Statens Forsøgsvirksomhed i Plantekultur **1232. beretning**

Statens Væksthusforsøg, Virum (V. Aa. Hallig)

The influence of low temperature on flowering of *Beloperone, Crossandra, Jacobinia* and *Mackaya*

Indflydelsen af lav temperatur på blomstringen hos Beloperone, Crossandra, Jacobinia *og* Mackaya

O. Voigt Christensen

Abstract

In contrast to the situation in *Aphelandra squarrosa,* low temperatures did not induce or advance flowering at low light intensities in the following four members of the Acanthaceae family: *Beloperone guttata, Crossandra infundibuliformis, Jacobinia carnea,* and *Mackaya bella.* In *Crossandra* photoperiods of 8 and 16 hours caused no difference in the time of flowering at any temperature.

Resumé

I modsætning til *Aphelandra squarrosa* kan lav temperatur hverken inducere eller fremme blomstringen ved lav lysintensitet hos følgende fire planter, der tilhører Acanthaceae familien: *Beloperone guttata, Crossandra infundibuliformis, Jacobinia carnea* og *Mackaya bella.* Daglængder på 8 og 16 timer ved de prøvede temperaturer havde ingen indflydelse på blomstringstidspunktet hos *Crossandra.*

Introduction

In 1965 it was established that the flowers in *Aphelandra squarrosa* were induced either by low temperature at low light intensity (Anon. 1965), or by high light intensity at high temperature (Herklotz, 1965). This was confirmed later by Heide and Hildrum (1966), Christensen (1969) and Heide (1969).

The optimum temperature for flower induction under low light intensity conditions is 10° C for *Aphelandra squarrosa* 'Dania'. This treatment should be applied for at least 6 weeks (Christensen, 1969). The natural time of flowering for *Aphelandra* is from March to September, when cultivated in greenhouse in Denmark. *Beloperone guttata, Crossandra infundibuliformis, Jacobinia carnea* and *Mackaya bella* grown under similar conditions, flower during the same period. These 4 plant species, like *Aphelandra,* belong to the Acanthaceae family and the morphology of their flowers are similar. It was, therefore, examined whether low temperatures at low light intensity had the same effect on these 4 plant species as on *Aphelandra.*

Materials and Methods

Beloperone guttata Brandegee originates from Mexico. It has terminal, drooping spikes. The individual flowers are white and the bracts are brownish-red.

Crossandra infundibuliformis Nees (*C. un-*

dulifolia Salisb.) 'Mona Wallhed' originates from India and the species are propagated by sexual reproduction, while the cultivated variety being sterile is propagated by vegetative reproduction. *C.* has erect spikes, situated in the axils. The individual flowers are orange.

Jacobinia carnea Nichoels originates from Brazil, its flowers are placed on a terminal spike and the colour of the individual flower is violet pink.

Mackaya bella Harv. (Asystasia bella Benth. E. Hook) is a shrub, its natural habitat is South Africa. The flowers form terminal clusters and they are violet blue.

A survey of the literature did not reveal which factors control the flowering of the 4 plant species.

Two experiments were carried out.

I. All 4 plant species were included in the experiment, and the influence of the temperature on the flowering was investigated utilizing the following temperature treatments (in °C): 7, 10, 13, 16, 19. The plants were exposed to the treatments for 3, 6 and 12 weeks at natural day length and light intensity.

II. This experiment only comprised *Crossandra.* The experimental design was the following: temperatures (in °C) 12, 16, 20 for 4, 6, 8, 10, 12 and 16 weeks, day length both 8 and 16 hours, and at natural light intensity.

The treatments were carried out in growth rooms made of glass and placed in a greenhouse. For further details see Christensen (1969). The day length was controlled by covering the growth room with a black sheet after 8 hours of daylight. Incandescent lamps (25 watt per m^2) were switched on for 8 hours in order to give a total of 16 hours of daylight.

The propagation of *Mackaya* plants took place on 6th November 1968, on the 22nd October *Beloperone* were propagated while the propagation of *Jacobinia* took place on the 12th November.

One year old *Crossandra* plants were potted on the 10th December into 10 cm pots. Before the experiment was commenced, all but one shoot was cut from each plant.

All treatments in the first experiments were started on the 20th December 1968, with 6 plants per treatment. In the second experiment commercial *Crossandra* plants were propagated at the end of October. The treatments were commenced on the 13th December 1967, with 5 plants per treatment. All visible inflorescences were removed before the experiment was started.

At the end of the treatments the plants from both experiments were transferred to a standard greenhouse, where the temperature was kept at 20–22° C, and they remained there until the date of anthesis.

Results

First experiment.

Beloperone guttata

Low temperature delayed the time of flowering, as may be seen from Fig. 1. The longer the

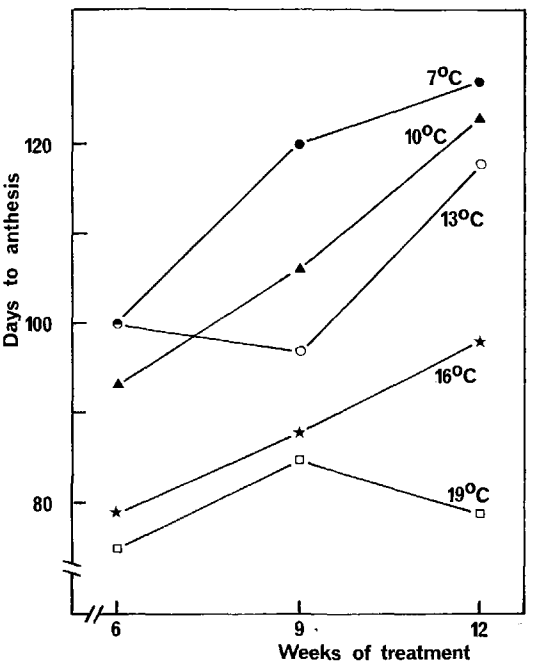

Figure 1. Number of days from commencement of treatment to anthesis for *Beloperone guttata* at various temperatures and treatment periods.

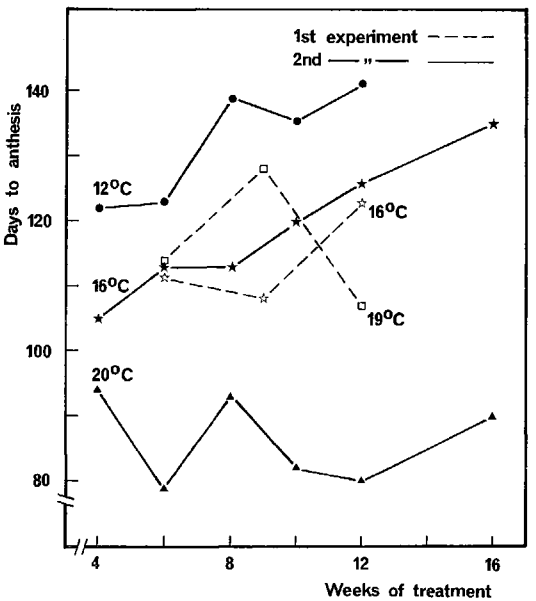

Figure 2. Number of days from commencement of treatments to anthesis for *Crossandra infundibuliformis* at various temperatures and treatment periods.

plants were influenced by low temperature, the more the flowering was delayed. Considering the time of flowering 19° C was not too high a temperature.

Crossandra infundibuliformis

C. dies, if they were exposed to low temperature (7–13° C) for more than 6 weeks. No dead plants were found at temperature treatments at 16 and 19° C. The experiment, furthermore, showed that the time of flowering in the plants treated for 6–12 weeks and at 16 and 19° C, was little influenced by the treatments (Fig. 2).

Jacobinia carnea

The time of flowering was only influenced a little by the temperature, but more so by the length of the treatment. The number of days from the commencement of treatment to flowering increased, when treatment was extended from 6 weeks to 12 weeks (Fig. 3).

Mackaya bella

Half a year after commencement of the treatments no plants had bud or flower. Only scattered flowering without any relation to the treatments was found at later observations.

The missing flowering may be due to the age and size of the young plants. They were propagated 6 weeks before the experiment was initiated.

Second experiment.

Crossandra infundibuliformis

Out of the 60 plants kept at 12° C (in short as well as long days) only 16 survived. The indications shown on Fig. 2 for 12° C should, therefore, be taken with reservation. The plants did not show any response to variation in the day length. On the average, the plants, which had been kept at short day, flowered 106 days after the commencement of the treatment, while the plants, which had been kept at long day flowered after 104 days. The treatments shown

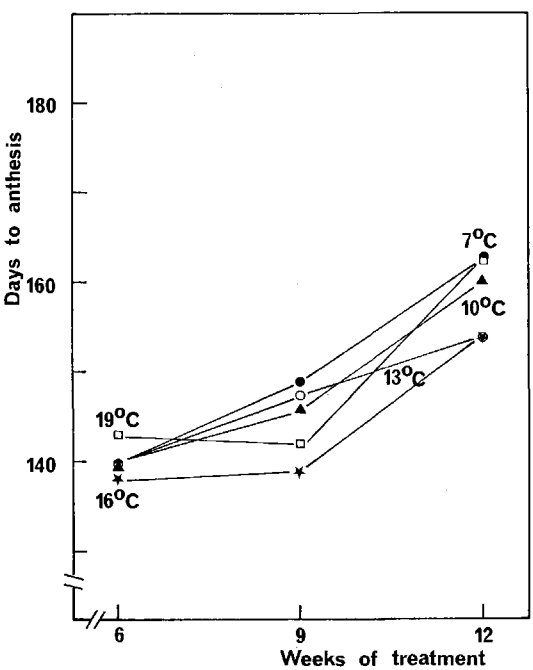

Figure 3. Number of days from commencement of treatments to anthesis for *Jacobinia carnea* at various temperatures and treatment periods.

on Fig. 2 are, therefore, means of the two day length treatments. The plants kept at 20° C for 12 and 16 weeks, on the average flowered before the termination of the treatment.

The flowering is delayed, when the plants are kept at 16° C, but apparently not at 20° C. The range is 15 days on the average number of days from the commencement of treatment to flowering at 20° C. At the commencement of the experiment, the plants had on the average 3.5 pair of leaves more than 2.5 cm long. On the day of anthesis it was registered at which pair of leaves the inflorescence was situated. It was found, that the variability was small and inconsistent from treatment to treatment (from 3.3 to 5.0). On an average for all plants, the first inflorescence, was situated at leaf pair number 3.8.

Discussion

As stated above *Beloperone, Crossandra, Jacobinia* and *Mackaya,* like *Aphelandra* flower during the summer months, when cultivated in the greenhouse. It is, therefore, conceivable that they all are induced to flower by high light intensity at high temperature and by low temperature at low light intensity, which is the case for *Aphelandra.* The latter part of the hypothesis was tested as described in this paper. It was not possible to prove, that low temperature at low light intensity induce the flowering of the four plant species. The result is interesting, because the plants all belong to the same family, have roughly the same morphology of their flowers and normally flower in the glasshouse at the same time of the year. Nevertheless, the four plant species do not have the same mechanism for flower inductions as *Aphelandra.* It remains to be tested, if high light intensity induces flowering at high temperature.

The conditions to which the plants are subjected in their natural habitat have undoubtly a prevailing influence on the flower inducing factor of the plants. *Beloperone* grows in Mexico, *Crossandra* in India, *Jacobinia* in Brazil and *Mackaya* in South Africa. *Aphelandra* like *Jacobinia* grows in Brazil, but not in the same region. From these informations it is not possible to draw any conclusion on their similarity in flower induction.

Conclusion

It is not possible to advance the flowering of *Beloperone guttata, Crossandra infundibuliformis* 'Mona Wallhed', *Jacobinia carnea* and *Mackaya bella* by treating the plants with low temperature at low light intensity for a shorter or longer period. Neither is the flowering of *Crossandra infundibuliformis* 'Mona Wallhed' influenced by 8 or 16 hours of day length.

References

Anon (1965): Blomstringsregulering af Aphelandra squarrosa Nees 'Dania'. Tidsskrift for Planteavl 69 (4): 593–595.

Christensen, O. Voigt (1969): Indflydelse af lave temperaturer på blomstringen af Aphelandra squarrosa. Tidsskrift for Planteavl 73 (3): 351–366.

Heide, O. M. og Hildrum, H. (1966): Samspil mellem lys og temperatur i vekst og blomstring hos Aphelandra. Gartneryrket 50: 1118–1121.

Heide, O. M. (1969): Interaction of light intensity and temperature in the flowering of Aphelandra squarrosa Nees. Acta Horticulturae, Tech. Comm. of ISHS, No. 14: 167–174. Symposium on flower regulation in florists crops. Vollebekk, 1968.

Herklotz, A. (1965): Über den Einfluss der Lichtintensität auf das Blühen von Aphelandra 'Fritz Prinsler'. Die Gartenbauwissenschaft 30: 107–113.

Manuskript modtaget den 4. april 1975.