K. Chandrasekhara NAIDU*: **Life history of *Corallocarpus epigaeus* Hook. (Cucurbitaceae)**

K. C. ナイヅ*: *Corallocarpus epigaeus* (ウリ科) の生活史

The tribe Melothrieae of the family Cucurbitaceae comprises 31 genera and 495 species (Jeffrey 1962) and is distributed mostly in the new world. Most of the embryological work in this tribe is confined to the development of female gametophyte, endosperm and seed coat (Kirkwood 1904, Paliwal 1950, Chopra 1953, Chopra & Agarwal 1958, Singh 1955, 1956, 1957, 1961, 1964, Singh & Dathan 1972, 1974a, 1974b, Johri & Chowdhury 1957, Dzevaltovsky 1963, Devi & Naidu 1983). Therefore a detailed embryological investigation has been carried out in *C. epigaeus* of this tribe.

Materials and methods The material was collected locally and fixed in formalin-acetic-alcohol. Customary methods of dehydration, infiltration and embedding were followed (Johansen 1940). The sections were cut between 5-12 μ thickness and stained in Delafield's haematoxylin.

Observations Microsporangium, microsporogenesis and male gametophyte. The anther is either tetrasporangiate or bisporangiate (Fig. 1). The archesporium is hypodermal and consists of two or three cells in transverse section. Although development of the anther wall corresponds to the dicotyledonous type (Davis 1966), due to periclinal division in the middle layer two layers are formed (Figs. 3-5). The tapetum is of the secretory type and its cells remain uninucleate throughout (Figs. 3, 4). The hypodermal layer develops fibrous thickenings forming the fibrous endothecium (Figs. 5, 6).

The primary sporogeneous cells undergo a few mitotic divisions to produce pollen mother cells. As a result of simultaneous cytokinesis by furrowing tetrahedral tetrads are formed. The nucleus of the young pollen grain is situated in the centre and cytoplasm shows no vacuoles (Fig. 9). At the time of shedding the pollen grain is 3-celled and tricolporate (Figs. 10, 11). Sometimes one, two or three pollen grains become degenerated from the tetrads of all the anthers (Fig. 8).

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Ovary, ovule and megasporogenesis and female gametophyte. The ovary is inferior, bicarpellary syncarpous and unilocular with two massive parietal placentae (Fig. 12). The ovule is anatropous, bitegmic and crassinucellate. The

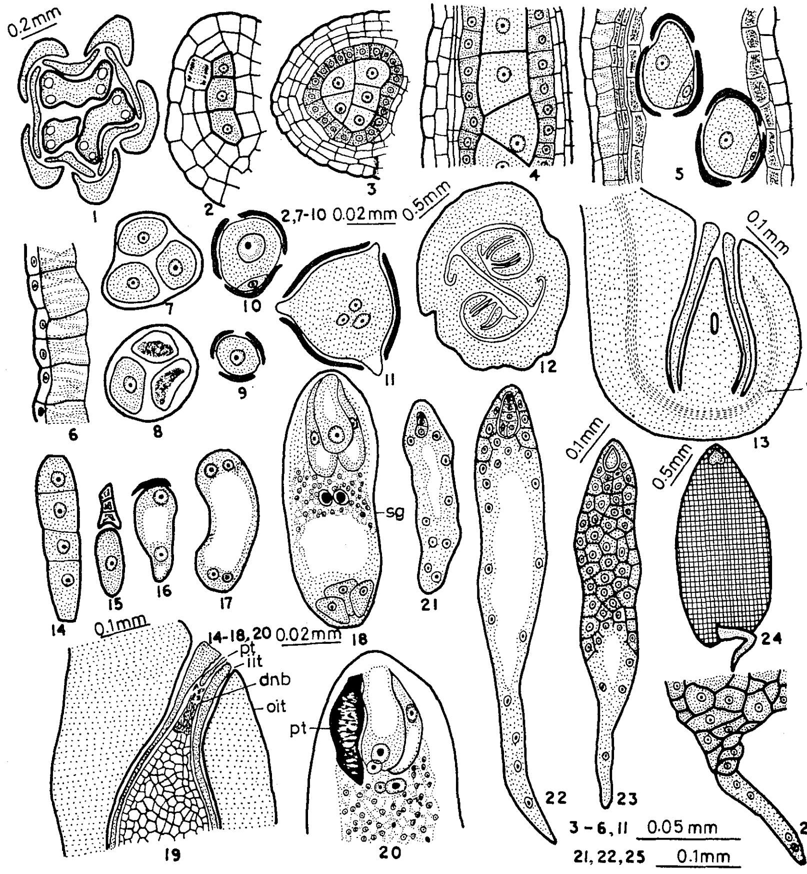


Fig. 1-25. 1. Transverse section of male flower showing anthers, petals and sepals. 2-5. Transverse and longitudinal sections of anther lobes showing development of wall layers, sporogenous tissue and pollen. 6. Fibrous endothecium with persistent epidermis. 7 & 8. Pollen tetrads. 9-11. Pollen grains. 12. Transverse section of ovary. 13. Longitudinal section of ovule. 14. Linear megaspore tetrad. 15-18. 2, 4 and 8-nucleate embryo sacs. 19. Longitudinal section of upper part of ovule showing entry of pollen tube and degeneration of nucellar beak. 20. Micropylar part of embryo sac showing fertilization. 21-25. Development of endosperm and haustorium. dnb: degenerating nucellar beak; iit: inner integument; oit: outer integument; pt: pollen tube; sg: starch grains.

micropyle is formed by the inner integument alone (Fig. 13). The hypodermal archesporium is single-celled. It divides periclinally and produces a primary parietal cell towards outside and a megaspore mother cell towards inside. The former divides both by anti- and periclinal divisions giving rise to several layered parietal tissue above the megaspore mother cell making it deep seated. The parietal tissue together with the nucellus forms a prominent nucellar beak which extends up to the micropyle (Fig. 13). The nucellus remains persistent upto the early heart-shaped embryo stage.

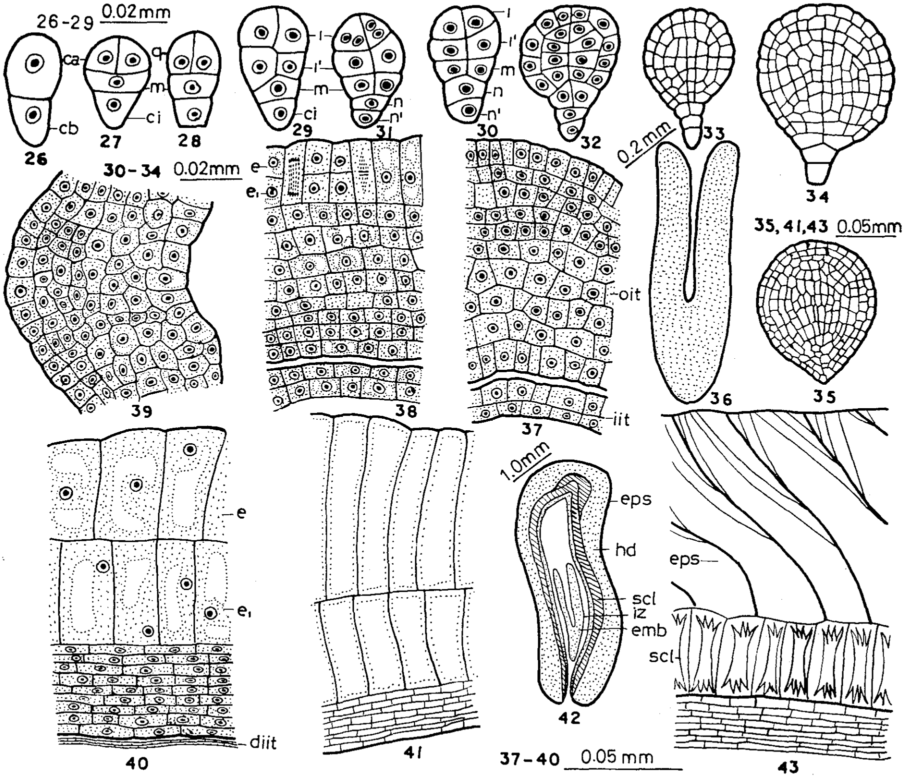
The megaspore mother cell undergoes meiotic division resulting in a linear tetrad of megaspores (Fig. 14). The development of female gametophyte is of the Polygonum type (Figs. 15, 17, 18). However, in a few cases besides Polygonum type, Allium type of embryo sac development is also recorded (Figs. 16, 18). The synergids are pear-shaped and larger than the egg. The three antipodals persist up to free nuclear endosperm stage. The mature embryo sac contains abundant starch grains mostly near the egg apparatus (Figs. 18, 20).

Fertilization and endosperm. The path of pollen tube is porogamous (Fig. 19). Syngamy and triple fusion take place more or less simultaneously (Fig. 20). The persistent pollen tube remains as a tubular structure.

The primary endosperm nucleus divides and produces a large number of free nuclei before the division of the zygote. The free nuclei are distributed evenly in the periphery of the embryo sac leaving a large central vacuole (Fig. 21). Simultaneously with the development of the endosperm the embryo sac enlarges considerably. Gradually the chalazal region elongates further giving rise to a tubular process into which a few free endosperm nuclei migrate. Finally, this acts as the chalazal endosperm haustorium. The size of the haustorium is 510 microns (Figs. 24, 25). Meanwhile wall formation starts in the upper part of the embryo sac and progresses from the apex to downwards leaving the chalazal free nuclear haustorium (Figs. 23-25).

Embryogeny. The zygote divides transversely resulting in a terminal cell *ca* and a basal cell *cb* (Fig. 26). Of the two cells the cell *ca* divides vertically forming two juxtaposed cells and the cell *cb* divides transversely producing two superposed cells *m* and *ci*. Thus a T-shaped four-celled proembryo is formed (Fig. 27). The two cells of the apical cell *ca* divide vertically to engender quadrants (Fig. 28). This tier is designated as *q*. As a result of transverse division in all the four cells of the tier *ca* octants are formed in two tiers of four cells each (Fig. 29). The apical tier is designated as *l* and the subapical as *l′*. Meanwhile the cell *ci* divides transversely to produce two superposed cells *n* and *n′* (Fig. 30). The cell *m* undergoes vertical division resulting in two juxtaposed cells (Fig. 30).

The tier *l* undergoes further divisions in all planes and gives rise to the cotyledons and stem tip (Figs. 32-35). The derivatives of *l′* contribute to the hypocotyledonary region and a part of the root and those of *m* contribute to the hypophyseal region (Figs. 32-35). The two cells *n* and *n′* directly function as a two-celled suspensor (Fig. 34). The mature embryo is straight with two leafy cotyledons (Fig. 36).



Figs. 26-43. 26-36. Stages in the development of embryo. 37-43. Stages in the development of seed coat. diit: degenerating inner integument; emb: embryo; eps: epidermis; hd: hypodermis; iit: inner integument; iz: inner zone; oit: outer integument; scl: sclerenchyma.

From the above, it is clear that the four-celled proembryo is *T*-shaped and major part of the embryo is formed from the terminal cell *ca* alone. Thus, the embryo development conforms to the Onagrad type.

Seed coat. The seed coat is formed by the outer integument alone. The inner integument which is two celled thick at the middle region and two or three celled thick at the apex shows signs of degeneration with the entry of pollen tube into the micropyle (Figs. 38, 40). Finally, by the time of globular embryo is formed no traces of the inner integument are seen (Fig. 41).

The number of wall layers in the outer integument is nine or ten (Figs. 37, 39). At about the time of fertilization the outer epidermis undergoes periclinal division resulting in two layers of cells which are designated as e and e_1 from outside to inside (Fig. 38). Of the two layers of cells the outer most layer e grows enormously in size and functions as the seed coat epidermis (Figs. 40, 41). At maturity its cells become broad and upright with branched thickenings on the radial walls (Fig. 43). The cells of e_1 divide anticlinally to keep pace with the enlarging seed upto the globular embryo stage (Figs. 40, 41). At maturity it becomes sclerenchymatous (Figs. 42, 43).

Besides the epidermis the rest of the layers of the outer integument including the inner epidermis comprises thin-walled parenchymatous cells (Figs. 37–39). At maturity they become tangentially elongated and contribute to the formation of the seed coat (Figs. 40–43). Thus, the outer integument alone forms the seed coat which is differentiated into the seed epidermis, sclerenchymatous hypodermal layer and parenchymatous ininer zone.

Discussion The anther wall although follows the dicotyledonous type of development, it shows slight variation in having two middle layers. The additional layer is formed as a result of periclinal division of the original layer.

The micropyle is formed by the inner integument in all the hitherto investigated taxa including the present investigation. Although, Singh & Dathan (1972) did not mention about the formation of the micropyle in *C. metuliferus*, the figures given by them show the involvement of the inner integument in its organisation. However, the figures of Singh (1955) in *C. melo* var. *pubescens* reveal that the micropyle is formed by both the integuments. The female archesporium is either uni- or multicellular (Kirkwood 1904, Paliwal 1950, Singh 1955, 1956, Dzevaltovsky 1963). However, in the present investigation the female archesporium is unicellular. Although Polygonum type of embryo sac development is a common feature to this tribe, in a few instances Allium type of embryo sac development is recorded (Kirkwood 1904, Singh 1955, 1956, Singh & Dathan 1972, Dzevaltovsky 1963, Devi & Naidu 1983 and present study). In the present investigation for the first time starch grains are recorded in the mature embryo sac.

In this tribe both Onagrad and Solanad types of embryo development are known to occur. In *Melothria madaraspatana*, it is of Onagrad type (Singh 1961) and in *C. melo* var. *pubescens* it is of Solanad type (Singh 1955).

The seed coat development follows the typical Cucurbitaceous pattern in the taxa of the tribe so far investigated (Singh 1956, Singh & Dathan 1974a, 1974b and present data).

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ウリ科スズメウリ連には31属知られているが，この群の胚発生の研究はほとんど雌性配偶体•内乳•種皮に限られていた。そこで著者は本群の一種 *Corallocarpus epigaeus* の小胞子嚢・小胞子発生・雄性配偶体，子房・胚珠・大胞子発生・雌性配偶体，受精・内乳，胚形成，種皮について，詳しい研究を行った。

□Gupta, A. & R. Udar: **Palyno-taxonomy of selected Indian liverworts** 202 pp. 1986. J. Cramer, Stuttgart. 蘚苔類の胞子形態については近年各国で研究が進められているが，本書はインド産の50種の苔類についての観察を取りまとめたもの。各種について胞子形態のくわしい記載と説明，顕微鏡写真とその解説図がある。胞子の型の分類，胞子表面の模様の分類等が述べられている。顕微鏡写真はすべて光学顕微鏡によるものである。 (井上 浩)

□Oliver-Bever, Bep: **Medicinal plants in tropical West Africa** 375pp. 1986. Cambridge University Press, Cambridge. ¥16,800. 熱帯西アフリカ産の生理活性のある植物が心臓血管系，神経系，抗感染作用，副腎皮質ホルモン，性・甲状腺ホルモン，低血糖作用に分けて効能別に記述されている。どの種についてもL，C，Pの見出しの下に，土俗的用例，成分，薬学的知見がのべられている。最近日本の経済活動の拡大とともに，なじみのうすいアフリカの植物についての質問，それも貿易業務上の質問がふえているので，こういう本を備えることにした。参考文献が86頁にもわたっているが，大部分は薬学的文献である。植物名索引は20頁にわたるが学名索引で，common name の見出しはあるが，英語名ばかりで現地名がほとんどないのは少々もの足りない。

(金井弘夫)