Inhibition imposed by developing flowers on further flower-bud initiation in *Chamelaucium uncinatum* Schau.

Ruth Shillo, Amram Weiner and Abraham H. Halevy
Department of Ornamental Horticulture, Hebrew University, P.O.B. 12, Rehovot 76100, Israel

**Abstract.** In *Chamelaucium uncinatum*, an Australian woody perennial, flower initiation ceases under continuous inductive short-day (SD) conditions after the first flowering flush. The developing flowers were found to be the prime cause of the cessation in flower initiation. Removal of flowering shoots or flowers as soon as the buds appeared resulted in continuous flower formation. Pruning the plants below the young flower buds at the same stage also caused increased flower formation at the tips of the new growth. If pruning was delayed until flower buds were approx. 3 mm in diameter, however, nor further flower initiation took place and the plants, although still under inductive conditions, shifted to vegetative growth. The inhibiting factor is translocated from one branch to another. At least a six-week “rest” period (a vegetative growth period under long-day conditions) is needed before the plants are able to respond to further SD stimuli.

**Key words:** *Chamelaucium* – Flowering (inhibition) – Photoperiod.

**Introduction**

Flower initiation in perennial woody plants is normally limited to a certain percentage of the buds. Most buds remain vegetative, and only a fraction of existing active meristems form flowers at any given time (see book by Bernier et al. 1981, vol. II, pp. 4–5). This limited production of flowers occurs under conditions apparently favorable for initiation. The percentage of flowers which are initiated from activated meristems varies and is affected by genetic factors and environmental conditions (for reviews see Jackson and Sweet 1972; Kramer and Kozlowski 1979, pp. 114–162).

The Geraldton Wax Flower (*Chamelaucium uncinatum* Schau., Myrtaceae) is an evergreen native to Western Australia. The plant may reach 2–3 m when grown outdoors. Native and cultivated plants possess many woody branches growing from the base of the plant. Potted plants are propagated from shoot-tip cuttings and are normally pruned to produce one main stem on which lateral woody branches develop. These main branches undergo branching in turn, producing soft axillary shoots, which may bear flowers under suitable conditions (Fig. 1). For a simple terminology we will designate the lateral woody branches as “branches” and their soft, short axillary shoots as “shoots”. Flowers are borne on these current-year shoots in the axils of leaves. They develop concurrently with the growth of the current branches. The terminal buds of the shoots always remain vegetative (Shillo 1984; Weiner 1981). Flower initiation is induced by short days (SD) and promoted by moderate temperatures. Under Israeli conditions (latitude 30–32° N) flowers appear from early November until the end of December, when flower initiation ceases, although inductive conditions still prevail. At the time flower initiation ceases, the flower buds already formed are at different stages of development, the proximal ones being further developed than the distal ones.

In winter, low temperature (5–8° C at night) often causes cessation of extension growth of an outdoor crop. Thus the flowering branches resemble terminal cymes. If, however, the plants are grown indoors at a higher temperature (12–18° C) under continuous SD, growth continues while the axillary buds cease producing flowering shoots and change to vegetative growth. We therefore as-
assumed that the cessation of flower initiation in *Chamelaucium*, while inductive environmental conditions prevail, might be caused by internal factors, and studied the inhibition of flower initiation imposed by the concurrently developing flower buds.

### Materials and methods

Three cultivars of *C. uncinatum* which were selected from native plants were used. They differed slightly from each other in flower color and growth habit. When the plants were grown outdoors in their natural season, flowering time varied for each cultivar in the following order: “Early Vista”, “Purple Pride”, “Late Vista”. However, at the optimum temperature of 24/16 °C (day/night), they bloomed simultaneously.

Plants for the experiments were produced as described in the Introduction for “potted plants” and grown in 10- or 15-cm pots, in a peat:vermiculite (1:1, v/v) medium, using normal commercial watering and feeding practices. The experiments were carried out in a fiberglass greenhouse which transmitted 40% of the sunlight (14-28 mW cm⁻², winter and summer, respectively), at a temperature range of 14-35 °C.

At the vegetative phase, care was taken to maintain the plants under long-day (LD) conditions with either natural LD in summer (13.5-15 h), or by supplementary light from incandescent lamps (approx. 50 μW cm⁻²) applied as a 4-h night break, during winter. At the reproductive phase, plants were maintained under SD conditions, with either natural SD (10-12 h) in winter, or by shortening the natural day to 8 h with black curtains in summer. Young, recently rooted plants were used without pruning back, and were shaped according to the experimental treatments as detailed with the results. When plants over one year old were used they were pruned to about half their size (approx. 25 cm) before imposing the experimental treatments.

Flowering shoots or flowering buds were removed three times a week. Details of specific experimental procedures are presented with the results.

### Experiments and results

1. **Removal of flowering shoots or flowering buds.** Ten-month-old, vegetative plants of the cultivar Early Vista were pruned on June 16, and were grown under natural LD conditions for three weeks. On July 7, the plants were exposed to SDs (8-h light in a temperature-controlled greenhouse, at 24/16 °C, day/night).

   The first flowering shoots appeared on August 1, i.e. after approximately three weeks of SD. At that time, the plants were divided into two lots: one remained in SD, the second was transferred to LD. In each lot there were three sublots: 1) control, 2) removal of flower buds, 3) removal of flowering shoots (deshooting). The flower buds were removed when their pedicels had elongated to 5-10 mm. At this time the bud diameter was 0.5-1.0 mm. The deshooting was carried out as soon as flower buds appeared. These procedures were carried out on all shoots of a plant. Data were taken from two representative branches of each plant, possessing normally eight to ten branches.

   Flower initiation was affected by daylength, bud removal and shoot removal (Table 1). In LD, control plants stopped producing new flowering shoots immediately after they were transferred from SD to LD. Bud removal or shoot removal treatments extended initiation for a few more days. In SD, control plants continued to initiate flower buds for seven weeks and then stopped doing so. In the two other treatments, shoot removal and bud removal, flower initiation continued for 3.5 months, at which time the experiment was terminated. During this 3.5-month period, 40 flowering shoots were produced per branch by the plants which received the deshooting treatment. The removal of individual flower buds caused both the development of new flowers on the existing flowering shoots and the initiation of new flowering shoots at the ends of the branches. The number of new flowering shoots produced was much less than that with the deshooting treatment. However,