

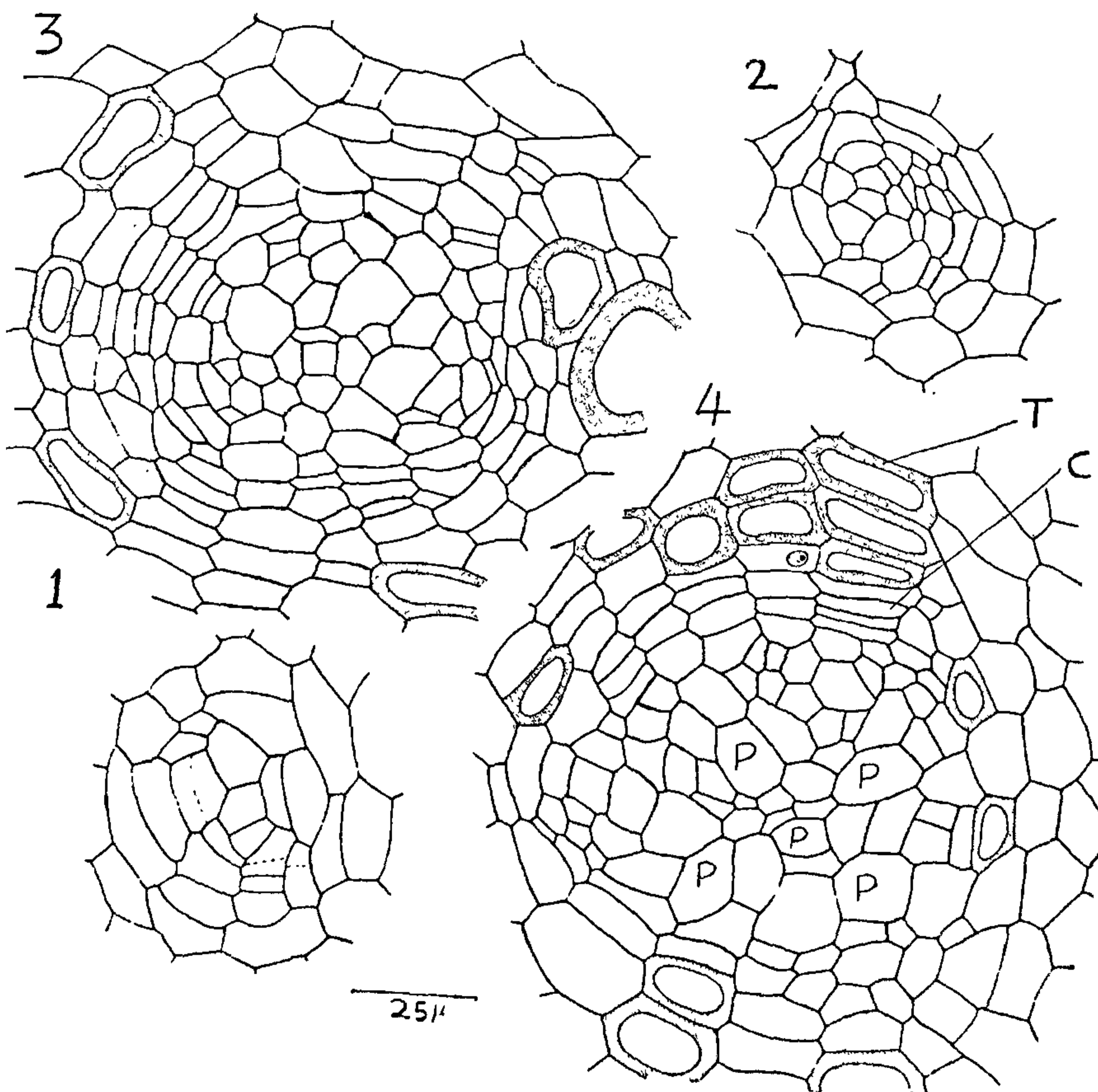
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VASCULAR NODULES IN THE STEM GALLS OF *COCCINIA INDICA*

VASCULAR nodules analogous to those normally observed in callus obtained through tissue culture are encountered

in the stem galls of *Coccinia indica* caused by the dipteran insect, *Neolasioptera cephalandrae*. These nodular islets are embedded in the reaction parenchyma of the galls. Since the occurrence of vascular nodules has not yet been reported in insect galls¹, the present contribution is made.

The larval entry causes the hypertrophy of the ground parenchyma of the stem that results in the galling. One to few cells of the reaction parenchyma form the initials for the nodules. These cells acquire deep cytoplasmic contents and divide in a periclinal or obliquely periclinal plane to result in a nest of cells (Fig. 1). To start with cell division is not followed by cell enlargement and so the cells derived are of much smaller in volume than their initial. After these initial divi-



FIGS. 1-4. Successive stages in the ontogeny of the vascular nodule. (C—Cumbiform layers; P—Phloem; T—Tracheary elements.)

sions the meristematism is gradually restricted to the cell layers that are cambiform in transverse sections (Figs. 2-4). Cells inner to these regularly arranged layers as well as those that are derived from them on the inside differentiate as phloem while the outer derivatives mature *in situ* as tracheary elements. Thus, each nodule consists of a centrally located phloem, a few cambiform layers and the tracheary cells that surround them. The tracheary elements are very short, mostly perforate and are comparable in pitting and wall ornamentations to those normally encountered in the secondary xylem. The authors have made sure that bits of original procambial or cambial tissues are not involved in the organisation of these nodules.



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FIGS. 5-6. Fig. 5. A portion of the transection of the gall showing the topography of the nodules. Fig. 6. A single nodule enlarged showing phloem cells (P) and Tracheids (T).

Gautheret² has summarized the available information on the vascular nodules (developed from callus cells) obtained in tissue cultures. He has recognized three types of nodules based on the relative disposition of xylem and phloem. In the first type the tissues are collateral, in the second, the phloem is surrounded by xylem and in the third, the xylem is enclosed by phloem. The vascular nodules present in *Coccinia* galls belong to the second category.

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DUAL ROLE OF THE TAPETUM

THE role of tapetum in the development of pollen grains has been established beyond doubt¹. Little attention has been paid towards understanding the mode of endothecial development and its role in inducing male sterility. The present study has been undertaken to obtain the detailed information about the development of endothecium in male fertile plants and comparing it with their genic, cytoplasmic, gene-cytoplasmic and chemically induced male-sterile lines of *Allium cepa* L., *Beta vulgaris* L., *Capsicum annuum* L., *Cucumis melo* L., *Cucurbita maxima* Duch., *Datura alba* L., *Ranunculus ruricatus* L., *Sesamum indicum* L. and *Triticum aestivum* L.

Endothecium is single-layered in the anthers of all the above-mentioned plants except *Sesamum indicum* where it becomes two layered at places. In the anthers of male fertile lines of these plants, the endothecial cells remain thin-walled and small from the time of their differentiation up to the early vacuolate microspore stage. During subsequent stages, these cells elongate radially and at late vacuolate pollen stage their enlargement reaches a peak. The characteristic fibrous thickenings appear on the radial walls of these cells (Fig. 1). This is accompanied by the degeneration of tapetal protoplast and by the time the thickenings develop within the endothecial cells, the tapetal protoplasts disintegrate completely.

These observations support the hypothesis that a product from the tapetum inhibits endothecial development of the anther and only after complete tapetal disintegration, inhibitor production ceases to occur and renders the normal development of endothecium possible².

This is also supported by the present observations on genic, cytoplasmic and gene-cytoplasmic male-sterile plants. The development of endothecium in most of the anthers of these sterile plants is completely inhibited (Figs. 2, 3). In such anthers, the tapetum does not show the usual cataclysmic mode of development, but instead, shows diverse forms of abnormal behaviour³. It seems that the malfunctioning tapeta in the anthers of these male-sterile plants fail to provide nutrition to the developing microspores and consequently render them sterile. On the other hand, these tapeta continue to produce the inhibitor substance that checks the development of endothecium and finally makes the anther indehiscent. This is further supported by the fact that in a few anthers of CMS *Allium cepa* and *Capsicum annuum*, the endothecium develops normally but only after tapetum has degenerated completely (Fig. 4).

The programmed control of endothecium development by tapetum is further confirmed by the present findings on chemically treated plants. In certain

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