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Phytosociology of Weeds in Function of the Cultivation of Genetic Materials of Beans and Castor Hybrids under Intercrop and Monoculture in the Brazilian Midwest

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Abstract

Despite the socioeconomic importance of beans and small-door castor hybrids, few studies have been carried out to investigate the phytosociological composition of weeds that interfere in this integrated production system. The objective of this work was to investigate the phytosociological composition of weeds in intercropped bean and castor hybrids adapted to mechanized harvesting, as well as in monoculture, involving genetic materials with different plant architectures. The design was randomized blocks, with four replications, and the treatments consisted of three bean cultivars with different growth habits and types (BRS Realce; BRS Esteio; Pérola), cultivated in an intercropped system with two small castor hybrids (Agima and Tamar), and the respective monoculture systems of the bean and castor hýbrids. Weed evaluation was performed 25 days after crop emergence. The bean growth habits and the size of castor hybrids directly affect the weed community, in both systems. *Cenchrus echinatus* and *Alternanthera tenella* species showed predominance in intercropping and monoculture conditions. The common bean monoculture and castor hybrids system, in general, provide greater problems with weeds compared to their respective monocultures, especially the Poaceae family. The weed species similarity indexes were higher than 75%.

Keywords: matology, intercropping, *Phaseolus vulgaris, Ricinus communis*

1. Introduction

Castor plant (*Ricinus communis*L.) is a species of oilseed used in the castor chemical industry, being raw material for the manufacture of various products and by-products such as pharmaceuticals, biodiesel and cosmetics (Anjani, 2012; Ying et al., 2017). The residue is used as fertilizer in agriculture (Zhang et al., 2015; Ferreira et al., 2018) or in animal nutrition (Gomes et al., 2017). Currently, castor oil production is predominant in India, China, and Brazil (Gad-Elkareem et al., 2019)

The crop has good characteristics for intercropping with short-cycle and small-sized species (Pereira et al., 2015; Salaudeen et al., 2022). In this sense, common bean (*Phaseolus vulgaris*) presents itself as an alternative for intercropping, as it is the main source of vegetable protein in human food (Mondo &Nascente 2018) and for the morphophysiological adaptation of plants to integrated systems (Karavidas et al. 2022). However, castor and common bean crops have C3 photosynthetic metabolism, low photosynthetic efficiency, slow initial growth and little competitiveness (Azevedo et al., 2007; Pereira et al., 2015; Santos et al., 2017), characteristics that make competition with weeds very sensitive.

Competition with weeds in integrated production systems compromises the yield of the crop of economic interest, reaching losses of up to 80% in relation to monoculture (Azevedo et al., 2014). This sensitivity and weed management is quite variable depending on the characteristics of the growing regions, with yield losses due to lack of information (Maciel 2006; Azevedo et al., 2007; Maciel et al., 2008).

The intercropping of agricultural crops has been used more frequently in family farming for food production, such as the association of small castor hybrids with common bean in the same area, can contribute to the reduction of the weed community by promoting greater occupation of the area (Fontes et al., 2014). The identification of weed species in a certain area is the first control measure, combined with frequency, density and dominance sampling. After this phase, one can decide which is the best management to be adopted, be it cultural, mechanical, physical, biological, chemical or integrated (Oliveira & Freitas, 2008; Costa et al., 2014; Cabrera et al., 2019).

Investigative studies on weed communities in different cropping systems are rare and inconclusive, like the work conducted by Santos et al. (2017) in State Goiás, Brazil, where they found that the main weed species of large bean and castor crops were *Cenchus echinatus* and *Althernanthera tenella,* in addition to the weed community having a high similarity index between the forms of intercropping and monoculture. On the other hand, D'Amico-Damião et al. (2020) in State São Paulo, Brazil, verified that the maize intercropping systems modify the emerged weed community and qualitatively and quantitatively alter the weed seedbank dynamics in cultivated area with bean crop later, being *Alternanthera tenella*, *Commelina benghalensis*, *Eleusine indica* and *Phyllanthus tenellus* the predominant species.

The plant architecture of commercial crops can change the composition of the weed community due to the change in the incidence of solar radiation in the area (Santos et al., 2017; Araújo et al., 2021). However, there is a lack of information on weed behavior in intercropped crops of small castor and common bean hybrids with different plant architectures. This work aimed to investigate the phytosociological composition of weeds in intercropped bean crops with castor hybrids, as well as in monocultures, involving genetic materials with different plant architectures.

2. Methods

The survey was carried out in the 2018/2019 "water" crop in November, in the experimental area belonging to the State University of Goiás, Campus Ipameri, municipality of Ipameri, Goiás, Brazil. The area has geographic coordinates 17º43'19" south latitude and 48º10'35" west longitude. The municipality's altitude is 772 m and the regional climate is classified as Cwa-Mesothermal Humid, with average annual precipitation and temperature of 1750 mm and 25 ºC, respectively.

The soil of the experimental area was classified as a dystroferric Red Yellow Latosol (Santos et al. 2018) with a very clayey texture, presenting the following physicochemical characteristics: pH (H_2O), 5,9; organic matter, 24,0 g kg^{-1}, V(%) 74,54, P 6,7 (mg dm^{-3}), K 0,28 (cmolc dm^{-3}), Cu 1,5 (mg dm^{-3}), Zn 7,5 (mg dm^{-3}), Fe 42,6 (mg dm^{-3}), Mn 18,8 (mg dm^{-3}) and B 0,18 (mg dm^{-3}), in addition to Ca, Mg, Al and potential acidity (H +Al), 3,5; 1,7; 0 e 1,9 $cmol_c$ dm^{-3}, repectively.

The design used was randomized blocks, with four replications, with treatments consisting of three bean cultivars with different growth habits and types (BRS Realce - type I; BRS Esteio - type II; Pérola – type II/III), cultivated in an intercropped system with two castor hybrids (Agima and Tamar), and the respective monoculture systems of the afore mentioned bean and castor genetic materials.

The cultivar Realce has a semi-early cycle of 75-85 days, straight size (type 1), brindle grains; The cultivar BRS Esteio has a normal cycle of 85-95 days, straight size (type II), black grains; The cultivar Pérola has a normal cycle of 90 days, prostrate size (type II/III), carioca grains. The castor hybrid Agima has a cycle of 140-160 days, height of 1.70-1.80 m (Embrapa, 2016), sympodial growth and first raceme appearance at 35 days; The castor hybrid Tamar - cycle of 140-160 days, height of 1.60-1.70 m, sympodial growth and first raceme appearance at 30 DAE (Lisboa et al., 2018).

At 25 DAE of the cultures in the two cropping systems, the weeds were sampled using a square inventory of 0.5 x 0.5m thrown three times inside the plot, the collected samples were packed in paper bags and taken to the laboratory for identification. through specialized literature (Lorenzi 2014). Subsequently, the material was placed in an oven at 70ºC for 72 hours, after drying, the dry biomass was quantified using a precision balance, in addition to the phytosociological factors: density; relative density; frequency; relative constancy; relative dominance; importance value index; relative importance, proposed by Mueller-Dombois & Ellenberg (1974).

3. Results and Discussion

The data obtained in the survey indicate that the weed flora in the experimental area is composed of 17 species distributed in 8 families, as shown in Table 1. The family with the highest number of individuals was the Poaceae with six species, followed by the Asteraceae family with three species, the Amaranthaceae and Euphorbiaceae families had two species each. These results corroborate those reported by Ferreira et al. (2019) and Santos et al. (2017) that point to the weeds of the Poaceae and Asteraceae families as the most important in the surveys carried out by the authors. This situation occurs due to the large number of mechanisms of dispersion of the species of these families (Lorenzi, 2008), allowing the establishment in the areas even in unfavorable conditions for the development of the plants.

The species *Cenchrus echinatus* and *Alternanthera tenella* were detected in all cultivation situations. This situation reinforces the results obtained in a survey conducted in intercropped common bean and large castor crops carried out by Santos et al. (2017), in which the authors point out that these are the main weed species in this intercropping system.

In common bean grown in monoculture, the population densities of weeds changed according to the evaluated cultivars, however, in general, the species that presented the highest averages per square meter were *Cenchrus echinatus, Urochloa plantaginea, Alternanthera tenella* and *Urochloa decumbens* (Table 2). All these species showed a contagious distribution pattern, that is, they were present throughout the area. This pattern of weed distribution is important for decision making regarding the control adopted to manage them (Concenço et al., 2013).

Table 1. Distribution of the species found in the weed survey in an intercropped bean crop with small hybrids

Family	Species	Situation										
		PEM	RM	EM	AM	TM	PEA	PET	RA	RT	EA	ET
Poaceae	*Urochloadecumbens*	X	X	X	X		X	X	-	-	X	-
	Digitariainsularis	X	X	-	X	X	-	-	X	-	X	X
	Cenchrusechinatus	X	X	X	X	X	X	X	X	X	X	X
	Urochloaplantaginea	X	X	-	X	X	X	X	X	X	X	X
	Eleusineindica	X	-	X	X	X	X	X	X	X	-	X
	Echinochloa crus-gali	-	-	-	X	-	-	-	-	-	-	-
Asteraceae	*Conyza Canadensis*	-	-	-	X	-	-	-	-	-	X	X
	Emilia fopsbergii	X	-	-	-	-	-	X	-	-	X	X
	Bidenspilosa	-	X	X	X	-	X	X	-	X	X	X
Amaranthaceae	*Alternanthera tenella*	X	X	X	X	X	X	X	X	X	X	X
	Amaranthus deflexus	-	-	X	-	-	X	-	-	X	X	-
	Chamaesycehirta	X	X	-	X	X	X	X	X	X	X	X
Euphorbiaceae	*Euphorbia heterophylla*	-	X	X	X	-	X	X	X	X	-	X
Commelinaceae	*Commelinabenghalensis*	-	X	-	X	X	X	X	-	-	X	-
Convolvulaceae	*Ipomoea triloba*	X	X	X	-	X	X	X	X	-	X	X
Cyperaceae	*Cyperusrotundus*	-	-	-	X	-	X	X	-	-	X	-
Rubiaceae	*Richardia brasiliensis*	X	X	X	-	-	-	-	-	X	-	-

Table 2. Weed population in different common bean cultivars

Scientific name	ID	Average	Variance	Distribution	De. R.	Co. R	Do. R.
		(plants m^{-2})				(%)	
		Pérolain monoculture					
Cenchrusechinatus	CCHEC	15.14	110.14	Contagious	39.70	26.92	27.73
Eleusineindica	ELEIN	0.50	0.50	Casualized	0.37	3.85	0.17
Chamaesycehirta	EPHHI	1.50	0.50	Casualized	1.12	7.69	1.66
Urochloadecumbens	BRADC	2.00	8.00	Contagious	1.50	3.85	2.03
Digitariainsularis	DIGIN	0.50	0.50	Casualized	0.37	3.85	5.86
Urochloaplantaginea	BRAPL	17.83	98.57	Contagious	40.07	23.08	44.07
Alternanthera tenella	ALRTE	6.75	8.92	Contagious	10.11	15.38	11.27

Richardia brasiliensis	RCHBR	2.00	12.00	Contagious	2.25	3.85	0.33
Emilia fosbergii	EMISO	2.00	0.00	Casualized	1.50	7.69	1.29
Ipomoea triloba	IPOTR	4.00	32.00	Contagious	3.00	3.85	5.59
BRS Realce in monoculture							
Cenchrusechinatus	CCHEC	13.83	122.57	Contagious	49.70	24.00	24.72
Chamaesycehirta	EPPHI	1.50	4.50	Contagious	1.80	4.00	7.24
Bidenspilosa	BIDPI	2.00	8.00	Contagious	2.40	4.00	1.66
Urochloadecumbens	BRADC	6.00	18.00	Contagious	7.19	8.00	8.60
Digitariainsularis	DIGIN	4.50	0.50	Casualized	5.39	8.00	27.48
Urochloaplantaginea	BRAPL	3.00	18.00	Contagious	3.59	4.00	9.98
Alternanthera tenella	ALRTE	8.75	15.58	Contagious	20.96	16.00	14.38
Euphorbia heterophylla	EPHHL	3.00	0.00	Casualized	5.39	12.00	2.62
Commelinabenghalensis	COMBE	0.50	0.50	Casualized	0.60	4.00	0.95
Richardia brasiliensis	RCHBR	1.00	2.00	Contagious	1.20	4.00	1.03
Ipomoea triloba	IPOTR	1.00	0.00	Casualized	1.80	12.00	1.34
BRS Esteio in monoculture							
Cenchrusechinatus	CCHEC	18.00	164.33	Contagious	30.36	20.59	30.18
Eleusineindica	ELEIN	1.00	0.00	Casualized	0.48	5.88	0.53
Bidenspilosa	BIDPI	0.50	0.50	Casualized	0.24	2.94	0.53
Urochloadecumbens	BRADC	0.50	0.50	Casualized	0.24	2.94	0.38
Urochloaplantaginea	BRAPL	9.00	28.80	Contagious	13.01	17.65	10.27
Alternanthera tenella	ALRTE	23.29	859.90	Contagious	39.28	20.59	34.42
Euphorbia heterophylla	EPHHL	6.50	84.50	Contagious	3.13	2.94	2.74
Richardia brasiliensis	RCHBR	0.50	0.50	Casualized	0.24	2.94	1.00
Amaranthus deflexus	AMADE	2.50	12.50	Contagious	1.20	2.94	3.45
Ipomoea triloba	IPOTR	7.00	47.33	Contagious	11.81	20.59	16.50

De. R: Relative density; Co. R.: Relative Constancy; Do. R: Relative dominance.

There was a change in the weed importance value index as a function of the evaluated bean cultivars. For the bean cultivar Pérola, the main weeds found were marmalade grass (*Urochloa plantaginea*), southern sandbur (*Cenchus echinatus*) and joyweed (*Alternanthera tenella*) (Figure 2A). In the cultivar Realce, they were southern sandbur, joyweed, signal grass (Urochloa decumbens) and sourgrass (*Digitaria insularis*) (Figure 2B). In the cultivar Esteio, the main species observed were joyweed, southern sandbur, littlebell (*Ipomoea triloba*) and marmalade grass (Figure 2C).

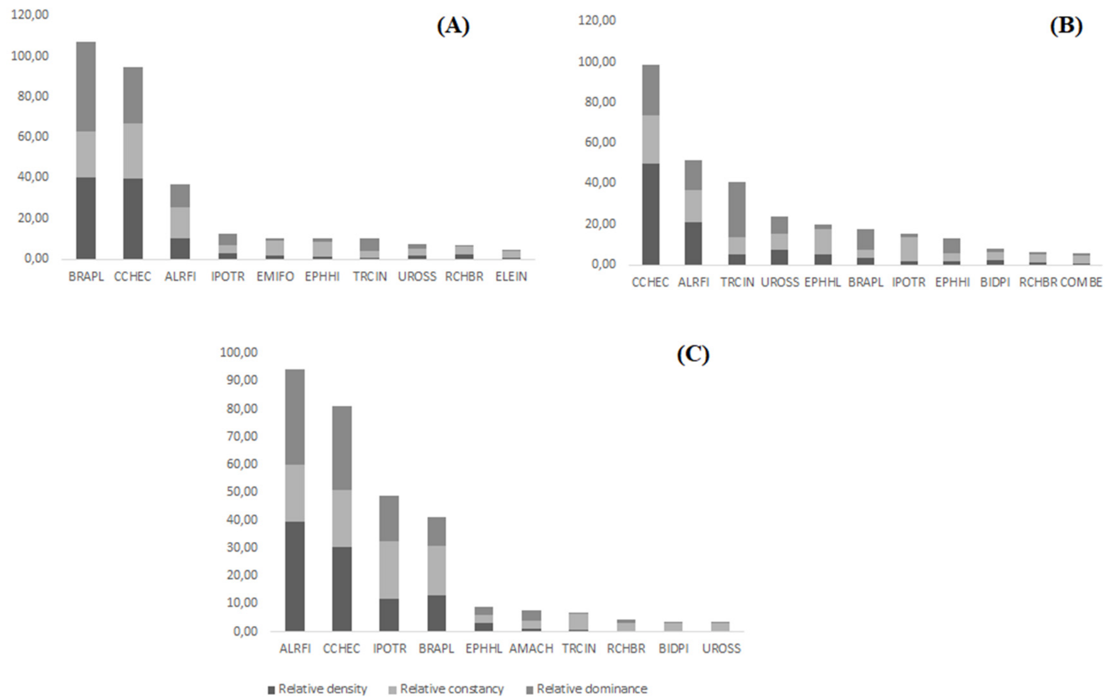

Figure 2. Weed importance value index in Pérola cv. (A), BRS Realce (B) and BRS Esteio (C) bean crops

The alteration in the floristic composition of the weeds is possibly due to the growth habit of the evaluated cultivars. Bean genotypes that have less branching and ground cover, such as type I and II beans, are less competitive due to their more straight growth habit (Teixeira et al., 2009), however materials with a more prostrate habit (Type III) allow the greater soil cover, reducing weed development (Blair et al., 2013), or changing the composition to species more adapted to the shaded environment, such as species with C3 photosynthesis (Santos et al., 2017). As observed in common bean, in monoculture castor cultivation, the species that presented the highest population densities were southern sandbur and joyweed (Table 3). According to Kissmann & Groth (1991), southern sandbur is one of the main weeds present in Brazil, and it causes damage due to the great competition with the crop, in addition to hampering manual harvesting processes due to the presence of thorns in the seeds. This species promotes a reduction in crop productivity as well as depreciating the quality of harvested products (Cury et al., 2011; Silva et al., 2015).

Table 3. Weed population in crops of different castor hybrids

Scientific name	ID	Average (plants m^{-2})	Variance	Distribution	De. R.	Co. R	Do. R.
						(%)	
	Tamar hybrid in monoculture						
Cenchrusechinatus	CCHEC	18.00	331.60	Contagious	41.86	22.22	16.82
Eleusineindica	ELEIN	1.33	0.33	Casualized	1.55	11.11	0.96
Chamaesycehirta	EPHHI	0.50	0.50	Casualized	0.39	3.70	1.25
Digitariainsularis	DIGIN	4.40	8.80	Contagious	8.53	18.52	64.92
Urochloaplantaginea	BRAPL	5.25	20.92	Contagious	8.14	14.81	2.28
Alternanthera tenella	ALRTE	16.50	461.90	Contagious	38.37	22.22	13.56
Commelinabenghalensis	COMBE	0.50	0.50	Casualized	0.39	3.70	0.13
Ipomoea triloba	IPOTR	1.00	2.00	Contagious	0.78	3.70	0.08

Agima hybridin monoculture								
Cenchrusechinatus	CCHEC	18.25	381.07	Contagious	51.96	22.22	35.96
Eleusineindica	ELEIN	5.13	22.70	Contagious	14.59	19.44	12.82
Chamaesycehirta	EPHHI	1.00	0.67	Casualized	1.42	8.33	1.55
Bidenspilosa	BIDPI	1.50	4.50	Contagious	1.07	2.78	0.50
Urochloadecumbens	BRADC	0.50	0.50	Casualized	0.36	2.78	0.90
Digitariainsularis	DIGIN	2.50	0.50	Casualized	1.78	5.56	9.40
Urochloaplantaginea	BRAPL	8.00	9.50	Contagious	14.23	13.89	24.15
Cyperusrotundus	CYPRO	1.00	2.00	Contagious	0.71	2.78	0.83
Alternanthera tenella	ALRTE	8.75	81.58	Contagious	12.46	11.11	12.61
Euphorbia heterophylla	EPHHL	0.50	0.50	Casualized	0.36	2.78	0.03
Echinochloa crus-galli	ECHCG	0.50	0.50	Casualized	0.36	2.78	0.12
Commelinabenghalensis	COMBE	0.50	0.50	Casualized	0.36	2.78	0.66
Conyza canadensis	ERICA	0.50	0.50	Casualized	0.36	2.78	0.48

De. R: Relative density; Co. R.: Relative Constancy; Do. R: Relative dominance.

In the Tamar castor hybrid, *Digitaria insularis*, even with a lower population density (4.4 plants m^{-2}), showed a value index of superior importance to the other species, due to its high competitive ability and ability to accumulate biomass (Figure 3A). According to Gazziero et al. (2011) this species has been increasing its infestation in Brazil, mainly in areas where cover crops are not used during the off-season.

Phytosociological surveys carried out by Araújo et al. (2021) in areas in the Brazilian Cerrado, indicate *Digitaria insularis* and *Cenchrus echinatus* among the species with greater economic importance in the region. *Digitaria insularis* is a very aggressive weed, capable of drastically reducing the productivity of affected crops (Gazziero et al., 2019) and is also resistant to herbicides used in Brazil (Heap 2021; Correia, 2023).

In the case of castor grown in monoculture, the spacing of the crop, as it is wide, favors the incidence of sunlight and allows for greater development of weeds, especially those with a C4 photosynthetic cycle that depend on greater amounts of sunlight (Santos et al., 2017). This behavior also justifies the predominance of weeds that show a C4 photosynthetic cycle observed in the Agima castor hybrid crop (Figure 3B).

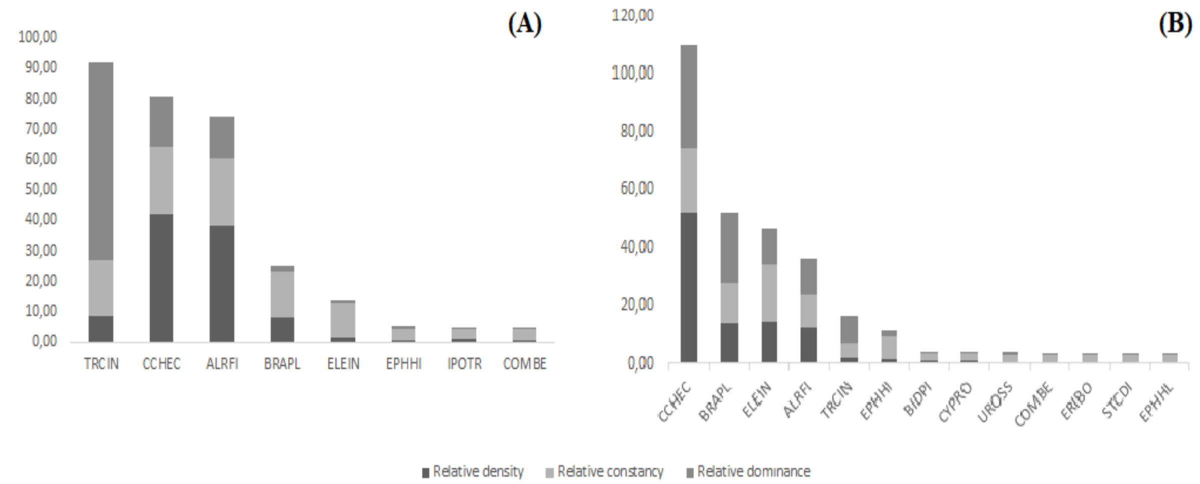

Figure 3. Weed importance value index in crops of hybrids of castor Tamar (A) and Agima (B)

Regarding the density of weeds in the crop conducted in an intercropped situation, the predominance of the same species observed in the monoculture is observed (Table 4). This behavior is possibly due to the lower height of castor hybrids, which does not promote a major change in the intercropping environment, principally regarding the availability of sunlight to change the specific flora, as reported by Santos et al. (2017) e Pereira et al. (2015) comparing the common bean intercropping with large castor with castor monoculture areas.

Table 4. Weed population in common bean cvs. intercropped crops with castor hybrids

Scientific name	ID	Average (plants m^{-2})	Variance	Distribution	De. R. (%)	Co. R (%)	Do. R. (%)
		BRS Esteio intercropped with Agima hybrid					
Cenchrusechinatus	CCHEC	16.78	428.44	Contagious	36.65	25.71	33.49
Chamaesycehirta	EPHHI	1.67	2.33	Contagious	1.21	5.71	0.32
Bidenspilosa	BIDPI	2.50	12.50	Contagious	1.21	2.86	2.86
Urochloadecumbens	BRADC	0.75	0.92	Contagious	0.73	5.71	0.55
Digitariainsularis	DIGIN	4.00	2.00	Casualized	1.94	5.71	15.98
Urochloaplantaginea	BRAPL	20.67	80.27	Contagious	30.10	17.14	21.06
Cyperusrotundus	CYPRO	3.00	18.00	Contagious	1.46	2.86	0.00
Alternanthera tenella	ALRTE	19.20	150.20	Contagious	23.30	14.29	22.37
Commelinabenghalensis	COMBE	1.50	4.50	Contagious	0.73	2.86	0.52
Conyza canadensis	ERICA	1.00	2.00	Contagious	0.49	2.86	2.86
Richardia brasiliensis	RCHBR	2.50	12.50	Contagious	1.21	2.86	0.00
Amaranthus deflexus	AMADE	1.00	0.00	Casualized	0.49	5.71	0.00
Emilia fosbergii	EMISO	0.50	0.50	Casualized	0.24	2.86	0.00
Ipomoea triloba	IPOTR	0.50	0.50	Casualized	0.24	2.86	0.00
		BRS Esteio intercropped with Tamar hybrid					
Cenchrusechinatus	CCHEC	12.40	123.38	Contagious	41.33	27.03	23.15
Eleusineindica	ELEIN	3.50	8.33	Contagious	4.67	10.81	4.21
Chamaesycehirta	EPHHI	2.50	4.50	Contagious	1.67	5.41	0.29
Bidenspilosa	BIDPI	2.67	4.33	Contagious	2.67	8.11	1.19
Digitariainsularis	DIGIN	1.00	1.00	Casualized	1.00	5.41	8.60
Urochloaplantaginea	BRAPL	22.00	61.33	Contagious	29.33	10.81	36.10
Alternanthera tenella	ALRTE	9.00	46.00	Contagious	15.00	13.51	19.26
Euphorbia heterophylla	EPHHL	0.50	0.50	Casualized	0.33	2.70	0.15
Conyza canadensis	ERICA	0.50	0.50	Casualized	0.33	2.70	1.04
Richardia brasiliensis	RCHBR	0.50	0.50	Casualized	0.33	2.70	0.19
Emilia fosbergii	EMISO	0.50	0.50	Casualized	0.33	2.70	0.47
Ipomoea triloba	IPOTR	3.00	12.00	Contagious	3.00	8.11	5.35
		Pérola cv. intercropped with Agima hybrid					
Cenchrusechinatus	CCHEC	14.50	67.00	Contagious	22.75	11.11	17.11
Eleusineindica	ELEIN	3.43	5.62	Contagious	9.41	19.44	8.94
Chamaesycehirta	EPHHI	2.25	0.92	Casualized	3.53	11.11	10.81
Bidenspilosa	BIDPI	5.00	8.00	Contagious	3.92	5.56	2.35
Urochloadecumbens	BRADC	3.00	18.00	Contagious	2.35	2.78	0.79
Urochloaplantaginea	BRAPL	11.67	80.67	Contagious	27.45	16.67	22.82
Cyperusrotundus	CYPRO	13.00	338.00	Contagious	10.20	2.78	5.89
Alternanthera tenella	ALRTE	12.33	42.33	Contagious	14.51	8.33	18.35
Euphorbia heterophylla	EPHHL	1.00	2.00	Contagious	0.78	2.78	0.76
Commelinabenghalensis	COMBE	1.50	0.50	Casualized	1.18	5.56	1.07
Amaranthus deflexus	AMADE	1.00	2.00	Contagious	0.78	2.78	0.29
Ipomoea triloba	IPOTR	2.00	1.33	Casualized	3.14	11.11	10.83

Pérola cv. intercropped with Tamar hybrid							
Cenchrusechinatus	CCHEC	38.00	171.33	Contagious	46.34	11.11	32.78
Eleusineindica	ELEIN	4.33	12.33	Contagious	3.96	8.33	3.58
Chamaesycehirta	EPHHI	6.00	72.00	Contagious	3.66	2.78	0.97
Bidenspilosa	BIDPI	2.50	12.50	Contagious	1.52	2.78	1.80
Urochloadecumbens	BRADC	1.67	2.33	Contagious	1.52	5.56	3.19
Urochloaplantaginea	BRAPL	10.25	187.58	Contagious	12.50	11.11	25.92
Cyperusrotundus	CYPRO	0.00	0.00	Casualized	0.00	0.00	0.00
Alternanthera tenella	ALRTE	18.00	648.00	Contagious	10.98	2.78	3.48
Euphorbia heterophylla	EPHHL	3.50	18.30	Contagious	6.40	16.67	3.69
Commelinabenghalensis	COMBE	6.20	29.70	Contagious	9.45	13.89	21.14
Richardia brasiliensis	RCHBR	0.50	0.50	Casualized	0.30	2.78	0.01
Amaranthus deflexus	AMADE	1.33	0.33	Casualized	1.22	8.33	0.91
Emilia fosbergii	EMISO	0.50	0.50	Casualized	0.30	2.78	0.11
Ipomoea triloba	IPOTR	1.50	1.00	Casualized	1.83	11.11	2.42
BRS Realcecv. intercropped with Agima hybrid							
Cenchrusechinatus	CCHEC	18.71	125.90	Contagious	51.78	24.14	28.72
Eleusineindica	ELEIN	1.75	0.25	Casualized	2.77	13.79	8.61
Chamaesycehirta	EPHHI	1.00	0.00	Casualized	0.79	6.90	5.06
Digitariainsularis	DIGIN	0.50	0.50	Casualized	0.40	3.45	16.64
Urochloaplantaginea	BRAPL	5.50	15.00	Contagious	8.70	13.79	11.21
Alternanthera tenella	ALRTE	18.50	9.67	Casualized	29.25	13.79	15.17
Euphorbia heterophylla	EPHHL	4.00	2.00	Casualized	3.16	6.90	6.90
Ipomoea triloba	IPOTR	1.60	0.80	Casualized	3.16	17.24	7.70
BRS Realcecv. intercropped with Tamar hybrid							
Cenchrusechinatus	CCHEC	15.50	261.90	Contagious	54.07	21.43	49.51
Eleusineindica	ELEIN	6.00	32.00	Contagious	6.98	7.14	3.82
Chamaesycehirta	EPHHI	1.50	0.33	Casualized	3.49	14.29	3.99
Bidenspilosa	BIDPI	5.40	51.30	Contagious	15.70	17.86	10.83
Urochloaplantaginea	BRAPL	5.00	22.00	Contagious	11.63	14.29	11.78
Alternanthera tenella	ALRTE	3.00	2.00	Casualized	3.49	7.14	3.19
Euphorbia heterophylla	EPHHL	1.00	2.00	Contagious	1.16	3.57	0.76
Richardia brasiliensis	RCHBR	1.50	4.50	Contagious	1.74	3.57	0.47
Amaranthus deflexus	AMADE	1.00	0.00	Casualized	1.74	10.71	14.07

De. R: Relative density; Co. R.: Relative Constancy; Do. R: Relative dominance.

Regarding the species similarity index in all evaluated conditions, the indexes exceeded 75% (Table 5). According to Matteucci & Colma (1982), similarity values above 25% are considered high. This high similarity of the weed flora is possibly due to the great similarity of the edaphoclimatic conditions and the cultural treatments carried out in the evaluated areas.

Table 5. Weed species similarity index intercropped with castor and bean hybrids

Bean cvs. in monoculture						
		PM	**RM**	**EM**		
	PM	-	90.9	86.96		
	RM	90.9	-	86.96		
	EM	86.96	86.96	-		
Castor hybrids in monoculture						
			TM	**AM**		
		TM	-	94.12		
		AM	94.12	-		
Intercrops						
	EA	**ET**	**PA**	**PT**	**RA**	**RT**
EA	-	87.5	92.31	93.33	77.78	80
ET	87.5	-	85.71	92.31	85.71	85.71
PA	92.31	85.71	-	100	84.61	88
PT	93.33	92.31	100	-	80	88
RA	77.78	85.71	84.61	80	-	88.89
RT	80	85.71	88	88	88.89	-

*PM: BRS Pérola cv. bean in monoculture; RM: BRS Realce cv. bean monoculture; EM: BRS Esteio cv. bean monoculture; TM: Tamar hybrids castor in monoculture; AM: Agima hybrids castor in monoculture; EA: BRS Esteio cv bean in intercrop with Agima hybrids castor; ET: BRS Esteio cv. bean in intercrop with Tamar hybrids castor; PA: Pérola cv. bean intercrop with Agima hybrids castor; PT: Pérola cv. bean intercrop with Tamar hybrids castor; RA: BRS Realce cv. bean intercrop with Agima hybrids castor; RT: BRS Realce cv. bean intercrop with Tamar hybrids castor.

4. Conclusion

In the cultivation areas involving common bean genetic materials intercropped with small castor hybrids and their respective monocultures, 17 weed species belonging to 8 botanical families were identified.

The predominant weeds in the cultivated areas belong to the Poaceae and Asteraceae families, followed by the Amaranthaceae and Euphorbiacea families. The southern species *Cenchus echinatus* and *Alternanthera tenella* showed predominance in intercropping and monoculture conditions;

Bean cultivars of different habits and castor hybrids directly influence the weed community. The common bean monoculture and castor hybrids system, in general, provide greater problems with weeds compared to their respective monocultures, especially the Poaceae family.The weed species similarity indexes were higher than 75%.

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