

FIG. 2. Interference of manganese at 350 mµ.

TABLE III
Cerium content in different matrices of the marine environment off Tarapur Coast

No.	Sample	Cerium content ppm
1	Sea-water	.. 1.0×10^{-3}
2	Sea-water	.. 0.8×10^{-3}
3	<i>Arius</i> sp. (Cat-fish)	.. 0.20
4	<i>Pseudosciaena dicanthus</i> (Ghol)	.. 0.38
5	<i>Pampus</i> sp. (Pomfret)	.. 0.38
6	<i>Panulirus polyphagus</i> (Lobster)	.. 0.32
7	<i>Aplysia</i> sp. (Sea-hare)	.. 0.40
8*	HCl leaches of sediment	.. 21.00
9*	EDTA leaches of sediment	.. 18.20
10*	Amm. cit. leaches of sediment	.. 21.00
11*	Amm. acet. leaches of sediment	.. 5.20

* Average of four samples. Biological samples are expressed on wet weight basis whereas sediment samples are expressed on dry weight basis.

Some of the general conclusions that can be drawn out of this work are :

- (i) The biological species accumulate large amounts of cerium,
- (ii) there is a large amount of labile cerium associated with sediments, and
- (iii) since EDTA and ammonium citrate are known to form strong complexes with rare-earths, similar values obtained for HCl, EDTA and ammonium citrate leaches is understandable.

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MORPHOLOGY OF THE SHAGGY GLANDS OF *CLEOME VISCOSA* L.

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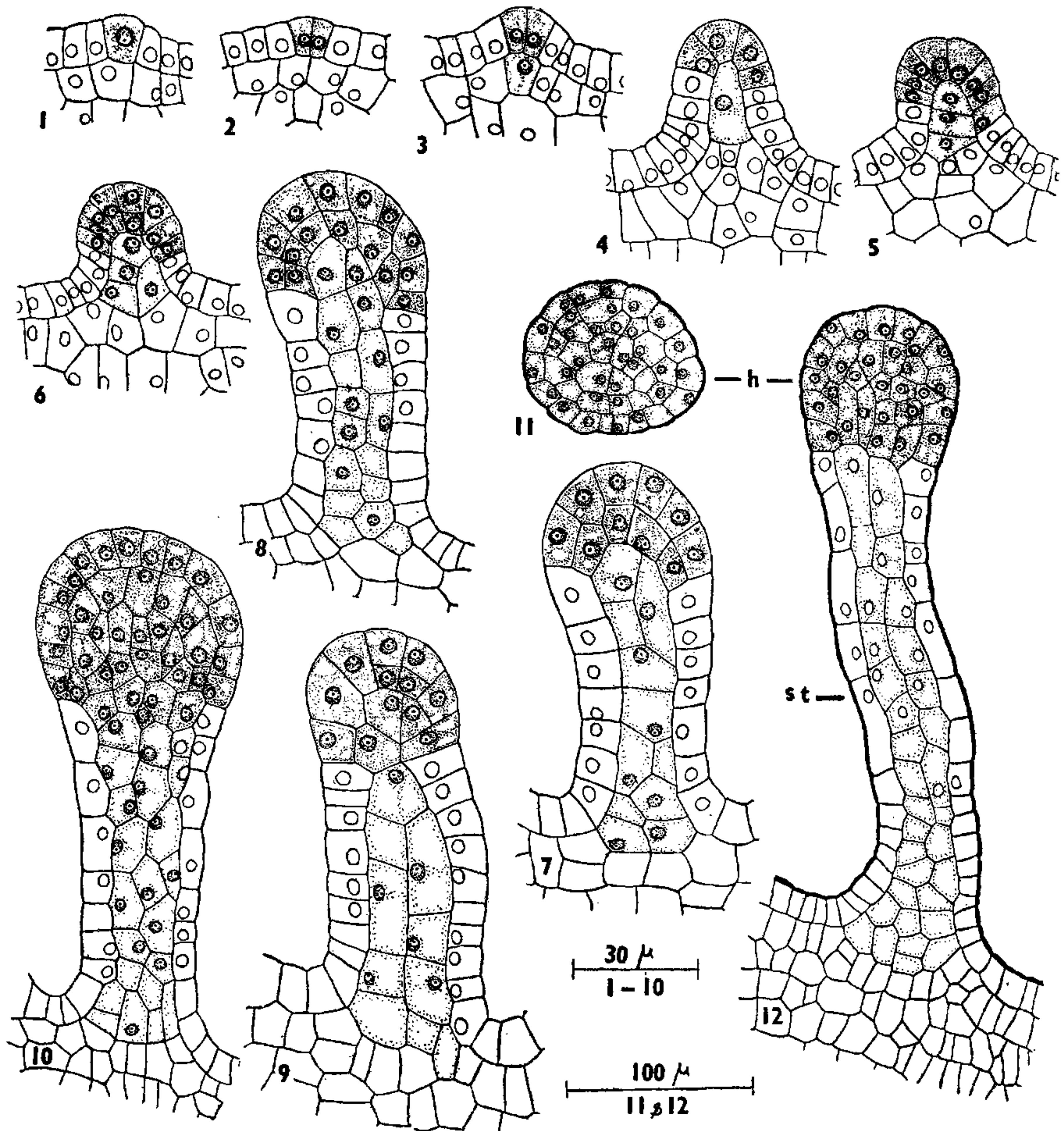
THOUGH plant hairs are well known for their taxonomic importance, a sustained use of these structures at all taxonomic levels has so far not come into practice. This is due to the fact that neither do we have authentic information about the total number of their types nor distribution in the vascular plants. Resume of mature trichome types occurring in

the different dicot families and several monocot groups have been given by Solereder⁰ and others,^{1,2,10-12} but one doubts if these could be taken as such, for typification in trichomes, particularly in the shaggy hairs, without a knowledge of their ontogeny, is not feasible. In a series of papers,³⁻⁷ the first author has earlier dealt with the structure, development,

and principles of classification of trichomes of the Compositæ and suggested that trichomes of vascular plants in general may be similarly classified so that they could be utilised as an effective taxonomic tool.

Study of the mature trichomes is being pursued under our current project 'Flora of Hyderabad',⁸ since this enables us to come into contact with a cross-section of angiosperms.

Ontogenetic studies are being undertaken



FIGS. 1-12. *Cleome viscosa* L. From L.S. developing ovary. For details of explanation see text. (st = stalk; h = head.)

In view of the above, in this laboratory, studies have been initiated to gain authentic information about mature trichome types on one hand and about their ontogeny, particularly of the shaggy hairs, on the other.

separately, of which the results of our findings on the shaggy glands of *Cleome viscosa* L. are communicated through this paper.

The shaggy glands are multiseriate and consist of a stalk and a head, of which the

latter is secretory in nature (Fig. 12). They are 50–1000 μ in length and 25–100 μ in diameter and borne by the stem, leaf (on both the surfaces; absent on the veins towards the upper side), sepal (lower surface) and ovary. The largest forms are frequent on the stem and pedicel.

Right from the beginning, the two parts of the gland, the head and the stalk show their development from two independent sources. The head is initiated from a single protodermal cell (Fig. 1), while the stalk from both sub-protodermal and protodermal initials subtending the initial of the head (Figs. 3 and 4). The head initial is conspicuous by its larger size and dense cytoplasm (Fig. 1). First it divides longitudinally into two (Fig. 2); then the dyads divide again in the same manner (Fig. 3) but at right angle to the previous partition so that a tetrad of four juxtaposed cells is produced. This is recognised due to the fact that this stage is represented by two cells in consequent sections. The quadrants also again divide and redivide but anticlinally, as a result of which the head now appears many-celled in median sections (Figs. 4 and 5). By this time, it becomes raised above the rest of the epidermis due to development of the subtending emergence tissue (details given below). In further development the head cells divide periclinally and then in other planes (Figs. 6–10). Consequently it attains its characteristic hemispherical form, 5–6-celled in height (Figs. 10 and 12) and 6–8-celled in breadth (Figs. 11 and 12). The cells become increasingly denser and secretory.

The stalk differentiates along with the head, remaining distinctive until about maturation, whereupon the two appear relatively less delimited. The first sign of the stalk development is indicated by an enlarged cell subtending the head when the latter is 4-celled (Fig. 3). The stalk cell is conspicuous by its large size and dense contents, though relatively less so as compared to the overlying head cells. Soon it enlarges and multiplies through transverse and other divisions due to which the gland as a whole appears like a small protuberance. By this stage the protodermal cells subtending the head also start dividing anticlinally as

indicated from the recently formed cells characterised by narrow diameter seen in Figs. 4–6. It is, however, difficult to recognise as to how many tiers of the protodermal cells participate in contributing to the formation of the epidermis of the stalk. Further development of the stalk follows the same course as before, but the ground cells undergo more longitudinal divisions due to which it becomes 4–6-celled in breadth (Fig. 12.) Finally the cells of both the epidermis and the ground tissue of the stalk mature through vacuolation and axial elongation (Fig. 12).

From the ontogeny it is obvious that the shaggy glands of *Cleome viscosa* are composite structures and not mere hairy appendages as has been considered in the past.^{1–9} The head is suggestive to be a trichome as it is derived from a single protoderm initial, whereas the stalk an emergence for it is produced from a primordium consisting of protodermal and sub-protodermal elements. Ramayya⁶ has previously shown the occurrence of similar structures in several other plants. Since the initial of the trichome part undergoes more than one anticlinical division at the outset, according to the trichome classification proposed by Ramayya⁴ it can be assigned to the P-multi-seriate trichome system.

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