A Study of the Growth of Axillary Buds in Angiosperms

A Dissertation Presented in Partial Fulfilment of the Requirements for the Degree of Master of Science in Botany at Massey University

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1991

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Abstract

A description of the growth of axillary buds in the period before bud break was made in a number of angiosperms. This entailed a study of the growth of buds at representative locations in a plant as well as at different stages in the plant's growth. A number of different patterns of axillary bud development were found to exist. A way of assessing the significance of the differences between patterns was found. This involved comparing the observations with the theoretical possibilities which existed. A loose classification of the patterns was then constructed using the theoretical possibilities as a basis. An analysis of the data for each species was carried out to see if a cause for the **cessation** of bud growth could be determined. This analysis pointed towards the existence, in a large number of species, of a correlation between growth in an axillary bud and growth in surrounding tissues, particularly the expanding subtending leaf. One species - *Salix fragilis* - was chosen as the subject for a particularly detailed analysis. A clear correlation was established between growth in an axillary bud and growth in the stem in the immediate vicinity of the bud as well as in its subtending leaf. A number of experiments aimed at finding out the nature of a correlation between growth in an axillary bud and its subtending leaf were carried out with this species. These demonstrated that removal of a subtending leaf at an early stage in its growth had a significant depressing effect on axillary bud growth. This depressing effect was most pronounced during the period of most rapid growth in the axillary bud and its subtending leaf.

The data from the general survey of over thirty plant species and the experiments with *Salix fragilis* seem to support the notion that the process of axillary bud growth - as opposed to that of lateral shoot outgrowth **from** axillary buds - is affected more by conditions within the growing stem than by influences exerted by the stem apex.

The author gratefully acknowledges the guidance and support of Professor R.G.Thomas. Appreciation is also expressed to Ed Minot for his guidance with statistical analysis, Dr R.E. Rowland for his help with histoautoradiography and the other members of staff and fellow students in the Department of Botany and Zoology who have assisted with this study.

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CHAPTER 1

Introduction

Growth in all but the simplest of plants depends on their ability to form branching structures. Branches can originate when the stem apex itself divides, as it does in lower vascular plants such as *Psilotum*, *Lycopodium* and *Selaginella* (Esau 1965), or from the outgrowth of lateral buds, laid down on the main shoot distal to the apex. These lateral buds are most frequently subtended by a leaf. In some ferns with dorsiventral rhizomes they seem to arise without reference to leaves, but it is more common for them to originate from or near to the adaxial side of a leaf base or rhachis (Esau 1965). The bulbils of *Lycopodium selago* occupy the sites where leaves are normally found (Cutter 1966).

In seed plants lateral buds - when present - are usually found in an axillary position, in other words on the stem just above the point of insertion of the leaf. Lateral buds are generally present in the axils of most leaves except those in the lower regions of annual shoots of some gymnosperms (Foster and Gifford 1974). In a few instances they are found in other than axillary positions - in species of *Nymphaea* and *Nuphar* occasional buds occur in what are normally leaf sites (Cutter 1965). Lateral buds in a number of species are associated more closely with the leaf above than the leaf below - the early slow growth of a tiller bud in the Gramineae involves the making of vascular connections with the leaf immediately above the bud. The later, exponential growth phase starts some time after the establishment of the vascular connection (Fletcher and Dale 1973; Sharman 1945).

In angiosperms, lateral buds are usually formed slightly later than subtending leaf primordia, commonly when such leaves are in their second or third plastochrone (Esau 1965). But in some species buds form much later by dedifferentiation of already vacuolated cells or from small pockets of meristematic cells - called **detached meristems** - which have become isolated from the apical meristem by differentiation of intervening tissues (Cutter 1971). Bud primordia may also arise adventitiously from various organs and tissues in the plant. Such a pattern is found in *Musa*: the earliest vascular connection of the lateral bud in this species is made, as in the grasses, with the trace of the next leaf above (Barker and Steward 1962). However, the lateral buds in the aforementioned cases are at least located in axillary positions. Indeed, lateral buds in angiosperms are usually referred to as **axillary buds**.