Technical Note/*Nota Técnica*

SPATIAL DISTRIBUTION PATTERN AND INTER-SPECIFIC ASSOCIATION OF EIGHT MEDICINAL SPECIES IN THE BRAZILIAN SAVANNA

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ABSTRACT: This main purpose of this work was the application of spatial dispersion indexes and inter-specific association among eight species with medicinal interest from the Brazilian Savanna, which are: Alibertia edulis, Anadenanthera falcata, Bauhinia holophyla, Bromelia balansae, Cochlospermum regium, Dimorphandra mollis, Duguetia furfuracea, and Tabebuia aurea. Data were collected in an area of 32 ha, where 32 plots of 30 x 10 meters, 100 meters far away from each other, were systematically allocated. In each plot, the number of individuals belonging to each specie were registered. In the characterization of the dispersion and inter-specific association the following indexes were utilized: Morisita, McGuinnes, Fracker and Brishle, Payandeh, and the Hurlbert coefficient. According to the dispersion indexes analyzed, the majority of the species showed a clustering trend or being aggregated, and only Dimorphandra mollis presented random distribution. The Hurlbert's inter-specific association coefficient indicated independent association among the species Duguetia furfuracea and Tabebuia aurea with the other analyzed species. It should be emphasized that there was a negative association among Anadenanthera falcata and two other species: Alibertia edulis and Dimorphandra mollis. Studies have demonstrated that the Anadenanthera genus presents alelopatic effects upon test-pants, which should help to explain this occurrence. In general, the other species studied showed independent or positive association.

Key words: Medicinal Plants, Phytosociology, Plant Dispersal, Species Aggregation, Brazilian Cerrado.

DISPERSÃO ESPACIAL E ASSOCIAÇÃO INTERESPECÍFICA DE OITO ESPÉCIES DE PLANTAS MEDICINAIS DO CERRADO BRASILEIRO

RESUMO: *O objetivo deste trabalho foi a aplicação de índices de dispersão espacial e de associação interespecífica em oito espécies com interesse medicinal do Cerrado brasileiro, sendo elas: Alibertia edulis, Anadenanthera falcata, Bauhinia holophylla, Bromelia balansae, Cochlospermum regium, Dimorphandra mollis, Duguetia furfuraceae e Tabebuia aurea. Dados foram coletados em uma área de 32 ha, onde foram alocadas sistematicamente 32 parcelas medindo 30 m x 10 m cada uma, distantes 100 m entre si. Em cada parcela foram registrados os números de indivíduos para as oito espécies. Na caracterização da dispersão e da associação interespecífica foram utilizados os seguintes índices: Morisita, McGuinnes, Fracker e Brischle, Payandeh e o Coeficiente de Hurlbert. Segundo os índices de dispersão analisados, a maioria das espécies teve tendência ao agregamento ou agregadas e somente Dimorphandra mollis apresentou distribuição aleatória. O coeficiente de associação interespecífica de Hurlbert indicou associação independente entre as espécies Duguetia furfuraceae e Tabebuia aurea com o restante do grupo analisado. Merece destaque a associação negativa entre Anadenanthera falcata e outras duas espécies: Alibertia edulis e Dimorphandra mollis. Estudos tem demonstrado que o gênero Anadenanthera apresenta efeitos alelopáticos sobre plantas-teste, o que ajuda a explicar esta ocorrência. Em geral, as outras espécies estudadas apresentaram associação independente ou positiva.*

Palavras-chave: Plantas Medicinais, Fotossociologia, Dispersão de Plantas, Agregação de Espécies, Cerrado.

1 INTRODUCTION

The Savanna recovers about 25 percent of the Brazilian territory and may be considered the most representative kind of vegetation of Brazil, following the Amazon Forest. It includes the Central Plain and occupies the major portion of Tocantins, Goiás, Mato Grosso do Sul, Mato Grosso, Minas Gerais, Bahia, Maranhão, and Piauí States, besides minor parts of São Paulo, Pará, Roraima, Amapá, and Rondônia States (MANTOVANI & PEREIRA, 1998).

It is estimated that in the Savanna are yearly developed 4,000 to 10,000 vascular species, which outnumbers that of the floras from a lot of countries (PEREIRA, 1992). It is calculated that around 800 wooden species and a much greater number of herbaceous species (RATER et al., 1988). It is presented with the format of a mosaic of communities that alternate and interact, forming complex environments.

The more intensive occupation of the savannas region has brought about environmental problems due to

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the lack of use of adequate technology and also due to the great territorial extension of these occupation areas. The indiscriminate deforestation and the forest fires cause problems like the loss of soil due to erosion, and losses of vegetable and animal species, which affects the region genetic arrays (MANTOVANI & PEREIRA, 1998).

The ecosystems in general are being threatened through the population growth and also through the inefficiency of the protective laws all around the world, and the Brazilian savannas are not excluded from this process. This fact demonstrate the urgent need of the domestication of useful species, as well as to populate the deforested areas again with trees, and to rationalize the forest's use , in order to preserve the species and to guarantee the knowledge transmission to future generations (RODRIGUES et al., 2002).

The management of natural populations and the domestication of plants species for medicinal nutritional purposes are important to the species preservation and to the benefit of the knowledge associated to them (BROWN JR., 1988).

Considering that only 1.5 percent of the savannas vegetation is protected by law within the environmental conservation areas (DIAS, 1990), it is foreseen the possibility of extinction of many species, even before being identified, due to the ecosystems growing fragility. From all existent literature about the usefulness of the savannas' vegetable species, a great number deal refers to the plants considered medicinal (CONCEIÇÃO, 1980; BARROS, 1996).

In one of the studies of native plants with medicine properties prospective and characterization in forest and savanna fragments in the Dourados county – Mato Grosso do Sul State/Brazil, were found, among other species, *Duguetia furfuraceae* (A. St.-Hil) Benth. & Hook. F., *Tabebuia aurea* (Silva Manso) Benth. & Hook. F. ex S. Moore, *Dimorphandra mollis* Benth., *Bromelia balansae* Mez, *Bauhinia holophylla* (Bong) Steud., *Cochlospermum regium* (Schrank) Pilg., *Anadenanthera falcata* (Benth.) Speg. and *Alibertia edulis* (Rich.) A. Rich. Ex DC., all cited as of popular use in that micro region (SANGALLI, 2000).

During the 1st. Technical Meeting about "Conservation and genetic resources management of medicinal and aromatic plants strategies", conducted in Brazilia, were defined the medicinal and aromatic species for conservation and management priority, according to viewpoints of importance for the pharmacy industry and family and organic agriculture, among the eight species cited above (VIEIRA et al., 2001).

Phytosociological studies of different savanna areas are fundamental for the species distribution and inter-relationship knowledge. Especially, information in respect to spatial distribution and association generate important subsidies to the recommendation of agroforestry treatments and for the elaboration of forest management and explotation plans that pursue the ecological equilibrium alterations minimization of this forestry typology

The spatial distribution, also denominated species dispersion, may be represented by aggregation indexes, such those by: Morisita (MORISITA, 1959; BROWER & ZAR, 1977); McGuinnes (1934), Fracker and Brischle (1944) and Payandeh (1970). The first, according to Brower and Zar (1977), is little influenced by the plots size.

To evaluate the inter-specific association degree, among the most common indexes is that of Hurlbert, applied with the corrections proposed by Ratliff (1982). Oliveira (2003), utilized the indexes of Cole and Hurlbert in a flora survey in the same area where this work was developed and detected similar results. He also noticed that the Hurlbert's coefficient is capable of detecting even small changes among the species relationship.

This study was developed aiming to subsidize the management of some medicinal plants species,. The objective was the application of inter-association and dispersion indexes into eight medicinal species from the Brazilian Savannah.

2 MATERIAL AND METHODS

This work was developed within the period comprehended between October 2001 and December 2002, in an area of legal reserve belonging to the Santa Madalena farm, situated at the left margin of BR 270 Road, at 45 km from the Dourados city. The local altitude is 452 meters above sea level and the climate is classified by the Köppen international system as Cwa – Humid Mesotermic (MATO GROSSO DO SUL, 1990). The surface is flat and the soil is classified as Red Distroferric Latosol (BRASIL, 1982; EMBRAPA, 1999).

The vegetation is savanna typical, and may be classified, according to IBGE (1982), as belonging to the Stricto Sensu Savannah typology. Eight native species with medicinal orientation were chosen, due to the fact of being situated within the most searched by the region population of Dourados county, Mato Grosso do Sul State (SANGALLI, 1999) and in function of being subject to

extinction risk (VIEIRA et al., 2001), being them: *Alibertia edulis, Anadenanthera falcata, Bauhinia holophylla, Bromelia balansae, Cochlospermum regium, Dimorphandra mollis, Duguetia furfuracea,* and *Tabebuia aurea*. The botanic species identification was done by the Professor Maria do Carmo Vieira, medicinal plants specialist, from the Department of Agrarian Sciences Mato Grosso do Sul Federal University– Brazil. The botanic material is deposited in the DDMS Herbary, from the same university.

In a 32 ha area were systematically allocated 32 plots measuring 30 by 10 meters each one, 100 meters separated one from another. In each plot, the number of individual for each specie, was registered. In the dispersion and inter-specific association characterization the following indexes were utilized: Morisita (Id), McGuinnes (D/D'), Fracker and Brischle (FB), and the Hurlbert's coefficient.

3 RESULTS AND DISCUSSION

Through the results obtained with the four calculated aggregation indexes (Table 1), it was concluded that only the *Dimorphandra mollis* specie presented aleatory dispersion, confirming *in locus* observation, where the individuals were found isolated in the majority of the plots. This specie is registered in several risk of extinction lists in Brazil, since it generates seeds of great commercial value (FERREIRA, 1998); these seeds produce Rutine, a phytopharmac product utilized to provoke uterus contractions which, associated with C vitamin, offers resistance to the micro vessel walls (RIZZINI & MORS, 1976). If, at one perspective, it is a species of human interest, on the other hand, it is not appreciated by the cattle raisers, since its consumption can be lethal for the bovines (POTT, 2005) and bees (CINTRA, 1998).

The random dispersion form of *Dimorphandra mollis* may facilitate its shared environment with the domestic animals and consequent cattle breeders' adherence. A natural conditions management system capable of avoiding high individuals density and that determine the fruits harvesting before being consumed by the animals, possibly would prevent the specie eradication from the pastures and yet to allow financial advantages to the landowners.

In the other seven species the pattern was of aggregation or of aggregation trend. In those, the natural dispersion standard probably has facilitated the collectors' work, increasing the extinction risk in which they are exposed, what has been affirmed by Vieira et al. (2001). *Bromelia balansae*, for instance, which was also considered as being of aggregated behavior by Duncan et al. (2002), besides its harvesting with medicinal purposes, is also consumed by wild animals and indigene communities (SCHWARTZMAN & SALVADOR, 1995; RIBAS et al., 2001). These facts are clear indicators about the benefits that the management of this and of other cited species can offer to the community. The results obtained for the Hurlbert's index, which shows the association among the eight observed species are interpreted through Table 2.

It is clearly noticed that the *Duguetia furfuraceae* and *Tabebuia aurea* species presented independent of the presence of other studied species. This may indicate that, in an eventual management strategy that includes any one of the eight studied species, which are highly searched by the regional community, there will be no need of considering the presence of the others.

This peace of information is also relevant to the execution of reforesting projects, since the result for the two species indicates that they could be managed in single crop, by not being ecologically dependent of the other evaluated species.

An important highlight must be given to the association between the *Anadenanthera falcata* and *Alibertia edulis* association analysis. The Hurlbert's index found (-0.93) indicated that these species probably present some rejection mechanism from one to the other, which must be further investigated. A strong negative association was pointed, that is, where one of them is found, the other is not detected in the vicinity. For the native vegetation or mixed plantings management, the choice of one of them may prevent the viability of the other.

The genus *Anadenanthera* has presented in alelopatic studies a tendency to influence the germination and development of test-plants (CARMO et al., 2003), which reveals the need of more detailed studies in the biochemistry field with the objective of investigating the causes of this occurrence better. Although in a lesser association degree of negative correlation, the same happened with *Anadenanthera falcata and Dimorphandra mollis* (-0.35), reinforcing the need of further detailing, mainly about the first one.

On the other hand, *Dimorphandra mollis* presented negative association with two other species: *Bauhinia holophylla* and *Bromelia balansae,* demonstrating in this way, the trend of not existing in the presence of at least three of the other studied species. This last one, grows in great clusters of individuals, which in general are around of larger trees.

Table 1 – Aggregation indexes of eight species of medicinal plants in Brazillian Savannah.

Tabela 1– *Índices agregados de oito espécies medicinais do cerrado brasileiro.*

Species	Indexes			
	Morisita (Id)	McGuinnes (D/D')	Fraker and Brischle(Fb)	Payandeh (P)
Anadenanthera falcata (Benth.) Speg.	1.57 (TA)	2.47 (A)	1.47 (A)	3.63 (A)
Cochlospermum regium (Schrank) Pilg.	4.17 (TA)	2.74 (A)	1.74 (A)	3.89 (A)
Bromelia balansae Mez	10.6 (A)	8.30 (A)	7.30 (A)	91.31 (A)
Duguetia furfuraceae (A. St.-Hil) Benth. & Hook. F.	1.63 (TA)	1.33 (TA)	0.0 (AL)	14.19 (A)
Dimorphandra mollis Benth.	1.00 (AL)	1.00 (AL)	0.08 (AL)	1.12 (AL)
Tabebuia aurea (Silva Manso) Benth. & Hook. F. ex S. Moore	1.26 (TA)	1.20 (TA)	0.0 (AL)	6.37 (A)
Alibertia edulis (Rich.) A. Rich. Ex DC.	1.66 (TA)	2.49 (A)	1.49 (A)	6.39 (A)
Bauhinia holophylla (Bong) Steud.	4.00 (TA)	3.66 (A)	2.66 (A)	12.11 (A)

Interpretation: A = aggregate; TA = aggregation trend; AL = aleatory

Table 2 – Hurlbert's index of inter-specific association and interpretation for eight species of medicinal plants in the Brazilian Savanna.

Tabela 2 – *Índice de Hurlbert's de associação e interpretação interespecífica de oito espécies medicinais do cerrado brasileiro.*

	Anadenanthera falcata	*Cochlospermum regium*	*Bromélia alansae*	*Duguetia furfuraceae*	*Dimorphandra mollis*	*Tabebuia aurea*	*Alibertia edulis*	*Bauhinia holophylla*
Anadenanthera falcata (Benth.)	-	0.04 (P)	0.33 (P)	0 (I)	-0.35 (N)	0 (I)	-0.93 (N)	0.47 (P)
Cochlospermum regium (Schrank) Pilg.	-	-	0.32 (P)	0 (I)	0.02 (P)	0 (I)	0.15 (P)	0.03 (P)
Bromelia balansae Mez	-	-	-	0 (I)	-0.44 (N)	0 (I)	0 (I)	0.07 (P)
Duguetia furfuraceae (A. St.-Hil) Benth. & Hook. F.	-	-	-	-	0 (I)	0 (I)	0 (I)	0 (I)
Dimorphandra mollis Benth.	-	-	-	-	-	0 (I)	0.04 (P)	-0.38 (P)
Tabebuia aurea (Silva Manso) Benth. & Hook. F. ex S. Moore	-	-	-	-	-	-	0 (I)	0 (I)
Alibertia edulis (Rich.) A. Rich. Ex DC.	-	-	-	-	-	-	-	0.33 (P)
Bauhinia holophylla (Bong) Steud.	-	-	-	-	-	-	-	-

Interpretation: N = negative association; I = independent association; P = positive association.

The majority of times in which these two species were detected, they did not occurred together. Two hypothesis may be raised with respect to this: the natural regeneration of *Dimorphandra mollis* does not happen in the middle of high *Bromelia balansae* density or, this tree presents large and dense canopy and its shadow may harm the other's regeneration.

The positive correlation among some of the evaluated species presented relatively weak association patterns, that is, very near zero coefficients, as it happened among: *Cochlospermum regium* with *Anadenanthera falcata*, *Dimorphandra mollis*, *Alibertia edulis* and *Bauhinia holophylla*; *Bromelia balansae* with *Bauhinia holophylla; Alibertia edulis* with *Dimorphandra mollis.* Possibly, this fact indicates an independence trend.

It is possible that the association models independent and positive may not be so relevant in natural population management strategies. In these cases, the presence of one specie could even enhance the development of the other. On the other hand, they alone would not satisfactorily develop.

The *Tabebuia aurea* and *Duguetia furfuraceae* species show independent association pattern with all evaluated species. This trait enormously facilitate their management job in natural conditions, in the enrichment of the savanna's vegetation or in the homogeneous planting.

The indicators of association and space dispersion of the eight species here evaluated do not allow to define conclusions with respect to the cause and effect relationships in the inter-specific relations. Nevertheless, they give directions to further investigations, for trying to explain the occurrences, mainly in the alelopaty and autoecology areas.

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