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MEASUREMENT OF DIVERSITY OF THE ETHNO-MEDICINAL PLANT SPECIES OF BEGUSARAI DISTRICT (BIHAR)

Botany

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ABSTRACT

Background: Ethno-medicinal plants valuable pharmaceuticals. Except antibiotics, all medicines are derived from ethno-medicinal plants. A significant loss of medicinal plants would reduce the variety of food sources, medicines and oxygen supply in a habitat and drastically alter the amount and distribution of the world's precipitation. **Aim:** To study the diversity of ethno-medicinal plants in grass land areas of Begusarai district. **Methodology:** Diversity of ethno-medicinal plant species was measured in terms of species richness, taxonomic distinctness and taxonomic diversity. **Results:** A total of 212 species of medicinal plants which belong to Angiosperms have been sampled from eighteen block areas of Begusarai District. Fifteen and twelve medicinal plant species were sampled from Begusarai and Barauni areas comprising 7.07 % and 5.66 % respectively. The taxonomic distinctness of other block areas was not more different from a random distribution of values. The taxonomic diversity of Begusarai was slightly less than that of Barauni. The Δ values of Begusarai and Barauni were 4.950 and 5.635 respectively, and the bootstrapped CI ranged from 4.575 to 4.757. **Conclusions:** The taxa of Ethno-medicinal plants in Begusarai District are maintained even under physiological restrictions due to water logging. The major consequence of water logging is to limit the number of species able to grow in such a condition.

KEYWORDS

Diversity, Ethno-medicinal plants, Species richness, Taxonomic distinctness

INTRODUCTION

Begusarai is the administrative headquarters of District Begusarai which is one of thirty-eight Districts of Bihar. Its total area is 1918 sq kilometers, and its total population is 2970541 with literacy rate of 59.13 %. The District lies on the northern bank of River Ganga. The District lies in the North Bihar between the latitudes 25°15' and 25°45' North and longitudes 85°45' and 86°36' East. Jai Mangla Temple, Nau Lakha Temple and Kabar Lake are the historical places of District Begusarai. The present study was carried out in eighteen blocks of District Begusarai viz. Begusarai, Barauni, Teghra, Matihani, Bachhwara, Mansurchak, Naokothi, Cheriabariyarpur, Sahebpur Kamal, Bakhari, Birpur, Dandari, Garhpura, Balia, Chhorahi, Khodawandpur, Bhagwanpur, and Samho Akha Kurha.

Ethno-medicinal plants belong to a huge variety of life forms including trees, herbs, shrubs, submerged aquatics, bulbs and epiphytes. The ethno-medicinal plants provide valuable pharmaceuticals. With the exception of antibiotics, almost all medicines are derived directly or indirectly from compounds produced by ethno-medicinal plants. This includes some vitamins, aspirin, narcotics and quinine. The contribution of the angiospermic taxa to biodiversity and habitat is so extremely important that human life is totally dependent on it. A significant loss of medicinal plants would reduce the variety of food sources, medicines and oxygen supply in a habitat and drastically alter the amount and distribution of the world's precipitation.

Water logging is an important determinant of species distribution and ranks alongside water shortage, salinity, and extreme temperatures as major abiotic stresses[1]. The consequences of water logging to terrestrial plants can be fatal, because, as aerobic respiration ceases, levels of energy-rich adenylates drop rapidly, causing a dramatic decline in ion uptake and transport[2, 3]. Even if a short period of water logging does not kill vegetation, it has considerable long-term effects on plant growth[4], reducing the competitive abilities of species[5]. Wherever water logging causes local extinctions of intolerant species, it may shape the composition of the local assemblages[6,1].

Clarke and Warwick[7] proposed a method to measure the taxonomic distinctness and taxonomic diversity of a community that was shown to be very sensitive to perturbation, robust with respect to differences in sampling methods, and appropriate to assess differences among communities[8-10]. The taxonomic distinctiveness refers to the distinctiveness of a particular species in relation to the rest of the community and differs from taxonomic distinctness, which is a property of the community as a whole[11]. Species are usually treated as equivalent units, with independent functional traits[12,13].

In the present study, eighteen block areas of Begusarai District were selected for the measurement of Biodiversity.

Methodology

Plants used for medicinal purposes were surveyed in all the four seasons. In each survey, ten 1 m^2 quadrates were placed randomly. A total of 50 quadrates were used in each vegetation form. The number of individuals belonging to each species was counted.

The data from all surveys were used to compute the taxonomic distinctness (Δ*), the taxonomic diversity (Δ), and the expected taxonomic distinctness (*Tm*) of all the areas.

The *T (m)* value was computed following the procedure described by Ricotta[14] (2004) and Ricotta *et a* [15] (2005). The values of *N (m)* was calculated using the following equation:

$$N(m) = \sum_{i=1}^{N} (1-(1-pi)^{m}$$

Where *pi* is the proportion of individuals belonging to the *I* th species and *m* is the sensitivity to rare species. By increasing the value of the parameter *m* , one can enhance the sensitivity of this index to the least abundant species, and the expected species diversity will be more and more sensitive to the abundances of a wider range of species and not only the most abundant ones (Ricotta, 2005). Then, we computed the The pair-wise species distances (d *ij)* was computed on the basis of the topological distance between the I^{th} and the j^{th} species in the taxonomic tree of each vegetation form, obtaining a species distance matrix. After that, we computed the The taxonomic distinctiveness *wi* of each species was computed by adding all *d ij* elements along row *I* of this matrix and dividing the result by the number of non-zero distances K − 1. The expected taxonomic distinctness was finally determined by increasing values of the parameter *m* through the equation:

$$T(m) = \frac{\sum_{i=1}^{N} wi\,(1-pi)^{m}}{N(m)}$$

The *m* values were selected arbitrarily that were equally spaced on a log 2 scale ranging from *m* = 1 (log 2 *m* = 0) to *m* = 32,768 (log 2 *m* = 15), as suggested by Ricotta *et al*[16]. The species, genus, and family similarities between the study areas were also calculated following the methods of Chao *et al*[17], Colwell[18]. Confidence intervals (CI) of each Chao–Sørensen index was obtained by multiplying the standard deviation value by the upper 2.5% limit of the *t* -distribution with *n* – 1 degrees of freedom[19].

The number of species of medicinal plants and their percentage occurrence in study areas of Begusarai has been estimated using geometric mean (G) and logarithmic version as follows:

$$G = \sqrt[n]{x1\,.x2\ \ldots\ x_n} = \sqrt[n]{\prod_{i=1}^{n} xi}$$

$$\log G = \frac{\sum_{i=1}^{n} \log(xi)}{n}$$

RESULTS AND DISCUSSION

In the present study, 212well known ethno-medicinal plants were surveyed from eighteen block areas of Begusarai. Ninteen species were more popular which included *Adhatoda vasica* (Acanthaceae), *Artemisia vulgaris* (Asteraceae), *Saraca indica* (Caesulpinaceae), *Mesua felrea* (Calophyllaceae), *Terminalia bellirica* (Combretaceae), *Aloe vera* (Liliaceae), *Psidium guajava* (Myrtaceae), *Piper betel* (Piperaceae), *Withania somnifera* (Solanaceae), *Achyranthus aspera* (Amaranthaceae), *Calotropis procera* (Asclepiadaceae), *Rauvolfia serpentina* (Apocyanaceae), *Centella asiatica* (Apiaceae), *Eclipta alba* (Asteraceae), *Carica papaya* (Caricaceae), *Cassia fistula* (Caesalpinaceae), *Terminalia arjuna* (Combretaceae), *Terminalia chebula* (Combretaceae) and *Tinospora cordifolia* (Combretaceae)[20].

The number and percentage of medicinal plants in eighteen block areas of Begusarai have been summarized in Table-1.

Table-1: Number and Percentage of species of ethno-medicinal plants in Begusarai

Block areas	Area in square kilometer	Number of species of medicinal plants	Percent age
Begusarai District	1918	212	
Begusarai		15	7.07
Barauni		12	5.66
Teghra		11	5.18
Matihani		12	5.66
Bachhwara		12	5.66
Mansurchak		12	5.66
Naokothi		12	5.66
Cheriabariyarpur		12	5.66
Sahebpur Kamal		11	5.18
Bakhari		12	5.66
Birpur		11	5.18
Dandari		12	5.66
Garhpura		10	4.71
Balia		13	6.13
Chhorahi		11	5.18
Khodawandpur		11	5.18
Bhagwanpur		11	5.18
Samho Akha Kurha		12	5.66

The taxonomic distinctness of medicinal plant species of only two block areas of Begusarai District viz. Begusarai and Barauni was studied, and the T(m) vs log2m profile have been presented in Figure-1.

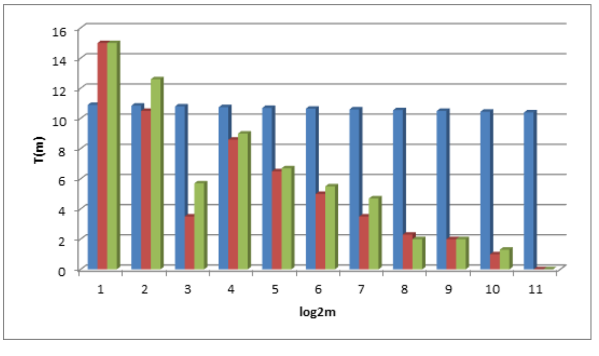

Figure-1: Expected taxonomic distinctness (*T*(*m*)) vs log2 *m* profiles of the Begusarai and Barauni block areas: red bar= Begusarai, green bar= Barauni

The vegetation of Begusarai is Grassland and is a part of Indo-Gangetic plain. In the present study a total of 212 species of medicinal plants which belong to Angiosperms have been sampled from eighteen block areas of Begusarai District. Fifteen and twelve medicinal plant species were sampled from Begusarai and Barauni areas comprising 7.07 % and 5.66 % respectively. The taxonomic distinctness of other block areas was not more different from a random distribution of values: the Δ* values of Begusarai and Barauni were 5.145 and 5.275 respectively and the bootstrapped CI ranged from 4.124 to 4.575. However, the taxonomic diversity of Begusarai was slightly less than that of Barauni. The Δ values of Begusarai and Barauni were 4.950 and 5.635 respectively, and the bootstrapped CI ranged from 4.575 to 4.757 (Figure-1).

The species richness in all the block areas of Begusarai grass land is more or less similar. Where the environment situations are spatiotemporally heterogeneous species are adapted to dynamism and evolve strategies for responding to shifting opportunities[21-26].

The diversity of functional groups is important to maintain the resilience of community structure and function[27]. High functional group diversity is expected for communities with high taxonomic diversity[12], because related species share more functional traits than unrelated ones[28-29]. Therefore, it can be postulated that the functional groups in grass land areas of Begusarai are maintained even under physiological restrictions due to water logging. The major consequence of water logging is to limit the number of species able to grow in such a condition[30-32].

CONCLUSIONS:

It can be concluded that the Ethno-medicinal plants in Begusarai District are maintained even under physiological restrictions due to water logging.

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