



ORIGINAL RESEARCH ARTICLE

STUDY OF ECO-FLORISTIC DIVERSITY OF HARIPUR (PURBA MEDINIPUR DISTRICT), WEST BENGAL: A PROPOSED SITE FOR NUCLEAR POWER PLANT**Dulal Chandra Das^{1*}, Maniklal Pati¹, Ghanashyam Mohato² and Monalisa Das³**¹Department of Botany, Raja N. L. Khan Women's College, Midnapore-721102, West Bengal, India.²Department of Botany, A. M. College, Jhalda, Purulia, West Bengal, India.³Department of Nutrition & Dietetics, Vidyasagar Institute of Health, Midnapore-721102, West Bengal, India.**Received for publication:** May 5, 2015; **Revised:** May 15, 2015; **Accepted:** June 11, 2015

Abstract: The coastal stretch of Purba Medinipur district of West Bengal 68 km long and very much rich in plant diversity comprising of herbs, shrubs, trees and lianes. The total coastal belt is divided into ten sections of which Haripur is selected for the establishment of "The Haripur Nuclear Power Plant of India" from the joint collaboration of India, USA, Russia Govt. Haripur occupied about 6 sqkm area of which 3.6 sq/km required for the nuclear power plant. The comprehensive floristic study of Haripur at present investigated for the first time and about 300 angiospermic species have been recorded. This proposed Nuclear power plant may hamper and damage the richness of plant biodiversity of Haripur and its neighbouring coastal areas of Purba Medinipur district in future.

Key words: Ecofloristic diversity, Haripur, Nuclear power plant, Purba Medinipur, West Bengal, India.

INTRODUCTION

The demand of electricity in India is increasing at the rate of 9% annually. Govt. is trying to fulfill the demand of power by introducing the new power plant projects in India whether its nuclear power plants, thermal power plants, coal based power plants etc. To fulfill the scarcity of electricity India Govt. agreed to settle seven new Nuclear power plants in India in collaboration with USA and Russia Govt. during 2006-2008 at different states [1]. In West Bengal Haripur in Purba Medinipur district was selected by the Department of Atomic Energy of India for setting up a new nuclear power plant having the capacity of producing 10000MW electricity with the help of the company Rosatom from Russian federation and National Power Corporation from India. Haripur is under Magilaput Gram Panchayet in Contai subdivision of Purba Medinipur district of West Bengal and occupies about 6sq km coastal zone consisting of Haripur and Samrajalpai villages and 156 km distance away from Kolkata and 30 km distance away from Haldia port. It lies between 21°41.964' N to 21°43.232' N latitude and 87°45.845'E to 87°48.884'E longitude.

The study of vegetation and flora of Haripur in West Bengal is essential for the reflection of the status of plant biodiversity of that region as well as to predict the exploitation of plant biodiversity after setting up of the nuclear power plant. The southern part of Haripur is richer with 6 types of mangroves and mangrove associated 6 marshy species which are immersed during tide and opened during flow while the terrestrial species were found to grow on sand dune at the sea shore. The forest department planted some

Mangroves *Bruguiera gymnorrhiza*, *Excoecaria agallocha* and xerophyte *Casuarina equisetifolia* [2]. The northern eastern and western part of Haripur contain various types of mesophytes, hydrophytes and xerophytes. About 286 angiospermic species under 218 genera 77 families of different economic purposes have been investigated from Haripur. The West Bengal flora and Midnapore district flora were studied [3-5]. A 12-membered site selection committee of the Department of Atomic Energy (DAE) submitted the final report to Atomic Energy Commission of India after their supervision of a number of coastal district in India (Nov'2006) but there was no floristic information of the Haripur of Purba Medinipur district. Hence the present study is an attempt to assess the composition and variation of flora of Haripur and an attempt to reflect the loss of plant biodiversity in future due to the implantation of the "Haripur Nuclear Power Plant" at Haripur.

MATERIALS AND METHODS

In the aid of the study of floristic diversity of Haripur-extensive field work, literature survey, herbarium scrutiny and critical examination of the plant specimens were carried out from 2010-2015. The entire aquatic, terrestrial and marshy vegetation of Haripur in both tidal and nontidal zone was thoroughly scanned by repeated visits in different seasons of the year. Sampling was done to prepare a complete herbarium for future reference. Normally 4-5 specimens of each species in flowering or fruiting stage were collected and life form photographs were prepared. Relevant field notes were made on the spot, noting down the

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interesting and diagnostic features of the plants. Due attention was paid to the plants of economic importance as well as plants of rare occurrence, biotic pressure on plants especially on the mangroves and other sand binding plants, industrialization and ecological disturbances also. The historical and geographical information was collected from DLRO the BLRO and Majilaput panchayet office of the Purba Medinipur district as well as the relevant information regarding the nuclear power plant was collected from the Department of Atomic Energy (DAE) of India and Nuclear Power Corporation of India Ltd. (NPCIL). The investigation on the vegetation of the area of proposed nuclear power plant in Haripur was made by walking on foot and riding on donga in water bodies. All the collected specimens were properly processed, preserved and mounted on herbarium sheets following the standard and modern herbarium techniques [6]. Specimens of all plants were critically identified in CNH at Howrah with the help of books, journals, floras, revisions, monographs and authentic specimens [7-21] and housed in the Raja N. L. Khan Women's College herbarium. For upto date author citation Brummit and Powell [22] was followed.

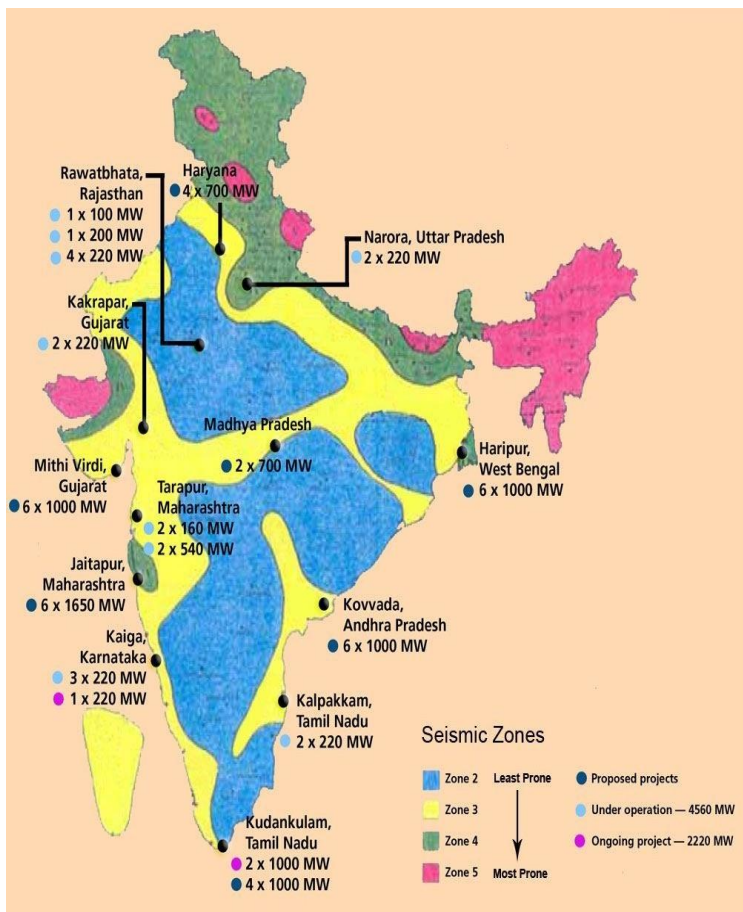


Figure 1: Position of Haripur in India.

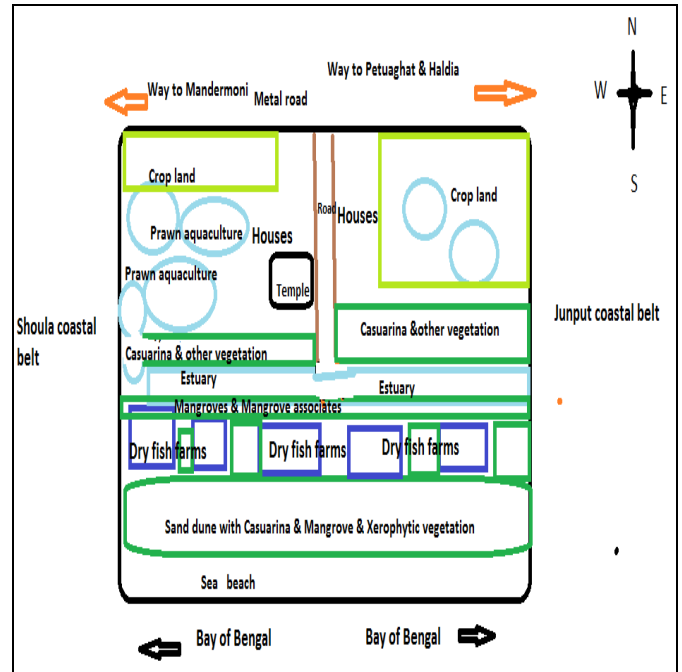


Figure 2: Proposed site for nuclear power plant in Haripur

Floristic Diversity

An analysis of the flora in the area of proposed nuclear power plant of Haripur revealed 286 species under 77 families and 218 Genera of which 6 are mangroves. On the basis of their habitat all the taxa have been grouped into aquatic, marshy and terrestrial categories in both tidal and nontidal zones of Haripur.

A) Aquatic Vegetation:

- a. Free floating hydrophytes which were found only in nontidal region.
- b. Plants attached with free floating hydrophytes which were found only in nontidal region.
- c. Submerged rootless hydrophytes, found only in nontidal region.
- d. Submerged rooted hydrophytes – found both in tidal and nontidal region.
- e. Emergent hydrophyte.

B) Marshy Vegetation:

These vegetations are mangroves and mangrove associates in the tidal zone of Haripur as well as the vegetations grown the border site lowland of aquatic bodies in nontidal region.

C) Terrestrial Vegetation:

Large number of vascular plants viz-trees, shrubs, herbs and climbers have been planted or grown naturally in the area of proposed nuclear power plant of Haripur providing shelter and roosting, nesting the breeding sites to avian flora.

Economic potential of the flora

Human and animals use plants of aquatic, marshy and terrestrial habitats in various ways as sources of food, fuel, fiber, vegetables, green manure, medicine, food for fishes and birds and for some other uses.

Hydrophytes as a sources of food for human, food for fish and duck, as sources of medicines, commercial uses, as food for animals.

Marshy mangroves as sources of fuel, timbers and medicine. Mangrove associates as sources of medicine, food for human.

Terrestrial plants as sources of food and medicine for human and animals and of other economic potential.

Rare and endangered species

Due to continuous removal of some medicinal plants as well as mangrove species by the villagers a serious threat is faced by 10 species (e.g. *Costus speciosus*, *Hemidesmus indicus*, *Ruelia tuberosa*, *Sesbania grandiflora* and the mangroves *Avicennia alba*, *Avicennia marina*, *Bruguiera gymnorrhiza*, *Ceriops decandra*, *Excoecaria agallocha*, *Rhizophora mucroata*) and *Sesbania grandiflora* remain at the top of the list of threatened species.

Table 1: List of investigated taxa

S. No.	Name of the Species	Habit	Habitat	Propagation
Acanthaceae				
1	<i>Acanthus ilicifolius</i> L.	S	M	Seeds
2	<i>Adhatoda vasica</i> Nees	S	T	Vegetative
3	<i>Andrographis paniculata</i> (Burm. f) Wall. ex Nees	H	T	Seeds
4	<i>Barleria cristata</i> L.	H	T	Seeds
5	<i>Barleria prionitis</i> L.	H	T	Seeds
6	<i>Hemigraphis hirta</i> (Vahl) T. Anders	H	T	Seeds and root stock
7	<i>Hygrophila auriculata</i> (Schum.) Heine	H	M	Seeds and stem cutting
8	<i>Hygrophila difformis</i> (L.f.) Blume	H	M	Seeds
9	<i>Justicia gendarussa</i> Burm. f.	H	T	Seeds and root stock
10	<i>Justicia quinqueangularis</i> Keen. ex. Roxb.	H	T	Seeds and root stock
11	<i>Ruellia tuberosa</i> L.	H	T	Seeds
12	<i>Rungia pectinata</i> (L.) Nees	H	T	Seeds
Aizoaceae				
13	<i>Glinus lotoides</i> L.	H	M	Seeds
14	<i>Glinus oppositifolia</i> (L.) DC.	H	M	Seeds
15	<i>Sesuvium portulacastrum</i> (L.) L.	H	M	Seeds
Amaranthaceae				
16	<i>Achyranthes aspera</i> L.	H	T	Seeds
17	<i>Achyranthes sicula</i> L.	H	T	Seeds
18	<i>Aerva lanata</i> (L.) Juss. ex Schult.	H	T	Seeds
19	<i>Alternanthera philoxeroides</i> (Mart.) Griseb.	H	A	
20	<i>Althernanthera sessilis</i> (L.) DC.	H	M	Seeds
21	<i>Amaranthus spinosus</i> L.	H	M	Seeds
22	<i>Amaranthus viridis</i> L.	H	T	Seeds
23	<i>Celosia argentea</i> L.	H	T	Seeds
24	<i>Gomphrena serrata</i> L.	H	T	Seeds
Ampelideae (Leeaceae)				
25	<i>Leea sambucina</i> Willd.	H	T	Seeds
Anacardiaceae				
26	<i>Mangifera indica</i> L.	Tr	T	Seeds
27	<i>Anacardium occidentale</i> L.	Tr	T	
Apiaceae				
28	<i>Hydrocotyle sibthorpioides</i> Lam.	H	M	Seeds
29	<i>Centella asiatica</i> (L.) Urban	H	M	vegetative
Apocynaceae				
30	<i>Alstonia scholaris</i> (L.) R. Br.	Tr	T	Seeds
31	<i>Catharanthus roseus</i> (L.) G. Don	H	T	Seeds
32	<i>Ervatamia divaricata</i> (L.) Burkill	S	T	vegetative
33	<i>Nerium indicum</i> Mill	S	T	Seeds
34	<i>Rauvolfia canescens</i> L.	S	T	Seeds
Araceae				
35	<i>Alocasia indica</i> Schott	H	A	Rhizome
36	<i>Colocasia esculenta</i> (L.) Schott in Schott & Bndl.	H	A	Rhizome

37	<i>Pistia stratiotes</i> L.	H	A	Veg. propagation
38	<i>Typhonium trilobatum</i> Schott	H	M	Rhizome
Areaceae				
39	<i>Areca catechu</i> L.	Tr	T	Seeds
40	<i>Borassus flabellifer</i> L.	Tr	T	
41	<i>Cocos nucifera</i> L.	Tr	T	Seeds
42	<i>Phoenix sylvestris</i> (L.)Roxb.	Tr	T	Seeds
Asclepiadaceae				
43	<i>Calotropis procera</i> (Aiton) Dryand.	S	T	Seeds
44	<i>Gymnema sylvestre</i> (Retz.) R. Br. ex Schutte		T	Seeds and stem cuttings
45	<i>Hemidesmus indicus</i> (L.) R. Br.	H	T	Seeds
46	<i>Pergularia daemia</i> (Forssk.) Chiov.	H	T	Seeds
47	<i>Tylophora asthmatica</i> W.&A.	H	T	Seeds
Asteraceae				
48	<i>Ageratum conyzoides</i> L.	H	T	Seeds
49	<i>Blumea lacera</i> (Burm. f.) DC.	H	T	Seeds
50	<i>Eclipta alba</i> (L.)Hassk.	H	T	Seeds
51	<i>Eclipta prostrata</i> (L.) L.	H	T	Seeds
52	<i>Emilia sonchifolia</i> (L.) DC.	H	T	Seeds
53	<i>Enydra fluctuans</i> Lour.	H	A	Vegetative
54	<i>Eupatorium odoratum</i> L.	H	T	Seeds
55	<i>Grangrea maderaspatana</i> (L.) Poir.	H	T	Seeds
56	<i>Launaea asplenifolia</i> (Willd.) Hook. f. in Hook. f.	H	T	Seeds
57	<i>Mikania cordata</i> (Burm.f.)Robins	H	T	
58	<i>Mikania micrantha</i> Kunth	H	T	Seeds
	<i>Mikania scandens</i> (L.)Willd.	H	T	Seeds
59	<i>Parthenium hysterophorus</i> L.	H	T	Seeds
60	<i>Sonchus asper</i> (L.) Hill	H	T	Seeds
61	<i>Sphaeranthus indicus</i> L.	H	M	Seeds
62	<i>Spilanthes calva</i> DC.	H	M	Seeds
63	<i>Syndrella nodiflora</i> (L.) Gaertn.	H	T	Seeds
64	<i>Tridax procumbens</i> L.	H	T	Seeds
65	<i>Vernonia cineria</i> (L.) Less.	H	T	Seeds
66	<i>Wedelia chinensis</i> (Osbeck) Merr.	H	M	Seeds
67	<i>Xanthium strumarium</i> L. var. <i>strumarium</i>	H	M	Seeds
Avicenniaceae				
68	<i>Avicennia alba</i> Blume	Tr	M	Seeds
69	<i>Avicennia marina</i> (Forssk)Vierh	Tr	M	Seeds
Bassellaceae				
70	<i>Basella alba</i> L.	H	T	Seeds
Boraginaceae				
71	<i>Coldenia procumbens</i> L.	H	M	Seeds
72	<i>Heliotropium indicum</i> L.	H	T	Seeds
Brassicaceae				
73	<i>Brassica juncea</i> L. Czern.	H	T	Seeds
74	<i>Brassica rapa</i> L. sub sp. <i>campestris</i> (L.) A.R. Clapham	H	T	Seeds
Cactaceae				
75	<i>Opuntia stricta</i> (Haw.) Haw. var. <i>dillenii</i> (Ker-Gawl.) Benson	H	T	Seeds
Caesalpiniaceae				
76	<i>Cassia occidentalis</i> L.	H	T	Seeds
77	<i>Delonix regia</i> (Bojke ex Hook.) Raf.	Tr	T	Seeds
78	<i>Senna sophora</i> (L.) Roxb.	S	T	Seeds
79	<i>Senna sumatrana</i> (DC.) Roxb.	S	T	Seeds
80	<i>Senna tora</i> (L.) Roxb.	H	T	Seeds
81	<i>Caesalpinia bonduc</i> (L.)Roxb.	S	T	Seeds
82	<i>Tamarindus indica</i> L.	Tr	T	Seeds
Capparidaceae				
83	<i>Cleome viscosa</i> L.	H	T	Seeds
Ceratophyllaceae				
84	<i>Ceratophyllum demersum</i> L.	H	A	Vegetative
Chenopodiaceae				
85	<i>Chenopodium album</i> L.	H	T	Seeds
86	<i>Suaeda maritima</i> (L.)Dumort	H	M	Seeds

Combretaceae				
87	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Tr	T	Seeds
88	<i>Quisqualis indica</i> L.	S	T	Seeds
Commelinaceae				
89	<i>Commelina benghalensis</i> L.	H	M	Seeds
90	<i>Commelina hasskarlii</i> Clarke	H	M	Seeds
91	<i>Murdannia nudiflora</i> (L.) Brenan	H	M	Seeds
92	<i>Murdannia spirata</i> (L.) Bruckn.	H	M	Seeds
93	<i>Murdannia vaginata</i> (L.) Bruckn.	H	M	Seeds
Convolvulaceae				
94	<i>Evolvulus alsinoides</i> (L.) L.	H	T	Seeds and root stock
95	<i>Evolvulus nummularius</i> (L.) L.	H	T	Seeds and root stock
96	<i>Ipomoea aquatica</i> Forssk.	H	A	Seeds
97	<i>Ipomoea carnea</i> Jacq. ssp. <i>fistulosa</i> (Mart. ex Chosy) Austin	H	T	Seeds root stock
98	<i>Ipomoea eriocarpa</i> R. Br.	H	T	Seeds
	<i>Ipomoea operculata</i> (Gomes) Mart.	H	T	Seeds
	<i>Ipomoea pes-caprae</i> (L.) R.Br.	H	T	Seeds and vegetative
99	<i>Ipomoea quamoclit</i> L.	H	T	Seeds
100	<i>Merremia emarginata</i> (Burm. f) Hallier f.	H	T	Seeds
Costaceae				
101	<i>Costus speciosus</i> (J. Koenig ex. Retz.) Sm.	H	T	Seeds & root stock
Cucurbitaceae				
102	<i>Coccinia grandis</i> (L.) Voigt.	H		Seeds
103	<i>Luffa acutangula</i> (L.) Roxb.	H	T	Seeds
104	<i>Luffa cylindrica</i> (L.) M. Roem.	H	T	Seeds
105	<i>Mukia maderaspatana</i> (L.) M. Roem.	H	T	Seeds
Cuscutaceae				
106	<i>Cuscuta reflexa</i> Roxb.	H	T	By stem
Cyperaceae				
107	<i>Cyperus brevifolius</i> (Rottb.) Hassk	H	A	Seeds & root stock
108	<i>Cyperus exaltatus</i> Retz.	H	A	Seeds & root stock
109	<i>Cyperus iria</i> L.	H	A	Seeds & root stock
110	<i>Cyperus rotundus</i> L.	H	T	Seeds & rhizome
111	<i>Eleocharis acutangula</i> (Roxb.) Schult.	H	M	Root Stock
112	<i>Fimbristylis aestivalis</i> (Retz.) Vahl	H	M	Rhizome
113	<i>Fimbristylis dichtoma</i> (L.) Vahl.	H	M	Rhizome
114	<i>Fimbristylis littoralis</i> Gaudich.	H	M	Rhizome
115	<i>Killingia monocephala</i> Rottb.	H	T	Rhizome
116	<i>Scirpus articulatus</i> L.	H	A	Rhizome
Dilleniaceae				
117	<i>Dillenia indica</i> L.	Tr	T	Seeds
Dioscoreaceae				
118	<i>Dioscorea alata</i> L.	H	T	Root stock
Euphorbiaceae				
119	<i>Acalypha indica</i> L.	H	T	Seeds
120	<i>Breynia vitis-idaea</i> (Burm. f.) Fisher	S	T	Seeds and root stock
121	<i>Chrozophora rottleri</i> (Geiseler) A. Juss.	H	T	Seeds
122	<i>Croton bonplandianus</i> Baill.	H	T	Seeds
123	<i>Euphorbia antiquorum</i> L.	S	T	Vegetative
124	<i>Euphorbia hirta</i> L.	H	T	Seeds
125	<i>Euphorbia heyneana</i> L.	H	T	Stem cuttings
126	<i>Excoecaria agallocha</i> L.	Tr	M	Seeds
127	<i>Jatropha curcus</i> L.	S	T	Stem cuttings
128	<i>Jatropha gossypifolia</i> L.	S	T	Stem cuttings
129	<i>Phyllanthus fraternus</i> Webster	H	T	Seeds
130	<i>Phyllanthus niruri</i> L.	H	T	Seeds
131	<i>Phyllanthus reticulatus</i> Poir. in Lam.	H	T	Seeds and root stock
132	<i>Phyllanthus virgatus</i> Forest. f.	H	T	Seeds
133	<i>Ricinus communis</i> L.	Tr	T	Seeds
134	<i>Tragia involucrata</i> L.	H	T	Seeds & root stock
Fabaceae				
135	<i>Abrus precatorious</i> L.	H	T	Seed
136	<i>Aeschynomene indica</i> L.	H	M	Seeds

137	<i>Alysicarpus vaginalis</i> (L.) DC.	H	T	Seeds
138	<i>Crotolaria pallida</i> W. Ait.	H	T	Seeds
139	<i>Dalbergia sissoo</i> Roxb.	Tr	T	Seeds
140	<i>Desmodium gangeticum</i> (L.) DC.	H	T	Seeds
141	<i>Desmodium triflorum</i> (L.) DC.	H	T	Seeds
142	<i>Mucuna pruriens</i> DC.	H	T	Seeds
143	<i>Pongamia pinnata</i> (L.) Pierre	Tr	T	Seeds
144	<i>Sesbania grandiflora</i> (L.) Poir. In Lam.	Tr	T	Seeds
145	<i>Sesbania palludosa</i> Prain	S	T	Seeds
146	<i>Tephrosia purpurea</i> (L.) Pers.	H	T	Seeds and root stock
147	<i>Tephrosia villosa</i> Wight & Arn.	H	T	Seeds and root stock
148	<i>Teramnus labialis</i> (L. f.) Spreng.	H	T	Seeds and root stock
Flacourciaceae				
149.	<i>Flacourtia indica</i> (Burm.f.) Merrill.	S	T	Seeds
Hydrocharitaceae				
150	<i>Hydrilla verticillata</i> (L. f.) Royle	H	A	Seeds
151	<i>Ottelia alismoides</i> (L.) Pers.	H	A	Rhizome
152	<i>Vallisneria natans</i> (Lour.) Hara	H	A	Veg. propagation
Hydrophyllaceae				
153	<i>Hydrolea zeylanica</i> (L.) Vahl	H	M	Seeds
Lamiaceae				
154	<i>Anisomeles indica</i> (L.) Kuntze	H	T	Seeds
155	<i>Hyptis suaveolens</i> (L.) Poit.	H	T	Seeds
156	<i>Leucas aspera</i> (Willd.) Link	H	T	Seeds
157	<i>Ocimum basilicum</i> L.	H	T	Seeds
158	<i>Ocimum tiniflorum</i> L.	H	T	Seeds
Lemnaceae				
159	<i>Lemna perpusilla</i> Torrey	H	A	Veg. propagation
Lentibulariaceae				
160	<i>Utricularia aurea</i> Lour.	H	A	Vegetative
Liliaceae				
161	<i>Asparagus racemosus</i> Willd.	H	T	Seeds
Lyrthraceae				
162	<i>Ammannia baccifera</i> L.	H	M	Seeds
Malvaceae				
163	<i>Abutilon indicum</i> (L.) Sweet emend. Hochr.	S	T	Seeds
164	<i>Hibiscus vitifolius</i> L.	S	T	Seeds
165	<i>Sida acuta</i> Burm. f. emend. K. schum.	H	T	Seeds
166	<i>Sida cordata</i> (Burm. f.) Borss.	H	T	Seed
167	<i>Sida cordifolia</i> L.	H	T	Seeds
168	<i>Sida rhombifolia</i> L.	H	T	Seeds
169	<i>Urena lobata</i> L.	H	T	Seeds & root stock
170	<i>Urena lobata</i> L. ssp. <i>sinuata</i> (L.) Borss.	H	T	Seeds & root stock
Meliaceae				
171	<i>Azadirachta indica</i> A. Juss.	Tr	T	Seeds
Menispermaceae				
172	<i>Cocculus hirsutus</i> (L.) Diels	H	T	Seeds and stem cutting
173	<i>Tinospora cordifolia</i> (Willd.) Hook. f. & Thomson	H	T	Root stock & vege
Menyanthaceae				
174	<i>Nymphoides hydrophylla</i> (Lour.) Kuntze.	H	A	Seeds
Mimosaceae				
175	<i>Acacia auriculiformis</i> A. Cunn. ex Benth.	Tr	T	Seeds
176	<i>Acacia catechu</i> (L.f.) Willd.	Tr	T	Seeds
177	<i>Acacia farnesiana</i> Willd.	Tr	T	Seeds
178	<i>Acacia mangium</i> Willd.	Tr	T	Seeds
179	<i>Acacia nilotica</i> (L.) Del. ssp. <i>indica</i> (Benth.) Brenan	Tr	T	Seeds
180	<i>Albizia lebbek</i> (L.) Benth.	Tr	T	Seeds
181	<i>Albizia procera</i> (Roxb.) Benth.	Tr	T	Seeds
182	<i>Leucaena leucocephala</i> (Lam.) de wit	Tr	T	Seeds
183	<i>Mimosa pudica</i> L.	H	T	Seeds
184	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Tr	T	Seeds
185	<i>Prosopis cineraria</i> (L.) Druce	Tr	T	Seeds
186	<i>Samanea saman</i> (Jacq.) Merr.	Tr	T	Seeds

187	Molluginaceae <i>Mollugo spergula</i> L.	H	M	Seeds
188	Moraceae <i>Ficus benghalensis</i> L.	Tr	T	Seeds
189	<i>Ficus cunia</i> Ham.	Tr	T	Seeds
190	<i>Ficus virens</i> Ait.	Tr	T	Seeds
191	<i>Ficus religiosa</i> L.	Tr	T	Seeds
192	Moringaceae <i>Moringa pterygosperma</i> Gaertn.	Tr	T	Seeds
193	Musaceae <i>Musa x paradisiaca</i> L.	H	T	Rhizome
194	Myrtaceae <i>Eucalyptus globulus</i> Labill.	Tr	T	Seeds
195	<i>Embllica officinalis</i> Gaertn.	Tr	T	Seeds
196	<i>Callistemon citrinus</i> (Curtis) Skeels.	Tr	T	Seeds
197	<i>Syzygium jambos</i> (L.) Alston	Tr	T	Seeds
198	<i>Syzygium cumini</i> (L.) Skeels.	Tr	T	Seeds
199	<i>Psidium guajava</i> L.	Tr	T	Seeds
200	Nyctaginaceae <i>Boerhaavia diffusa</i> L.	H	T	Seeds and root stock
201	<i>Mirabilis jalapa</i> L.	H	T	Seeds and root stock
202	Nymphaeaceae <i>Nymphaea nouchali</i> Burm.f.	H	A	Seeds
203	<i>Nymphaea pubescens</i> Willd.	H	A	Seeds
204	Ochnaceae <i>Streblus asper</i> Lour.	Tr	T	Seeds
205	Onagraceae <i>Ludwigia adscendens</i> (L.) Hara	H	A	Root stock
206	<i>Ludwigia perennis</i> L.	H	A	Seeds
207	Oxalidaceae <i>Oxalis corniculata</i> L.	H	M	Seeds
208	Papavaraceae <i>Argemone mexicana</i> L.	H	T	Seeds
209	Piperaceae <i>Peperomia pellucida</i> (L.) Kunth	H	M	Seeds
210	<i>Piper betle</i> L.	H	T	Vegetative
211	Plumbaginaceae <i>Plumbago zeylanica</i> L.	H	T	Seeds
212	Poaceae <i>Arundo donax</i> L.	S	T	Root stock
213	<i>Bambusa tulda</i> Roxb.	S	T	Root stock
214	<i>Bambusa arundinacea</i> Willd.	S	T	Root stock
215	<i>Chloris barbata</i> Sw.	H	T	Seeds & root stock
216	<i>Chrysopogon aciculatus</i> (Retz.) Trin.	H	T	Seeds & root stock
217	<i>Cyanodon dactylon</i> (L.) Pers.	H	T	Seeds & root stock
218	<i>Dactyloctenium aegyptium</i> (L.) P. Beauv.	H	T	Seeds
219	<i>Digitaria biformis</i> Willd.	H	T	Seeds
220	<i>Echinochloa colonum</i> (L.) Link.	H	T	Seeds
221	<i>Eleusine indica</i> (L.) Gaertn.	H	T	Seeds & root stock
222	<i>Eragrostis tenella</i> (L.) P. Beauv ex Rhoem & schutt	H	T	Seeds
223	<i>Oplismenus burmannii</i> (Retz.) P. Beauv.	H	M	Seeds
224	<i>Oryza quarcata</i> Roxb.	H	A	Rhizome
225	<i>Porteresia coarctata</i> Takeoka	H	A	Rhizome
226	<i>Perotis indica</i> (L.) Kuntze	H	M	Seeds
227	<i>Phragmites karka</i> (Retz.) Trin. ex Steud.	H	M	Root stock
228	<i>Saccharum spontaneum</i> L.	H	T	Seeds
229	Pandanaceae <i>Pandanus odoratissimus</i> L.f.	S	T	Seeds
230	Polygonaceae <i>Persicaria barbatum</i> (L.) H. Hara	H	M	Seeds
231	<i>Rumex dentatus</i> L. ssp. <i>klotzschianus</i> (Meisn.) Rech. f.	H	M	Seeds
232	Pontederiaceae <i>Eichhornia crassipes</i> (Mart.) Solms	H	A	Rhizome

233	<i>Monochoria vaginalis</i> (Burm. f.) Presley	H	A	Root stock
	Potamogetonaceae			
234	<i>Potamogeton crispus</i> L.	H	A	Veg. propagation
	Ranunculaceae			
235	<i>Ranunculus sceleratus</i> L.	H	M	Seeds
	Rhamnaceae			
236	<i>Ziziphus jujuba</i> (L.) Gaertn	S	T	Seeds
237	<i>Ziziphus mauritiana</i> Lam.	S	T	Seeds
238	<i>Ziziphus nummularia</i> (Burn.f.)Wight & Arn.	S	T	Seeds
239	<i>Ziziphus oenoplia</i> (L.)Mill.	S	T	Seeds
	Rhizophoraceae			
240	<i>Bruguiera gymnorrhiza</i> (L.)Savigny	Tr	M	Seeds
241	<i>Ceriops decandra</i> (Griff)Ding Hou	Tr	M	Seeds
242	<i>Rhizophora mucronata</i> Lamk	Tr	M	Seeds
	Rubiaceae			
243	<i>Adina cordifolia</i> (Willd. ex Roxb.) Hook.f. ex Brandis	Tr	T	Seeds
244	<i>Anthocephalus cadamba</i> (Roxb.)Miq.	Tr	T	Seeds
245	<i>Anthocephalus chinensis</i> (Lam.) A. Rich. ex Walp.	Tr	T	Seeds
246	<i>Dentella repens</i> J.R. & G. Forst.	H	M	Seeds
247	<i>Hedyotis biflora</i> L.	H	T	Seeds
248	<i>Hedyotis corymbosa</i> L.	H	T	Seeds
249	<i>Oldenlandia corymbosa</i> L.	H	T	Seeds
250	<i>Spermacoce articularis</i> L. f.	H	T	Seeds
	Rutaceae			
251	<i>Murraya paniculata</i> (L.)Jack	S	T	Seeds and stem cutting
	Sapindaceae			
252	<i>Cardiospermum halicacabum</i> L.	H	T	Seeds
253	<i>Dodonaea viscosa</i> auct.non(L.)Jacq.	S	T	Seeds
	Scrophulariaceae			
254	<i>Bacopa monnieri</i> (L.) Penn.	H	M	Stem cutting
255	<i>Limnophila heterophylla</i> (Roxb.) Benth.	H	A	Seeds
256	<i>Lindenbergia indica</i> (L.) Kuntze.	H	T	Seeds
257	<i>Lindernia crustacea</i> (L.) f. Muell.	H	M	Seeds
258	<i>Scoparia dulcis</i> L.	H	T	Seeds
	Solanaceae			
259	<i>Datura metel</i> L.	H	T	Seeds
260	<i>Nicotiana plumbaginifolia</i> Viv.	H	M	Seeds
261	<i>Phyllanthus urinaria</i> L.	H	T	Seeds
262	<i>Physalis angulata</i> L.	H	T	Seeds
263	<i>Solanum indicum</i> auct.non L.	H	T	Seeds
264	<i>Solanum nigrum</i> L.	H	T	Seeds
265	<i>Solanum sisymbirifolium</i> Lam.	H	T	Seeds
266	<i>Solanum surattense</i> Burm.f.	H	T	Seeds
267	<i>Solanum virginianum</i> L.	H	T	Seeds
	Sterculiaceae			
268	<i>Melochia corchorifolia</i> L.	H	T	Seeds
	Tiliaceae			
269	<i>Corchorus aestuans</i> L.	H	T	Seeds
270	<i>Corchorus capsularis</i> L.	H	T	Seeds
	Trapaceae			
271	<i>Trapa natans</i> L. var. <i>bispinosa</i> (Roxb.) Makino	H	A	Rhizome
	Typhaceae			
272	<i>Typha angustata</i> Chaub., Bory et al.	H	A	Rhizome
	Urticaceae			
273	<i>Pouzolzia zeylanica</i> (L.) Benn.	H	M	Seeds
	Verbenaceae			
274	<i>Clerodendrum inerme</i> (L.) Gaertn.	H	T	Seeds
275	<i>Clerodendrum viscosum</i> Vent.	S	T	Seeds
276	<i>Clerodendrum siphonanthus</i> R.Br.	S	T	Seeds
277	<i>Lantana camara</i> L.	H	T	Seeds
278	<i>Lippia germinita</i> Kunt.	H	T	Seeds and root stock
279	<i>Lippia javanica</i> (Burm. f.) Spreng.	H	T	Seeds and root stock
280	<i>Phyla nodiflora</i> (L.) Greene	H	T	Seeds

281	<i>Tectona grandis</i> L. f.	Tr	T	Seeds
282	<i>Vitex negundo</i> L.	Tr	T	Seeds
283	<i>Vitex trifolia</i> L.f.	Tr	T	Seeds
Vitaceae				
284	<i>Cayratia carnosa</i> (Lam.) Gagnep. var. <i>cinerea</i> (Lam.) Gagnep.	C	T	Seeds
285	<i>Cayratia pedata</i> (Lam.) Juss.ex. Gagnep.	C	T	Seeds
286	<i>Vitis trifolia</i> L.	H	T	Seeds

C=Climber; H=Herbs; S=Shrubs; Tr=Trees; A=Aquatic; M=Marshy; T=Terrestrial

DISCUSSION

Thorough and detailed investigation in the area of proposed nuclear power plant of Haripur in different seasons of the consecutive five years as well as statistical analysis of the flora had been done and 286 types of angiospermic species under 77 families had been enumerated. Out of 77 families 63 families are dicot of which the family Asteraceae occupying the first position with 21 species and 32 families have single species.

Among the 14 monocotyledonous families, Poaceae with 17 species stands the highest position. Out of 286 species, 29 species are purely aquatic, 44 species are marshy of which 6 species are mangroves and the rest 113 species are terrestrial. Again terrestrial taxa are grouped into herbs, shrubs, trees and climbers. Aquatic species are classified into free floating, attached with free floating, submerged rootless, submerged rooted and emergent hydrophytes. Poor as well as rich people collect whole plants, twigs, leaves, roots, rhizomes, fruits and bark from the region using these as food, fodder, medicine for asthma, burns, cuts, gastrointestinal problem, insomnia, jaundice, rheumatic pain, skin infection, urinary complaints, bone complaints, vermifuge etc. and as health tonic. Some hydrophytes are used for commercial purposes like weaving mats and screens, as fuel for cooking and thatching as fodder for animals and for production of manure. Terrestrial plants of the area are also a great source of timber, food, fodder, fiber and medicine. The paddy, brinjal, potato, green chili, sesame, kawrola, jhinghy yield are exceptionally high in Haripur and Haripur also famous for its tasty kumra (gourd). Beetle leaf is another common cash crop of this area. The area is liberally dotted by orchards of banana, coconuts, beetle nut, mangoes and berries. There are hundreds of water bodies for prawn culture and sweet water pisci culture. Sea fishing, boat making, weaving of fishing net, maintenance and repairing of mechanized boat are the other occupations of the people of Haripur. Near about 15000-20000 villagers are traditionally depended on agriculture which falls within the buffer zone of the proposed nuclear power plant [23]. The socio-economic status, the education, the industry and culture of Haripur is directly or indirectly related with the floristic diversity.

Mangroves are used for timber and medicine. It has been observed that gradual increase the number of dry fish farms and extensive use of chemical (Chlorpyriphos 20% EC) by dry fish farm hampering the richness of species at the tidal zone of Haripur [24,25] and increase urbanization also hampering the species diversity at the nontidal rural zone of Haripur. In future the total vegetation and floristic diversity of Haripur and its adjoining region would be abolished due to the foundation of the proposed nuclear power plant in the coastal area of Haripur.

Conservation measures

For maintaining the status and quality of floristic diversity and increase the richness of the vegetation in tidal and nontidal zone of Haripur of Purba Medinipur district, following measures should be taken.

- I. Stopping the over exploitation of different medicinal plants by people.
- II. Stopping the destruction of mangrove and other woody plants by people for timber and fuel.
- III. Stopping the extensive use of chemicals (chlorpyriphos 20% EC) by dry fish farms.
- IV. Stopping the set up the proposed nuclear power plant.

In order to minimize damages and safe guard the loss of floristic diversity, the central as well as state govt. should take the steps right now as well as Govt. of India and the Department of Atomic energy (DAE) of India should think again to set up the nuclear power plant in coastal village Haripur to avoid the destruction of coastal ecosystem including the total destruction of endangered mangrove species and other medicinal species in Haripur and its neighboring coastal zones

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