DENSITY AND COVERAGE OF ASTROCARIUM ACULEANTISSIMUM (SCHOTT) BURRET E EUTERPE EDULIS MART. AS DISTURBANCE INDICATORS AT ATLANTIC FOREST FRAGMENTS (GUAPI - MIRIM, RJ).

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INTRODUCTION

Astrocarium aculeantissimum (Schott) Burret and Euterpe edulis Mart., belong to the same Family (Areaceae), and have high abundances at Atlantic Forest areas, achieving very high densities at some of them (near 500 ind./ha) (Pires 2006, Prieto 2008). These two species have very different morphological and ecological characteristics. A. aculeatissimum is a monoicious specie, slow growth, shade tolerant and can present one or many trunks with many thorns (Lorenzi *et al.*, 2004). It is a endemic Atlantic Forest specie presenting sexual and assexual reproduction. Euterpe edulis (Jussara palm) is monoicious with a single trunk, slow growth, presenting only sexual reproduction (Pires 2006).

Palms are strongly influenced by environmental heterogeneity (Clark *et al.*, 2005) and species can present different answers to this, due to their ecological characteristics. Individuals of A. aculeatissimum can be found on the forest understory, edges, clearings and rarely at canopy. It is never found on humid soils. Prieto (2008) found high densities of this specie at the edge and interior forest areas, been its density significantly higher at forest interior achieving densities near by 500 ind/ha. Portela (2008), found that densities of individuals of A. aculeatissimum vary between preserved areas (reserves) and they were not correlated with forest fragment size but stated that it is probably with the time since areas are been preserved. The oldest reserve presented lower densities (309 ind/ha) of this specie and the newest higher densities (1253 ind/ha). Kurtz e Araújo (2000), show that this specie occurs in lower densities in a sub - montane preserved area. In forest fragments at Guapiaçu riverbasin, was observed that these areas had marked differences on A. aculeatissimum abundance and, probably, these differences are not related with fragments size. Due to the ecological characteristics of this palm and the results and observations showed above, can be stated that, among other factors, type or intensity of disturbance can influence the abundance of this palm. Higher densities of it can be related with disturbances that not modify drastically basic environmental needs for its survive (e.g. humidity), as it occurs in lower densities at forests edges. Since it occurs at lower densities on more mature sites, can also be postulated that, at sites where disturbances are avoided for longer times this palm occurs, also, in lower densities. The hypothesis postulated here is that higher abundances of this palm is found at sites where lower intensity disturbance occurs or on sites where time since these disturbances are been avoided are lower than others sites.

E. edulis is shade tolerant and it is found mainly at forest interior, can occurs on more humid soils and, many times, at swamp areas (Silva - Matos 1995). It is a endangering specie and is intensively used for human diet (Galetti & Aleixo 1998, Portela 2008). It is found in higher abundances in preserved areas where extraction activities can be controlled and it is also suggested, that this palm is seriously affected by some edge effects (reduced humidity) (Portela sup.cit., Prieto 2008). So, can be expected that, higher densities of this palm are found at areas with less disturbance and extraction pressures or at areas been preserved for longer times.

OBJECTIVES

Densities and occurrence of E. edulis and densities of A. aculeatissimum were compared between six forest fragments with different surrounding properties and disturbance characteristics.

MATERIAL AND METHODS

1 Study area

This study was conducted at forest fragments on the GuapiAçu river basin, localized at the Guapi - Mirim and Cachoeiras de Macacu Municipalities (22º 21' - 22º 39'S e

42º40' - 43º01'W, respectively), Rio de Janeiro - RJ. This area is situated between the coastal plain of Guanabara Bay and the high scarped mountains of Serra dos Órgãos National Park. The area belongs to the Mares de Morros formations (Ab'Saber 1971), formed by extense plain with many low altitude mountains (100 - 200 mts.). It was a flood plain by the 1930 and 1940 years when it was drained and flood plains became dry and were used for human economic activities. Since then, forests areas were submitted to many anthropogenic pressures, and the lowland forests were transformed to cattle and plantations areas. Forest remains are encountered at low mountain hills and are also subjected to diverse anthropogenic pressure types.

Six forest fragments with similar altitude (100 a 200 mts sea level) of different sizes and submitted to different anthropogenic disturbance were selected. Fragments selection was based on the surrounding properties type (inside a unique large property or surrounded by many small properties), areal photographs (1975, 1996 and 2003), interviews with the owners and surrounding population and local visits. Control area (PARAÍSO, size=13ha) is a forest fragment located inside the Parque Estadual do Paraíso and is close (less than 100m) to the continuous forest. Two forest fragments selected are surrounded by many properties (FS - 27, size=17,5ha and INCRA, size=73,5ha) and three forest fragments inside a unique big property (IBIO1, size=31,5ha; IBIO2, size=8ha and IBIO 3, size=35ha). FS - 27 is a forest fragment with no reduction since 1996, although it was severely reduced between 1975 and 1996, extraction activities were registered as timber extraction for houses and fences. IBIO 1 and IBIO 2 also presented area some reduction from 1975 to 1996 but almost no detectable area reduction between 1996 and 2003, its also present some timber extraction activities, mainly for bridges and fences production. IBIO 3 is located near a Conservation Unity, the Reserva Ecológica do GuapiAçu (REGUA) and had no detectable area reduction since 1975. This area belongs to a owner that try to avoid timber extraction and hunt activities, according to him the area had no intense disturbances for almost 60 years. Besides, it is possible to see some banana plantations and other exotic species inside the forest, related to old intense economic exploitation of this area. PARAÍSO didn't show any great disturbance since 1975, since 1930 this is a area protected from hard timber extraction and forestry activities as it was a area preserved by many public organs related with water supply for human population (CEDAE) and the conservation units existing since this time. INCRA has many small properties around it and intense population growth is observed at his edge. High area reduction was observed from 1975 to 1996, less intense but detectable area reduction was observed from 1996 to 2003. Periodic impacts on fire, timber extraction, were registered at the study period, been the last great impact occurred near five years ago.

According to the forest fragments historical disturbance, the forest fragments were divided in three groups, according to their disturbance intensities. So, areas were classified as high intensity disturbed (FS - 27 and INCRA), low intensity disturbed (PARAÍSO) and medium intensity disturbed (IBIO1, IBIO2, IBIO3). Since disturbances types are difficult to measure was not possible to separate the medium disturbed fragments, discussion will be made about this aspect.

Data collection

Eight 25 x 50 m plots were established at each forest fragment (four contiguous plots at west side and four contiguous plot at south side). At each side, two inferior plots were located 20m distant from forest edge and two superior plots were located 70m from forest edge. All three individuals with DAP >5 cm were measured and their height was visually estimate.

All the individuals of Astrocarium aculeantissimum and Euterpe edulis measured belong to the imature or non - reproductive and mature or reproductive age classes, according to the classification adopted by Portela (2008).

Data analysis

Absolute densities for each species were calculated for each plot at each fragment. Densities were compared between fragments using the non - parametric analysis of variance Kruskall - Wallis (KW) and a test z for multiple comparisons as a posteriore test. E. edulis was encountered at fragments FS - 27 (1 ind/ha), IBIO 1 (2 ind/ha), IBIO 3 (51 ind./ha) and PARAÌSO (20 ind/ha). So, to test differences of density and DBH between the two last fragments Mann - Whitnney (U) test was used. Total density in each fragment was correlated with fragment area using Spearman Rank Correlation (r).

Diameter at Bright Height (DBH) was used as a measure of specie coverage as it is directly related to the basal area. Kolmogorov - Sminorv normality test was used for analyze distribution of DBH values. It did not differed from a normal distribution for both species (A. aculeantissimum: D=0.12, p <0.10 and E. edulis:D=0.73, p >0.20) and presented low coefficients of variance for all fragments (A. aculeantissimum: Fs - 27=15%, IBIO1=14%, IBIO2=10%, IBIO3=15%, INCRA=19%, PARAÍSO=17%, E. edulis:IBIO3=18%, PARAÍSO=22%). Analysis of Variance (ANOVA) and Tukey (HSD), as a posteriore test, were used two compare fragments in relation to these two variables.

RESULTS AND DISCUSSION

Densities found for A. aculeantissimum for each fragment was FS - 27=253 ind/ha, IBIO 1=122 ind/ha, IBIO 2=378 ind/ha, IBIO3=292 ind/ha, INCRA=92 ind/ha and PARAÍSO=105 ind/ha. A. aculeantissimum densities were significantly different between fragments (H(5,46)=22.32, p=0.005). IBIO 2 density was higher than INCRA (HSD=3.38, p=0.0005) and PARAÍSO (HSD=3.18, p=0.0005), although IBIO 2 densities did not differed from other fragments (FS - 27, HSD=1.24; IBIO 1, HSD=2.57; IBIO 3, HSD=0.09; for all comparisons p >0.05). IBIO 3 had significant higher densities than INCRA and PARAÍSO (z=3.17 and z=2.98, both with p=0.0005), but no significant differences were found when compared with other fragments (FS - 27, HSD=1.11, IBIO1, HSD=2.39, for all comparisons p >0.10).

No correlation was found between fragment area and density of A. aculeantissimum in each forest fragment (n=6, r= - 0.47, p=0.26).

Means (± SD) and medians of DBHs (cm) for each fragment were FS - 27, mean=8.44 (±1.3), median=8.28; IBIO1, mean=8.75 (±1.25), median=8.91; IBIO2, mean=9.2 (±0.92), median=8.91; IBIO3, mean=8.5 (±1.27), median=8.59; INCRA, mean=8.23 (±1.61), median=8.58; PARAÍSO, mean=7.85 (±1.33), median=8.12. Significative differences were also found for the A. aculeantissimum DBHs between fragments. (F=30.35, p=0.000001). IBIO 2 presented significant higher values than FS - 27 (HSD= 25.2, p=0.00002), IBIO1 (HSD=15.1, p=0.004), IBIO 3 (HSD=24.6, p=0.00002), INCRA (HSD=10.5, p=0.002) and PARAÍSO (HSD=27.2, p=0.000049). PARAÌSO presented significant lowest DBHs from FS - 27 (HSD=18.4, p=0.00037), IBIO1 (HSD=23, p=0.00002), IBIO3 (HSD=22.3, p=0.000049) but not differed from INCRA (HSD=3.4, p=0.25). INCRA had significant smaller DBHs from IBIO 1 (HSD=15, p=0.02) but not differed from IBIO 3 (HSD=4.3, p=0.41) and FS - 27 (HSD=1.5, p=0.7). IBIO 3 not differed from FS - 27 (HSD=0.8, p=0.99) and IBIO 1 (HSD=3.9, p=0.41). IBIO 1 did not differed from FS - 27 (HSD=5, p=0.17).

For E. edulis, the densities between IBIO 3 (51ind/ha) and PARAÍSO (20 ind/ha) did not differed significantly (U=49.5, p=0.20). DBH mean (±SD) and median was at IBIO3 7.38cm (±1.31) and 7.51cm., for PARAÍSO was 6.85cm (±1.51) and 6.85cm. Significant differences were not find for this variable either between the two fragments (F=2.25, p=0.14).

DISCUSSION

Although inferences about disturbance types and intensity are difficult to analyze and measure, the tools used here can be a start point to think about how to measure and select fragments based on human use to study disturbance. At this case, the junction of these tools proved to be reasonable and seems to reflect relatively well the probable conservation state of these areas.

Patterns of density and cover of A. aculeantissimum and E. edulis presented very different characteristics between fragments. These differences, despite the different ecological needs for both species, seems to be highly influenced by different anthropogenic pressures at the forest fragments.

Portela (2008) showed that higher densities of E. edulis are found at forest areas that has been protected for a longer time. At this study, the higher densities of E. edulis was encountered at forest fragments (IBIO3 and PARAÍSO) with a disturbance history less severe than others, strongly suggesting that extraction activities on these areas are, probable, a decisive factor for the occurrence and abundance of this specie and demonstrating the importance of the maintenance and increasing the protected areas of Atlantic forest.

Guedes - Bruni (2006) observed, visually, that A. aculeantissimum occurs at areas of higher canopy density at forest interior than at areas of more open canopy. These authors reinforce the study of Souza & Martins (2002) which stated that large scale variations, like clearings on the forest and higher or lower conservation state, are more important that micro - scale factors like humidity, soil and topography for the population structure of other palm (Attalea humilis). A. aculeantissimum occurred at lower densities and had the lower coverage at forest fragments classified as high and low disturbed (INCRA and PARAÍSO). Higher densities and coverage occur at areas classified as medium disturbed and at the areas classified as high disturbed (FS - 27). Although FS - 27 was also classified as high disturbed, it did not presented a frequency of disturbance and the same disturbance types as INCRA, that is submitted to fire incidents, for example. So, it is reasonable to state that higher density of A. aculeantissimum occurs at intermediate successional stages or where the low intensity and frequent impacts occurs, increasing forest heterogeneity.

CONCLUSION

It is important to stress that the purpose of this work is to serve as a start point for discussion on the biological indicators for anthropogenic pressures, measure of abiotic factors and community biological characteristics and interactions are very important for solid conclusions. Quantitative estimates for these anthropogenic pressures are also needed.

As Chazdon (1996) stated, human activity and historical perturbation are so important in influencing the distribution and the dynamic of palm populations as are soil, topography and other abiotic factors. This study is in accordance to him.

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