Scientific Research Publishing

Open Journal of Applied Sciences, 2025, 15(6), 1625-1638
https://www.scirp.org/journal/ojapps
ISSN Online: 2165-3925
ISSN Print: 2165-3917

Characterization of the Weed Flora in Rainfed Crops in the Northern Peanut Basin (Senegal)

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How to cite this paper: Ka, M., Diouf, N., Lo, P., Faye, M., Ka, S.L. and Noba, K. (2025) Characterization of the Weed Flora in Rainfed Crops in the Northern Peanut Basin (Senegal). *Open Journal of Applied Sciences*, **15**, 1625-1638.
https://doi.org/10.4236/ojapps.2025.156111

Received: May 22, 2025
Accepted: June 10, 2025
Published: June 13, 2025

Abstract

In Senegal, pearl millet (*Pennisetum glaucum* (L.) R. Br.), groundnut (*Arachis hypogaea* L.), and cowpea (*Vigna unguiculata* [L.] Walp.) are the main crops of the groundnut basin. These crops play a crucial role in food security programs and socio-economic development strategies. However, their productivity is increasingly affected by various biotic constraints (pests, diseases, and weed pressure) and abiotic factors (poor soil fertility, declining rainfall), leading to a continuous decrease in yields. To address these challenges, it is essential to develop effective solutions, particularly for weed management, to enhance agricultural production. Effective weed control requires a thorough understanding of weed flora, its dynamics, vegetation structure, and the harmfulness of different species. This study was conducted to improve knowledge of Senegal's weed flora to optimize agricultural production, particularly in the Niakhène area. Specifically, it aims to characterize the weed flora of rainfed crops in this region. To achieve this, field surveys were conducted on 309 plots between 2020 and 2021 in pearl millet, groundnut, cowpea, and fallow fields using the "field border walk" method. This approach allowed the identification of 112 species belonging to 78 genera and 34 families. The flora was predominantly composed of dicotyledons, accounting for 78.57% of the recorded species. The most represented families were Fabaceae (22.32%) and Poaceae (15.18%). In terms of biological types, therophytes were the most dominant (71.43%), followed by phanerophytes (21.43%), while other types (nanophanerophytes, chamaephytes, and parasitic species) collectively accounted for only 4.47%. From a biogeographical perspective, African species were the most prevalent (41.07%), followed by pantropical species (30.36%). The study also revealed that rare or accidental species were dominant, representing 64.3% of the weed flora in the Niakhène area. Floristic variability analysis in-

dicated no significant differences in species composition between the weed flora of pearl millet, groundnut, cowpea, and fallow fields, nor between different field types (home fields and bush fields).

Keywords

Characterization, Flora, Weeds, Rainfed Crops, Peanut Basin, Senegal

1. Introduction

In Senegal, agriculture plays a key role in the economy, contributing 14% of the GDP and employing approximately 50% of the workforce [1]. It mainly relies on family farms, cultivating millet, peanuts, sorghum, maize, and cowpea, which occupy 90% of agricultural lands [2].

Millet (Pennisetum glaucum) is the staple food for rural populations, while peanuts (Arachis hypogaea) are the main cash crop [3]. Cowpea (*Vigna unguiculata* (L.) Walp.) provides more than half of the consumed proteins and plays an essential role in the diet [4].

However, the agricultural sector faces many challenges, including low soil fertility, declining rainfall, and weed pressure, which accounts for over 25% of crop losses in tropical areas [5]. Weed management is therefore a major concern [3] [4]. A significant portion of producers' working time is devoted to weeding. Yet, below a certain threshold of harmfulness, some weeds can be beneficial to crops [3]. Studies have shown that they promote mycorrhization and plant development [6] [7], especially when the weed flora includes highly mycotrophic species [8].

In addition to their agronomic role, some weeds are used as condiments, herbal teas, or medicines [9]. It is therefore essential to know more about them for effective management. Several studies have been conducted on weed flora in the southern peanut basin [2] [4] [10]-[12], as well as on their biology and harmfulness [3] [4] [11]. However, the weed flora of the northern peanut basin has been less studied.

This work aims to improve the knowledge of this flora to optimize agricultural production in Senegal, particularly in Niakhène. The specific goal is to characterize the weed flora in rainfed crops in this area.

2. Methodology

2.1. Study Area

The study was conducted in the commune of Niakhène, located in the Northern Peanut Basin of Senegal (**Figure 1**). This region, characterized by a Sahelian climate and primarily "Dior" type soils, is suitable for agriculture but faces environmental pressures, particularly drought and erosion. Annual rainfall ranges between 400 and 600 mm, and the dominant vegetation includes species such as *Cenchrus biflorus* and *Faidherbia albida* [13].

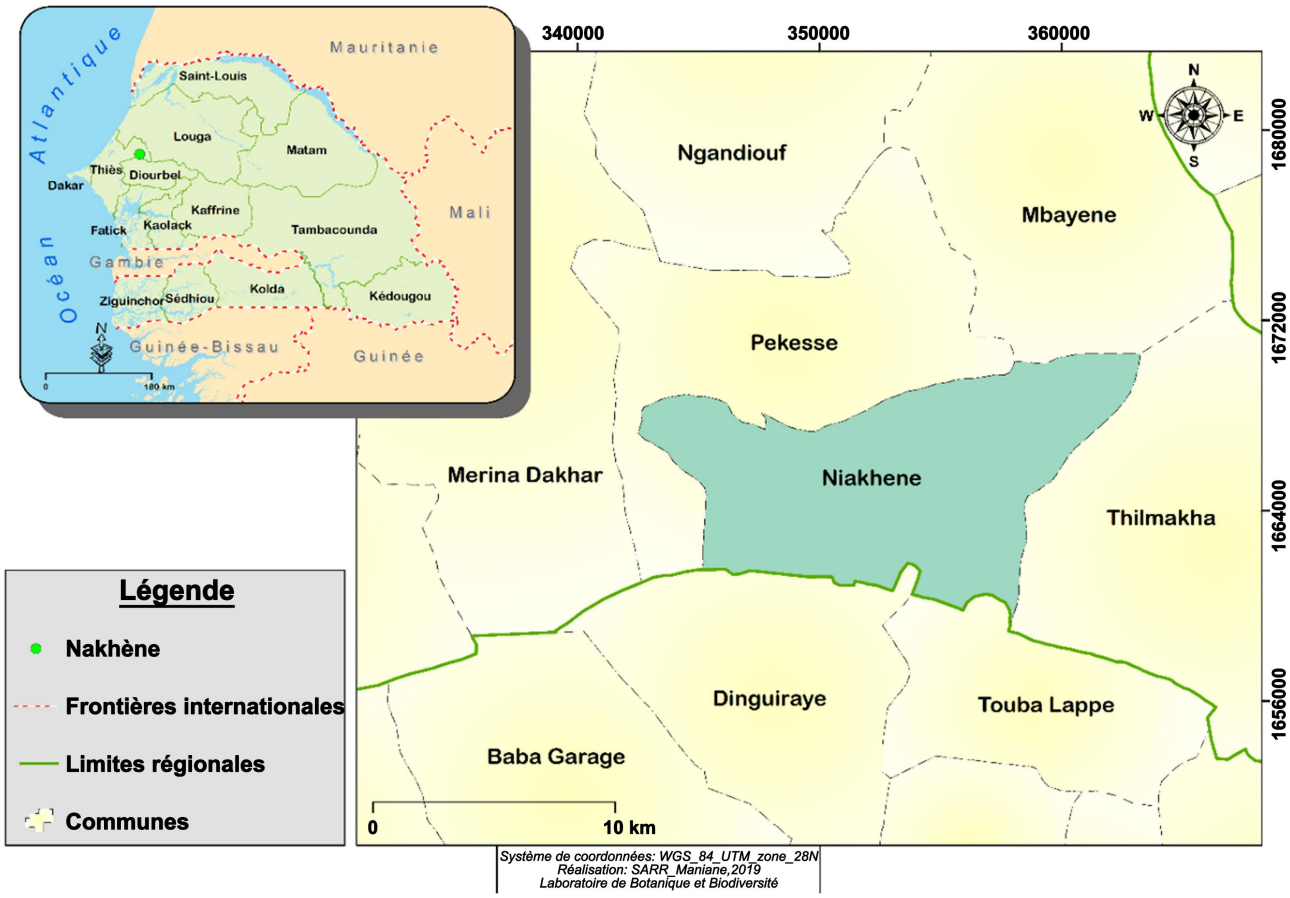

Figure 1. Presentation of the study area.

2.2. Data Collection

2.2.1. Inventory of Weed Flora and Vegetation

This study was conducted between 2020 and 2021 on plots of millet, peanuts, cowpeas, and fallows. A total of 309 surveys were carried out using the "field walk" method, an itinerant survey technique that involves cataloging all weed species encountered while traversing the various areas of the field. This process continues until a new species is only encountered after a significant additional distance has been covered. This approach allows for the identification of rare but agronomically important species, particularly those with a high capacity for dissemination or that are indicative of specific ecological conditions [14].

For each survey, species were identified, collected, and classified according to an abundance-dominance scale based on the Braun-Blanquet classification [15].

- **5**: Species covering more than three-quarters of the surveyed area.
- **4**: Species covering between half and three-quarters of the area.
- **3**: Species covering between a quarter and half of the area.
- **2**: Abundant species or those covering at least 5% of the area.
- **1**: Infrequent species with coverage less than 5%.
- **+**: Very few individuals have insignificant coverage.
- **R**: Rare or isolated species (~0).

2.2.2. Species Identification

Species identification was carried out in the field or laboratory using several floras of Senegal, notably [16], the Illustrated Flora of Senegal [17]-[19], as well as the work from the Laboratory of Botany and Biodiversity (LBB) at Cheikh Anta Diop University in Dakar (UCAD). The adopted nomenclature follows that of [20].

2.3. Analysis of Weed Flora Structure

The analysis of the weed flora is based on three criteria: taxonomic, biological, and chorological.

2.3.1. Taxonomic Spectrum

Each identified species was associated with its botanical family, allowing for the determination of the total number of species, genera, and families present in the studied weed flora.

2.3.2. Biological Spectrum

To establish the biological spectrum, species were classified according to their life form using Raunkiaer's classification [18], adapted for tropical regions where the unfavorable season corresponds to the dry season [21] [22]. This classification distinguishes six (6) biological types: nanophanerophytes (P), chamaephytes (C), hemicryptophytes (H), geophytes (G), therophytes (T), and parasitic plants (Par).

2.3.3. Chorological Spectrum

Species were classified based on their geographical distribution, relying primarily on the Illustrated Flora of Senegal [17] [18]. The categories of biogeographical distribution used are: African Species (Af), Afro-American Species (Am), Afro-American and Asian Species (Am As), Afro-Asian Species (As), Afro-Asian and Australian Species (Asu), Afro-Malagasy Species (M), Afro-Malagasy and Asian Species (Mas), Afro-Asian-American-Australian or European Species (Masue), and Pantropical Species (Pt) [23].

2.4. Influence of Crop Type on Weed Flora

Degree of Similarity

The degree of similarity between floristic surveys was assessed using correspondence factor analysis.

3. Main Results

3.1. The Taxonomic Spectrum

The table below (**Table 1**) represents the weed flora of rain-fed crops in the northern area of the peanut basin. Each species is characterized by its presence in the house fields and bush fields of crops (millet, peanut, cowpea) and fallow land, as well as by its family, number of genera, biological type, and geographical distribution. The flora consists of 112 species distributed across 78 genera and 34 families.

Table 1. Weed flora of rain crops.

Familles	Subfamilies	N.G	N.E	Species	T.B	R.G	CB	CC	CA	CM	CN	JA
Acanthaceae (D)		1	1	*Monechma ciliatum* (Jacq.) Milne-Reddh	T	Af	+	+	+	+	+	+
Aizoaceae (D)		2	2	*Sesuvium portulacastrum* L.	T	Pt	+	+	+	+	+	+
				Triantema portulacastrum	T	Pt	+	+	+	+	+	+
Amaranthaceae (D)		2	2	*Achyranthes aspera* L.	T	Cosm	+	+	+	+	+	+
				Amaranthus viridis L.	T	Pt	+	+	+	+	+	+
Amaryllidaceae (M)		1	1	*Pancratium trianthum* Herb.	G	Af	+	+	+	+	+	+
Anacardiaceae (D)		1	1	*Sclerocarya birrea* A. Rich.	P	Af	+	−	+	−	−	−
Annonaceae (D)		1	2	*Annona senegalensis*	P	Af	+	+	+	+	−	−
				Annona squamosa	P	Am	+	+	−	+	+	+
Apocynaceae (D)	Asclepioideae	2	2	*Calotropis procera*	P	Pt	+	+	+	−	−	−
				Leptadenia lanceolata (Poir.) Goyder.	P	Af	+	+	+	+	+	+
Araceae (M)		1	1	*Stylochaeton lancifolius* Kotshy & Peyr.	G	Af	+	+	+	+	+	+
Asteraceae (D)		1	1	*Acanthospermum hispidum* DC.	T	Pt	+	+	+	+	+	+
Boraginaceae (D)		1	1	*Heliotropium bacciferum* Forssk	T	Pt	+	−	+	−	−	−
Capparaceae (D)		2	2	*Cleome viscosa* L.	T	Pt	+	+	−	+	+	+
				Maerua crassifolia Forsk.	P	Af	+	−	−	−	−	+
Chrysobalanaceae (D)		1	1	*Neocarya macrophylla* (Sabine) Prance	P	Af	+	+	+	+	+	+
Combretaceae (D)		2	3	*Combretum acculeata*	P	Af	+	+	+	+	+	+
				Combretum glutinosum	P	Af	+	−	+	+	+	+
				Guiera senegalensis	P	Af	+	+	+	+	+	+
Commelinaceae (M)		1	2	*Commelina benghalensis* L.	T	As	+	+	+	+	+	+
				Commelina forsskaolii Vahl.	T	Mas	+	+	+	+	+	+
Convolvulaceae (D)		3	8	*Ipomea eriocarpa* R. Br.	T	Mas	+	+	+	+	+	+
				Ipomoea coptica (L.) Roth	T	Asu	+	+	+	+	+	+
				Ipomoea pestigridis L.	T	Asu	+	+	+	+	+	+
				Ipomoea vagans (Baker.)	T	Af	+	+	+	+	+	+
				Jacquemontia tamnifolia (L.) Griseb.	T	Am	+	+	+	+	+	+
				Merremia aegyptiaca (L.) Urb.	T	Af	+	+	+	+	+	+
				Merremia pinnata (Hoch.)	T	Af	+	+	+	+	+	+
				Merremia tridentata (L.) Hallier f.	T	Af	+	+	+	+	+	+
Cucurbitaceae (D)		2	2	*Cucumis melo* L. var. agrestis Naudin	T	As	+	+	+	+	+	+
				Momardica charantia L.	T	As	+	+	−	+	+	+
Cyperaceae (M)		3	3	*Bulbostylis hispidula* (Vahl)R. W. Haine	T	Pt	+	+	+	+	+	+
				Cyperus rotundus L.	G	Cosm	+	+	+	+	+	+
				Kyllinga squamulata Thonn. ex Vahl	T	AmAs	+	+	+	+	+	+
Euphorbiaceae (D)		2	3	*Chrozophora senegalensis* (Lam.) A.Jus	T	Af	+	+	−	+	+	+
				Euphorbia balsamifera Aiton	P	Af	+	+	+	+	+	+
				Euphorbia hirta L.	T	Pt	−	+	−	+	−	−

Continued

				Bauhinia rufescens	P	Af	−	+	−	−	−	+
				Cassia sieberiana	P	Af	−	+	−	+	−	−
	Ceasalpinoidae	5	6	*Chamaecrista absus* (L.)H. S.Irwin & B.	T	Asu	+	−	+	−	−	−
				Chamaecrista mimosoides (L.) Greene	T	Af	−	+	−	−	+	+
				Piliostigma reticulatum (DC.) Hotchst.	P	Af	+	+	+	+	+	+
				Tamarindus indica L.	P	Pt	+	+	+	+	−	−
				Alysicarpus ovalifolius Thonn.	T	Pt	+	+	+	+	+	+
				Crotalaria perrottetii DC.	T	Af	+	+	−	−	+	+
				Crotalaria podocarpa L.	T	Af	+	+	+	+	+	+
				Crotalaria retusa	T	Pt	+	−	+	+	+	+
				Crotalaria sphaerocarpa DC.	T	Af	+	−	+	+	+	+
				Cyamopsis senegalensis Guill. & Perr.	T	Af	+	+	+	+	+	+
Fabaceae (D)				*Faidherbia albida* (*Delile*) *A. Chev.*	P	Af	+	−	+	+	+	+
	Faboidae	9	16	*Indigofera astragalina* DC.	T	Af	+	+	+	+	+	+
				Indigofera berhautiana J. B. Gillet.	T	Af	+	+	+	+	+	+
				Indigofera hirsuta Var. ex Baker	T	Amu	+	−	+	−	+	+
				Indigofera tinctoria L.	C	As	+	+	+	−	+	+
				Senna obtusifolia (L.) H. S. Irwin & Bar.	T	Pt	+	+	+	+	+	+
				Senna occidentalis L.	T	Pt	+	+	+	+	−	−
				Sesbania pachycarpa DC.	T	Asu	+	+	+	+	+	+
				Tephrosia purpurea DC.	T	Af	+	+	+	+	+	+
				Zornia glochidiata Reichb	T	Pt	+	+	+	+	+	+
				Acacia nilotica L.	P	Af	−	+	+	+	+	+
	Mimosoidae	1	3	*Acacia radiana*	P	Af	−	+	−	−	+	+
				Acacia senegal L. Willd	P	Af	−	+	+	−	+	+
				Limeum diffusum (Gay.) Schinz	T	Af	+	+	+	+	−	−
Limeaceae (D)		1	3	*Limeum pterocarpum* (Gay.) Heimerl	T	Af	+	−	+	+	+	+
				Limeum viscosum (Gay.) Fenzl	T	Af	−	+	+	+	+	+
	Bambacoidae	1	1	*Adansonia digitata* L.	P	Mas	+	+	+	+	+	+
				Hibiscus cannabinus L.	T	Af	+	+	+	+	+	+
	Malvoideae	2	4	*Hibiscus physaloides* Guill. & Perr.	T	Af	−	+	−	−	+	+
Malvaceae (D)				*Hibiscus sabdariffa* L.	T	Af	+	+	+	+	+	+
				Sida acuta (Burm.)	T	Pt	−	+	−	−	+	+
	Sterculoideae	1	1	*Waltheria indica* L.	C	Pt	+	+	−	−	+	+
	Tiloideae	2	2	*Corchorus tridens* L.	T	Asu	+	+	+	+	+	+
				Triumfetta pentandra A. Rich	T	Pt	+	+	+	+	+	+
Meliaceae (D)		1	1	*Azadirachta indica* A. Juss.	P	Pt	−	+	+	+	+	+
Molluginaceae (D)		1	1	*Mollugo cerviana*	T	Am	−	+	−	+	−	−
Myrtaceae (D)		1	1	*Eucaluptus alba*	P	Pt	−	+	+	−	−	−

Continued

Nyctaginaceae (D)	1	1	*Boerhavia erecta* L.	T	Pt	+	+	+	+	+	+
Orobanchaceae (D)	1	2	*Striga gesnerioides* Willd.	Par	Pt	−	+	+	−	−	−
			Striga hermonthica (Del.) Benth.	Par	Mas	+	+	−	+	+	+
Pedaliaceae (D)	2	2	*Cerathotheca sesamoides* Endl.	T	Af	+	+	+	+	+	+
			Sesamum alatum L.	T	Af	+	+	+	+	+	+
Phyllanthaceae (D)	1	2	*Phyllanthus amarus* Sch. et Th.	T	Pt	−	+	−	+	−	−
			Phyllanthus pentandrus (Sch. et Th.)	T	Af	+	+	+	+	+	+
Poaceae (M)	10	17	*Andrapogon gayanus* Kunth.	H	Af	−	+	−	+	−	−
			Aristida adscensionis L.	T	Pt	+	+	+	+	+	+
			Aristida mutabulus Trin. & Rupr.	T	Pt	+	+	+	+	+	+
			Brachiaria lata (Schum)	T	Pt	+	+	+	+	+	+
			Brachiaria xantholeuca (Hack.ex Sch)	T	Pt	+	+	+	+	+	+
			Cenchrus biflorus (Roxb.)	T	As	+	+	+	+	+	+
			Cenchrus ciliaris L.	T	Cosm	+	+	+	+	+	+
			Cenchrus pedicellatus Trin.	T	Asu	+	+	+	−	+	+
			Cenchrus violaceus (Lam.) Marrone	T	Asu	+	+	+	+	+	+
			Dactylactenum aegyptium (L.) (P.) (B.)	T	Pt	+	+	+	+	+	+
			Digitaria horizontalis Willd. (F.P.) (B.)	T	Pt	+	+	+	+	+	+
			Eleusine indica L. Gaertn.	T	Pt	+	+	+	−	+	+
			Enteropogon prieurii Kunth.	T	Af	+	+	+	+	+	+
			Eragrotis ciliaris Var.ciliaris (L.) R. Br.	T	Pt	−	+	+	+	+	+
			Eragrotis tennela (L.) P. B.Ex R. et S.	T	Af	+	+	−	−	+	+
			Eragrotis tremula (Lam.)	T	As	+	+	+	+	+	+
			Setaria viridis L. P. Beauv.	T	Asu	+	−	+	+	−	−
Portulacaceae (D)	1	1	*Portulaca oleracea*	T	Cosm	+	−	+	+	+	+
Rhamnaceae (D)	1	1	*Ziziphus mauritiana* Lam.	P	As	+	−	+	+	−	−
Rubiaceae (D)	4	6	*Diodella sarmentosa* Sw	T	Pt	+	+	+	+	+	+
			Mitracarpus hirtus (L.) DC.	T	AmAs	+	+	+	+	+	+
			Oldenlandia corymbosa L.	T	Pt	+	+	+	+	+	+
			Oldenlandia herbacea L. Roxb. A.	T	Pt	+	+	+	−	+	+
			Spermacoce ruelliae DC.	T	Af	+	+	+	+	−	−
			Spermacoce stachydea (DC.) Hut	T	Af	+	+	+	+	+	+
Solanaceae (D)	1	1	*Datura metel* L.	T	Cosm	+	+	+	+	+	+
Zygophyllaceae (D)	2	2	*Balanites aegyptiaca* (L.) Delile	P	As	+	+	+	+	+	+
			Tribulus terrestris L.	T	Cosm	+	+	+	+	+	+
34	**78**	**112**				**95**	**99**	**93**	**91**	**92**	**94**

D = Dicots; M = Monocots; NG = Number of genera; NE = Number of species; Pt = Pteridophytes; TB = Biological type; Therophytes (T); Geophytes (G); Chamaephytes (C); Phanerophytes (P); R.G = geographical distribution; African (Af); Pantropical (Pt); Afro-Malagasy (Ma); Afro-Asiatic (As); Cosmopolitan (Cosm); Afro-Asiatic and American (As Am); Afro-American (Am); Afro-Malagasy, Asiatic, and American (Mas); Afro-American and Australian (Amu). CC = House Fields; CB = Bush Fields; CM = Millet Crops; CA = Peanut Crops; CN = Cowpea Crops; Ja = Fallow.

The table provides information on the taxonomic spectrum of the weed flora of rain-fed crops in the northern peanut basin (Niakhène).

This flora is composed exclusively of angiosperms (Table 2). Within this group, dicots are dominant, comprising 85.29% of the families, 79.48% of the genera, and 78.57% of the species recorded, compared to 14.71% of the families, 21.05% of the genera, and 20.51% of the species for monocots.

Table 2. Structure of the weed flora of rain-fed crops in the area.

	Families		Genera		Species	
	Numbers	%	Numbers	%	Numbers	%
Dicotyledons	29	85.29	62	79.48	88	78.57
Monocotyledons	5	14.71	16	20.51	24	21.43
Total	**34**	**100.00**	**78**	**100.00**	**112**	**100.00**

Importance of the Families in the Flora of Rain-fed Crops in the Northern Peanut Basin.

The analysis of families present in the weed flora of rain-fed crops in the north of the peanut basin reveals a strong dominance of five main families: Fabaceae (22.32%), Poaceae (15.18%), Convolvulaceae, Malvaceae (7.14%), and Rubiaceae (5.36%). Together, these families account for 57.14% of the recorded species. Additionally, four other families are relatively well-represented: Cyperaceae, Combretaceae, Euphorbiaceae, and Limeaceae (2.68%). The remaining twenty-six families, although present, collectively account for only 42.86% of the species and generally include one or two species each (Table 3).

Table 3. Species richness of weed families recorded in the Northern Peanut Basin (Niakhène).

Families	Genera		Species	
	Numbers	Contribution	Numbers	Contribution
Fabaceae (D)	15	19.23	25	22.32
Poaceae (M)	10	12.82	17	15.18
Malvaceae (D)	6	7.69	8	7.14
Rubiaceae (D)	4	5.13	6	5.36
Convolvulaceae (D)	3	3.85	8	7.14
Cyperaceae (M)	3	3.85	3	2.68
Aizoaceae (D)	2	2.56	2	1.79
Apocynaceae (D)	2	2.56	2	1.79
Combretaceae (D)	2	2.56	3	2.68
Cucurbitaceae (D)	2	2.56	2	1.79
Euphorbiaceae (D)	2	2.56	3	2.68
Pedaliaceae (D)	2	2.56	2	1.79

Continued

Zygophyllaceae (D)	2	2.56	2	1.79
Acanthaceae (D)	1	1.28	1	0.89
Amaranthaceae (D)	1	1.28	2	1.79
Amaryllidaceae (M)	1	1.28	1	0.89
Anacardiaceae (D)	1	1.28	1	0.89
Annonaceae (D)	1	1.28	2	1.79
Araceae (M)	1	1.28	1	0.89
Asteraceae (D)	1	1.28	1	0.89
Boraginaceae (D)	1	1.28	1	0.89
Capparaceae (D)	1	1.28	2	1.79
Chrysobalanaceae (D)	1	1.28	1	0.89
Commelinaceae (M)	1	1.28	2	1.79
Limeaceae (D)	1	1.28	3	2.68
Meliaceae (D)	1	1.28	1	0.89
Molluginaceae (D)	1	1.28	1	0.89
Myrtaceae (D)	1	1.28	1	0.89
Nyctaginaceae (D)	1	1.28	1	0.89
Orobanchaceae (D)	1	1.28	2	1.79
Phyllanthaceae (D)	1	1.28	2	1.79
Portulacaceae (D)	1	1.28	1	0.89
Rhamnaceae (D)	1	1.28	1	0.89
Solanaceae (D)	1	1.28	1	0.89
Total	**78**	**100.00**	**112**	**100.00**

3.2. The Biological Spectrum of Species

The remaining twenty-six families, although present, collectively account for only 42.86% of the species and generally include one or two species each (Table 4).

Table 4. Distribution of biological types of weeds in Rain-fed Crops in the Northern Peanut Basin.

Biological types	Numbers	%
Therophytes	80	71.43
Phanerophytes	24	21.43
Geophytes	3	2.68
Parasites	2	1.79
Chamaephytes	2	1.79
Hemicryptophytes	1	0.89
Total	**112**	**100.00**

3.3. The Chorological Spectrum

The recorded species are predominantly African (41.07%) and Pantropical (30.36%). The other groups are less represented: Afro-Asiatic and Australian (7.14%), Afro-Asiatic (7.14%), Cosmopolitan (5.36%), Afro-American and Asian (3.57%), Afro-Malagasy and Asian (3.57%) (Table 5).

Table 5. Distribution of species according to geographical distribution.

Species	Numbers	Proportion %
African Species (Af)	46	41.07
Pantropical Species (Pt)	34	30.36
Afro-Asiatic and Australian Species (Asu)	8	7.14
Afro-Asiatic Species (As)	8	7.14
Cosmopolitan Species (Cosm)	6	5.36
Afro-Malagasy and Asian Species (Mas)	4	3.57
Afro-American Species (Am)	3	2.68
Afro-American and Asian Species (Am As)	2	1.79
Afro-American and Australian Species (Amu)	1	0.89
Total	**112**	**100.00**

3.4. Floristic Variability

The analysis of flora based on agricultural crops and field types reveals little influence of the crops and their location on the diversity and abundance of species (Figure 2). Cowpea and peanut crops host 92 species, compared to 82 species for millet. House fields show greater floristic diversity (100 species) compared to bush fields (92 species).

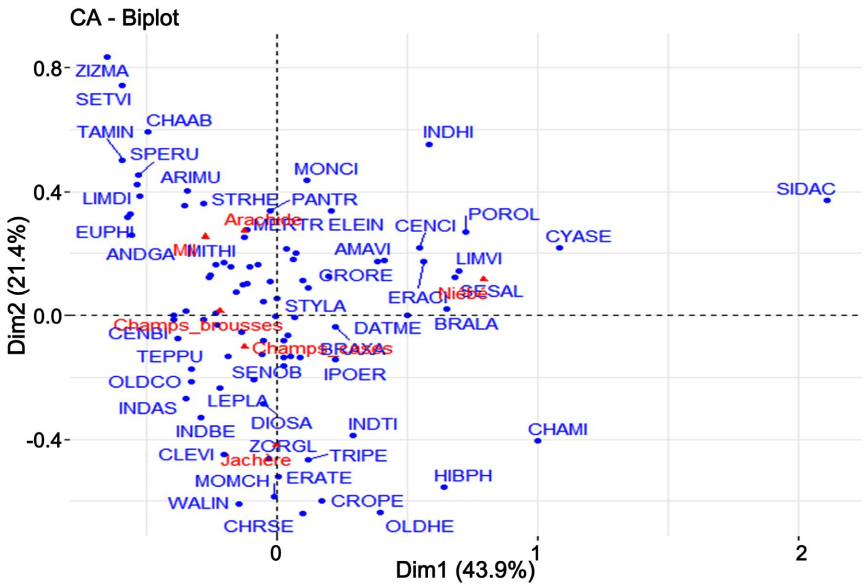

Figure 2. Influence of species based on crop types.

3.5. Discussions

The characterization of the weed flora of rain-fed crops in the northern area of the peanut basin has identified 112 weed species, belonging to 72 genera and 34 families. The number of species in this flora is smaller than that of other weed floras studied in certain areas of the country, both in terms of species and genera. Among these weed floras, we can note that of the food crops in the southern peanut basin with 125 species, 81 genera, and 31 families [2], the flora of onion crops in the peri-urban area of Dakar with 131 species distributed across 88 genera and 34 families [10], the weed flora of maize crops in the southern peanut basin with 128 species, 65 genera, and 25 families [24], the weed flora of irrigated rice crops in the Senegal River Valley with 179 species distributed among 117 genera and 46 families [4], as well as the weed flora of sorghum and cotton crops in Eastern Senegal and Upper Casamance with 232 weed species belonging to 138 genera and 43 families, and 204 species distributed among 118 genera and 35 families, respectively [25] [26].

The relatively low number of weed species in the rain-fed crops' flora in the northern peanut basin compared to other studied crop floras could be explained by differing agroecological conditions prevalent in the various study environments. Indeed, the Casamance region, the peri-urban zone (Niayes), and the southern peanut basin have relatively high rainfall, exceeding 1000 mm/year [27], contrary to the northern peanut basin, where the average annual rainfall is relatively low (700 mm/year). This disparity can also be explained by the nature of the soil, which is sandy and tends not to retain much water, a fundamental element for flora richness [3] [4].

Within this flora, it emerges that fallow land hosts the largest collection of weeds with 94 species, followed by cowpea and peanut crops, each with 92 species, and finally, millet crops with 82 species. Regarding proximity to dwellings, the flora of house fields is more diverse with 100 species than that of bush fields, which only has 92 species of the overall flora.

In this flora, all encountered species are Angiosperms, divided into 29 families, 60 genera, and 88 species of dicotyledons, as well as 5 families, 16 genera, and 24 species of monocotyledons. This strong dominance of dicotyledons is observed in almost all flora studies across the country, with varying proportions depending on the zones and crops. For this study, the percentage of monocotyledon species relative to dicotyledon species (M/D*100) is 27.27%, a value significantly lower than those obtained in other studies conducted in the country: 43.67% in the food crops of the southern peanut basin [2], 55.88% in the mixed millet-cowpea crops of the southern peanut basin, 45.77% and 38.12% respectively in cotton and sorghum crops in Eastern Senegal and Upper Casamance [25] [26].

Furthermore, even though house fields show slightly higher diversity than bush fields, this difference remains minimal. This finding suggests that the proximity to dwellings does not have a significant effect on floristic diversity, in contrast to what is observed in some areas where house fields benefit from greater nutrient

inputs related to human activities [28].

The low floristic variability observed in this study confirms the decisive influence of abiotic factors, such as soil and climate, on the distribution of weeds rather than specific agricultural practices associated with different crops.

4. Conclusion and Suggestions

This study has provided a better understanding of the composition and dynamics of weed flora in the rain-fed crops of the peanut basin, particularly in the Niakhène area. The inventory of weeds revealed significant floristic diversity, with 112 species recorded, largely dominated by dicotyledons and therophytes. The predominance of African and pantropical species highlights the adaptation of this flora to local agroecological conditions.

The results show that the specific composition of weeds is relatively homogeneous across the different studied crops (millet, peanut, cowpea) and field types (house fields and bush fields). Furthermore, the high proportion of rare or accidental species reflects a constantly evolving plant dynamic under the influence of agricultural practices and environmental conditions.

Ultimately, this study highlights the importance of a reasoned management of weeds to limit their impact on agricultural productivity. A better understanding of their diversity, biology, and distribution will allow for the development of integrated control strategies adapted to local specificities. Thus, these results provide a valuable scientific basis for optimizing the production of rain-fed crops and strengthening food security in the Senegalese peanut basin.

Acknowledgements

The authors of this work thank the Cheikh Anta Diop University of Dakar in through the botany-biodiversity laboratory for facilitating this work. They also thank all the producers of the northern area of the peanut basin, especially those of Niakhène, who helped realize this study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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