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Levantamento fitossociológico de plantas daninhas em área de videira no submédio São Francisco

Phytosociological survey of weeds in a grapevine área in the sub-medium São Francisco

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Resumo

O conhecimento da diversidade de espécies de plantas daninhas que compõem a comunidade infestante pode revelar informações sobre as características morfológicas, fisiológicas e ecossistêmicas dessas espécies importantes para o manejo da videira. Neste sentido, o presente artigo teve como objetivo quantificar, por meio do levantamento fitossociológico das espécies de plantas daninhas presentes na cultura da videira na região do Submédio São Francisco, caracterizando o serviço ecossistêmico destas espécies para auxílio no manejo da cultura. O levantamento foi realizado em área irrigada de videira (*Vitis vinífera* L.) de 16 hectares da variedade benifuji com idade de 15 anos no município de Curaçá - BA. O levantamento fitossociológico foi realizado utilizando o método do quadrado inventário (medindo: 0,50 x 0,50 m), lançado a cada 15 metros em zigue-zague, dentro e fora das linhas de irrigação, totalizando 30 arremessos em 4 linhas de plantio. O material coletado foi contabilizado, identificado e os dados obtidos analisados mediante parâmetros fitossociológicos, além da análise da diversidade utilizando índices ecológicos e o programa estatístico PAST 4.0. Foram identificadas 13 espécies de plantas daninhas classificadas em 09 famílias, com destaque para a família Poaceae com 4 espécies, seguida da Asteraceae com 2 espécies. A área apresentou índice de Shannon-Wierner de *H'*=1,13 nat.ind^{-1}, equitabilidade de Pielou de *J'*=0.40 e índice de dominância de Simpson de D=0,43. Entre as espécies identificadas, a *Commelina* sp. apresentou a maior densidade, abundância e frequência na área, seguida das espécies *Eleusine indica* (L.) Gaertn. e *Dactyloctenium aegyptium* (L.) Willd.

Palavras-chave: *Vitis vinifera* L., Fruticultura irrigada, Vale do São Francisco.

Abstract

*Understanding the diversity of weed species that compose the infesting community can provide valuable insights into the morphological, physiological, and ecosystem traits of these species, which are essential for effective vineyard management. In this context, the present study aimed to quantify and characterize, through a phytosociological survey, the weed species present in vineyards in the Sub-middle São Francisco region, with a focus on identifying their ecosystem services to support sustainable crop management. The survey was conducted in a 16-hectare irrigated vineyard (**Vitis vinifera** L.), cultivated with the 'Benifuji' variety, aged 15 years, located in the municipality of Curaçá, Bahia, Brazil. The phytosociological assessment was carried out using the inventory quadrat method (dimensions: 0.50 × 0.50 m), thrown every*

15 meters in a zigzag pattern, covering both within and between irrigation lines, totaling 30 sampling points across four planting rows. The collected plant material was quantified and botanically identified. The resulting data were analyzed based on standard phytosociological parameters. Additionally, species diversity was assessed using ecological indices and the statistical software PAST 4.0. A total of 13 weed species were identified, belonging to 9 botanical families, with Poaceae being the most represented (4 species), followed by Asteraceae (2 species). The ecological indices obtained were: Shannon-Wiener index (H') = 1.13 nat.ind^{-1}, Pielou's evenness (J') = 0.40, and Simpson's dominance index (D) = 0.43. Among the identified species, ***Commelina*** *sp. exhibited the highest density, abundance, and frequency, followed by* ***Eleusine indica*** *(L.) Gaertn. and* ***Dactyloctenium aegyptium*** *(L.) Willd.*

Keywords*: Vitis vinifera L., Irrigated fruit growing, Vale do São Francisco.*

INTRODUCTION

The Vale do São Francisco (VSF) in northeastern Brazil has made a name for itself in Brazilian agribusiness due to its highly productive and efficient irrigated fruit-growing center. This production system is located in the sub-medium of the VSF, encompassing the municipalities of Lagoa Grande, Santa Maria da Boa Vista and Orocó, in Pernambuco, and Sobradinho, Casa Nova and Curaçá, in Bahia, with more than 120,000 hectares under irrigation (Vidal, 2023).

Brazil stands out in the production of grapes (*Vitis vinifera* L.) in the fruit-growing agribusiness, with a planted area of 74,435 hectares and a production of 1,435,596 tons, 50% of which is destined for the production of wines, juices and derivatives, and 50% for table grapes (Almeida, 2022). The VSF ranks second in this market, with a planted area of 11,000 hectares and a production of 594,678 tons, second only to the southern region (IBGE, 2022), accounting for 98% of the country's total exports.

This has been made possible by the productive potential of the Vale do São Francisco, the merit of which can be attributed to climatic characteristics and conditions such as: the number of hours of sunshine, high luminosity, low relative humidity, abundance and quality of water provided by the Rio São Francisco, deep and well-drained soils made up of a

combination of sand and clay, ideal for growing fruit, among others. The favorable natural resources, combined with the appropriate use of irrigation, favor the cultivation of grapes with high productivity and fruit quality (Baiardi and Ribeiro, 2023).

These advantages compared to other Brazilian regions give the VSF the potential to produce fruit in a continuous cycle, from two to three harvests a year, such as grapes, which can be harvested every day of the year, a unique feature in the semi-arid northeast.

However, the weed community, which is considered a productivity-limiting factor for most crops, is still little studied in the context of grapevine production (Sena et al., 2019). Weeds require the same natural factors for their development as the crop of interest, i.e. water, light, nutrients and space, which establishes a process of competition when both develop in the same place and at a certain period of the vegetative cycle (Barroso and Murata, 2021).

These species can directly affect the productivity of the grapevine crop, for example by reducing the crop's leaf area through competition for water and/or nutrients, as well as hindering cultivation and, consequently, reducing the producer's income (Santos et al., 2023). In order to avoid or reduce the coexistence of these plants with the grapevine crop, it is necessary to use correct management and, for this, the main weed species must be identified first. However, if managed correctly, they can also provide important ecosystem services for the crop, such as erosion control, addition of organic matter to the system, carbon sequestration, regulation of hydrological processes and the microclimate, nutrient cycling, abundance of beneficial organisms such as natural enemies, pollinators, antagonistic microorganisms, indicators of soil characteristics, as well as medicinal potential (Saradón and Flores, 2014).

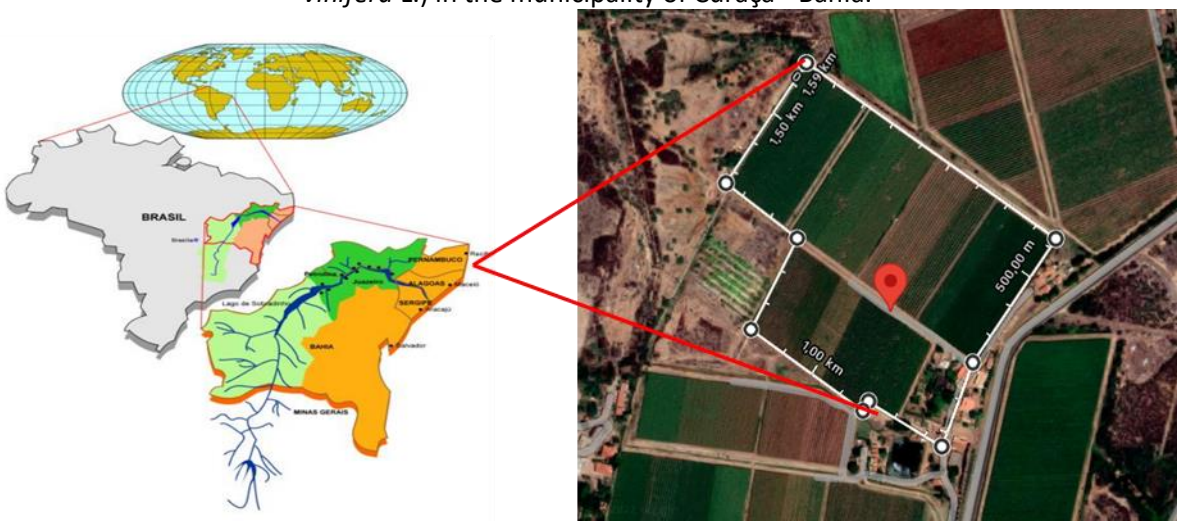
Phytosociological studies are therefore recommended as a tool for analyzing the impact that management systems and agricultural practices have on the growth and occupation dynamics of weed communities in production systems (Pitelli, 2000). Phytosociological studies classify, quantify and compare weed populations at a given time in a given location, so it is necessary to carry out these studies at different times during the development of the grapevine crop, as they can indicate the relevance of one or more weed species at different stages of the crop's development (Barroso and Murrata, 2021)

This information helps to plan crop management, so that specific and efficient measures can be used, bringing greater economic return and less environmental impact (Lessa et al., 2021). In this context, the aim of this study was to carry out a phytosociological survey of the weed community present in the grapevine crop in a productive area in the São Francisco Sub-medium region, Brazil.

MATERIAL AND METHODS

The phytosociological survey was carried out at Fazenda Neri Komine in the second half of 2022, located in the Cooperativa Agrícola de Juazeiro - CAJ, in the municipality of Curaçá - BA, northeastern Brazil, at coordinates 9°10'05.0"South and 40°01'57.6"West and altitude 365 m (Figure 1). The region's climate is of the Bsh type (semi-arid), according to the Koppen classification, with an average annual temperature of 26 ºC and an average annual rainfall of 450 mm (Alvares et al., 2013). The area has 16 hectares of vines (*Vitis vinifera* L.) of the *Benifuji* variety, 15 years old and in the vegetative stage for table grape production, with clay-textured soil and micro-sprinkler irrigation. An area measuring 0.37 hectares was used to carry out the survey.

Figura 1 – Geographical location of the Fazenda Neri Komine with the cultivation of grapes (*Vitis vinifera* L.) in the municipality of Curaçá - Bahia.



For the phytosociological survey, the traditional inventory square method was used, made from a pvc pipe structure measuring 0.5m x 0.5m (0.25m²), thrown every 15 meters in

a zigzag pattern, inside and outside the irrigation lines, totaling 30 throws in 4 planting lines. The species sampled along the walk were counted and packed in paper bags for later identification and production of exsiccates. The material collected was identified with the help of taxonomists, by consulting dichotomous keys and the species link database (http://www.splink.org.br/).

To dry the plants and prepare the exsiccata, an iron press with two wooden planks was used to hold the collected specimens for drying for 15 days under natural climatic conditions. After drying, the plants were placed in a classification folder containing plastic sheets to protect the plants from each other and identification labels

The data collected was used and analyzed using the phytosociological parameters density (D), relative density (Dr), frequency (F), relative frequency (Fr), abundance (A), relative abundance (Ar), importance value index (IVI) and relative importance value index (IVIr), using the formulas proposed by Mueller-Dombois and Ellemberg (1974) described below:

-Density (D):

D = (total number of individuala per species)/(number of squares obtained (total área))

-Relative Density (Dr):

Dr = (100 * species density)/(total density of all species)

-Abundance (A):

A = (total number of individuals per species)/(total number of squares containinh the species)

-Relative Abundance (Ar):

Ar = (100 * species abundance)/(total abundance of all species)

-Frquency (F):

F = (number of squares containinh the species)/(number of squares obtained (total área))

-Relative Frquency (Fr):

Fr = (100 * frequency species)/(total frequency all species)

-Importance Value Index (IVI):

IVI = Fr + Dr + Ar

-Relative IVI (IVIr):

IVIr = (100 *species importance value)/(total importance value of all species)

The analysis of the diversity of the area through richness and diversity was also carried out using the Shannon Index (*H'*, nats./ind.), equity of Pielou (*J'*) and dominance by the Simpson Index (D) using the PAST 4.0 statistical program.

RESULTS AND DISCUSSION

The weed community was made up of 13 species, distributed in 9 families, with the Poaceae family out with 4 species, followed by Asteraceae with 2 species (Table 1). Other studies carried out with perennial crops have also shown a greater diversity of weed species (Almeida et al., 2018; Canuto et al., 2020).

The diversity of the area was analyzed using ecological and phytosociological indices, which are important indices for analyzing the impact of the management used in productive agroecosystems. The area showed a richness of 13 species, a diversity with a Shannon-Wierner index of *H'*=1.13 nat.ind^{-1}, Pielou's evenness of *J'*=0.40 and Simpson's dominance index of D=0.43. These data suggest a low diversity of species, which can be explained, among various factors, by the integrated weed management used in grape growing, which includes the use of control practices such as manual mowing and the use of broad-spectrum herbicides (Silva et al., 2023; Barroso and Murata, 2021).

Table 1. Identification and popular name of weeds found in grape (*Vitis vinifera* L.) in the municipality of Curaçá - Bahia.

Class	Family	Scientific Name	Popular Name
Eudicotiledônea	Aizoaceae	*Trianthema portulacastrum* L.	Bredo
Eudicotiledônea	Asteraceae	*Ageratum conyzoides* L.	Catinga-de-bode
		Bidens subalternans DC.	Picão-preto
Monocotiledônea	Commelinaceae	*Commelina* sp.	Trapoeiraba
Eudicotiledônea	Convolvulaceae	*Ipomoea alba* L.	Boa-noite
Eudicotiledônea	Euphorbiaceae	*Euphorbia hirta* L.	Erva-de-santa-luzia
Eudicotiledônea	Fabaceae	*Senna obtusifolia* (L.) H. S. Irwin & Barneby	Fedegoso
Eudicotiledônea	Malvaceae	*Malvastrum coromandelianum* Garcke	Vassourinha
Phyllanthaceae	Phyllanthaceae	*Phyllanthus niruri* L.	Quebra-pedra
Monocotiledônea	Poaceae	*Cenchrus echinatus* L.	Capim-carrapicho
		Dactyloctenium aegyptium (L.) Willd.	Capim-calandrini
		Digitaria ciliaris (Retz.) Koeler	Capim-milhã
		Eleusine indica (L.) Gaertn.	Capim pé-de-galinha

Table 2 shows the density, abundance and frequency of the weed species. Among the species identified, *Commelina* sp. had the highest density, abundance and frequency in the area, followed by *Eleusine indica* (L.) Gaertn. and *Dactyloctenium aegyptium* (L.) Willd.

The species with the highest relative importance was *Commelina* sp. with 45% (Figure 2). Similar results were found in the work of Lessa et al. (2021) when they also carried out a survey in vineyard areas in the Vale do São Francisco, finding the species *Commelina benghalensis*, *Euphorbia hirta* and *Cyperus aggregatus* with the highest levels of importance.

Table 2. Phytosociological parameters of weed species found in grape (*Vitis vinifera* L.) in the municipality of Curaçá - Bahia.

SPECIES	D[1]	DR[2] (%)	F[3]	FR[4] (%)	A[5]	AR[6] (%)
Commelina sp.	24.70	74.47	0.73	32.35	1.12	27.97
Eleusine indica (L.) Gaertn.	2.13	6.43	0.33	14.71	0.21	5.31
Dactyloctenium aegyptium (L.) Willd.	1.47	4.42	0.17	7.35	0.29	7.31
Trianthema portulacastrum L.	1.07	3.22	0.30	13.24	0.12	2.95
Digitaria ciliaris (Retz.) Koeler	0.73	2.21	0.17	7.35	0.15	3.65
Malvastrum coromandelianum Garcke	0.60	1.81	0.03	1.47	0.60	14.95
Euphorbia hirta L.	0.57	1.71	0.10	4.41	0.19	4.71
Phyllanthus niruri L.	0.57	1.71	0.23	10.29	0.08	2.02
Bidens subalternans DC.	0.50	1.51	0.03	1.47	0.50	12.46
Ageratum conyzoides L.	0.27	0.80	0.03	1.47	0.27	6.64
Cenchrus echinatus L.	0.20	0.60	0.03	1.47	0.20	4.98
Senna obtusifolia (L.) H. S. Irwin & Barneby	0.20	0.60	0.03	1.47	0.20	4.98
Ipomoea alba L.	0.17	0.50	0.07	2.94	0.08	2.08
TOTAL	**33.17**	**100**	**2.27**	**100**	**4.01**	**100.00**

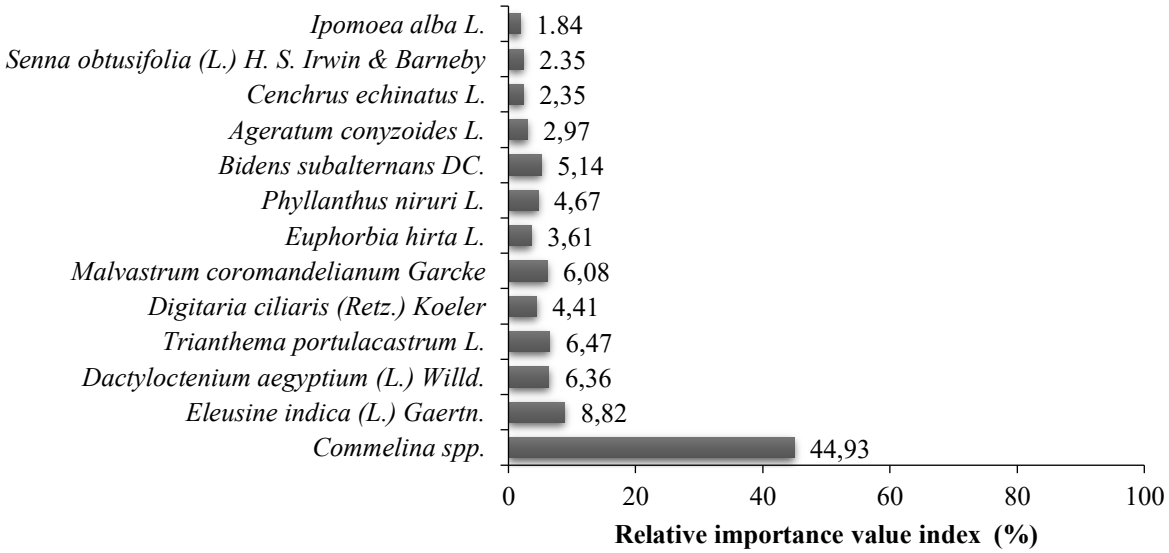
[1]Density (D), [2]Relative density (DR), [3]Frequency (F), 4Relative frequency (FR), 5Abundance (A), 6Relative Abundance (AR).

The *Commelina* genus, which belongs to the Commelinaceae family, is a common weed species in perennial and annual crops, reproducing by seeds in the root regions and vegetatively, which makes it difficult to manage in agricultural areas (Lorenzi, 2014, Cavalcante et al., 2018). In addition to the factors inherent to the species, the high infestation of *Commelina* sp. can be explained by the management practices used.

Commelina sp. is tolerant to the herbicide glyphosate, and the practice of weeding also favors its propagation since it propagates by seed and vegetatively, which means that each time the nodal region of the stem is cut, it gives rise to a new plant (Brito et al., 2017). Another very important characteristic is the production of seeds in the roots, which makes it highly persistent, making it difficult to manage (Lessa et al., 2021).

The species *Eleusine indica* (L.) Gaertn. and *Dactyloctenium aegyptium* (L.) Willd also present in high numbers in the cultivation area, are exotic grasses belonging to the Poaceae family, with high plasticity and resistance to drought. This characteristic helps in the large production of seeds of these species. These seeds are small in size, which favors their dissemination and the formation of seed banks in the soil (Brighenti, 2001, Mendonça et al., 2023). In addition to affecting the grape crop through competition, these weeds are host to pests and diseases such as mites of the genus *Tetranychus* sp. and viruses of the genus *Potyvirus* sp., as well as having allelopathic potential (Bélle et al., 2017).

Figura 2 – Relative Importance Value Index (IVIr) of weeds found in the area of grape (*Vitis vinifera* L.) in the municipality of Curaçá – Bahia.



According to various studies, in addition to the direct and indirect negative effects that weeds can have on an agricultural crop, there are species that are considered beneficial. They offer important ecological services, such as erosion control, addition of organic matter, carbon sequestration, regulation of hydrological processes and the microclimate, nutrient cycling, abundance of beneficial organisms such as natural enemies, pollinators, antagonistic

microorganisms, indicators of soil characteristics, as well as medicinal potential (Saradón and Flores, 2014)

Commelina sp. is a quality indicator species, present in fertile soils with good humidity and shaded areas such as the soils of the VSF grape plantations. These species, if well managed, protect soils from the high temperatures found in the Brazilian semi-arid region and can improve soil fertility, as they favor the development of microorganisms in the soil capable of recycling nutrients and making them available to the plant (Teles et al., 2013).

The other species found, despite their low densities and abundances, can benefit productive agroecosystems by being managed between the crop rows, providing benefits such as soil cover, lowering the temperature and favoring the microbiota; they can be attractive to natural enemies and pollinating insects, fixing nitrogen and making nutrients available through the decomposition of organic matter (Altieri and Nicholls, 2020).

FINAL CONSIDERATIONS

As a result, we can conclude that the *Commelina* sp species was the most commonly found in the area and is the most important in crop management, followed by the *Eleusine indica* (L.) Gaertn species, *Dactyloctenium aegyptium* (L.) Willd and *Trianthema portulacastrum* L, *Dactyloctenium aegyptium* (L.) Willd and *Trianthema portulacastrum* L. Based on the phytosociological survey, it is possible to predict and plan different strategic weed management and control measures in a sustainable way, reducing costs and improving environmental conditions, strengthening the ecological services that can be offered, such as improved soil fertility and the presence of natural enemies.

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