Floral Development in Pohutukawa

John Clemens; Lekha Sreekantan, Robert Henriod and Paula Jameson,
Institute of Molecular BioSciences, Massey University, Palmerston North

Introduction

Selections of New Zealand *Metrosideros* make beautiful tub specimens and cut flowers, as well as garden plants. We have been working on a number of projects related to the horticultural development of these floricultural products. Topics studied include the acceleration and maturation in young plants rejuvenated by micropropagation (Clemens et al., 1999a), a description of flower initiation and development in the field (Clemens et al., 1999b), controlling flowering in cultivation (Henriod et al., 2000), and prolonging the life of flowers.

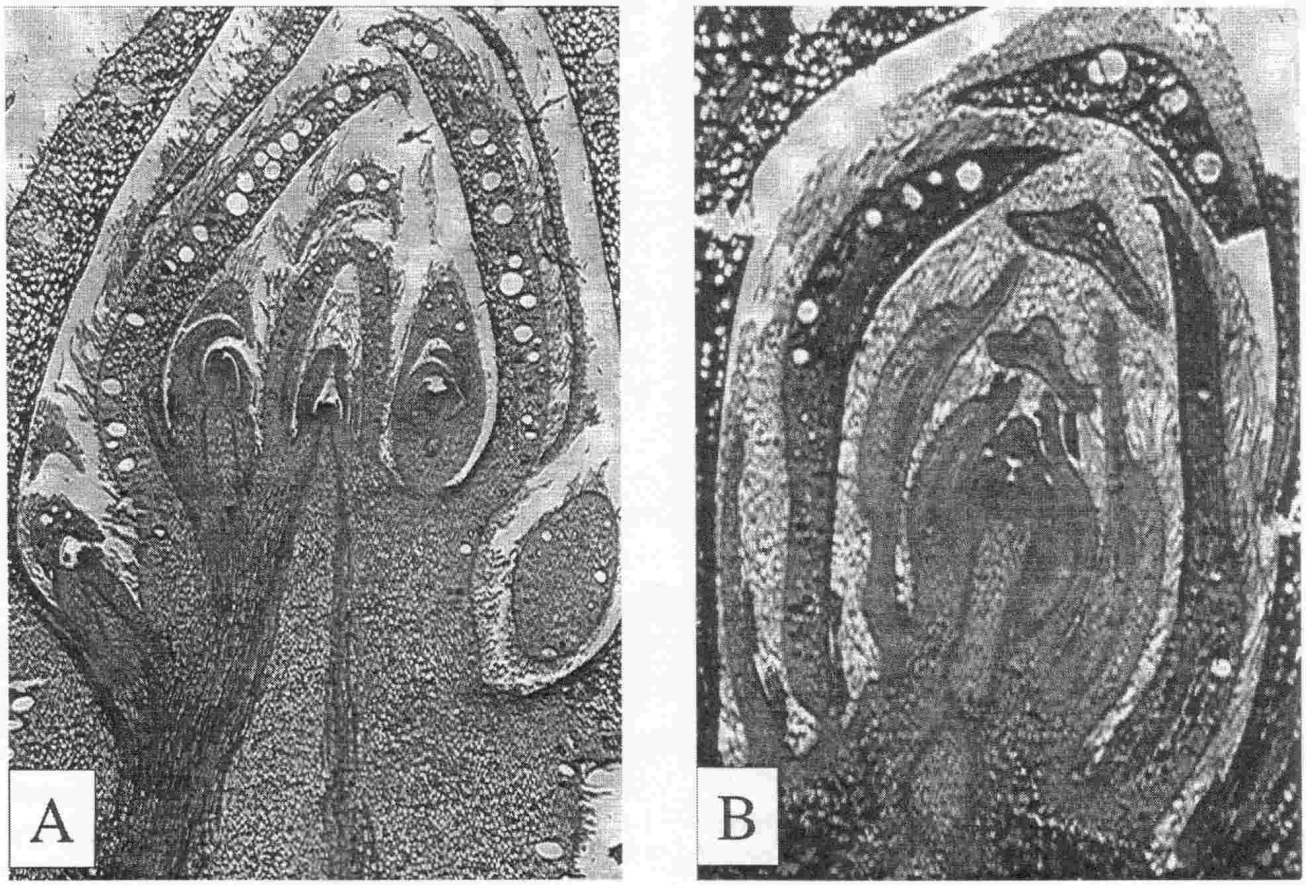
In this paper we outline progress on two of these topics, describing the microscopic changes taking place in vegetative and floral buds of pohutukawa *(M. excelsa)* as they develop in garden plants over winter, and how flowering in container plants can be manipulated by temperature and daylength signals.

The birth of pohutukawa flowers

Our first objective was to describe when and how the flowers are first formed in the buds of pohutukawa before they break in spring. We wanted to gain an insight into how environmental factors, such as temperature and daylength, might affect floral initiation and the development of flowers. With this information we hoped to be able to have some control over flowering in plants grown in the nursery.

The pohutukawa flower buds we see breaking in spring each have 1~7 pairs of fully developed three-flowered cymules, which are borne on a compressed shoot. The cymules arise from the axillary buds of this shoot or inflorescence, and each is protected by a bud scale or bract, rather than a leaf. So when are these cymules formed in the bud scale axils? To answer that question, we needed to study the pohutukawa buds through the preceding autumn and winter.

Fig. 1
Microscopic images of Metrosideros excelsa buds in August showing (A) a floral bud with cymule development in bud scale axils, and (B) a vegetative bud with leaf formation by apical meristem and little axillary development. Magnification l0x.



A pohutukawa bud is extremely and microscopically hairy; and the apical meristem at the heart of the bud is protected by numerous pairs of scales. The inside of the bud desiccates very quickly once the scales are cut away, making them impossible to study with a conventional dissecting microscope. We quickly moved to a protocol that enabled us to preserve the buds so that they could be sectioned and stained before microscopic study.

The earliest evidence of floral primordia was seen as a swelling of the axillary meristems in May. These continue to swell through June and July, but it is not until August that distinct cymule development occurs (Figure 1A). Between that time and bud break, further development of floral organs occurs. Therefore, floral bud initiation is evident 1-2 months after the period when daylength decreases at its fastest rate at the autumn equinox. The apical meristems of buds that are going to break in spring as vegetative shoots, produce leaves during winter, and no swelling comparable to that seen in floral buds occurs in the leaf axils (Figure 1B).

Flowering pohutukawa in containers

By studying plants in the field under natural conditions, we believed that a shortening daylength was the key environmental factor leading to floral development. We did not know at that stage whether the lowered temperature that buds experience in winter was important for subsequent flowering. To answer this question, we grew pohutukawa plants over winter in greenhouses that were artificially heated, or had daylength artificially extended. As expected, plants grown under long days did not flower well; they did not flower at all if they were kept warm over winter while receiving long days. Plants flowered when allowed to grow under short daylengths, and flowering was better when the plants were allowed to experience cool winter temperatures.

Conclusion

With these pieces of information we are drafting a protocol for the control of flowering in pohutukawa, paving the way for their development as flowering pot plants that can be produced to schedule. Since then we have extended our knowledge of the light environment required to enhance flowering. We have also tested ways of accelerating or slowing flowering by modifying the temperature regime in which the plants are grown after bud break. There are numerous *Metrosideros*. We are progressing our research with several *M. excelsa* cultivars, including *M. excelsa* cv. Vibrance, and with those from other parts of the Pacific.

References

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