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Growth, developmental features and flower production of *Anthurium andreanum* Lind. in tropical conditions

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Abstract

Anthurium cultivation is becoming very important in global cut flowers production. Soilless and protected cultivation have been developed for 20 years in tropical countries in order to improve yields and flowers quality and to reduce phytosanitary problems, but the different parameters that govern flower formation are poorly understood. Particularly, a better understanding of plant structure and functioning is needed to explain yield components. Young tissue-cultured plants have first a monopodial growth which corresponds to the juvenile and vegetative phase. After this, the plants have a sympodial phase, with a flower produced for each leaf. The time separating the emergence of two aerial organs and the size of these organs were measured. Accumulated day degrees, with a threshold of 14°C, from planting to first flowering were 2143°Cdays (219 days). The apparent phyllochron decreased during the monopodial phase from 680 to 280°Cdays (14°C threshold) and increased quite

regularly in the beginning of the sympodial phase from 330°Cdays for the first leaf to 615°Cdays for the seventh leaf. This seemed to represent a threshold for the phyllochron; it varied less for the next leaves. The size of the leaves and flowers increased from the first to the seventh leaf of the sympodial phase and to the seventh flower. The size of the peduncle and spathe of the first-formed flowers are too small to be sold in the best quality categories. It might be possible to make large flowers appear earlier by suppressing small flowers as soon as they emerge. On the other hand, the suppression of the young leaf, i.e. the strongest sink in the plant, can accelerate the emergence of the next flower, but it reduces the leaf area, and hence the amount of assimilate for subsequent flowers.

Introduction

Cut flowers production has an important part to play in the diversification of tropical agriculture. In the global market the anthurium is second, only to the orchid, among tropical cut flowers (Galinsky and Laws, 1996). Soilless cultivation systems have been developed in the French West Indies since 1982 because of the casual introduction of a bacterial disease with plants from Southern America. These systems require expensive equipment, so the yield and quality of the flowers have to be very high. Yield level depends on a balance between supply, given by environment factors (light, water, mineral elements, etc.) and possibly reserve organs, and demand, created by crop growth and development. The first step towards improved flower production is knowledge of plant development.

Anthurium is a member of the family Araceae (monocotyledon) which includes more than 100 genera and about 1500 species, chiefly from the tropics (Higaki et al., 1994). Blanc, 1977a, Blanc, 1977b and Ray, 1987, Ray, 1988 described the shoot organization and branching patterns of some Araceae. They described two basic types of shoot that have monopodial and sympodial growth. The monopodial phase corresponds to the juvenile phase described by Christensen (1971) for seed-propagated *Anthurium andreanum* and *Anthurium scherzerianum* plants. During the sympodial phase, one flower is produced from each leaf axil. In fact, the commercial flower is an inflorescence, composed of a peduncle, a colored bract called the spathe, and a spike of small, perfect flowers, the spadix (Higaki et al., 1984).

Daï and Paull (1990) studied the growth and development of the flower before and after its emergence. They showed that the developing leaf competes with the young flower for

the assimilates distribution. Flower growth depends on source–sink relations in the plant and can be accelerated by reducing the other sinks or by increasing the sources.

The aim of this study was to follow each developmental stage of the plant in order to understand the relationships between leaf and flower and to try to improve flower production. We therefore chose to study the growth and development of plants and to analyze the succession of events that leads to flower formation.

Section snippets

Plant materials and cultivation conditions

The experiment took place at the Duclos experimental station of INRA Antilles—Guyane which is situated at 16.12°N latitude and 61.40°W longitude at an altitude of 110m above MSL. The environment is characterized by a warm humid tropical climate, with an annual average temperature of 24.6°C and rainfall of 2800mm.

Tissue-cultured plantlets of *A. andreanum* ‘Cancan’ (Anthura B.V. variety) were planted in 2.5l pots filled with a substrate consisting of 1:2 (vol:vol) of composted and disinfected wood …

The two developmental phases

In the first stages of its development, the plant produces a leaf and an axillary bud at each node. The internode, the leaf and the bud form a monopodial phytomer. The successive segments, that constitute the monopodial shoot, are produced by the continued activity of a single apical meristem. The phyllotaxy is distichous. The leaves have short sheaths surrounding the stem, at the petiole base. The internodes are long (about 2cm).

The end of the monopodial phase is marked by the emergence of a…

Discussion

The growth sequences of *A. andreanum* 'Cancan' correspond to those of some other Araceae plants described by Blanc, 1977a, Blanc, 1977b and Ray, 1987, Ray, 1988. The plant has a monopodial juvenile phase without any flower production, then a sympodial generative phase during which it produces a flower for each leaf. In our conditions, there is no flower bud abortion, contrary to what generally happens in a temperate climate (Klapwijk and van der Spek, 1988).

During the monopodial phase, as the…

Conclusions

We have shown that *A. andreanum* development begins with a vegetative monopodial phase followed by a reproductive sympodial one. The monopodial phase represents an expense for the producer because he has to maintain his plantation without producing any flowers. Later we shall try to reduce the length of the monopodial phase by varying environmental factors, such as mineral nutrition and light; and we shall test whether this reduction has an influence on subsequent flower production.

In tropical…

Acknowledgements

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Genotypic differences in vase life of Anthurium andraeanum (Hort.) cut-flowers are associated with differences in spathe chlorophyll content

2023, Postharvest Biology and Technology

> *Citation Excerpt :*
>
> …is an important ornamental crop in the cut-flower industry. The cut-flower comprises a spathe (modified leaf), spadix (inflorescence) and peduncle (stalk) (Dufour and Guérin, 2003). Its appeal is partly due to the exceptionally long vase life which can vary from 14 d to greater than 40 d (Elibox and Umaharan, 2010)….

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The impact of light on vase life in (Anthurium andraeanum Hort.) cut flowers

2020, Postharvest Biology and Technology

> *Citation Excerpt :*
>
> …a herbaceous perennial, is one of the most important ornamental crops in the global cut flower market. It produces a cut flower, which comprises a modified bract (spathe) and a stalk-like inflorescence (spadix), supported on a peduncle (Dufour and Guérin, 2003). Horticulturally mature cut flowers of some cultivars have exceptionally long vase lives (> 40 days), while many other varieties have short vase lives (< 15 days) despite possessing other desirable market characteristics (e.g. brightly coloured, large or showy spathes) (Elibox and Umaharan, 2010)….

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Silver nitrate enhances in vitro development and quality of shoots of Anthurium andraeanum

2019, Scientia Horticulturae

> *Citation Excerpt :*
>
> …The main breeder companies developing new varieties of Anthurium are located in the Netherlands (Noman and Stiglitz, 2015). Although seeds can be used for propagation in Anthurium, this method is basically used for breeding and/or conservation purposes because of the high heterozygosity, a small number of seeds per plant, and long juvenility period for seedling development (Dufour and Guerin, 2003; Bejoy et al., 2008). The clonal micropropagation of Anthurium andraeanum, using shoot organogenesis from leaf explants, is the main technique used for the large-scale propagation of

commercial varieties producing large quantities of plantlets with high clonal fidelity in different cultivars (Cardoso and Habermann, 2014)....

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Current status and biotechnological advances in genetic engineering of ornamental plants

2016, Biotechnology Advances

Citation Excerpt :

...Reports on genetic engineering of Alstroemeria are listed in Table 7. With about 1500 flowering species, the genus Anthurium is the largest in the Araceae family (Dufour and Guerin, 2003). Due to its attractive long-lasting inflorescences, it has become popular as a cut flower and pot-plant....

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2015, Scientia Horticulturae

Citation Excerpt :

...is a collective name that refers to modern anthurium cultivars that are complex interspecific hybrids between A. andraeanum Linden ex André and other species within the section Calomystrium that were initially imported to Hawai'i from Colombia where an intensive breeding program was implemented (Nakasone and Kamemoto, 1962; Kamemoto and Kuehnle, 1996). The genus Anthurium, which consists of approximately 1500 species (900 published) endemic to the neotropical zones of northern Mexico and south through Central America to southern Brazil, and on the Caribbean Islands (Croat, 1988; Mayo et al., 1998; Frodin and Govaerts, 2002; Boyce and Croat, 2012), is conventionally propagated by seed but seed storage is difficult (Zeng, 2000; Dufour and Guérin, 2003, 2006). All Anthurium spp. are perennial, epiphytic or (infrequently) terrestrial herbs (Franz, 2007)....

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