UFSM

Ciência Florestal

ISSN 1980-5098
OPEN ACCESS

Ci. Fl., Santa Maria, v. 35, e84796, p. 1-20, 2025 • https://doi.org/10.5902/1980509884796
SSubmitted: 15th/08/2023 • Approved: 11th/07/2024 • Published: 30th/05/2025

Articles

Schinus terebinthifolia Raddi (Anacardiaceae) as facilitator in ecological recomposition

Schinus terebinthifolia Raddi (Anacardiaceae) como facilitadora na recomposição ecológica

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ABSTRACT

The floristics and structure of the natural regeneration of Cerrado species under plantations of *Schinus terebinthifolia* Raddi were analyzed at Fazenda Entre Rios in the Federal District. In October 2013, 200 *Schinus terebinthifolia* seedlings were planted in two 20 m x 80 m blocks, spaced 4 m x 4 m apart, with a total area of 3,200 m^2. Natural regeneration was evaluated in 2021, considering the 4 m^2 under its canopy as an area of influence. The control (area of low canopy influence) was established between the four neighboring tree canopies. 152 plots of direct canopy influence and 152 control plots were randomly selected. Besides the height and diameter, the regenerating individual's botanical identification, the species' dispersal strategy, and the absolute and relative density were assessed in each 4m2 plot. The Shannon-Wiener diversity index was compared using the Hutcheson t-test, the occurrence of zoochoric using the Mann-Whitney-Wilcoxon test, and density using ANOVA between the two environments. There was no significant difference between the diversity found in the environments, nor the greater occurrence of zoochoric individuals below the canopy. On the other hand, the density of individuals was higher in the area under the canopy influence, suggesting that *Schinus terebinthifolia* facilitates the colonization of new individuals under its canopy in restoration areas but without adding any species richness.

Keywords: Cerrado; Degradaded area; Facilitator species; S*chinus terebinthifolia*; Natural regeneration

RESUMO

A diversidade florística e densidade de indivíduos da regeneração natural de espécies do Cerrado sob plantio de pimenta-rosa (*Schinus terebinthifolia* Raddi) foram analisadas na Fazenda Entre Rios no Distrito Federal. Em outubro de 2013 foram plantadas em dois blocos de 20 m x 80 m, 200 mudas de pimenta-rosa com espaçamento de 4 m x 4 m perfazendo uma área total de 3.200 m^2. A regeneração foi avaliada em 2021, sendo considerada como área de influência os 4 m^2 sob a copa de cada indivíduo plantado. A área de baixa influência da copa (controle) foi estabelecida entre as quatro copas de árvores vizinhas. Foram selecionadas aleatoriamente 152 parcelas de influência direta da copa e 152 parcelas controle. Em cada parcela de 4m^2 foi realizada a identificação botânica de cada indivíduo regenerante, a estratégia de dispersão das espécies e avaliada a densidade absoluta e relativa. Entre os dois ambientes foram comparados o índice de diversidade de Shannon-Wiener pelo Teste t Hutcheson, ocorrência de zoocoria pelo teste de Mann-Whitney-Wilcoxon e densidade por ANOVA. Não houve diferença significativa entre a diversidade encontrada nos ambientes, nem a maior ocorrência de indivíduos zoocóricos abaixo da copa. Por outro lado, a densidade de indivíduos foi maior na área sob influência da copa. Os resultados sugerem que *Schinus terebinthifolia* atua como facilitadora na colonização de novos indivíduos sob sua copa, em áreas em processo de recomposição, mas não agrega riqueza de espécies.

Palavras-chave: Cerrado; Área degradada; Espécie facilitadora; *Schinus terebinthifolia;* Regeneração natural

1 INTRODUCTION

The liability of Permanent Preservation Areas (APP) in Brazil is around 8 million ha, and Legal Reserve (RL) is 11 million ha (Brasil, 2017). Estimates show that more than half of this RL deficit is in the Cerrado biome, where 4.2 million ha of native vegetation need to be recovered (Guidotti; Freitas; Sparovek; Guedes Pinto; Hamamura; Carvalho; Cerignoni, 2017). In this context, restoring degraded areas is of great environmental and even socioeconomic importance, especially regarding bringing economic alternatives to those owners with less than four fiscal modules.

Degraded RL areas in Brazil need to be restored according to recommendations of the Native Vegetation Protection Law (Brasil, 2012). For this reality, Federal Law 12,651/2012 indicates that 50% of the area can be restored via planting of a single exotic species if the property has less than four fiscal modules. Since some species can facilitate the occurrence and establishment of others during the implementation or restoration processes, it becomes necessary to understand how they are related to the aspects pertinent to the capacity for natural regeneration in altered sites. In this way, these species could help the owner in the restoration process.

These species, known as nurse plants, have been recommended to restore degraded areas in several locations around the world (Myers; Mittermeier; Mittermeier; Fonseca; Kent, 2000; Walker; Delm Moral, 2003; Gómez-Aparicio; Zamora; Gómez; Hódar; Baraza, 2014; Navarro-Cano; Goberna, 2017; Spadeto, 2019), as it is a process that can occur in different climatic conditions (Callaway, 1995) and plant formations. These facilitating species can improve significantly improve the environmental quality around them, providing conditions for other species to develop (Yarranton; Morrison, 1974). Among the conditions provided by these plants is the ability to alleviate abiotic stresses under their canopies through shading (Padilla; Pugnaire, 2006; Lima; Gandolfi, 2009; Yang; Ren; Liu; Wang, 2010), which helps control humidity and extreme temperatures (Padilla; Pugnaire, 2006; Liu; Zhu; Sun; Yang; Yuan; Ren, 2014). Furthermore, it also helps in the availability of organic matter (George; Bazzaz, 1999) and, consequently, an increase in the concentration of mineral nutrients and water in the surface layer of the soil (Kellman, 1979; Callaway, 1995), and in the supply of resources to animals dispersers (Figueroa-Rangel; Olivera-Vargas, 2000). For George and Bazz (1999), changes caused under the canopy of facilitating species can inhibit or favor seed germination, survival, and seedling growth in that location.

Specific traits must be present in facilitator species such as sufficient crown size to act as such (Liu; Zhu; Sun; Yang; Yuan; Ren; 2014). For Callaway (1995), it is the shading provided by the canopy that increases interaction with the projected area and facilitates the recruitment and establishment of species, especially in environments with more severe conditions, such as the semi-arid climate or degraded areas (Carnevale; Montagnini, 2002), as it prevents the drying out of seeds and seedlings (Vieira; Scariot 2006), in addition to photoinhibition (Lemos Filho, 2000). Another important aspect is the availability of fruits for feeding fauna and the canopy structure provided by the facilitating species, which could also serve as a perch for seed-dispersing birds (Duarte; Santos; Hartz; Pillar, 2006; Zwiener; Cardoso; Padial; Marques; 2013; Spadeto, 2019).

Schinus terebinthifolia Raddi (Anacardiaceae), popularly known as pink pepper or red “Aroeira”, is widely distributed in the Cerrado biome (gallery forest and forest edges), Caatinga, Atlantic Forest, and Pampa. It is a pioneer, heliophyte, and evergreen (Lorenzi, 1998). With an arboreal or shrubby habit, it is of great importance due to its high level of vegetation cover (Assumpção; Nascimento, 2000), with a low canopy. The species develops well in different soil types, with variations in thickness, texture, fertility, and water regimes (Bonnet; Curcio; Moura; Santos; Ogata, 2016). Its fruits are spherical drupes measuring 4-5.5 mm in diameter, with a smooth epicarp and red color when ripe (Carvalho, 1994), and are widely consumed by birds (Kuhlmann, 2018). With a spicy flavor, the fruits are used in cooking as condiments and can replace black pepper. Trunks can be used as firewood or to make fences (Bonnet; Curcio; Moura; Santos; Ogata, 2016).

Based on information about rapid growth, high levels of vegetation cover and fruits attractive to birds, this study aims to evaluate whether the species *Schinus terebinthifolia* can be considered a facilitator species. The aspects evaluated were the floristic composition and the structure of natural regeneration under the influence of the *Schinus terebinthifolia* canopy and in an area with low direct influence of the canopy (control). After eight years of planting, the *Schinus terebinthifolia* trees developed from seedlings planted in an abandoned exotic pasture in an area that looked like a former Cerradão.

In this study, the following hypotheses were tested: 1) The diversity of regenerating species differs between treatments and will be greater in the area under the influence of the canopy; 2) The density of regenerants with zoochoric dispersion syndrome differs between treatments and will be greater in the area under the influence of the canopy; and 3) The density of regenerants differs between treatments and will be greater in the area under the influence of the canopy.

2 MATERIALS AND METHODS

The present study was developed in the experimental area of the Biomas Project at Fazenda Entre Rios (Guzerá da Capital) (15°57'30"S and 47°27'26"W) located on the DF 120 highway, Paranoá, Federal District, Brazil, presenting climate type Aw, according to the classification of Alvares, Stape, Sentelhas, Gonçalves and Sparovek (2013), with rainy summers and dry, cold winters. The same authors defined the average annual temperature as 21°C, with a maximum average of 22°C in September and a minimum average of 18°C in July, and yearly precipitation ranging from 1,400 mm to 1,600 mm.

Originally, the study area was covered by the Cerradão physiognomy and was later converted into a crop/livestock area. These practices had already been suspended two years before this study began. The areas were practically dominated by the exotic grass *Urochloa decumbens* (Stapf) R. D. Webster (brachiaria), *Ipomoea* sp. (viola string), and *Sorghum bicolor* L. (Caribbean sorghum) (approximately 100% coverage).

To set up the experiment, mechanical control was carried out followed by soil preparation with subsoiling at a depth of 40-50 cm, to eliminate possible soil compaction. Top dressing with NPK was applied at different doses once a year in the first two years. There was intense leaf-cutter ant control at the beginning of planting (in the first two years, weekly to fortnightly) and after this period only when the attack on the seedlings was verified.

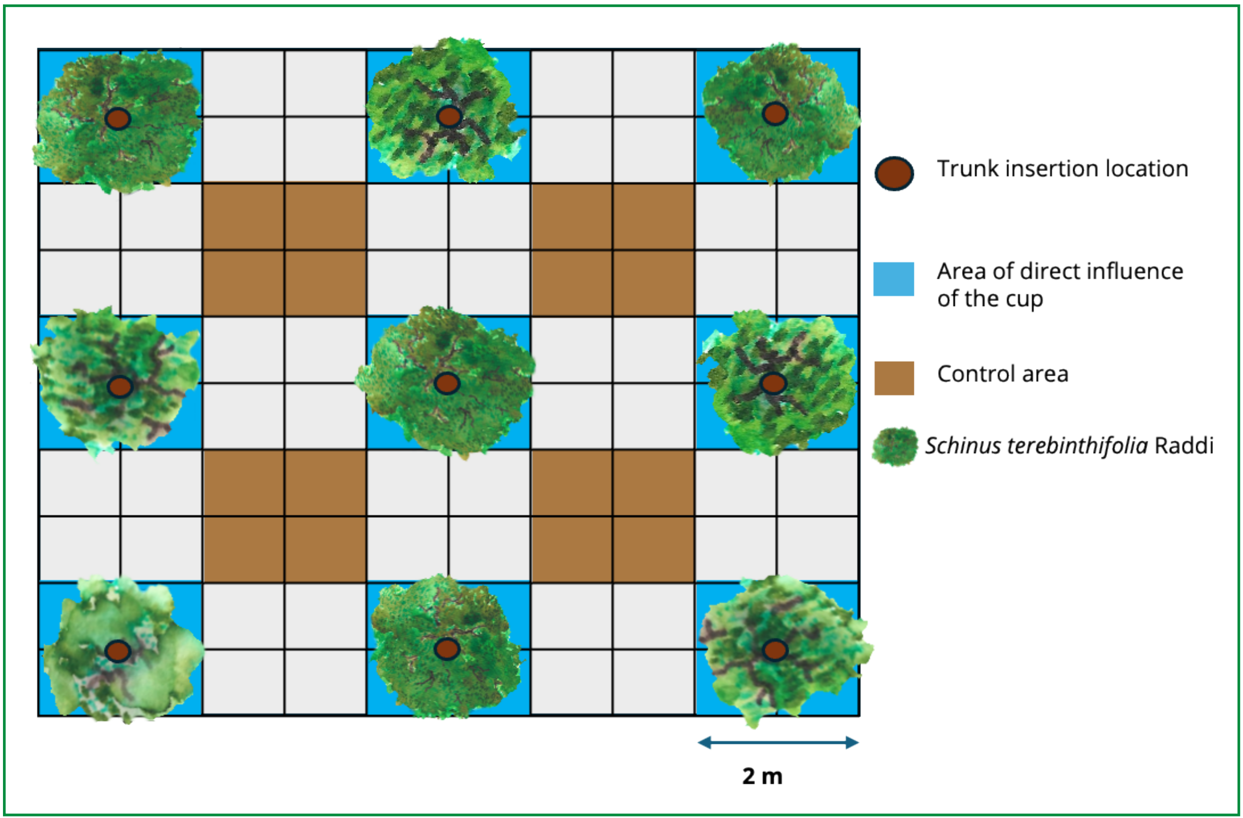
The experiment was installed in 2013 as part of a larger production recomposition experiment with 10 species intercropped in the central portion and a monospecific planting of *Schinus terebinthifolia* seedlings on the sides, in the soil of the type Cambisol Haplic Dystrophic gleissoil, moderate A horizon and clayey texture in a gentle relief area (Bonnet; Curcio; Moura; Santos; Ogata, 2016). The monospecific planting consisted of two blocks of 20 m x 80 m, where 200 *Schinus terebinthifolia* seedlings were planted with a spacing of 4 m x 4 m, with a total area of the experiment making up 3,200 m2 (0.32 ha). In 2015, two years after planting, the individuals began to bear fruit. In 2016, individuals were pruned to 1.20 m above the ground. According to Bonnet, Curcio, Moura, Santos, and Ogata (2016), pruning has to eliminate the central branches and cause the plants to branch out in a cup shape.

The natural regeneration was assessed in May 2021 (eight years after planting). To do this, the area of four (4) m2 under the canopy was considered to be the plot of influence of *Schinus terebinthifolia*, with the center being the position where its main trunk is inserted (Figure 1). This portion of crown influence was based on the average diameter of the individual crowns. Thus, one meter was considered for each side of the central point of the trunk insertion (Figure 1), with the dimensions of the plots being 2 m x 2 m.

The control plot (low direct canopy influence) was considered to be the central area between the trees, located in the center of four neighboring *Schinus terebinthifolia* plants (Figure 1). In this way, 152 control plots were identified (low canopy influence), and 152 out of the 200 *Schinus terebinthifolia* influenced plots/individuals that would be included in the study were drawn. This was done to obtain an equivalent number of plots under the influence of *Schinus terebinthifolia* and control plots.

In each plot under the direct influence of the *Schinus terebinthifolia* canopy and plots with the canopy low direct influence (control), richness and diversity were recorded, and the absolute and relative density (%) of all-natural-regeneration individuals (height ≥ 2 cm) were calculated (Kent; Coker, 1992). The taxonomic identification of the species was carried out based on the List of Species of the Flora of Brazil (Flora e Funga do Brasil, 2020). Additionally, the species with complete identification were classified according to the phytophysiognomy of origin and dispersal strategy by Van der Pijl (1982) into zoochoric, anemochoric and autochoric. The identification of the physiognomies of the species origin, as well as the dispersal syndromes, were carried out in consultation with the literature, namely: Silva Júnior (2005); Sano; Almeida; Ribeiro (2008), Silva Júnior; Pereira (2009); Silva Júnior (2012) and Kuhlmann (2018).

Figure 1 – Location diagram of the *Schinus terebinthifolia* Raddi canopy influence plots and those of low influence (control) in the Legal Reserve restoration area at Fazenda Entre Rios, Federal District



Source: Authors (2024)

The Shannon-Wiener index calculated diversity, and Hutcheson's t-test detected differences in the index between plots under direct canopy influence and low direct one.

The data on the density of regeneration individuals in the plots under the direct canopy influence and those under control were first tested for normality using the Q-Q plot, which showed that the data needed to be transformed. The transformed data (log (x+1)) of the individual densities between the two treatments were compared by ANOVA, followed by a 5% t-test. The Mann-Whitney-Wilcoxon test was used to test the importance of the zoochoric dispersal syndrome (density) between treatments.

The analyses were processed using the Past 4 program (Hammer; Harper; Ryan, 2001) and the Agricolae 1.3-7 package of version 4.2.3 of "R".

3 RESULTS AND DISCUSSIONS

The survey identified 38 species (belonging to 36 genera and 20 botanical families), two at the genus level, and six were unidentified (Table 1). Of the 30 identified, only one species has a liana habit (*Serjania lethalis* A.St.-Hil.), and the others are shrubs or trees.

Table 1 – Families, species, and individual densities found in plots under the canopy influence and low canopy influence of *Schinus terebinthifolia* Raddi (Anacardiaceae) at Fazenda Entre Rios, Federal District

Family	Species	Density	
		Under the canopy influenence	Low canopy influenence
Anacardiaceae	*Astronium urundeuva* (M.Allemão) Engl.	9	5
	Lithraea molleoides (Vell.) Engl.	167	48
	Schinus terebinthifolia Raddi	130	48
	Tapirira guianensis Aubl.	139	21
Annonaceae	*Xylopia aromatica* (Lam.) Mart.	24	11
Asteraceae	*Vernonia* sp.	6	2
Chrysobalanaceae	*Hirtella gracilipes* (Hook.f.) Prance	1	
Combretaceae	*Terminalia argentea* Mart. & Zucc.	3	
Dilleniaceae	*Davilla* sp.	38	8
Erythroxylaceae	*Erythroxylum daphnites* Mart.	918	245
Fabaceae	*Anadenanthera colubrina* (Vell.) Brenan	2	
	Copaifera langsdorffii Desf.	6	4
	Leptolobium dasycarpum Vogel	1	1
	Platypodium elegans Vogel	1	
	Plathymenia reticulata Benth.		1
Lamiaceae	*Aegiphila verticillata* Vell	2	
Lythraceae	*Lafoensia pacari* A.St.-Hil.	11	5
Moraceae	*Brosimum gaudichaudii* Trécul	2	
Myristicaceae	*Virola sebifera* Aubl.	1	0
Myrtaceae	*Eugenia dysenterica* (Mart.) DC.	1	2
	Myrcia splendens (Sw.) DC.	2	3
	Myrcia tomentosa (Aubl.) DC.	110	37
Primulaceae	*Myrsine guianensis* (Aubl.) Kuntze	25	9

To be continued ...

Table 1 – Conclusion

Family	Species	Density	
		Under the canopy influenence	Low canopy influenence
Rubiaceae	*Alibertia edulis* (Rich.) A. Rich.	5	1
	Chomelia ribesioides Benth. ex A.Gray	3	1
	Tocoyena formosa (Cham. & Schltdl.) K.Schum.	10	
Rutaceae	*Zanthoxylum riedelianum* Engl.	1	
	Zanthoxylum rhoifolium Lam.	40	5
Sapindaceae	*Serjania lethalis* A.St.-Hil.	12	7
Sapotaceae	*Chrysophyllum marginatum* (Hook. & Arn.) Radlk.	4	
Simaroubaceae	*Simarouba versicolor* A.St.-Hil.	47	8
Urticaceae	*Cecropia pachystachya* Trécul	1	
Indeterminada	Morphospecies 1	16	5
	Morphospecies 2	7	
	Morphospecies 3	4	
	Morphospecies 4	1	
	Morphospecies 5	5	2
	Morphospecies 6	3	

Source: Authors (2021)

Of the total species, 37 were found in plots that were influenced by the canopy of *Schinus terebinthifolia* with a Shannon-Wiener index of 1.90, 23 species in plots with a low direct influence of the canopy with a Shannon-Wiener index of 1.88, and 21 species were common in both environments (Table 1). Hutcheson's t-test showed no significant difference between the Shannon-Wiener diversity indices in the environments ($t = -0.23$; $df = 800.23$; $p < 0.81$). This result refuted the hypothesis that diversity would be greater in the area under the direct influence of the canopy.

In this sense, Melo, Daronco, Scorzoni, and Durigan (2015) found in a study with five tree species, including *Schinus terebinthifolia*, that the highest canopies concerning the land surface had more diverse habitat conditions to the availability of sunlight than those species that had crowns that approached the surface of the land, as is the case of *Schinus terebinthifolia*. For these authors, higher canopies create constantly shaded areas in the center of the canopy, and the entry of light at the beginning and end of the day in periphery, allowing the admission of species with different light requirements and consequently increasing the richness of the regenerating stratum. Nichols, Morris, and Keith (2010) had also observed a similar result in a study with several species planted in the Cumberland Plain Woodland in the Australian savanna.

In the present study, the families with the highest species richness in the plots influenced by the *Schinus terebinthifolia* canopy were: Anacardiaceae (4 species), Fabaceae (4), Mytaceae (3), and Rubiaceae (3) (Table 1). These four families accounted for 38.8% of all species found. Of the 20 families found, 75.0% are represented by just one species each (Table 1). Of the 13 botanical families found in plots with low direct influence from the canopy, those with the greatest richness were also: Anacardiaceae (4 species), Fabaceae (3), and Myrtaceae (3). These three families represented 43.5% of all species. Of the 13 families in these plots, 61.5% are represented by just one species each. Species from the Fabaceae family are very desirable in restoration projects, as they present nodulation in the roots, resulting from the action of symbiotic bacteria that fix atmospheric nitrogen (Faria; Lewis; Sprent; Sutherland, 1989), which improves soil conditions.

Erythroxylum daphnites Mart., *Lithraea molleoides* (Vell.) Engl., *Tapirira guianensis* Aubl., *Schinus terebinthifolia*, and *Myrcia tomentosa* (Aubl.) DC. were the five species that had the highest density in both environments (tables 2 and 3). These species together represented 83.3% of the total density. *Erythroxylum daphnites* was the one with the highest density, with more than 50.0% of individuals recruited in both the condition with direct influence of the canopy (918 / 52.2%) (Table 2) and in the condition with low influence of the canopy (245 / 51.2%) (Table 3*). Erythroxylum daphnites*, as well as the other four species listed above, are present in environments of Galeria Forests, Dry Forests, and Cerradões (Table 2), whose fruits are dispersed by birds and mammals (Kuhlmann, 2018). This source of propagules may be happening at the site due to the proximity (30 meters) of the area being restored to the preserved natural area of Mata de Galeria at the experimental site. In this way, propagules must be reaching the area since there is the presence of dispersing agents in the area, as pointed out in the survey by Kuhlmann (2020) who recorded 108 species of birds in this experimental area of Fazenda Entre Rios. This survey represents 23.4% of the birds observed in the Federal District. Besides that *Schinus terebinthifolia* produces fleshy fruits that attract the fauna, as already mentioned, whose characteristics matter for the dispersion and introduction of regenerants in the local restoration process.

Noteworthily both conditions of direct influence of the canopy and low influence of the canopy were composed of approximately 60.0% of the species whose fruits are dispersed by animals (tables 2 and 3). In this sense, when the densities of regenerants with zoochoric dispersion syndrome were evaluated, no significant differences were observed ($w = 53273$; $p = 0.06$), that is, individuals of *Schinus terebinthifolia* do not function as attractants for fauna seed disperser, contradicting the second hypothesis of this study. It was believed that the production of fruits of this species would attract seed-dispersing animals and thus could favor the arrival of more species in the canopy's area of influence. Melo, Daronco, Scorzoni and Durigan (2015) also did not observe this functional characteristic of trees, facilitating the entry of new individuals under trees, including the same species targeted in the present study, in addition to five other species (*Anadenanthera colubrina*, *Croton floribundus* Spreng., *Inga vera* Willd. and *Syzygium cumini* (L.) Skeels) in restoration projects in forest areas in Assis, São Paulo. Ferreira, Gomes, Batista, Bernardi, Costa, Bortoluzzi, and Mantovani (2013) mention the importance of zoochoric species that act as facilitators in the process of ecological succession, being essential in restoration programs, as they provide interaction with fauna, benefiting the increase of the biological flow between the fragments and the areas under restoration.

However, other studies have already reevaluated the importance of this functional attribute of trees in facilitating the entry of new individuals into the environment (Guerin, 2010; Melo, Daronco, Scorzoni and Durigan; 2015). The greater frequency of fauna may be associated with other attributes of the tree than fruit dispersal syndrome (Melo, Daronco, Scorzoni and Durigan; 2015). Wydhayagarn, Elliott and Wangpakapattanawong (2009) mention the tree canopy architecture acting as a perch, or even an observation post, rather than foraging. Another important point is the modification of the light penetration under the canopy, which is associated with tree size. Melo, Daronco, Scorzoni and Durigan (2015) found that the higher the facilitating individual, mainly due to the projection area of its canopy, the more abundant and diverse the regenerating community will be under its canopy.

In this sense, Arantes, Rodrigues-Souza, Prado Júnior, and Vale (2015) observed greater richness and density of individuals concerning ornithochoric-type dispersion in the nuclei of *Bowdichia virgilioides* Kunth than in areas without tree cover. It is worth mentioning that this species is anemochorous and, therefore, does not provide a fruitful resource for dispersing fauna, which means that the nuclei of this species are only attractive as perches for birds.

Table 2 – Species identified in natural regeneration in plots influenced by the canopy of *Schinus terebinthifolia* Raddi (Anacardiaceae) on the Entre Rios farm, Federal District

Species	Absolute density	Relative density (%)	Origin phytophysiognomy	Dispersal strategy
Erythroxylum daphnites	918	52.22	MG, MS, Ce	zoochoric
Lithraea molleoides	167	9.50	MG, ME, Ce	zoochoric
Tapirira guianensis	139	7.10	MG, ME, Ce	zoochoric
Schinus terebinthifolia	130	7.39	MG, Matas, Ce	zoochoric
Myrcia tomentosa	110	6.26	ME, MG, Ce	zoochoric
Simarouba versicolor	47	2.67	Matas, Ce, Csr	zoochoric
Zanthoxylum rhoifolium	40	2.28	MS, Ce, Csr	zoochoric
Davilla sp.	38	2.16	-	-
Myrsine guianensis	25	1.42	Cer; Csr	zoochoric
Xylopia aromatica	24	1.37	Matas, Ce, Csr	zoochoric
Serjania lethalis	12	0.68	MG, Ve	anemochoric
Lafoensia pacari	11	0.63	MG, MS, Ce, Csr	anemochoric
Tocoyena formosa	10	0.57	Ce, Csr	zoochoric

To be continued ...

Table 2 – Conclusion

Species	Absolute density	Relative density (%)	Origin phytophysiognomy	Dispersal strategy
Astronium urundeuva	9	0.51	MC, MS, Ce, C	anemochoric
Copaifera langsdorffii	6	0.34	MG, ME, Ce, C	zoochoric
Vernonia sp.	6	0.34	-	-
Alibertia edulis	5	0.28	MG, ME, Ce	zoochoric
Chrysophyllum marginatum	4	0.23	MG, ME	zoochoric
Chomelia ribesioides	3	0.17	Csr, Cr	zoochoric
Terminalia argentea	3	0.17	MS, Ce, Csr	anemochoric
Aegiphila verticillata	2	0.11	MG, Ce, Csr, Ca	zoochoric
Anadenanthera colubrina	2	0.11	MG, MS, Ce	autochoric
Brosimum gaudichaudii	2	0.11	Ce, Csr	zoochoric
Myrcia splendens	2	0.11	MG, Ce	zoochoric
Cecropia pachystachya	1	0.06	MG, MS, Csr	zoochoric
Eugenia dysenterica	1	0.06	Ce, Csr	zoochoric
Hirtella gracilipes	1	0.06	MG, Ce, Csr	zoochoric
Leptolobium dasycarpum	1	0.06	MG, Ce, C	anemochoric
Platypodium elegans	1	0.06	MG, MS, Ce	anemochoric
Virola sebifera	1	0.06	MG, ME, Ce	zoochoric
Zanthoxylum riedelianum	1	0.06	MG, Ce	zoochoric
Morphospecies 1	16	0.91	-	-
Morphospecies 2	7	0.40	-	-
Morphospecies 5	5	0.28	-	-
Morphospecies 3	4	0.23	-	-
Morphospecies 6	3	0.17	-	-
Morphospecies 4	1	0.06	-	-
Total	**1758**	**100**		

Source: Authors (2021)

In where: MG – Gallery Forest; MS – Dry Forest; Ce – Cerradão; ME – Seasonal Forest; Csr – Cerrado stricto sensu - Savanna; Ve – Wetland mosaic; C - Cerrado; Cr –Rupestrian field; Ca – Fields.

The total number of regenerants in the area was 2,237 individuals in 0.32 ha (tables 2 and 3), equivalent to 6,990 individuals/ha. Of the total regenerating individuals, 1,758 (78.58%) or 5,494/ha were found in plots under the influence of the *Schinus terebinthifolia* canopy (Table 2), and 479 (21.41%) or 1,497/ha in plots with low influence of the cup (Table 3). The t-test indicated significant differences between the average number of individuals in both environments (t = -10.40, df = 300.82, p < 2.2e-16). Thus, from the total estimated value of 6,990 regenerants/ha, it was found that the number of regenerants (5,494) in the environment under the canopy was significantly higher than the value of regenerants (1,497) in the control plots of *Schinus terebinthifolia.*

Table 3 – Species identified in natural regeneration in plots with low influence of the canopy of *Schinus terebinthifolia* Raddi (Anacardiaceae) on the Entre Rios farm, Federal District

Species	**Absolute density**	**Relatve density (%)**	**Origin phytophysiognomy**	**Dispersal strategy**
Erythroxylum daphnites	245	51.15	MG, MS, Ce	zoochoric
Lithraea molleoides	48	10.02	MG, ME, Ce	zoochoric
Schinus terebinthifolia	48	10.02	MG	zoochoric
Myrcia tomentosa	37	7.72	ME, MG, Ce	zoochoric
Tapirira guianensis	21	4.38	MG, ME, Ce	zoochoric
Xylopia aromatica	11	2.30	Matas, Ce, Csr	zoochoric
Myrsine guianensis	9	1.88	Ce, Csr	zoochoric
Davilla sp.	8	1.67	-	-
Simarouba versicolor	8	1.67	Matas, Ce, Csr	zoochoric
Serjania lethalis	7	1.46	Cls	anemochoric
Astronium urundeuva	5	1.04	MC, MS, Ce, C	anemochoric
Lafoensia pacari	5	1.04	MG, MS, Ce, Csr	anemochoric
Zanthoxylum rhoifolium	5	1.04	MS, Ce, Csr	zoochoric
Copaifera langsdorffii	4	0.84	MG, ME, Ce, C	zoochoric
Myrcia splendens	3	0.63	MG, Ce	zoochoric
Eugenia dysenterica	2	0.42	Ce, Csr	zoochoric
Vernonia sp.	2	0.42	-	-
Alibertia edulis	1	0.21	MG, ME, Ce	zoochoric
Chomelia ribesioides	1	0.21	Csr, Cr	zoochoric
Leptolobium dasycarpum	1	0.21	MG, Ce, C	anemochoric
Plathymenia reticulata	1	0.21	Ce, Csr, Cc	anemochoric
Morphospecies 1	5	1.04	-	-
Morphospecies 5	2	0.42	-	-
Total	**479**	**100**		

Source: Authors (2021)

In where: DA = MG – Gallery Forest; MS – Dry forest; Ce – Cerradão; ME – Seasonal Forest; Csr – Cerrado stricto sensu; Cls – Cerrado lato sensu; MC - Riparian forest; C - Cerrado; Cr – Rupestrian field; Cc – Cerrado field.

These values may indicate more favorable conditions for greater recruitment of individuals from the natural regeneration of native species under its canopy, compared to the environment with more adverse conditions outside the canopy. Among the most attractive conditions, we name the availability of safer perches for birds inside the canopy, a microenvironment of greater shading of the soil surface close to the trunk, accumulation of organic matter in the soil that results in increased humidity, milder temperatures, in addition to contributing to the formation of nuclei of other species around it (Yarranton; Morrison, 1974; Reis; Bechara, Espíndola, Vieira; Souza, 2003).

Finally, there was a promising result of 6,990 regenerating individuals/ha in just eight years of recomposition regarding the minimum of 3,000 regenerating individuals/ha for forest formations established for the Federal District in Technical Note 01/2018 of the Brasília Environmental Institute (IBRAM).

4 CONCLUSIONS

This study proved that *Schinus terebinthifolia* facilitates the colonization of individuals in the area of direct influence of its canopy, corroborating the first hypothesis of the work. However, it was neither able to promote species richness, nor the greater occurrence of zoochoric individuals below the canopy, as predicted by the second and third hypotheses.

ACKNOWLEDGEMENTS

We thank the Biomas projects for the initial establishment of the experiment and FIP Paisagens for maintaining the field experiment. To the Scientific Initiation Program (PIBIC/FAPDF) of the University of Brasília for granting the scientific initiation scholarship.

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How to quote this article

OLIVEIRA, M. C.; BORGES, L. M.; OGATA, R. S.; RIBEIRO, J. F. *Schinus terebinthifolia* Raddi (Anacardiaceae) as facilitator in ecological recomposition. **Ciência Florestal**, Santa Maria, v. 35, e84796, p. 1-20, 2025. DOI 10.5902/1980509884796. Available from: https://doi.org/10.5902/1980509884796. Accessed in: day month abbr. year.