Stamens and Carpels within the ovary of **Durio zibethinus.** Murr.

by

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Introduction

During embryological investigations of the *Durian* plant (*Durio zibethinus*) some abnormal ovaries were seen to have stamens and carpels developing inside the ovary. These abnormal ovaries had normal ovules developing, and in the central region of the ovary, superfluous carpels as well as stamens were in different stages of development.

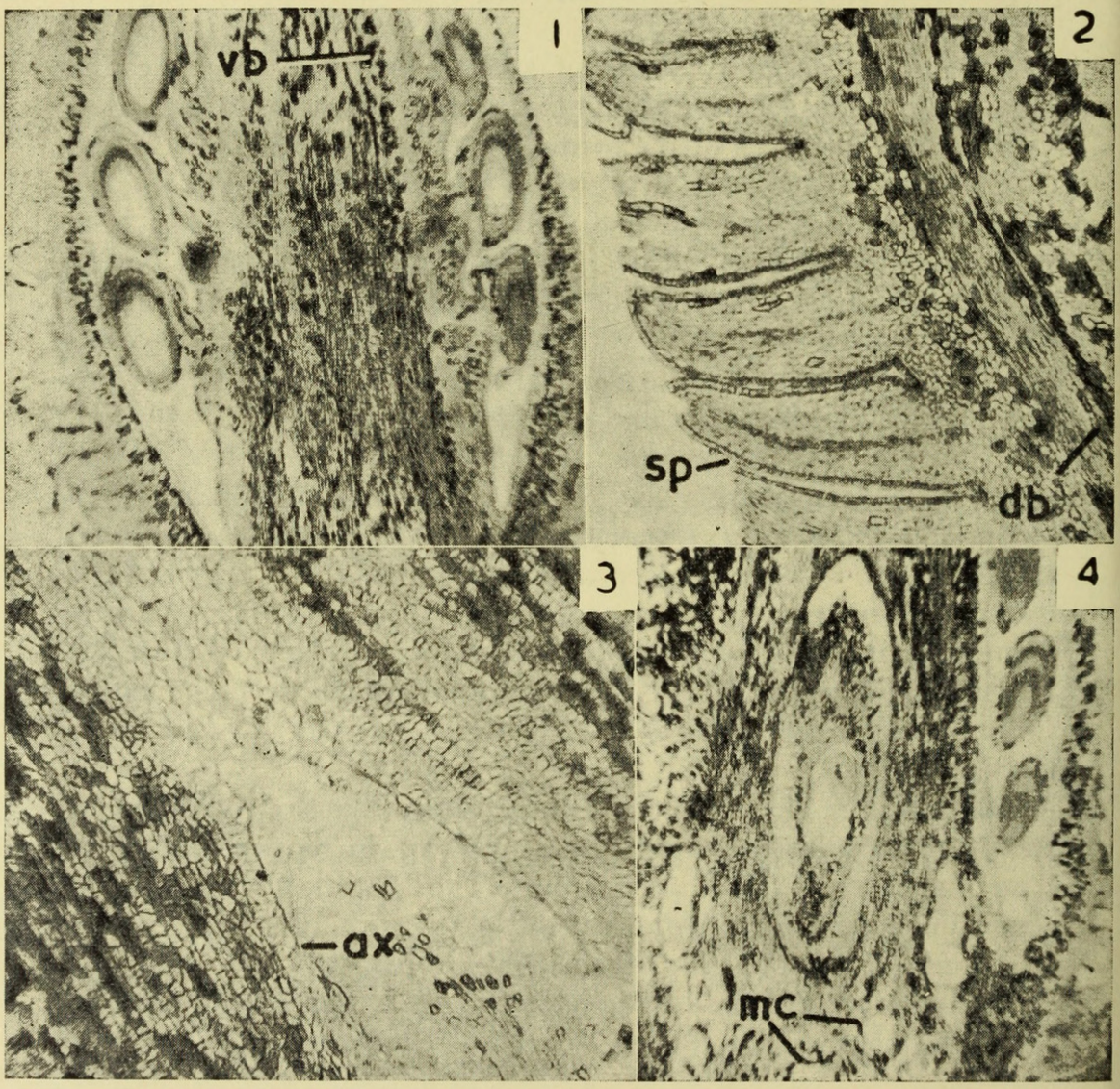
Previous recorded accounts of such a kind are very few and that too mostly in the family Cruciferae. Masters (1869) describes a few instances of the formation of adventitions flowers and fruits within the ovary. In *Cheiranthus cheirii* (Cruciferae) the development of a small silique within the normal ovary has been illustrated (Masters, p. 182). This small silique developed on the placenta amidst the other ovules. In *Baeckia diosmaefolia* (Myrtaceae) formation of stamens within the cavity of the inferior ovary has been recorded. These abnormal stamens, replaced the ovules and had distinct filaments and anther lobes (Masters, p. 184, Fig. 98). Worsdell (1916) recorded the development of anthers on the inner carpellary margin in *Tulipa gesneriana* (Liliaceae). In *Alamanda grandiflora* (Apocynaceae), Kausik (1938) reported the formation of an elongated axis (gynophore) that replaced the ovary, carrying two leaf-like carpels on its distal end. These carpels formed open ovaries, with ovules present on their adaxial surfaces. Recently Hulbary *et al* (1957) have described the development of flowers within the ovary of *Raphanus sativus* (Cruciferae — Radish).

Young and mature flower buds in different stages of development were collected from Durian plants, growing in Singapore Orchid Gardens, Mandai Road, Singapore. The material was fixed in formalin-acetic-alcohol. After removing a portion of the ovary wall they were dehydrated and embedded in paraffin. Long sections of ovaries were prepared and stained to study the development of female gametophyte and seed.

Observations

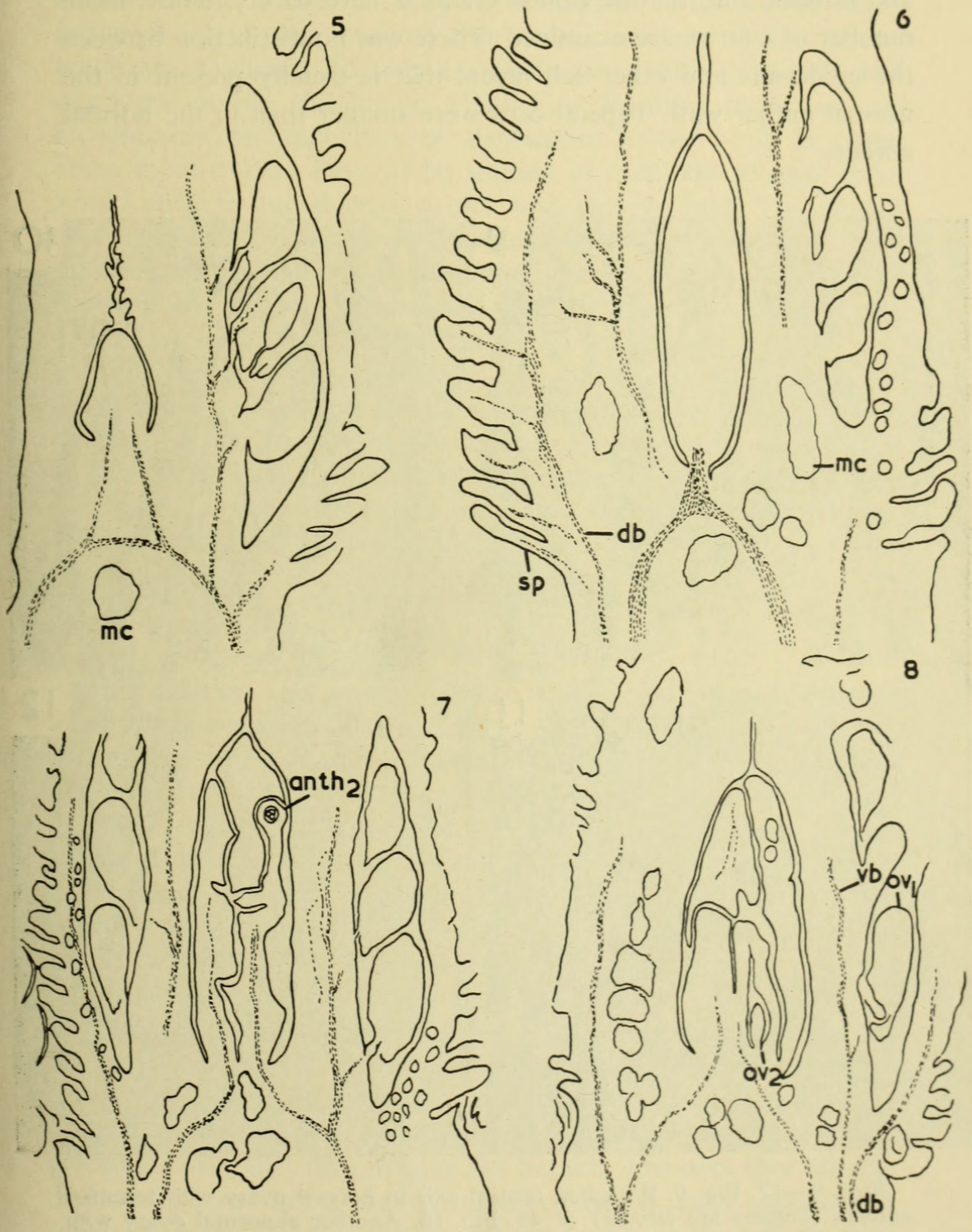
The normal ovary in *D. zibethinus* consists of 5–6 carpels, syncarpous, with axile placentae that produce 1–4, bitegmic, crassinucellate ovules in each locule. In the median long section of the

normal ovary two locules are present on either side of the central placental tissue (Fig. 1). Mucilaginous canals and tannin filled cells are very common in the ovary wall, placental tissues and receptacle. Normally there is no space, or cavity in the central placental tissue, and cells in the receptacle as well as in placentae are compactly arranged (Fig. 1). Vascular strands that enter the ovary, branch in the receptacular region, forming dorsal and ventral bundles of the carpels. The dorsal bundle vascularises the ovary wall and produces a number of lateral branches that enter the spine primordia (Figs. 1, 2, 6). The ventral bundles continue in the central placental region and vascularise the ovules with funicular strands.



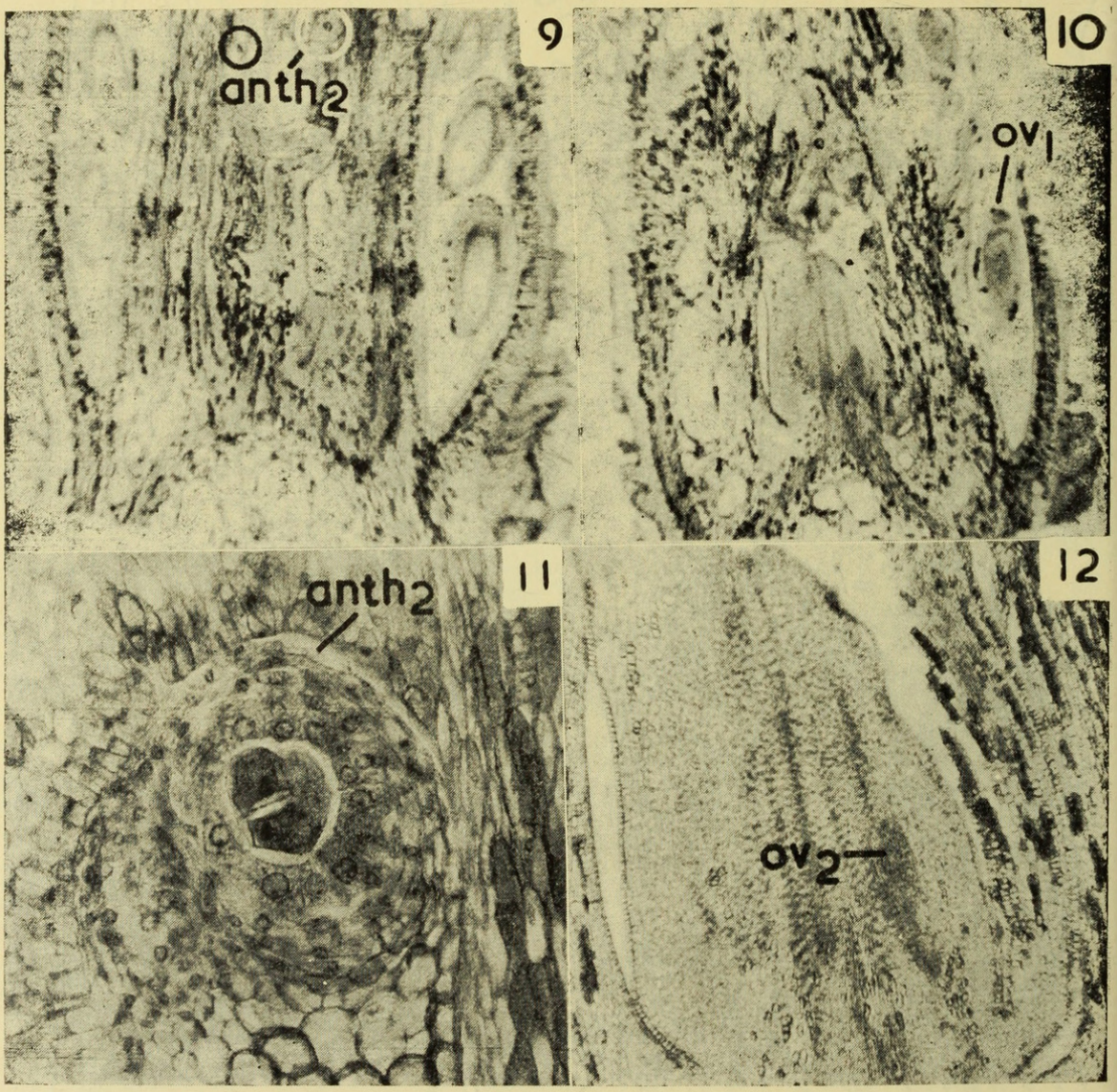
Figs. 1—4. Fig 1. Median L.S. of normal ovary. Note the absence of a central cavity × 51. Fig. 2. A portion of the ovary wall enlarged showing spine primordia and their vasculature × 140. Fig. 3. Central region of an abnormal ovary with the conical axis × 140. Fig. 4. Abnormal ovary with an elongated axis × 56. (ax, central axis; db, dorsal bundle; mc, mucilaginous canal; sp, spine primordia; vb, ventral bundle).

In some of the abnormal ovaries, the cells of the receptacular tissue, show cambial activity. Usually such ovaries can be distinguished from the normal ones, by the presence of a central cavity in the placental tissue (Figs. 5, 8). Cells situated below this cavity are meristematic, and as a result of their division, a small axis is organized (Figs. 3, 5). This axis may elongate and remain without further development (Figs. 4, 6). In some other abnormal ovaries the central axis branches either once or twice,



Figs. 5—8. Outline drawings of the ovaries of Figs. 3, 4, 9 and 10 respectively, showing vasculature and the arrangement of different parts × 22. (anth2, superfluous anther; db, dorsal bundle; mc, mucilaginous canal; ov1, normal ovule; ov2, ovule in superfluous ovary sp, spine primordium; vb, ventral bundle).

carrying the anthers at their tips, recalling the condition of stamen fascicles in normal flowers (Figs. 7, 9). Both transverse as well as long sections of anther lobes were observed. The wall of such anther lobes appear to be normal, with epidermis, middle layers, and uni-binucleate secretory tapetum (Fig. 11). In most of the anther sections, pollen mother cells or rounded uninucleate pollen grains were present. Whether the latter are the products of meiosis and develop into mature pollen grains is hard to say, unless more number of ovaries are examined. There was no distinction between the epidermis and other cell layers that is usually present in the normal anther wall. Tapetal cells were smaller than in the normal anthers.



Figs. 9—12. Fig. 9. Branched central axis in normal ovary with terminal anthers (anthers are circled) × 48. Fig. 10. Another abnormal ovary with superfluous ovary and anthers × 49. Fig. 11. T.S. of superfluous anther enlarged from Fig. 9 showing the anther wall and pollen mother cells × 640. Fig. 12. Superfluous ovary enlarged with the ovule primordia × 180. (anth2, superfluous anther, ov1, normal ovule, ov2, ovule in superfluous ovary).

In some of the other abnormal ovaries, both stamens and carpels had developed (Figs. 8, 12). In such instances, the carpels occupy the central region of the inner cavity, and on either side of them the branched stamens were present. Structure of these anthers was the same as described previously. The carpel initials originate in the same way, as the normal carpels, and show a tendency towards the organization of a second ovary (Figs. 8, 10, 12). The upper region of the second ovary is somewhat flat without any style or stigma. Unlike the normal carpels, the carpels of the second ovary are made up of comparatively thin walled cells and devoid of any mucilaginous canals. In only two instances ovular primordia had developed inside the locule (Fig. 12). Further, there was no recognizable archesporium or megaspore mother cell in them. Some more ovaries have to be studied to conclude whether these would develop into mature ovules with embryo sacs. The growth and formation of superfluous stamens and carpels did not upset the normal development of ovules (Figs. 9, 10). The superfluous stamens and carpels are vascularised by the extensions of the ventral bundles of the normal carpels (Figs. 5—8).

From the external appearance it is difficult to distinguish the abnormal ovaries. Many of them were teased under a dissecting microscope and in a few, the intracarpellary structures appeared as small papillae. More than 120 ovaries were dissected. The frequency of their occurrence was approximately in 5% of the ovaries examined. However, the presence of a central axis was more common in more than 30% of the ovaries studied.

Summary and Conclusions

Two different and extreme points of view have been expressed about the significance of teratological phenomena in plants (Arber, 1931). According to some botanists the teratological examples do not contribute any valid information towards the understanding of phylogeny and classification. Others regard the teratological structures as atavistic and use the data to explain the phylogeny and interrelationships of certain taxa. Views of several botanists of the last century and of the early part of this century have been summarized (Masters, 1869; Worsdell, 1916).

Normally, in *Durian* flower, the floral meristem becomes indistinguishable after the organization of carpels, as it usually happens in other flowers. But in some cases, the floral meristem resumes its activity after the formation of regular floral parts; this meristematic activity leads to the formation of a central axis inside the placental tissue that may or may not branch. The ones that branch, divide twice or thrice, the terminals of which carry anthers. In some others the carpels as well as stamens are organised, the former occupying a central position, and stamens being present outside the carpels. All these are vascularised by extensions of ventral bundles. It is interesting to note that only the stamens and/or

carpels are formed, and at least in the cases observed so far, there was no trace of sepal or petal development. The important difference between the present and previous cases reported is, in *Durian* the stamens and carpels develop as superfluous structures, not replacing either ovules or carpels as in *Baeckia*, *Raphanus* or *Alamanda* (Masters, 1869, Hulbary *et al*, 1957, & Kausik, 1938). The formation of a regular axis recalls the condition reported in *Alamanda*.

The present case of abnormality in *Durian* ovary is considered as an anomalous floral structure, because of the small number of such incidences. An examination of a large number of ovaries may help us to understand the regularity of such an occurrence, which may also throw some light on the evolutionary advancement of *Durian* flower.

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