

**Weeds in pastures: a phytosociological approach in Ceara areas*****Ervas daninha em pastagens: uma abordagem fitossociológica nas áreas do Ceará***

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Abstract: The aim of this work was to study the phytosociology of weed species in areas of pasture cultivated with *Brachiaria decumbens* and *Cynodon* sp. (Tifton 85), in Ceará State, Brazil. The square inventory methodology was used in order to assess the weed community. Weed samples were quantified and classified by family, genus and species, using books and classification keys. The classification and quantification data of species allowed to calculate the following phytosociological variables: frequency (F), relative frequency (Fr), density (D), relative density (Dr), absolute dominance (DoA), relative dominance (DoR), importance value index (IVI), and similarity index (IS). The Amaranthaceae family was the one with the greatest intensity of species in both areas, represented mainly by *Alternanthera tenera colla* and *Amaranthus viridis*. In the area cultivated with *B. decumbens*, *Cyperus rotundus* presented higher results for frequency, density and abundance. In the Tifton 85 area, *Nicandra physalodes* presented higher values of density and abundance. The similarity of weed populations in pasture areas was 42.11%, with four species common to both areas.

Keyword: *Brachiaria decumbens*, phytosociology, importance value index

Resumo: O objetivo deste trabalho foi estudar a fitossociologia das espécies de ervas daninhas em áreas de pastagem cultivadas com *Brachiaria decumbens* e *Cynodon* sp. (Tifton 85), no estado do Ceará, no Brasil. A metodologia de inventário quadrado foi utilizada para avaliar a comunidade de ervas daninhas. As amostras de ervas daninhas foram quantificadas e classificadas por família, gênero e espécie, usando livros e chaves de classificação. Os dados de classificação e quantificação das espécies permitiram calcular as seguintes variáveis fitossociológicas: frequência (F), frequência relativa (Fr), densidade (D), densidade relativa (DR), dominância absoluta (DoA), dominância relativa (DoR), importância índice de valores (IVI) e índice de similaridade (IS). A família Amaranthaceae foi aquela com maior intensidade de espécies em ambas as áreas, representada principalmente por *Alternanthera tenera colla* e *Amaranthus viridis*. Na área cultivada com *B. decumbens*, *Cyperus rotundus* apresentou maiores resultados de frequência, densidade e abundância. Na área de Tifton 85, os de *Nicandra physalodes* apresentaram maiores valores de densidade e abundância. A semelhança das populações de plantas daninhas em áreas de pastagem foi de 42,11%, com quatro espécies comuns a ambas as áreas.

Palavras-chave: *Brachiaria decumbens*, fitossociologia, índice de valor de importância

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Introduction

Historically, pasture has been the main source of food for Brazilian cattle, sheep and goat herd. Until the 1970s, the native pastures represented most of the total pasture area in Brazil. However, since the 1980s, with the increasing demand for

meat, milk and dairy products and the expansion of agricultural frontiers, the country's total pasture area is estimated at around 174 million hectares. From this area, about 80% are represented mainly by forage species cultivated by plants of the genus *Brachiaria* (IBGE, 2010).





One of the major issues regarding pasture production is the weed control. Weeds are one of the main factors responsible for the low productivity of Brazilian pastures, especially those that are toxic to animals. These plants compete with forages for light, water, nutrients and physical space. Besides, when they are toxic, they are also responsible for the mortality of some animals (Pereira and Silva, 2006).

As a result of this problem, there is a growing need to establish new strategies that promote the reduction of weed community to acceptable levels of infestation to maintain the productive longevity of forage species. Such measures are fundamental for the sustainability and profitability of the activity in the region (EMBRAPA, 2006).

In this scenario, the phytosociological survey is important in obtaining knowledge about the populations and the biology of the species found on pasture. Therefore, it is an important tool in the technical basis of management recommendations and crops practices for implantation, recovery or management of pasture (Svicero et al., 2008; Mascarenhas et al., 2009).

Thus, the aim of this work was to study the phytosociology of weeds in pasture areas cultivated with *Brachiaria decumbens* and *Cynodon* sp in Ceará state, Brazil.

Materials and Methods

The study was performed in experimental pasture areas at the Federal University of Ceará. According to the Köppen classification system, the climate of the region is Aw' (Alvares et al., 2014), a tropical rainy climate with an average annual rainfall of 1,600 mm and average temperature of 26 °C.

Two irrigated pasture areas with *Brachiaria decumbens* (Brachiaria grass) and *Cynodon* sp. (Tifton 85 grass) were evaluated, in September, 2015. The areas are located at 38°32 'S, 3°43' W and 19.5 m of altitude.

The weeds' community was assessed by the Square Inventory Method (Braun-Blanquet, 1979). Hollow squares with dimensions of 0.5x0.5 m were randomly thrown in zigzag, 20 times in each area.

In each sample unit, the weeds were quantified and identified according to the family, genus and species, with the aid of botanical identification keys. The spelling correction of species names was performed by consulting The Plant List (2013).

With the classification and quantification data of the species, the phytosociological variables described by Müller-Dombois and Ellenberg (2002) and Kent (2011) were calculated for each area. The variables were density, frequency, dominance and importance value index.

The evaluation and comparison of areas were also carried out through the analysis of Diversity Profiles (Tóthmész, 1985) and Sorensen's Similarity Index (Sorensen, 1972). These analyzes were performed using the software Fitopac 2.1 (Shepherd, 2009) and Past 2.08 (Hammer et al., 2001), respectively.

Results and Discussion

In the literature, there are studies of the occurrence of weed classes in pastures (Inoue et al., 2012; Guglieri-caporal et al., 2010). However, there are few studies of this kind in the Northeastern region of the country and none of them approaches pastures in the state of Ceará. Thus, this work has significant relevance regarding the understanding of the phytosociology of weed plants in pastures cultivated in this region.

In the area cultivated with *Brachiaria*, nine weed species from eight different botanical families were found. Among them, the family Amaranthaceae with two species and Asteraceae, Convolvulaceae, Cyperaceae, Cucurbitaceae, Euphorbiaceae, Molluginaceae and Solanaceae with one species each (Table 1).



Table 1. List of family, species and phytosociological parameters recorded in areas cultivated with Brachiaria and Tifton 85, in Ceará

Family	Species	Brachiaria							Tifton 85						
		Ni	DA	DR	FA	FR	DoA	DoA	Ni	DA	DR	FA	FR	DoA	DoA
Amaranthaceae	<i>Alternanthera tenera colla</i>	4	0.40	1.00	0.05	1.92	4.00	9.64	118	11.80	27.19	0.75	23.81	7.81	17.59
	<i>Amaranthus viridis</i>	8	0.80	2.02	0.15	5.77	2.67	6.43	50	5.00	11.52	0.30	9.52	8.33	18.77
Asteraceae	<i>Emilia sonchifolia</i>								23	2.30	5.30	0.40	12.61	2.86	6.44
	<i>Eupatorium pauciflorum</i>	4	0.40	1.00	0.15	5.77	1.33	3.2							
Brassicaceae	<i>Raphanus raphanistrum</i>								5	0.50	1.15	0.20	6.35	1.23	2.77
Commelinaceae	<i>Commelina benghalensis</i>								21	2.10	4.84	0.30	9.52	3.50	7.88
Convolvulaceae	<i>Ipomoea asarifolia</i>	1	0.10	0.25	0.05	1.92	1.00	2.41							
Cyperaceae	<i>Cyperus rotundus</i>	263	26.30	66.25	0.70	26.91	18.18	45.24	3	0.30	0.69	0.15	4.76	1.00	2.25
Cucurbitaceae	<i>Momordica charantia</i>	20	2.00	5.04	0.35	13.47	2.86	6.89							
Euphorbiaceae	<i>Chamaesyce hysopifolia</i>	5	0.50	1.26	0.15	5.77	1.67	4.02							
Lamiaceae	<i>Marsypianthes chamaedrys</i>								3	0.30	0.69	0.05	1.59	1.00	2.25
Molluginaceae	<i>Mollugo verticillata</i>	56	5.60	14.11	0.50	19.23	5.60	13.5	4	0.40	0.92	0.10	3.17	2.00	4.51
Phyllanthaceae	<i>Phyllanthus tenellus Roxb</i>								6	0.60	1.38	0.25	7.94	1.20	2.70
Solanaceae	<i>Nicandra physalodes</i>								201	20.10	46.32	0.65	20.63	15.46	34.83
	<i>Physalis angulata L</i>	36	3.60	9.07	0.50	19.24	3.60	8.67							
Total		397	39.70	100	2.60	100	40.91	100	434	43.40	100	3.15	100	44.39	100

Ni = number of individuals; DA = absolute density (%); DR = relative density (%); FA = absolute frequency (%); FR = relative frequency (%); DoA = absolute dominance ($m^2 \cdot ha^{-1}$); DoR = relative dominance (%)



In the Tifton 85 area, nine botanical families and ten different weed species were found. The Amaranthaceae family had the largest occurrence of species, presenting two (Figure 1). Therefore, in both areas, Amaranthaceae presented the largest

number of species. It is a family of tropical and subtropical climate, with predominance of cosmopolitan species. Thus, it fits very well in any type of environment.

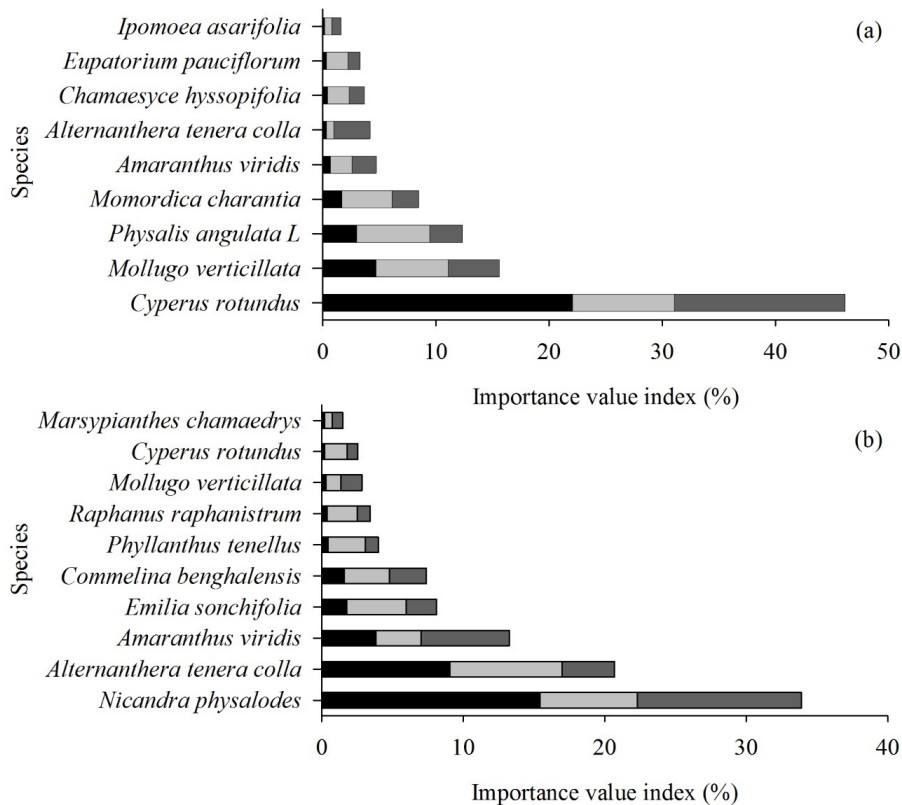


Figure 1. Importance value index (%) of weeds in pasture areas of *Brachiaria* grass (a) and Tifton 85 grass (b), in the state of Ceará

In a phytosociological surveys in pastures, Inoue et al. (2012) also found the Amaranthaceae family with two species, but the family which has been the most outstanding was the Asteraceae with seven species. Ferreira et al. (2014), working with a phytosociological survey of weeds in degraded pastures in Middle Rio Doce Valley, Minas Gerais, found the Fabaceae family with ten species.

In the area with *Brachiaria*, the species that were more frequent were *Cyperus rotundus* (0.70), *Mollugo verticillata* and *Physalis angulata* (0.50)

and *Momordica charantia* (0.49). These same species also had higher densities, ie, number of plants per species per unit of area, with expressive values for this variable, standing out *C. rotundus* (26.30), *M. Verticillata* (5.60), *P. angulata* (3.60) and *M. Charantia* (2.00). Following the same pattern of behavior, *C. rotundus* (18.18), *M. verticillata* (5.60), *P. angulata* (3.60) and *M. charantia* (2.86) presented the highest concentration (abundance) in the area (Table 1).



In the Tifton 85 area, *Alternanthera tenera colla* (0.75), *Nicandra physalodes* (0.65), *Emilia sonchifolia* (0.40), *Amaranthus viridis* e *Commelina benghalensis* (0.30) presented the highest frequency values. *Nicandra physalodes* (20.10), *Alternanthera tenera colla* (11.80) and *Amaranthus viridis* (5.00) stood out for density values. For the species dominance, it was verified that *Nicandra physalodes* (15.46), *Amaranthus viridis* (8.33) and *Alternanthera tenera colla* (7.81) showed more expressive results.

With the sum of Fr, D and Do data, the importance value index (IVI) was obtained, demonstrating, in fact, which species or group of species are of primary importance (Figure 1). It was observed that the species with the highest indexes of importance were *C. Rotundus* (138.4), *M. Verticillata* (46.84), *P. angulata* (36.98) and *M. Charantia* (25.4). This index indicates that *C. Rotundus* should receive top priority regarding its control.

The present phytosociological evaluation confirmed the fact that *C. Rotundus* can be considered the weed species with the greatest potential to cause damage in several crops. Thus, under favorable conditions, it can produce up to 8,700 m² tubers, which release allelopathic

substances (dicarboxylic acids, phenolic and fatty acids) in the soil by root exudation, negatively affecting the development of the surrounding plants (Durigan, 1991)

For the Tifton area, the weeds that had the highest importance value index were *N. Physalodes* (101.71), *A. Tenella colla* (68.10), *A. Viridis* (39.11) and *E. Sonchifolia* (24.34) (Figure 2).

Working on the phytosociological survey of weeds in pastures in Nova Olímpia-MT, Inoue et al. (2013) reported that the species that obtained the highest importance indexes were *Sida carpinifolia*, *Sida spp.*, *Andropogon bicornis*, *Richardia scabia*, *Mimosa wedelliana* and *Cyperus esculentus*. Ferreira et al. (2014), in a phytosociological survey on degraded pastures, also observed that species of the genus *Sida* had higher importance value indexes.

In terms of species diversity, which is the relation between species richness and the distribution of individuals among species, the Tifton 85 area stood out in all parameters of diversity when compared to the Brachiaria area (Figure 2). This greater diversity demonstrates a larger and more homogeneous weed infestation, which is generally related to weeds management and their characteristics.

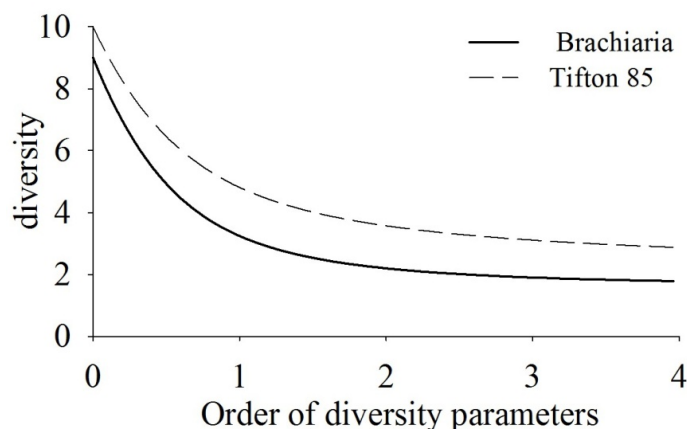


Figure 2. Diversity profile in pasture areas with Brachiaria grass and Tifton 85 grass, in the state of Ceará

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The similarity index of the species found in the areas was 42.11%, with four species common to both areas. When the values are above 25%, it can be inferred that there is similarity among the factors compared by this index. According to Carvalho and Pitelli (1992), similarity indexes are not only related to the soils or the distance between areas, but also to the management used in these areas. These changes may influence the germination and development of weeds and, consequently, the management strategies of the most important weeds. Similarly to what was found in the present study, Inoue et al. (2012) found similarity indexes above 50% for most of the comparisons made among the areas.

Conclusion

The Amaranthaceae family is the one with the greatest intensity of species in both areas, represented mainly by *Alternanthera tenera colla* and *Amaranthus viridis*.

In the area cultivated with *B. decumbens*, *Cyperus rotundus* presented higher results for frequency, density and abundance. In Tifton 85 area, *Nicandra physalodes* presented higher values of density and abundance.

The similarity of weed populations in pasture areas was 42.11%, with four species common to both areas.

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