Preliminary studies on the growth of *Phyllanthus niruri* L. (Euphorbiaceae)

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Resumo

Alguns parâmetros fenológicos e de crescimento foram comparados em plantas de *Phyllanthus niruri* crescidas na primavera (1991) e no outono (1993). O crescimento foi mais rápido e maior durante os meses mais quentes. A produção de flores e frutos foi bastante variável entre as plantas e entre os períodos de análise, mas as plantas foram capazes de florescer e frutificar mesmo durante o outono. A área foliar média foi muito menor para as plantas crescidas no outono.

Unitermos: *Phyllanthus niruri*, crescimento, comparação, primavera, outono.

Summary

Growth and phenological parameters were compared for *Phyllanthus niruri* L. plants grown in Spring (1991) and in Autumn (1993). Plants grew much higher and faster during the hottest months. The production of flowers and fruits was quite variable among individuals and over the period analysed, but the plants were able to bloom and bear fruit even during Autumn. The

average leaf area was much smaller for plants grown during Autumn.

Key words: *Phyllanthus niruri,* growth, comparison, Spring, Autumn.

Introduction

Phyllanthus niruri L.(Euphorbiaceae) is a small monoecious herb which has had many traditional and folk medicine uses. In Brazil the whole plant or parts of the plant are used to treat various urinary complaints: edema, excessive albumin, excessive uric acid, calcification in the bladder, liver or kidney. A decotion of the leaves is used to treat diabetes or jaundice (Unander et al., 1991a).

Aqueous extracts of the plant inhibits endogenous DNA polymerase of hepatites B virus and binds to the surface antigen of hepatites B virus in vitro (Venkateswaran et al., 1987). Alcoholic extracts of *Phyllanthus niruri* were found to have inhibitory activity against angiotensin-converting enzyme (Ueno et al., 1988). Aqueous extract of *Phyllanthus niruri* was also shown to inhibit the human immunodeficiency virus type-1 reverse transcriptase HIV "in vitro" (Ogata et al., 1992).

Studies carried out in Brazil have demonstrated that hydroalcoholic extracts of plants and callus of several *Phyllanthus* species exhibit potent and grade antinociceptive activity in several models of nociception in mice (Costa et al., 1989, Gorski et al., 1993, Santos et al., 1994, Santos et al., 1995).

Little is known about the growth of plants from the genus *Phyllanthus*. *P. amarus* grows slowly and reaches a maximum size and vigour at about 5-7 months after sowing, under South Florida conditions, and the inhibition of endogenous hepadnavirus DNA polymerase differs little between cultivated *Phyllanthus amarus* and wild plants (Unander et al., 1993). The purpose of the present study is to compare some phenological and growth parameters in

Phyllanthus niruri plants cultivated at two different seasons to define the ideal conditions to maximize the growth.

Material and Methods

Plants were collected in the campus of Universidade Federal de Santa Catarina, Florianópolis, SC., Brazil. Seeds were obtained by allowing plants to dry and the fruits to dehisce on paper. The seeds were sown in vessels filled up with sterilized comercial humic soil (used in gardens to cultivate flowers). Plants were grown under natural conditions. The first experiment started in November 1991 (end of Spring) and 10 plants were analysed every week for 17 weeks (approximately 4 months). The second experiment started in March 1993 (autumn) and 13 plants were analysed once a week for 27 weeks (approximately 6 months). During the experiments, the number of leaves, male flowers, female flowers, fruits as well as the plant height were analysed.The experimental design was entirely randomized. The leaf area was calculated by drawing 20 leaves over millimetric quad paper, counting the number of squares and calculating the mean. The height curve was analysed by regression and the logistic function was applied, where: $y = e^{a+bx} / 1 + e^{a+bx}$ according to Chatterjee and Price (1977) where y=means of the height, x= number of weeks,a and b are parameters found by experiments data. The means of the height, and number of leaf, male flowers, fruit and female flowers were compared after 17 weeks of growth by the "t" test for each season. Mean comparisons between the seasons were obtained using Tukey's multiple range test (Snedecor and Cochran, 1962).

Results

Figure 1 shows the data of *Phyllanthus niruri* plants sown in November 1991. After 17 weeks, the average height observed was 25.0cm and the plants continued to grow (Figure 1A). The male flowers appeared after 10 weeks (Table 1) and after 17 weeks

the average was 11.2 flowers (Figure 1B) but there was an oscilation in the mean number of male flowers among plants and among observations. Female flowers appeared after 9 weeks and fruits after 12 weeks (Table 1).

TABLE 1 – Blossom and time of fruit appearance from *Phyllanthus niruri* plants grown in the Spring (1991) and in the Autumn (1993).

	Spring	*Autumn*
	Number of Weeks	*Number of Weeks*
Male flowers	*10*	*15*
Female flowers	*9*	*16*
Fruits	*12*	*22*

Figure 1C shows the data for female flowers and fruits, where the average number after 17 weeks was 35.0. There was also oscillation among plants and observations. As observed for height, older plants showed higher flower and fruit numbers. Signs of senescence were not observed during the 17months of observation and the plants showed a tendency to keep growing. Figure 2 shows the data for plants sown in March 1993. After 27 weeks the average plant height was 12.00 cm (Figure 2A). Male flowers appeared after 15 weeks (see Table 1) and in this case there was also an oscillation among plants and observations (Figure 2B). The male flowers average after 27 weeks was 4.69. Female flowers appeared after 16 weeks and fruits after 22 weeks (Table 1). Figure 2C shows the female flower and fruit data where the average number after 27 weeks was 16.39. In this case the plants also seemed to keep the growth. Figure 3 compares the growth parameters analysed for *Phyllanthus niruri* plants grown in November 1991 and in March 1993 after 17 weeks after sowing. There was a clear reduction of the growth when the seeds were sown in March 1993 (end of the Summer) and except for the

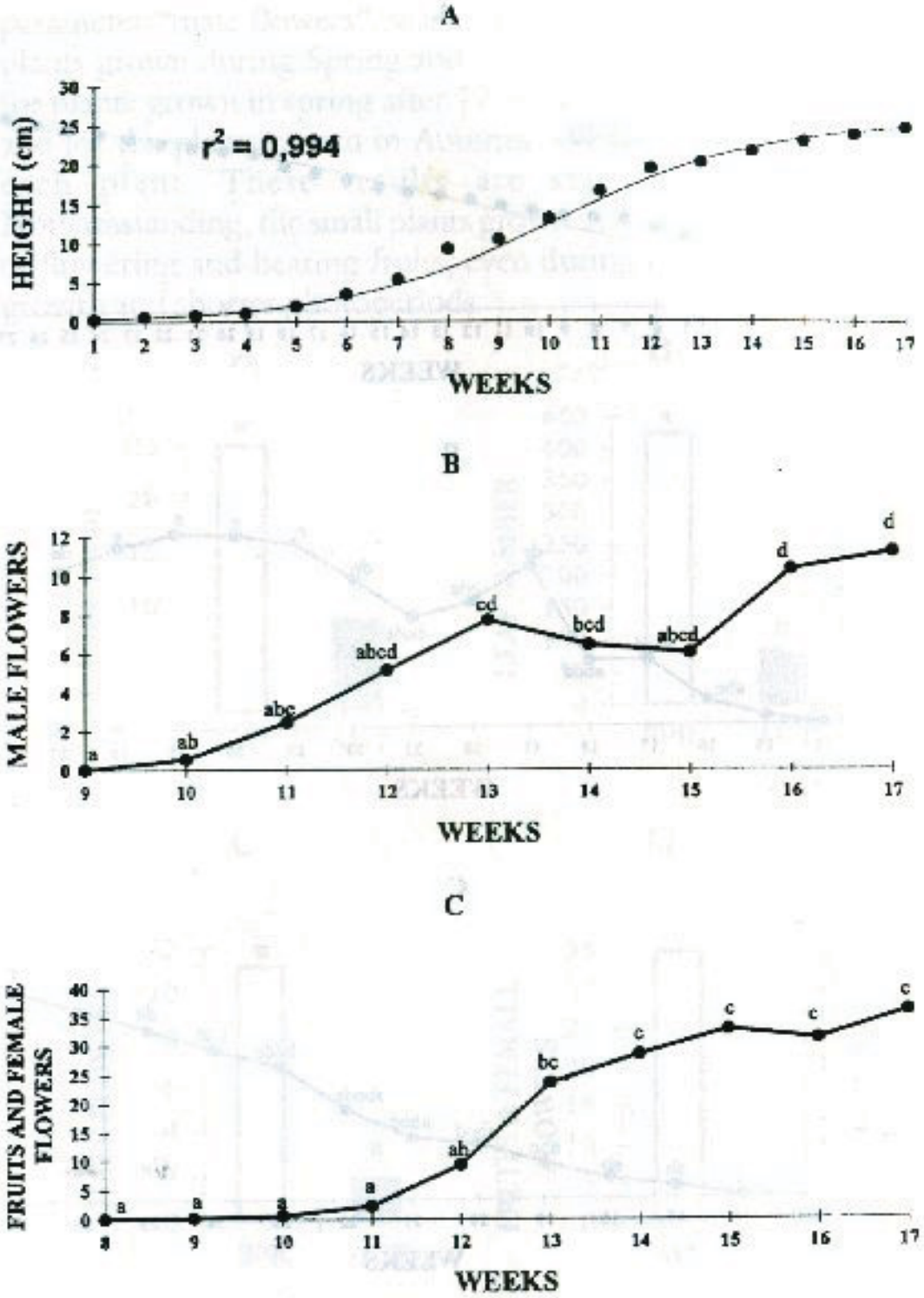

FIGURE 1 – Growth curves of *Phyllanthus niruri* plants grown from seeds sowed in November 1991 (Spring) a) height curve; b) male flowers number curve; c) female flowers and fruit number curve.

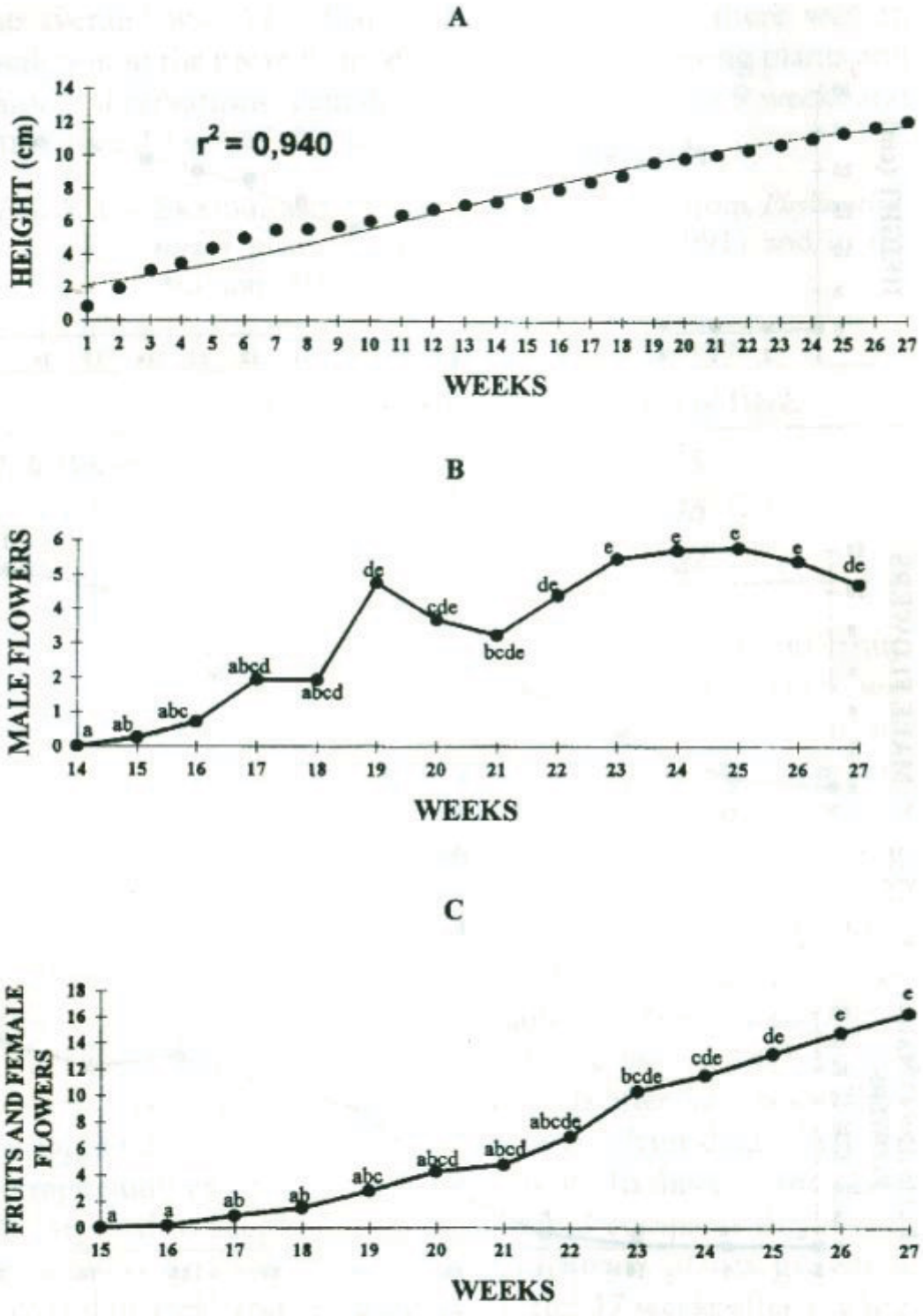

FIGURE 2 – Growth curves of *Phyllanths niruri* plants grown from seeds sowed in March 1993 (Autumn) a) height curve; b) male flowers number curve; c) female flowers and fruit number curve.

parameter "male flowers", was a significant difference between plants grown during Spring and Autumn. The average leaf area for plants grown in spring after 17 weeks was 80.79 ± 9.84 cm^2 and for the plants grown in Autumn was 15.78± 1.92 cm^2 for each plant. These results are statistically different. Notwithstanding, the small plants grown in Autumn were capable of flowering and bearing fruits, even during the season of poor growth and shorter photoperiods.

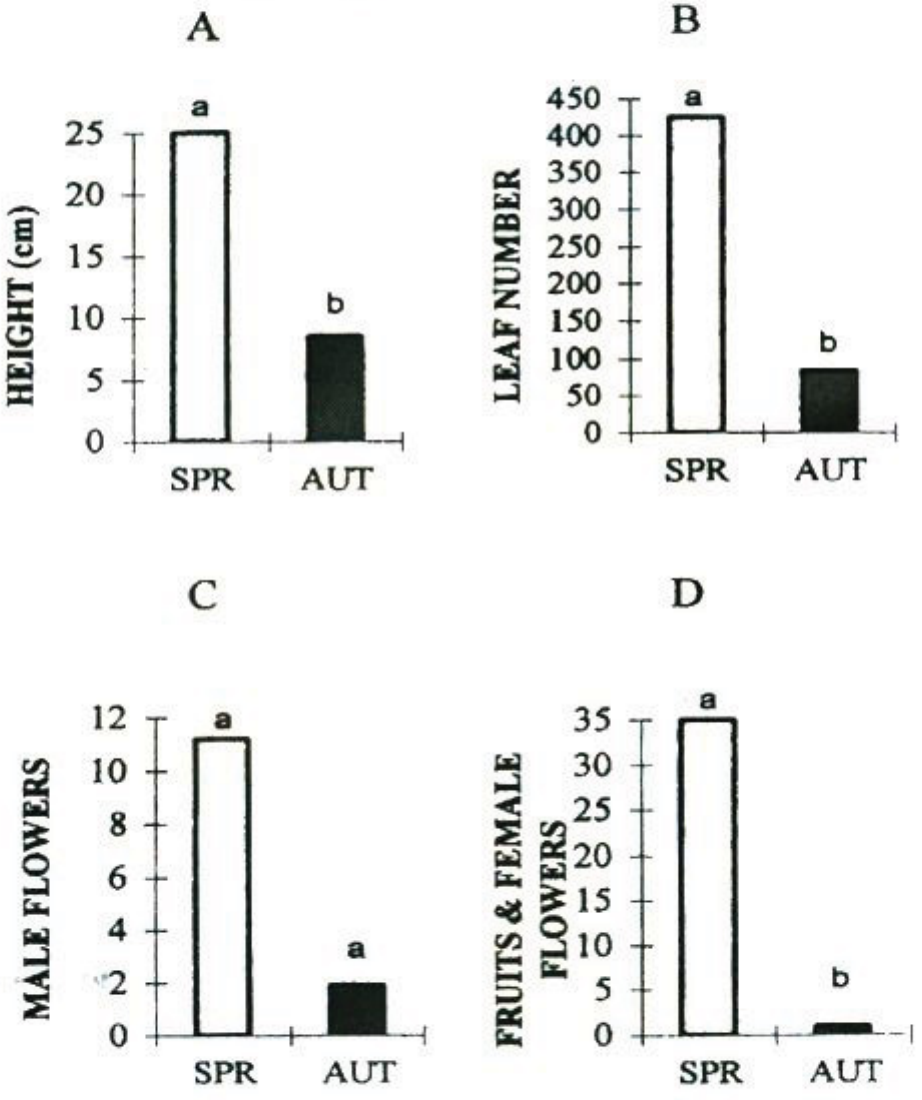

FIGURE 3 – Comparison of height, leaf number, male flowers, female flowers and fruits between *Phyllanthus niruri* plants grown during Spring and Autumn, after 17 weeks of growth.

Discussion

The growth of *Phyllanthus niruri* L. plants was compared at two seasons of the year. When seeds were sown at the end of Spring, the growth was higher and faster than in plants grown from seeds sown at the end of Summer. In this case, the growth was slow and after 6 months, the plants were smaller, but able to produce flowers and fruits although this process was delayed. The production of flowers and fruits was heterogeneous. Strong winds and rain may have provoked abscission of some flowers and fruits, but the individual plant variation was also an important factor for the heterogeneity. The biomass was not verified in this work but one could infer that the greatest biomass should occur for plants grown from seeds sown in November 1991 since these plants were higher than those grown from the seeds sown in March 1993. These data are consistent with the results obtained for *Phyllanthus amarus*. This species yielded the greatest biomass in Florida when sown for harvesting, during the hottest months, and most of the biomass seemed to be obtained 4-6 months after sowing. In all experiments *Phyllanthus amarus* grew slowly and reached a maximum size and vigour about 5-7 months after sowing. After seven months, most plants become senescent and lose their leaves. The poorest yields of all occurred when plants were grown through the rainy season (Unander et al., 1993). The cultivation of several *Phyllanthus* species including *Phyllanthus niruri,* during the cool season was also a limiting factor in the HBV DNA polymerase (ADNp) since there was a dramatic decrease in activity (Unander et al., 1991b). The present data, indicates that *Phyllanthus niruri* grows better when cultivated during the Summer months in Florianópolis (Santa Catarina State)

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