Some Aspects of the Ecology of *Vernonia cinerea* (Linn.) Less. in Awka Town, Anambra State, Nigeria.

Nwaogaranya, U. P. and E. I. Mbaekwe

Department of Botany, Nnamdi Azikiwe University, Awka, Anambra State,Nigeria.

Abstract- This study was carried out to assess how the presence of *Vernonia cinerea* (Linn.) Less. impacts on plant biodiversity wherever it occurs, and to determine the species diversity in the plots where *V. cinerea* was present and those in which the plant was absent. Abundance measures of *V. cinerea* and other associated species in its natural environment and species diversity (using Shannon-Wiener Index) were determined using the quadrat method. Four different plots were chosen for the study: two plots were chosen from sites where *V. cinerea* was present and the other two plots were chosen from sites where *V. cinerea* was absent. Results from the species abundance of *V. cinerea* and other associated species in plots where *V. cinerea* was present showed that *V. cinerea* had low density, frequency and importance value; implying that, *V. cinerea* had very low species abundance. While the observations from the diversity of species showed that although, the plots where *V. cinerea* was present and absent had high species diversity, plots where *V. cinerea* was present had a higher number of species and these species were more evenly distributed. It is concluded from the results that the presence of *V. cinerea* did not have any observable impact on the plant biodiversity in areas where it occurred and *V. cinerea* is, therefore, not an invasive species.

Index Terms- Abundance measures, quadrat, species diversity, *Vernonia cinerea.*

I. INTRODUCTION

Vernonia cinerea (Linn.) Less. is a member of the Asteraceae family, belonging to the class: Dicotyledonae; order: Asterales and tribe: Vernonieae. *Vernonia cinerea* is an annual plant widely distributed in Africa, India, Bangladesh and Srilanka. It is commonly known as little iron weed. Its other names include; blue fleabane, inflammation bush, strongman bush, tropical fleabane, goat weed and ash-coloured fleabane (Herrera *et al*., 1980). *V. cinerea* is native to Africa (e.g Benin, Cameroon, Nigeria, Gabon, Ghana, Kenya, Liberia, Madagascar etc.), tropical and temperate Asia (e.g China, Fujian, Bangladesh, Jiangxi, India, Japan, Indonesia, Malaysia etc.) and Australia (Harborne and Williams, 1977). It occurs mostly in sunny or slightly shaded habitats, in general, corresponding with young secondary vegetation, wasteland, roadsides, disturbed areas, cultivated land and other anthropogenic habitats (Harborne and Williams, 1977). *V. cinerea* reproduces and spreads by seeds which are adapted to wind dispersal. In addition, seeds may be secondarily dispersed as a contaminant in crop seeds, pasture seeds, and in agricultural machinery (Holm *et al*., 1997). *V. cinerea* is a plant of high medicinal importance. In India, the flowers are administered to treat conjunctivitis and the root is given in cases of dropsy, whereas the seeds are also employed as an antihelmintic and alexipharmic (Tadesse *et al.*, 1993). The leaves either ground or as a decoction, are also used to treat skin diseases (Oliver, 1986).

Hopkins (1974) noted that one qualitative method of analysis of a community is to list all the species present. The number of species in a community is important ecologically since the species diversity seems to increase as the community becomes stable (Michael, 1984). In ecological methods, Jackson and Forrester (1974) stated that a typical modern technique is to select a proportion of the total population from which the characteristics of the whole can be inferred. Smith (1991) noted that in a simple random sample at a given size, all such subsets of the frame are given an equal probability. Sutherland (1997) stated that a quadrat is a frame of any shape that can be placed over vegetation so that cover can be estimated, plants counted and species listed. Curtis and McIntosh (1950) noted some important quantitative analysis such as density, frequency, and abundance of plant species. Communities are often described by the species or genera that are determined to be the most important in the community. This is quantified by calculating the statistics known as Importance Value (Schmidt, 2005). Clarke and Warwick (2001) stated that Shannon diversity is a very widely used index for comparing diversity between various habitats.

The objectives of this study are to determine the abundance of *Vernonia cinerea* and other associated species in areas where *V. cinerea* is present, and also, to determine the species diversity in areas wherever *V. cinerea* is present and absent, so as to determine the impact of the presence of *V. cinerea* on plant biodiversity.

II. MATERIALS AND METHODS

Description of the study areas

Ecological field studies were carried out in Awka town, Anambra State. Awka town lies between latitudes 7˚00 and 7˚10 N and longitudes 6˚05 and 6˚15 E (Richards, 2005). The study area is in the tropical rain forest zone of Nigeria. The temperature in Awka is generally 27-30˚C between June and December but rises to 32-34˚C between January and March, with the last few month of the dry season marked by intense heat. The rainfall is intensive with an annual range of between 1200 mm and 1500 mm and it occurs in a single season from April to November (Akamigbo, 1992). The pedology of the area shows that the soil is of sedimentary origin with sandstone and shale as the two

dominant parent materials (Akamigbo, 1992). The study areas were of uniform elevation, very well exposed and homogeneous.

METHODOLOGY

A total of four plots were chosen for the study: two plots were chosen from sites where *V. cinerea* was present and the other two plots, adjacent to the first, were chosen from sites where *V. cinerea* was absent.

Mapping Out of Four Sampling Areas

An area of 225 m^2 (15 m by 15 m) was mapped out in the four different plots with a 30 metre tape. Pegs were inserted at the four corners of the study areas. Rope was used to demarcate the measured areas.

Sampling Technique Used

The sampling unit used for counting species in the study areas was the quadrat.

The sampling percentage intensity used in the study areas was 6.67 %.

Quadrat Method

A 1 m^2 quadrat was placed fifteen times in each of the mapped out areas. This, therefore, gave a sample area of 15 m^2 for each site.

Sampling Method

Random sampling method was used in sampling the study areas. At each random point, the quadrat was placed in such a way that the random point was in the centre of the quadrat. The species present were counted and identified. Only plants that were actually rooted inside the quadrat were counted. The number and type of species present in each quadrat were recorded. This procedure continued until the fifteen random points were sampled for each of the infested and the un-infested plots. Code numbers were given to all plants that could not be identified in the field. They were collected, preserved, properly labeled and taken to the Botany Department Herbarium of the university, for identification.

Computation of Data

From the results obtained, the following were determined for both the infested and the un-infested plots.

(1) Sampling intensity $= \frac{\text{Sampled Area}}{\text{Total Area}} \times \frac{100}{1}$

That is, $\frac{15}{225} \times \frac{100}{1}$ X 6.67 %

(2) Density $= \frac{\text{No. of Individuals of a species}}{\text{Total area sampled}}$

(3) Relative density $= \frac{\text{Density of one species}}{\text{Total density for all species}} \times \frac{100}{1}$

(4) Frequency $= \frac{\text{No. of occurences of a species}}{\text{No.of quadrats sampled}} \times \frac{100}{1}$

(5) Relative frequency $= \frac{\text{Frequency of one species}}{\text{Total frequency for all species}} \times \frac{100}{1}$

(6) Importance value Relative density of one species + Relative frequency of same species

(7) Extrapolation = e.g if in 15 m^2, the density of *V. cinerea* for infested plot was 0.67/m^2. Therefore, in 225 m^2, the density would be 225 m^2 x 0.67 m^{-2} = 150.75 per 225 m^2, and in one hectare, the density would be

10,000 m^2/ha × 0.67 m^{-2} = 6,700 /ha

(Note that one can extrapolate density in either per square metres (/m^2) or per hectare (/ha))

(8) Species Diversity: using Shannon-Wiener Index

Step 1 $H^{I} = -\sum_{i-1}^{S} (Pi) \times (\ln Pi)$

(Where Pi is the sum of each species divided by sum of all species)

Step 2: $H_{Max} = \ln S$

(Where S is the total number of species)

Step 3: $E = \frac{H^{I}}{H_{Max}}$

Where, Pi = Sum of individual species divided by sum of all species.

H^{I} = Shannon Wiener's Index of diversity

H_{Max} = Maximum diversity possible

S = Number of species

E = Equitability

i-1 = individual species to one

(Note that equitability value ranges from 0.1 to 0.99 and the higher the value, the higher the species diversity)

III. RESULTS

Density and Importance Value of species in the plots where *V. cinerea* was present and in those ones where the plant was absent

Oldenlandia herbaceae had the highest density, followed by *Scoparia dulcis* and *Eleusine indica*, while *Emilia praetermissa* had the lowest density, followed by *Cyperus rotundus* in plot 1 where *V. cinerea* was present (Table 1). *Oldenlandia herbaceae* had the highest frequency, followed by *Eleusine indica*, *Scoparia dulcis*, *Calapogon mucunoides*, *Pennisetum purpureum* and *Cocculus pendulus* th the same frequency, while *Euphorbia heterophylla* had the lowest frequency, followed by *Emilia praetermissa* and *Spigelia anthelmia*, with the same frequency (Table 1). *Oldenlandia herbaceae* had the highest importance value, followed by *Scoparia dulcis* and *Eleusine indica*, while *Emilia praetermissa* had the lowest importance value, followed by *Euphorbia heterophylla* in plot 1 where *V. cinerea* was present (Table 1). *Vernonia cinerea* in this plot had low density, frequency and importance value (Table 1).

Oldenlandia herbaceae had the highest density, followed by *Scoparia dulcis* and *Eleusine indica*, while *Crotalaria retusa* had the lowest density, followed by *Mimosa invisa* and *Andropogon tectorum* in plot 1 where *V. cinerea* was absent (Table 2). *Oldenlandia herbaceae* had the highest frequency, followed by *Eleusine indica* and *Scoparia dulcis*, while *Andropogon tectorum* and *Crotalaria retusa* had the lowest and the same frequency, followed by *Mimosa invisa* (Table 2). *Oldenlandia herbaceae*

had the highest importance value, followed by *Eleusine indica* and *Scoparia dulcis*, while *Crotalaria retusa* had the lowest importance value, followed by *Andropogon tectorum* and *Mimosa invisa* in plot 1 where *V. cinerea* was absent (Table 2). *Eleusine indica* had the highest density, followed by *Gomphrena celosioides* and *Oldenlandia herbaceae*, while *Spigelia anthelmia* had the lowest density, followed by *Euphorbia heterophylla* in plot 2 where *V. cinerea* was present (Table 3). *Ageratum conyzoides* had the highest frequency, followed by *Eleusine indica*, *Gomphrena celosioides* and *Oldenlandia herbaceae* which had the same frequency, while *Tridax procumbens* and *Euphorbia hirta* had the lowest and the same frequency (Table 3). *Eleusine indica* had the highest importance value, followed by *Gomphrena celosioides* and *Ageratum conyzoides*, while *Tridax procumbens* had the lowest importance value, followed by *Spigelia anthelmia* and *Euphorbia hirta* in plot 2 where *V. cinerea* was present (Table 3). *Vernonia cinerea* in this plot had low density, frequency and importance value (Table 3).

Ageratum conyzoides had the highest density, followed by *Tridax procumbens*, while *Emilia praetermissa* had the lowest density, followed by *Spigelia anthelmia* in plot 2 where *V. cinerea* was absent (Table 4). *Tridax procumbens* had the highest frequency, followed by *Ageratum conyzoides* and *Sida acuta* which had the same frequency, while *Crotalaria retusa*, *Spigelia anthelmia*, *Emilia praetermissa*, *Panicum repens* and *Calapogonium mucunoides* had the lowest and the same frequency in plot 2 where *V. cinerea* was absent (Table 4). *Ageratum conyzoides* had the highest importance value, followed by *Tridax procumbens*, while *Emilia praetermissa* had the lowest importance value, followed by *Spigelia anthelmia* and *Crotalaria retusa* in plot 2 where *V. cinerea* was absent (Table 4).

Species Diversity

Although the plots where *V. cinerea* was present and absent had high species diversity, plots where *V. cinerea* was present had a higher number of species and these species were more evenly distributed (Table 5).

Table 1: **Abundance of species in the first plot where *V. cinerea* was present**

Quadrat Size: 1 m^2 Sampling intensity: 6.67 %

S/N	Species	No. of each species	Density (m^{-2})	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrap-olation (/ha)
1	*Ageratum conyzoides*	21	1.40	7.28	40.00	6.38	13.66	14,000
2	*Calapogonium mucunoides*	13	0.83	4.52	46.67	7.45	11.97	8,700
3	*Cocculus pendulus*	16	1.07	5.56	46.67	7.45	13.01	10,700
4	*Cyperus rotundus*	5	0.33	1.72	26.67	4.26	5.98	3,300
5	*Eleusine indica*	34	2.27	11.80	46.67	7.45	19.25	22,700
6	*Emilia praetermissa*	3	0.20	1.04	20.00	3.19	4.23	2,000
7	*Euphorbia heterophylla*	7	0.47	2.44	13.33	2.13	4.57	4,700
8	*Euphorbia hirta*	13	0.87	4.52	40.00	6.38	10.90	8,700
9	*Gomphrena celosioides*	7	0.47	2.44	26.67	4.26	6.70	4,700
10	*Oldenlandia herbaceae*	43	2.87	14.92	66.67	10.64	25.56	28,700
11	*Panicum maximum*	22	1.47	7.64	40.00	6.38	14.02	14,700
12	*Pennisetum purpureum*	21	1.40	7.28	46.67	7.45	14.73	14,000
13	*Scoparia dulcis*	40	2.67	13.88	46.67	7.45	21.33	26,700
14	*Senna mimosoides*	11	0.73	3.80	40.00	6.38	10.18	7,300
15	*Sida acuta*	13	0.87	4.52	26.67	4.26	8.78	8,700
16	*Spigelia anthelmia*	9	0.60	3.12	20.00	3.19	6.31	6,000
17	*Vernonia cinerea*	10	0.67	3.48	33.33	5.32	8.80	6,700
		∑288	∑19.20		∑626.69			

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

Table 2: **Abundance of species in the first plot where *V. cinerea* was absent**

Quadrat Size: 1 m^2 Sampling intensity: 6.67 %

S/N	Species	No. of each species	Density (m^{-2})	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrap-olation (/ha)
1	*Ageratum conyzoides*	21	1.40	7.28	40.00	6.38	13.66	14,000
2	*Andropogon tectorum*	11	0.73	4.10	20.00	4.17	8.27	7,300
3	*Cocculus pendulus*	17	1.13	6.35	40.00	8.33	14.68	11,300
4	*Crotalaria retusa*	4	0.27	1.52	20.00	4.17	5.69	2,700
5	*Eleusine indica*	37	2.47	13.88	53.33	11.11	24.99	24,700
6	*Mimosa invisa*	8	0.53	2.98	26.67	5.56	8.54	5,300
7	*Oldenlandia herbaceae*	42	2.80	15.73	60.00	12.50	28.23	28,000
8	*Panicum maximum*	19	1.27	7.13	40.00	8.33	15.46	12,700
9	*Panicum repens*	18	1.20	6.74	33.33	6.94	13.68	12,000
10	*Pennisetum purpureum*	21	1.40	7.87	33.33	6.94	14.81	14,000
11	*Phyllanthus amarus*	16	1.07	6.01	33.33	6.94	12.95	10,700
12	*Scoparia dulcis*	39	2.60	14.61	46.67	9.72	24.33	26,000
13	*Sida acuta*	14	0.93	5.22	33.33	6.94	12.16	9,300
		∑267	∑17.80		∑479.99			

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

Table 3: **Abundance of species in the second plot where *V. cinerea* was present**

Quadrat Size: 1 m^2 Sampling intensity: 6.67 %

S/N	Species	No. of each species	Density (m^{-2})	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrap-olation (/ha)
1	*Ageratum conyzoides*	33	2.20	11.04	60.00	11.11	22.15	22,000
2	*Chromolaena odorata*	21	1.40	7.02	33.33	6.17	13.19	14,000
3	*Crotalaria retusa*	14	0.93	4.67	40.00	7.41	12.08	9,300
4	*Cyperus rotundus*	13	0.87	4.37	33.33	6.17	10.54	8,700
5	*Eleusine indica*	45	3.00	15.05	46.67	8.64	23.69	30,000
6	*Euphorbia heterophylla*	11	0.73	3.66	33.33	6.17	9.83	7,300
7	*Euphorbia hirta*	14	0.93	4.67	26.67	4.94	9.61	9,300
8	*Gomphrena celosioides*	41	2.73	13.70	46.67	8.64	22.34	27,300
9	*Oldenlandia herbaceae*	34	2.27	11.39	46.67	8.64	20.03	22,700
10	*Panicum maximum*	21	1.40	7.87	33.33	6.94	14.81	11,300
11	*Scoparia dulcis*	22	1.47	7.38	40.00	7.41	14.79	14,700
12	*Spigelia anthelmia*	39	2.60	14.61	46.67	9.72	24.33	6,700
13	*Tridax procumbens*	12	0.80	5.22	33.33	6.94	12.16	8,000
14	*Vernonia cinerea*	12	0.80	4.01	33.33	6.17	10.18	8,000
		∑299	∑19.93		∑540.00			

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

Table 4: **Abundance of species in the second plot where *V. cinerea* was absent**

Quadrat Size: 1 m^2 Sampling intensity: 6.67 %

S/N	Species	No. of each species	Density (m^{-2})	R.D. (%)	Freq. (%)	R. F. (%)	I.V.I. (%)	Extrap-olation (/ha)
1	*Ageratum conyzoides*	62	4.13	23.65	46.67	10.94	34.59	41,300
2	*Calapogonium mucunoides*	20	1.33	7.62	26.67	6.25	13.87	13,300
3	*Cocculus pendulus*	13	0.81	4.98	33.33	7.81	12.79	8,100
4	*Crotalaria retusa*	12	0.80	4.58	26.67	6.25	10.83	8,000
5	*Emilia praetermissa*	6	0.40	2.29	26.67	6.25	8.54	4,000
6	*Mimosa invisa*	14	0.93	5.33	33.33	7.81	13.14	9,000
7	*Oldenlandia herbaceae*	19	1.27	7.27	40.00	9.37	16.64	12,700
8	*Panicum repens*	16	1.07	6.13	26.67	6.25	12.38	10,700
9	*Pennisetum purpureum*	14	0.93	5.33	40.00	9.37	14.70	9,300
10	*Sida acuta*	22	1.47	8.42	46.67	10.94	19.36	14,700
11	*Spigelia anthelmia*	11	0.73	4.81	26.67	6.25	10.43	7,300
12	*Tridax procumbens*	53	3.53	20.22	53.33	12.50	32.72	35,300
		∑262	∑17.46		∑426.68			

Where R. D. =Relative Density, Freq. =Frequency, R. F. = Relative Frequency and I. V. I. = Importance Value Index.

Table 5: **Species diversity for the plots where *V. cinerea* was present and absent**

Plots	**Equitability**
Where *V. cinerea* was present	0.95
Where *V. cinerea* was absent	0.92

Where H^{l} = Shannon Wiener Index of Diversity.

IV. DISCUSSION

Observations from the abundance of *V. cinerea* and other associated species in the infested plots showed that *V. cinerea* had very low density, frequency and importance value index; implying that, *V. cinerea* had very low species abundance. This also implies that the presence of *V. cinerea* had no influence on the abundance of other associated species in areas where it was present. This observation could be as a result of the presence of some plant species with high competitive ability, capable of suppressing *V. cinerea* and some other species around them. Okereke and Mbaekwe (2011) noted that *Mimosa invisa* has the ability to dominate and suppress all other species around it due to its high competitive ability in any environment it was found. Competition for nutrient, water and light will cause the plants that are more fit, to suppress the plants that are less fit. Speaking on fitness in plant, it describes individual reproductive success. Vandermeer (1989) stated that differences in the way plant species respond to the environment in which they are grown are thought to lead to a more efficient use of available growth resources (nutrients, water, light) with the potential of increasing yields and the competitive suppression of weeds.

Observations from the diversity of species showed that although the plots where *V. cinerea* was present and those in which the plant was absent had high species diversity, plots where *V. cinerea* was present had a higher number of species and these species were more evenly distributed. The high diversity of the species in the plots where *V. cinerea* was present and absent could be as a result of the presence of less invader species in the plots (though not investigated). This agrees with what Kercher and Zedler (2004) stated that an increase in abundance of the invaders can decrease the diversity of species.

V. CONCLUSION

It was concluded that the presence of *V. cinerea* did not have any observable impact on the plant biodiversity in areas where it occurs and *V. cinerea* is, therefore, not an invasive species. Because of its low competitive ability as established in this study and its high medicinal value as found in the literature, effort should be made to conserve this plant and prevent it from going into extinction.

REFERENCES

[1] Akamigbo, F. O. R. (1992). Environmental Problems of Anambra State: Land Degradation, Solution and Strategy for Sustainable Environment. Government House Press, Enugu.

[2] Clarke, K. R. and Warwick, R. M. (2001). *Change in Marine Communities*: An Approach to Statistical Analysis and Interpretation, 2nd edition, PRIMER-E Ltd., Plymouth Marine Laboratory, UK. 172pp.

[3] Curtis, J. T. and McIntosh, R. P. (1950). The Interrelations of Certain Analytic and Synthetic Phytosociological Characters. *Ecology* 31(3):434-455.

[4] Harborne, J. B. and Williams, C. A. (1977). Vernonia – Chemical Review. In: *The Biology and Chemistry of Compositae* (Volume 1). Academic Press, London. pp. 523-537.

[5] Herrera, C. L., Chanco, G. L. and Sison, F. M. (1980). Chemical and Pharmacological Studies on Vernonia patula and Vernonia cinerea. In: *4th Asian Symposium on Medicinal Plants and Spices: Abstracts*. Department of Chemistry, Faculty of Science, Mahidol University, Bangkok. 249pp.

[6] Holm, L., Doll, J., Holm, E., Pancho, J. and Heiberger, J. (1997). *World Weeds*: Natural Histories and Distribution. John Wiley and Sons, New York, United States. 1129pp.

[7] Hopkins, B. (1974). *Forest and Savanna*: An Introduction to Tropical Plant Ecology. Hernmann Educational Books Ltd, London. 154pp.

[8] Jackson, A. and Forrester, E. (1974). *Practical Geography*. Toranto: McGraw-Hill Ryerson Limited. 190pp.

[9] Kercher, S. M. and Zedler, J. B. (2004). Multiple disturbances accelerate invasion of reed canary grass (Phalaris arundinacea L.) in a mesocosm study. *Oecologia* 138:455-464.

[10] Michael, P. (1984). *Ecological methods for field and laboratory investigation*. Tata Mc Graw Hill Publishing Co. Ltd., New Delhi.

[11] Okereke, C. N. and Mbaekwe, E. I. (2011). Some Aspects of the Biology and Ecology of Mimosa invisa Mart. around Agu-Awka, Anambra State, Nigeria. *Nigerian Journal of Botany* 24(1):67-80.

[12] Oliver, B. B. (1986). *Medicinal Plants in Tropical West Africa*. Cambridge University Press, Cambridge, New York, Melbourne. 125pp.

[13] Richards, W. (2005). INCN/SSC. Invasive Species Specialist Group (ISSG), Global Invasive Species Database. *Annals of Botany* 21:287-314.

[14] Smith, A. C. (1991). *Flora Vitiensis Nova*: A New Flora of Fiji. Lawai, Kauai, Hawai. National Tropical Botanical Garden, Volume 5, 626pp.

[15] Sutherland, W. J. (1997). *Ecological Census Techniques*. Cambridge: Cambridge University Press. 336pp.

[16] Tadesse, A., Gebre, H. A., Asres, K., Djote, M. and Frommel, D. (1993). The in Vitro Activity of Vernonia amygdalina on Leishmania aethiopica. *Ethiopian Medical Journal* 31(3): 183-189.

[17] Vandermeer, J. H. (1989). *The ecology of intercropping*. Cambridge University Press, Cambridge, Great Britain. 237pp.

AUTHORS

First Author – NWAOGARANYA, Uche Patrick, B. Sc (Botany) and M. Sc (Plant Ecology), Department of Botany, Nnamdi Azikiwe University, Anambra State, Nigeria, e mail: brightpledge001@gmail.com

Second Author – MBAEKWE, I. Ebenezer, B. Sc, M. Phil and Ph.D (Plant Ecology), Department of Botany, Nnamdi Azikiwe University, Anambra State, Nigeria.

Corresponding Author – NWAOGARANYA, Uche Patrick, e mail: brightpledge001@gmail.com, contact no: 08060533994.