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Biodiversity Analysis of Herbaceous Flora in Ramgarh Shekhawati Beed, Rajasthan

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Abstract

This study investigates the herbaceous diversity of the Ramgarh Beed area in the Shekhawati region of Rajasthan, using the quadrat method from 2018 to 2022. A total of 120 herbaceous species were recorded and analyzed for species density, frequency, abundance and ecological indices. *Argemonemexicana* exhibited the highest density (4.2) and abundance (4.67), while *Crotalaria medicaginea* showed the lowest density (0.1). The Shannon-Weaver diversity index (H') was 4.61, indicating moderate biodiversity, with a Simpson dominance index (D) of 0.011 and species evenness (e) of 0.962. The findings highlight a stable and diverse herbaceous community, emphasizing the need for conservation efforts to maintain ecological integrity.

Keywords: Herbaceous Diversity, Ramgarhbeed, Shekhawati Region, Phytosociological Analysis, Biodiversity Indices, Species Distribution

Introduction:

Rajasthan is renowned for its diverse range of plant life, which can be attributed to the state's varied climatic, physiographic, soil and habitat conditions. These diverse factors create unique ecosystems that support a wide array of plant species. The Shekhawati region of Rajasthan is particularly rich in floristic diversity, with a unique combination of desert, semi-arid and tropical climates that foster the growth of numerous plant species. This region is also known for its rich cultural heritage, with many plant species holding significant cultural and economic importance for local communities. By studying the biodiversity and ethnobotanical flora in the Shekhawati region, we can better understand the intricate relationships between plants and humans in this environment and contribute to the conservation of its valuable plant life for future generations.

The term "biodiversity" was first introduced by Walter G. Rosen in 1986 and has since gained widespread recognition (Caillon and Degeorges, 2007). Biodiversity encompasses the vast variety of living organisms on Earth, including plants, animals, invertebrates and microorganisms. Scientists estimate that there may be over 50 million species on our planet, yet only a small fraction, approximately two million, have been scientifically documented (May, 1988). Recent advancements in science and technology continue to expand our understanding and appreciation of the complexity and richness of biodiversity.

Biodiversity is crucial for human survival and well-being. Its loss has far-reaching consequences, not just ethically and aesthetically but also economically and socially. The rapid decline in Earth's

biodiversity over the past century is largely attributed to the unprecedented growth in human population, resulting in the over-exploitation of natural resources. Human activities have significantly impacted ecosystems, altering landscapes, depleting species and disrupting the delicate balance of nature. The need to comprehend the relationship between humans and biodiversity is particularly urgent in India, where cultural and linguistic diversity are diminishing alongside global species loss. A growing body of research has documented the consequences of species loss on ecosystem functions and services, indicating that local species richness positively impacts the maintenance and provision of various ecosystem services (Pasari et al., 2013).

The present study aims to conduct a comprehensive investigation into the herbaceous diversity of this area, alongside an evaluation of key ecological parameters.Conducted between 2018 and 2022, this study endeavors to provide a detailed analysis of the flora under consideration while systematically evaluating various ecological parameters and ensuring the accurate identification of the plant species involved.

Materials and Methods:

The present study employed the quadrat method, as described by Tripathi&Misra, (1971), to investigate the herbaceous diversity of the Ramgarh Beed area. This research builds upon prior ecological studies conducted in this district. Field excursions will be conducted twice a year to ensure comprehensive coverage of the entire Fatehpur Beed area. During these excursions, meticulous documentation will be maintained, with each collected plant specimen assigned a unique identification number for reference. Detailed field notes will be recorded, including observations on the plant's habit, habitat and the number of individuals observed within each quadrat. For herbaceousspecies, 1 x 1 meter quadrats will be utilized.

The methodology adopted in this study aims to gather extensive data on the flora of the district, encompassing species distribution, abundance and habitat preferences. This approach facilitates a thorough ecological analysis of the study area. Species richness, as defined by Magurran, (1988), is the count of different species present within a community, landscapeor region. It estimates total species richness, including species that may not have been directly observed but are likely to exist based on available data. Species richness provides valuable insights into the overall diversity of the area.

Species density refers to the number of individuals of a species found within a specific unit area. As noted by Oosting& Billings, (1942), density helps assess the concentration or abundance of species within a given space, indicating potential levels of competition among individuals. This measure provides an understanding of how closely packed or dispersed species are, offering insights into resource competition.

Abundance, as defined by Roberts &Oosting, (1958), represents the number of individuals of a particular species within each sampling unit. This metric helps evaluate the prevalence of various species in the study area.

To quantify species diversity, the Shannon-Weaver diversity index (H') was calculated using the formula provided by Shannon & Weave, (1949). This index accounts for both species richness and

abundance, providing a robust measure of biodiversity. Additionally, the Simpson dominance index (D) was calculated following Simpson, (1949), emphasizing the dominance of certain species within the community. Finally, species evenness (e), which assesses the uniformity of individual distribution across species, was determined using Pielou formula (1966). Collectively, these indices offer a comprehensive analysis of species diversity, dominance and evenness in the study area.

Results and Discussions:

The phytosociological analysis of herbaceous species in the Ramgarh Beed area revealed significant insights into species composition, distribution and ecological parameters. A total of 120 herbaceous species were recorded, exhibiting diverse density, frequency, abundance and biodiversity indices.Species density varied across different species, indicating differences in population sizes within the study area. *Argemonemexicana* recorded the highest density at 4.2, followed by *Dactylocteniumaegyptium* and *Mollugocerviana* with densities of 3.5 each. These species' high densities suggest their dominance and ability to thrive in the local environmental conditions. Conversely, species like *Crotalaria medicaginea* and *Farsetiahamiltonii* exhibited the lowest density values, indicating their limited presence (Table 1).

Frequency analysis provided insights into species distribution patterns. Species such as *Achyranthesaspera* and *Verbesinaencelioides* demonstrated 100% frequency, indicating their widespread occurrence across the quadrats. In contrast, species like *Citrullusfistulosus* and *Citrulluslanatus* were recorded with the lowest frequency of 10%, suggesting restricted distribution within the study area.Abundance, reflecting the number of individuals per unit area, varied significantly. *Argemonemexicana* displayed the highest abundance at 4.67, followed closely by *Dactylocteniumaegyptium* and *Mollugocerviana*. Lower abundance values were observed for species like *Crotalaria medicaginea* and *Farsetiahamiltonii*, indicating their relatively lower success in establishing themselves within the ecosystem.

The diversity index (H') consistently measured around 4.61, indicating a moderately high level of biodiversity. This suggests a stable herbaceous community with diverse species present. The evenness index (D) remained consistently low at 0.011, reflecting a balanced distribution of species without significant dominance. Additionally, the similarity index (e) was calculated at 0.962, indicating a high degree of similarity across different quadrats, suggesting homogeneity in the herbaceous community composition.Several species demonstrated ecological significance due to their high abundance and frequency. *Mollugocerviana*, *Dactylocteniumaegyptium* and *Chenopodium album* were particularly notable for their prevalence and consistent presence, indicating their adaptive advantage in the Ramgarh Beed area.

Overall, the study highlights a diverse and well-distributed herbaceous community in the Ramgarh Beed area. The balance in species distribution, coupled with the moderate diversity and high similarity indices, reflects a stable and resilient herbaceous flora that plays a crucial role in the ecological integrity of the region.

Table 1 Phytosociological aspect of Herb species at Ramgarh Beed area

Sr. No.	Species Name	Species density	Frequency	Abundance	H'	D	e
1	*Achyranthes aspera*	2.2	100	2.20	4.61	0.011	0.962
2	*Aervalanata*	0.9	40	2.25	4.61	0.011	0.962
3	*Aloe vera*	0.6	30	2.00	4.61	0.011	0.962
4	*Amaranthushybridis*	2.6	90	2.89	4.61	0.011	0.962
5	*Amaranthusspinosus*	1.2	50	2.40	4.61	0.011	0.962
6	*Amaranthusviridis*	1.2	60	2.00	4.61	0.011	0.962
7	*Anagallis arvensis*	0.5	30	1.67	4.61	0.011	0.962
8	*Argemonemexicana*	4.2	90	4.67	4.61	0.011	0.962
9	*Aristidafuniculata*	1.5	70	2.14	4.61	0.011	0.962
10	*Asphodelustenuifolius*	1.5	70	2.14	4.61	0.011	0.962
11	*Barleriapriontis*	0.9	40	2.25	4.61	0.011	0.962
12	*Blepharissindica*	1.5	60	2.50	4.61	0.011	0.962
13	*Boerhaviadiffusa*	1.5	70	2.14	4.61	0.011	0.962
14	*Boerhaviaerecta*	1.0	60	1.67	4.61	0.011	0.962
15	*Borreriaarticularis*	0.5	40	1.25	4.61	0.011	0.962
16	*Brachiariaramosa*	2.5	80	3.13	4.61	0.011	0.962
17	*Brachiariareptans*	2.6	70	3.71	4.61	0.011	0.962
18	*Celosia argentia*	2.0	80	2.50	4.61	0.011	0.962
19	*Cenchrusbarberi*	1.2	60	2.00	4.61	0.011	0.962

Sr. No.	Species Name	Species density	Frequency	Abundance	H'	D	e
20	*Cenchrus biflorus*	0.6	30	2.00	4.61	0.011	0.962
21	*Cenchrusciliaris*	1.2	60	2.00	4.61	0.011	0.962
22	*Cenchrusprieurii*	1.1	50	2.20	4.61	0.011	0.962
23	*Cenchrussetigerus*	0.6	30	2.00	4.61	0.011	0.962
24	*Chenopodium album*	3.5	80	4.38	4.61	0.011	0.962
25	*Chenopodiummurale*	2.9	80	3.63	4.61	0.011	0.962
26	*Citrulluscolocynthis*	0.6	20	3.00	4.61	0.011	0.962
27	*Citrullusfistulosus*	0.2	10	2.00	4.61	0.011	0.962
28	*Citrulluslanatus*	0.3	10	3.00	4.61	0.011	0.962
29	*Cleome gynandra*	1.4	60	2.33	4.61	0.011	0.962
30	*Cleome viscosa*	1.2	50	2.40	4.61	0.011	0.962
31	*Commelianabenghalensis*	0.6	30	2.00	4.61	0.011	0.962
32	*Corchorusdepressus*	1.4	60	2.33	4.61	0.011	0.962
33	*Corchorustridens*	1.0	70	1.43	4.61	0.011	0.962
34	*Corchorustrilocularis*	1.2	40	3.00	4.61	0.011	0.962
35	*Crotalaria medicaginea*	0.1	10	1.00	4.61	0.011	0.962
36	*Croton sparsiflorus*	0.8	50	1.60	4.61	0.011	0.962
37	*Cynodondactylon*	2.3	80	2.88	4.61	0.011	0.962
38	*Cyperusarenarius*	2.5	70	3.57	4.61	0.011	0.962
39	*Cyperusbulbosus*	1.5	80	1.88	4.61	0.011	0.962
40	*Cyperuscompressus*	1.3	50	2.60	4.61	0.011	0.962
41	*Cyperusconglomeratus*	1.1	60	1.83	4.61	0.011	0.962

Sr. No.	Species Name	Species density	Frequency	Abundance	H'	D	e
42	*Cyperusflavidus*	0.8	70	1.14	4.61	0.011	0.962
43	*Cyperusiria*	0.7	70	1.00	4.61	0.011	0.962
44	*Cyperusrotundus*	0.6	60	1.00	4.61	0.011	0.962
45	*Dactyloctenіumaegyptium*	3.5	90	3.89	4.61	0.011	0.962
46	*Dactyloctenіumsindicum*	1.4	50	2.80	4.61	0.011	0.962
47	*Daturainnoxia*	1.5	70	2.14	4.61	0.011	0.962
48	*Datura stramonium*	1.0	50	2.00	4.61	0.011	0.962
49	*Desmostachyabipinnata*	1.3	50	2.60	4.61	0.011	0.962
50	*Dichanthiumannulatum*	0.6	30	2.00	4.61	0.011	0.962
51	*Digeriaalternifolia*	2.8	70	4.00	4.61	0.011	0.962
52	*Digeriamuricata*	0.8	30	2.67	4.61	0.011	0.962
53	*Digitariabiformis*	0.3	20	1.50	4.61	0.011	0.962
54	*Digitariaciliaris*	1.1	50	2.20	4.61	0.011	0.962
55	*Digitariasanguinalis*	0.3	20	1.50	4.61	0.011	0.962
56	*Echinopsechinatus*	1.6	90	1.78	4.61	0.011	0.962
57	*Eragrostisciliaris*	2.0	70	2.86	4.61	0.011	0.962
58	*Eragrostispilosa*	1.4	60	2.33	4.61	0.011	0.962
59	*Eragrostistremula*	1.2	40	3.00	4.61	0.011	0.962
60	*Erianthusmunja*	1.2	80	1.50	4.61	0.011	0.962
61	*Euphorbia granulata*	1.0	70	1.43	4.61	0.011	0.962
62	*Euphorbia hirta*	0.8	60	1.33	4.61	0.011	0.962
63	*Euphorbia prostrata*	0.7	60	1.17	4.61	0.011	0.962

Sr. No.	Species Name	Species density	Frequency	Abundance	H'	D	e
64	*Euphorbia thymifolia*	1.4	60	2.33	4.61	0.011	0.962
65	*Evolvulusalsinoides*	1.2	50	2.40	4.61	0.011	0.962
66	*Farsetiahamiltonii*	0.3	20	1.50	4.61	0.011	0.962
67	*Fumaria indica*	0.6	30	2.00	4.61	0.011	0.962
68	*Gisekiapharnaceoides*	1.4	60	2.33	4.61	0.011	0.962
69	*Heliotropiummarifolium*	1.0	70	1.43	4.61	0.011	0.962
70	*Heliotropiumovalifolium*	0.8	50	1.60	4.61	0.011	0.962
71	*Heliotropiumsubulatum*	0.3	30	1.00	4.61	0.011	0.962
72	*Indigofera cordifolia*	1.0	40	2.50	4.61	0.011	0.962
73	*Indigoferahochstetteri*	1.6	70	2.29	4.61	0.011	0.962
74	*Indigoferalinifolia*	2.1	80	2.63	4.61	0.011	0.962
75	*Indigoferalinnaei*	0.3	20	1.50	4.61	0.011	0.962
76	*Lasiurussindicus*	2.5	70	3.57	4.61	0.011	0.962
77	*Launaeanudicaulis*	1.5	80	1.88	4.61	0.011	0.962
78	*Launaeaprocumbens*	0.8	70	1.14	4.61	0.011	0.962
79	*Lemnaperpusilla*	0.7	70	1.00	4.61	0.011	0.962
80	*Mililotusindica*	0.6	60	1.00	4.61	0.011	0.962
81	*Mollugocerviana*	3.5	90	3.89	4.61	0.011	0.962
82	*Mollugonudicaulis*	1.5	80	1.88	4.61	0.011	0.962
83	*Oligochaetaramosa*	0.7	30	2.33	4.61	0.011	0.962
84	*Orobanchecernua*	2.0	70	2.86	4.61	0.011	0.962
85	*Oscimumamericanum*	1.0	50	2.00	4.61	0.011	0.962

Sr. No.	Species Name	Species density	Frequency	Abundance	H'	D	e
86	*Panicumantidotale*	1.5	70	2.14	4.61	0.011	0.962
87	*Panicum turgidum*	1.7	60	2.83	4.61	0.011	0.962
88	*Partheniumhysterophorus*	2.2	60	3.67	4.61	0.011	0.962
89	*Pedalium murex*	0.4	30	1.33	4.61	0.011	0.962
90	*Peristrophebicalyculata*	2.6	60	4.33	4.61	0.011	0.962
91	*Perotisindica*	1.5	70	2.14	4.61	0.011	0.962
92	*Phyllanthusamarus*	1.1	70	1.57	4.61	0.011	0.962
93	*Phyllanthusfraternus*	2.2	50	4.40	4.61	0.011	0.962
94	*Phyllanthusniruri*	0.9	70	1.29	4.61	0.011	0.962
95	*Physalis minima*	0.5	30	1.67	4.61	0.011	0.962
96	*Polycarpaeacorymbosa*	0.4	40	1.00	4.61	0.011	0.962
97	*Polygala arvensis*	0.2	20	1.00	4.61	0.011	0.962
98	*Polygala erioptera*	1.6	70	2.29	4.61	0.011	0.962
99	*Polygala irregularis*	1.9	70	2.71	4.61	0.011	0.962
100	*Portulaca oleracea*	0.6	40	1.50	4.61	0.011	0.962
101	*Portulacapilosa*	1.5	80	1.88	4.61	0.011	0.962
102	*Portulacaquadrifida*	1.2	60	2.00	4.61	0.011	0.962
103	*Pulicariacrispa*	1.1	50	2.20	4.61	0.011	0.962
104	*Pulicariawightiana*	0.6	30	2.00	4.61	0.011	0.962
105	*Sacchrumspontaneum*	0.8	40	2.00	4.61	0.011	0.962
106	*Sesamum indicum*	1.0	60	1.67	4.61	0.011	0.962
107	*Solanum nigrum*	1.1	40	2.75	4.61	0.011	0.962

Sr. No.	Species Name	Species density	Frequency	Abundance	H'	D	e
108	*Solanumsurattense*	0.8	60	1.33	4.61	0.011	0.962
109	*Sonchus asper*	0.5	40	1.25	4.61	0.011	0.962
110	*Sorghum halepense*	2.6	80	3.25	4.61	0.011	0.962
111	*Spermacocearticularis*	1.1	60	1.83	4.61	0.011	0.962
112	*Tephrosia purpurea*	0.4	30	1.33	4.61	0.011	0.962
113	*Trianthemaportulacastrum*	0.6	50	1.20	4.61	0.011	0.962
114	*Trianthematriquetra*	1.0	70	1.43	4.61	0.011	0.962
115	*Verbesinaencelioides*	3.0	100	3.00	4.61	0.011	0.962
116	*Vernonia cinerea*	1.9	70	2.71	4.61	0.011	0.962
117	*Withaniasomnifera*	2.5	80	3.13	4.61	0.011	0.962
118	*Xanthium strumarium*	1.9	70	2.71	4.61	0.011	0.962
119	*Zaleyaredimita*	1.6	80	2.00	4.61	0.011	0.962
120	*Zygophyllum simplex*	2.2	60	3.67	4.61	0.011	0.962

Conclusion:

The present study provides a comprehensive analysis of the herbaceous flora of the Ramgarh Beed area, revealing a moderately high level of biodiversity with 120 recorded species. *Argemonemexicana* exhibited the highest density and abundance, indicating its dominance, while species like *Crotalaria medicaginea* were sparsely distributed. The calculated ecological indices, including a Shannon-Weaver diversity index (H') of 4.61 and Simpson dominance index (D) of 0.011, highlight a stable and diverse herbaceous community with a well-distributed species presence. The study underscores the ecological significance of this flora and emphasizes the need for conservation measures to preserve the region's biodiversity against potential anthropogenic pressures.

References:

1. Caillon, S., &Degeorges, P. (2007). Biodiversity: negotiating the border between nature and culture. Biodiversity and Conservation, 16, 2919–2931.
2. Magurran, A. E. (1988). *Ecological diversity and its measurement*. Princeton university press.
3. May, R. M. (1988). How many species are there on earth? Science, 241(4872), 1441–1449.

4. Oosting, H. J., & Billings, W. D. (1942). Factors effecting vegetational zonation on coastal dunes. *Ecology*, *23*(2), 131–142.
5. Pasari, J. R., Levi, T., Zavaleta, E. S., &Tilman, D. (2013). Several scales of biodiversity affect ecosystem multifunctionality. Proceedings of the National Academy of Sciences, 110(25), 10219–10222.
6. Pielou, E. C. (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology*, *13*, 131–144.
7. Roberts, P. R., &Oosting, H. J. (1958). Responses of Venus fly trap (Dionaea muscipula) to factors involved in its endemism. *Ecological Monographs*, *28*(2), 193–218.
8. Shannon, C. E., & Weave, W. (1949). The mathematical theory of communication. In *The University of Illinois. Urbana, Chicago, London* (pp. 3–24).
9. Simpson, E. H. (1949). Measurement of diversity. *Nature*, *163*(4148), 688.
10. Tripathi, R. S., &Misra, R. (1971). *Phytosociological studies of the crop-weed association at Varanasi*.