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Growth Regulation of New Clones of *Rotheca myricoides* 'Ugandensis' (syn. *Clerodendrum ugandense*)

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Summary

The occurrence of position effects, i.e. topophysis, was tested for two new clones (29 and 112) of *Rotheca myricoides* (Hochst.) Steane & Mabb. 'Ugandensis' (syn. *Clerodendrum ugandense* Prain). The position from which cuttings are taken from of the mother plant can affect the later vegetative and generative development of the plants, e.g. partly reduce their extensive longitudinal growth. Three different kinds of cuttings were used during propagation in two sets of experiments: tip cuttings of vegetative branches, stem cuttings of vegetative branches and stem cuttings of generative branches. Their height, branching and flowering development was assessed in periodic intervals over a period of four months.

Compared to 112, clone 29 displayed a significantly reduced longitudinal growth and a significantly better rate of branching was displayed. Furthermore, the results for the vegetative tip cuttings of both clones showed a significant decrease in height (6–10 cm) compared to the stem cuttings from vegetative branches combined with an increase in branching (1–2.5 branches) compared to both other types of cuttings. Apart from choosing the appropriate clone, using vegetative tip cuttings can therefore be a partly effective method to reduce the extensive height and improve the branching during commercial production of *Rotheca myricoides* 'Ugandensis'. With regard to flowering, no significant differences between the two clones and the three types of cuttings were found in the statistical analysis.

Key words. new floricultural crops – position effects – topophysis – propagation – type of cutting – genotypic differences

Introduction

Despite its attractive flower colour and shape, the 'butterfly bush' *Clerodendrum ugandense* Prain is only grown on a small scale in Europe as a pot or a container plant. Previously belonging to *Verbenaceae*, new molecular biology evidence by Steane et al. (1997, 1999) now includes this species in *Lamiaceae*. It has been renamed *Rotheca myricoides* (Hochst.) Steane & Mabb. 'Ugandensis' (Steane and Mabberley 1998; Mabberley 2000).

Main problems for the grower of this relatively new floricultural crop are its lack of branching and its too intensive longitudinal growth. The breeding efforts of the Institute of Ornamental Plant Breeding of the Federal Centre for Breeding Research on Cultivated Plants (BAZ) in Ahrensburg, Germany, resulted in five new clones of *Rotheca myricoides* 'Ugandensis' which showed an improved branching compared to the two parent genotypes (Preil et al. 2001). These new clones, numbered 29, 56, 79, 85 and 112, have been jointly tested for their commercial value by different research institutions within Germany during the last years.

One of the factors investigated was whether position effects occur during propagation of this species, and specifically while propagating these new clones. The type of cutting, i.e. the kind and amount of plant hormones which it contains (e.g. auxins, giberellins), is known to vary within the branch of a plant and to influence the rooting success as well as the future growth and flowering in some plant species, e.g. in *Euphorbia pulcherrima* (Hentig 1996) or *Coffea arabica* (Hartmann et al. 2002). Knowledge about these effects, also termed 'topophysis', could lead to an at least partly effective method to reduce the longitudinal growth of a plant, i.e. the amount of growth regulators needed within commercial production. Therefore, the objective of this research was to examine the influence of three different types of cuttings on the following three characteristics of future plant growth: height, branching and flowering of two of the mentioned new clones.

Materials and Methods

Plant material

Preliminary experiments in 2001 and 2002 resulted in the unanimous exclusion by all participating research institutions of two of the five clones (56 and 79) because they lacked adequate growing properties (Oschek 2003). Our institute also excluded clone 85, due to its high sen-

sitiveness to wetness and cold during further experiments. The two remaining clones (29 and 112) were subjected to two sets of trials, one during summer 2003 and one in winter 2003/2004.

Types of cuttings

Three different types of cuttings were used for the experiments. They were taken from mother stock plants of both clones which were one to one and a half years old and were cut as follows:
- tip cuttings of vegetative branches
- soft to medium soft stem cuttings from first to fourth leaf pair of vegetative branches
- soft to medium soft stem cuttings from first to fourth leaf pair of generative branches

The cuttings were rooted during a period of four weeks at 24 °C. Well rooted cuttings were each then planted in a 12 cm-pot and subsequently grown at 20 °C for about four months during which data collection took place. No trimming or application of growth regulators was done during that period. The plants grown in winter were given additional light with SON-T lamps at a rate of 104 µmol m^{-2} s^{-1} for nine hours a day (6 a.m. to 10 a.m. and 3 p.m. to 8 p.m.).

Plant characteristics

Height of the plants was measured in centimetres from the growing medium surface to the end of the longest branch of the plant. Branching data was collected by counting all the branches of a plant longer then 3 cm. Height and branching were assessed every four weeks.

Flowering was evaluated by counting lateral branchlets of the panicles present on the plants without differentiating between branchlets carrying only flowers, flower buds or both. Data collection for this characteristic took place every two weeks. This shorter time period compared to the two other characteristics determined in four week intervals gave more accurate results, as at higher temperatures – especially during the summer – a quick opening and fading of flowers can be observed.

Statistical analysis

The experiments with the two crossed factors clone and type of cutting were arranged in a completely randomised design with 30 to 60 plants (depending on the rooting success) for each clone / type of cutting combination. Statistical analysis of data with the programme Statgraphics Plus version 4.1 was performed using analysis of variance followed by Tukey's multiple range test in order to compare the means where statistical differences ($P<0.05$) were detected. If an analysis of variance was impossible, alternative statistical methods (t-test, test of Nemenyi and Dunn) were chosen to evaluate the collected data.

Results and Discussion

Despite additional light for the plants of the winter batch, they only reached 25–30 % of the height, 25–50 % the amount of branches and 15–30 % the amount of panicle branchlets compared to the plants of the summer batch. Growing this crop during Central European winter months does not seem profitable, as the quality of the plants was poor. The following presentation and discussion of the obtained results will therefore focus on the results of the collected data from the plants of the summer batch. For the most part, the differences within the results for the winter batch were similar to the differences within the results displayed by the summer experiment, although the results of the summer batch showed more significant differences between clones and types of cuttings.

Plant height

Evaluation of data for the plant height during the summer trial is shown in Fig. 1. The obvious differences between clones and also the different types of cuttings were confirmed in the Tukey's multiple range test of the data of the last date. Plants of clone 29 were significantly smaller than plants of clone 112, so that a genotypic difference between the two clones could be determined.

In addition, significant differences in height were shown between the stem cuttings from vegetative branches and the two other types of cuttings, which were significantly smaller within both clones. Topophysis effects similar to those described by HARTMANN et al. (2002) and HENTIG (1996) can be assumed from these results as plants raised from tip cuttings stay smaller than those from stem cuttings. In the stem cuttings from generative branches seems to inhibit this extended longitudinal growth is inhibited compared to plants raised from stem cuttings from vegetative branches. Overall, these findings could lead to a partly effective method for reducing the height of the plants within commercial production.

Plant branching

Results of the data collected for the factor branching are shown in Fig. 2. As for the plant height, the statistical analysis of the data of the last measurement showed significant differences between the two clones as well as between the types of cuttings. Except for the comparison of

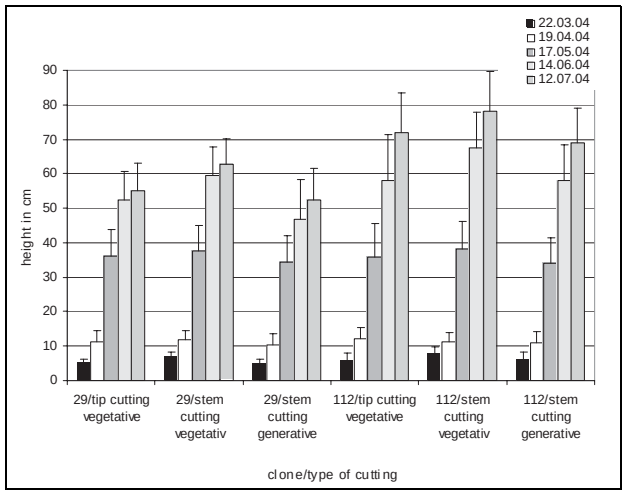


Fig. 1. Height means in cm and their standard deviations (summer batch) of the clones 29 and 112 of *Rotheca myricoides* 'Ugandensis'.

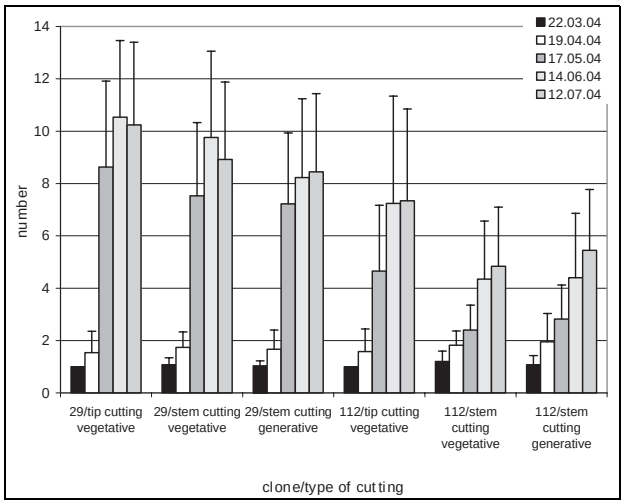


Fig. 2. Means of the number of branches and their standard deviations (summer batch) of the clones 29 and 112 of *Rotheca myricoides* 'Ugandensis'.

29 / stem cutting generative and 112 / tip cutting vegetative, which do not show a significant difference, plants originating in all other types of cuttings of clone 29 branch significantly better than those of clone 112. This may again result from a genotypic difference between the clones.

Furthermore, the tip cuttings of both clones branched significantly better than both types of stem cuttings. Again, topophysis can be inferred from these results which confirm previous findings of our institute (OSCHEK 2003). Besides the fact that clone 29 shows a genotypic advantage over clone 112, vegetative tip cuttings are to be preferred when an increase in branching and a reduced height is desired during commercial production.

Plant flowering

No significant differences were detected either between the two clones or between the three different types of cuttings (data not shown). Consequently, no position effect can be deduced from the results of this factor. The average amount of panicle branchlets per plant was 25 at the end of the experiment in the summer batch. The only difference was that plants of clone 29 generally started flowering a bit earlier and were slightly more floriferous than the plants of clone 112, but these differences were not significant.

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