

Different Length of Basal Internodes in Inflorescences of Cyperaceae

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Summary

Between December 2003 and January 2004, we observed in some inflorescences of *Cyperus entrerianus* Boeck. var *entrerianus* and *Oxycaryum cubense* (Poepp. & Kunth) Lye f. *paraguayense* (Maury) Pedersen, which grew in different environmental conditions, different lengths of the basal internode in both species. To obtain the frequency of appearance of this phenomenon, we measured the length of the first internode of 60 inflorescences of each species and environment.

The frequency of appearance of long basal internodes is between 3% and 9%. According to the data obtained in this work, the length of internodes does not seem to correlate with environmental factors; nevertheless further analyses are necessary in order to clarify the mechanisms causing different degrees of development of basal internodes in the anthelodium of Cyperaceae.

1. Introduction

In Cyperaceae the flowers are forming spikelets (KUKKONEN, 1984, 1986) which can be arranged solitary and terminal in the stem (VEGETTI, 1992; GOETGHEBEUR, 1998) or be grouped in a more or less complex inflorescence, as anthelodium or paniculodium (THOLL, 1964; RUA, 1999).

Both types of complex inflorescences present a common structural plan (RAYNAL, 1971) differing in the intercalary growth of their internodes. The anthelodium presents a short main axis, whereas in a paniculodium this axis is long (ALVES, 2000). These structures can display an important reduction in the growth of the internodes and in the degree of ramification, forming a capitulum or small heads (GOETGHEBEUR, 1998; VEGETTI, 2003). In *Cyperus entrerianus* Boeck. var *entrerianus* and *Oxycaryum cubense* (Poepp. & Kunth) Lye f. *paraguayense* (Maury) Pedersen, we observed inflorescences with different length of the basal internode.

The purpose of this note is to inform and to characterize the occurrence of such anomaly.

2. Material and Method

Between December 2003 and January 2004 we observed that some inflorescences of species of Cyperaceae presented a long basal internode instead of a short one like the majority of the inflorescences studied from different populations and environmental conditions. With the purpose of documenting this abnormal extension and to register the frequency of appearance in different populations, inflorescences of *Cyperus entrerianus* Boeck. var. *entrerianus* were collected and studied in three different places: (1) the Ecological Reserve "Paraje el Pozo" of the Litoral National University where plants grew under the shade, (2) from a land next to this university city where plants grew in the sun, and (3) in the streets of the Santa Fe City, where plant grew under pauperized conditions. Also, for *Oxycuryum cubense* (Poepp. & Kunth) Lye f. *paraguayense* (Maury) Pedersen, plants were collected from the Ecological Reserve "Paraje el Pozo" of the Litoral National University where plants grew in a small and little deep lagoon.

The length of the basal internode of 60 inflorescences of each species which grew under different environmental conditions was measured. Those data were statistically analyzed in terms of relative frequency and test of Duncan for the difference of averages ($p \leq 0.05$).

3. Result

***Cyperus entrerianus* var. *entrerianus*:** Usually the main axis of this anthelodium presents internodes which remain short comparatively. Nevertheless in some specimens that grew under different environmental conditions an abnormal extension of the basal internode was observed in comparison with the length reported as normal for the inflorescence of *C. entrerianus* var. *entrerianus*. When this anomaly occurred, the long procladia corresponding to the first bract could be absent or present, and the epipodium showed a different degree of development (fig 1 B-D). Also, the inflorescences with the first developed internode appeared with the normal inflorescences.

In the inflorescences of *C. entrerianus* var. *entrerianus* in more of the 90% of the cases the first internode varies its length between 1.5 and 4.5 mm, whereas in some specimens, the length of this internode could be up to 79 mm with a frequency between 3% and 9% (fig 2). These anomalies were observed in specimens that grew in light, shade and pauperized conditions (fig 1 B-D), appearing most frequently in plants that grew under the sun.

We observed a significant decrease ($p < 0.05$) in the length average of those basal internodes of the main axis that have normal development in



Fig 1: A-D: *Cyperus entricianus* var. *entricianus*; A: normal basal internode (Vegetti & Guarise 1268); B-D: abnormal development of the basal internode, B: sun (Vegetti & Guarise 1268) - C: shade (Vegetti & Guarise 1269) - D: pauperization (Vegetti & Guarise 1271); E-F: *Oxycaryum cubense* f. *paraguayense* (Vegetti & Guarise 1270); E: normal basal internode; F: abnormal development of the basal internode. Abbreviations: eb: basal internode-pc: paracladium-br: bract. Scale in A: 2 mm, B-D: 1 cm, E: 1 mm, F: 5 mm

the following sequence: sun ($x = 2.59$ mm) - shade ($x = 2.33$ mm) - pauperized environment ($x = 1.95$ mm).

Oxycaryum cubense f. *paraguayense*: We observed that in 97% of the cases the first internode could be from 0.5 up to 1.5 mm ($x = 1.12$ mm) in length, and sometimes in some inflorescences the first long internode, could be 4.5 mm long (fig 1 E and F).

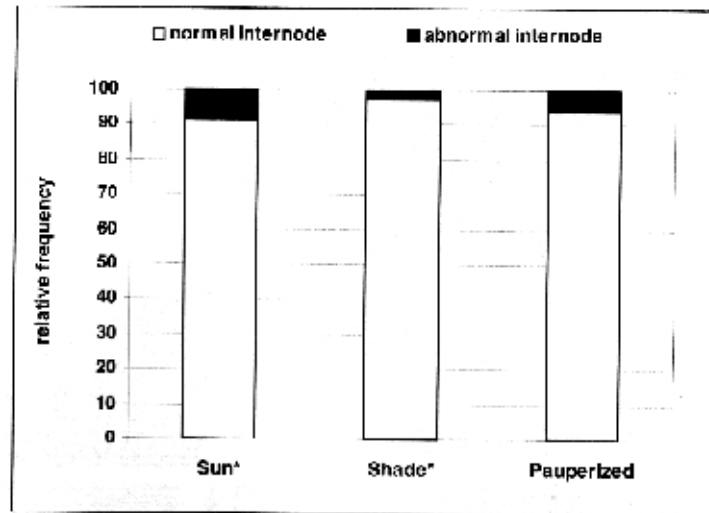


Fig 2: Relative frequency of the length of the basal internodes in *Cyperus entrianus* var. *entrianus* in different environmental conditions. * same population.

4. Discussion

In *C. entrianus* var. *entrianus* the inflorescence is an anthelodium (GUAGLIAMONE, 1996) composed (TUCKER, 1983; CARTER, 1990; CARTER & BRYSON, 1996) sometimes contracted (BARROS, 1947; 1960), whereas in *Oxycaryum cubense* f. *paraguayense* the inflorescence is formed by dense agglomerated fascicles of spikelets (BARROS, 1947). In the inflorescences of both species the internodes are little developed.

The extension of the internodes varies according to the zone of the plant that is observed (MORA-OSEJO, 1960), in this way, in the orthotrophic part of the stem, in the zone of foliar leaves (trophotagma), considered by MORA-OSEJO (1960), and HEINZEN & VEGETTI (1994) as inhibition zone, the internodes generally increase their length towards the apex (MORA-OSEJO, 1960). That phenomenon was not observed by HEINZEN & VEGETTI (1994) for *Cyperus rotundus* L. and *Cyperus corymbosus* Rottb. var. *subnudus* (Nees et Meyen). The internode following the zone of vegetative leaves reaches the maximum length and it behaves like a scape carrying the inflorescence; then the following internodes of the main axis are less developed in comparison to those below (MORA-OSEJO, 1960; HEINZEN & VEGETTI, 1994).

In contrast with the normal scape in most of the Cyperaceae the reduction in the length of the inflorescence internodes, is drastic as was observed by MORA-OSEJO (1960) for *Cladium mariscus* (L.) Pohl, *Cyperus fuscus* L., *C. alternifolius* L., species of *Scirpus* L. among others, and by HEINZEN & VEGETTI (1994) for *Cyperus rotundus* and *Cyperus corymbosus* var. *subnudosus*.

Unlike the anthelodium, many inflorescences show paniculodia formed by long internodes (ALVES, 2000), as in the case of *Rhynchospora pirrensis* W. Thomas (THOMAS, 1986), in which at least the first internode (proximal) of the inflorescence is long giving the inflorescence the aspect of a panicle (paniculodium). Then already towards the distal part of the inflorescence, the internodes are short, the first order paracladia remaining very close to each other.

Although in this work the length of the scape was not measured, the presence of basal internodes with different length attenuates the drastic reduction observed by MORA-OSEJO (1960) and HEINZEN & VEGETTI (1994). The inflorescences vary in the number, length and degree of ramifications of the paracladia, depending on the environmental conditions. In unfavorable conditions the number, length and degree of ramification of paracladia decrease (DENTON, 1978; BROWNING & GORDON-GRAY, 1999; RUA, 1999). In the latter case of pauperization, the inflorescence can be represented by its main florescence only (BROWNING & GORDON-GRAY, 1999; IJUA, 1999). Other factors, as the infection of plants by pathogenic agents (e.g. fungi) as in *Cyperus virens* Michx., can affect the development of the inflorescences of the host plants, these being very reduced (CLAY, 1986).

According to the data reported in this paper and differing from the authors mentioned before, the length of the internodes of main axis of the examined specimens does not seem to correlate to environmental factors. From these, further analysis are necessary in order to clarify the mechanisms influencing the development of long basal internodes the anthelodium of Cyperaceae.

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Reference Material

- Cyperus entrerianus* Boeck. var. *enterianus*
Vegetti & Guarise 1268 (SF), 1269 (SF), 1270 (SF)
- Cyrtocarpum cubense* (Poepp. & Kunth) Iye I. *paraguayense* (Maury) Pedersen
Vegetti & Guarise 1271 (SF).

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