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MICROHABITAT DISTRIBUTION OF *ALLAMANDA CARTHATICA* LINN. AND *PANDIAKA INVOLUCRATA* (MOQ) JACKSON

Ogbemudia, F.O.[a], Ogie- Odia, E[b] and Kekere. O.[c]
a. University of Uyo, P.M.B.1017,Uyo, Akwa Ibom State
b. Ambrose Ali University, Ekpoma,Edo State
c. Department of Plant Science and Biotechnology, Adekunle Ajasin University, Ondo State.
Corresponding author's Email: femeg2005yahoo.com

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Abstract: A microhabitat distribution of *Allamanda cathartica* Linn and *Pandiaka involucrata* (Moq.) Jackson was studied. The plants belong to the families Apocynaceae and Amaranthaceae, respectively. This study was carried out in Uyo municipality, Akwa Ibom State. At each site random sampling method was used in sampling the vegetation within 2m x 2m quadrates and the vegetation components were enumerated and identified to species level. One soil samples was collected from each quadrant to the depth of 20cm using the soil auger. Thus, a total of 20 soil samples were taken and analyzed for soil properties. Results showed that 32 plant species were indentified in the vegetation containing *Allamanda cathartica* and *Pandiaka involucrata* both species had 100% frequency. Their densities were 3.6 ± 0.34 and 10.0 + 1.71 stems/ha^2, respectively height, crown cover. The soils where these plants grew were strongly acidic with low organic carbon content, high phosphorus and iron content. The soils were sandy loam in nature. The soils had sand particles ranking highest (75.20 ± 1.96 and 75.74 ± 2.63%), followed by clay (13.66 ± 1.96 and 10.40 ± 0.45%) and silt texture being sandy loam. Regression analysis between *Allamanda cathartica* Linn and *Pandiaka involucrata,* and soil properties revealed that edaphic factors had minor effect on the growth and distribution of these plant species. This showed that *Allamanda cathartica* Linn and *Pandiaka involucrata* are not randomly distributed but found in specific areas of soil rich in iron (Fe), Manganese (Mn) and Phosphorus contents.
Key words: Akwa Ibom State, *Allamanda cathartica,* Microhabitat, *Pandiaka involucrate*.

INTRODUCTION

Allamanda carthatica Linn is commonly known as golden trumpet. *Allamanda cathartica* is native to South and Central America. *Allamanda cathartica* grows on river banks in Surinam (Tropilab Inc, 2002), along roads (Liogier, 1995). The plant *Allamanda carthatica* protects the soil and furnished cover for wildlife .*Allamanda carthatica* has numerous medicinal uses: the leaves, roots and flower are prepared as a powerful *carthatic* milky sap which is considered as antibacterial possibly anti-cancer (Liogier, 1995). It is used in traditional medicine for different purposes including treatment of liver tumors, gastro-intestinal ailment, fever, malaria, pain and diabetes. All parts of this species contain the toxic iridoid lactone allamandin. In herbal medicine tea prepared from leaves and roots is used as a strong purgative that must be taken with caution (Liogier, 1995).

Pandiaka involucrata (Moq.) Jackson

Synonym; *Achyranthes involucrata* (Moq.) is commonly known as velvet bush willow; it is an annual herb belonging to the family Amaranthaceae. *Pandiaka involucrata* is found on roadsides on rocky ground and gritty soil, weedy species in sandy soils, savanna and a weed of cultivation. *Pandiaka involucrata* has numerous medicinal uses. According to researchers, claims have been established in the use of *pandiaka* as infusion drug by women after childbirth (Etukudo, 2003). It is also used in the control of high blood pressure. There has been no detailed study of the micro habitat distribution of *Pandiaka involucrata* and *Allamanda carthatica* and the present study was undertaken with the underlisted objectives. To elucidate the soil factors affecting the distribution of *Allamanda cathartica* and *Pandiaka involucrata.* To examine the microhabitat distribution of *Allamanda cathartica* and *Pandiaka involucrata.* Habitat of an organism is a part of the total environment of the region and it must offer the resident organism, food, shelter and climatic condition that are well suited for the organism to survive and reproduce (Taylor *et al*., 2004). The term microhabitat is often used to describe the small scale physical requirements of a particular organism or population. When plants are associated with particular habitat or microhabitat, it is often assumed that they prefer to be there, or that they have actively adapted to that habitat and rejected the other that is available (Bennett, 1993). Ecological science is the scientific study of the distribution and abundance of living organisms and how distributions of organisms (for example plants) are affected by interactions between the plants and their environment (Alford, 1999). The patterns of distribution of plants are frequently explained by the behavior of the species under consideration or of those with which they interact (Chapman and Underwood, 1998).

MATERIALS AND METHODS

Study Area

A microhabitat distribution of *Allamanda carthatica* and *Pandiaka involucrata,* study was carried out in Uyo municipality, Akwa Ibom State. Akwa Ibom State is situated between latitudes, $4^{0}12$ and $4^{0}21^{1}$N and longitudes $8^{0}12^{1}$ and $8^{0}18^{1}$E. On the basis of its geographical location, the climate of Akwa Ibom State can be described as a tropical rainy type which experiences abundant rainfall with very high temperature. The mean annual temperature lies between 26^{0}C and 28^{0}C while mean annual rainfall ranges from 2000mm to 3000mm depending on the area. Naturally, maximum humidity is recorded in July while the minimum occurs in January with relative humidity of 75% - 85%. Evaporation is high with annual values that range from 1500mm to 1800mm. Akwa Ibom State has a humid tropical climate with characteristic dry and wet seasons. The wet season lasts between eight to nine months starting from March till the end of November. The dry season has a short duration of between the last week of November or early December and lasts till early March. Despite the seasonal variations, by the nature and location of the state along the coast, these expose it to hot maritime air mass and rainfall is expected every month of the year.

Vegetation and Soil Sampling

In the study sites, random sampling method of Cochran (1963) was used to sample the vegetation containing *Allamanda cathartica* and *Pandiaka involucrata* within 5m x 5m quadrats. The study was conducted in 20 sites in Uyo municipality, Akwa Ibom State. The vegetation components were enumerated and identified to the species levels (Etukudo, 2003). Two soil samples were taken in each quadrat using the soil auger, to a depth of 20cm and the soil samples were bulked into a composite sample per quadrat and put into labeled polythene bags. Twenty soil composite samples were taken. The soil samples were taken to the laboratory and 300g of each soil sample were weighed out and air-dried. Also occasional turning was done to expose new surface of the soil sample with a view of facilitating the drying process. When the soil samples were dried, they were reweighed and the values obtained were subtracted from the original values in order to get the moisture content of the soil (Udo and Ogunwale, 1986. Afterwards, pestle and mortar were used to lightly ground the air dried

samples and passed through a 2.00mm mesh to sieve the soil samples. The soil samples were then put into labeled polythene bags and taken to the soil science laboratory, University of Uyo, for analysis.

RESULT AND DISCUSSION

Vegetation Analysis

The vegetation containing *Allamanda carthatica* had other plant species. Eighteen plant species belonging to eleven families and eighteen genera were indentified. *Allamanda carthatica* had the highest frequency of 100% and density with mean value of 3.60±0.34 followed by *Desmoduim scorpiurus* with mean value of 2.10±0.62. *Paspalum vaginatium* and *Stachylarpheta cayennensis* had the lowest frequency (0.10±0.00 and 0.10±0.00). *Lannea acida* was the tallest plant with a height of 2.26m followed by *Rauvolfia vomitoria* with a height of 2.24m, and the shortest was *Platostoma africana* with a height of 0.14m. *Urena lobata* had the largest crown cover with mean value of 2.10±0.34 and *Emilia sonchifolia* with mean value of 0.001±0.00004 (Table 1).

The vegetation containing *Pandiaka involucrata* had other plant species. Fourteen plant species belonging to nine families and thirteen genera were indentified. *Pandiaka involucrata* had the highest frequency of 100% and density with mean value of 10.20±1.71, followed by *Aspilia africana* (70%) and the least *Paspulium vaginatium* (40%) respectively. *Aspilia africana* had the mean density value of 5.30±1.27; *Starchytapheta cayennensis* had the lowest frequency of 0.10±0.00. *Chromadaena odorata* was the tallest plant with a height of 0.81m, followed by A*spilia africana* with a height of 0.42m. All the species were herbs and hence basal area measurement could not be carried out. *Pandiaka involucrata* had the largest crown cover while *Ageratum conyzoides* had the smallest crown cover mean value of 0.008±0.001 (Table 2).

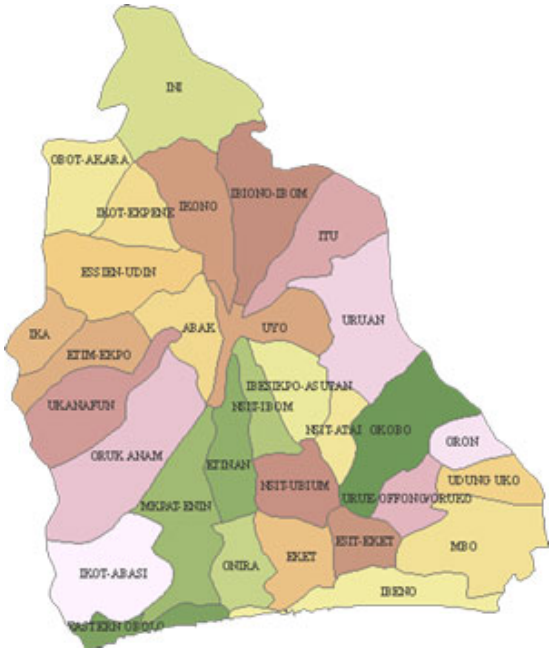

Figure 1. Map of Akwa–Ibom State

Soil Analysis

Mean properties of soils associated with *Allamanda cathartica* and *Pandiaka involucrata* are presented in Tables 3 and 4 respectively. Mean properties of soils associated with *Allamanda cathartica* showed that the pH was 4.90±0.07 indicating that the soil was very strongly acidic. Electrical conductivity and total nitrogen values (0.02±0.000ds/m and 0.09±0.001%) were low. The organic carbon content was also low with mean value of 3.79±0.26%. Calcium was the most abundant exchangeable base with the highest mean value of 3.82±0.24 cmol/kg followed by magnesium (1.26±0.03 cmol/kg) while potassium and sodium were low with mean values of 0.18±0.01 and 0.10±0.00 cmol/kg, respectively. High available phosphorus characterized the soil sites (108.71±6.48m^{2}g/kg). The heavy metals concentrations of soil showed that iron had highest concentration with mean value of 117.76±3.68mg/l, followed by manganese (22.08±2.41mg/l). Copper had low mean value of 6.21±0.38mg/l zinc and lead had least mean values of 5.50±0.22mg/l and 5.37±0.59mg/l, respectively.

Table 1: Frequency and density of *Allamanda carthatica* and associated species in Uyo municipality

S.No.	Species	Author	Family	Frequency (%)	Stend. D (Setmo/m^2)	Height (m)	Crown cover
1	*Allamanda cathartic*	Linn.	Apocynaceae	100	3.60±0.34	1.09±0.08	0.183±0.177
2	*Aspilia africana*	(Pers.) C. D. Adams	Asteraceae	20	0.40±0.26	0.14±0.002	-
3	*Asystasia gangetica*	(Linn.) T. Anders	Acanthaceae	20	0.40±0.30	0.50±0.20	0.002±0.001
4	*Caladium bicolor*	(Ait.) Vent	Araceae	10	0.10±0.00	-	0.588±0.199
5	*Chromolaena odorata*	(Linn.) R. M. and King Robinson	Asteraceae	20	0.40±0.26	0.65±0.15	0.245±0.186
6	*Clithoria ternatea*	Linn.	Fabaceae	10	0.30±0.00	-	-
7	*Desmondium scorpiuru*	(Sw.) Desv.	Fabaceae	70	2.10±0.62	0.50±0.06	0.011±0.005
8	*Emilia sonchifolia*	(Linn.) DC	Asteraceae	10	0.20±0.00	0.08±0.02	0.000±0.000
9	*Lcacina trichantha*	Oliv.	Icacinaceae	20	0.60±0.40	0.28±0.10	0.042±0.031
10	*Lannea acida*	A. Rich.	Anacardiaceae	10	0.60±0.00	2.26±0.06	0.490±0.134
11	*Lonchocarpus cyanesense*	(Schum. & Thonn.) Benth.	Fabaceae	10	0.50±0.00	2.50±0.22	0.455±0.149
12	*Paspalum vaginatum*	Sw.	Poaceae	10	0.10±0.00	-	0.007±0.000
13	*Platostoma africana*	P. Beauv.	Lamiaceae	20	1.30±0.86	0.14±0.01	0.004±0.000
14	*Ravolifia vomitoria*	Afzel.	Apocynaceae	20	2.30±1.86	2.24±0.05	2.072±0.337
15	*Sida acuta*	Burm. f.	Malvaceae	20	1.00±0.68	0.81±0.16	0.001±0.000
16	*Sida rhombifolia*	Linn.	Malvaceae	40	0.70±0.39	0.48±0.09	0.386±0.118
17	*Stachytarpheta cayennensis*	(L.C. Rich) Schau.	Verbenaceae	10	0.10±000	-	-
18	*Urena lobata*	Linn.	Malvaceae	10	0.40±0.00	2.00±0.00	2.109±0.344

Table 2: Frequency and density of *Pandiaka involucrata* and associated species in Uyo municipality

S.No.	Species	Author	Family	Frequency (%)	Density (Stems/ha^2)	Height (m)	Crown cover (m^2/ha)
1	*Ageratum conyzoides*	Linn.	Asteraceae	10	1.2±0.00	0.16±0.02	0.008±0.001
2	*Aspilia africana*	(Pers.) C. D. Adams	Acanthaceae	70	5.3±1.27	0.42±0.02	0.108±0.026
3	*Chromolaena mucunoldes*	(Linn) R. M. King & Robinson	Asteraceae	20	0.60±0.42	0.81±0.10	0.810±0.100
4	*Clithorea ternatea*	Linn.	Fabaceae	30	1.20±0.62	-	0.121±0.046
5	*Commelina benghalensis*	Linn.	Commelinaceae	20	1.3±1.01	0.39±0.03	0.001±0.001
6	*Ipomoea involucrata*	P. Beauv.	Convulvulaceae	10	3.40±0.00	-	-
7	*Justicia flava*	T. Anders	Acanthaceae	10	3.50±0.82	0.05±0.10	-
8	*Pandiaka involucrata*	(Moq.) Jackson	Amaranthaceae	100	10.20±1.71	0.28±0.01	0.262±0.062
9	*Paspulum vaginatum*	Sw.	Poaceae	40	2.40±1.06	0.32±0.02	0.028±0.006
10	*Plastoma africana*	P. Beauv.	Lamaceae	20	1.40±1.04	0.25±0.04	0.082±0.030
11	*Setaria barbata*	(Lam.) Kunth	Poaceae	30	1.92±0.99	0.24±0.02	0.035±0.007
12	*Sida acuta*	Burm. f.	Malvaceae	10	0.30±0.00	0.20±0.06	0.001±0.001
13	*Sida rhombifolia*	Linn.	Malvaceae	10	0.10±0.00	-	-
14	*Urena lobata*	Linn.	Malvaceae	10	0.30±0.00	0.40±0.06	-

Table 3: Mean (± standard) deviation) soil properties associated with *Allamanda cathartica*

Parameters	Values
Ph	4.90±0.07
Electrical conductivity (ds/m)	0.02±0.00
Organic carbon (%)	3.79±0.26
Total Nitrogen (%)	0.09±0.01
Available phosphorus (mg/kg)	108.71±6.48
Calcium (cmol/kg)	3.82±0.24
Magnesium (cmol/kg)	1.26±0.03
Sodium (cmol/kg)	0.10±0.00
Potassium (cmol/kg)	0.20±0.01
Exchangeable Acidity (cmol/kg)	4.76±0.33
ECEC (cmol/kg)	10.12±0.56
Base saturation (%)	58.17±4.66
Fe (mg/kg)	117.76±3.68
Zn (mg/kg)	5.50±0.22
Cu (mg/kg)	6.21±0.38
Mn (mg/kg)	22.08±2.41
Pb (mg/kg)	5.37±0.59
Sand (%)	75.20±1.96
Silt (%)	8.86±0.53
Clay (%)	17.38±1.63
Soil Texture	Sandy loam

Mean properties of soil associated with *Pandiaka involucrata* are presented in Table 4. The pH of the soil (5.23±0.14) indicated that the soil was strongly acidic. Electrical conductivity and total nitrogen mean values of 0.02±0.00 and 0.10±0.01% were low. The organic carbon content was 4.14±0.26%. Calcium was the most abundant exchangeable base with the highest mean value of 3.94±0.10cmol/kg, followed by magnesium 1.28±0.42cmol/kg while potassium and sodium were the least with mean values of 0.02±0.01 and 0.10±0.00cmol/kg, respectively. High available phosphorus characterized the sites (89.46±9.5mg/kg). The heavy metal concentrations of the soil showed that iron had the highest mean value of 107.67±6.28mg/kg, followed by manganese with mean value of 9.66±0.94mg/kg. Copper and lead had mean values of 3.97±0.26 and 3.42±0.53mg/kg respectively, and the least was zinc with mean value of 3.00±0.28mg/kg.

Table 4: Mean (± standard deviation) soil properties associated with *Pandiaka involucrata*

Parameters	Values
pH	5.23±0.14
Electrical conductivity (ds/m)	0.02±0.00
Organic carbon (%)	4.14±0.26
Total Nitrogen (%)	0.10±0.00
Available phosphorus (mg/kg)	89.46±9.50
Calcium (cmol/kg)	3.94±0.10
Magnesium (cmol/kg)	1.28±0.04
Sodium (cmol/kg)	0.10±0.00
Potassium (cmol/kg)	0.20±0.01

Exchangeable Acidity (cmol/kg)	3.38±0.30
ECEC (cmol/kg)	8.86±0.35
Base saturation (%)	62.42±2.62
Fe (mg/kg)	107.67±6.28
Zn (mg/kg)	3.00±0.28
Cu (mg/kg)	3.97±0.26
Mn (mg/kg)	9.65±0.93
Pb (mg/kg)	3.43±0.53
Sand (%)	75.74±2.63
Silt (%)	10.40±1.45
Clay (%)	13.66±1.33
Soil texture	Sandy loam

Relationship between soil properties and *Allamanda carthatica* and *Pandiaka involucrata* parameters

Figures 1, 2, 3 and 4 represent the relationships between soil properties and *Allamanda carthatica* frequency, density height and crown cover; figures 1, 2 and 3 showed negative relationship between soil properties and this species frequency, density and height while crown cover related positively with soil properties of (Fig 4). Figure 5, 6, 7 and 8 represent the relationship between soil properties and *Pandiaka involucrata* parameters. Again species frequency density and crown cover showed negative relationship with soil properties (Fig 5, 6 and 8) while height showed a positive relationship with soil properties (figure 7).

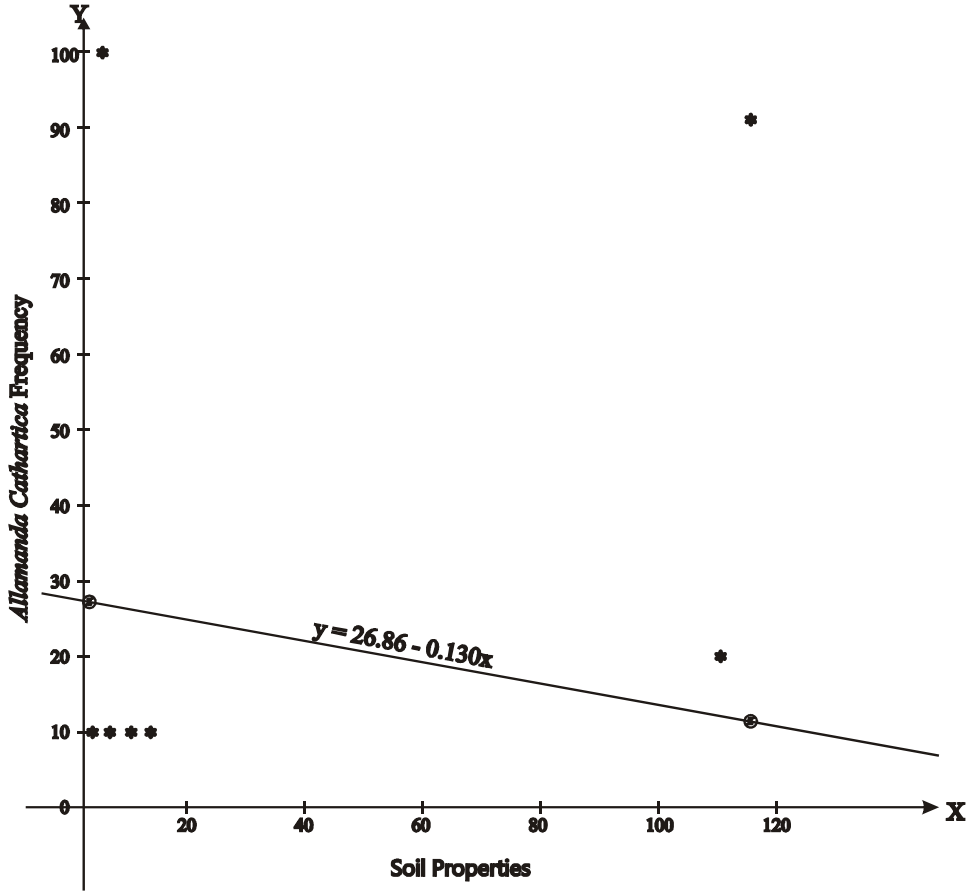

Figure 1. Relationship between *Allamanda cathrtica* frequency and soil properties

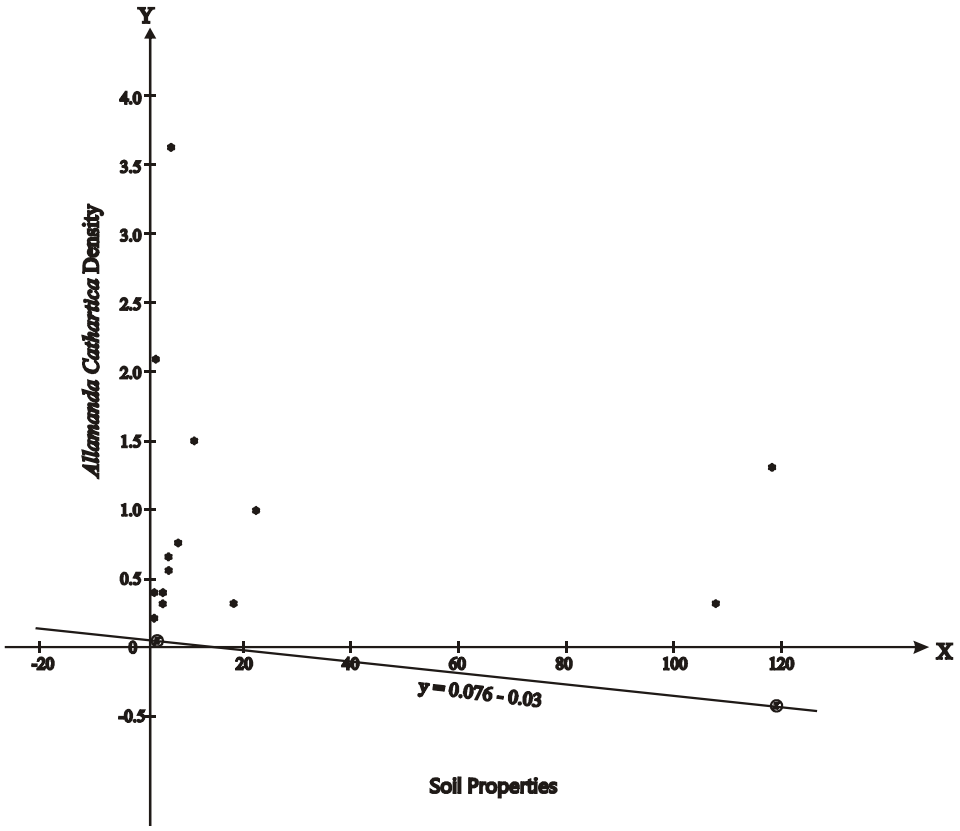

Figure 2. Relationship between *Allamanda cathrtica* density and soil properties

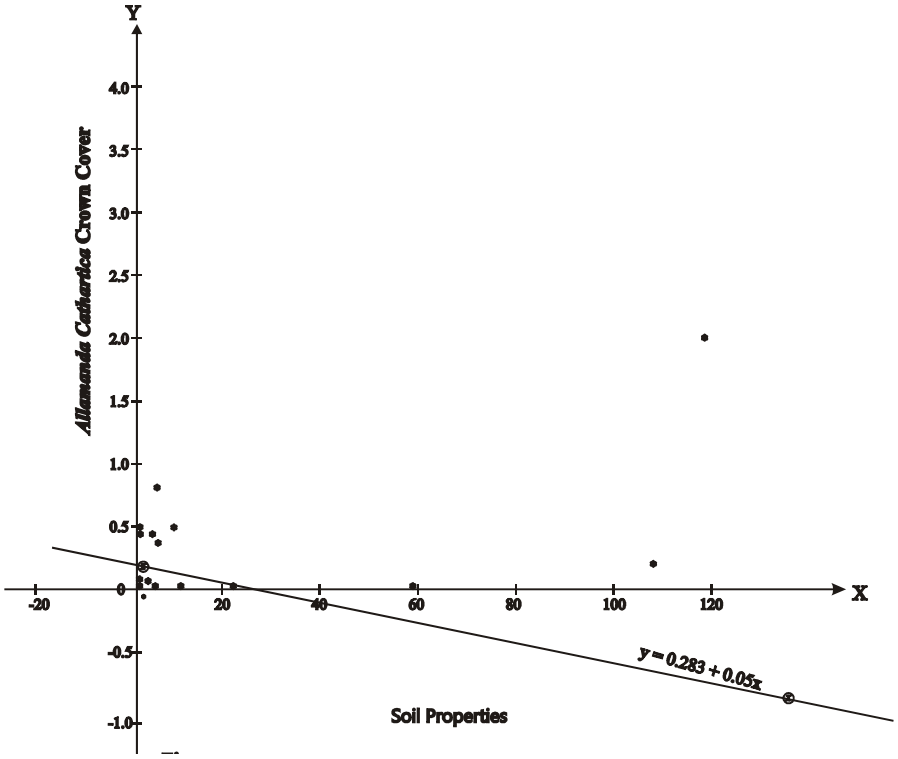

Figure 3. Relationship between *Allamanda cathrtica* crown cover and soil properties

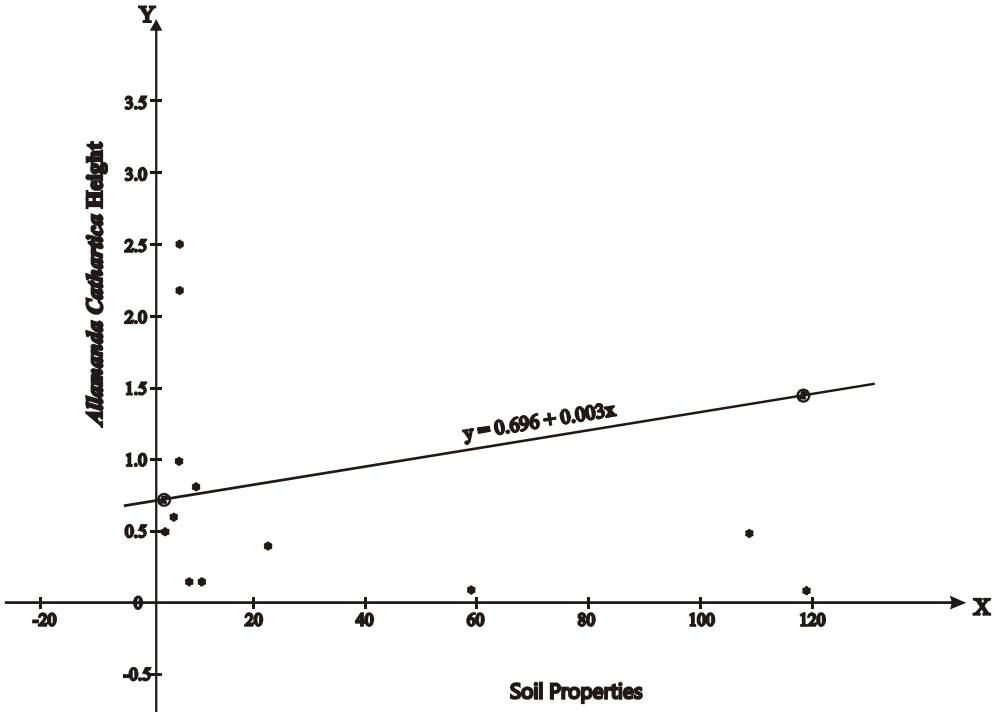

Figure 4. Relationship between *Allamanda cathrtica* height and soil properties

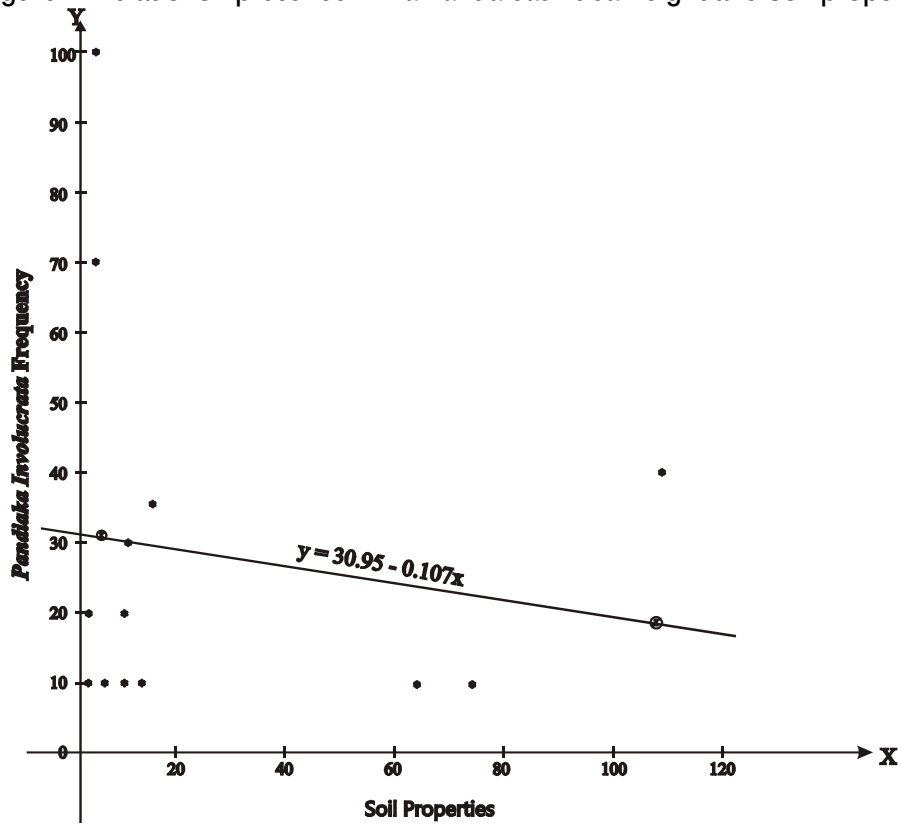

Figure 5. Relationship between *Pandiaka involucrata* frequency and soil properties

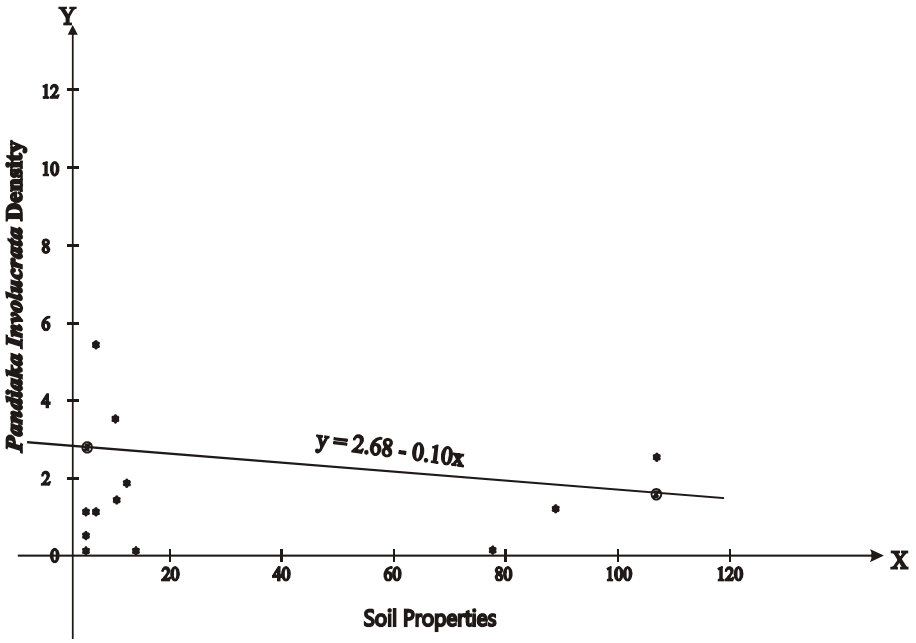

Figure 6. Relationship between *Pandiaka involucrata* density and soil properties

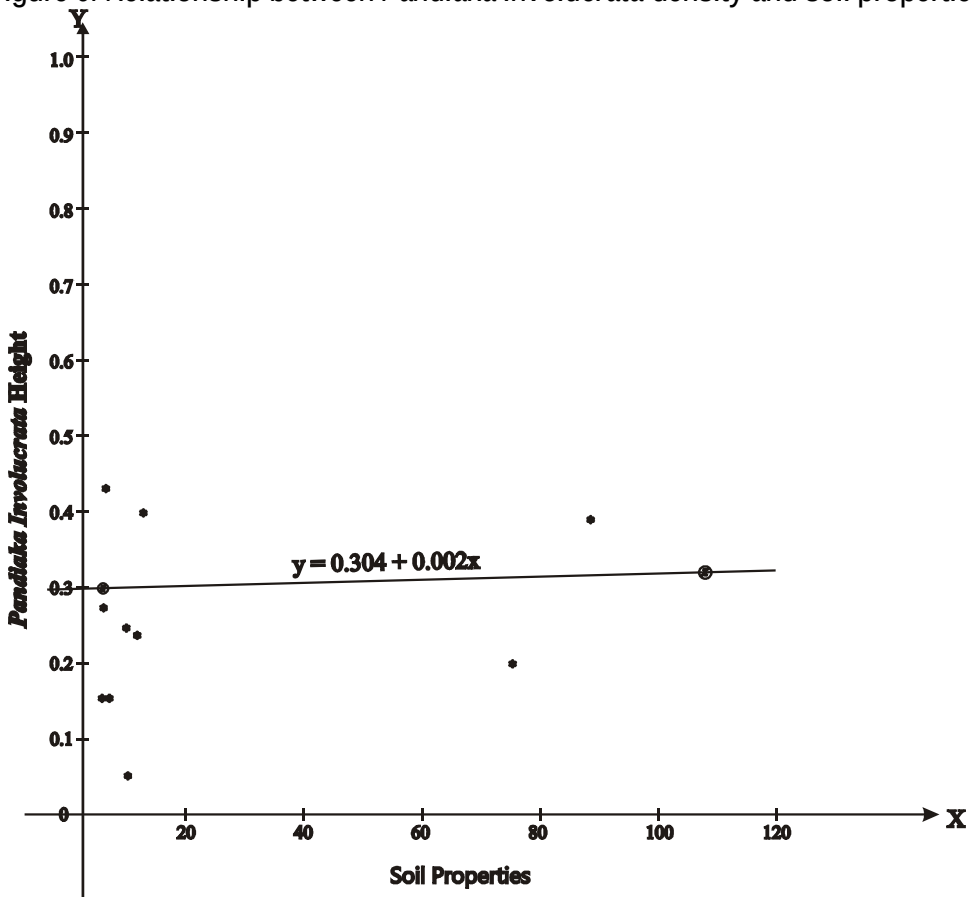

Figure 7. Relationship between *Pandiaka involucrata* height and soil properties

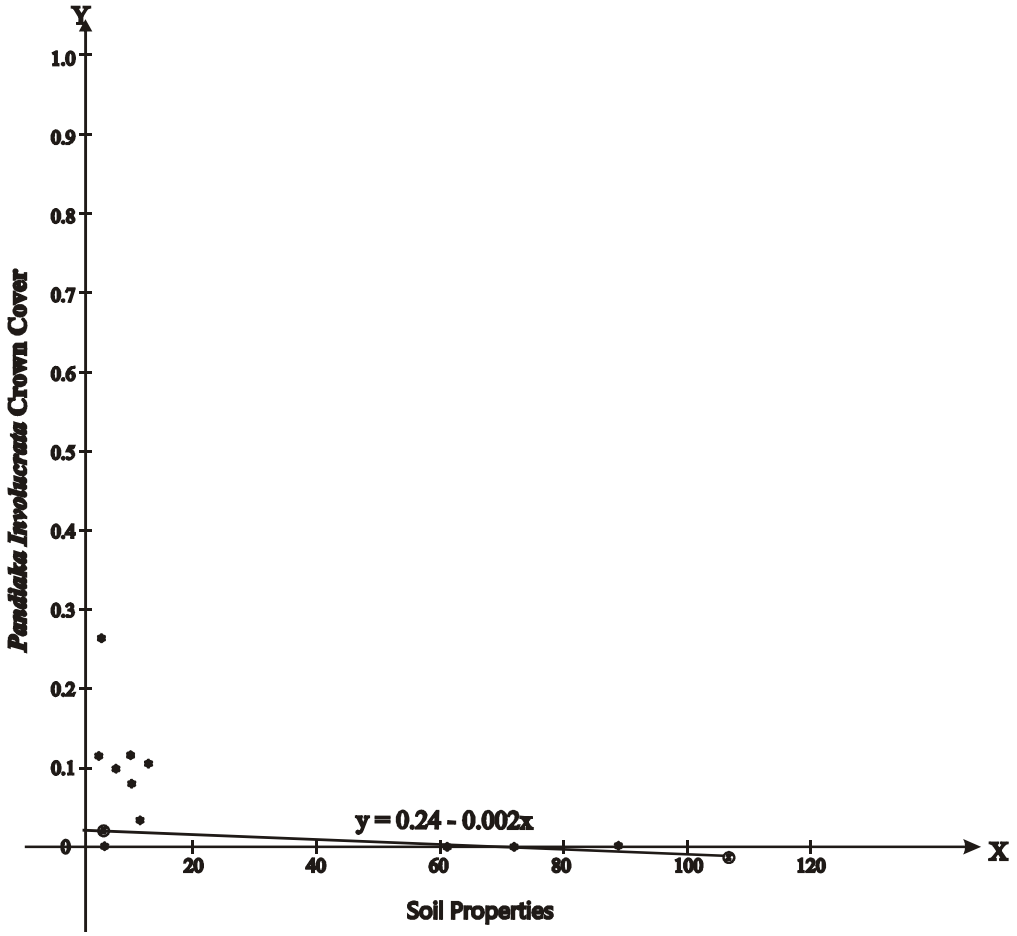

Figure 8. Relationship between *Pandiaka involucrata* crown cover and soil properties

The distribution of the plant species under study related the edaphic properties. Both species were found in strongly acidic soils with low nitrogen and potassium contents and high iron (Fe) and available phosphorus contents. Soil analysis (Table 3 and 4) revealed that the soil was dominated by sand separates followed by clay, while silt ranked least. Texturally the soil was sandy loam and these combined to influence other soil properties. The soil has a sandy surface which may increase infiltration rate. Silt and clay contents were low. Kadeba (1970) demonstrated the importance of clay in predicting effective cation exchange capacity. Sand, silt clay and organic matter affect the plant distribution or soil structural stability. The acidic nature of the soil results in low values of the nutrients observed in the study sites. Regression is a biometric method that obtains an indication as to whether there is any interrelationship or association between variables and discovers the nature of relationships between these variables. Monton, (1970), reported edaphic properties to be of great significance in the distribution of plants. In this result, as negative relationships between soil properties and *Allamanda carthatica* frequency increased, there was a corresponding decrease in these species parameters. This indicated that the soil properties may have played a minor role in the plant species distribution. The positive relationship between *Allamanda* crown cover and soil properties indicated a corresponding increase in both soil properties and crown cover of this species. This might mean that the soil properties played a major role in determining the crown size of the species. Similarly *Pandiaka involucrata* frequency density and crown cover had negative relationships with soil properties indicating that increase in soil properties gave a corresponding decrease in these species

parameters.This mean that the soil properties played a minor role in determining these species parameters in question. The height of *Pandiaka involucrata* gave a positive relationship with soil properties indicating that the soil properties might play a major role in determining *Pandiaka's* height. Generally, therefore, soil properties may not be the only factors that determine the distribution of these species. Their distribution may also be controlled by other environmental factors not measured in the study.

CONCLUSION

The study has shown the relationship found to exist between *Allamanda carthatica* and *Pandiaka involucata* and soil properties suggested that these soil properties have effecst on the distribution of these plant species. Also *Pandiaka involucata* and *Allamanda carthatica* are not randomly distributed but preponderantly found in strongly acidic soil and in specific areas of soil rich in iron, manganese and phosphorus, and in sandy loam soils. From the observation obtained in the course of this research work, it is recommended that further investigation should be done on this plant *Allamanda carthatica* and *Pandiaka involucrata* through phytochemical screening so as to determine the chemical constituents which may aid their uses as a medicinal plant.

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