in *Naregamia alata* (NAIR, 1959) and *Azadirachta indica* (NAIR & KUSUM KATA, 1961).

As regards embryogeny of the species ,it may be stated that it does not conform to the crucifer type embryo of *Naregamia* (NAIR. 1959) but the present taxon somewhat resembles *Azadirachta indica* in having similarity with the Megarchetype of embryo which falls in the series A of group I in the SOUEGES (1939) system of embryonic classification with slightest difference and as such the genus, *Azadirachata* belongs to III Megarchetype (GARUDAMMA, 1956) and Walsura to VI Megarchetype only (GHOSH, 1965). Later on NAIR and KUSUM KANTA Megarchetype only (GHOSH, 1965). Later *Melia azedarch* (*Azadirachta indica*) could not typify the embryo as done by GARUDAMMA (1956). So the tribes Meliae to which *Melia* or *Azadirachta* belongs and Trichilleae of HOOKER (1875) which consist of *Naregamia, Aphanamixis* and *Walsura* do not conform each other from the view point of embryogenesis. It is interesting to note that out of three genera *Naregamia, Walsura* and *Aphanamixis,* the latest one shows the presence of nucellar polyembryony (GHOSH, 1972) in contrast to two previous taxa which show definite embryogenic classification stated in the text. It may be presumed that the proposed tribes of HOOKER (1875) appear to be somewhat artificial on the basis of embryogeny, if considered and this statement needs further corroboration on the basis of detailed investigation of embryogenesis of all the unexplored taxa of Meliaceae.

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LITERATURE CITED

GARUDAMMA, G. K.
1956 Studies in the Meliaceae I. Development of embryo in *Azadirachta indica* A. Juss. *J. Indian bot Soc.* **35**: 222-25.
1956 Studies in the Meliaceae. II. Gametogenesis in *Melia azadirachta* Linn. *Ibid.* **36**: 227-231.

GHOSH, R. B.
1965 Anatomical, Cytological and Embryological investigations of some members of Rutales in relation to their phylogeny and affinity D. Phil. Dissertation (Unpublished).
1966a Studies in the family Meliaceae. I. Development of the famale gametophyte of *Aphanamixis polystachya* (Wall.) Parker *Beitr. Biol. pflanzen.* **42**: 133-138.
1966b Studies in the family Meliaceae. II. The development of the gametophytes in *Walsura piscidia* Roxb. *Ibid.* **42**: 373-380.
1972 Studies in the Embryology of the family Meliaceae IV. Fertilisation, endosperm and embryogeny of *Aphanamixis polystachya* (Wall) Parker A medicinal plant with a discussion on its taxonomic status and horticulture. *An. Aula Dei,* **11** (3-4).

HOOKER, J. D.
1875 The Flora of British India. I. Reeve & Co. London.

JULIANO, *J. B.*
1934 Studies on the morphology of Meliaceae. I. *Sandoricum koetjape* (Burm. *f.*) Merr *Philip J. Agr.* **23**: 11-48.

MAURITZON, J.
1935 Kritik von J. Wigers's Abhandbung Embryological studies on the families Buxaceae, Meliaceae, Simarubaceae and Burseraceae. *Bot. Notiser.* 1935. 490-502.

NAIR, N. C.
1959a Studies on Meliaceae. I. Floral morphology and embryology of *Naregamia alata* W. & A. J. *Indian bol. Soc.* **38**: 351-365.
1959b Studies on Meliaceae. II. Floral morphology and embryology of *Melia azedarch Ibid.* **38**: 367-378.
1961 Studies in meliaceae. IV. Floral morphology and embryology of *Azadirachta* A. Juss. A Reinvestigation. *Ibid.* **40**: 382-396

NARAYANA, L. L.
1958 Name changes in common Indian Plants. *Indian Forester,* **54**: 467-535.

PAETOW, W.
1931 Embryologische Untersuchungen an Taccaceen, Meliaceen and Dilleniaceen. *Planta* **14**: 441-470.

RAIZADA, M. B.
1958 Name changes in common Indian Plants. *Indian Forester,* **54**: 467-535.

SCHNARF, K.
1931 Vergleichende Embryologie der Angiosperm. Gebruder Borntraeger, Berlin.

WIGER, J.
1935 Embryological studies on the families Buxaceae, Meliaceae, Simarubaceae and Burseraceae. Lund.

WILLIS, J. C.
1955 A Dictionary of the Flowering Plants and Ferns, Cambridge University Press.