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Research Article

Studies on family Convolvulaceae of Howrah, West Bengal, India.

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Abstract: The present communication provides a comprehensive description of family Convolvulaceae of Howrah, West Bengal, India. Overall 5 genera and 15 species have been reported from this district. Ipomoea is the dominant genus among them. 4 species viz., *Evolvulus alsinoides, Ipomoea pes-caprae, Ipomoea quamoclit and Ipomoea triloba* have been newly recorded among 15 species from the area.

Key words: Convolvulaceae, Ipomoea, newly record, Howrah, West Bengal, India.

Introduction

Convolvulaceae is one of the major families of flowering plants known as morning glory family with approximately 2000 species and of 58 genera from all over the world (Staple and Yang, 1998). Major numbers of species are incorporated in the genera Ipomoea and Convolvulus (Cronquist, 1988). Approximately 650 species of Ipomoea have been mentioned from the entire world by Mabberley (Mabberley, 1997). India is represented by 158 species of family Convolvulaceae among 20 genera and also by the reportedly 60 species of Ipomoea from the entire country (Oudhia, 2001). Members of the Family Convolvulaceae are widely distributed and occur in the moist places of West Bengal, Gujarat, Bihar, Chhattisgarh, Maharashtra, Goa and Karnataka (Undirwade et al, 2015).

Many researchers have researched on different subjects of *Ipomoea,* biodiversity and taxonomy of the tropical plant of Calcutta (Sivdasan and Mathue, 1998), the climbers of the taluka Modasa, Dist. Sabarkantha (Gujrat) India (Jangid and Sharma, 2011), the foliar anatomy of some uninvestigated species of Convolvulaceae (Tayade and Patil, 2012), the leaf anatomical studies in some species Convolvulaceae (Tayade and Patil, 2012), the karyotype analysis in some south Indian Convolvulaceae (Sampathkumar, 1970) and the taxonomic significance of karyotypology in *Ipomoea* species (Sinha and Sharma, 1992). Prain was the pioneer to report about Convolvulaceae from West Bengal and afterwards several other workers studied on Convolvulaceae from West Bengal (Prain, 1908). Prain reported 21 genera and 64 species from Bengal province of British India. Studies on Family Convolvulaceae in the district Howrah were led by SSR Bennet who documented 4 genera and 10 species in the year of 1979. Most of the plants of this family are herbs (Bennet, 1979). The present study carried out to document diversity of family Convolvulaceae from entire Howrah district.

Material and Methods

Study Area

Howrah is a small southern district (467 km^2) of the West Bengal (Figure 1). The Howrah district situated between 22°48' N and 22°12' N latitudes and between 88°23' E and 87°50' E longitudes. Rupnarayan River and Bhagirathi-Hooghly River boundary are the west and east borderline of this district whereas Bally canal and Damodar River are located at the north-east and north-west boundary. Annual average rainfall is 1461 millimeter and temperature varies between 9-42°C.

Sampling techniques and species identification

District Howrah was assessed for plant diversity, Frequency and abundance from February, 2014 to August, 2018 through quadrate methods. The study was continued through stratified random quadrate method. In this method 2m x 2m sample plots were nested for plant species in each block (15) of this district. Within each plot the number and name of all the plants of Convolvulaceae were counted and recorded. Density (D), frequency (F), abundance (A) was calculated through Shukla and Chandal (2000). Collected specimens were deposited in the herbarium of Department of the Botany and Forestry, Vidyasagar University. Plats were identified with the help of herbarium specimen of different weeds with the help of the experts. Photographic documentation was done through Cannon EOS 550D with 18-55 mm lens.

Data analysis:

Data analyses were performed by PAST software Version 3.02 (Hammer *et al.*, 2001)

Measurement of diversity

The type of diversity used here is α- diversity which is the diversity of species within a community or habitat. The diversity index was calculated by using the Shannon – Wiener diversity index (Shannon and Wiener, 1949).

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Diversity index =

$$H = -\sum Pi \ In \ Pi, \text{ where } Pi = S / N$$

S = number of individuals of one species
N = total number of all individuals in the sample
In = logarithm to base.

Measurement of species richness

Margalef's index was used as a simple measure of species richness (Margalef, 1958)

$$\text{Margalef's index} = (S - 1) / In \ N$$

S = total number of species
N = total number of individuals in the sample
In = natural logarithm

Dominance and Simpson Index

$$D = \sum (ni/n)^2$$

where ni is number of individuals of taxon i.
Dominance = 1-Simpson index. Ranges from 0 (all taxa are equally present) to 1 (one taxon dominates the community completely).
Simpson index 1-D. Measures 'evenness' of the community from 0 to 1. Dominance and Simpson indices are often used interchangeably.

Species Accumulation Curve

Species accumulation curve is a move towards by plotting the cumulative number of species recorded against the sampling years (2014-2018). From the year 2014, the species accumulation curve of whole district sampled individually, increased from 2015 to 2017 sampling through the number of new records added slowly but after 2017 number of new records were same in 2018.

PCA (Principle Component Analysis) and PCO (Principle Coordinates Analysis)

Principal components analysis (PCA) finds hypothetical variables (components) accounting for as much as possible of the variance in your multivariate data [30, 31]. Two variables were choosing based on higher variance and eigenvalue scale. Density was plotted as component 1 and frequency was plotted on component 2.

Results

A total of 15 species of family Convolvulaceae (Table1) **belonging to** 5 genera were **recorded from** the district Howrah, West Bengal, India. Five genera were *Evolvulus, Hewiitia, Ipomoea, Merremia* and *Operculina.* Species composition was highest in the genus *Ipomoea* 10 (66.67%) followed by the genus Evolvulus 2 (13.34%), *Hewiitia* **1** (6.67%)**,** *Merremia* **1** (6.67%)**, and** *Operculina* **1** (6.67%) (Figure 2)**.** Species accumulation curve is represented in the figure 3. Measurements of diversity related indices are representing in the table 2. Principal component analysis (PCA) of species based on Density and Frequency data (these two variables are taken based on higher Variance and Eigenvalue scale) are presented in figure 4. On both the cases, X axis (component 1) i.e. Density and on the Y axis (component 2) i.e. Frequencies are plotted which show similarities between different species. PCA (Principle component analysis) of species showing extension region presented in figure 5. In figure 6, 7, and 8 Normal Probability distribution of Density, Frequency and Abundance are presented. XY plot with error bars of Number, Density, Frequency and Abundance presented in figure 9. Bubble and Elliptical bubble plot of Density, Frequency and Abundance of plant species presented in figure 10 and 11. Matrix plot with of Number, Density, Frequency and Abundance of plant species are presented in figure 12. Observed species were photographed by Canon EOS 550 D with EFS 18-55 mm lens represented in the figure 13- figure 14.

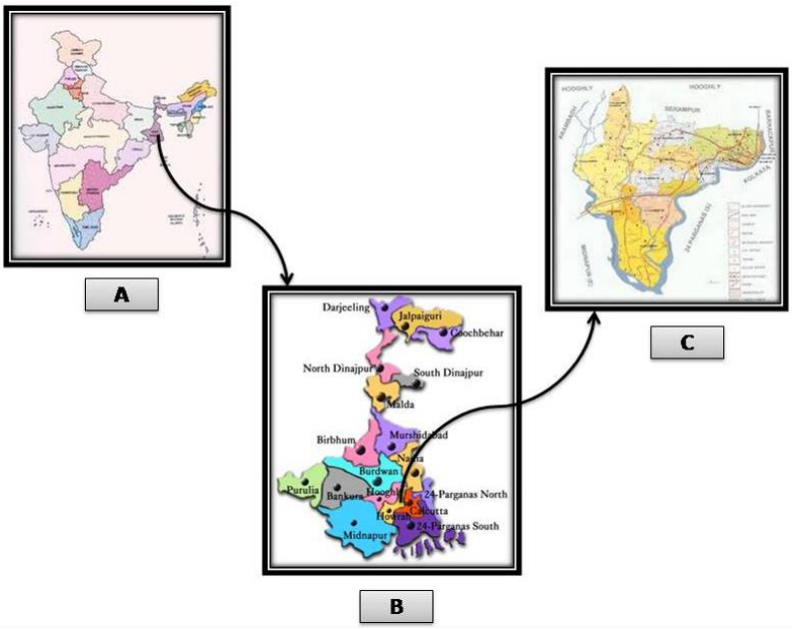

Figure 1: Study area [India (A), West Bengal (B), Howrah District (C)]

Table 1: List of Odonta (Dragonfly and Damselfly) fauna of Howrah district (West Bengal, India) during 2012 to 2017

Sl No.	Common name	Scientific name	Status
1	Nil bhuiankra	*Evolvulus alsinoides* (L.) L.	C
2	Bhuikamri, Bhumisushni	*Evolvulus nummularius* (L.) L.	VC
3	Jarad Kalmi	*Hewiitia malabarica* (L.) Suresh	C
4	Kalmi shak	*Ipomoea aquatica* Forssk.	VC
5	Morning glory	*Ipomoea cairica* (L.) Sweet	UC
6	Ban Kalmi	*Ipomoea carnea* Jacq.	VC
7	Purple heart glory	*Ipomoea marginata* (Desr.) Verdc.	R
8	Small white morning glory	*Ipomoea obscura* (L.) Ker Gawl.	U
9	Chagal khuri	*Ipomoea pes-caprae* (L.) R. Br.	R
10	Languli lata	*Ipomoea pes-tigridis* L.	R
11	Tarulata	*Ipomoea quamoclit* L.	VC
12	Ban Kalmi	*Ipomoea sepiaria* Koenig ex Roxb.	C
13	Choto ghanta	*Ipomoea triloba* L.	R
14	Komalata	*Merremia hederacea* (Burm. f.) Hallier f.	U
15	Dudh Kalmi	*Operculina turpethum* (L.) Silva Manso	VC

[VC: Very Common (>50), C: Common (20-50), U: Uncommon (5-20), LC: Locally Common (Common in particular area), R: Rare (<5)

Table 2: Measurements of diversity related indices

SL. No.	Diversity related indices	Calculated result
1	Taxa_S	15
2	Simpson_1-D	0.8909
3	Dominance_D	0.1091
4	Shannon_H	2.358
5	Evenness_e^H/S	0.7045
6	Margalef	2.298

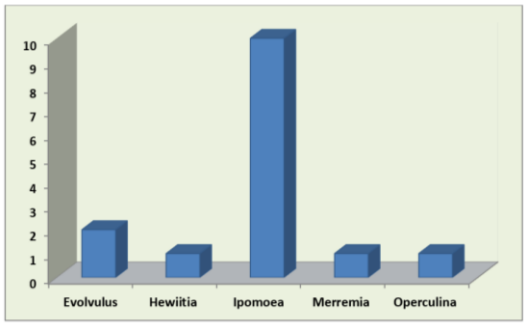

Figure 2: Genus wise graphical representation of plant species

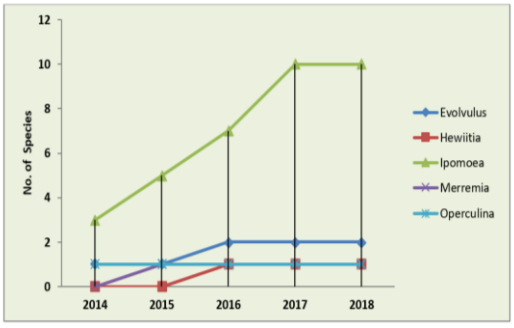

Figure 3: Graphical representation of cumulative number of species collected against the sampling years (2014-2018).

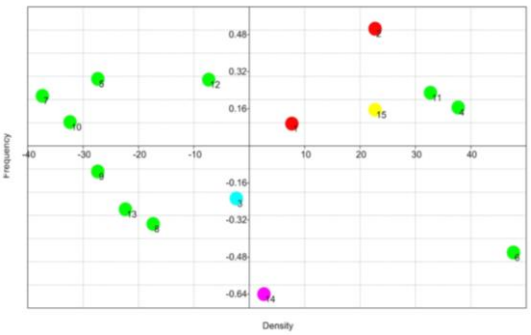

Figure 4: PCA (Principle component analysis) of plant species created through PAST software. (Used characters: Density and Frequency).

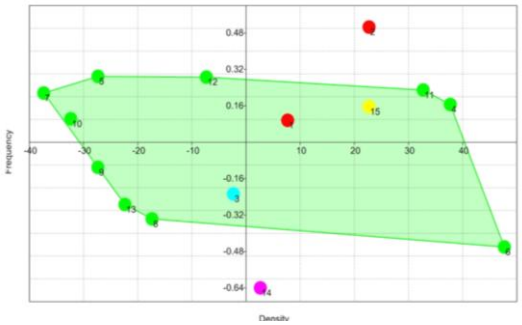

Figure 5: PCA (Principle component analysis) of species showing extension region

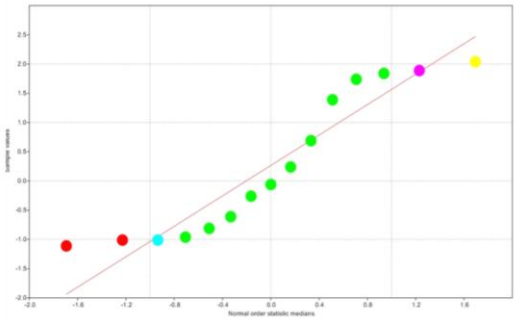

Figure 6: Normal Probability Plot of Density of plant species

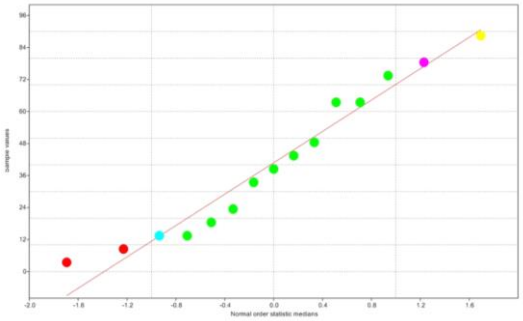

Figure 7: Normal Probability Plot of Frequency of plant species

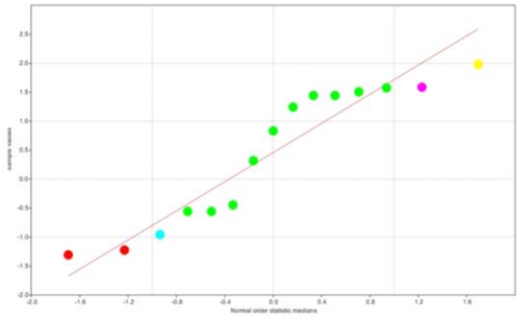

Figure 8: Normal Probability Plot of Abundance of plant species

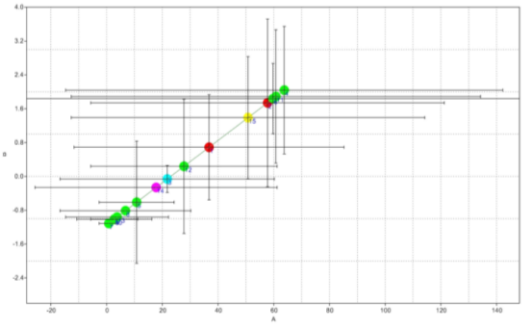

Figure 9: XY plot with error bars of Number, Density, Frequency and Abundance

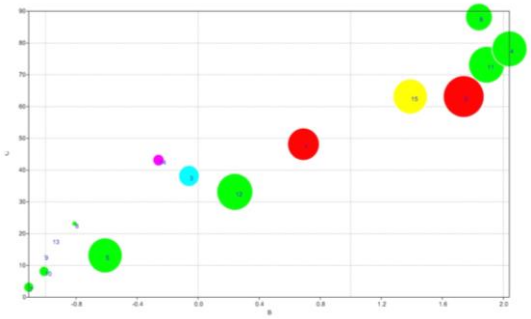

Figure 10: Bubble plot of Density, Frequency and Abundance of plant species

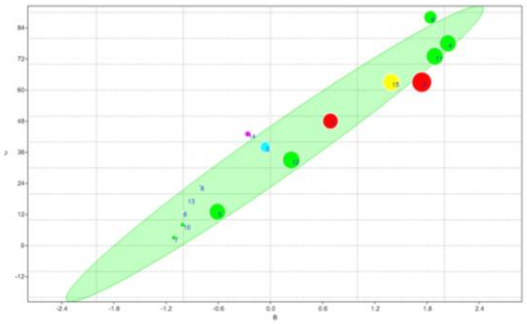

Figure 11: Elliptical Bubble plot with of Density, Frequency and Abundance of plant species

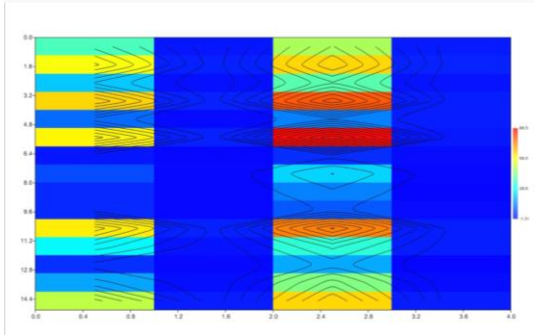

Figure 12: Matrix plot with of Number, Density, Frequency and Abundance of plant species

Discussion

The outcomes of the study so far clearly indicate that the overall diversity of the species of Convolvulaceae in this district is pretty good as, in Howrah, forests and large protected areas are absent and density of human population is high. Five species viz. *Evolvulus alsinoides, Ipomoea nil, Ipomoea pes-caprae, Ipomoea quamoclit and Ipomoea triloba* were documented for the first time from this District. Again four previously recorded species, namely *Argyreia nervosa, Ipomoea mauritiana, Merremia gangetica and Stictocardia tilifolia* could not be found during the period of this study. Previous status of *Argyreia nervosa* and *Ipomoea mauritiana* was rare, *Merremia gangetica* and *Stictocardia tilifolia* was very rare. After 38 years of their documentation, many changes in their habitat have occurred in this district and human population has also increased so there is a chance for their extinction from this district. *Ipomoea triloba* has been reported for the second time from the entire West Bengal. *Ipomoea pes-caprae,* a coastal species has been found only in two places of Shyampur II Block.

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Figure 13: A) *Evolvulus alsinoides* B) *Evolvulus nummularius* C) *Hewiitia malabarica* D) *Ipomoea aquatica* E) *Ipomoea cairica* F) *Ipomoea carnea* G) *Ipomoea marginata* H) *Ipomoea obscura* I) *Ipomoea pes-caprae*

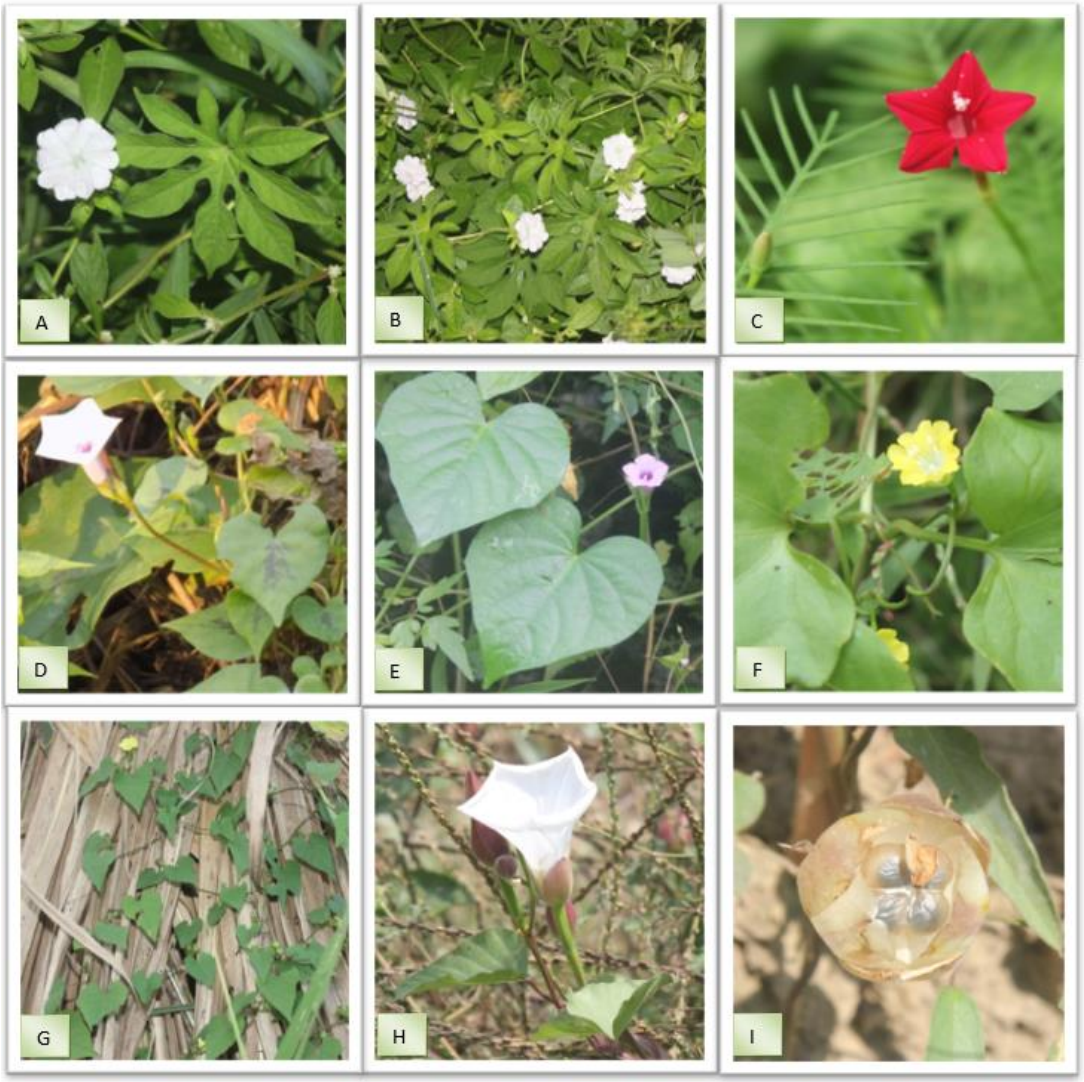

Figure 14: A) *Ipomoea pes-tigridis* B) Habitat picture of *Ipomoea pes-tigridis* C) *Ipomoea quamoclit* D) *Ipomoea sepiaria* E) *Ipomoea triloba* F) *Merremia hederacea* G) Habitat picture of *Merremia hederacea* H) *Operculina turpethum* I) Fruit of *Operculina turpethum*

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