VEGETATIVE PROPAGATION OF STRELITZIA REGINAE *

P.A. van de Pol and T.F. van Hell
Department of Horticulture
Agricultural University
P.O. Box 30
6700 AA Wageningen
The Netherlands

Abstract

S t r e l i t z i a r e g i n a e is propagated either by division of naturally developed branches known as fans or by seeds. Vegetative propagation by division is limited by a low rate of multiplication being 0.5-1.5 divisions per branch per year. Branching originates in the division of the apical dome with an absolute abscence of branching from axillary buds. Propagation by seeds is undesirable due to juvenility and genetic variation. Therefore induction of branching to increase the multiplication rate of S t r e l i t z i a by elimination of apical dominance was the purpose of this study. Selected plants were excavated and divided in fans. After shortening the roots to 20 cm, the fans were planted in containers and left for recovery and root regeneration. Then the apex was reached by a triangular excision of a part of the plant with a transversal cut 8-12 mm above the basal plate throughout the basal leaf sheaths keeping the leaves in contact with the roots. Thereafter the apex was removed and after 2-6 months lateral sprouts developed, varying in number from 2 to 30 per fan depending on age and size of the fan. In order to obtain shoots with roots most of the old roots were removed and during the next 6 months the newly formed laterals, rooted and could be divided in individual plants. These plants could be treated again from one year on. The total period for the sequential processes took one year.

1. Introduction

Plants of S t r e l i t z i a r e g i n a e Ait. (Musacea) are propagated either by seeds or by division of naturally developed branches known as fans (Dyer, 1972). Propagation by seeds is undesirable due to a prolonged period of juvenility of about 4 years and a great degree

*Publication 543

of genetic variation (Vonk Noordegraaf and Van der Krogt, 1976). Vegetative propagation by division is limited by a low rate of multiplication of 0.5-1.5 divisions per branch per year (Vonk Noordegraaf and Van der Krogt, 1976). Branching is originated in the division of the apical dome (Fisher, 1976), while there is an absolute abscence of branching from axillary buds. This is maybe a result of a strong apical dominance effect.
In vitro propagation of S t r e l i t z i a was impossible due to oxidative browning. Ziv and Halevy (1983) reported that they could control this phenomena by antioxydant treatment. They showed shoot development from explants of as well terminal as axillary buds. In this system the proliferation was limited to 5 new shoots at most. *Introduction of branching in vivo to increase the multiplication rate* of S t r e l i t z i a by elimination of apical dominance was the purpose of the present study.

2. Material and methods

The S t r e l i t z i a plants were grown in greenhouses with minimal day and night temperature of 20°C and 18°C respectively, while the maximum day temperature remained uncontrolled.
Selected plants were excavated and divided in fans. After shortening the roots to 20 cm the fans were planted in 10 or 25 l containers and left for a period of 8 weeks for recovery and root generation. Then, *the plants were lifted with the base above the soil level*, the base was washed with a stream of water and the soil surface was covered with gravel in order to diminish pathological infection.
The apex was reached by a triangular excision of a part of the plant with a transversal cut 8-12 mm above the basal plate through the basal leaf sheaths (figure 1). During this handling the leaves should be kept in contact with the roots. Thereafter the apex thus made visible as well as reachable was removed by using a surgical blade. The next 2 weeks the wound healed. Further on as a result of preliminary experiments the following environmental conditions were maintained in all the experiments: minimal air temperature 25°C, soil temperature 23°C and air humidity almost 100%.
Details of the particular experiments will be described along with the results.

3. Results

The multiplication potential of adult plants was examined in 14 different 9 year old seedling plants consisting of single branches after

division in February and excision of the apex in April. After 6 months the number of newly formed lateral shoots counted on seven different out of the 14 treated plants were: 10, 24, 25, 27, 35, 37 and 47 (figure 2 and table 1). In the remaining 7 treated plants no new shoots were formed. In these plants the apical dome redeveloped. The apical dome was removed again and one year later 9.7 new shoots in average were formed per plant. In 14 untreated plants only 2 shoots per one branch in average were formed.

In a separate experiment the multiplication ability of 2 year old seedlings was compared with this of 2 year old clonal plants from previously multiplied 9 year old mother plants. As well as multiplication of 4 one year old newly formed clonal plants was examined. The 2 year old seedlings and clones were bearing an average of 10 developed leaves, while the 1 year old ones had an average of 3 leaves only. Shoot development of a 2 year old plant is demonstrated in figure 2. The results (table 1) show that the multiplication potential of 2 year old plants either clones or seedlings was 6-8 times greater than this of 1 year old clones.

In a multiplied cluster of lateral shoots the new roots of the newly formed shoots were ununiformely intertwined distributed among the old roots. A division of such a newly formed cluster resulted in having shoots with and without new roots. Therefore an experiment was carried out in order to promote root regeneration. In autumn a cluster of 14 shoots, 6 months after the excussion of the apex, was divided in 2 equal parts with 7 shoots each (a and b). The parts were treated by 2 different ways. In one (a) the shoots were divided and planted individually. In the second (b), the whole cluster of the newly formed shoots was excavated from the soil, all the old roots but one were removed. Then the cluster was planted again for a period of root generation of 6 months. In cluster a 5 out of 7 lateral shoots divided from the mother plants without roots were unable to proceed further development and died, only 2 shoots with small roots initially survived. On the other hand (b) all out of 7 newly formed laterals formed new roots, continued their growth and development (figure 3) and were easy to divide in individual plants (figure 4).

Results of preliminary experiments indicated that:

- the apex should be removed very precisely with a minimal amount of tissue because the most central axillary buds showed the fastest development;
- the best period of treatment for adult plants was in spring. This was after flowering when the branches were in the natural stage of dividing in 2 parts.

4. Discussion

In previous studies was described flower bud formation in the axil of each leaf (Fisher, 1976; Criley and Halevy, 1985), while the vegetative development takes place by dichotomous branching of the apex (Fisher, 1976). However, the results presented in this study showed a possibility of vegetative lateral branching when the apex was removed. This may indicate that axillary buds which were observed in the axils of leaf primordia (Fisher, 1976) are in a vegetative state. While inhibited by apical dominance floral differentiation of the axillary buds may occur. Some of these flower buds may abort during later stages of development (Criley and Kawabata, 1982; Van de Pol and Herlaar, 1981).

Only rarely more than one flower bud has been observed per leaf axil (Criley and Halevy, 1985). Ziv and Halevy (1983) also reported vegetative shoot development from axillary buds. In their in vitro system the proliferation was limited to 5 new shoots at most.

Table 1 shows great differences in numbers of shoots corresponding with the age of the plants. The number and size of the axils increase with the age of the branch and it is likely that the number of axillary buds increases as well.

Another possibility is that the new shoots origin from adventitious buds, developing in the axils of the leaves. This is not probable because of the limited number of new shoots from our young plants and the in vitro experiments.

The method described in this study is of importance in acceleration of clonal propagation of valuable S t r e l i t z i a r e g i n a e plants with a naturally low rate of multiplication.

References

Criley, R.A. and Kawabata, O., 1984. Development of the flower spike of Bird of Paradise and its flowering period in Hawaii. J. Am. Soc. Hortic. Sci., 109, 702-706.

Criley, R.A. and Halevy, A.H., 1985. STRELITZIA REGINAE. In: Handbook of Flowering, Abraham A. Halevy. Vol. IV. CRC Press, Boca Raton, Florida: 396-402.

Dyer, R.A., 1972. Vegetative multiplication of S t r e l i t z i a r e g i n a e and its allies. Bothallia, 10: 575-578.

Fisher, J.B., 1976. Development of dichotomous branching and axillary buds in S t r e l i t z i a (Monocotyledonae). Can. J. Bot, 54: 578-592.

Pol, P.A. van de and Herlaar, F., 1981, unpublished data.

Vonk Noordegraaf, C. and Krogt, Th. M. van der, 1976. Produktie en bloei van Strelitzia. Vakbl. Bloemisterij, 31(49): 18-19.
Ziv, M. and Halevy, A.H., 1983. Control of Oxidative Browning and in vitro Propagation of Strelitzia reginae. Hort. Science 18(4): 434-436.

Table 1 - The effect of apex excision on lateral shoot formation of different plant types of Strelitzia reginae. (*The average number of new shoots was calculated after 6 months per multiplying plants only.)

Plant age and origin	Number of plants examined	Number of plants responded to the apex removal treatment	Number of new shoots per plant
1 year clones	4	4	1.7
2 year clones	18	15	10.8 ± 7.4
2 year seedlings	14	10	12.5 ± 7.8
9 year seedlings	14	7	29.3 ± 11.8

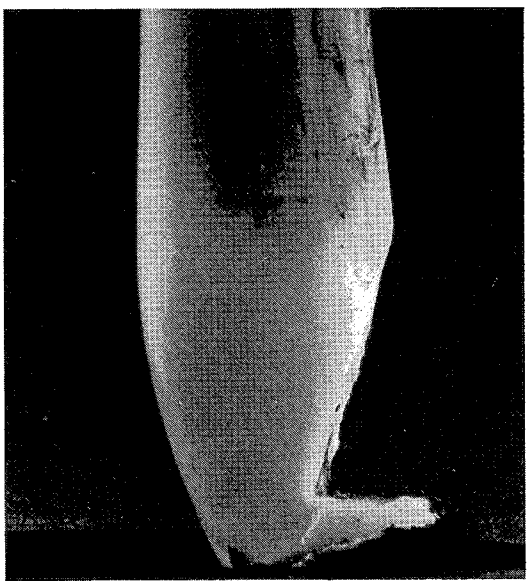

Figure 1 - A triangular excision in the base of a separated branch to reach and remove the apex from an adult plant of Strelitzia reginae.

Figure 2 - Lateral shoot formation from 1 branch of a 2 year old clonal plant of S t r e l i t z i a r e g i n a e, 4.5 months after excision of the apex.

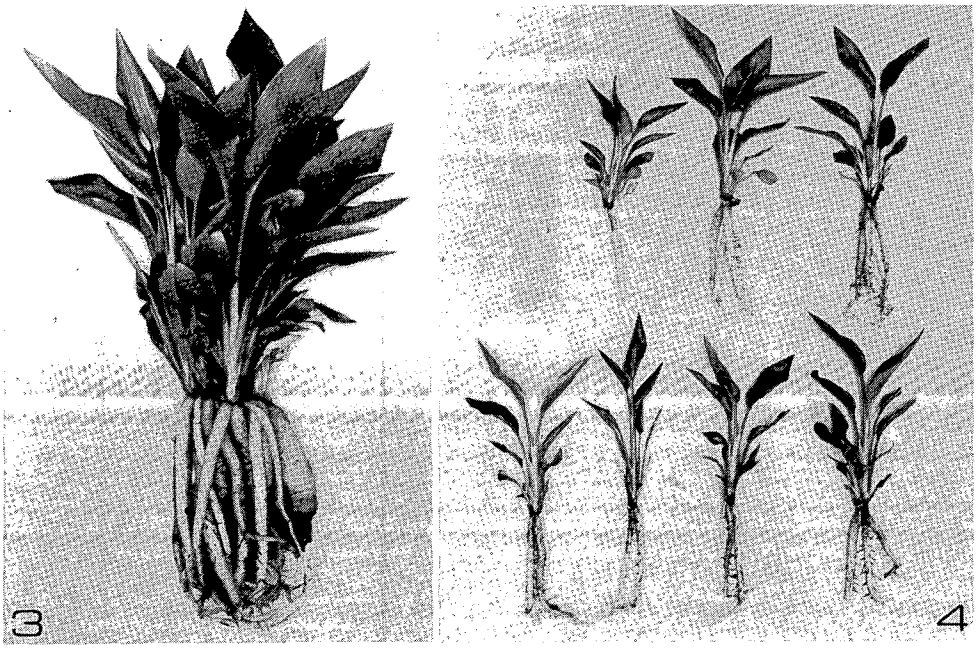

Figure 3 - Multiplied cluster of S t r e l i t z i a r e g i n a e with new roots, when 1 old root is left, 1 year after excision of the apex.

Figure 4 - Individual plantlets from a cluster.