TABLE 1

Pigment contents and fixation of $^{14}CO_2$ in V. faba after herbicide treatments

Duration of Treatment	Pigment content (mg/g fr. wt.) Chl.a	Chl.b	Carotenoids	Counts/minute
Simazine				
1 hr	2.61	1.30	0.73	197
6 hr	2.42	1.17	0.71	167
2 days	2.14	1.12	0.70	107
4 days	1.91	0.97	0.68	74
Cobex				
1 hr	2.60	1.36	0.76	213
6 hr	2.56	1.36	0.72	194
2 days	2.45	1.18	0.69	171
5 days	2.11	1.01	0.66	146
2,4-D				
1 hr	2.66	1.30	0.71	198
6 hr	2.63	1.28	0.71	192
2 days	2.58	1.24	0.70	159
5 days	2.41	1.20	0.68	141
Dalapon				
1 hr	2.68	1.34	0.71	205
6 hr	2.68	1.33	0.68	202
2 days	2.64	1.30	0.68	197
5 days	2.51	1.26	0.66	170

at UCNW, for suggestions and facilities and to UGC, India for his visit to UK.

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TAPETAL DIMORPHISM IN TWO SPECIES OF *PREMNA* L.

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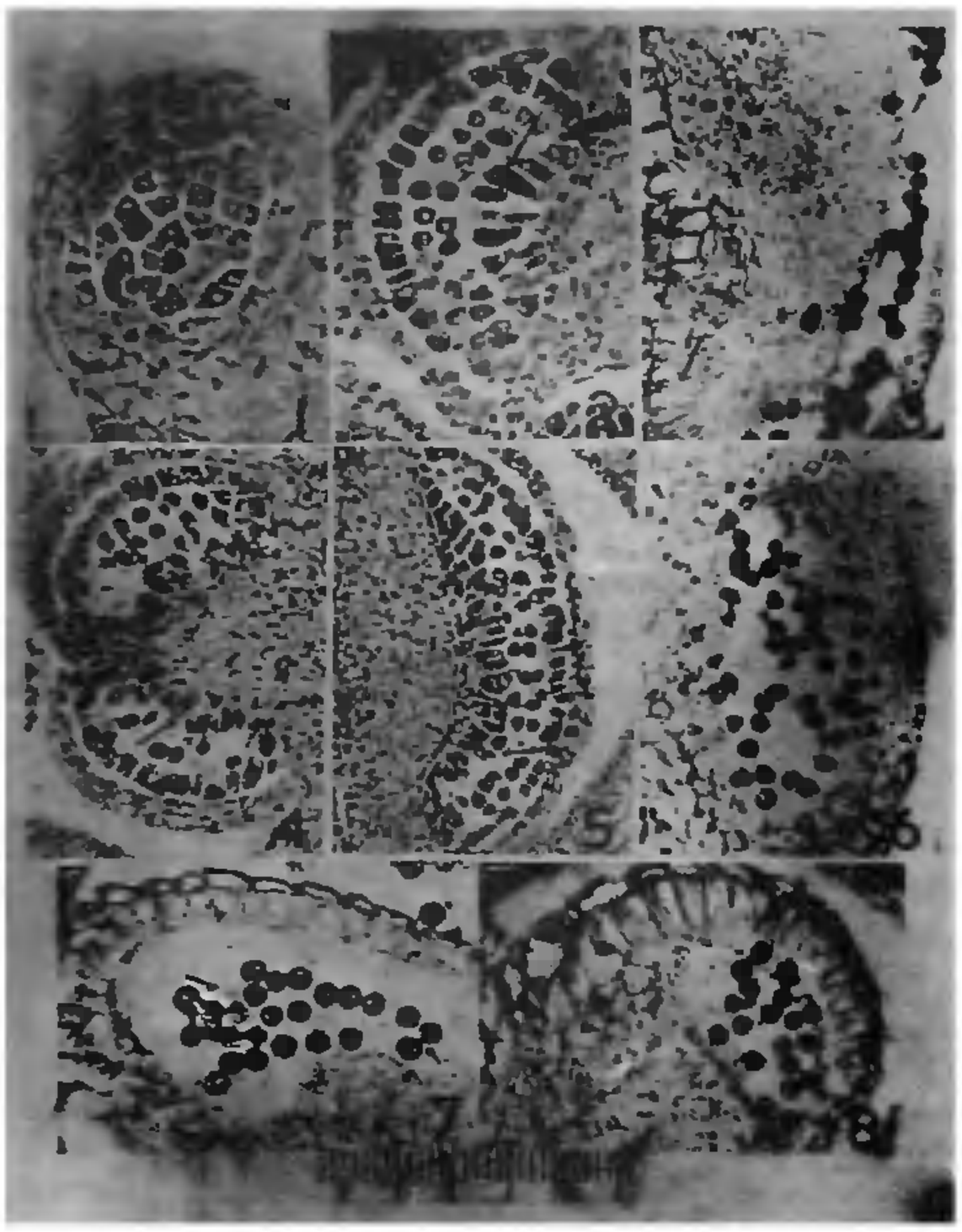
THE importance of anther tapetum as one of the embryological parameters of systematic significance is well established[1]. During the examination of the embryology of two species of *Premna* (*P. latifolia* Roxb. and *P. serratifolia* Linn.) tapetal dimorphism and *in situ* germination of pollen grains have been encountered. Since these features have not hitherto been known in the earlier embryological literature[2-7], it is desirable to describe these features along with some observations on the genesis of anther.

The anther is quadrisporangiate. The development of the anther wall from the hypodermal plate of archesporial cells, which is differentiated at the corner of each anther lobe, corresponds to the Dicot type[8]. At the microsporocyte stage, the anther lobe comprises three wall layers—the endothecium, middle layer and secretory tapetum—below the epidermis (figures 1,4 and 6). This agrees closely with that reported in *Nyctanthes arbor- tristis*[2] but stands in contrast to the one described in *Lippia nodiflora* (-*Phyla nodiflora*)[3] in which the genesis of the anther wall is referable to the Monocot type[8] and in *Avicennia officinalis*[4] in which an anther wall comprises three to five cell layers.

The cells of the middle layer of the anther wall (figures 1, 4) get stretched, crushed and finally leave no trace of them by about the time the anther matures (figures 1–8). The fibrous endothecium becomes two or three-layered toward connective side (figures 3,7,8) while on outer side its cells manifest a definite gradient both in their size and thickenings (figures 7,8).



Figures 1–3,7: *Premna latifolia* Roxb., **4–6,** B: *Premna serratifolia* Linn. Stages in anther development. **1.** T. S. anther lobe showing wall layers and sporogenous cells; **2.** L. S. anther lobe showing dimorphic tapetum and microsporocytes; **3.** L. S., part of anther lobe showing pollen grains; note the germinating pollen grains and cells of the connective developing fibrous thickenings; **4.** T. S. anther lobes showing dimorphic tapetum, uninucleate tapetal cells and microsporocytes; **5.** L. S. anther lobe showing dimorphic tapetum and crushed middle layer; **6.** T. S. anther lobe showing sterile and fertile pollen grains and degenerating tapetum; **7.** T. S. anther lobe showing mature pollen grains, germinating pollen grains, fibrous endothecial cells and some of the connective cells developing fibrous thickenings; **8.** T. S. anther lobe with pollen grains, fibrous endothecium and remnents of pollen grains (arrows indicate dimorphic tapetum, endothecial cells and germinating pollen grains).

The tapetum, which is of dual origin, being contributed by the primary parietal layer on outer side and by the connective and septal tissues along the inner side of the microsporangium, is secretary and is represented by single layer toward outer side and two to three-layered-condition toward connective side (figures 2,4,5). This observation lends additional support to the contention made by Periasamy and Swamy[13] that '... the outer tapetum of angiosperms, although physiologically homogeneous in most instances, is morphologically heterogeneous .....'. Our observation of the occurrence of dimorphic tapetum in the two species (figures 2,4,5), though known to occur in a few more taxa[9–12] of diverse affinity, has not hitherto been recorded in Verbenaceae. The inner tapetum, particularly at the connective region is organised into a two or three cells thick hemispherical plug-like structure projecting into the sporangial cavity with some of its cells elongated considerably (figures 2,4,5). Added to this the two species studied presently seem to stand apart from other embryologically known verbenaceous taxa in that the tapetal cells remain uninucleate throughout (figures 1,2,4 5) as against the earlier reports of bi-or tetranucleate tapetal cells in other members[2–7]. The observation of Patermann[7] that only in *Lantana* the individual tapetal cells and cell complexes wander in between pollen grains without organising periplasmodium has not been encountered in the present species and, therefore, needs confirmation. Tapetal cells persist uptill one-nucleate pollen grains are formed and become obliterated during further maturation of the pollen grains (figures 7,8). The presence of minute oil globules against the inner wall of endothecium in *L. nodiflora* has been reported by Maheshwari[3], but such a feature is not observed in present study.

The earlier observation of the occurrence of simultaneous cytokinesis, predominence of tetrahedral pollen tetrads, aperturate pollen grains and 2-celled pollen grains at the time of shedding could be confirmed. A low percentage (18%) of pollen sterility has been observed in *P. serratifolia* (figure 6). About 6% of the pollen grains have been discerned to germinate in the anther locule itself (figures 7,8); this feature is reported for the first time in the family.

Extensive embryological studies of several verbenaceous taxa may bring to light some more interesting features which will assist in the apprisal of interrelationships of the taxa of diverse tribes of the family.

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FORMATION OF NEGATIVELY-GEOTROPIC ROOTS IN SHOOT APEX CULTURES OF *CARTHAMUS TINCTORIUS* LINN.

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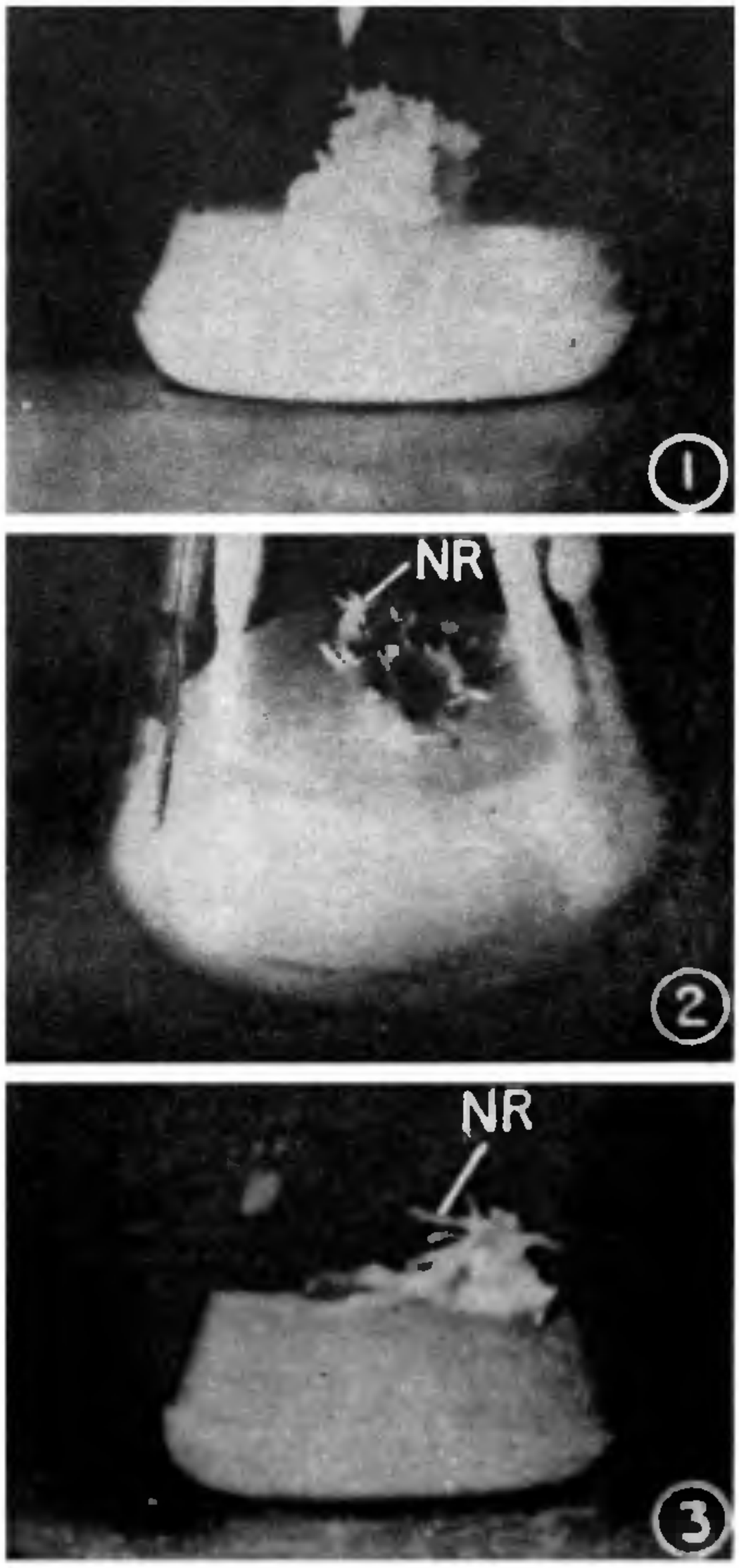
CONTROLLED differentiation and formation of shoots and roots have been reported in tissue cultures of Compositae[1-3]. In the present study negatively-geotropic roots were observed in cultures of shoot apex explants of *Carthamus tinctorius* Linn.

Shoot tips (1 cm) of *C. tinctorius* Linn. from 11-week old plants were surface-sterilized with 0.1% $HgCl_2$ solution for 10 min and washed six times in sterile double-distilled water. Meristems (0.2-2 mm) were dissected aseptically and cultured on Murashige and Skoog's (MS)[4] medium supplemented with various combinations of NAA and kinetin. The following combinations of kinetin and NAA were used in MS media (a) K (0.04 mg/l) + NAA (1.5 mg/l), (b) K (0.08 mg/l) + NAA (1.5 mg/l),(c) K (0.04 mg/l) + NAA (3 mg/l) and (d) K (0.08 mg/l) + NAA (3 mg/l). In media a, b and d



Figures 1-3. 1. Shoot apex culture on MS medium (6 weeks). + (K-0.08 mg/l and NAA-1.5 mg/l). **2.** Shoot apex culture on MS medium with (K – 0.04 mg/l and NAA 3 mg/l) showing formation of negatively geotropic roots (4 weeks). **3.** Subculture on same medium (MS + K – 0.04 mg/l and NAA – 3 mg/l) showing more negatively geotropic roots (6 weeks). (NR, Negatively geotropic roots).