POPULATION STRUCTURE OF *MICONIA ALBICANS* (SW.) TRIANA (MELASTOMATACEAE) IN A CERRADO AREA SUBJECTED TO FIRE

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Introduction

The Cerrado is the largest savanna area in the Neotropical region (Gottsberger & Silberbauer-Gottsberger, 2006). Its vegetation presents a physiognomic gradient ranging from open field (*campo limpo*) to forest (*cerradão*), depending on the relative abundance of herbs/subshrubs and shrubs/trees (Coutinho, 2006). Most of its area is occupied by savanna physiognomies (*campo sujo* to *cerrado* sensu stricto), with well defined herbaceous and tree layers. Among other factors, the physiognomy is defined by the periodicity of fire.

A plant population can be characterized by its performance and space structure; one of the common ways of assessing performance of a population is by its size structure (Hutchings, 1997). They can be influenced by abiotic factors such as disturbances and biotic factors such as intra- and interspecific competition. At high population densities density-dependent mortality known as self-thinning may occur (Silvertown & Lovett Doust 1993).

*Miconia albicans* (Melastomataceae) presents some interest for the study of fire effects on cerrado plant population ecology. Its distribution is negatively associated with fire occurrence (Moreira, 2000). In spite of surviving better in open physiognomies (Miyanishi & Kellman 1986), it is sensitive to fire, suffering complete topkill during a fire occurrence (Hoffman & Solbrig 2003) and disappearing from communities with frequent fires due to insufficient reserve accumulation (Miyanishi & Kellman 1986). Fires severely impair its seed output (Hoffman, 1998), but stimulate resprouting (Miyanishi & Kellman 1986).

In this work we studied the performance and spatial structure of a *M. albicans* population in a cerrado sensu stricto fragment and examined the effects of fire and the possibility of self-thinning.
Material and methods

*Miconia albicans* (Sw.) Triana (Melastomataceae) is a common cerrado shrub or small tree, common in the cerrado. It produces fleshy fruits with 25 to 35 seeds each (Goldenberg, 2004). Its roots reach up to 45 cm below soil level, disfavouring water absorption during the dry season (Monteiro & Prado, 2006). According to Haridasan & Araújo (1988), it is an alluminium accumulating species.

We studied a population of *M. albicans* in a cerrado reserve in São Carlos, SP, Brazil. The area was accidentaly burnt in August 2006. One and a half years after the fire we measured basal diameter and height of all ramets of *M. albicans* located in 96 25 m² plots distributed in five parallel transects, totalizing 0.24 Ha. Ramets were classified in sprouts, adult burnt or adult unburnt. *M. albicans* doesn't produce root suckers (Hoffmann, 1998), and all shoots arise from a single stem. We considered a genet to be a group of shoots connected to each other above or below ground, and a ramet to be each shoot separated from the others above ground. Sprouts were differentiated from the adults mostly by their non-woody texture.

Spatial distribution was analyzed using Morisita's index (Im) for adults (live and dead) and sprouts, as well as for genets; chi square was used to see if the computed index was significantly different from 1 (David & Moore 1954 *apud* Souza & Martins 2002):

\[ \chi^2 = (Q - 1) s^2/x_m \]

Where Q is the number of plots, s² the variance and x_m the mean number of plants per plot; DF=Q-1.

Size structure of live adults and sprouts was assessed graphically.

In order to see if self-thinning occurs in this population, we compared Im’s for sprouts and adult ramets. Since most of the mortality occured in the fire event, we calculated Im for adults using both live and dead ramets.

Size structure was assessed graphically with histograms for basal diameter and height distributions of sprouts and live adult ramets. Spearman’s correlation was used to see if there is any correlation between basal diameter and height.
The effect of fire was assessed by comparing the number of sprouts on burnt and unburnt genets with the proportion of burnt and unburnt ramets.

Results and discussion

In the area sampled, we 1005 genets comprising of 3775 sprouts and 633 live adult shoots; 1549 dead shoots were found as well. This gives us a mean density of about 4,200 genets, 15,700 sprouts, and 2,650 live adults per hectare. There were 39.3±34.5 sprouts, 22.7±16.5 adult ramets, and 10.5±7.7 genets per plot. Morisita index (Im) was of 1.75 for sprouts ($\chi^2=2889$, p<0.05), 1.49 for adult ramets ($\chi^2=1147$, p<0.05), and 1.45 for genets ($\chi^2=543$, p<0.05). This shows that the spatial distribution of this plant is significantly clumped. Sprouts are slightly more clumped than adults, indicating a possible self-thinning (Silvertown & Lovett-Doust, 1993); however, this study is inconclusive in this respect.

The basal area of sprouts was equal to 2.1 m$^2$/Ha, and the total basal area of adult live ramets was of 3.85 m$^2$/Ha. This is about five times more than the combined basal areas of all Miconia species in an experimental Eucalyptus plantation (Silva, Higuchi & Pifano, 2007). Even if we consider the methodological differences, this result shows how abundant this species may be in a natural area. Mean basal area per plot was of 52.7±52.5 m$^2$ for sprouts and of 650.5±3,551.5 m$^2$ for adult ramets, both live and dead. The high standard deviation shows that there is much spatial variation in the basal area, as expected from the clumped distribution of this population.

No significant correlation was found between basal diameter and height for either sprouts or live adults. Size structure for sprouts and live adults is presented in figure 1. It can be seen in this figure that both sprouts and adult ramets present a structure resembling a reverse J, but with fewer individuals in the lower size classes. This agrees with a study performed by Westphal (2006) in a different environment (temperate forest), where they saw that rever J is not universally appliable to plant populations.

Of the 3775 sprouts, less than 40 (about 1%) were born of not burnt ramets. However, 375 of the 2182 ramets (live or dead) were not hit by the fire (17%). This shows that fire stimulates resprouting. Few burnt individuals were not killed completely to the ground (i.e. had green leaves), and most of them had no old branches, only new ones, grown after the fire and without a woody texture. These individuals produced fewer sprouts (the absolute majority of genets with live ramets
produced no sprouts at all), evidence for a possible tradeoff between maintaining green leaves and resprouting.

Figure 1. Size structure of sprouts (left) and adult live ramets (right) of *Miconia albicans* in a cerrado *sensu strictu* area.

**Conclusions**

1) *Miconia albicans* presents a clumped spatial distribution at all levels examined (genets, adult ramets, sprouts).

2) There is evidence for self-thinning (sprouts are more clumped than adults).
3) Fire stimulates intensive resprouting; topkill is almost complete, as seen by the small number of live adult ramets.

4) Size structure resembles a reverse J for both sprouts and adult live ramets.

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References


