(Fig. 6) in these trichomes is again due to anticlinal subdivisions of the cells of those regions in their primordial biseriate stage. In the trichomes with the Pattern IV type of structure, the primordial biseriate stage undergoes the subdivisions throughout its length and hence the wholly multiseriate structure, possessed by these trichomes, is produced (Fig. 7).

III. *The first two or more divisions of the initial anticlinal* (Fig. 12).—This is noticed among the remaining ones of the Pattern IV type of structure. The two or more anticlinal divisions that the initial undergoes results in a group of four or more juxtaposed cells. This establishes the multiseriate structure of the trichomes right at the very outset unlike in the others of this pattern as described above. Further divisions take place in various directions to complete the formation of the trichome (Fig. 8). The Terminal Glands of *Calycadenia* show a similar mode of development as described by Carlquist.[3]

It is obvious that the Pattern IV type of structure has two kinds of origin, one through the II mode of development and the other through the III, so that for the identification of the trichomes belonging to this pattern a knowledge of their mode of development is essential.

In the past several workers[1-6] have taken up the study of the phylogeny of the trichomes. They have traced their relationships according to the concept of the organic evolution 'from simple to complex', but the present studies reveal that more significant evidences in this respect can actually be derived from their structural patterns and modes of development. The author has, therefore, made a detailed study of the relationships of the trichomes in the family by taking into account evidences from the above aspects[9] and will shortly be publishing its conclusions elsewhere.

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INDUCTION OF CELL DIVISIONS IN THE MATURE ENDOSPERM OF *RICINUS COMMUNIS* DURING GERMINATION

ALTHOUGH both the zygote and the primary endosperm nucleus are products of fertilization, the former gives rise to a new plant while the latter produces a nutritive tissue. This contrasting behaviour has been ascribed, with some exceptions, to the usually triploid nature of the endosperm (for details see Maheshwari[1]). *In vitro* culture of the endosperm has been attempted by La Rue,[2] Lampton,[3] Pieczur,[4] Sternheimer,[5] Straus and LaRue,[6] Straus,[7] Norstog,[8] Tamaoki and Ullstrup,[9] and Straus.[10] In all these cases the endosperm was isolated at an early stage of development and it showed potentialities for unlimited growth but without any differentiation.

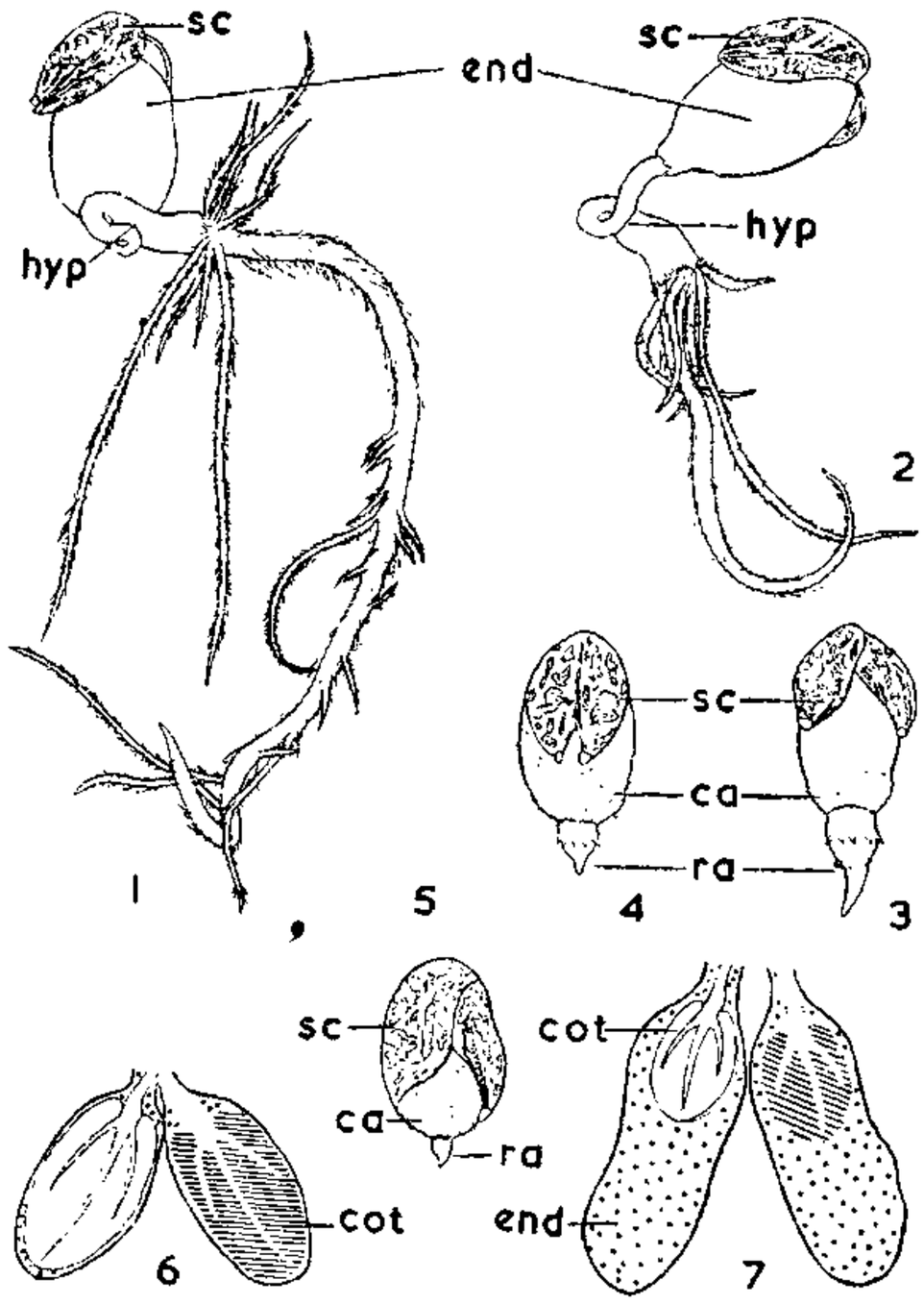
During the germination of an albuminous seed the reserve food materials stored in the endosperm are hydrolysed and made available to the growing embryo. While there is an enormous increase in the size of the endosperm cells due to absorption of water, there is practically no increase in their number.

The following report concerns an interesting observation made while studying the effect of 2, 4-D and kinetin on the germination of seeds of castor.

Twenty castor seeds of the variety TMV 1 were soaked in various concentrations of 2, 4-D and kinetin (0; 0·5; 5; 50; and 500 p.p.m. for 8 and 24 hours after pre-soaking in distilled water for 24 hours). After surface drying they were transferred to petri dishes, kept moist by cotton pads soaked in distilled water and stored under the laboratory conditions of light and temperature.

2, 4-D treatment resulted in marked inhibition of the growth of the radicle and hypocotyl at 5·0, 50·0 and 500·0 p.p.m. (Figs. 3-5). There was retardation of plumular growth at all con-

centrations of 2,4-D and in the controls (Figs. 1-5). Root growth was normal in the control seeds and those treated with 0·5 ppm. 2,4-D (Figs. 1-2).



FIGS. 1-7. Figs. 1-5. Effect of 24-hours soaking in 0, 0·5, 5·0, 50·0 and 500·0 p.p.m. of 2,4-D respectively on the germination of castor seeds. Note callusing of the endosperm and suppression of radicle in Figs. 3-5. Figs. 6-7. Relative growth of endosperm and the cotyledons in the control (Fig. 6) and kinetin (50 p.p.m.) treated seeds (split length-wise). All Figs., × 2
(*ca*, callus; *cot*, cotyledon; *end*, endosperm; *hyp*, hypocotyl; *ra*, radicle; *sc*, seed-coat.)

The endosperm showed callusing at 5·0, 50·0 and 500·0 ppm. (Figs. 3-5). Microscopic examination of the macerated endosperms (in a 1 : 1 mixture of 10% hydrochloric and 10% chromic acid) showed an increase in cell dimensions at all concentrations as compared with the controls (Table I). Although there was a decrease in cell number at 50·0 ppm. of 2,4-D, the average cell size was greater than at 5·0 p.p.m. At 500·0 p.p.m. both cell number and cell size were greatly increased. The endosperm cells showed a multi-vacuolate condition at higher concentrations of 2,4-D. The oil globules were fewer at 0·5 and 5·0 and they practically disappeared at 50·0 and 500·0 p.p.m.

Kinetin at 50·0 p.p.m. caused a more pronounced growth of the endosperm than 2,4-D. In the control seed the cotyledons (Fig. 6) gradually enlarged and used up the endosperm while in the kinetin (50·0 p.p.m. treated seeds the growth of the cotyledons was suppressed and that of the endosperm (Fig. 7) enhanced. However, the endosperm did not show callusing.

Cell counts following macerations of endosperm revealed (Table I) that at higher concentrations of kinetin (5·0 and 50·0 p.p.m.) the increase in the number of cells was also accompanied by an increase in cell size.

TABLE I

Effect of 2,4-D and kinetin on size and number of cells of endosperm of Ricinus communis
(*soaking period : 24 hours*)
7 Days' growth

Concentration (p p.m.)	2, 4-D		Kinetin	
	Number of cells per endosperm*	Average diameter of cell in microns*	Number of cells per endosperm*	Average diameter of cell in microns*
0	$8·73 \times 10^9$	72·8	$8·73 \times 10^9$	72·8
0·5	$6·85 \times 10^9$	89·7	$5·48 \times 10^9$	91·0
5·0	$8·91 \times 10^9$	114·1	$9·34 \times 10^9$	164·7
50·0	$6·42 \times 10^9$	194·5	$12·32 \times 10^9$	204·6
500·0	$10·2 \times 10^9$	345·0	..	..

* Average of 20 counts.

Thus the mature and differentiated cells of the endosperm can be brought to active proliferation by the application of growth-promoting substances. The reason why the capacity for proliferation of the endosperm is inhibited under normal conditions may be due to the action of some substances secreted by the embryo. This inhibition is perhaps overcome by the special growth adjuvants.

The work suggests a technique for raising an actively growing endosperm tissue for morphogenetic and biochemical investigations.

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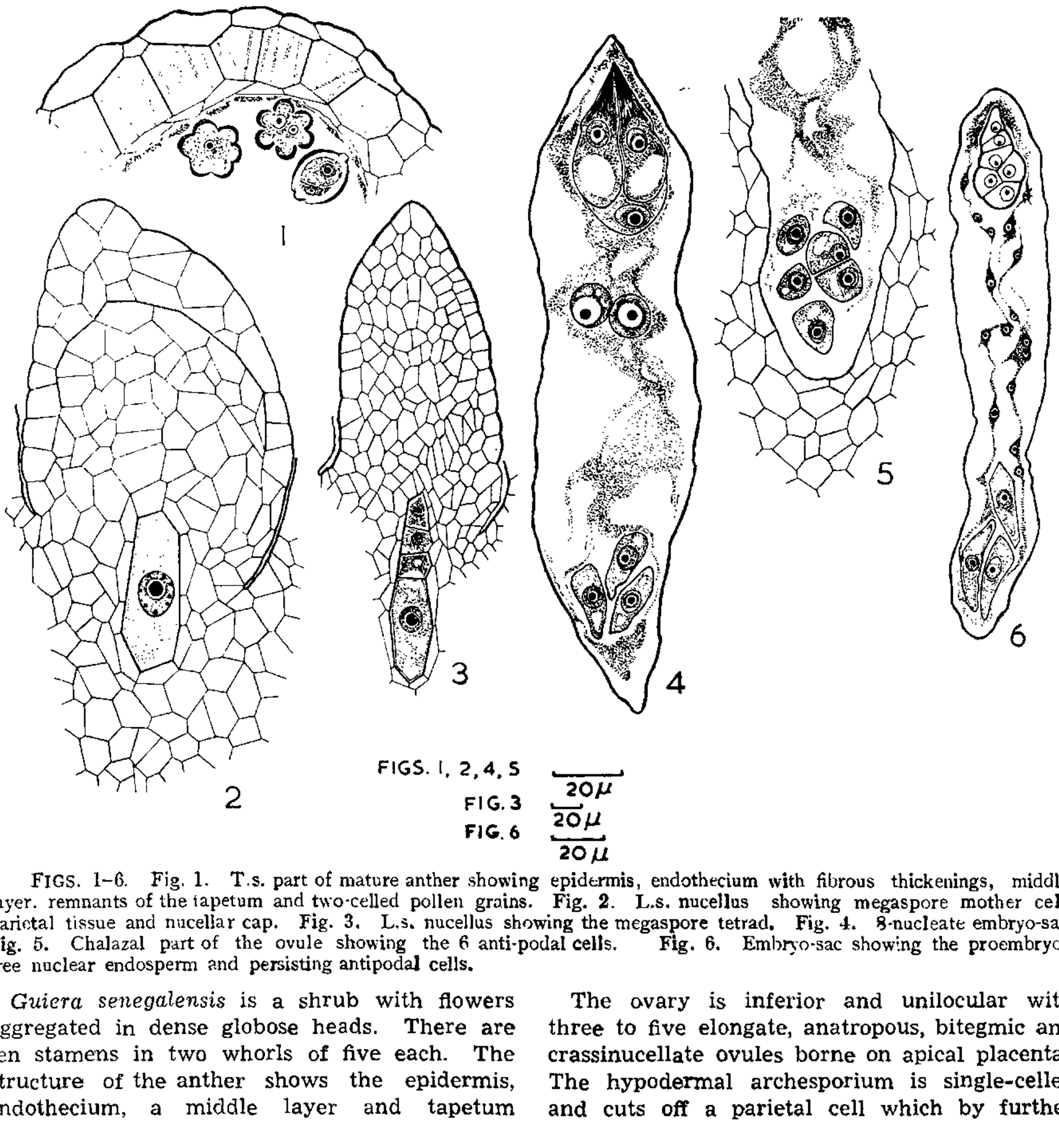
SOME EMBRYOLOGICAL OBSERVATIONS OF *GUIERA SENEGALENSIS* LAM.

As far as known, the African genus *Guiera*, belonging to the Combretaceæ, has not been embryologically investigated. Hence the present study of *Guiera senegalensis* Lam., is undertaken.



FIGS. 1, 2, 4, 5 — 20μ
FIG. 3 — 20μ
FIG. 6 — 20μ

FIGS. 1–6. Fig. 1. T.s. part of mature anther showing epidermis, endothecium with fibrous thickenings, middle layer, remnants of the tapetum and two-celled pollen grains. Fig. 2. L.s. nucellus showing megaspore mother cell, parietal tissue and nucellar cap. Fig. 3. L.s. nucellus showing the megaspore tetrad. Fig. 4. 8-nucleate embryo-sac. Fig. 5. Chalazal part of the ovule showing the 6 anti-podal cells. Fig. 6. Embryo-sac showing the proembryo free nuclear endosperm and persisting antipodal cells.

Guiera senegalensis is a shrub with flowers aggregated in dense globose heads. There are ten stamens in two whorls of five each. The structure of the anther shows the epidermis, endothecium, a middle layer and tapetum of the secretory type with two-nucleate cells surrounding the rather extensive sporogenous tissue. The pollen mother cells divide in a simultaneous manner. Cytokinesis takes place by furrowing. The pollen tetrads are mostly of the tetrahedral type. The pollen grains, which are shed at the 2-celled stage, are ridged and furrowed and triporate. In the mature anther the epidermal cells become greatly stretched and flattened while the cells of the endothecium become radially elongated and develop the usual fibrous thickenings (Fig. 1).

The ovary is inferior and unilocular with three to five elongate, anatropous, bitegmic and crassinucellate ovules borne on apical placentæ. The hypodermal archesporium is single-celled and cuts off a parietal cell which by further