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Phytosociological survey of weeds in cassava growth area

Eduardo Hélder Horácio[1]*, Isac Bernardino José António Cabo[2], Elias Carlos Sousa[2], Ana Débora Ribeiro Cardoso Gusmão[3] and Paulo César Timossi[3]

[1]Faculty of Food and Agrarian Sciences, Universidade Rovuma (UniRovuma), Napipine University Campus, Nampula, Mozambique.
[2]Faculty of Natural Sciences, Universidade Rovuma (UniRovuma), Napipine University Campus, Nampula, Mozambique.
[3]Agronomy Graduate Program, Universidade Federal de Jataí (GO), Jataí, Goiás, Brazil.

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The presence of weeds in agricultural crops causes direct losses in productivity, causing economic losses, which makes it necessary to know the quality and quantity of weeds that compete with agriculture crops. Therefore, the objective of this work was to identify the weed community associated with cassava cultivation through a phytosociological survey, carried out in a cassava cultivation area, in the city of Nampula. The frequency, density and absolute and relative dominance, and the importance value index were analyzed. A total of 196 individuals were identified, distributed in 15 families and 27 species, with greater emphasis on Asteraceae followed by the Poaceae family. The most important species was *Amaranthus deflexus*.

Key words: *Manihot esculenta* L., competition, importance value index, phytosociology.

INTRODUCTION

In Mozambique, cassava (Manihot esculenta Cruntz) plays an important role in food security, being a source of income for rural families and can be used for human and animal food. It is estimated that the provinces of Zambézia, Nampula and Cabo Delgado account for about 85% of the total national production, and it is mostly produced by the family sector in areas ranging from 0.25 to 2.0 ha (Cuambe and Avijala, 2018).

Weeds that occur in areas cultivated with cassava negatively interfere with plant growth and root productivity (Fontes et al., 2014).

Inadequate weed management is one of the main factors limiting cassava root productivity. According to Albuquerque et al. (2008), the coexistence of the crop with the weeds can result in high productivity losses, being able to be superior to 90%. In low populations, weed species can interfere with the ideal growth and development of the crop (Albuquerque et al., 2012).

Due to the variability of factors that affect weeds, the phytosociological survey is an important tool in the

*Corresponding author. E-mail: ehoracio1986@gmail.com. Tel: (+258) 857051895.

analysis of the impact that management systems and agricultural practices have on the dynamics of growth and occupation of weeds in the agroecosystem (Concenço et al., 2013; Ferreira et al., 2014; Santos et al., 2015). For this purpose, evaluation methods established by phytosociology are used, which consists of the study of plant communities, in order to establish a comprehensive view of the composition and distribution of species in an area (Guglieri-Caporal et al., 2010), as well as the importance of each species taking into account the phytosociological parameters of frequency, density, dominance and importance value index (Erasmo et al., 2004; Pinotti et al., 2010).

Research related to the biology and management of weeds in the agriculture crops in Mozambique is still incipient. Thus, the objective of this work was to know and quantify the weed community associated with cassava cultivation through a phytosociological survey.

MATERIALS AND METHODS

The study was conducted in May 2022 in one cassava farm in Carrupeia village, in the city of Nampula (15°06'01"S and 39°15'51"E), whose climate is classified as Aw tropical with seasonal summer drought, according to the Köppen classification. The region presents mean annual rainfall depth of 959 mm and mean annual temperature of 23.9°C, with mean minimum of 16°C and mean maximum 32°C. The studied area was 3000 m² (30 × 100 m) in a Yellow Latosol soil with the following chemical characteristics: pH(H_2O)=5.3, P=61 mg dm^{-3}, K=75 mg dm^{-3}, Ca=1.8 cmolc dm^{-3}, Mg=1.3 cmolc dm^{-3}, H+Al=4.5 cmolc dm^{-3}, V (%)=40, MO= 13.7 g dm^{-3}. It is an area considered the Municipal Green Zone, where the majority of residents are dedicated to agriculture, with greater emphasis on the cultivation of cassava for over five years. During the phytosociological survey, a wide variety of weeds was found. To control these plants, manual mechanical weeding (hoe) was carried out. The soil was prepared with plowing, harrowing and furrowing and fertilization was not performed. The variety of cassava planted was “Eyope”, with cuttings of 3 to 4 cm in stem diameter, 30 cm in length and seven buds. The spacing used was 1.0 m between rows and 0.6 m between plants. The evaluations were carried out 90 days after planting, using the square method (1.0 m^2), according to the method proposed by Braun-Blanquet et al. (1979). A square frame was randomly launched in each parcel of the area, following a zigzag path, to determine the sample plot and assess the weeds within it; the last launching was performed when no more new species were found. A total of 10 sample plots were determined for the area. The plants in each sample plot were counted and separated by species. An individual of each specie was collected, pressed, and sent to the Biology Laboratory of the Rovuma University, confirm their identification, and add to the exsiccate collection. The classification system adopted was based on the system The Angiosperm Phylogeny Group - APG II (2003), with assistance in the delimitation of families and genera (Souza and Lorenzi, 2005) and through specific manuals for this activity (Lorenzi, 2014). The plants in the sample plots were collected by cutting their shoots, separated by species, placed in kraft paper bags, and dried in an oven at 70°C for 72 h to determine their dry biomass (Cabrera et al., 2019).

The data collected were subjected to weed community analysis using phytosociological parameters, which show the absolute and relative values of weed the absolute frequency, relative frequency, absolute density, relative density, and importance value index, through the formulas proposed by Mueller-Dombois and Ellemberg (1974) and described by Cabrera et al. (2019). The results were considered when the importance value index of the weed plant was equal to or higher than 1%. The results obtained were presented in the form of a table, where the species were organized according to the importance value index, from highest to lowest.

RESULTS AND DISCUSSION

The phytosociological survey of the weed community showed the occurrence of 26 weed species in the entire cultivation area, distributed in 15 families, which are represented in Table 1. The main families were Asteraceae with 6 species, Poaceae with 5 species of the total species found, followed by Amaranthaceae, Cyperaceae and Euphorbiaceae, both with two species, and one species for other families (Table 1).

The families identified with the highest occurrence in this work are also common in other agricultural regions (Almeida et al., 2019; Canuto et al., 2020). In papaya cultivation, for example, Costa et al. (2019) determined that the Poaceae family represented 27% of the total identified species, followed by the Asteraceae family, with 19%, and Amaranthaceae with 8%. In an area of grain sorghum cultivation, Custódio et al. (2019) determined that 39% of the species found belonged to the Poaceae family, and 22% to the Asteraceae. In this work, the Asteraceae family composed 22% of the identified species, and together with the families Poaceae (19%), Amaranthaceae (7%), Cyperaceae (7%) and Euphorbiaceae (7%), they add up to 62% of the total identified species across the cultivated area. The high incidence of species from the identified families is explained, in part, by the large amount of diaspore production, which facilitates its dissemination in different environments, becoming species of high influence in the area under study (Caetano et al., 2018). It is believed that this high dispersion capacity may be related to the size of the seeds of these plants, given that they are small, averaging 0.8 mm in length (Xavier et al., 2019).

Amaranthus deflexus presented the highest incidence with relative frequency (8.4%), relative density (9.7%), relative abundance (4.4%) and importance value index (22.6%) of entire weed community in the research area (Table 2). Other species that should be highlighted are the *Commelina benghalensis* with 18.6% of IVI, *Indigofera hirsuta*, *Ischaemum rugosum* and *Digitaria horizontalis* both with 17.7% of IVI, the *Cyperus esculentus* with 16.1% of IVI, *Sida spinosa* with 14.9% of IVI and *Conyza canadensis* with 14% of IVI (Table 2), which can be considered as the main target for control. The widespread occurrence of the *A. deflexus* species in the study area may have been attributed to the high infestation potential. Therefore, it can be said that

Table 1. Botanical families, species and common name of weeds found in the cassava growing area in Nampula City.

Family	Species
Asteraceae	*Conyza canadenses*
	Bidens pilosa
	Gamochaeta coarctata
	Galinsoga parviflora
	Tridax procumbens
	Acanthospermum hispidum
Amaranthaceae	*Amaranthus deflexus*
	Amaranthus hybridus
Boraginaceae	*Echium plantagineum*
Commelnaceae	*Commelina benghalensis*
Convolvulaceae	*Ipomoea purpurea*
Cucurbitaceae	*Momordica charantina*
Cyperaceae	*Cyperus esculentus*
	Cyperus odoratus
Euphorbiaceae	*Ricinus communis*
	Camaesyce hirta
Faboideae	*Aeschynomene denticulata*
Fabaceae-Caesalpinioideae	*Senna obtusifolia*
Fabaceae-Faboideae	*Indigofera hirsuta*
Malvaceae	*Sida spinosa*
Phyllantaceae	*Phyllanthus tenellus*
Poaceae	*Pennisetum clanestinum*
	Ischaemum rugosum
	Eleusine indica
	Digitaria horizontalis
	Dactyloctenium aegyptium
Onagraceae	*Ludwigia leptocarp*

Source: The Authors.

families with low representation in terms of number of species do not imply a lower degree of importance, since the species *C. benghalensis* and *I. hirsuta*, the only representatives of the Commelinaceae and Fabaceae-Faboideae families, stood out as the second and third species with the highest IVI. Costa et al. (2019) state that it is important to consider that the low representativeness in quantitative terms of some species does not imply less importance in the cultivation area, as they may have greater relevance in subsequent cultivations, especially if they are not properly controlled.

In view of the results obtained, the knowledge about the weed population in an agricultural system makes the realization of a phytosociological survey help in the management of existing weeds in cassava cultivation areas, providing a reduction in production costs and impact on the environment, making it possible to plan strategies for the prevention and sustainable control of existing weeds in cultivated areas.

Among the limitations found, we can highlight the lack of control of climatic factors, which can influence the dynamics of the weed community. Changes in climate,

Table 2. Number of individuals (NI), frequency (F), relative frequency (RF), absolute density (AD), relative density (RD), relative abundance and abundance and importance value index (IVI), of a weed population found in the cassava growing land.

Species	NI	F	RF%	AD	RD%	A	RA%	IVI (%)
Conyza canadenses	10	0.4	4.8	1.0	5.1	2.5	4.1	14.0
Bidens pilosa	4	0.3	3.6	0.4	2.0	1.3	2.2	7.8
Gamochaeta coarctata	6	0.4	4.8	0.6	3.1	1.5	2.4	10.3
Galinsoga parviflora	3	0.1	1.2	0.3	1.5	3.0	4.9	7.6
Tridax procumbens	6	0.3	3.6	0.6	3.1	2.0	3.3	9.9
Acanthospermum hispidum	6	0.4	4.8	0.6	3.1	1.5	2.4	10.3
Amaranthus deflexus	19	0.7	8.4	1.9	9.7	2.7	4.4	22.6
Amaranthus hybridus	4	0.2	2.4	0.4	2.0	2.0	3.3	7.7
Echium plantagineum	3	0.2	2.4	0.3	1.5	1.5	2.4	6.4
Commelina benghalensis	15	0.5	6.0	1.5	7.7	3.0	4.9	18.6
Ipomoea purpurea	4	0.2	2.4	0.4	2.0	2.0	3.3	7.7
Momordica charantina	2	0.2	2.4	0.2	1.0	1.0	1.6	5.1
Cyperus esculentus	12	0.5	6.0	1.2	6.1	2.4	3.9	16.1
Cyperus odoratus	1	0.1	1.2	0.1	0.5	1.0	1.6	3.3
Ricinus communis	2	0.1	1.2	0.2	1.0	2.0	3.3	5.5
Camaesyce hirta	9	0.3	3.6	0.9	4.6	3.0	4.9	13.1
Aeschynomene denticulata	6	0.3	3.6	0.6	3.1	2.0	3.3	9.9
Senna obtusifolia	3	0.2	2.4	0.3	1.5	1.5	2.4	6.4
Indigofera hirsuta	14	0.5	6.0	1.4	7.1	2.8	4.6	17.7
Sida spinosa	11	0.4	4.8	1.1	5.6	2.8	4.5	14.9
Phyllanthus tenellus	5	0.2	2.4	0.5	2.6	2.5	4.1	9.0
Pennisetum clanestinum	5	0.2	2.4	0.5	2.6	2.5	4.1	9.0
Ischaemum rugosum	14	0.4	4.8	1.4	7.1	3.5	5.7	17.7
Eleusine indica	7	0.2	2.4	0.7	3.6	3.5	5.7	11.7
Digitaria insulares	14	0.4	4.8	1.4	7.1	3.5	5.7	17.7
Dactyloctenium aegyptium	6	0.2	2.4	0.6	3.1	3.0	4.9	10.4
Ludwigia leptocarp	5	0.4	4.8	0.5	2.6	1.3	2.0	9.4
Total	196	8.3	100	19.6	100	61.2	100	300

Source: The Authors.

seasonality, make the experiment appropriate for the region in which it was carried out, however in other locations, with different climatic conditions, the results may be different.

For future research, it is important to explore similar management conditions in other regions or even in the same region at different times. Furthermore, the accumulation of dry mass of weeds in the weed community can be evaluated, with the aim of implementing the results obtained.

Conclusions

The phytosociological survey of the weed community showed the occurrence of 27 weed species in the entire cultivation area, distributed in 15 botanical families, highlighting the Asteraceae and Poaceae families with the largest number. The species that presented the highest importance value were *A. deflexus*, *C. benghalensis, I. hirsuta*, *I. rugosum, D. horizontalis, C. esculentus*, *S. spinosa* and *C. canadensis* species, and must be prioritized in the implementation of management measures.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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REFERENCES

Albuquerque JAA, Sediyama T, Silva AA, Carneiro JES, Cecon, PR, Alves JMA (2008). Interferência de plantas daninhas sobre a produtividade da mandioca (*Manihot esculenta*). Planta Daninha 26(2):279-289.

Albuquerque JAA, Sediyama T, Silva AA, Alves JMA, Finoto EL, Neto FA, Silva GR (2012). Desenvolvimento da cultura de mandioca sob interferência de plantas daninhas. Planta Daninha 30:37-45. Available at: http://dx.doi.org/10.1590/S0100-83582012000100005.

Almeida UO, Andrade Neto RC, Marinho JTS, Gomes RR, Oliveira JR, Santos RS, Teixeira Júnior DL, Araújo JC (2019). Fitossociologia de plantas daninhas em cultivo de açaizeiro. Revista Brasileira de Agropecuária Sustentável 9(3):59-67.

Braun-Blanquet J, Lalucat Jo J, de Bolòs OF (1979). Fitossociologia: bases para el estudio de las comunidades vegetales. Blume: Madrid, Spain 820 p.

Cabrera DC, Chaila S, Sobrero MT, Varela AE (2019). Phytosociological Survey of Sugarcane Crop Weeds in Different Agroecological Areas in Tucumán Province, Argentina. Planta Daninha 37:1-10.

Caetano APO, Nunes RTC, Rampazzo MC, Silva GL, Soares MRS, São José AR, Moreira ES (2018). Levantamento fitossociológico na cultura 70 da soja em Luís Eduardo Magalhães/BA. Scientia Agraria Paranaensis, Marechal Cândido Rondon 17(3):359-367.

Canuto RSO, Canuto DMF, Oliveira LS, Jacobi NMNS, Ribeiro Neto JC (2020). Levantamento fitossociológico de plantas daninhas em área de produção de café catuaí amarelo. Revista Inova Ciência & Tecnologia 6(1):18-23.

Concenço G, Tomazi M, Correia IVT, Santos SA, Galon L (2013). Levantamentos fitossociológicos: ferramentas para a ciência das ervas daninhas? Planta Daninha 31(2):469-482. Available at: http://dx.doi.org/10.1590/S01008358201300020002 5

Costa RN, Ribeiro Silva DM, Rocha AO, Silva Lima AN, Camilo dos Santos JCC, Santos Silva LK, Acchile S (2019). Levantamento fitossociológico de plantas daninhas em área de produção de mamão. Revista Científica Rural 21(3):183-193.

Cuambe CE, Avijala MF (2018). Desenvolvimento de variedades de mandioca com alto teor de proteínas, ricas em vitamina A e com menores índices de cianetos adaptadas a região norte de Moçambique. Instituto de Investigação Agrária de Moçambique. Nampula:15.

Custódio IG, Karam D, Borges ID (2019). Levantamento fitossociológico de plantas daninhas na cultura do sorgo granífero em função do manejo químico. Revista Brasileira de Milho e Sorgo 18(1):148-157.

Erasmo EAL, Pinheiro LLA, Costa NV (2004). Levantamento fitossociológico das comunidades de plantas infestantes em áreas de produção de arroz irrigado cultivado sob diferentes sistemas de manejo. Planta Daninha 22(2):195-201. Available at: http://dx.doi.org/10.1590/S0100-83582004000200004.

Ferreira EA, Fernandez AG, Souza CP, Felipe MA, Santos JB, Siva DV, Guimarães FAR (2014). Levantamento fitossociológico de plantas daninhas em pastagens degradadas do Médio Vale do Rio Doce, Minas Gerais. Revista Ceres 61(4):502-510. Available at: http://dx.doi.org/10.1590/0034-737X201461040008.

Fontes JRA, Oliveira IJ, Pedrozo CA, Rocha RNC, Morais RR, Muniz AW (2014). Período de interferência de plantas daninhas na cultura da macaxeira, variedade Aipim-manteiga, em terra firme do Amazonas. Manaus: Embrapa Amazônia Ocidental 7. (Embrapa Amazonia Ocidental. Circular Tecnica 46 p.

Guglieri-Caporal A, Caporal FJ, Pott A (2010). Phytosociology of sown pasture weeds under two levels of degradation in Brazilian savanna areas, Mato Grosso do Sul State, Brazil. Pesquisa Agropecuária Tropical 40(3):312-321.

Lorenzi H (2014). Manual de Identificação e Controle de Plantas Daninhas: plantio direto e convencional. 7.ed. Nova Odessa: Plantarum 384.

Mueller-Dombois D, Ellenberg H (1974). Aims and methods of vegetation ecology. New York: John Wiley e Sons 547.

Pinotti EB, Bicudo SJ, Curcelli F, Dourado W de S (2010). Levantamento florístico de plantas daninhas na cultura da mandioca no município de Pompéia-SP. Revista Raízes e Amidos Tropicais 6:120-125.

Santos CS, Santos JCC, Melo EB, Matos RM, Silva PF (2015). Levantamento fitossociológico de plantas daninhas na cultura da laranja. Journal of Agronomic Sciences 4(2):50-59.

Souza VC, Lorenzi H (2005). Botânica sistemática: guia ilustrativo para identificação das famílias de Angiospermas da flora brasileira, baseado em APGII. Nova Odessa: Instituto Plantarum 640 p.

The Angiosperm Phylogeny Group- (APG) II (2003). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG II. Botanical Journal of the Linnean Society 141(4):399-436.

Xavier JB, Andrade DB, Souza DC, Guimarães GC, Resende LV, Guimarães RM (2019). Morphological, chemical and physiological characterization of *Amaranthus spp*. seeds. Journal of Seed Science 41(4):478-487.