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Research Article

Weed Diversity in *Manihot Esculenta Crantz., Zea Mays* l. and *Cucumis Sativus* l. Farms within Four Communities in OBIO/AKPOR Local Government Area

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Abstract

Weed diversity around *Manihot esculenta, Zea mays* and *Cucumis sativus* in four villages (Alakahia, Choba, Ozuoba and Rumuosi) within Obio/Akpor L.G.A. was studied to determine the species of weeds common to them. Parameters such as frequency, density, relative abundance and species evenness were used to determine the species diversity as well as the important value index. Analysis of variance was calculated for all. Result showed that *Ageratum conyzoides* L. had the highest frequency (87.5%) and importance value index (98.4) among all weeds found around *M. esculenta* while *Rottboellia conchinensis* and *M. alternifolius* had the highest density (5.69 kg/m^3) and relative abundance (8.10) respectively. In *Zea mays* farm, *Cyperus esculentus* L. was the most frequently seen (81.2%) and the most densely populated (6.06 kg/m^3) while *M. invisa* recorded the highest relative abundance (12.24). Four weed species had the same highest frequency of 75% in *C. sativus* farm among which *S. monostachyus* had the highest density of 7.19 kg/m^3 recorded in this study. The highest importance value index of 96.9 was recorded in *C. esculentus* at the *Zea mays* farm. Out of the 26 species present in all the locations, *A conyzoides* and *S monostachys* were present in all the sites The outcome of this study will enable agronomists to know the kind of weeds to expect around these crops when cultivating in the Obio/Akpor L.G.A. This will form the basis in the control and management of weeds including the measures and practices to adopt.

Keywords: Arable Weed; Crops; Diversity; Weed Control

Introduction

The practice of agriculture involves disturbance of soil which include tilling and ploughing etc. This practice in turn creates suitable habitats for some well-adapted native plants which constitute a nuisance and menace by competing with crops for light, soil moisture and nutrients, reducing yield and causing damages to drains, ponds, rivers, ocean, landscape architecture, golf course, road surfaces, foundations and in horticultural activities through their roots [1-3]. These plants with the negative influences are called weeds. Several authors have defined weeds in different ways. According [4], a weed as a plant growing out of place, where it is not desirable and without any economic value. Arable weeds are all such plants found in cultivated fields. Normally, when overgrown or unkempt, they host pests, rodents, reptiles and disease pathogens which could be harmful to humans and plant health as well. Weeds are mostly transferred by humans via contact with the crops and movement to another location. Several weed species have been classified by the Oregon State Weed Board under ORS 569615 as noxious weed because they cause the greatest public menace [5]. These weeds are often introduced accidentally or purposefully into a region where there is no or few natural controls to limit or inhibit

their population and spread [6] and they keep multiplying in addition to other native species.

Weeds exhibit different characteristics [7]. Confirmed that some weeds are crop and site specific while others grow over a wide range of habitats without any adverse effects. Weeds do not only constitute nuisance to the ecosystem but also have some desirable properties. Weeds perform and support ecosystem services for crop production which include pollination and control of soil erosion and also serve as auxiliaries in the vicinity of crops.

Weeds are a major threat to world agriculture as they detrimentally reduce crop yield and crop quality but at the same time they are major interacting components of the agroecosystem. Weed species and diversity vary significantly among several communities fueled by the fundamental role of tillage intensity and nutrition supply. The study of the relationship of weed species with their associated environment is what gives rise to the knowledge of their effects in ecosystems. This work involve diversity of weeds in relation to crops falls under phytosociology [8]. Explained that phytosociology allows for estimating the density, frequency and dominance of each plant species in the weed community and it also helps to determine the importance of certain weeds in agriculture. Knowledge of weeds as reported by [9] may help in establishing crop management strategy necessary to favour the best use of natural resources. Different weeds have been associated for different plants and areas either as crops such as staple crops like cassava, maize, sorghum etc. or plants.

Cassava is one of the major staple food crops of the people in sub-Saharan Africa especially in Nigeria [10]. It provides employment opportunities, regular income and food security for families and it also serves as a very important source of industrial raw materials for production of starch, alcohol, pharmaceuticals, gums, confectionaries and feed for livestock [7,11,12]. Cucumber is a fruit well loved by all and also a cash crop. Maize is a universal cash crop that cuts across human resources and providing alcohol, flour, oil and feed for livestock.

There have been a number of studies on weeds and their relationship with crop plants but much has not been done on the specific weeds on these crop plants [13]. Postulated that knowing the level of infestation and the composition of the weed community provides information to determine efficient weed management. The aim of this study was to determine the diversity of weed species associated with cassava, maize and cucumber farms in four different locations in Obio/Akpor Local Government Area of Rivers State. The research would provide a floristic database of weed species in association with farms where the targeted crops are grown in the area. The findings from this study may be of importance to cassava, maize and cucumber farmers in providing control measures of the weed species that will be identified.

Materials and Method

Study Area

The survey was conducted in four different locations in Obio/Akpor L.G.A in Rivers State. These locations and their geographical coordinates are as presented in Table 1. The study locations were Choba, Ozuoba, Rumuekini and Alakahia (Figure 1). Cassava, cucumber and maize farms were studied.

Sampling technique

Sampling was carried out using quadrat method [3]. Quadrats measuring 0.04m × 0.04m was used. Twelve quadrat throws were established in each location: four each for cassava, maize and cucumber. The distances between throws were 100m apart. All species found within the quadrat were collected, identified and counted according to species and all identified species recorded

Figure 1: Map of Obio/Akpor local Government Area showing the four study locations.

Location	Plot	Longitude (N)	Latitude (E)
CHOBA	1	4°54'42"	6°54'50"
	2	4°53'20"	6°56'57"
	3	4°53'21"	6°56'59"
	4	4°54'05"	6°54'45"
RUMUEKINI	1	4°54'15"	6°56'23"
	2	4°53'59"	6°54'11"
	3	4°53'14"	6°54'00"
	4	4°52'40"	6°57'05"
ALAKAHIA	1	4°54'14"	6°56'16"
	2	4°53'15"	6°55'30"
	3	4°52'57"	6°55'31"
	4	4°52'54"	6°55'28"
OZUOBA	1	4°53'51"	6°54'20"
	2	4°51'57"	6°56'04"
	3	4°51'56"	6°56'03"
	4	4°54'16"	6°56'15"

Table 1: Study locations and their coordinates.

and statistically analyzed. Data collected was analyzed using one way Analysis of Variance. The research was carried out randomly by visually assessing the plant [14]. The survey was done using frequency, density, relative abundance and the important value index to arrive at the results obtained. These parameters were calculated thus.

Frequency

The weeds in all quadrats were identified from each study area, counted and recorded. Frequency was calculated using the formula

$$\frac{\text{Total number of sample plot in which the species occur}}{\text{Total number of sample plot studied}}$$

Density

This is the numerical strength of the species in the area. It was calculated using the formula

$$\frac{\text{Total number of individual of a species in all the sample plots}}{\text{Total number of sample plots studied}}$$

Relative Abundance

Relative abundance is the number of species per sampling unit of occurrence. It refers to the density of population in these sampling units in which a given species occur. It was calculated using the formula: -

$$\frac{\text{Total number of individuals of the species in all sample units}}{\text{Total number of sampling units in which the species occurred}}$$

Data analysis

Data obtained from the diversity parameters were computed and analyzed on the SPSS software. Analysis of variance (ANOVA) was used to compare the mean values of each parameter across the farm type. Mean separation was done using the LSD method at 0.05 level of significance ($P \leq 0.05$).

Results

The results for the frequency, density, relative abundance and important value index of the different fields studied are tabulated below in the order according to crops vis; cassava, maize and cucumber. In the four locations investigated with *A. conyzoides* and *S. mostachyus* occurring among the sites for the three crops while weeds like *Chromolaena odourata* and *P. amarus* occurred only in the plot for maize and cucumber. Four species vis *Chloris pilosa*, *E. indica*, *K. erecta* and *Sida acuta* occurred in plots of cassava and maize. The frequency of weed diversity in the fields studied for the 3 plants varied both in abundance and in the density. *A. conyzoides* L. had the highest frequency of 87.5% around *M. esculenta* while *K. erecta* had the lowest 37.5%. *Rottboellia conchinensis and Larpotea aestuans,* had the highest density (5.69kg/m^3) while *C. pilosa* had the least density of 0.94kg/m^3. *Melanthera alternifolius* was highest for relative abundance (8.10) while *C. pilosa* was lowest with 2.15 (Table 2). Cassava had 17 weed species where *A. conyzoides* L. was the most frequently encountered (87.5%) and it also recorded the highest density (5.25 kg/m^3) and important value index (94.4) while *M. alternifolius* had the maximum relative abundance of 8.1.

For *Zea mays* L, the highest frequency of 81.2% each was found in *Cyperus esculentus* and *Melanthera scandens* Schum and Thonn while *Mimosa invisa* had the lowest frequency of 25.0%. *C. esculentus* had the highest density of 6.88kg/m^3 while *M. invisa* had the lowest (3.06kg/m^3). M.invisa had the highest (12.24) for relative abundance while the lowest (6.18) was found in *S. acuta* (Table 3).

Maize was surrounded by 12 weed species where *C. odorata*. was the most frequently encountered (68.8%). The maximum density (6.88 kg/m^3) and importance value index (96.6) was recorded in *C. esculentus.* while *M. invisa* had the highest relative abundance (12.24). In the *Cucumis sativus* L field, 4 plants; *Brachiaria lata, Solenostemon monostachyus, Phyllanthus amarus* and *Sporobulus pyramidalis* had the highest frequency of 75.0% while the lowest was 50% in *A. conyzoides.* Highest density was found in *S. monostachyus,* (7.19kg/m^3) and A. *conyzoides* had the lowest (3.25 kg/m^3) as found in Table 4. *Cucumis sativus* was surrounded by 8 weed species where four species had the same frequency of occurrence (75%) among which *S. monostachyus* had the highest density (7.19 kg/m^3) and importance value index (91.8) while *C. odorata* recorded the highest relative abundance (10.4). In *Manihot esculenta,* Rumuekini and Ozuoba recorded 16 weed species maximum (Table 5). *Larpotea aestuans, Mariscus alternifolius* and *R. conchinensis* had the highest average number of occurrence of 5.6875, 5.625 and 5.6875 respectively around *M. esculenta* and this cuts across the four villages within Obio/Akpor L.G.A. In *Zea mays,* 12 weed species were found in each of the locations except Ozuoba (10 species) as shown in Table 6. *C. esculentus, C. odorata* and *S. monostachyus* had the highest number of occurrences of 6.875, 6.5 and 6.75 respectively around *Zea mays* whereas only 8 weed species were found uniformly around *C. sativus* in each of the location (Table 7). in the four villages, *S. monostachyus* and *Sporobulus pyramidalis* had the highest number of occurrences around *C. sativus*.

The *M. esculenta* farms in Alakahia and Rumuekini had the highest number of species found around it while, *Zea mays* in Choba, Rumuekini and Alakahia had the highest number of species than Ozuoba, *C. sativus* in all the areas had all the species. Out of the 26 species present in all the locations, *A conyzoides* and *S monostachys* were present in all the sites, this could be related to their versatility and viable ground and underground seeds which are both viable and makes it difficult to control very similar to the findings of [15]. *M. esculenta* and *C. sativus* had more of grasses around it while, *Zea mays* has more of broad-leaved weeds than grasses because they tend to be more abundant in frequently disturbed tillage system unlike the more perennial weeds which thrive more in the absence of disturbance. This statement is in agreement with Bell (2005) who observed that the nature of the habitat and its disturbances will determine which weed community will become dominant [16]. Reported that the impact of weeds differ with various crops and locations on agricultural impacts because many of them are crop and location dependent.

Species	Frequency (%)	Density (kg/m^3)	Relative abundance	Importance value index
Ageratum conyzoides l.	87.5	5.25	5.6	98.4
Axonopus compressus (sw.) P. Beauv.	50.0	3.19	6.38	59.6
C. Pilosa schumach.	43.8	0.94	2.15	46.9
C. Benghalensis l.	62.5	4.38	7.01	73.9
C. Olitorious l.	50.0	3.88	7.76	61.6
D. Longiflora (ret.) Pers.	62.5	4.19	6.70	73.4
Eleucine indica l.	62.5	4.88	7.81	75.1
Euphobia hirta l.	68.8	3.19	4.64	76.6
G. Celosioides mart.	75.0	4.50	6.00	85.5
Kylinga erecta schumach.	37.5	2.38	6.35	46.2
K. Pumila michx.	75.0	1.63	2.17	78.8
L. Aestuans l.	75.0	5.69	7.59	88.2
*Melanthera. Alternifolius*vahl.	62.5	5.06	8.10	75.7
Sida acuta burn. F.	68.8	3.31	4.81	76.9
Solenestemon monostachyus p.beauv	62.5	4.31	6.90	73.7
R. Conchinensis (lour.) Clayton	81.2	5.69	7.00	93.9

Table 2: Diversity parameters of weed species around *Manihot esculenta.*

Species	Frequency (%)	Density (kg/m³)	Relative abundance	Importance value index
*A. conyzoides*L.	62.5	5.62	8.99	77.1
C. pilosa Schumach.	68.8	4.62	6.72	80.1
*C. odorata*L.	68.8	6.50	9.45	84.8
*C. esculentus*L.	81.2	6.88	8.47	96.6
*E. indica*L.	43.8	4.88	11.15	59.8
K. erecta Schumach	56.2	3.50	6.22	65.9
M. scandens Schum & Thonn.	81.2	6.06	8.46	95.7
M. invisa Mart.	25.0	3.06	12.24	40.3
P. amarus Schum. & Thonn.	62.5	4.00	6.40	72.9
S. occidentalis L.	56.2	6.00	10.67	72.9
S. acuta Burn. F.	68.8	4.25	6.18	79.2
S. monostachyus P. Beauv.	75.0	6.75	9.00	90.75

Table 3: Diversity parameters of weed species around *Zea mays.*

Species	Frequency (%)	Density (kg/m³)	Relative abundance	Importance value index
A. conyzoides L.	50.0	3.25	6.5	59.8
B. lata Schumach	75.0	5.12	6.8	86.9
C. odorata L.	56.2	5.88	10.4	72.5
D. longiflora (Ret.) Pers.	56.2	4.62	8.2	69.0
I. asariflora (Desr.) Roem. & Schult.	68.8	5.00	7.2	81
P. amarus Schum. & Thonn.	75.0	4.93	6.6	86.5
S. monostachyus P. Beauv.	75.0	7.19	9.6	91.8
S. pyramidilis P. Beauv.	75.0	7.00	9.3	91.3

Table 4: Diversity parameters of weed species found around *Cucumis sativus.*

Species	Choba	Alakahia	Rumuekini	Ozuoba
A. conyzoides	+	+	+	+
A. compressus	+	+	+	+
C. pilosa	+	+	+	+
C. benghalensis	+	+	+	+
C. olitorious	+	-	+	+
D. longiflora	+	+	+	+
E. indica	+	+	+	+
E. hirta	+	+	+	+
G. celosioides	+	+	+	+
K. erecta	-	+	+	+
K. pumila	+	+	+	+
L. aestuans L.	+	+	+	+
M. alternifolius	+	+	+	+
S. acuta	+	+	+	+
S. monostachyus	+	+	+	+
R. conchinensis Lour	+	+	+	+
Alpha	15	15	16	16
Beta	Choba vs Ozuoba 1	Choba vs Alakahia 2	Alakahia vs Rumuekini 1	Ozuoba vs Alakahia 1
Gamma	16			

Table 5: Species distribution in *Manihot esculenta* farm.

Species	Choba	Alakahia	Rumuekini	Ozuoba
A. conyzoides	+	+	+	+
C. pilosa	+	+	+	+
C. odorata	+	+	+	+
C. esculentus	+	+	+	+
E. indica	+	+	+	-
K. erecta	+	+	+	+
M. scandens	+	+	+	+
M. invisa	+	+	+	-
P. amarus	+	+	+	+
S. occidentalis	+	+	+	+
S. acuta	+	+	+	+
S. monostachyus	+	+	+	+
Alpha	12	12	12	10
Beta	Rumuekini vs Choba 2	Alakahia vs Rumuekini 2	Ozuoba vs Rumuekini 2	Choba vs Ozuoba 2
Gamma = 12				

Table 6: Species distribution in the *Zea mays* farm under study.

Species	Choba	Alakahia	Rumuekini	Ozuoba
A. conyzoides	+	+	+	+
B. lata	+	+	+	+
C. odorata	+	+	+	+
D. longiflora	+	+	+	+
I. asariflora	+	+	+	+
P. amarus	+	+	+	+
S. monostachyus	+	+	+	+
S. pyramidilis	+	+	+	+
Alpha	8	8	8	8
Beta	0	0	0	0
Gamma = 8				

Table 7: Species distribution in the *Cucumis sativus* farm.

Conclusion

From the results and analysis, weeds found more common around *Manihot esculenta* in Obio/Akpor L.G.A in Rivers State include *Larpotea aestuans, Mariscus alternifolius* and *Rottboellia conchinensis.* For Zea mays, *Cyperus esculentus, Chromolaena odorata.* and *Solenostemon monostachyus* were more common, while *Solenostemon monostachyus* and *Sporobulus pyramidalis* were more common around *Cucumis sativus* in the four villages during the wet seasons in Rivers state. Out of the 26 species present in all the locations, *A conyzoides* and *S. monostachys* were present in all the sites. The outcome of this study will enable agronomists to know the kind of weeds to expect around these crops when cultivating in the Obio/Akpor L.G.A. This will form the basis in the control and management of weeds including the measures and practices to adopt.

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