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Investigations of some Floral Vascular Systems
with particular reference to
Interpretations Involved in the Gonophyll Theory

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PROLOGUE

Throughout the history of Plant Science, the Angiosperm flower has provided botanists with one of their most intriguing structural entities. The number of theories which have been advanced to account for the origin of the flower and for the nature of its component appendages are multitudinous and in large part unproven. In 1960 the British botanist Melville propounded a new theory, the Gonophyll theory, and this has excited considerable interest among floral morphologists. The basic tenets of Melville's interpretation were based on the course taken by vascular bundles, and in an arena still bedevilled by conflicting opinion, the lucid presentation of the Gonophyll theory carried some conviction.

The present writer was at the time pursuing an interest in the development of the patterns displayed by vascular tissue in vegetative shoots and did in fact demonstrate an instance in which there was considerable change in vascular pattern during the period of primary trace development (Skipworth 1962). In addition, Tepfer (1953) had reported an instance where some alteration in vasculature of a fertile shoot did take place during the time between anthesis and fruit maturity. From these two reports emanated the suspicion that when they first appear, the strands comprising the vascular system of flowers may not display the relationships apparent at floral maturity.

The aims of the present inquiry therefore became twofold.

1. An appraisal of some of Melville's observations and if necessary a reevaluation of his theory.
2. The testing of a hypothesis that vascular

systems of flowers are not the same as those revealed during floral ontogeny.

Clearly a critique of the Gonophyll theory might become especially pertinent if changes in vascular pattern prior to anthesis could be demonstrated.

It appeared clear that these aims could most satisfactorily be attained if the inquiry were based on the apocarpous flowers of the Ranales. This group contains the families from which Melville had procured much of his basic information, and the apparent simplicity of the flowers suggested that they might also be an appropriate group in which to investigate early stages of vascular development.

The Magnoliaceae, the family whose members possess flowers which were interpreted by Melville as providing a link with the gymnospermous Gnetum became an obvious starting point. From here the inquiry led to Gnetum itself and to the Winteraceae, an Angiosperm family usually supposed to be related to the Magnoliaceae but to be even more primitive. Magnoliaceous flowers possess a cortical vascular system, a feature not unknown elsewhere but conspicuously and very regularly developed in the vegetative stem in another family suspected of Magnoliaceous affinity, the Calycanthaceae. Floral vasculature of this family was therefore investigated.

Another of the cornerstones of the Gonophyll theory was provided by flowers of the Ranunculaceae, the two carpel types in the family, achene and follicle, being held by Melville to be of quite different origin. The ancestry of these was moreover viewed as involving sequences quite different from those envisaged by the vast majority of theorists. Because Melville used these two basic entities as building blocks for various types of syncarpous gynoecia, the more positive establishment

of their identity seemed of paramount importance in any critique of his theory.

Despite the attention that over the years has been focussed on certain of the taxa involved in the present inquiry, there are many intrinsically interesting features which have not been accounted for in the literature. Where the investigation of these did not involve a substantial digression from the main course of the project - as for example the phyllotaxis of floral phyllomes which might be expected in any case to have a bearing on final conclusions - their description has been included in the text.

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