

**Table 2** Prominent gamma energies and abundances of short lived radon and thoron daughters

RaB(pb-214) keV	RaC(bi-214) keV	ThB(pb-212) keV	ThC(bi-212) keV	ThC(Tl-208) keV
242(07.6)		239(43.1)		277(06.5)
295(18.9)		300(03.3)		
352(36.0)				
	450(01.0)			
	465(01.0)			
	509(01.2)			511(22.5)
				583(86.0)
	609(41.2)			
	666(02.3)		727(6.5)	
	703(01.0)			
	769(04.2)		785(1.1)	763(01.7)
	787(01.2)			
	787(01.2)			
	806(01.5)			
	826(01.4)			
	934(03.2)			860(12.0)

\* Numbers within brackets are the percentage abundances of gamma energies

suitable computer programme is available for spectral analysis.

Table 1 gives the uncrumbled counts due to ThB and ThC for the seven samples analysed and the ratios of the ThC/ThB on the filters. These ratios refer to the specified counting intervals after correcting for gamma abundance and detector efficiency. The ratios in the atmosphere corresponding to these values of ThB/ThC on the filter for the counting and collection periods used can be calculated using programme Radium<sup>6</sup>. The calculated atmospheric ratios are also given in table 1. In general, the ratios fall in the range of 0.4–0.8 indicating that, as for radon daughters, equilibrium is not always attained in the case of thoron daughters also. The values of the ThC/ThB ratios given here are in general agreement with the few ratios reported in the literature<sup>2</sup>. The use of these ratios in atmospheric radioactivity and health physics studies will be discussed elsewhere.

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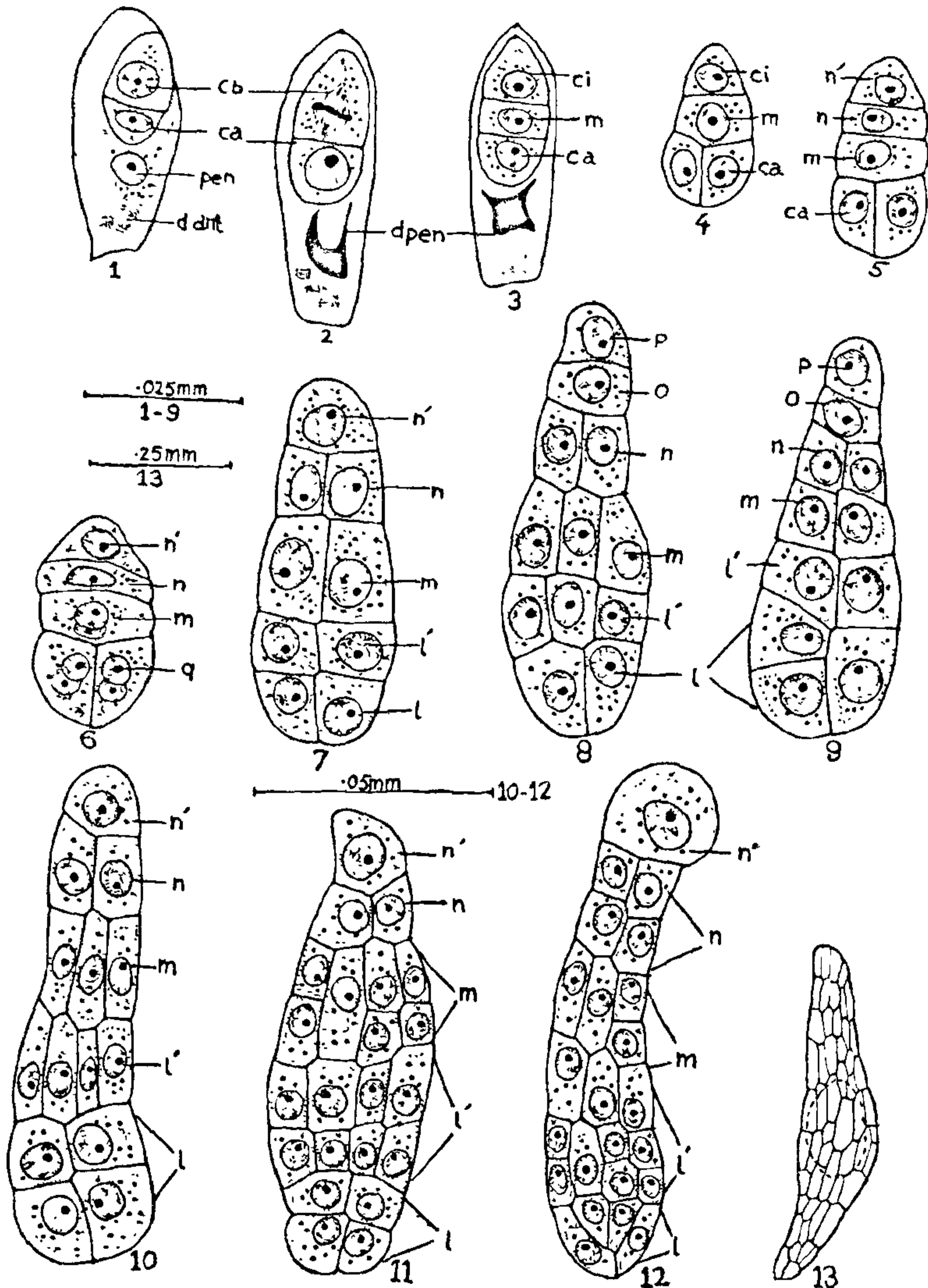
## EMBRYO DEVELOPMENT IN *GOODYERA BIFLORA* HOOK. F. (ORCHIDACEAE)

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THE family Orchidaceae with 735 genera and more than 20,000 species<sup>1</sup>, is embryologically highly interesting and the embryogeny exhibits great diversity<sup>2</sup>. Compared to the extensiveness of the family, embryological studies so far are confined only to about 60 genera and 140 species<sup>3,4</sup>. In the present note the embryogeny of *Goodyera biflora* Hook. f. is described.

The zygote divides transversely to form a terminal (ca) cell and a basal (cb) cell (figures 1, 2). The former divides longitudinally and the latter transversely to form a T-shaped, 4-celled proembryo (figures 2–5).



**Figures 1–13.** 1. Two-celled proembryo, primary endosperm nucleus and degenerated antipodals. 2. Same; basal cell in division; note degenerated primary endosperm nucleus. 3, 4. Three-celled proembryo and T-shaped proembryonal tetrad. 5, 6. Five- and 8-celled proembryos. 7. Octant stage; note the longitudinally divided *m* and *n* cells. 8–12. Later stages leading to the formation of globular proembryos. 13. Surface view of mature seed. (dant, degenerated antipodals; dpen, degenerated primary endosperm nucleus; pen, primary endosperm nucleus).

The two cells (ca) undergo another longitudinal division at right angles to the first, to give rise to a quadrant (q) the cells of which divide transversely giving rise to an octant with tiers (1) and (1') (figures 6, 7). The suspensor initial (ci) cell undergoes a transverse division forming two cells (n) and (n') (figure 6). A longitudinal division occurs in the cell (m) (figure 7). The cell (n) divides longitudinally whereas (n') swells and forms an unbranched suspensor haustorium (figures 7, 12). Sometimes n' divides transversely forming 2 or 3 cells which constitute the suspensor (figures 8, 9). Subsequent divisions are confined to tiers (1), (1'), (m) and (n) (figures 10-12) and form the mature undifferentiated embryo. The seeds are minute, extremely light and numerous. Each seed consists of an embryo which is surrounded by a transparent seed coat (figure 13).

Swamy<sup>5</sup> classified the orchid embryos into Group 'A' (Asterad type), Group 'B' (Onagrad type) and 'Cymbidium form'. In group 'A' the suspensor initial cell, middle cell and terminal cell participate in the formation of mature embryo whereas in group 'B' the suspensor cell gives rise to the suspensor while the mature embryo is organized from the derivatives of terminal and middle cells. The *Cymbidium* form is characterized by the presence of irregular divisions in the terminal and basal cells. The embryogeny of *Goodyera biflora* is unique in sharing the characteristic features of both Group 'A' and Group 'B' of Swamy<sup>4</sup>. However, keeping in view, of the greater share of terminal cell and middle cell in the organisation of mature embryo it is more appropriate to classify its embryogeny under a variation of Group 'B' (Onagrad type) of Swamy<sup>5</sup>, as it comes more close to this type. Treub<sup>6</sup> and Afzélius<sup>7</sup> reported the presence of 1-celled suspensor in *Goodyera discolor* and *G. repens*.

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## ALLANTOIN CONTENT OF CAJANUS CAJAN (L.) MILL SP. INOCULATED WITH VA-MYCORRHIZA AND RHIZOBIUM

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DUAL inoculation with *Rhizobium* and vesicular-arbuscular mycorrhiza (VAM) enhances nodulation and nitrogen fixation in legumes<sup>1,2</sup>. The nitrogen obtained through fixation or from soil in inorganic form is transported *via* xylem in plants and the principal transport compounds of nitrogen reported are nitrates, aminoacids, amides and ureides<sup>3</sup>. In pigeonpea and soybean most of the biologically fixed nitrogen is transported in the form of allantoin<sup>4,5</sup>. No information is available about the ureide content of mycorrhizal legumes. Allantoin and nitrogen content of pigeonpea, which was inoculated dually with different cultures of vesicular-arbuscular mycorrhiza (VAM) and *Rhizobium* strains, is reported here.

Three mycorrhizal cultures ( $M_1$ —Isolate No. 6;  $M_2$ —Isolate No. 2;  $M_3$ —*Glomus fasciculatum*) obtained from department of Agricultural microbiology, UAS, Bangalore and four *Rhizobium* strains ( $R_1$ —Tal 255;  $R_2$ —IHP 195;  $R_3$ —IHP 100;  $R_4$ — $F_4$ ) in all combinations were used for the experiment conducted in p-deficient alfisol (pH 5.6; 0.3 M  $NH_4F-HCl$  extractable p-2.4 mg/kg soil; total nitrogen 0.03%; indigenous mycorrhizal spore count-62/50 ml soil). The crop was raised with selfed seeds of *Cajanus cajan* (L.) Mill sp. in 30 cm diameter pots. Four replications were maintained with one plant in each pot.

### Estimation of allantoin

When the plant was 40 days old, the plant top was cut off at the collar region with a sharp blade. A rubber tube was fixed at the cut portion in such a way that the stem bleeding was collected in the tube. Total quantity