Eco. Env. & Cons. 26 (November Suppl. Issue) : 2020; pp. (S423-S427)
Copyright@ EM International
ISSN 0971–765X

Ecological significance of plant life forms of an urban green space of Purulia Region, West Bengal, India

Rimi Roy*, Manideepa Bhattacharya, Barsha Baral and Deblina Das Modak

Department of Botany, Jagannath Kishore College, Purulia 723 101, West Bengal, India

(Received 14 April, 2020; Accepted 10 June, 2020)

ABSTRACT

Purulia is one of the prominent arid regions of West Bengal, India. The present work was conducted to determine the lifeforms of the existing plants and their ecological significance at the Jagannath Kishore College campus which is an urban green space located in Purulia city, West Bengal. Work also aimed to determine the biological spectrum of the study site that reflects the phytoclimate and adaptations to arid conditions of the region. On comparison with Raunkiaer's normal spectrum it was revealed that there was much higher abundance of therophytes (23.86%) than the normal spectrum thus, indicating warm and arid climatic conditions. However, phanerophytes (46.59%) and cryptophytes (5.68%) were almost equal to the normal spectrum, depicting more or less stable vegetation. From the present study it was observed that the study site is phanero-therophytic in nature.

***Key words**: Lifeforms, Phytoclimate, Biological spectrum, Purulia*

Introduction

The plants can be classified into life forms depending on their similarities in ecological conditions. Plant life form in a community is generally defined as the sum adaptation of plant to certain ecological conditions (Mera *et al*., 1999). Humboldt (1886) for the first time formulated the concept of the life forms for which he considered the location of perennating buds or organs. Later the system of Raunkiaer (1934) became the most accepted worldwide, which is based on the place of the plant's growth point (bud) during seasons with adverse conditions. He constructed a normal biological spectrum which could act as a null model against which different life form spectra could be compared. Differences in the life form distribution between the normal spectrum and a biological spectrum would point out which life form characterizes the phytoclimate or the vegetation under study.

India forms an important biogeographic zone due to huge variations in its vegetation (Manral *et al.*, 2013). The growth and development of natural vegetation in India are influenced by the geographical factors such as climate (temperature and precipitation), topography and soil. The type of vegetation in a particular area is largely determined by the elements of climate i.e., temperature, rainfall, sunshine, relative humidity and winds. Soil in addition to retaining and providing nutrients for the growing plants, also accounts for the types of trees (Mani, 1974).

In India, several workers have studied life forms and biological spectrum of different regions (Saxena *et al*., 1982; Rana *et al*., 2002; Sharma *et al*., 2014). The biological spectra of different regions of West Bengal have been worked out by different researchers (Banerjee *et al.*, 2005; Ghosh *et al*., 2007; Bhattacharya and Mukherjee, 2013; Roy *et al*., 2014).

The vegetation under Purulia division falls under

the zone of Northern tropical Dry Deciduous forest (Mahato, 2010). However, no studies related to phytoclimatic nature of vegetation have been carried out in regions of Purulia. In this view, the present study deals with the determination of the phytoclimate as well as biological spectrum of Jagannath Kishore (J.K.) College campus which is an important urban green space in Purulia district in order to assess the ecological significance of plant life forms.

Materials and Methods

Study site

Purulia, lying between 22º602 and 23º502 North latitude and 85º752 and 86º652 East longitude, is the westernmost district of West Bengal that occupies an area of 6259 sq km with forests covering nearly 87.60 thousand hectares. The district is characterized by undulating topography with rugged hilly terrain in the western and southern part. General elevation ranges from 100 to 300 meters. Master slope ranges between 10 to 20 m/km. climatologically, Purulia district falls under semi-arid and drought-prone region. The soil is of lateritic type and the temperature ranges from 26 ºC to 44 ºC during summer and from 11 ºC to 24 ºC during winter. Average rainfall recorded during last fifty years is 1375.2 mm.

J.K. College campus lies between latitude 23.317135 longitude 86.368746 (source: Google map) of Purulia district of West Bengal state. The campus covers an area of 20 acres. It is 1.5 km from both Purulia Railway Station in South Eastern Railway and Purulia Bus Stand, enjoined with the township through the bypass that connects itself with NH 32.The campus harbours various indigenous/naturalized as well as cultivated plant species.

The percentage distribution of all the constituent species in different life forms was calculated for preparation of the biological spectrum of the study site as described elsewhere (Roy and Mukherjee, 2011).

Based on the life forms, biological spectrum of the plant community was prepared taking percentage value of each life form and presented in tabulated form (Table 1).

$$\text{Biological spectrum (\%)} = \frac{\text{Total no of species in a life form class}}{\text{Total no of species found in the study area}} \times 100$$

The values thus determined, were compared with the normal spectrum given by Raunkiaer (1934) in order to determine the phytoclimate of the study site.

Results

A total of 88 plant species have been reported from this area according to Roy *et al.* (unpublished). Each of the plant species along with its habit and life-form has been represented (Table 1).

The most dominant life forms were represented by phanerophytes (46.59%), followed by therophytes (23.86%) and chamaephytes (15.91%). The least frequent life forms were hemicryptophytes (7.96%) and cryptophytes (5.68%) respectively (Table 2).

The biological spectrum of the present study shows variation from the normal biological spectrum of Raunkiaer (1934) (Fig. 1). The data revealed much higher abundance of therophytes than the normal spectrum thus, indicating warm and arid climatic conditions. However, phanerophytes and cryptophytes are almost equal to the normal spectrum, depicting more or less stable vegetation.

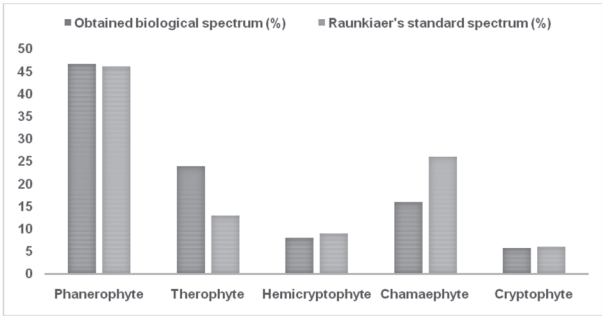

Fig. 1. Biological spectrum of the present study site and its comparison with the Raunkiaer's normal biological spectrum representing world flora

Due to the abundance of phanerophytes and therophytes, the phytoclimate of the study site could be described as phanero-therophytic in nature.

Discussion

The predominance of phanerophytesis attributed to various factors like prevalent microclimate of the region as mentioned elsewhere (Sharma, 2003). Also, the higher percentage of therophytes occur-

Table 1. List of plant species present is J.K. College campus and surroundings with habitat and life-forms

Name of the plant	Family	Habit	Phytoclimate
Acacia auriculiformis A. Cunn	Fabaceae	Dicot, tree	Phanerophyte
Acalypha indica L.	Euphorbiaceae	Dicot, herb	Therophyte
Achyranthes aspera L.	Amaranthaceae	Dicot, herb	Chamaephyte
Aegle marmelos Corr.	Rutaceae	Dicot, tree	Phanerophyte
*Agave americana*L.	Asparagaceae	Monocot, herb	Hemicryptophyte
Ageratum conyzoides L.	Asteraceae	Dicot, herb	Therophyte
Aloe vera (L.) Burm. f.	Asphodelaceae	Monocot, herb	Phanerophyte
Alternanthera sessilis (L.) R. Br. ex DC.	Amaranthaceae	Dicot, shrub	Therophyte
Alysicarpus monilifer (L.) DC.	Fabaceae	Dicot, herb	Therophyte
Andrographis paniculata (Burm.f.) Wall. ex Nees	Acanthaceae	Dicot, herb	Therophyte
Annona squamosa L.	Annonaceae	Dicot, tree	Phanerophyte
Asparagus racemosus Willd.	Asparagaceae	Monocot, shrub	Hemicryptophyte
Averrhoa carambola L.	Oxalidaceae	Dicot, tree	Phanerophyte
Azadirachta indica A. Juss	Meliaceae	Dicot, tree	Phanerophyte
Boerhavia diffusa L.	Myctaginaceae	Dicot, herb	Therophyte
Butea monosperma (Lam.) Taub.	Fabaceae	Dicot, tree	Phanerophyte
Caladium bicolor Vent.	Araceae	Monocot, herb	Cryptophyte
Carica papaya L.	Caricaceae	Dicot, tree	Phanerophyte
Caryotaurens L.	Arecaceae	Monocot, tree	Phanerophyte
Catharanthus roseus (L.) G. Don	Apocynaceae	Dicot, herb	Chamaephyte
Citrus aurantiifolia (Christm.) Swingle	Rutaceae	Dicot, shrub	Chamaephyte
Cleome viscosa L.	Cleomaceae	Dicot, herb	Therophyte
Clitori aternatea L.	Fabaceae	Dicot, herb	Cryptophyte
Coccinea grandis L.	Cucurbitaceae	Dicot, shrub	Phanerophyte
Commelina benghalensis L.	Commelinaceae	Monocot, herb	Therophyte
Crotalaria pallida Aiton.	Fabaceae	Dicot, herb	Therophyte
Croton bonplandianum Bail.	Euphorbiaceae	Dicot, herb	Therophyte
Cynodon dactylon (L.) Pers.	Poaceae	Monocot, herb	Hemicryptophyte
Cyperus rotundus L.	Cyperaceae	Monocot, herb	Cryptophyte
Delbergia sissoo Roxb.	Fabaceae	Dicot, tree	Phanerophyte
Delonix regia (Boj. Ex Hook.) Raf.	Fabaceae	Dicot, tree	Phanerophyte
Desmodium gangeticum DC.	Fabaceae	Dicot, herb	Hemicryptophyte
Dieffenbachia seguine (Jacq.) Schott	Araceae	Monocot, herb	Cryptophyte
Dillenia indica L.	Dilleniaceae	Dicot, tree	Phanerophyte
Duranta erecta L.	Verbenaceae	Dicot, shrub	Phanerophyte
Dypsis lutescens (H.Wendl.) Beentje & J. Dransf.	Arecaceae	Monocot, tree	Phanerophyte
Elusine indica (L.) Gaertn.	Poaceae	Monocot, herb	Hemicryptophyte
Eragrostis tenella (L.) Wight & Arn. Ex Nees	Poaceae	Monocot, herb	Hemicryptophyte
Euphorbia cyathophora Murr	Euphorbiaceae	Dicot, herb	Therophyte
Euphorbia hirta L.	Euphorbiaceae	Dicot, herb	Therophyte
Ficus benghalensis L.	Moraceae	Dicot, tree	Phanerophyte
Ficus religiosa L.	Moraceae	Dicot, tree	Phanerophyte
Gmelina arborea Roxb.	Lamiaceae	Dicot, tree	Phanerophyte
Gomphrena celosioides Mart.	Amaranthaceae	Dicot, herb	Therophyte
Hibiscus rosasinensis L.	Malvaceae	Dicot, shrub	Phanerophyte
Hibiscus schizopetalus (Dyer.) Hook.fil.	Malvaceae	Dicot, shrub	Chamaephyte
Hyophorbe lagenicaulis (L. H. Bailey) H. E. Moore	Arecaceae	Monocot, tree	Phanerophyte
Ixora grandiflora L.	Rubiaceae	Dicot, shrub	Therophyte
Jatropha gossypifolia L.	Euphorbiaceae	Dicot, herb	Therophyte
Kyllinga brevifolia Rottb.	Cyperaceae	Monocot, herb	Hemicryptophyte
Lantana camara L.	Verbenaceae	Dicot, shrub	Chamaephyte
Mangifera indica L.	Anacardiaceae	Dicot, tree	Phanerophyte

Table 1. *Continued ...*

Name of the plant	Family	Habit	Phytoclimate
Melaleuca viminalis (Sol. ex Gaertn.) Byrnes	Myrtaceae	Dicot, tree	Phanerophyte
Melia azedarach L.	Meliaceae	Dicot, tree	Phanerophyte
Mimosa pudica L.	Fabaceae	Dicot, shrub	Chamaephyte
Mimusops elengi L.	Sapotaceae	Dicot, tree	Phanerophyte
Mirabilis jalapa L.	Nyctaginaceae	Dicot, herb	Phanerophyte
Moringa oleifera Lam.	Moringaceae	Dicot, tree	Phanerophyte
Murdannia triquetra (Wall. ex C.B.Clarke) G.Brückn.	Commelinaceae	Monocot, herb	Therophyte
Murrayap aniculata (L.) Jack	Rutaceae	Dicot, tree	Phanerophyte
Musa paradisiaca L.	Musaceae	Monocot, tree	Phanerophyte
Musaenda frondosa L.	Rubiaceae	Dicot, tree	Phanerophyte
Neolamarckia cadamba (Roxb.) Bosser	Rubiaceae	Dicot, tree	Phanerophyte
Nerium indicum Mill.	Apocynaceae	Dicot, shrub	Chamaephyte
Oldenlandia corymbosa L.	Rubiaceae	Dicot, herb	Chamaephyte
Oxalis corniculata L.	Oxalidaceae	Dicot, herb	Chamaephyte
Parthenium hysterophorus L.	Asteraceae	Dicot, herb	Therophyte
Phyllanthus simplex Retz.	Euphorbiaceae	Dicot, herb	Therophyte
Pistia stratiotes L.	Araceae	Monocot, shrub	Cryptophyte
Plumeria rubra L.	Apocynaceae	Dicot, tree	Phanerophyte
Polyalthia longifolia Sonn.	Annonaceae	Dicot, tree	Phanerophyte
Psidium guajava L.	Myrtaceae	Dicot, tree	Phanerophyte
Pterospermum acerifolium (L.) Willd.	Malvaceae	Dicot, tree	Phanerophyte
Punica granatum L.	Lythraceae	Dicot, tree	Phanerophyte
Rosa indica L.	Rosaceae	Dicot, shrub	Chamaephyte
Ruelia tuberosa L.	Acanthaceae	Dicot, herb	Therophyte
Sida acuta Burm. f.	Malvaceae	Dicot, herb	Chamaephyte
Solanum sisimbrifolium Lam.	Solanaceae	Dicot, herb	Chamaephyte
Swietenia mahagoni (L.) Jacq.	Meliaceae	Dicot, tree	Phanerophyte
Synedrella nodiflora (L.) Gaertn.	Asteraceae	Dicot, herb	Therophyte
Syzygium cumini (L.) Skeels	Myrtaceae	Dicot, tree	Phanerophyte
Tamarindus indica L.	Fabaceae	Dicot, tree	Phanerophyte
Tecoma castanifolia (D. Don) Melch.	Bignoniaceae	Dicot, shrub	Chamaephyte
Tectona grandis L. f.	Lamiaceae	Dicot, tree	Phanerophyte
Tephrosia purpurea (L.) Pers.	Fabaceae	Dicot, herb	Chamaephyte
Terminalia bellirica (Gaertn.) Roxb.	Combretaceae	Dicot, tree	Phanerophyte
Thevetia parviflora L.	Apocynaceae	Dicot, tree	Phanerophyte
Tridax procumbens L.	Asteraceae	Dicot, herb	Therophyte

Table 2. Biological spectrum of the study site

Life form	No. of species	Raunkiaer's standard (%)	Obtained biological spectrum (%)
Phanerophyte	41	46	46.59
Therophyte	21	13	23.86
Hemicryptophyte	7	9	7.96
Chamaephyte	14	26	15.91
Cryptophyte	5	6	5.68

ring in the area is the characteristic of subtropics and often related to soil conditions and climate (Subramani *et al.,* 2007).

Climatically, the study area is generally warm and arid during summer and warm and moist during rainy season which is an evidence for the dominance of phanerophytes followed by therophytes. Though the most dominating life-form is phanero-

phyte (46.59%) which includes plants whose perennating buds are located on the twigs and branches exposed to the atmosphere during unfavourable condition, the next dominating class with about 23.86% population is therophytes. This group also includes annual summer plants which survive under unfavourable seasons in form of seeds.

It is noteworthy that the study site is a college campus with conspicuous anthropogenic activities such as development of new buildings, fragmentation, landscape designing, introduction of new plant species as part of the plantation programme and is one of the most important urban green spaces in the region, which is reflected by its phanero-therophytic phytoclimate as revealed in the present study.

Acknowledgements

The authors are grateful to Dr. Santanu Chattopadyay, the Principal, Jagannath Kishore College, Purulia for providing the necessary facilities to carry out the research work.

References

Banerjee, B., Bhattacharya, A. and Mukherjee, A. 2005. Biological spectrum of Sonamukhi Forest in Bankura District, West Bengal. *Geobios.* 32 (4) : 275-276.

Bhattacharya, A. and Mukherjee, A. 2013. Phytospectroscopy of forest patches in Bardhaman district. *Indian Forester.* 139 (12) : 1146-1150.

Ghosh, A., Ghosh, T., Choudhuri, A. and Bhattacharya, A. 2007. Biological Spectrum of Bahadurpur Forest, Nadia-Murshidabad Forest Division, Nadia, West Bengal. *Environment and Ecology.* 25(4): 1077-1080.

Humboldt, A. 1886. *Ideen zueiner Physiognomik der Gewechra*. Tubingeon.

Mahato, N.K. 2010. Environment and Migration, Purulia, West Bengal. CRG Research Paper Series, Policies and Practices, 30, p.2.

Mani, M.S. 1974. Ecology and Biogeography in India. *Monographiae Biologicae*; Series Volume: 23; pp-773.

Manral, U., Raha, A., Solanki, R., Hussain, S.A., Babu, M.M., Mohan, D., Veeraswami, G.G., Sivakumar, K. and Talukdar, G. 2013. Plant species of Okhla Bird Sanctuary: a wetland of Upper Gangetic Plains, India [with erratum]. *Check List.* 9 (2) : 263-274.

Mera, A.G., Hagen, M.A. and Orellana, J.A.V. 1999. Aerophyte, a new life form in Raunkiaers classification? *J. Veg. Sci.* 10: 65-68.

Raunkiaer, C. 1934. *The Life Forms of Plants and Statistical Plant Geography.* Clarendon Press, Oxford, U.K.

Roy, R. and Mukherjee A. 2011. Study of floral diversity in Belbaid Patch deranged by opencast mining in Raniganj coalfield area, West Bengal. *Indian J Applied and Pure Bio.* 26 (2) : 229-233.

Roy, R., Mukherjee, A. and Ghosh, W. 2014. Taxonomic and phytoclimatic surveillance of the naturalized vegetation in an opencast coal mine site of Burdwan district, West Bengal. *Indian Journal of Life Sciences. 4*(1) : 105-110.

Sharma, J., Raina, A.K. and Sharma, S. 2014. Phytodiversity (Angiosperms and Gymnosperms and Pteridophytes) in Lamberi Forest Range, Rajouri, J&K, India. *Environ. Conserv. J.* 15 (1&2) : 35-47.

Saxena, A.K., Pandey, P. and Singh, J.S. 1982. Biological Spectrum and other structural functional attributes of the vegetation of Kumaun Himalaya. *Vegetatio.* 49 (2) : 111-119.

Rana, T.S., Datt, B. and Rao, R.R. 2002. Life forms and biological spectrum of the flora ofTons valley, Garhwal Himalaya (Uttaranchal), India. *Taiwania.* 47 (2) : 164–169.

Sharma, N. 2003. *Biodiversity characterization at landscape levelusing RS and GIS in District,* Jammu. Ph.D. Thesis, University of Jammu, Jammu, J&K, India.

Subramani, S.P., Jishtu, V., Verma, R.K. and Kapoor, K.S. 2007. Floristic composition, life forms and biological spectrum of Renuka Wildlife Sanctuary, Himachal Pradesh. *Indian Forester.* 133 : 79-92.