I J P S INTERNATIONAL JOURNAL OF PLANT SCIENCES
ISSN-0973-1547 Volume 17 | OCAEBGD- 2022 | 23-27
DOI: 10.15740/HAS/IJPS/17/OCAEBGD/23-27
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RESEARCH ARTICLE

Assessment of diversity indices and rank abundance curve for herbaceous community of Junaghad district of Saurashtra

■ **Mubassera Qureshi, Shrey Pandya, Punita Parikh and Chirag Tank**

SUMMARY

This Research was aimed at studying diversity indices and plotting a Rank Abundance Curve for herbaceous plant community at Kapuriyavadi area located in Junagadh District of Saurashtra region. The study was conducted from July to September 2021-22. Five quadrats of 1mx1m size were randomly laid down in the study area in such a way that they include maximum vegetation cover. Total number of individuals of each plant species, Rank abundance curve and Simpsons and Shannon-Wiener indices were calculated. A total of 33 plant species were identified and listed.*Brachiariasp.Cyanodondactylon* and *Phyllanthus niruri*recorded more number of individual of species than the other species in the area, *Brachiaria sp.* being maximum (63 individuals) followed by *C. dactylon (58) and P. niruri*(47 individuals).Simpson's and Shannon diversiy indices were then calculated for the plant community under investigation. The values were found to be 0.082 and 2.861 for Simpson's and Shannon-Weiner respectively. To overcome shortcomings of these indices, Rank Abundance Curve to display relative species abundance was plotted for the community. The species richness was found to be maximum for *Brachiaria sp.* whereas the lowest were recorded for *Xanthium strumarium, Calotropis procera, Sesamum sp., Trichodesma indicum, Boeerhaviaerecta and Cardiospermum halicacabum. Brachiarasps.* was investigated to be the highest ranking species that have much higher abundance as compared to other species in the area. *Xanthium strumarium, Calotropis procera, Sesamum sp., Trichodesma indicum, Boeerhaviaerecta*and *Cardiospermum halicacabum*were found to be lower raking spp. with much lower abundances. A steep gradient of the curve obtained for Rank Abundance indicated low evenness in the community since the high ranking species have much higher abundances than the low ranking species. Descriptive statistics followed by statistical test was applied to understand the variation in biodiversity indices within all quadrates.

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Key Words : Herbaceous communities, Simpson's index, Shannon-wiener index, Speciesrichness, Species evenness, Rank abundance curve

How to cite this article : Qureshi, Mubassera, Pandya, Shrey, Parikh, Punita and Tank, Chirag (2022). Assessment of diversity indices and rank abundance curve for herbaceous community of Junaghad district of Saurashtra. *Internat. J. Plant Sci.*, **17** (OCAEBGD): 23-27, **DOI: 10.15740/HAS/IJPS/17-OCAEBGD/23-27,**

Article chronicle : Received : 14.11.2022; **Accepted :** 18.11.2022

Biodiversity refers to the diversity of all forms of life, including the variation in genes, species and functional traits. It is often measured as: Richness, a measure of the quantity of distinctive life forms, evenness, a measure of the equity between life forms, and heterogeneity, a measure of the differences between life forms [1]. The biodiversity we observe today is the product of billions of years of evolution, shaped by natural forces and, increasingly, by the influence of humans.

About 2.1 million species have so far been recognised, mainly small creatures like insects. Despite UNEP estimates that there are between 9.0 and 52 million species on earth, scientists believe that there are actually around 13 million species[13].Every ecosystem has a community of living things, including humans, who interact with one another as well as the air, water, and soil around them. Thus, there are three main levels of biodiversity. Genetic diversity which is simply the variety of genes within species and populations.Species diversity that refers to the variety of species or living things and is calculated using- the number of species present in a given area can also be called as the area's species richness. Understanding an ecosystem's structure and function as well as predicting future changes depends on knowing what species live there and how many of each kind there are in total. Species Abundance refers to the relative numbers among species. A community's functioning can be understood by understanding the species abundance. In nature, not all species of a community are equally different.

Ecosystem diversity that relates to the variety of habitats, biotic communities and ecological processes in the biosphere.Ecologists use a graph to show relative species abundance, a component of biodiversity, called a rank abundance curve or Whittaker plot. It can be used to illustrate both species richness and species evenness. The information provided by rank abundance curves is crucial for understanding species richness and community complexity. This method allowed scientists to predict how community patterns will shift in response to environmental changes. It is also possible to analyse microbial communities using rank abundance curves [15]. A community's species diversity can be quantified mathematically using a diversity index. Important data on the rarity and abundance of species within a community can be found in diversity indices.The ability to quantify diversity in this way is an important tool for biologists trying to understand community structure.

The current study was carried out in order to assess the species richness and abundance of a herbaceous community at Kapuriya-vadivistar, Nonjanav of District Junagadh,,. Additionally, a Rank Abundance curve was generated to represent the relative abundance of the species. For the community, diversity indices like Simpson's and Shannon indices were computed.

MATERIAL AND METHODS

For finding out species richness and abundance of the community, method of Magurran (2004) and Saeedghalati, M. (2017) was applied respectively. Species identification was done by Flora of Bombay Presidency and flora of Saurashtra[16]. Based on the data obtained, Simpson's and Shannon diversiy indices were calculated for the community [22].

RESULTS AND DISCUSSION

Dorji *et al.,* 2018 had reported 93 plant species belonging to 63 genera. Graminoid species *K. pygmaea*, *C. incurva, C. moocroftii,* and *P. hirtiglumis* were found to be dominant species in the study area . Species of Fabaceae, Rosaceae, Caryophyllaceae, and Asteraceae were also common. In total, 11 graminoids, 4 cushion plants, 4 shrub species, and 74 forb species were found.

The community under study reported a total 33 plant species (Table 1) belonging to the 17 families, the species richness being maximum for *Brachiaria sp.* and the lowest for *Xanthium strumarium, Calotropis procera, Sesamum sp., Trichodesma indicum, Boeerha viaerecta and Cardiospermum halicacabum.* The dominant families were found in the order Fabaceae >Poaceae>Commelinaceae = Euphorbiaceae = Convolvulaceae = Asteraceae > Solanaceae = Phyllanthaceae = Apocynaceae = Malvaceae = Pedaliaceae = Cleomaceae = Boraginaceae = Rubiaceae = Nyctaginaceae = Sapindaceae.(Table 2, Fig.1).

Rank abundance curves (RAC) provide essential information that supports species richness and community complexicity. With the help of this tool, scienists could predict changes in community patterns in response to environmental changes.A rank abundance curve are a chart to display relative species abundance, which is a component of biodiversity. It also can be used to visualize species richness and evenness. The species with the most individuals has a rank of 1 and the species with the next highest count of individuals has a rank of 2. Species

Table 1 :

Sr. No.	Code	Species	Quadrate					Total No. of individuals	Rank abundance
			Q1	Q2	Q3	Q4	Q5		
1.	A	*Brachiaria spp.*	17	15	17	0	14	63	0.155555556
2.	B	*Commelinadiffusa*	8	6	5	2	8	29	0.071604938
3.	C	*Commelinabeghalensis L.*	5	13	2	1	3	24	0.0.59259259
4.	D	*Acalypha indica L.*	6	2	1	0	3	12	0.027160494
5.	E	*Desmodiumdichotomum*	4	0	0	2	0	6	0.014814815
6.	F	*Physalis minima L.*	4	5	4	2	0	15	0.37037037
7.	G	*Euphorbia hirta*	2	0	2	0	1	5	0.012345679
8.	H	*Phyllanthisniruri*	17	13	10	3	4	47	0.116049383
9.	I	*Digera arvensis Forssk.*	5	9	8	2	0	24	0.59259259
10.	J	*Ipomoea triloba L.*	3	0	4	0	0	7	0.017283951
11.	K	*CyanodonDactylon*	14	16	7	12	9	58	0.143209877
12.	L	*Achyranthes aspera*	3	4	0	0	0	7	0.017283951
13.	M	*Tridexprocubens*	2	4	0	6	4	16	0.039506173
14.	N	*Xanthium strumarium*	0	1	0	0	0	1	0.002469136
15.	O	*Calotropis procera*	0	1	0	0	0	1	0.002469136
16.	P	*Eragrostistenella*	0	1	4	6	5	16	0.039506173
17.	Q	*Corchorus olitoris*	0	0	1	1	1	3	0.007407407
18.	R	*Sesamum*	0	0	1	0	0	1	0.002469136
19.	S	*Cleome viscosa L.*	0	0	1	3	1	5	0.012345679
20.	T	*Vigna (Fabaceae) Member*	0	0	1	0	2	3	0.007407407
21.	U	*Senegaliachundra*	0	0	0	3	0	3	0.007407407
22.	V	*Chloris barbata*	0	0	0	26	0	26	0.064197531
23.	W	*Amaranthaceae member*	0	0	0	2	0	2	0.004938272
24.	X	*Trichodesma indicum*	0	0	0	1	0	1	0.002469136
25.	Y	*Evolvulusnummularius*	0	0	0	6	1	7	0.017283951
26.	Z	*Oldenlandiasps.*	0	0	0	7	3	10	0.024691358
27.	A1	*Alternanthera sessilis*	0	0	0	0	2	2	0.004938272
28.	B1	*Alternanthera sps.*	0	0	0	0	2	2	0.004938272
29.	C1	*Vigna (Fabaceae) sp.*	0	0	0	0	3	3	0.007407407
30.	D1	*Boerhaviaerecta L.*	0	0	0	0	1	1	0.002469136
31.	E1	*Cajanus cajan*	0	0	0	0	2	2	0.004938272
32.	F1	*Cordiospermumhalicacabum*	0	0	0	0	3	3	0.002469136
33.	G1	*Rhynchosia minima*	0	0	0	0	3	3	0.007407407

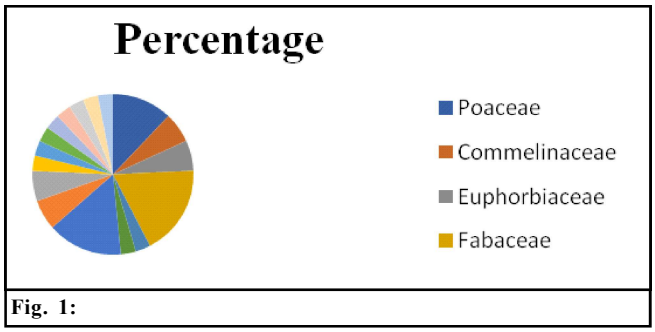

Fig. 1:

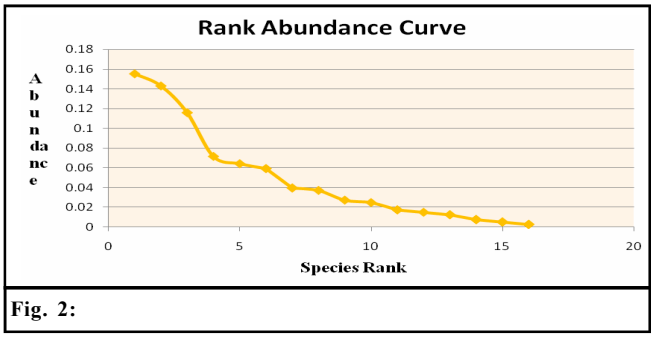

Fig. 2:

Table 2 :

Family	Percentage
Poaceae	12.1
Commelinaceae	6.0606
Euphorbiaceae	6.0606
Fabaceae	18.1
Solanaceae	3.0303
Phyllanthaceae	3.0303
Amaranthaceae	15.15
Convolulaceae	6.0606
Asteraceae	6.0606
Apocynaceae	3.0303
Malvaceae	3.0303
Pedaliaceae	3.0303
Cleomaceae	3.0303
Boraginaceae	3.0303
Rubiaceae	3.0303
Nyctaginaceae	3.0303
Sapindaceae	3.0303

richness can be indicated as the number of different species on the chart; how many species were ranked. Moreover, species evenness is shown from the slope of the line that fits the graph [8]. A rank abundance *Brachiarasps.* was investigated to be the highest ranking species that have much higher abundance as compared to other species in the area. *Xanthium strumarium, Calotropis procera, Sesamum sp., Trichodesma indicum, Boeerhaviaerecta*and *Cardiospermum halicacabum*were found to be lower raking species with much lower abundances.

Avolio *et al.*, had worked on comprehensive approach to analyzing community dynamics using rank abundance curves and had focused exploration of RAC measures. They investigated that reordering of species in the community may be a larger driver of community change than species gains, losses, and changes in species richness and evenness. Further, they noted that the remarkable similarity of RAC shapes within and across systems has intrigued ecologists for decades as the shapes arguably represent a simple yet highly informative representation of community structure [1]. Quantitative RAC curve comparisons have the potential to reveal the ecological factors that drive shape changes or, alternatively, verify that shapes remain constant despite community changes such as rank shifts or species gains and losses.

The current research also recorded Simpsons index 0.0821155 and Shannon-Weiner index which was 2.841248809 [4].

RESULTS AND DISCUSSION

The non-parametric Kruskal-Wallis test was used to determine whether there was a difference in the mean number of species with regard to family and quadrate.An alternative to the one-way ANOVA is the Kruskal-Wallis test. This was chosen since there were fewer samples and it was therefore harder to determine whether the data were normal.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Values is the same across categories of Species.	Independent-Samples Kruskal-Wallis Test	.000	Reject the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Hypothesis Test Summary

	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Values is the same across categories of Quadrats.	Independent-Samples Kruskal-Wallis Test	.954	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

The results of this study revealed that,with respect to species family it varied significantly as p-value was less than 0.05 while with respect to quadrate, it depicted that average species in all the quadrats are same and are not differing significantly.

Conclusion :

The community under study reported a total 33 plant species belonging to the 17 families, the species richness being maximum for *Brachiaria sp.* and the lowest for *Xanthium strumarium, Calotropis procera, Sesamum sp., Trichodesma indicum, Boeerhaviaerecta and Cardiospermum halicacabum.*A rank abundance *Brachiarasps.* was to be the highest ranking species that have much higher abundance as compared to other species in the area. *Xanthium strumarium, Calotropis procera, Sesamum sp., Trichodesma indicum, Boeerhaviaerecta* and *Cardiospermum halicacabum* were found to be lower raking species with much lower abundances. Simpsons index 0.0821155 and Shannon-Weiner index which was 2.841248809.

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