Effects of temperature and flower bud formation stimulating techniques on the induction of flower bud formation in Cryptomeria in Winter

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Introduction

The study on the induction of flower bud formation in Cryptomeria (Kumotōshi clone) effected by environmental factors and chemical spray was investigated by Miyajima and Chon.[5] The results revealed that the sex differentiation of flower buds depended on degree of temperature. The amount of male flower buds was related to high temperature up to 30°C; at 33°C, chlorosis caused by high temperature occurred at new leaves. Most of female flower buds was induced at 20°C and decreased when temperature was higher or lower. The temperature of 25°C was determined as optimal temperature for the induction of both sexes. Gibberellic treatment, in comparison with control treatment, strikingly caused flower buds in number even at 33°C. The purpose of this experiment is to clarify effects of temperature, gibberellic and girdling treatments on the induction of flower bud formation in the same material in course of winter.

Materials and Methods

60 of 1-year-old Cryptomeria propagules (Kumotōshi clone) with 38.42 g of average weight and 34.35 cm of average top height, derived from cutting, were planted in 1/5,000 a Wagner's pots (a propagule per pot). The experiment was laid out with 5×3 factorial experimental designs (two treatments : temperature and flower bud formation stimulating techniques) with 4 replications. The former comprised 15, 20, 25, 30°C and natural condition ; the latter comprised gibberellic spray, girdling and control. 200 cc of 150 ppm of aqueous gibberellic solution (GA_3) were sprayed to a propagule to dip off on 29 January and 29 February 1972 as gibberellic treatment ; a 5 mm-wide-circular girdling was performed at about 15 cm from pot-soil surface at propagule stem on 28 January 1972 as girdling treatment. Biotron Institute of Kyushu University and nursery of Silvicultural Laboratory were used as constant temperature control and natural condition respectively. This experiment was started 6 November 1971 and ended on 31 March 1972.

Results

The new vegetative growth, in this experiment, emerged early at high temperature condition in the order of 30, 25, 20 and 15°C on 25 December, 31 December, 29 January and 1 February respectively ; and no growth was found in natural condition. The growth at 30°C and 25°C was longer and more developed than that of at other temperatures as shown in Table 1. Male flower buds were produced only at 30 and 25°C, but with gibberellic spray, they were induced at 30°C rather than at 25°C and the difference between them was statistically significant. The diameter of male flower buds at 30°C was significantly larger than at 25°C, but not in length. Since male and female flower buds formed with girdling treatment appeared on one or two propagules ; so, no statistical comparison with gibberellic treatment was done. However, their sizes of male flower buds at 30°C were similar to those at 30°C and bigger than those at 25°C, with gibberellic treatment. Female flower buds were produced at 20 and 25°C with gibberellic treatment and 25°C with girdling treatment. At 25°C with gibberellic treatment they were remarkedly formed and their diameter and length were greater in comparison with others.

The twice spray of gibberellin caused male flower buds after each treatment and the above comparison concerned with their sizes were derived from the first formed buds. Chlorosis, like at 33°C but not so severe, was occurred at 30°C as well.

Discussion

According to the determination of vegetative growth, the result at least proved that high temperature condition can break winter dormancy ; they, however, need a time to develop endogenous mechanism for new growth as short as one and a half month at 30°C or as long as two and a half months at 15°C. With gibberellic treatment, results resembled those of Miyajima[5], Chon[1] and Kato[4] that gibberellic spray could considerably cause flower bud formation in Cryptomeria ; but, in this experiment, they were few at 20°C and none at 15°C. This was attributable to few or undeveloped vegetative growth and treating time of gibberellin, not to the non-effect of gibberellic treatment. For, although the total growth shown in Table 1 was 43.23 and 6.25 cm at 20 and 15°C respectively, the length of vegetative growth of each branch in average was about at 1.5 and 0.8 cm at 20 and 15°C respectively, and the first gibberellic spray coincided with the initiation of growth at 20°C and preceded the initiation of growth at 15°C. In general, depending on temperature, the evidence was the same to those of Miyajima and Chon[1)5)]. Results concerning girdling treatment seem to have been ambiguous because some propagules did not form flower bud, in contrast with those of Hashizume[2] and Chon.[1] As to no flower bud induced with control treatment, from a quite obvious role of gibberellin in flower bud induction in Cryptomeria, this might be attributed to the lower content of endogenous gibberellin under short-day condition.[3]

In addition, some materials had naturally produced flower bud in summer before this experiment was started ; and at 25 and 30°C with gibberellic treatment, they formed flower bud again. This might lead to the conclusion that flower bud formation in Cryptomeria, especially Kumotōshi clone, in the same propagules, they can be stimulated by gibberellin two times a year, growth and dormant periods, under favourable temperature.

References

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Table 1 : Average of total increment of experimental plants (cm)

flower bud formation stimulating techniques / temperature (℃)	gibberellic treatment	girdling treatment	control
30	137.78	222.03	129.35
25	120.03	211.93	175.30
20	43.23	35.50	26.23
15	6.75	19.83	11.30
nature	0	0	0

Each statistic was averaged from 4 plants.