

Phyto-geography and Ecology of Bio Fertilizer-pteridophytes in Coastal Saline Zone of West Bengal

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Abstract—An extensive survey of the bio-fertilizer pteridophytic flora of Coastal Saline Zone of West Bengal has been carried out extending over a period of three years. Altogether, 6 species are recorded in this region and out of these 3 appears to have introduced comparatively in recent times. In addition to this, 1 taxon has become threatened due to ruthless activities for urbanization. Most important event of this region is that both sacred and evil water bodies in different parts of West Bengal are playing most valuable roles from time immemorial for the in situ conservation of these water ferns. Due to religious dicta no one dares to disturb the tranquility and the status quo of those water bodies.

Keywords: Bio-fertilizer, coastal saline zone, photo geography, pteridophytes.

District	Geographic area (ha)	Cultivable area (ha)	Saline area (ha)	Cultivable saline area (ha)	Cropping intensity (%)
North 24 Parganas	3,78,047	2,69,942	1,47,112	95,097	198
South 24 Parganas	9,96,172	4,08,359	3,50,625	2,37,911	134
Howrah	1,36,015	92,196	57,599	43,474	234
East Midnapore	4,90,744	3,72,058	2,65,112	1,81,948	167
Total	20,00,978	11,42,555	8,20,448	5,58,430	183.25

1. INTRODUCTION

The present treatise is virtually the first detailed account of the diversities, diagnostic properties, distribution, ecology and conservation of the Bio fertilizer-pteridophytes of Coastal saline Zone of West Bengal. This study is based on intensive survey carried out over a period of three years. It is indeed surprising that even in the celebrated works of Hooker and Baker¹, Beddome², Prain³ and Others (Ghosh *et al.*)⁴ only the occurrence of those taxa of pteridophytes of the region under survey, have been recorded, and that too without relevant information. More astonishing is the fact that in the National and Regional Herbaria, herbarium specimens of those taxa of pteridophytes collected from West Bengal, but unfortunately those specimens too are without apposite details

2. MATERIAL AND METHODS

Ecological background of the area

The coastal region of West Bengal lies between 87° 25' E and 89° E latitude and 21° 30' N and 23° 15' N latitude covering an extensive area of land along the Bay of Bengal. The distribution of coastal salt affected soils in coastal districts of West Bengal is presented in Table-1. Table-1 Distribution of coastal saline zone of West Bengal

The zone is categorized in two different agro-ecological sub-regions (AESR) viz. 15.1 (Bengal basin and north Bihar plains, hot moist sub-humid eco-sub-region with deep loamy to clayey alluvial derived soils, medium to high AWC and LGP 210-240 days) and 18.5 (Gangetic delta, hot moist sub-humid to humid ESR, with deep loamy clayey coastal and deltaic alluvium derived soils, medium AWC and LGP 240-270 days) respectively. The major problems in this region may be outlined as below.

High soil salinity, shallow water table enriched with salts contributing to salinity build-up in soil during winter and summer seasons, heavy texture of soil, influence of tidal waves and periodical inundation by tidal water, low-lying situation of the land, poor surface and sub-surface drainage conditions, lack of good quality irrigation water during summer and winter seasons, heavy and intensive rains during monsoon resulting in deep water logging of cultivated fields and frequent cyclonic storms along with heavy rains causing damage to the plants.

Mangrove eco-system of Sundarban maintains a very rich biodiversity of coastal saline zone. The Royal Bengal Tiger (*Panthera tigris* L.) in the forest of Sundari (*Heritiera minor* Roxb.), Hental (*Phoenix paludosa* Roxb.), Golpata (*Nipa*

fruticans Wurm.), Jelegaran (*Ceriops decandra* (Griff.) Ding Hou.) etc and Crocodile (*Crocodilus Porosus* Schneider) in the tidal brackish water are world famous fauna

3. DISTRIBUTION AND HABITAT OF DIFFERENT TAXA :

Azolla filiculoides subsp *asiatica* and *Azolla caroliniana* occur in fresh-water regions of West Bengal, the former one in throughout West Bengal, while the later species is found only in Jaynagar and adjacent areas of South Bengal. *Azolla filiculoides* subsp *asiatica* being a primeval taxon for over half a century has quite adopted itself even in semi-saline water bodies. Both these two taxa grow in shallow ditches, small ponds and paddy fields. Ramakrishna Mission Ashram, a NGO for improving the fertility of the soil, introduced *Azolla caroliniana*. *Azolla filiculoides* subsp *asiatica* dries up after March, but the vegetative body of *Azolla caroliniana* withstands hot summer and serves continuously as a bio-fertilizer. These species, however, cannot withstand saline water when the salinity exceeds 1-1.6 %.

Two species of *Salvinia*, *Salvinia molesta* and *Salvinia natans* occur in West Bengal. Of these two, *Salvinia molesta* is common and grows abundantly throughout the coastal belts of South (Dimond Harbour Subdivision) and North 24 Parganas (Hasnabad, Sandeshkhali-I and II, Hingalganj, Basirhat I and II blocks of Basirhat Subdivision), East Midnapore (Tamluk Subdivision) and Howrah (Sankrail, Panchla, Domjur, Jagadballavpur, Uluberia, Bagnan and Udaynarayanpur blocks of Uluberia Subdivision). *Salvinia natans* occurs infrequently only in the restricted areas of Gosaba, Basanti and Kultali of South 24 Parganas block and Panskura, Tamluk, Mayna and Contai blocks of East Midnapore. *Salvinia*, incidentally also acts partly as a bio-fertilizer due to its harboring nitrogen fixing alga, *Anabina* inside the sporocarps and folded leaves.

The present survey reveals that in entirety 3 taxa of bio-fertilizer-pteridophytes grow in the sacred and evil water bodies of West Bengal from time immemorial. One introduced taxon of comparatively recent time, *Azolla caroliniana* are absent in these ethnic water bodies. It spreads in adjacent blocks viz. Joynagar-I and II, Mathurapur I, Mandirbazar and Kulpi of South 24 Parganas.

The ecology i.e. habitat, frequency of occurrence, density of population, site of occurrence and state of exposure of light to the individual taxon of pteridophytes of this region is indicated in Table I. Interestingly, the timings of sporulation of different pteridophytes of this region are quite variable, varying from two to ten months (Table II).

Diagnostic properties of different taxa:

4. AZOLLA CAROLINIANA WILLD.

Plants free floating, minute with prostrate, 0.5-1 cm long, delicate stem, growing in great speed forming multilayered

mat, dark green, often turning rusty red in winter, infrequently fertile; leaves overlapping, bearing dermal appendages, the largest appendage being on the upper surface developing close to the base of lamina near the stem, characteristically 2 or more cells broad at the basal part and terminating in a curved apical cell with its tip nearly parallel to leaf surface; megaspore without raised angular bumps or pits and densely and uniformly covered with langed filaments.

5. AZOLLA FILICULOIDES SUBSP ASIATICA RMK SAUNDERS & K FOWLER

Plants minute, 2-6 mm in size with horizontally floating, repeatedly delicate stem; leaves small, bilobed, sessile and beset with numerous water repellent hairs; roots numerous, very well developed; functional megaspore trilete covered with hyaline, alveolate epispore.

6. SALVINIA MOLESTA DS MITCHELL

Plants small, bright green with very fragile, soft, spongy, highly branched stem developing one submerged and two lateral leaves from each node; roots absent; submerged leaf highly dissected root like in appearance, floating leaves little elevated and upwardly curved; rhizome and abaxial surface of floating leaves covered with numerous multicellular, long or short hairs while numerous characteristic egg-beater-like dermal appendages present on the adaxial surface of the floating leaves, sporocarp borne on submerged leaves in bunches; both micro and megasporocarps similar in appearance bearing many sporangia; spores tetrahedral, trilete.

7. SALVINIA NATANS (L.) ALL.

Plants small, bright green with slender, hairy rhizome bearing three leaves from each node – two floating and one submerged, root like in appearance; roots absent; floating leaves spreading, flat, small, hairy, oval-oblong, shortly petiolate and with apiculate apex; midvein strong; micro- and megasporocarps in bunches arising from the node, hairy, globose, shortly stalked and almost similar looking; spores tetrahedral, trilete.

REFERENCES

- [1] Hooker WJ, Baker JGH. Synopsis Filicum. London: R. Hardwicke, 1868.
- [2] Beddome RH Ferns of the British India. Calcutta: Thacker Spink and Co, 1892.
- [3] Prain D. Bengal Plants (Vol. II). DehraDun, India: Bishen Singh Mahendra Pal Singh, DehraDun, India. 1906
- [4] Ghosh SR, Ghosh B, Biswas A, Ghosh RK. The Pteridophytic Flora of Eastern India. Kolkata: Botanical Survey of India, 2004.

Table I: Ecology of pteridophytes of Coastal Saline Zone of West Bengal

Sl. No.	Taxa	Habitat	Frequency of occurrence	Density of occurrence	Site of occurrence of the taxon/host plant				State of exposure of Light		
					River Bank	Swampy place	Clamy place	Droughty place	Copius	Partial	Marky
1.	<i>Azolla caroliniana</i>	Fl	O	A		+			+		
2.	<i>Azolla pinnata</i>	Fl	C	A		+			+		
3.	<i>Salvinia cucullata</i>	Fl	F	A		+			+		
4.	<i>S. natans</i>	Fl	R	A		+			+		

Habitat: T – Terrestrial, L – Lithophyte, Epa – Epiphyte on the trunk and major branches, Fl – Floating, Aq – Aquatic

Frequency of Occurrence: C – Common, O – Occasional, F – Frequent, R – Rare

Density: A – Abundant in big colonies, D - Dispersed

Table II: Timings of sporulation of different Pteridophytes in Coastal Saline Zone of West Bengal

Sl. No.	Taxa	Family	Sporulation Time
1.	<i>Azolla caroliniana</i> Willd.	Azollaceae	December to January
2.	<i>Azolla pinnata</i> R. Br.	Azollaceae	December to January
3.	<i>Salvinia cucullata</i> Roxb.	Salviniaceae	November to April
4.	<i>S. natans</i> (Linn.) All. Fl. Pedem	Salviniaceae	January to March