



Eco-floristic diversity of the family acanthaceae in Purba Medinipur district, West Bengal

Arjun Patra¹, Amal Kumar Mondal^{2*}, Debdulal Banerjee²

¹Department of Botany, Prabhat Kumar College, Contai, West Bengal, India

²Professor of Botany, Department of Botany and Forestry, Vidyasagar University, West Bengal, India

Abstract

The fast development and rise of modern day system have substantially converted both natural environments and present agricultural system over the globe. Community and species of an area are closely related to the plant diversity and ecosystem. The present study deals with the diversity with different indices of Acanthaceae family in Purba Medinipur district. A total of 35 species were observed and recorded with their medicinal use by the rural people. The species *Ruellia tuberosa* is most abundant among all the species with maximum number of individuals. According to the Simpson's index the species richness value is 0.063 and as to Shannon's diversity index, the relative abundance of species was 3.04 i.e. it provides more weight for species abundance and the evenness value is 0.785. The descriptive floristic diversity presented here are important for utilization and conservation of these medicinal important plant.

Keywords: acanthaceae, floristic diversity, medicinal plants, Purba Medinipur

Introduction

Diversity is the measure of types or species in a given region or area. Floristic diversity is related to the different form and variability of plant species in a conferred region [25]. Floristic diversity are often measured at any direction from entire global variability to ecosystem, species, community, Population, individual and also to genes within single individual. In general, floristic diversity may be a complex yet balancing and dynamic network of various species, which are mutually hooked in to one another [40].

Plants possess immense therapeutic potential and an outsized number of such plants are unexplored till date. Medicinal plant species are emerging source of considerable chemical compounds that possess beneficent pharmacologic and curative properties [38]. These are often used directly or extracts are used as source material in synthesis of pharmaceutical drugs. Traditional medicinal plants are utilized to develop synthetic medicines, currently in developing world; about 25% of ingredients within the prescribed modern medicine are obtained from extracts of medicinally used plant [12, 31, 19].

The improvement of modern irrigation schemes across arid areas of the globe has substantially converted each natural environments and current areas for agricultural manufacturing [44, 10, 2, 29]. Present modern and productivity oriented agriculture has create environmental and social challenges including declining biodiversity, lack of cultural and atmospheric values [32, 7, 3, 42, 2].

In India 300 tribal communities comprising of more than 50 million tribal people which constituting of approximately 8% of total populace depend on the indigenous plants or the primary treatment [20]. Indian sub-continent has a completely wealthy range of plant species in a huge range of ecosystems and additionally 8,000 species are considered as medicinally crucial and used for human in addition to veterinary care throughout the country by village communities or in conventional medicinal system [28]. India has been regarded to be a prosperous storehouse of

medicinal plants. In India, wooded area is the foremost storehouse for large variety of fragrant and medicinal vegetation. They're largely used as raw materials for the manufacture of drugs and related products. About 50,000 plants, a total of the 4, 22, 000 flowering plant had been used for medicinal purpose [17].

The distribution of plant species is affected not only through present day environmental conditions but also by anthropogenic effects [44, 4]. WHO has proven remarkable hobby for documenting the purpose of medicinal vegetation used by tribes from the entire human community [15]. There's a global attention in herbal medicine for the treatment of numerous disease because of affordable, less side effect and available to the rural population compared to synthetic drugs. It is also expected that only about 30,000 plant species were documented for medicinal properties [27, 33, 16, 21, 13]. The ethnic people all over the world have emotional and symbiotic relationship with biodiversity, so that they have been protecting and preserving considering the fact that historical instances [18].

Purba Medinipur is a large district of West Bengal surrounded by Bay of Bengal and it occupies with dense vegetation. This district is an agriculture based area. The people of this district completely depend on agricultural crop and indigenous plants for their economic as well as primary medicinal treatments. Most of the traditional plants used by the people belong to the family Acanthaceae. The Acanthaceae is the family comprises of 250 genera and 2500 species [36].

Phytochemical study on family Acanthaceae shows that the members of this family mostly contain active constituents like phenolic compounds, flavonoids, benzenoids, triterpenoids, naphthoquinone and glycosides [5]. *Justicia adhatoda* is a source of many pharmacologically and medicinally important bioactive compounds such as Vasicoline, Vasiconone, Vasicine, and other various useful minor alkaloids. The root of this plant also contains different alkaloids like vasicinal and adhatonine,

carbohydrates, steroid and alkanes [38]. In the flower of this family triterpenes like α - amyrin, flavonoids like Apigenin, Astragaln, Kaempferol, Quercetin and Vitexin as well as alkanes have also been found [11].

The present study was conducted to find out the floristic composition of Acanthaceae in Purba Medinipur. For this purpose species abundance, diversity of species and evenness were taken into consideration.

Materials and Method

Study Area

Purba Medinipur is large area about 4,736 km² (21° 56' 14'' N, 87° 46' 35'' E to 21° 94' 30" N, 87° 77' 99" E and elevation 8 m) with in the agricultural area of West Bengal. Soil type of this area is fertile with a vast expanse of younger alluvial soils. Mean Annual temp. 25°-27° C with maximum 38° C and minimum 15° C. Survey was conducted in different blocks (Table 1) and are showed in map (Fig 1).

Table 1: Survey locations for floristic diversity

Name of the block	Location	Name of the block	Location
Bhagabanpur I & II (22° 07' 12" N, 87° 45' 0" E)	Gurgram, Gorvera, Monohorpur and Sekbard	Kolaghat (22° 25' 48" N, 87° 52' 12" E)	Banpur, Dienan And Amalhanda
Chandipur (22° 07' 29" N, 87° 51' 37" E)	Narandari, Rampur and Mangolkhali	Panskura (22° 25' 12" N, 87° 42' 0" E)	Baju, Baruipur and Chakgogras
Contai-I, II & III (21° 46' 47" N, 87° 44' 56" E)	Baidyharana, Betbani, Bankipur, Dariapur, Kendua, Balagerya, Bhadua and Chhota Naoai	Patashpur (22° 01' 45" N, 87° 33' 13" E)	Bankibheri, Chakdebi and Rupa Dighi
Deshapran (21° 48' 21" N, 87° 46' 26" E)	Bargolia, Bhogpur and Danguapur	Ramnagar- I & II (21° 41' 0" N, 87° 33' 0" E)	Bherichauli, Deulbatta, Gopl Chak and Kanchibar
Egra I & II (21° 53' 58" N, 87° 32' 16" E)	Ailan, Baranihari, Benachakri, Amipara, Daudpur, Atbati and Khagda	Tamluk (22° 18' 0" N, 87° 55' 12" E)	Khas Panchpukhuria and Sadichak

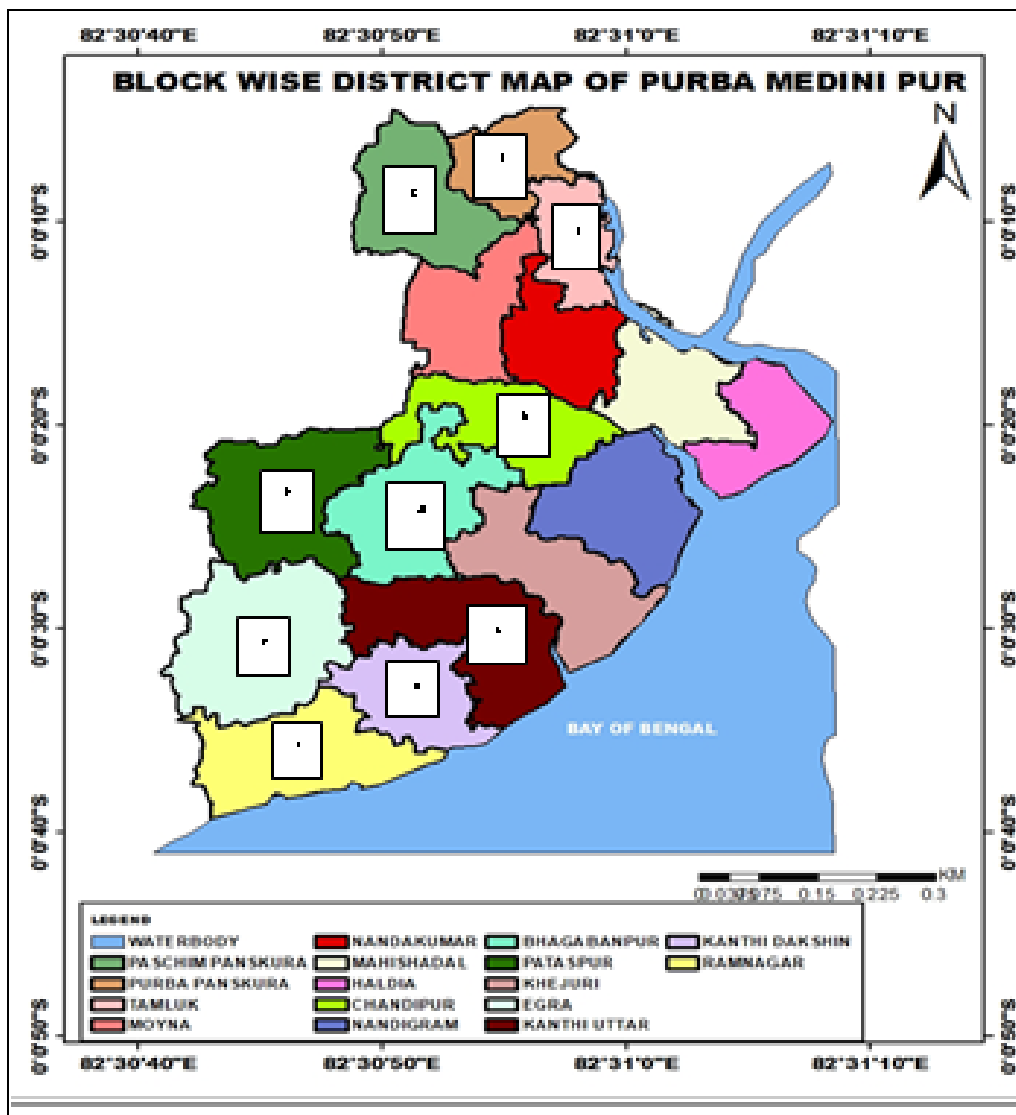


Fig 1: Map showing the study area of floristic diversity of Acanthaceae family in Purba Medinipur district; a-Bhagabanpur, b-Chandipur, c-Contai, d- Deshapran, e- Egra, f- Kolaghat, g- Panskura, h- Patashpur, i- Ramnagar and j- Tamluk block

Floristic survey

A floristic survey of Acanthaceae family was carried out during August 2015 to October 2017 in Purba Medinipur. The survey was based on the repeated field trip to interior pockets of locality and entire aquatic, terrestrial and marshy vegetation in different season of the year. Plant specimens of the species in flowering condition were collected, field notes were prepared, and identification was done using standard taxonomic literature. Herbarium were prepared and conservation status was determined using IUCN Red List.

Data analysis

Quadrat method was performed randomly for studying phytosociological attributes of plant species. Quadrat of 2m×2m have been laid down and total 40 quadrates were studied.

The phytosociological attributes, abundance (A), density (D), frequency (F) additionally relative values (RA, RD and RF) and Importance value index (IVI) had been calculated based on the methods of Curtis and McIntosh (1950)^[14], Misra (1968) and Mueller-Dombois and Ellenberger (1974)^[24].

$$\text{Abundance (A)} = \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrates in which the species occurred}}$$

$$\text{Density (D)} = \frac{\text{Total number of individuals of a species in all quadrates}}{\text{Total number of quadrates studied}}$$

$$\text{Frequency (F \%)} = \frac{\text{Total number of quadrates in which the species occur}}{\text{Total number of quadrates studied}} \times 100$$

$$\text{Relative Abundance (RA \%)} = \frac{\text{Abundance of individuals of a species}}{\text{Total abundance of all species}} \times 100$$

$$\text{Relative density (RD \%)} = \frac{\text{Density of individuals of a species}}{\text{Total density of all species}} \times 100$$

$$\text{Relative Frequency (RF \%)} = \frac{\text{Frequency of individuals of a species}}{\text{Total frequency of all species}} \times 100$$

Importance Value Index (IVI) = Relative density + Relative frequency + Relative abundance.

Shannon's Index for plant species of Acanthaceae was calculated as proposed by Margalef (1957)^[22].

$$H = -\sum (n/N) \log_e (n/N)$$

Where 'H' is the diversity index, 'N' is the total number of individuals of all species and 'n' is total number of individuals of the individual species.

Simpson's Index was calculated as given by Simpson (1949).

$$\text{Simpson's Index (D)} = \sum (n/N)^2$$

Where 'n' is total number of individuals of plant species and 'N' is the total number of individuals of all species.

The evenness of plant species was calculated according to the Pielou (1996).

$$\text{Evenness (e)} = H/\log S$$

Where 'H' is Shannon Index and 'S' is the total number of species.

Result and Discussion

During this study a total no. of 35 plant species of Acanthaceae family of different habitat (aquatic, marshy and terrestrial) and different habit (herb, shrub, undershrub and tall shrub) were observed and recorded. Floristic survey is listed in Table 2.

Table 2: Floristic survey of plants belong to acanthaceae family

Plant name	Flowering time	Habit	Habitat	Flower Colour	Traditional Uses	Threat status
<i>Acanthus ilicifolius</i> L.	Dec-May	S	M	Light violet	Plant parts are used as remedy of respiratory problem and blood Sugar	LC
<i>Andrographis echinoides</i> Nees	Dec-Apr	H	T	Whitish Violet	Plant decoction is used to cure fever, dysentery and liver disorders.	NT
<i>Andrographis paniculata</i> Wallich ex nees.	Apr-Jun	H	T	Yellowish Brown	Used traditionally for diabetes, high blood pressure, bronchitis, skin diseases treatment	NT
<i>Asteracantha longifolia</i> (L.) Nees	Oct-Apr	H	T	Light violet	Used to reduce blood sugar level.	LC
<i>Barleria cristata</i> L.	Sep-Feb	S	T	White	Decoction of roots and leaves used to treat cough	NT
<i>Barleria inaequalis</i> Benth.	Aug-Feb	S	T	White	Leaves paste is used on cut and wound.	NT
<i>Barleria lupulina</i> Lindl.	Apr-Aug	S	T	Yellow	Leaves paste is applied on wounds for blood clotting	NT
<i>Barleria prionitis</i> L.	Sep-Feb	US	T	Yellow	Leaves and Root juice is used for cough, tooth pain and treat pimples	NT
<i>Barleria strigosa</i> Willd.	Oct-Feb	S	T	Yellow	Leaves juice is used to treat gastric problem and voice clear.	NT
<i>Crossandra infundibuliformis</i> (L.) Nees.	Jun-Jan	S	M	Light Orange	Leaf paste is used for skin diseases of children.	NT
<i>Ecbolium linneanum</i> Kurz.	Oct-Jan	H	T	Blue	Crushed plant is used in gout. Root juice is given in jaundice,	NT
<i>Ecbolium viride</i> (Forssk.) Alston	Sep-Jan	US	T	White	Plant parts are used for gout. Root juice are used for jaundice	NT
<i>Hemigraphis latebrosa</i> Nees.	Nov-Dec	H	T	Violet White	Plant decoction used as blood purifier	NT
<i>Hygrophila auriculata</i> (Schumach.) Heine	Oct-Apr	H	M	Light Pink	Leaves decoction is used for joint pain	LC
<i>Hygrophila difformis</i> (L.f.) Blume	Apr-May	H	M	White	Root decoction is used in chronic cough.	NT
<i>Hygrophila heinei</i> Sreem.	Aug-Mar	H	M	Whitish Pink	Leaves juice is used in asthma, blood diseases and gastric disorder.	LC
<i>Hygrophila phlomidis</i> Nees.	Sep-Apr	H	A	Light Pink	Used to treat cough.	NT

<i>Hygrophila polysperma</i> (Roxb.) T.Anderson	Oct-Mar	H	A	White	Root decoction is used as cooling of stomach.	LC
<i>Hygrophila ringens</i> (L.) R.Br. ex Spreng.	Sep-Apr	H	M	Light Pink	Used for sexual disorder.	NT
<i>Justicia betonica</i> L.	Sep-Dec	H	T	Pink	Leaves juice is used in constipation, snake bite and stomach pain.	NT
<i>Justicia adhatoda</i> Nees	Feb-Apr	H	T	White	Leaves are boiled with water and bathed to cure cough	NT
<i>Justicia gendarussa</i> Burm.f.	Dec-Apr	S	T	White Violet	Warm leaves juice vapour is taken to relief from headache and chronic cough	NT
<i>Justicia petiolaris</i> E.Mey.	Nov-May	H	T	Blue	Warm leaf juice is used to treat cough.	NT
<i>Justicia procumbens</i> L.	Jun-Jan	H	T	Violet	Plant decoction is used to cure asthma, cough and skin disease.	NT
<i>Justicia simplex</i> D.Don	Oct-Dec	H	T	Light Purple	Leaf juice is dropped into eyes.	NT
<i>Peristrophe bicalyculata</i> (Retz.) Nees	Sep-Jan	H	T	Pink	This herb is used for snake poison and in bone fracture.	NT
<i>Peristrophe paniculata</i> (Forssk.) Brummitt	Aug-Dec	H	T	Pink	Plant parts are used for respiratory inflammation.	NT
<i>Ruellia prostrata</i> Poir.	Aug-Sep	H	T	Violet Blue	Leaves paste is used in skin disease	NT
<i>Ruellia suffruticosa</i> Roxb.	Aug-Dec	H	T	Violet White	Dried root decoction is used for birth control.	NT
<i>Ruellia tuberosa</i> L.	whole year	H	T	Violet White	Leave juice is taken to relief from cough and weakness.	NT
<i>Rungia pectinata</i> (L.) Nees	Oct-Apr	H	T	Light Pink	Leaves paste is applied on fore head to relief from headache.	NT
<i>Rungia repens</i> (L.) Nees	Oct-Mar	H	T	Light Blue	Leaves are used as cooling agent.	NT
<i>Thunbergia erecta</i> (Benth.) T.Anderson	Nov-Feb.	US	T	Dark Purple	Control blood sugar level	NT
<i>Thunbergia fragrans</i> Roxb.	Mar-Nov	C	T	White	Twigs paste applied all over the body for fever. tender leaf paste applied on face for giddiness	NT
<i>Thunbergia grandiflora</i> Roxb.	Mar-Nov	C	T	White	Root decoction is used for treating joint pain.	NT

H- Herb, S- Shurb, US- Under Shurb; A- Aquatic, M- Marshy, T- Terrestrial; LC- Least Concern, NT- Near Threatened

Diversity analysis i.e. Diversity, Abundance, Frequency and pattern and Importance Value Index of the plant species Relative Values are calculated for finding the distribution (Table 3).

Table 3: Floristic diversity of plant species of acanthaceae family

Plant name	TQI	TNI	D	A	F	RD (%)	RA (%)	RF (%)	IVI
<i>Acanthus ilicifolius</i> L.	20	422	10.55	21.1	50	5.7	5.23	3.98	14.91
<i>Andrographis echiooides</i> Nees	12	103	2.58	8.58	30	1.39	2.13	2.39	5.91
<i>Andrographis paniculata</i> Wallich ex Nees.	23	395	9.88	17.17	57.5	5.33	4.26	4.58	14.17
<i>Asteracantha longifolia</i> (L.) Nees.	10	53	1.33	5.3	25	0.72	1.31	1.99	4.02
<i>Barleria cristata</i> L.	23	425	10.63	18.48	57.5	5.74	4.58	4.58	14.9
<i>Barleria inaequalis</i> Benth.	4	12	0.3	3	10	0.16	0.74	0.8	1.7
<i>Barleria lupulina</i> Lindl.	18	315	7.88	17.5	45	4.25	4.34	3.59	12.17
<i>Barleria prionitis</i> L.	22	456	11.4	20.73	55	6.16	5.14	4.38	15.68
<i>Barleria strigosa</i> Willd.	5	59	1.48	11.8	12.5	0.8	2.92	1	4.72
<i>Crossandra infundibuliformis</i> L. Nees.	3	32	0.8	10.67	7.5	0.43	2.64	0.6	3.67
<i>Ecbolium linneanum</i> Kurz.	7	24	0.6	3.43	17.5	0.32	0.85	1.39	2.57
<i>Ecbolium viride</i> (Forssk.) Alston	31	724	18.1	23.35	77.5	9.78	5.79	6.18	21.74
<i>Hemigraphis latebrosa</i> Nees.	5	24	0.6	4.8	12.5	0.32	1.19	1	2.51
<i>Hygrophila auriculata</i> (Schumach.) Heine	20	327	8.18	16.35	50	4.42	4.05	3.98	12.45
<i>Hygrophila difformis</i> (L.f.) Blume	8	39	0.98	4.88	20	0.53	1.21	1.59	3.33
<i>Hygrophila heinei</i> Sreem.	5	47	1.18	9.4	12.5	0.63	2.33	1	3.96
<i>Hygrophila phlomoides</i> Nees.	7	84	2.1	12	17.5	1.13	2.97	1.39	5.5
<i>Hygrophila polysperma</i> Roxb.	6	42	1.05	7	15	0.57	1.73	1.2	3.5
<i>Hygrophila ringens</i> (L.) R.br.ex Steudel.	5	15	0.38	3	12.5	0.2	0.74	1	1.94
<i>Justicia betonica</i> L.	11	62	1.55	5.64	27.5	0.84	1.4	2.19	4.42
<i>Justicia adhatoda</i> Nees	25	490	12.25	19.6	62.5	6.62	4.86	4.98	16.45
<i>Justicia gendarussa</i> Burm.f.	32	785	19.63	24.53	80	10.6	6.08	6.37	23.05
<i>Justicia petiolaris</i> E. Mey.	9	73	1.83	8.11	22.5	0.99	2.01	1.79	4.79
<i>Justicia procumbens</i> L.	10	137	3.43	13.7	25	1.85	3.39	1.99	7.24
<i>Justicia simplex</i> D. Don.	11	125	3.13	11.36	27.5	1.69	2.82	2.19	6.69
<i>Peristrophe bicalyculata</i> (Retz.) Nees	21	208	5.2	9.9	52.5	2.81	2.45	4.18	9.45
<i>Peristrophe paniculata</i> (Forssk.) R.K. Brummitt	19	116	2.9	6.11	47.5	1.57	1.51	3.78	6.86
<i>Ruellia prostrata</i> Poir.	20	187	4.68	9.35	50	2.52	2.32	3.98	8.83
<i>Ruellia suffruticosa</i> Roxb.	10	35	0.88	3.5	25	0.47	0.87	1.99	3.33
<i>Ruellia tuberosa</i> L.	35	962	24.05	27.49	87.5	12.99	6.81	6.97	26.77

<i>Rungia pectinata</i> (L.) Nees	16	195	4.88	12.19	40	2.63	3.02	3.19	8.84
<i>Rungia repens</i> (L.) Nees	12	97	2.43	8.08	30	1.31	2	2.39	5.7
<i>Thunbergia erecta</i> (Benth.) T. Anders.	15	207	5.18	13.8	37.5	2.8	3.42	2.99	9.2
<i>Thunbergia fragrans</i> Roxb.	10	57	1.43	5.7	25	0.77	1.41	1.99	4.17
<i>Thunbergia grandiflora</i> Roxb.	12	72	1.8	6	30	0.97	1.49	2.39	4.85
TNQ- Total no. of Quadrate studied, TQI- Total Quadrate Individual, TNI- Total no. of Individual, D - (Density) = $\frac{TNI}{TNQ}$, A- (Abundance) = $\frac{TNI}{TQI}$, F- (Frequency) = $\frac{TQI}{TNQ} \times 100$, RD- (Relative density) = $\frac{D}{TD} \times 100$, RA- Relative abundance = $\frac{A}{TA} \times 100$, RF- Relative frequency = $\frac{F}{TF} \times 100$ and IVI (Importance Value Index) = RD+RA+RF									

A total no. of 35 species belonging to Acanthaceae was recorded from 40 quadrates. *Ruellia tuberosa* is most abundant (24.05) followed by the *Gendarussa vulgaris* (19.63), *Echbolum viride* (18.10), *Justicia adhatoda* (12.25), *Barleria prionitis* (11.40), *Barleria cristata* (10.68), *Acanthus ilicifolius* (10.55), *Andrographis paniculata* (9.88), *Hygrophila auriculata* (8.18) and *Barleria lupulina* (7.88). Most important species is *Ruellia tuberosa*, IVI is 26.77 and followed by the *Gendarussa vulgaris* (23.05), *Echbolum viride* (21.74), *Justicia adhatoda* (16.45), *Barleria prionitis* (15.68) and *Acanthus ilicifolius* (14.91). The biological diversity can be quantified by using different factors. The richness and evenness, two important factors were taken into consideration during measuring the diversity. The diversity of the species are represented by Shannon's index (3.04), the index value lies in between 1.5 and 3.5 which signifies the commonness of the species of family Acanthaceae in Purba Medinipur district. The Simpson's index is 0.063 and species evenness in this study area is 0.785. In this study, Simpson's Diversity Index (0.063) ranged between 0 and 1 ('0' denotes no evenness and '1' denotes complete evenness), which is significantly higher than zero providing more weight for the species abundance in Purba Medinipur District. Species Evenness value (0.785) referred that all the species were not evenly distributed numerically in the community.

Earlier, 24, 17 and 44 species belong to 17 and 12 genera of Acanthaceae were reported from Tamenglong and Tengoupal district of Manipur [8]. The genus *Strobilanthes* (senu. lato) of the family Acanthaceae is remarkable in having nearly 46 species in the rain forests of Western Ghats [26]. A total of 45 weed species belonging to 15 dicot families and 4 monocot families was recorded from 30 quadrates. Plant *Oxalis latifolia* (abundance is 4.40) belongs to Oxalaceae was most abundant weed followed by *Scoparia dulcis* and *Spilanthes calva* each one has (abundance are 2.00). The diversity of weed species represented by Shannon's (3.584) and Simpson's (0.003) indices and species evenness in the maize crop is (36.01) [35]. Floristic survey in agricultural areas of southwestern goiás region recorded 79 species belonging to 58 genera with the Shannon-Wiener and Simpson diversity indices as 1.86 and 0.79, respectively [34].

Diversity indices for coastal flora growing in different location of Bhal region of Gujarat shows the Shannon's indices were ranges between 0.181 to 0.188, 0.335 to 0.395, 0.399 to 0.466 and 0.399 to 0.468 suggested low diversity and the Simpson indices 0.735 to 0.749, 0.434 to 0.483, 0.403 to 0.437 and 0.346 to 0.440 were suggested the species richness [39]. Tree species survey of Likovala in Republic of Congo recorded a total of 1611 trees belonging to 114 species and 35 families with the Shannon's index ranges from 0.75 to 4.46 and the Simpson's index ranges

from 0.23 to 0.95 revealed biodiversity of the forest of this area [41].

Some of the Surveyed species *Justicia adhatoda*, *Barleria lupulina*, *Barleria prionitis*, *Andrographis paniculata* and *Hygrophila auriculata* are facing threat in their native habitat because of human activity due to extensive vannamei shrimp cultivation and Urbanization. As urbanization is required, simultaneously conservation indigenous medicinally important species are also need. To conserve these species public awareness, initiative from knowledgeable academician as well as initiative from administrative level is important to identify and protect the species rich area from different anthropogenic activity.

Conclusion

Diversity is the most important factor for the stability and productivity of ecosystem. In this study it is shown that the species commonness and abundance of the Acanthaceae is more significant in Purba Medinipur district which is also the coastal site of West Bengal. This diversity study also points to a need for scientific management and conservation of these species to prevent their loss especially for their medicinal importance.

Acknowledgements

The authors are thankful to the people of Purba Medinipur district for their valuable co-operation. The authors are also thankful to Professor Ranjan Chakraborti, Honourable Vice-Chancellor of Vidyasagar University for giving the opportunity to carry out this work.

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