Takasi YAMAZAKI*: **Embryological studies in Ebenales (3)**

山崎 敬*: カキノキ目の胚発生 (3)**

(Pl. VIII—IX)

Sapotaceae

The embryological studies in the Sapotaceae are very poor and imperfect. Only the formation of the embryo sac and the endosperm of *Bassia latifolia* has been reported (Murthy 1941). I report the embryology of *Pouteria obovata* var. *dubia* in this paper. The materials were collected from Bonin Isls.: Isl. Hahazima in Aug. 1969 and Isl. Mukouzima in May 1970. They are fixed in formalin-acetic-alcohol.

Ovule and embryo sac The superior ovary has five locules and an anatropous ovule in each locule on an axile placenta (Pl. VIII, 1). The ovule is unitegumic and tenuinucellate. The thick integument is consisted of 15–18 cell layers without any recognizable differentiated organizations (Pl. VIII, 2—3). A single hypodermal archesporial cell differentiates into the young nucellus (Fig. 1—2). The nucellus represented by a single layer of cells degenerates early. The archesporial cell functions directly as the megaspore mother cell, and divides giving rise to a linear tetrad of four megaspores (Fig. 3—4). The chalazal one functions and gives rise to the embryo sac. The functional megaspore undergoes three nuclear divisions leading to the formation of two, four and eight-nucleate gametophyte stages (Fig. 5—6). The mature embryo sac is triangular in shape and shows the usual organization. Three antipodal cells lie side by side and degenerate early before the fertilization (Fig. 7, Pl. VIII, 3).

Formation of the endosperm The endosperm formation is nuclear. After the fertilization, the cells of the inner few layers of integument become swollen and vacuolate. These large vacuoles containing many oil

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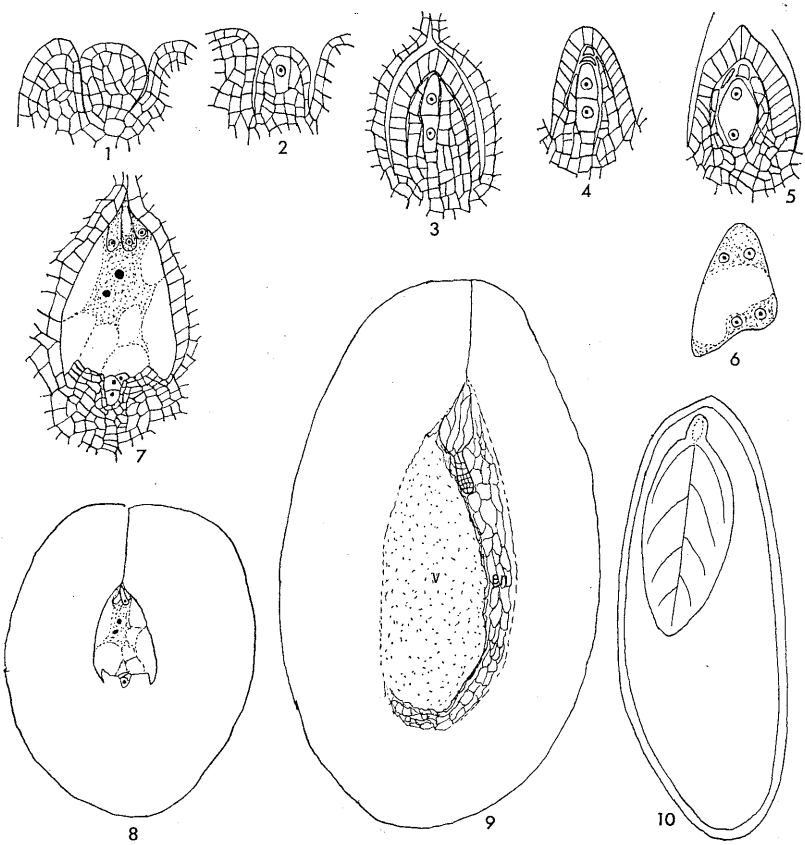
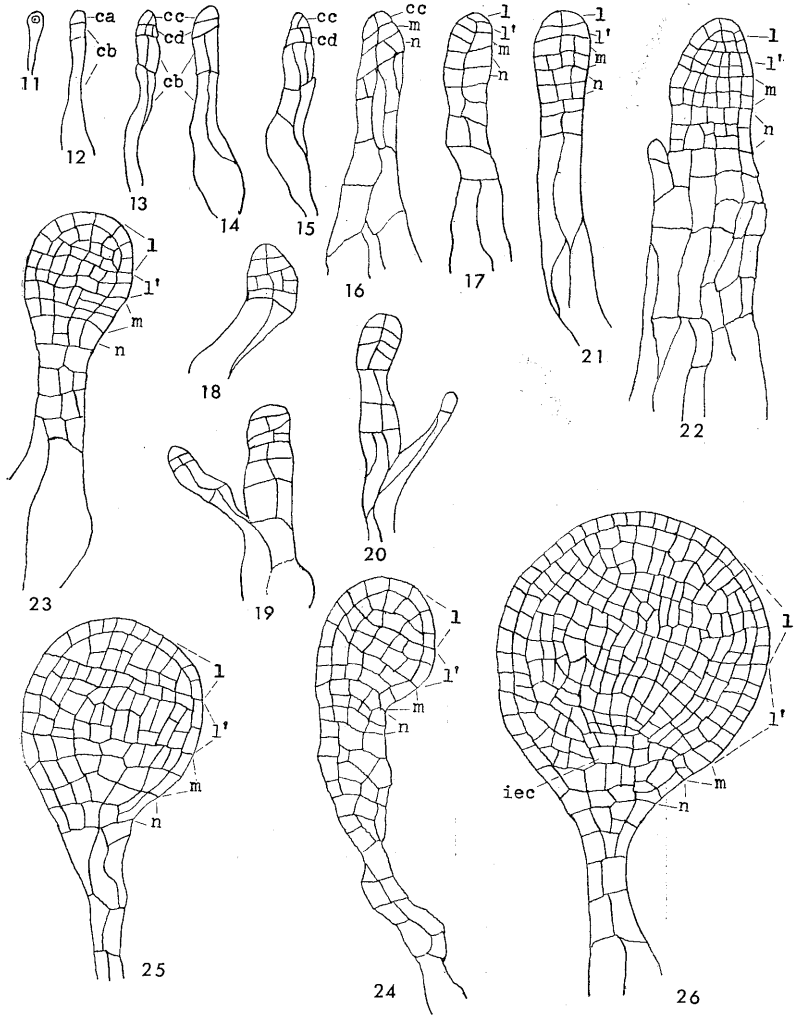


Figs. 1-10. *Pouteria obovata* var. *dubia*. 1-8. Stages in development of the embryo sac. 1-7. ×230, 8. ×110. 9. Young stage of the endosperm formation showing the cellular endosperm (en) and a large vacuole (v). ×50. 10. Young seed. ×8.

granules develop into a large mass in a embryo sac cavity (Pl. VIII, 4). The division of the primary endosperm nucleus precedes that of the zygote. For some time, only free nuclear divisions occur, and a large number of free nuclei are formed (Pl. VIII, 5). In 30-40 celled embryo stage, the cell-wall formation commences around the each nuclei. In this stage, the thin and elongated endosperm is situated in the peripheral part, and a large central vacuole is obserbed. (Pl. VIII, 6). In the late globular stage of the embryo, the endosperm gradually enlarges and fills up the ovular cavity.

In mature stage, the seed is occupied by the large embryo, and the almost disappeared endosperm.

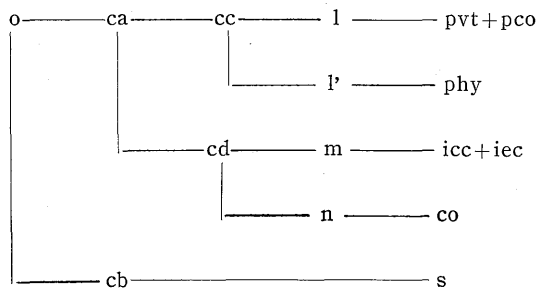
Embryogeny After the fertilization, the zygote elongates and by some irregular divisions forms few celled embryo *ca* and *cb* (Fig. 12). Some of



Figs. 11-26. *Pouteria obovata* var. *dubia*. Stages in the embryo formation. ×200.

the basal cells derived from the cell *cb*, give rise to a elongated suspensor with many cells. The upper cell *ca* divides transversely to form two cells *cc* and *cd* (Fig. 13–15). The cells *cc* and *cd* divide by vertical walls to give rise to two tiers of two cells each. The lower tier *cd* divides transversely to form the tiers *m* and *n*, and next transverse division in the upper tier *ca* results to form the tiers *l* and *l'* (Fig. 17).

It is frequently observed that the very young embryonal mass divides and forms two branched mass which has the proper embryonal portion in each apical part (Fig. 19–20). The cells of the upper tier *l* are divided by tangential walls to form the outer and inner daughter cells. The outer daughter cells are divided only by anticlinal walls and give rise to the epidermal initials. The divisional sequence of the inner daughter cells is not definite, whether longitudinal followed by transverse or in the reverse order. Thus formed inner daughter cells of the tier *l* differentiate to be the mother cells of the cotyledonary initials from lateral side, and the elements which constitute the stem apex from inside. The cells of tier *l'* repeat periclinal and anticlinal divisions and produce the plerome and periblem initials. The tier *m* divides comparatively slowly to form the initials of the central cylinder of the hypocotyl *icc* and the initials of the root cortex *iec*. The tier *n* differentiates as the apical part of the root cap *co* (Fig. 23—26, Pl. IX. 7—11). The mature embryo comprises two large cotyledons and a short thickened hypocotyl. The process of the embryo formation of *Pouteria obovata* var. *dubia* is as follows:



Seed In the flowering stage, the ovary has 5 ovules, but very often only one develops and the other four degenerate early about the time of megaspore formation stage, thus the ripe fruit has usually one seed. In mature

seed, the cells of the outermost layer of the integument enlarge and are covered with cutinized hyaline thick cell wall. The integument is differentiated into three zones: 5-6 celled layers of exocarp consisting of thick walled large cells (a), one or two layers of mesocarp consisting of lignified thick-walled small cells (b), and 8—9 celled layers of endocarp consisting of hyaline thin-walled cells (c). A vascular bundle run in endocarp (Pl. IX, 12).

Literature

Murthy, S. N., Morphological studies on the Sapotaceae. 1. Embryology of *Bassia latifolia* and related genera. Journ. Mysore Univ. B. 2: 67-80 (1941).

Explanation of plates VIII—IX

Pl. VIII. *Pouteria obovata* var. *dubia*. 1. Longitudinal section of the young flower. ×10. 2. Two celled stage of the megaspore. ×185. 3. Mature embryo sac. ×100. 4. Early stage of the endosperm formation showing the swollen and vacuolate cells in the embryo sac cavity. ×100. 5. Young endosperm showing free nuclei. ×175. 6. Young stage of the endosperm formation, same with fig. 9. ×50.

Pl. IX. *Pouteria obovata* var. *dubia*. 7-11. Young embryo. 7-10. ×180, 11. ×40. 12. Seed coat: e. epidermis; a. exocarp; b. mesocarp; c. endocarp; en. endosperm. ×50.

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アカテツ科の胚形成は殆んど調べられていないし，今までの報告も非常に不完全である。小笠原諸島調査のさい採集した，コバノアカテツの胚形成を報告した。コバノアカテツの子房は5室で，各室1個の胚珠をもつが，多くは1個のみが生育し，他の4個は大胞子形成の初期に退化して発育しない。したがって果実は普通1個の種子のみをもっている。胚珠は1枚の厚い珠皮をもち，3角状の胚嚢が作られる。胚嚢形成は普通型である。

胚乳形成の初期に珠皮の内側の数層の細胞が膨潤して多くの油滴をもち，胚嚢の空隙に入りこむ。これは次第に癒合して1個の大きな液胞となり，胚珠の内腔の大部分をしめ，胚乳は側方におしやられ，薄い膜状となっている。胚乳形成は初めは多核であるが，胚が発育しはじめると，胚乳の各々の核のまわりに細胞膜ができて多細胞の胚乳となる。胚乳は次第に発達して，胚形成の中期以後は胚珠内腔の全体をしめるようになる。しかし胚乳細胞の膜は薄く，胚が大きくなるにつれて消失しはじめ，種子

完成の頃には胚乳は殆んどなくなる。

胚形成のごく初期に，胚柄のよく発達した多細胞の塊ができ，その先端に胚の本体が分化してくる。かなりしばしば，この集塊の先が 2 分し，2つの胚が発達するのがみられる。しかし一方のみが生育して 2 つが同様に発育することはないようである。このような胚形成は裸子植物の前胚形成にやや類似した行動である点に大きな特徴がある。しかし胚本体の分化は Chenopodiad Type で，エゴノキ科の胚形成と基本的には同じである。原根層の分化はエゴノキ科やハイノキ科にくらべると不明瞭である。上記のように胚乳形成，胚形成はアカテツ科はハイノキ科やエゴノキ科とはかなり異っている。

○*Pseudopohlia bulbifera* の学名について（水島うらら）Urara Mizushima: On the nomenclature of *Pseudopohlia bulbifera* sensu Ochi

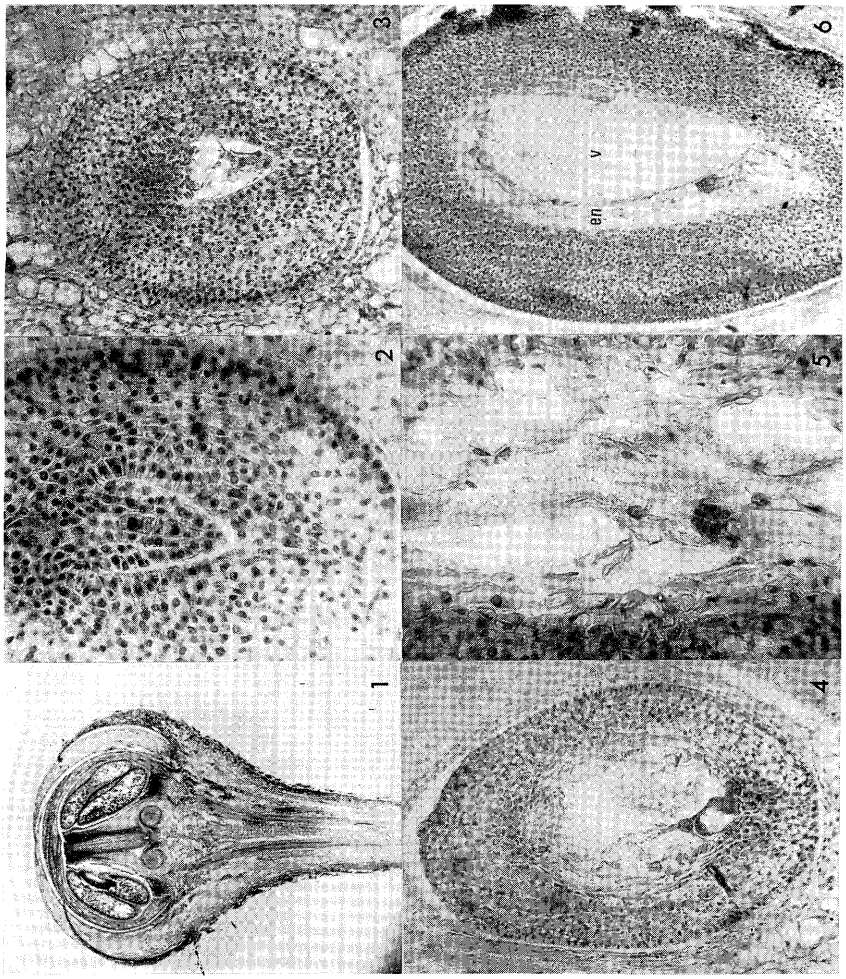
本誌 4 月号に越智春美氏が書いておられるセン類覚えがき (VIII) を拝見し，117 頁にある *Pseudopohlia bulbifera* (1914) の有効性に疑問を抱いた。氏はフィリッピンから記載されたこの種と雲南産の *P. yunnanensis* (1925) とは全く同一のものであることを述べられ，インド・ネパール地方産の *Brachymenium microstomum* も多くの標本を見た結果，矢張りこれも前 2 者と同一であると述べておられる。然しこれら 3 者を合一するに当り，越智氏は *P. bulbifera Williams* を正名とされた。ところが異名と見做された *Brachymenium microstomum* Harv. (1836) は筆者が調べた限りでは有効名である。従って上記 3 者を同一種と見る限り，また *Pseudopohlia* 属のものと見る限り，その正名は *Brachymenium microstomum* Harv. を組み換えた *Pseudopohlia microstoma* (Harv.) U. Mizushima でなければならないと思う。

Pseudopohlia microstoma (Harv.) U. Mizushima, comb. nov.

——*Brachymenium microstomum* Harv. in Hooker, Icon. Pl. 1: tab. 19, f. 4 (1836)——*Pseudopohlia bulbifera* Williams in Bull. New York Bot. Gard. 8: 346, 172 (1914); Ochi in Journ. Jap. Bot. 46: 117, f. 50 (1971)——*P. yunnanensis* Herz. in Hedwigia 65: 157, 4 (1925).

蛇足であるが *Brachymenium microstomum* Harv. という名は Musci Indici として載せられている Harvey の図版の中にある。同巻中の種子植物では記載文があるが，セン類については "Companion to the Botanical Magazine" の Vol. 2 に記文を載せる筈である（第 17 図版の註）と書かれているだけで記文はない。Comp. Bot. Mag. Vol. 2 は 1836 年に発刊になっているが，その中には Hooker の Icones Plantarum についての紹介があって，セン類には図が幾つあると書いてあるのみでこゝにも記文はないが図解はされたことになり，命名規約第 44 条によって有効に出版された名と認めることが出来る。

（東京都立大学理学部牧野標本館）



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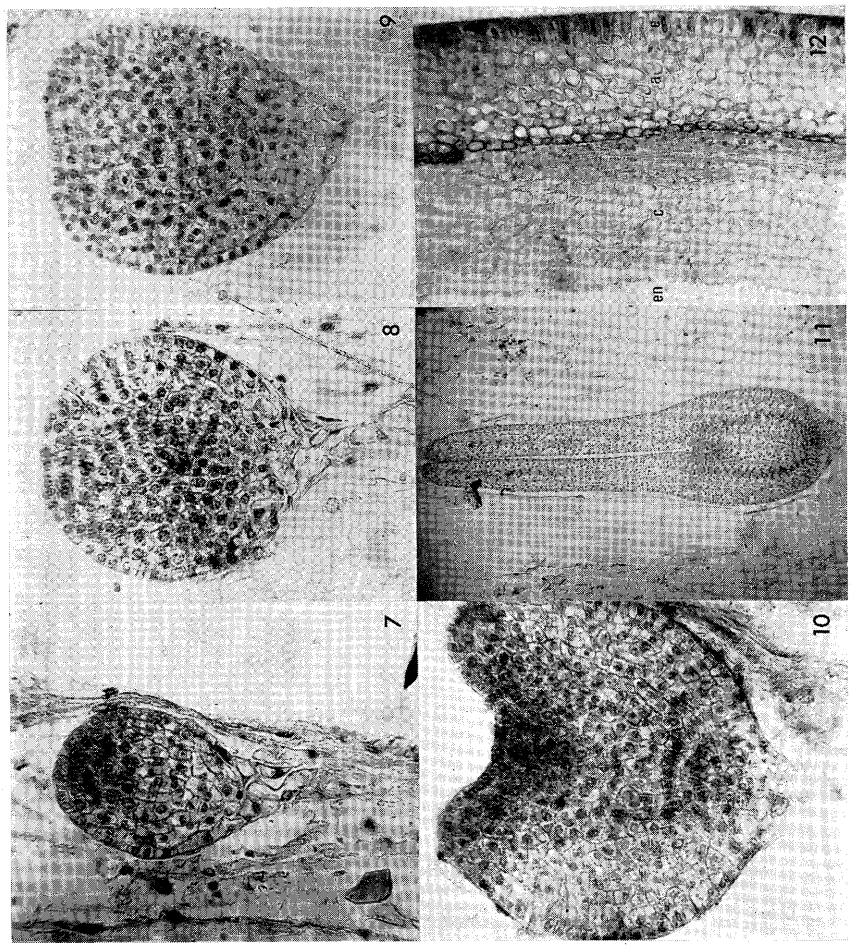

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