



## Ecological diversity of certain herbs of Rewa district Madhya Pradesh

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### Abstract

Ecology is the interrelationship between organisms and their environment. The environment includes climatic, edaphic and biotic factors and it determines the distribution, prevalence, competing ability, behaviour and survival of the plant. During present investigation the phytosociological experiments were made in three selected study sites. The 43 associates was observed in Kuthulia and Padra locality where 41 associates was noted from Saman locality. The *Ageratum conyzoides* is recorded as dominant associates by calculating the IVI 7.612, 8.16 and 8.138 in all the selected sites viz., Kuthulia, Padra and Saman respectively. While the highest IVI of *Bidens pilosa* was observed 2.816, 2.694 and 1.499 in all localities. The highest IVI of *Ageratum conyzoides* was noted in Saman locality and highest IVI of *Bidens pilosa* is also Padra locality. It is due to some invasive plants are so successful in new environments may be that they bring novel mechanisms of interactions with the recipient community.

**Keywords:** ecological, diversity, herbs, phytosociology, Rewa

### Introduction

Species diversity, the most important characteristics of the biological community, may be either in their pattern of distribution in a particular area/environment/climate or in their genetic make-up/constitution or in their centres of origin. Thus three types of species diversity namely pattern diversity, genetic diversity and geographical diversity are most common and highly informative to botanists/biologists, however, the pattern diversity, results from zonation, stratification, periodicity, patchiness, food webs and other arrangements of components population, is more informative to ecologist. The genetic diversity originates from heterozygosity, polymorphism and genetic drift is more help full to breed us whereas geographic diversity represents the centre of origin of a species helps to biologists in determining the wild species of a particular genus. In the present ecological study, the margin emphasis is being given on pattern diversity.

The notion of diversity was first given by Fisher *et al.* (1943)<sup>[1]</sup> to mean the number of species, called species richness or species diversity considering common and rare species alike. Whittaker (1965)<sup>[2]</sup> suggested the terms,  $\alpha$ ,  $\beta$  and  $\gamma$  diversity depending upon the magnitude and range of environment and community. The  $\alpha$  diversity represents the diversity within a single community. The beta diversity pertains to diversity between communities in one range of environment where as the gamma diversity deals with the diversity between communities occurring in large range of environments. According to McIntosh (1967)<sup>[3]</sup> diversity is a mechanism which generates community stability. Pielou (1966)<sup>[4]</sup> used the term "pattern diversity" to refer the degree of segregation of individuals of one population from those to another. Peet (1974)<sup>[5]</sup> considered the diversity as indices of heterogeneity and reported that the diversity is function of both the number of species present and their relative abundance. Sai & Mishra (1986)<sup>[6]</sup> also define the diversity as a function of the number

of species precise present in a given area and of the evenness with which the individuals are distributed. It is, thus, clear that the important components of diversity are species richness or species diversity and evenness or equitability.

Two broad approaches are known to measure the species diversity. In the first approach, the species abundance or dominant frequencies are fitted to the various theoretical distributions and when one or the other of these are found well fitted, the parameter of the fitted distribution are taken as the measures of species diversity. The theoretical distribution commonly used are log normal, negative binomial, geometric and log arthmic series (Pielou, 1966)<sup>[4]</sup>. This approach, however, is not suitable and widely applicable on account of difficult and impractical assumptions. The second approach used to measure the species diversity is diversity indices based on descriptive statistics. Among the diversity indices, one is an index of species richness and second is an index of evenness or equitability. The combined index of both components is termed as general indices of diversity. Besides, the concentration of dominance, measured by Simpson's index (Simpson, 1949)<sup>[7]</sup> is the fourth index of diversity.

### 2. Material and methods

The Rewa district is located between 81-15. East longitude and 24-42 North latitude and is situated on the Vindhya Plateau at the height of 318 m above MSL.

Rewa is synonyms of holy river Narmada. Narmada flows in a larger part of Rewa-Khand hence the name Rewa was adopted. The town is situated on the confluence of Bihar and Bichhia river. Rewa is connected by National Highway 7 and many other state highways pass through the town. The town is connected from Satna through railway link. It has got a small air strip at Chorahata. It is connected by road with Allahabad (127 km.), Nagpur (495 km.), Satna (52 km.), Sidhi (100 km.) and Shahdol (161 km.).

*Ageratum conyzoids* and *Bidens pilosa* are a common weed of gardens cultivated fields and waste lands. They also reported on disturbed grounds such as cleared areas in forest, uncultivated fields, path and road side etc. In the present study qualitative characteristics viz. relative frequency, relative dominance or relative cover and Importance Value Index (I.V.I.) were estimated in the three selected localities of Rewa viz. Kuthulia, Padra and Saman.

Using the quadrat of M<sup>2</sup> random method was used. Quadrats are thrown at ten different places in each of the selected sites for study. Weed associates of different species were counted each time and the average for each area was calculated. Frequency classes of associates were assigned as per method suggested by Mishra and Puri (1954) and Pandey *et al.* (1968). Then the total number of quadrats in which the individual species occurred is counted. Also the total number of individual species in all the quadrats was counted. Relative frequency, relative density, relative dominance, basal area Importance Values Index (IVI) was calculated by the following formula.

$$\text{Relative Frequency (R.F.)} = \frac{\text{No. of occurrence of a species}}{\text{No. of occurrence of all species}} \times 100$$

$$\text{Relative Density (R.D.)} = \frac{\text{Total No. of individuals one species in all quadrats}}{\text{Total No. individuals of all species in all quadrats}} \times 100$$

$$\text{Relative Dominance (R. Dom)} = \frac{\text{Total basal area of species in all quadrats}}{\text{Total basal area of all species in all the quadrats}} \times 100$$

$$\text{Importance Value Index} = \text{Relative Frequency} + \text{Relative Density} + \text{Relative Dominance}$$

### 3. Results and discussion

#### Phytosociology

Plants generally prefer to live in groups or colonies because they do not prefer to live as isolated individual. Various type of plants form a plant community by living in a habitat. Plant communities differ from place to place and at the same place at different times. The plant associations are studied in a plant community. The special field of the study of communities with respect to their components, structure and classification forms the basis of a special field of ecology called phytosociology (Ambasht, 1988)<sup>[8]</sup>. An individual community is characterised by its species diversity, growth forms, structure, dominance and successional trend etc. Two sets of characters viz. analytic and synthetic are studied in a community at the same time. The synthetic characters are based on analytical characteristics. The analytic characters are studied by two methods-namely quantitative and qualitative methods. Quantitative methods can be measured easily than the others while qualitative can be described and not measured.

The continuous interactions and reactions of various climatic, edaphic and biotic factors among the different species as well as the same species affect the structure of a particular plant community.

In the present study only the qualitative characteristics viz., Frequency, density, abundance, cover (dominance) and IVI (Importance Value Index) were estimated to assess the

structure of the community in which the plants *Ageratum conyzoids* and *Bidens pilosa* grows.

For the sampling of vegetational cover, random sampling method is used with the help of quadrat (Mishra and Puri, 1954, Puri, 1954 and Pandeya, 1961-64)<sup>[9-11]</sup>. M<sup>2</sup> size quadrat is used for present study. Three sites were chosen for present study Kuthulia, Padra & Saman. The quadrat was placed randomly at 10 places in three selected sites of each area. Care was taken to choose only those spots where minimum disturbances were expected to take place.

Frequency: In the community the individuals of all species are not evenly distributed. Individuals of some species are widely spaced while those of some other species are found in clumps or mats. The distribution patterns of individuals of different species indicate their reproductive capacity as well as their adaptability to the environment.

Frequency refers to the degree of dispersion in an area in terms of percentage occurrence. It was introduced by Raunkaier (1918)<sup>[12]</sup>. If the individuals of a species are evenly distributed over the area they may occur in all the sample plots and thus the frequency of species will be 100%. Poorly dispersed species will occur only in a few quadrats and their frequency will be low. This indicates that higher frequency value of a species in the area will be greater.

Density: The numerical strength of a species in relation to a definite unit space is called its density. So it is an expression of numerical strength of a species where the total number of individuals of each species is divided by the total number of quadrat studied.

Each organisms occupies only the area that can adequately meet its requirements. Thus the density of an organisms refers to this amount of area available as living space. Some times the term density does not give a clear idea about an individual where it stands in the relative density has calculated for getting a clear picture of an individual in a community.

Cover: Cover meant the area occupied by leaves stems, and flowers as viewed from the top. It has great ecological importance because it gives an idea as to how much of area a species is occupying. The cover is independent of density and frequency. It is expressed in terms of percentage of area covered.

The coverage is studied at the canopy level and at the basal region. The average basal area is calculated out of average cross section of stem penetrating the soil. The average area of one stem multiplied by the density (no. of individuals per unit area), gives the basal cover per unit area.

Importance Value Index: In any plant community data of frequency, density, abundance and cover of species do not yield total picture of ecological importance independently. The overall picture of ecological importance of a species in relation to the community structure can be obtained by adding the values of relative density, relative dominance, and relative frequency. This total value out of 300 is called Importance Value Index (IVI) of the species.

The importance of IVI was first pointed out of Curtis, & Cottom, (1956)<sup>[13]</sup>. The IVI gives complete picture of sociological characters of a species in the community but it does not give the dimension of relative density, relative dominance, and relative frequency. Three radii from centre to circumference are divided in to 100 segments and are marked

the value of relative frequency, relative density and relative dominance. The fourth radius is divided in to 300 parts and marked the value of IVI. All these points on different radii are

joined by lines. Thus a graph illustrating the sociological character and IVI of individual species is obtained.

**Table 1:** Importance Value Index (I.V.I.) of the species found in Kuthulia as associates of *Ageratum conyzoids* and *Bidens pilosa*

S. No.	Name of the species	Relative frequency	Relative Density	Relative Cover	I.V.I.
1.	<i>Achyranthus aspera</i>	1.932	1.990	0.28	4.202
2.	<i>Ageratum conyzoides</i>	1.621	2.040	3.951	7.612
3.	<i>Alysicarpus longifolius</i>	2.510	1.606	0.324	4.440
4.	<i>Amaranthus gangeticus</i>	0.966	1.326	2.634	4.926
5.	<i>Argemone maxicana</i>	1.998	1.406	0.622	4.026
6.	<i>Aurea lanata</i>	1.081	1.020	0.252	2.353
7.	<i>Bidens pilosa</i>	0.959	0.859	0.998	2.816
8.	<i>Boerhaavia diffusa</i>	4.324	2.891	0.531	7.746
9.	<i>Bothriochloa pertusa</i>	4.235	4.359	1.102	9.696
10.	<i>Caesulia axilaris</i>	0.966	0.829	0.439	2.234
11.	<i>Cassia obtusifolia</i>	1.932	1.658	0.043	3.633
12.	<i>Cassia tora</i>	3.864	3.482	0.490	7.863
13.	<i>Chrochorus capsularis</i>	0.966	0.497	0.108	1.571
14.	<i>Croton sparciflorus</i>	1.499	1.160	0.576	3.185
15.	<i>Cynodon dactylon</i>	4.830	5.970	1.577	12.377
16.	<i>Cyperus rotundus</i>	2.898	2.653	4.020	9.571
17.	<i>Desmodium triflorum</i>	4.712	4.451	0.389	9.552
18.	<i>Desmostachya bipinnata</i>	2.898	2.155	3.171	8.224
19.	<i>Dichanthium annulatus</i>	5.235	6.041	1.338	12.614
20.	<i>Dicliptera micranthes</i>	4.324	4.081	0.106	8.511
21.	<i>Eclipta prostrata</i>	1.081	1.190	0.206	2.477
22.	<i>Euphorbia hirta</i>	4.324	5.102	0.284	9.710
23.	<i>Euphorbia microphylla</i>	0.837	0.937	0.639	2.413
24.	<i>Evolvulus alsinoides</i>	2.510	2.141	0.145	4.796
25.	<i>Indigofera cordifolia</i>	2.092	1.399	0.035	3.466
26.	<i>Indigofera linifolia</i>	0.837	0.803	0.102	1.742
27.	<i>Launea nudicaulis</i>	0.540	0.170	0.005	0.715
28.	<i>Leonotis nepetifolia</i>	6.405	8.927	30.480	45.857
29.	<i>Malvestrum coromandelianum</i>	4.235	6.041	12.845	23.121
30.	<i>Martinia diandra</i>	0.523	0.317	1.00	1.840
31.	<i>Melilotus alba</i>	1.570	1.907	0.173	3.650
32.	<i>Melilotus parviflora</i>	2.702	2.721	0.088	5.511
33.	<i>Oldenlandia corymbosa</i>	1.047	0.953	0.500	2.500
34.	<i>Oxalis corniculata</i>	3.664	3.497	0.107	7.268
35.	<i>Parthenium hysterophorus</i>	2.415	2.487	0.298	5.20
36.	<i>Phyllanthus niruri</i>	4.188	3.38	0.124	7.650
37.	<i>Ruellia petula</i>	2.617	3.179	0.389	6.185
38.	<i>Ruellia tuberosa</i>	1.570	1.589	0.222	3.381
39.	<i>Rungia elegans</i>	2.094	1.907	0.180	4.181
40.	<i>Sida cordifolia</i>	4.188	4.133	0.455	8.776
41.	<i>Striga ephrasoides</i>	1.483	1.331	1.070	3.884
42.	<i>Tridax procumbens</i>	3.864	3.482	2.579	9.925
43.	<i>Vernonia cinerea</i>	1.047	0.476	1.361	2.884

**Table 2:** Importance Value Index (I.V.I.) of the species found in Padra as associate of *Ageratum conyzoids* and *Bidens pilosa*

S. No.	Name of the species	Relative frequency	Relative Density	Relative Cover	I.V.I.
1.	<i>Achyranthus aspera</i>	3.347	4.284	8.948	16.579
2.	<i>Ageratum conyzoides</i>	1.884	1.554	4.722	8.16
3.	<i>Alysicarpus longifolius</i>	2.510	1.606	0.324	4.44
4.	<i>Alysicarpus monilifer</i>	4.324	3.401	0.488	8.213
5.	<i>Amaranthus gangeticus</i>	0.837	1.020	2.294	4.151
6.	<i>Argemone maxicana</i>	2.510	1.606	0.772	4.838
7.	<i>Bidens pilosa</i>	0.837	1.803	0.054	2.694
8.	<i>Boerhaavia diffusa</i>	2.824	2.220	0.676	5.72
9.	<i>Bothriochloa pertusa</i>	1.474	1.272	4.364	7.11
10.	<i>Caesulia axilaris</i>	0.947	0.635	0.130	1.712

11.	<i>Cassia obtusifolia</i>	2.412	2.940	0.442	5.794
12.	<i>Cassia tora</i>	3.110	2.901	0.115	6.127
13.	<i>Corchorus capsularis</i>	1.325	0.935	0.090	2.35
14.	<i>Croton sparciflorus</i>	2.116	2.518	0.982	5.616
15.	<i>Cynodon dactylon</i>	4.584	4.455	5.442	14.481
16.	<i>Cyperus rotundus</i>	2.248	3.224	0.919	9.391
17.	<i>Desmodium triflorum</i>	3.437	4.018	0.284	7.739
18.	<i>Desmostachya bipinnata</i>	0.947	0.643	5.112	6.702
19.	<i>Dichanthium annulatum</i>	4.248	4.422	1.624	10.294
20.	<i>Dicliptera micranthes</i>	1.847	4.822	1.625	8.294
21.	<i>Eclipta prostrata</i>	1.552	1.933	0.204	3.689
22.	<i>Euphorbia hirta</i>	2.646	3.484	0.213	6.343
23.	<i>Euphorbia microphylla</i>	0.980	0.947	0.649	2.576
24.	<i>Evolvulus alsinoides</i>	2.612	2.241	0.148	5.001
25.	<i>Indigofera cordifolia</i>	2.290	1.993	0.145	4.328
26.	<i>Indigofera linifolia</i>	0.938	0.802	0.106	1.846
27.	<i>Launea nudicaulis</i>	3.249	2.848	6.972	13.069
28.	<i>Leonotis nepetifolia</i>	8.148	12.324	32.816	53.342
29.	<i>Malvestrum coromandelianum</i>	4.184	2.144	6.040	12.373
30.	<i>Martinia diandra</i>	0.948	0.525	0.162	1.635
31.	<i>Melilotus alba</i>	1.584	1.249	0.545	3.378
32.	<i>Melilotus parviflora</i>	2.184	1.078	0.045	3.937
33.	<i>Oldenlandia corymbosa</i>	0.849	0.632	0.021	1.502
34.	<i>Oxalis corniculata</i>	2.002	2.464	0.080	4.456
35.	<i>Parthenium hysterophorus</i>	2.982	2.542	0.482	6.006
36.	<i>Phyllanthus niruri</i>	2.948	3.178	0.160	6.286
37.	<i>Ruellia petula</i>	4.814	4.355	0.188	9.287
38.	<i>Ruellia tuberosa</i>	1.322	1.065	0.074	2.461
39.	<i>Rungia elegans</i>	1.764	1.806	0.025	3.595
40.	<i>Sida cordifolia</i>	2.612	2.912	0.298	5.822
41.	<i>Striga ephrasoides</i>	0.947	0.632	0.156	1.735
42.	<i>Tridax procumbens</i>	2.928	2.932	2.640	8.5
43.	<i>Vernonia cinerea</i>	0.803	0.339	0.392	1.534

**Table 3:** Importance Value Index (I.V.I.) of the species found in Saman as associate of *Ageratum conyzoides* and *Bidens pilosa*

S. No.	Name of the species	Relative frequency	Relative Density	Relative Cover	I.V.I.
1.	<i>Achyranthus aspera</i>	4.188	4.133	7.825	16.146
2.	<i>Ageratum conyzoides</i>	1.932	2.321	3.885	8.138
3.	<i>Alysicarpus longifolius</i>	1.932	1.990	3.441	7.363
4.	<i>Amaranthus gangiticus</i>	1.047	0.953	1.758	3.758
5.	<i>Argemone maxicana</i>	2.106	1.988	0.918	5.022
6.	<i>Aurea lanata</i>	1.449	1.160	0.065	3.647
7.	<i>Bidens pilosa</i>	0.837	0.535	0.127	1.499
8.	<i>Bothriochloa pertusa</i>	3.830	5.965	1.486	11.281
9.	<i>Cassia obtusifolia</i>	2.510	2.945	0.448	5.903
10.	<i>Cassia tora</i>	2.162	2.040	9.592	13.794
11.	<i>Chorchorus capsularis</i>	1.081	1.020	0.144	2.215
12.	<i>Croton sparciflorus</i>	3.783	2.552	0.077	6.411
13.	<i>Cynodon dactylon</i>	5.405	6.632	1.892	13.929
14.	<i>Cyperus rotundus</i>	2.662	1.870	5.426	9.458
15.	<i>Decliptera micranthes</i>	1.047	1.271	0.220	2.538
16.	<i>Desmodium triflorum</i>	4.184	4.622	1.523	10.329
17.	<i>Desmostachya bipinnata</i>	3.783	4.591	0.408	8.782
18.	<i>Dichanthium annulatum</i>	1.674	1.473	0.099	3.246
19.	<i>Eclipta prostrata</i>	4.712	4.769	0.212	9.603
20.	<i>Euphorbia hirta</i>	0.483	0.165	10.004	10.652
21.	<i>Euphorbia microphylla</i>	0.483	0.165	10.004	10.652
22.	<i>Evolvulus alsinoides</i>	1.449	0.995	0.688	3.132
23.	<i>Indigofera cordifolia</i>	0.966	0.829	3.030	4.825
24.	<i>Indigofera linifolia</i>	0.966	0.995	0.707	2.668
25.	<i>Launea nudicaulis</i>	1.932	1.990	6.840	10.762
26.	<i>Leonotis nepetifolia</i>	5.830	7.633	28.934	42.397
27.	<i>Malvestrum coromandelianum</i>	3.234	5.041	10.845	19.12

28.	<i>Martinia diandra</i>	0.966	0.497	0.140	1.603
29.	<i>Melilotus alba</i>	2.617	2.543	0.040	5.200
30.	<i>Melilotus parviflora</i>	3.864	2.985	0.083	6.932
31.	<i>Oldenlandia corymbosa</i>	0.966	0.995	0.707	2.668
32.	<i>Oxalis corniculata</i>	3.864	2.985	0.083	6.932
33.	<i>Parthenium hysterophorus</i>	3.141	2.702	0.014	4.857
34.	<i>Phyllanthus niruri</i>	3.864	3.316	0.154	7.336
35.	<i>Ruellia petula</i>	3.381	3.482	0.418	7.281
36.	<i>Ruellia tuberosa</i>	2.449	1.326	1.078	4.853
37.	<i>Rungia elegans</i>	1.483	1.165	1.267	3.145
38.	<i>Sida cordifolia</i>	4.347	3.648	0.368	8.363
39.	<i>Striga euphrasioides</i>	2.415	1.824	0.097	4.336
40.	<i>Tridax procumbens</i>	2.415	1.824	0.097	4.336
41.	<i>Vernonia cinerea</i>	1.081	0.680	1.774	3.535

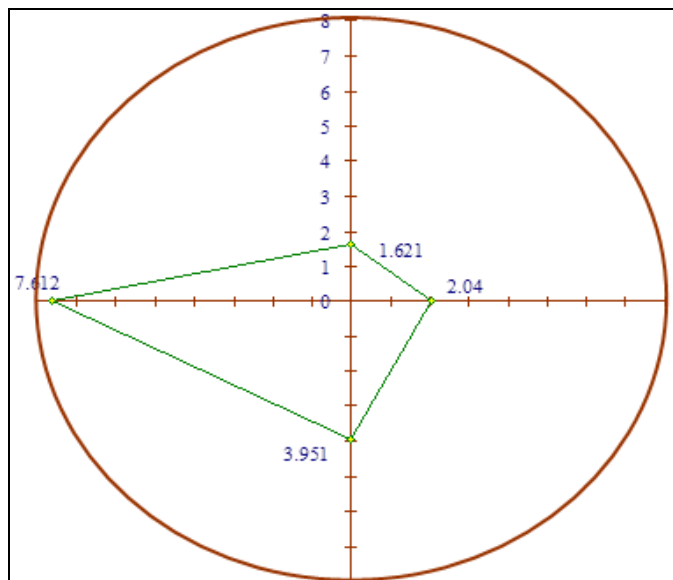


Fig 1: Importance Value Index (I.V.I.) of the species found in Kuthulia as associates of *Ageratum conyzoids*

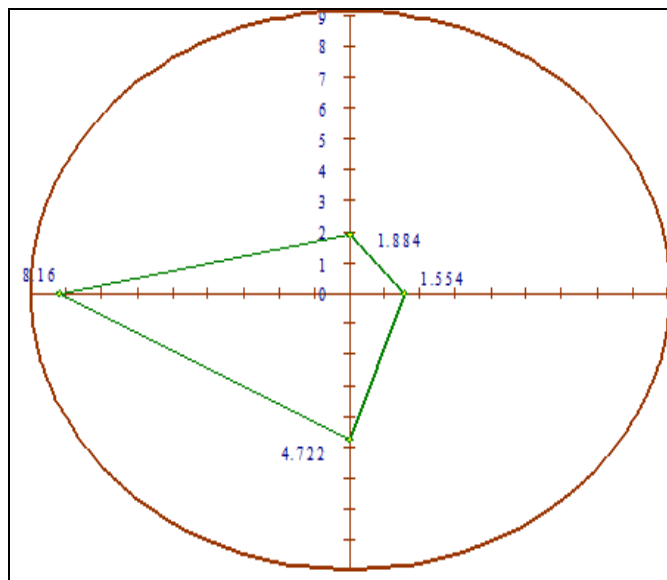


Fig 3: Importance Value Index (I.V.I.) of the species found in Padra as associates of *Ageratum conyzoids*

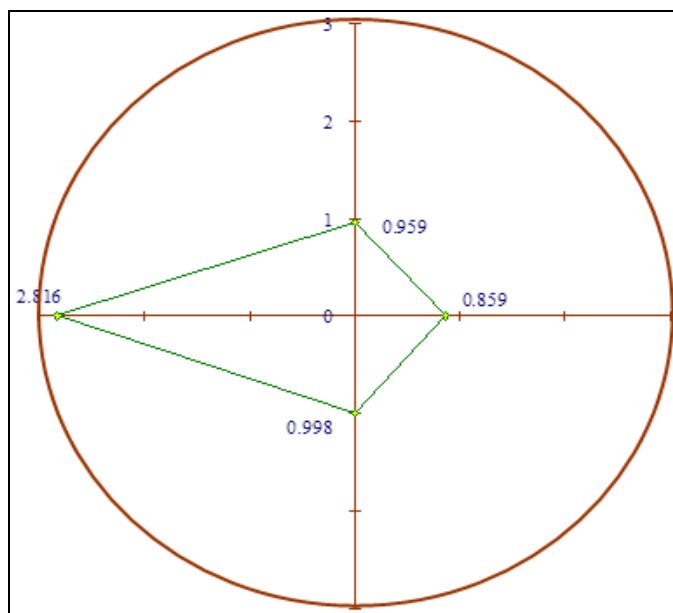


Fig 2: Importance Value Index (I.V.I.) of the species found in Kuthulia as associates of *Bidens pilosa*

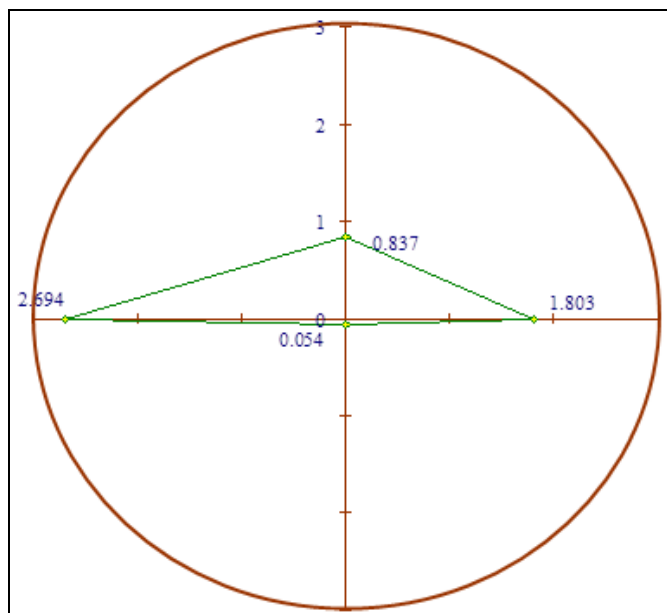
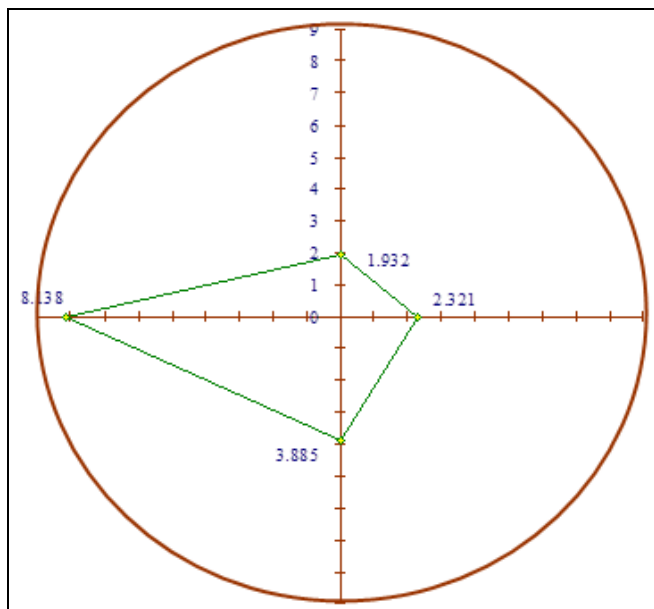
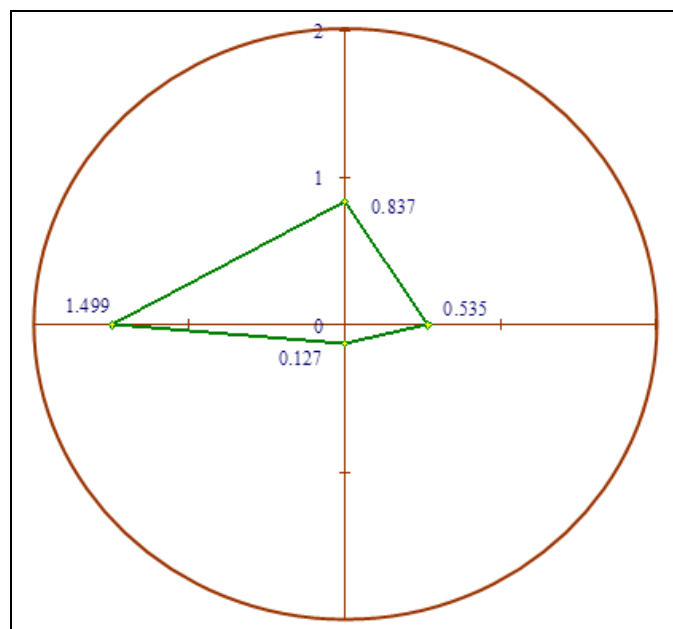


Fig 4: Importance Value Index (I.V.I.) of the species found in Padra as associates of *Bidens pilosa*



**Fig 5:** Importance Value Index (I.V.I.) of the species found in Saman as associates of *Ageratum conyzoides*



**Fig 6:** Importance Value Index (I.V.I.) of the species found in Saman as associates of *Bidens pilosa*

#### 4. Conclusion

Ecology is the interrelationship between organisms and their environment. The environment includes climatic, edaphic and biotic factors and it determines the distribution, prevalence, competing ability, behaviour and survival of the plant.

The phytosociological study were made in three selected study sites. The 44 associates was observed in Kuthulia and Padra locality where 42 associates was noted from Saman locality. The *Ageratum conyzoides* is recorded as dominant associates by calculating the IVI 7.612, 8.16 and 8.138 in all the selected sites viz., Kuthulia, Padra and Saman respectively. While the highest IVI of *Bidens pilosa* was observed 2.816, 2.694 and 1.499 in all localities. The highest IVI of *Ageratum conyzoides*

was noted in Saman locality and highest IVI of *Bidens pilosa* is also Padra locality. It is due to some invasive plants are so successful in new environments may be that they bring novel mechanisms of interactions with the recipient community. However, Wagh and Jain (2015)<sup>[14]</sup> concluded that factors other than allelopathy might be operating in nature that favours rapid establishment and persistence of dense stands of alien species.

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#### 6. References

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