

## **Biological Spectrum of Kishalay Boy's Home Campus at Barasat in District North 24-Parganas, West Bengal**

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### **Abstract**

The North 24 Parganas is a district in southern West Bengal, India (latitudes 22° 11' 6'' north to 23° 15' 2'' north and longitudes 88° 20' east to 89° 5' east). The effort was to prepare a botanical document of the urban vegetation of the district. The Kishalay Boy's Home Campus at Barasat was picked up as an approximate proxy of the urban phytodiversity of the district. Biological spectrum of the site (Kishalay campus) was determined to decipher some ecological properties of the milieu. In Kishalay campus, out of a total of 137 species of vascular plants, phanerophytes occupy 48.91%, chamaephytes 21.17%, hemicryptophytes 15.33%, cryptophytes 5.12% and therophytes 9.49. Thus the phytoclimate is phanero-chamaephytic that indicates moist, warm, humid tropical nature of the geoclimate. High dominance of Phanerophytes indicates the geoclimate of moist, warm, humid nature; high percentage of chamaephytes indicates sunlight reaching ground to nourish them, this is the result of felling and lopping of trees and shrubs. Scantiness of hemicryptophytes is possibly due to the changes in microhabitats, regeneration niche and soil niche because of grazing and trampling by invading cattle and anthropogenic disturbances. Lower values of cryptophytes and therophytes are satisfactory as these indicate desertification may not be a probability at least in near future. Correlation values of biological spectrum of Kishalay with those of semi-arid and arid zones and deserts are low and even negative in some cases indicating ecoclimatic distance of Kishalay from those dry and less biodiverse regions. The values are significantly positive in case of sites in the districts viz. Bardhaman, Nadia, Bankura and Hooghly as these are adjacent to North 24-Parganas.

**Key words :** Urban phytodiversity, Biological spectrum, Phanero-chamaephytic phytoclimate, Correlation study.

The North 24 Parganas is a district in southern West Bengal, India. The natural vegetation of the district consists of both forest flora and patches of dispersed urban community intermingled with the human settlement. Today we are losing at least one higher plant species per day from tropical forests alone (1) and approximately 1,800 populations per hour are being destroyed (2). The State of Forest Report (3) informs that the total quantity of forest in the district is 127 sq km, i.e. only 3.1% of the total geographical area (of the district). Under the circumstances, the urban vegetation which is highly disturbed due to high population density and urban development, deserves more importance as it acts like the green lungs of the settlements; so present work tries to determine the biological spectrum of the urban vegetation of the district to characterize the phytoclimate. For this purpose, the Kishalay Boy's Home Campus at Barasat

was chosen as an approximate proxy of the urban phytodiversity of the North 24 Parganas since the site (Kishalay) still harbours some more or less undisturbed small pockets and packets of local phytodiversity. The phytoclimate (plant's climate) (or geoclimate or bioclimate according to different authors) of a region can be determined by the statistical distribution of life-forms in the flora present there. Expression of the percent distribution or relative proportion of different life-forms in the flora of a region is known as the biological spectrum of that place. Raunkiaer (4) referred to this measure as the "the spectrum of life-forms" (5) or biological spectrum. This assessment, a kind of biomonitoring, at a periodic interval is likely to set guidelines for eco-restoration and environmental management.

(Authors are grateful to Shri Prantik Ghosh, Superintendent, Kishalay Home for his kind permission

**Table 1.** Plants dwelling in the Kishalay campus. Ph=Phanerophytes, Ch=Chamaephytes, Her = Hemicryptophytes, Cr=Cryptophytes, Th=Therophytes.

Plant name	Life form
1 <i>Acalypha indica</i> L.	Th
2 <i>Achyranthes aspera</i> L.	Th
3 <i>Aegle marmelos</i> (L.) Corr.	Ph
4 <i>Albizia lebbek</i> Benth.	Ph
5 <i>Alocasia fornicata</i> Schoot	Cr
6 <i>Alstonia scholaris</i> R. Br.	Ph
7 <i>Alternanthera sessilis</i> (L.) R. Br.	Hcr
8 <i>Alternanthera tamalla</i>	Hcr
9 <i>Anthocephalus chinensis</i> (Lamk.) A. Rich. ex Walp.	Ph
10 <i>Antidesma ghaesembilla</i> Gaertn.	Ph
11 <i>Argemone mexicana</i> L.	Ch
12 <i>Artocarpus hetreophylla</i> Roxb.	Ph
13 <i>Asplenium nidus</i> L.	Ph
14 <i>Azadirachta indica</i> A. Jss.	Ph
15 <i>Bauhinia purpurea</i> L.	Ph
16 <i>Blumea lacera</i> (Burm. f.) DC.	Th
17 <i>Blumea mollis</i>	Th
18 <i>Boerhavia repens</i> L.	Hcr
19 <i>Bombax ceiba</i>	Ph
20 <i>Borassus flabellifer</i> L.	Ph
21 <i>Brachiaria ramosa</i> (L.) Stapf.	Hcr
22 <i>Calotropis procera</i> R. Br.	Ph
23 <i>Canna indica</i> L. var. <i>orientalis</i>	Cr
24 <i>Cardiospermum halicacabum</i> L.	Th
25 <i>Carica papaya</i> L.	Ph
26 <i>Cassia siamea</i> Lamk.	Ph
27 <i>Cassia sophera</i> L.	Ph
28 <i>Christella Leveille</i>	Cr
29 <i>Chrozophora rottleri</i> (Geis.) A. Juss. ex Spreng.	Th
30 <i>Citrus decumana</i> L.	Ph
31 <i>Cleome rutidosperma</i> DC.	Ch
32 <i>Cleome viscosa</i> L.	Ch
33 <i>Clerodendron viscosum</i> Vent.	Ph
34 <i>Clerodendron siphonanthus</i> R. Br.	Ch
35 <i>Clitoria ternatea</i> L.	Ph
36 <i>Coccinia grandis</i> (L.) Voigt	Ph
37 <i>Colocasia esculenta</i>	Cr
38 <i>Costus speciosus</i> Smith	Cr
39 <i>Croton bonplandianum</i> Baill.	Ch
40 <i>Cuscuta reflexa</i> Roxb.	Ph
41 <i>Cynodon dactylon</i> Pers.	Hcr
42 <i>Dalbergia sisoo</i> Roxb.	Ph
43 <i>Datura metel</i>	Ph
44 <i>Delonix regia</i>	Ph
45 <i>Desmodium gangeticum</i> DC.	Ch
46 <i>Desmodium triflorum</i> (L.) DC.	Hcr
47 <i>Diospyros melanopylon</i> Roxb.	Ph
48 <i>Echinocloa colonum</i>	Hcr
49 <i>Eclipta prostrata</i> (L.) L.	Hcr
50 <i>Eleutheranthera ruderalis</i>	Ch
51 <i>Eragrostis tenella</i> Roem. & Schult.	Hcr

**Table 1.** Continued.

Plant name	Life form
52 <i>Euphorbia hirta</i> L.	Hcr
53 <i>Euphorbia microphylla</i> Hyne	Hcr
54 <i>Evolvulus alsinoides</i> L.	Hcr
55 <i>Evolvulus nummularius</i> L.	Hcr
56 <i>Ficus religiosa</i> L.	Ph
57 <i>Ficus cunia</i> Ham.	Ph
58 <i>Fioria vitifolia</i> (L.) Mattei	Ph
59 <i>Glycosmis pentaphylla</i> Corr.	Ch
60 <i>Heliotropium indicum</i> L.	Ch
61 <i>Hemigraphis hirta</i> T. And.	Hcr
62 <i>Hibiscus rosa-sinensis</i> L.	Ph
63 <i>Ipomoea nil</i> Roth.	Ph
64 <i>Lantana camara</i> L.	Ph
65 <i>Leea macrophylla</i> Roxb. ex Horn.	Ph
66 <i>Leonurus sibiricus</i> L.	Th
67 <i>Lepidagathis roxburghiana</i>	Th
68 <i>Lippia geminata</i> H. B. & K.	Ch
69 <i>Lippia nodiflora</i> Rich.	Hcr
70 <i>Mallotus repandus</i> Muell.—Arg.	Ph
71 <i>Mangifera indica</i> L.	Ph
72 <i>Melochia corchorifolia</i> L.	Th
73 <i>Mikania micrantha</i> Kunth	Ph
74 <i>Mukia scabrella</i> Arn.	Ph
75 <i>Moringa pterygospermum</i> Gaertn.	Ph
76 <i>Morus indica</i> L.	Ph
77 <i>Murraya koenigii</i> Spreng.	Ch
78 <i>Musa</i> sp.	Cr
79 <i>Nasturtium indicum</i> DC	Ch
80 <i>Nicotiana plumbaginifolia</i> Viv.	Ch
81 <i>Nyctanthes arbor-tristis</i> L.	Ph
82 <i>Odina wodier</i> Roxb.	Ph
83 <i>Oldenlandia corymbosa</i> L.	Hcr
84 <i>Oldenlandia paniculata</i> L.	Hcr
85 <i>Oplismenus compositus</i> Beauv.	Hcr
86 <i>Oxalis cirriiculata</i> L.	Hcr
87 <i>Panicum maximum</i> Jacq.	Hcr
88 <i>Parthenium hysterophorus</i>	Ch
89 <i>Passiflora suberosa</i> L.	Ph
90 <i>Pedilanthus tihymeloides</i> Poit.	Ch
91 <i>Phoenix sylvestris</i> Roxb.	Ph
92 <i>Phyllanthus fraternus</i> Webster	Ch
93 <i>Phyllanthus reticulatus</i> Poir	Ph
94 <i>Phymatosorus longissimus</i> (Blume) Pichi Serm.	Ph
95 <i>Physalis minima</i> L.	Ch
96 <i>Pilea microphylla</i> Liebm.	Ch
97 <i>Plumeria lutea</i>	Ph
98 <i>Polyalthia longifolia</i> Benth. & Hook. f.	Ph
99 <i>Polyalthia suberosa</i> Benth. & Hook. f.	Ph
100 <i>Polycarpon prostratum</i> Stapf.	Ch
101 <i>Polygonum orientale</i> L.	Ph
102 <i>Portulaca oleracea</i> L.	Hcr
103 <i>Pothos</i> sp	Ph

**Table 1.** Continued.

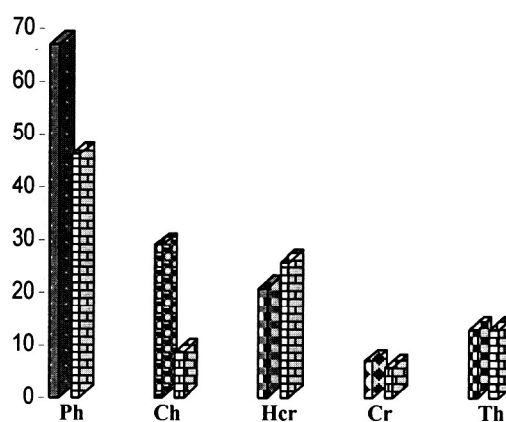
	Plant name	Life form
104	<i>Pouzolzia indica</i> Gaud.	Ch
105	<i>Psidium guyava</i> L.	Ph
106	<i>Pteris longifolia</i> L. var. <i>vittata</i>	Cr
107	<i>Quisqualis indica</i> L.	Ph
108	<i>Ricinus communis</i> L.	Ph
109	<i>Ruellia tuberosa</i> L.	Ch
110	<i>Rumex dentatus</i> L.	Ch
111	<i>Scindapsus aureus</i> Schott.	Ph
112	<i>Scoparia dulcis</i> L.	Th
113	<i>Sida rhombifolia</i> var. <i>retusa</i>	Ch
114	<i>Sida rhombifolia</i> var. <i>rhombifolia</i>	Ch
115	<i>Solanum nigrum</i> L.	Ch
116	<i>Solanum sisymbriifolium</i> Lamk.	Ph
117	<i>Solanum torvum</i> Swartz.	Ph
118	<i>Stephania hernandifolia</i> Walp.	Ph
119	<i>Streblus asper</i> Lour.	Ph
120	<i>Swietenia mahagoni</i> L.	Ph
121	<i>Syngonium podophyllum</i>	Ph
122	<i>Tabernaemontana coronaria</i> R. Br.	Ph
123	<i>Tamarindus indica</i> L.	Ph
124	<i>Tectona grandis</i> L. f.	Ph
125	<i>Tiliacora racemosa</i> Colebr.	Ph
126	<i>Tinospora cordifolia</i> Miers	Ph
127	<i>Tragia involucrata</i> L.	Ch
128	<i>Trema orientalis</i> Bl.	Ph
129	<i>Tridax procumbens</i> L.	Ch
130	<i>Triumfetta rhomboidea</i> Jacq.	Ch
131	<i>Urena lobata</i> L.	Th
132	<i>Vanda tessellata</i> (Roxb.) Lodd ex G. Don	Ph
133	<i>Vernonia cinerea</i> Less.	Th
134	<i>Vinca rosea</i> L.	Ch
135	<i>Vitis trifolia</i> L.	Ph
136	<i>Xanthium strumarium</i> L.	Th
137	<i>Zizyphus jujuba</i> Lamk.	Ph

to carry out the work within the Kishalay Campus).

#### Study Site

The district North 24-Parganas is situated in the tropical zone and extends from latitude 22°11'6" north to 23°15'2" north and from longitude 88°20' east to 89°5' east. It is bordered to Nadia by north, to Bangladesh (Khulna Division) by north and east, to South 24 Parganas and Kolkata by south and to Kolkata, Howrah and Hooghly by west. Barasat is the district headquarters of North 24 Parganas.

Elevation of the district is 2, 134 m (7,001 ft). The district lies within the Ganga-Brahmaputra delta. The river Ganga flows along the entire west border of the



**Figure 1.** Biological spectrum of Kishalay Flora, with normal spectrum of Raunkiaer (each column-duo stands for a specific life-form category defined just below it ; in each column-duo the left one stands for the observed value while the right one stands for Raunkiaer's normal value).

district. There are many other rivers, which include the Ichhamati, Jamuna and Bidyadhari. Soil Status varies from alluvial to clay loam. The Monsoon lasts from early June to mid-September. Annual rainfall is 1,579 mm. The weather remains dry during the winter (mid-November to mid February) and humid during summer. Temperature remains 41 C in May (max) and 10 C in January (min). Relative humidity remains between 50% in March and 90% in July (6, 7).

The Kishalay Boy's Home Campus is situated on the KNC Road of Barasat near Hatkhola (Ward 26, near Hatkhola, Barasat Sadar Subdivision). Since 1986 the Institute works as Kishalay Children's Home, now it is under the Women and Child Development and Social Welfare Wing of the West Bengal Government.

#### Methods

The Kishalay Boy's Home Campus was botanized thoroughly and frequently during the study period (February—May, 2010). Identification, nomenclature and systematic positions of these specimens were ascertained with the help of pertinent literature (8—18).

During study, the habit of the plants and the form and position of the perennating buds/structures of each plant species were recorded in the field along with other important features necessary for determination of life-forms according to the system of



**Figure 2.** Adjacent districts of North 24-Parganas. Source : State of Forest Report 2003.

Raunkiaer (1934) as modified by Muller-Dombois and Ellenberg (19). The percent distribution of the constituent species in different life-form categories was

calculated for preparation of biological spectrum of the area. The values, thus determined, were compared with the normal spectrum given by Raunkiaer. For correlation study, the software Statistica version 5.0 was utilized to find out correlation values.

## Results and Discussion

From present study it is known that out of a total of 137 species of vascular plants (Table 1), phanerophytes occupy 48.91%, chamaephytes 21.17%, hemicryptophytes 15.33%, cryptophytes (5.12% and therophytes 9.49% while normal values in Raunkiaer's normal spectrum are 46, 9, 26, 6 and 13 respectively. The observed values and Raunkiaer's normal values are compared in Figure 1. Here phanerophytes top the list in respect of numerical strength and cryptophytes lie at the bottom. The phytoclimate is phanero-chamaephytic that indicates moist, warm, humid tropical nature of the geoclimate.

**Table 2.** Biological spectra of different eco-climatic zones in India. Ph = Phanerophytes, Ch = Chamaephytes, Hcr = Hemicryptophytes, Cr - Cryptophytes, Th = Therophytes.

Eco-climatic zones in India	Percent distribution of life-forms					Phytoclimate or bioclimate
	Ph	Ch	Hcr	Cr	Th	
1. Normal Spectrum (4)	46	9	26	6	13	Normal Spectrum
2. Semi-arid zone of N. India (21)	30.3	18.3	10.4	8.2	33	Thero-chamaephytic
3. Semi-arid zone of S. India(21)	38.3	12.4	11	10	28	Thero-chamaephytic
4. Extreme arid regions of Indian Desert (22)	34	9	6	2	49	Therophytic
5. N-E Rajasthan (23)	20	8.8	9.7	15.3	46.2	Thero-cryptophytic
6. N-E Haryana (24)	23.9	22.8	5.1	5.2	42.5	Thero-chamaephytic
7. Rajasthan desert (25)	31	3	13	14	39	Thero-cryptophytic
8. Punjab State (26)	21.7	4.4	7.4	19.2	47.3	Thero-cryptophytic
9. Semi-arid Punjab (27)	13.7	6.7	13.9	10.9	54.8	Thero-cryptophytic
10. Punjab Shivaliks (28)	29.9	3.5	8.4	18.3	39.9	Thero-cryptophytic
11. Berhampur (29)	5.7	25.7	14.5	5.7	48.6	Thero-chamaephytic
12. Indian Desert (30)	22.1	18.9	15.5	40	3.5	Therophytic
13. West Rajasthan Desert (31)	24	19	9	2	46	Therophytic
14. Sonamukhi forest in Bankura District (32)	38.4	25.32	6.75	13.08	16.46	Phanero-chamaephytic
15. Chandur Forest in Hooghly District (33)	46.2	20	8.97	20	4.83	Phanero-chamaephytic
16. Bahadurpur Forest (34)	57.59	6.33	8.23	22.15	5.7	Phanero-therophytic
17. Bethuadahari Wildlife Sanctuary (35)	61.16	15.7	5.79	4.13	13.22	Phanero-chamaephytic
18. Ramnabagan Wildlife Sanctuary, Burdwan (20)	51.40	16.78	9.09	9.19	13.28	Phanero-chamaephytic
19. Bhalki-Machan Forest (36)	52.78	10.19	12.96	5.56	18.52	Phanero-therophytic
20. Bishtupur Forest (37)	48.21	17.86	9.82	12.5	11.61	Phanero-chamaephytic
21. Forest Patches of Bardhaman District	46.86	20.16	12.83	11.78	8.38	Phanero-chamaephytic
22. Present Study Site	48.91	21.17	15.33	5.12	9.49	

**Table 3.** Correlation between the biological spectrum of Kishalay and those of some other eco-climatic zones of India.

Eco-cimatic zone	Correlation value	Significant at	N	P
1 Normal spectrum	0.8761	$P > 0.05$	5	0.051
2 Semi-arid zone of N. India	0.4874	$P > 0.05$	5	0.405
3 Semi-arid zone of S. India	0.7194	$P > 0.05$	5	0.171
4 Extreme arid regions of Indian Desert	0.2973	$P > 0.05$	5	0.627
5 N-E Rajasthan	- 0.1611	$P > 0.05$	5	0.796
6 N-E Haryana	0.1576	$P > 0.05$	5	0.8
7 Rajasthan desert	0.2183	$P > 0.05$	5	0.724
8 Punjab State	- 0.1583	$P > 0.05$	5	0.799
9 Semi-arid Punjab	- 0.2943	$P > 0.05$	5	0.631
10 Punjab Shivaliks	0.1323	$P > 0.05$	5	0.832
11 Berhampur	- 0.3783	$P > 0.05$	5	0.53
12 Indian Desert	- 0.0480	$P > 0.05$	5	0.939
13 West Rajasthan Desert	0.1378	$P > 0.05$	5	0.825
14 Sonamukhi forest in Bankura District	0.8736	$P > 0.05$	5	0.053
15 Chandur Forest in Hooghly District	0.8709	$P > 0.05$	5	0.055
16 Bahadurpur Forest	0.8169	$P > 0.05$	5	0.091
17 Bethuadahari Wildlife Sanctuary	0.9603	$P > 0.05$	5	0.009
18 Ramnabagan Wildlife Sanctuary, Burdwan	0.9620	$P > 0.05$	5	0.009
19 Bhalki-Machan Forest	0.9189	$P > 0.05$	5	0.027
20 Bishtupur Forest	0.9571	$P > 0.05$	5	0.011
21 Forest Patches of Bardhaman District	0.9785	$P > 0.05$	5	0.004

The high dominance of Phanerophytes indicating the geoclimate of moist, warm, humid tropics is obvious in the area as is the case in a tropical monsoonic biome (20). This speaks of an adequate rain and corroborative nature's economy. This indicates if adequate measure could be taken, phanerophytes in the site would become further stronger numerically which proves that the tropical ecological processes are active here to permit still higher percentage of trees and shrubs.

The high percentage of chamaephytes indicates that the canopy is disturbed with gaps (like an old umbrella) to allow sunlight to penetrate and to reach the ground to nourish chamaephytes. This is the result of felling and lopping of trees and shrubs. This would result in the change in microhabitats and regeneration-niche of trees of shrubs, which in turn, is likely to affect the regeneration-status of the whole community.

In the present site hemicryptophytes, constituted by grasses and sedges exhibit the percentage value about half of the Raunkiare's normal value. This is possibly due to the changes in microhabitats, regeneration niche and soil niche because of grazing and trampling by invading cattle and anthropogenic disturbances such as building construction, road con-

struction. As those plants play essential role in eco-restoration, particularly in conservation of soil and in preservation of nutrient status and water content, their scarcity indicates that the soil in the site is at the risk of erosion, so increase in their number would certainly be desirable. Lower values of cryptophytes and therophytes are satisfactory as these indicate that desertification may not be a probability at least in near future.

#### *Correlation Study of the Biological Spectra*

Table 2 (4, 21—37) presents a synoptic account of the biological spectra of different ecoclimatic zones in India that have been performed from time to time. Study of correlation of those spectra with the observed spectrum of Kishalay Campus might be interesting. Table 3 shows the correlation between the Kishalay spectrum and those other spectra. The correlation values of Kishalay with semi-arid and arid zones and deserts are generally low and even negative in some cases. It is pleasing as it indicates ecoclimatic distance of the study site from those dry and less biodiverse regions. The values are significantly positive in the districts viz. Bardhaman, Nadia,

Bankura and Hooghly, this is normal as those are close to the district (North 24-Parganas) of the study site. The places which show more or less similar spectra to that of Kishalay are forest patches of Bardhaman district (Correlation value 0.9785) Ramnabagan Wildlife Sanctuary (Bardhaman district) (0.9620) > Bethuadahari Wildlife Santuary (Nadia district) (0.9603) > Bishtupur forest (Burdhaman district) (0.9571) > Bhalki-Machan forest (Bardhaman district) (0.9189) > Normal spectrum (4) (0.8761) > Sonamukhi forest (Bankura district) (0.8736) > Chandur forest (Hooghly district) (0.8709) > Bahadurpur forest (Nadia district) (0.8169). It is attention-grabbing that Kishalay shows the highest similarity to Bardhaman district, although it is not the immediate adjacent to North 24-Pgs (Fig. 2). The matter is same in Bankura. Both of Brdhaman (partly) and Birbhum districts harbor lateritic soil. Similarity of the study site to those districts may result from poor organic content and water holding capacity of soil, which are the characteristic features of lateritic soil. Similarity of Kishalay to Nadia and Hooghly is natural as the districts flank North 24-Parganas and share more or less similar climate and edaphic conditions.

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