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A Taxonomic Reconnaissance in Himachal Vihar Complex, Matigara, Siliguri, West Bengal

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ABSTRACT

Considering the preparation of a taxonomic document of the urban phytodiversity in Himachal Vihar Complex (Matigara, Siliguri, Darjeeling), present effort brings out a list of 241vascular plant species. At all specific, generic and family levels, dicots have much greater contribution to the flora. The high number of angiospermic families, most of which nest few species gives an indication of considerable heterogeneity. The tree diagram shows that at linkage distance 1.420 Kishalay and Himachal Vihar Flora segregate from others indicating the effect of anthropogenic influence. Some ecological disturbances in the area possibly function as 'intermediate disturbance' and contribute to increase in species richness, lending support to the **"Intermediate disturbance hypothesis".**

Key words: taxonomic reconnaissance, tree diagram, intermediate disturbance hypothesis.

The Himachal Vihar Complex is situated on the outskirts of Siliguri (Darjeeling District, West Bengal) as a satellite township. The natural vegetation of the district is world famous. However, present study focuses on the patches of dispersed urban plant community intermingled with human settlements in the complex as now-a-days, the urban vegetation also deserves immense importance because it acts like the green lungs of the settlements; so its documentation is essential. As a part of this, the taxonomic reconnaissance in the complex has been considered.

Study site:

Beside NH 31 Highway, from Matigara

to Siliguri, after Matigara bifurcation and river Chamta the Himachal Vihar (spelled as Himanchal Vihar also) Complex (PIN CODE 734 010) is situated just before the Uttarayan Complex. It was established by the Siliguri Jalpaiguri Development Authority (SJDA) in 2003. Coordinates of the site are $26^0$42.645'N and $88^0$21.352'E[1] and elevation is ~122 m or 400ft[17]. Within the Complex there are the Acharya Prafulla Chandra Roy Govt. College, a river *viz*. Chamta and an ephemeral rivulet Panchanai/Poiri (Fig. 1).

Climate:

The site is under the influence of three seasons: summer, monsoon and winter. Dense fog occurs at winter nights. During monsoon (June to September), moderate to heavy rains occur. The climate is suitable for growing tea and the surrounding regions have many tea gardens.

Edaphology:

Soil of the site is devastated due to continuously on-going constructional work and due to indiscriminate constructional rubbish dumping and cutting and felling of trees. In remote past, the site was cleared for agriculture. Now soil environment suffers from deficiency of nutrients, clay particles and organic matter. In the site (in reality, within the Campus of APC Roy Govt. College) soil reaction or soil pH ranges from 5.4 (surface or upper layer soil) to 5.33 (subsurface soil), thust it tends to be somewhat acidic and soil pH is moderate in the given edaphoclimate. Soil conductivity (determining Cation Exchange Capacity) is 12 moh (surface or upper layer soil) to 18 moh (subsoil or subsurface sample)[4]. Such difference in conductivity in surface and subsurface soils indicates differential clay and organic content and biotic activity. The soil needs care to enhance conductivity; otherwise it will be unable to nourish plant roots.

The complex was botanized thoroughly and frequently. Plant names are arranged alphabetically with their respective family names covering dicots and monocots, pteridophytes and few bryophytes. To determine the Coefficient of Generic Diversity (total), following formula was used: 100 * G/S [G = no. of genera, S = no. of species].

For cluster analysis the software 'Statistica' version 7.0 as used. For analysis purpose, the distance was measured by '**Euclidean Distance**' which is the actual geometric distance in the multidimensional space used. The distance could be calculated as per the formula:

$$\text{Distance } (X, Y) = \left\{ \sum_{i=1}^{n} (V_{xi} - V_{yi})^2 \right\}^{1/2}$$

[where d(X, Y) = distance between X and Y; n = total number of characters; V_{xi}= the character-state value of X for character I; V_{yi} is the character state value of Y for character i]

The taxonomic reconnaissance can be divided under four heads *viz*. phytocensus and taxonomic analysis, habitat diversity, habit analysis and cluster analysis.

Phytocensus and taxonomic analysis:

The aim of phytocensus was to determine the species diversity (species richness) as it is an approximate proxy for biodiversity and characterizes community structure[16],

although the work was confined to vascular plant species diversity (phytodiversity) (Table-1). The Table is divided into 1a to 1f categories which are self-explanatory. For ecological study, Group 1a plants are important being native; they are adapted to local edapho-climate. Group 1b plants are escape ones which are undergoing acclimatization process to local climate. Group 1c plants are tree and now are established in the site, these have been planted mainly along the bank of Poiri. Group 1f plants are indigenous, and are under the 'umbrella species'. In a biotic community, if conservational efforts for a target species automatically conserve some other species also of the habitat, the target species is known as 'umbrella species'. The Group 1f plants are present within the CPWD Quarter Campus, where man is the conserved species (umbrella species) and the plants are gaining their niche in some narrow, shady, moist lanes in the place which are more or less 'undisturbed'.

The data was further analyzed and is presented in Table-2. Relatively lower value of Coefficient of Generic Diversity (63.12) and the value of species quota for each genus (1.58) reflect sufficient degree of divergence at species level. Values of species quota (3.44) and genus quota (2.17) for each family also show conformity with this. At all specific, generic and family levels, dicots score high percentages over monocots and thus have much greater contribution to the flora.

Table-3 presents the name of ten dominant families[3-15] (on the basis of the no. of included genera and species) at the site. Their sequence in descending order is as follows: Compositae (no. of genera-22, no. of species-23) > Leguminosae (g-16, sp-23) > Graminae (g-15, sp-19) > Cyperaceae (g-7, sp-15) > Scrophulariaceae (g-6, sp-8)>Solanaceae(g-2, sp-8)>Rubiaceae (g-6, sp-7)> Euphorbiaceae (g-5, sp-7) > Labiatae (g-5, sp-7) > [Cucurbitaceae (g-6, sp-6) and Verbenaceae (g-6, sp-6) (g = genus, sp = species)].

Habit analysis:

Sir Theophrastus classified the plants into four categories: trees, shrubs, undershrubs and herbs. This ancient elementary habit classification can indicate some ecological features of a site. In the study sites tree: shrub: herb: vine: epiphyte ratio is 2: 1.88: 10.38: 1: 0 (Table-2). Very little value of trees and shrubs indicate high degree of denudation on the site, this in turn allows sufficient penetration of sun light down to ground to enhance herbal diversity. Poor canopy hindrance to rain results in soil erosion and increase in soil acidity. Very little number of vines and absence of epiphytes also reflect very poor canopy on the site.

Habitat diversity:

During study in the site, it was seen that the different patches of the ground noticeably differ from each other regarding the covering herbs or shrubs. Different patches can be identified which are dominated by *Clerodendron viscosum*, *Cassia occidentalis*, *Cassia tora*, *Sida rhomboidea*, *Leucas indica*, *Lantana camara*, *Boerhaavia repens*, *Urena lobata* and *Xanthium strumarium*. These may be identified as different 'societies' (subdominant species belonging to lower levels of life-forms than the dominants) on ground as per Clementsian Units of vegetation[6]. Of these plants, *Clerodendron viscosum*, a wasteland species, indicates prevalence of disturbance in the community

and *Lantana camara* indicates ecological degradation. *Argemone mexicana* and *Boerhaavia repens* also indicate soil degradation due to dumping of solid wastes, especially constructional material. *Lantana camara*, *Parthenium hysterophorus* and some other species may start secondury succession. Parallel roads cutting the area have contributed to increase in species diversity by adding some ruderal (road-side) species like *Achyranthes aspera,Croton bonplandianum*, *Ageratum conyzoides, Ageratum houstonianum*, *Blumea lacera*, *Eleutheranthera ruderalis etc.* which may bring microhabitat change. But ultimately this results in ecological fragmentation and shrinkage of ecological niche through edge effect. The site shows some difference in floral composition from nearby adjoining areas, for example, *Acalypha indica* and *Sida cordata* (*S. veronicifolia*) are absent in the site while they are common in Matigara Railway Station. *Spermacoce hispida*, *Richardia scabra*, *Sida cordifolia* and *Ricinus communis* are scanty in the site, but the plants are very common in other places of Matigara.

The site exhibits some prominent ongoing change in floral composition. For example, *Solanum diphyllum* has just kept foot in the site, being represented by a single individual. *Croton bonplandianum* and *Solanum torvum* is increasing in number. Before 2-3 years, there were few individuals of *Cleome rutidosperma* while *Cleome viscosa* was common. Now *C. rutidosperma* is increasing in number.

Cluster Analysis:

The ten dominant families of Himachal Vihar Complex are listed along with those of different regions in India for cluster analysis (Table-3). The cluster analysis method finds out overall similarity or conversely distance in pairs between *Operational Site Units* (**OSU**s *i.e.*11Sites) and classifies all of them in accordance with their affinity (here, on the basis of commonness in ten dominant families). This ultimately yields a tree diagram or dendrogram (Fig. 2).

The dendrogram shows that at linkage distance 1.7375 three major groups or clusters (OSU) are recognizable. At distance 1.420 each of the clusters again divides. Herefrom, Kishalay and Himachal Vihar Flora segregate from others (right ward cluster). This proves what anthropogenic influence can do – it brings two sites mathematically together from two very distant districts with different edaphoclimates – the North 24-Parganas (Kishalay) and Darjeeling (Himachal Vihar at Siliguri). The middle cluster contains Gangetic Plain, Bengal, Nadia district (Bahadurpur) and Bankura district (Sonamukhi). This is the Gangetic Delta of West Bengal. The left one contains Bihar, Bardhaman District (Forest patches and Chandur), Orissa and Madras. Interestingly, this creates a south-east continuum in India wherefrom somehow Andhra Pradesh has been excluded. Edaphoclimate might be the causal factor for creation of this continuum.

From the study it is revealed that the site shows a high degree of habitat diversity as well as heterogeneity. However, ecosystem of the site is devastated due to continuous constructional work, constructional rubbish dumping, destruction of trees, grazing and denudation, habitat fragmentation by roads *etc.* The soil is poor in microhabitat variation. Still the site harbours high species richness. All the ecological disturbances in the area possibly

Table-1a. Indigenous species

Sl.	Plant Name with Author	Family	Habit
1	*Ageratum conyzoides* L.	Compositae, 2	herb
2	*Ageratum haustonianum* Miller	Compositae, 2	herb
3	*Alocasia fallax* Schott	Araceae, 1	herb
4	*Alocasia macrorrhiza* (L.) G. Don	Araceae, 1	herb
5	*Alstonia scholaris* R. Br.	Apocynaceae, 2	tree
6	*Alternanthera sessilis* (L.) R.Br.	Amaranthaceae, 2	herb
7	*Alysicarpus vaginalis* (L.) DC.	Leguminosae, 2	herb
8	*Amaranthus spinosus* L.	Amaranthaceae, 2	herb
9	*Amaranthus viridis* L.	Amaranthaceae, 2	herb
10	*Ammania multiflora* Roxb.	Lythraceae, 2	herb
11	*Anisomeles indica* (L.) O. Kunzte	Labiatae, 2	shrub
12	*Aponogeton* L. f. sp.	Aponogetona-ceae, 1	herb
13	*Argemone mexicana* L.	Papaveraceae, 2	herb
14	*Argyreia roxburghii* Choisy var. *ampla*	Convolvulaceae, 2	vine
15	*Axonopus compressus* (Swartz) P. Beauv.	Graminae, 1	herb
16	*Azadirachta indica* A. Jsss.	Meliaceae, 2	tree
17	*Bidens pilosa* L.	Compositae, 2	herb
18	*Blumea lacera* (Burm. f.) DC.	Compositae, 2	shrub
19	*Boerhaavia repens* L.	Nyctaginaceae, 2	herb
20	*Bothriochloa pertusa* (L.) A. Camus	Gramineae , 1	herb
21	*Bulbostylis barbata* Kunth	Cyperaceae, 1	Herb
22	*Callicarpa tomentosa* (L.) Murray	Verbenaceae, 2	shrub
23	*Calotropis gigantea* R. Br.	Asclepiadaceae, 2	shrub
24	*Calotropis procera* R. Br.	Asclepiadaceae, 2	shrub
25	*Cassia occidentalis* L.	Leguminosae, 2	shrub
26	*Cassia tora* L.	Leguminosae, 2	herb
27	*Centella asiatica* (L.) Urb.	Umbelliferae, 2	herb
28	*Centranthera humifusa* Wallich	Scrophulariaceae, 2	herb
29	*Chromolaena odorata* (L.) King & Robinson	Compositae, 2	shrub
30	*Chrysopogon aciculatus* (Retz.) Trin.	Gramineae, 1	herb
31	*Citrullus vulgaris* Schrad.	Cucurbitaceae	vine
32	*Cleome rutidosperma* DC.	Capparidaceae	herb
33	*Cleome viscosa* L.	Capparidaceae	herb
34	*Clerodendron viscosum* Vent.	Verbenaceae	herb
35	*Colocasia esculenta* Schott	Araceae, 1	herb
36	*Commelina diffusa* Burm. f.	Commelinaceae, 1	herb
37	*Commelina suffruticosa* Bl.	Commelinaceae, 1	herb
38	*Crassocephalum crepidioides* (Benth.) Moore	Compositae, 2	herb
39	*Crotalaria elata* Welw.	Leguminosae, 2	herb
40	*Crotalaria juncea* L.	Leguminosae, 2	herb
41	*Crotalaria prostrata* Rottler ex Willdenow	Leguminosae, 2	herb
42	*Crotalaria saltiana* Andr.	Leguminosae, 2	herb
43	*Croton bonplandianum* Baill.	Eupborbiaceae, 2	herb
44	*Cuphea hyssopifolia* Kunth	Lythraceae, 2	herb
45	*Cyanoglossum lanceolatum* Forsk.	Boraginaceae, 2	herb
46	*Cyanotis axillaris* Roem. & Schult	Commelinaceae, 1	herb
47	*Cyanotis vaga* (Lour.) Schult. & Schult.	Commelinaceae, 1	herb

48	*Cynodon dactylon* Pers.	Gramineae, 1	herb
49	*Cyperus compressus* L.	Cyperaceae, 1	herb
50	*Cyperus difformis* L.	Cyperaceae, 1	herb
51	*Cyperus iria* L.	Cyperaceae, 1	herb
52	*Cyperus pilosus* Vahl	Cyperaceae, 1	herb
53	*Cyperus pseudokyllingioides* Kuk.	Cyperaceae, 1	herb
54	*Cyperus rotundus* L.	Cyperaceae, 1	herb
55	*Dactyloctenium aegypticum* (L.) Willd.	Gramineae, 1	herb
56	*Dalbergia sissoo* Roxb.	Leguminosae, 2	tree
57	*Dentella repens* (L.) Forst.	Rubiaceae, 2	herb
58	*Desmodium heterophyllum* DC.	Leguminosae, 2	herb
59	*Desmodium triflorum* (L.) DC.	Leguminosae, 2	herb
60	*Dichanthium annulatum* (Forsk.) Stapf	Gramineae, 1	herb
61	*Dombeya matersii* Hooker	Sterculiaceae, 2	shrub
62	*Drymaria cordata* Willd.	Caryophyllaceae, 2	Herb
63	*Eclipta alba* Hassk.	Compositae, 2	herb
64	*Eichhornia crassipes* (Mart.) Solm	Hydrocharitaceae,2	Aq. herb
65	*Elephantopus scaber* L.	Compositae, 2	herb
66	*Eleusine indica* Gaertn.	Gramineae, 1	herb
67	*Eleutheranthera ruderalis* (Sw.) Sch. Bip.	Compositae, 2	herb
68	*Emilia sonchifolia* DC.	Compositae, 2	herb
69	*Enydra fluctuans* Lour.	Compositae, 2	herb
70	*Eragrostis gangetica* Steud.	Gramineae, 1	herb
71	*Eragrostris nigra* Nees ex Steudel.	Gramineae, 1	herb
72	*Eragrostis tenella* Roem. & Schult.	Gramineae, 1	herb
73	*Eragrostis tremula* Hochst.	Gramineae, 1	herb
74	*Eragrostis unioloides* (Retz.)	Gramineae, 1	herb
75	*Eriocaulon* L. sp. Nees	Eriocauleae, 1	herb
76	*Euphorbia hirta* L.	Euphorbiaceae, 2	herb
77	*Euphorbia microphylla* Hyne	Euphorbiaceae, 2	herb
78	*Evolvulus alsinoides* L.	Convolvulaceae, 2	Herb
79	*Ficus bengalensis* L.	Urticaceae, 2	tree
80	*Ficus cunia* Ham.	Urticaceae , 2	shrub
81	*Ficus hispida* L. f.	Urticaceae, 2	shrub
82	*Ficus religiosa* L.	Urticaceae, 2	tree
83	*Fimbristylis aestivalis* Vahl.	Cyperaceae, 1	herb
84	*Fimbristylis densa* (Wall.) Koyama & Chuang	Cyperaceae, 1	herb
85	*Fimbristylis miliacea* (L.) Vahl	Cyperaceae , 1	herb
86	*Fimbristylis ovata* (Burm. f.) Kern	Cyperaceae, 1	herb
87	*Glinus lotoides* L.	Molluginaceae, 2	herb
88	*Gnaphalium purpureum* L.	Compositae , 2	herb
89	*Grangea maderaspatana* Poir.	Compositae, 2	herb
90	*Gynura cusimbua* D. Don.	Compositae, 2	Herb
91	*Hedyotis corymbosa* (L.) Lamk.	Rubiaceae, 2	herb
92	*Heliotropium indicum* L.	Boraginaceae, 2	herb
93	*Hydrocotyle sibthorpioides* Lamarck	Umbelliferae, 2	herb
94	*Hydrolea zylanica* Vahl.	Hydrophyllaceae, 2	herb
95	*Hydrilla verticillata* Casp.	Hydrocharitaceae, 1	herb
96	*Hygrorhiza aristata* Nees.	Graminae, 1	herb
97	*Hygrophila phlomoides* Nees.	Acanthaceae, 2	herb

98	*Hymenachne acutigluma* (Steudal) Gilliland	Graminae, 1	herb
99	*Hypericum japonicum* Thunb.	Hypericaceae, 2	herb
100	*Hyptis capitata* Jacq.	Labiatae, 2	shrub
101	*Hyptis suaviolens* Poit.	Labiatae, 2	shrub
102	*Ilysanthes parviflora* Benth.	Compositae, 2	herb
103	*Imperata cylindrical* (L.) P. Beauv.	Graminae, 1	herb
104	*Ipomoea carnea* ssp. *fistulosa* (Mar. ex Choisy) Austin	Convolvulaceae, 2	herb
105	*Ipomoea reptans* Poir	Convolvulaceae, 2	herb
106	*Kyllinga triceps* Rottb.	Cyperaceae, 1	herb
107	*Lantana camara* L.	Verbenaceae, 2	shrub
108	*Lemna minor* L.	Lemnaceae, 1	Aq. herb
109	*Leucas indica* L.	Labiatae, 2	herb
110	*Limnophila racemosa* Benth.	Scrophulariaceae, 2	herb
111	*Lindernia ciliata* (Colsm.) Pennell	Scrophulariaceae, 2	herb
112	*Lindernia crustacea* (L.) F. Muell.	Scrophulariaceae, 2	herb
113	*Lindernia parviflora* (Roxb.) Haines	Scrophulariaceae, 2	herb
114	*Lippia javanica* (Burm. f.) Spreng.	Verbenaceae, 2	shrub
115	*Lobelia trigona* Roxb.	Campanulaceae, 2	herb
116	*Ludwigia adscendens* (L.) Hara	Onagraceae, 2	Aq. herb
117	*Ludwigia octavalvis* (Jacq.) Raven	Onagraceae, 2	herb
118	*Ludwigia perennis* L.	Onagraceae, 2	herb
119	*Luffa aegyptiaca* Mill.	Cucurbitaceae, 2	vine
120	*Mazus pumilus* (Burm. f.) Steen.	Scrophulariaceae, 2	herb
121	*Mecardonia procumbens* (Miller) Small	Scrophulariaceae, 2	herb
122	*Melochia corchorifolia* L.	Sterculaceae, 2	herb
123	*Melothria leucocarpa* Cogn.	Cucurbitaceae, 2	vine
124	*Merremia hirta* (L.) Merrill	Convolvulaceae, 2	vine
125	*Mikania micrantha* Kunth	Compositae, 2	vine
126	*Mimosa pudica* L.	Leguminosae, 2	herb
127	*Mitracarpus hirtus* (L.) DC.	Rubiaceae, 2	herb
128	*Monochoria hastata* (L.) Solms	Pontederiaceae, 2	herb
129	*Monochoria vaginalis* Presl	Pontederiaceae, 2	herb
130	*Mukia maderaspatana* (L.) Roem.	Cucurbitaceae, 2	vine
131	*Murdannia nudiflora* (L.) Brenan	Commelinaceae, 1	herb
132	*Murdannia spirata* (L.) Bruckner	Commelinaceae, 1	herb
133	*Najas* L. sp.	Najadaceae, 1	herb
134	*Nelsonia canescens* (Lam.) Speng.	Acanthaceae, 2	herb
135	*Nymphaea L.*	Nymphaeaceae, 1	herb
136	*Nymphoides* Seguier sp.	Nymphaeaceae, 1	Herb
137	*Oenantha benghalensis* (Roxb.) Benth. et Hook. f.	Umbelliferae, 2	herb
138	*Oxalis corniculata* L.	Geraniaceae, 2	herb
139	*Panicum* sp.	Graminae, 1	herb
140	*Parthenium hysterophorus* L.	Compositae, 2	herb
141	*Phyllanthus amarus* Schum & Th.	Euphorbiaceae, 2	herb
142	*Phyllanthus urinaria* L.	Euphorbiaceae, 2	herb
143	*Physalis minima* L.	Solanaceae, 2	herb
144	*Pilea microphylla* (L.) Liebm.	Urticaceae, 2	herb
145	*Polycarpon prostratum* (Forsk.) Asch. & Schweinf.	Caryophyllaceae, 2	herb
146	*Polygala linarifolia* Willdenow	Polygalaceae, 2	herb
147	*Polygonum hydropiper* L.	Polygonaceae, 2	herb
148	*Polygonum microphyllum* Klotzsch ex Meisn	Polygonaceae, 2	herb

149	*Polygonum orientale* L.	Polygonaceae, 2	herb
150	*Polygonum plebeium* R. Br.	Polygonaceae, 2	herb
151	*Portulaca oleracea* L.	Portulacaceae, 2	herb
152	*Pouzolzia indica* Gaud.	Urticaceae, 2	herb
153	*Pseudognaphalium luteo-album* ssp. *affine* (D. Don) Hillard & Burtt	Compositae , 2	herb
154	*Pueraria phaseoloides* Benth.	Leguminosae, 2	vine
155	*Pueraria sikkimensis* Prain	Leguminosae, 2	vine
156	*Ricinus communis* L.	Euphorbiaceae, 2	shrub
157	*Richardia scabra* L.	Rubiaceae, 2	herb
158	*Rikliella squarrosa* (L.) Raynal	Cyperaceae, 1	herb
159	*Rorippa indica* (L.) Hiern	Brasicaceae, 2	herb
160	*Rotala ritchiei* (Cl.) Koehne	Lythraceae, 2	herb
161	*Rumex* L. sp.	Polygonaceae, 2	herb
162	*Rungia pectinata* (L.) Nees	Acanthaceae, 2	herb
163	*Saccharum spontaneum* L.	Gramineae,1	shrub
164	*Salomonia ciliata* (L.) DC.	Polygalaceae, 2	herb
165	*Sauropus quadrangularis* Muell.-Arg.	Euphorbiaceae , 2	shrub
166	*Schoenoplectus* Palla sp.	Cyperaceae, 1	herb
167	*Scirpus littoralis* Schrad	Cyperaceae, 1	herb
168	*Scoparia dulcis* L.	Scrophulariaceae, 2	herb
169	*Setaria glauca* Beauv.	Gramineae, 1	herb
170	*Sida acuta* Burm. f.	Malvaceae, 2	shrub
171	*Sida cordifolia* L.	Malvaceae, 2	shrub
172	*Sida rhombifolia* L.	Malvaceae, 2	shrub
173	*Solanum diphyllum* L.	Solanaceae, 2	herb
174	*Solanum ferox* L.	Solanaceae, 2	shrub
175	*Solanum indicum* L.	Solanaceae, 2	shrub
176	*Solanum khasianum* Cl.	Solanaceae, 2	herb
177	*Solanum nigrum* L.	Solanaceae, 2	herb
178	*Solanum sisymbrifolium* Lamk.	Solanaceae, 2	herb
179	*Solanum torvum* Swartz.	Solanaceae, 2	shrub
180	*Sonchus asper* Vill.	Compositae, 2	herb
181	*Spermacoce hispida* L.	Rubiaceae, 2	herb
182	*Spermacoce ocymoides* auct. non Burm. f.	Rubiaceae, 2	herb
183	*Spilanthes acmella* L.	Compositae, 2	herb
184	*Sporobolus indicus* var. *purpureosuffusus* (Ohwi) Koyama	Graminae, 1	herb
185	*Stephania hernandifolia* (Willd. Walp.)	Menispermaceae, 2	vine
186	*Tectona grandis* L. f.	Verbenaceae, 2	tree
187	*Trema orientalis* Bl.	Urticaceae, 2	tree
188	*Trewia nudiflora* L.	Urticaceae, 2	tree
189	*Tridax procumbens* L.	Compositae, 2	tree
190	*Triumfetta rhomboidea* Jacq.	Tiliaceae, 2	shrub
191	*Urena lobata* L.	Malvaceae , 2	shrub
192	*Utricularia aurea* Lour.	Lentibulariaceae, 2	marsh herb
193	*Utricularia bifida* L.	Lentibulariaceae, 2	Aq. herb
194	*Vernonia cinerea* Less.	Compositae , 2	herb
195	*Xanthium strumarium* L.	Compositae , 2	herb
196	*Zanonia indica* L.	Cucurbitaceae, 2	herb
197	*Zizyphus jujuba* Lamk.	Rhamnaceae, 2	tree

Table-1b. Escaped from gardens but now established species

Sl.	Plant Name with Author	Family	Habit
198	*Agave angastifolia* Haw.	Agavaceae, 1	herb
199	*Aglaonema crispum* (Pitcher & Manda) Nicolson	Araceae, 1	herb
200	*Andrographis paniculata* Nees	Acanthaceae, 2	herb
201	*Carica papaya* L.	Caricaceae, 2	tree
202	*Clitoria ternatea* L.	Leguminosae, 2	vine
203	*Crotalaria juncea* L.	Leguminosae , 2	shrub
204	*Ocimum basilicum* L.	Labiatae, 2	herb
205	*Ocimum sanctum* L.	Labiatae, 2	shrub
206	*Ocimum sanctum* L. var. tenuifolium	Labiatae, 2	shrub
207	*Passiflora foetida* Linn.	Passifloraceae, 2	vine
208	*Sesamum indicum* DC.	Pedaliaceae, 2	herb
209	*Vinca rosea* L.	Apocynaceae, 2	shrub

Table-1c. Planted but now established species

Sl.	Plant Name with Author	Family	Habit
210	*Acacia auriculiformis* A. Cunn.	Leguminosae, 2	tree
211	*Ailanthus excelsa* Roxb.	Simaroubaceae, 2	tree
212	*Albizzia lebbek* Benth.	Leguminosae, 2	tree
213	*Anthocephalus chinensis* (Lamk.) A. Rich. ex Walp.	Rubiaceae, 2	tree
214	*Artocarpus integrifolia* L.f.	Urticaceae, 2	tree
215	*Bauhinia acuminata* L.	Leguminosae, 2	tree
216	*Bauhinia purpurea* L.	Leguminosae, 2	tree
217	*Butea monosperma* (Lamk.) Taub	Leguminosae, 2	tree
218	*Caesalpinia pulcherrima* Sw.	Leguminosae, 2	tree
219	*Delonix regia* (Boj.) Raf.	Leguminosae, 2	tree
220	*Eugenia jambolana* Lamk.	Myrtaceae, 2	tree
221	*Gmelina arborea* L.	Verbenaceae, 2	tree
222	*Lagerstroemia reginae* Roxb.	Lythraceae, 2	tree
223	*Michelia champaca* L.	Annonaceae, 2	tree
224	*Mimusops elengi* L.	Ebenacae, 2	tree
225	*Momordica charantia* L.	Cucurbitaceae, 2	vine
226	*Oroxylum Indicum* Vent.	Bignoniaceae, 2	tree
227	*Peltophorum pterocarpum* (DC.) Backer ex K.	Leguminosae, 2	tree
228	*Phyllanthus emblica* L.	Euphorbiaceae, 2	tree
229	*Swietenia mahagoni* L.	Meliaceae, 2	tree
230	*Syzygium cumini* (L.) Skeeles	Myrtaceae, 2	tree
231	*Toona ciliata* Roem.	Meliaceae, 2	tree

Table-1d. Indigenous Pteridophytes

Sl.	Plant Name	Family	Habit
232	*Aleuritopteris albomarginata* (C.B. Clarke) Ching	Pteridaceae	herb
233	Azolla pinnata R. Br.	Salviniaceae	Aq. herb
234	*Athyrium* Roth. *sp.*	Athyriaceae	herb
235	*Cyclosorus* Link. *sp.*	Thelypteridaceae	herb
236	*Diplazium esculentum* (Retz.) Sw.	Athyriaceae	herb
237	*Lygodium flexuosum* Sw.	Schizaeaceae	vine
238	*Lygodium japonicum* Sw.	Schizaeaceae	vine
239	*Lygodium microphyllum* R. Br.	Schizaeaceae	vine
240	*Marsilea minuta* L.	Marsiliaceae	herb
241	*Selaginella bisulcata* Spreng.	Selaginellaceae	Herb

Table-1e. Indigenous Bryophytes

Sl.	Plant Name	Class	Habit
242	*Anthoceros* L. sp.	Anthocerotopsida	Herb
243	*Marchantia* L. sp.	Hepaticopsida	Herb
244	*Ricccia* L. sp.	Hepaticopsida	Herb

Table-1f. Plants conserved under the umbrella species

Sl.	Plant Name	Class	Habit
1	*Anthoceros* L. sp.	Anthocerotopsida	Herb
2	*Marchantia* L. sp.	Hepaticopsida	Herb
3	*Ricccia* L. sp.	Hepaticopsida	Herb
4	*Selaginella bisulcata* Spring	Lycopsida	herb

Table-1g. Garden species (Contd.)

Sl.	Plant Name with Author	Family	Habit
1	*Adhatoda vasica* Nees	Acanthaceae, 2	tree
2	*Agave angastifolia* Haw.	Agavaceae, 1	herb
3	*Aloe vera* (L.) Burm. f.	Amaryllidaceae, 1	herb
4	***Araucaria cooki* R. Br. ex D. Don**	**Auraucariaceae, g**	tree
5	***Araucaria heterophylla* (Salisb.) Franco**	**Auraucariaceae, g**	tree
6	*Areca catechu* L.	Palmae, 1	tree
7	*Basella rubra* L.	Chenopodiaceae, 2	vine
8	*Begonia* L. sp.	Begoniaceae, 2	herb
9	*Bougainvillea glabra* Chois.	Nyctaginaceae, 2	climber
10	*Bougainvillea spectabilis* Willd.	Nyctaginaceae, 2	climber
11	*Caesalpinia pulcherrima* Sw.	Leguminosae, 2	tree
12	*Capsicum annum* L.	Solanaceae, 2	herb
13	*Carica papaya* L.	Caricaceae, 2	tree
14	*Cestrum nocturnum* L.	Solanaceae, 2	vine
15	*Chamabainia cuspidata* Wight.	Urticacae, 2	herb
16	*Chrysanthemum* L. spp.	Compositae, 2	herb
17	*Citrullus vulgaris* Schrad.	Cucurbita, 2	vine
18	*Codiaeum variegatum* (L.) Blume	Euphorbiaceae, 2	herb
19	*Crinum defixum* Ker.	Amaryllidaceae, 1	herb
20	*Cucurbita pepo* DC.	Cucurbitaceae	climber
21	*Dahlia* L. sp.	Compositae	herb
22	*Dictyospermum album* (Bory) H. Wendel. & Drude ex Scheff.	Palmae, 1	shrub
23	*Dracaena fragrans* (L.) Ker Gawl.	Asparagaceae, 1	herb
24	*Duranta repens* L.	Verbenaceae, 2	shrub
25	*Ficus benjamina* L.	Urticaceae, 2	tree
26	*Ficus elastic* Roxb.	Urticaceae, 2	tree
27	*Gardenia jasminoides* J. Ellis	Rubiaceae, 2	shrub
28	*Heliconia rostrata* Ruiz & Pavon	Heliconiaceae, 1	herb
29	*Hibiscus rosa-chinensis* L.	Malvaceae, 2	shrub
30	*Ixora chinensis* Lamk.	Rubiaceae, 2	shrub
31	*Jasminum pubescens* Willd.	Oleaceae, 2	climber
32	*Jasminum sambac* Ait.	Oleaceae, 2	climber
33	*Kalanchoe blossfeldiana* Poelln	Crassulaceae, 2	herb
34	*Kalanchoe laciniata* DC.	Crassulaceae, 2	herb
35	*Mangifera indica* L.	Anacardiaceae, 2	tree
36	*Mimusops elengi* L.	Sapotaceae, 2	tree
37	*Monstera deliciosa* Lieb.	Araceae, 1	climber
38	*Murraya exotica* L.	Rutaceae, 2	shrub
39	*Murraya koenigii* (L.) Spreng	Rutaceae, 2	shrub

40	*Musa paradisiaca* L.	Musaceae, 1	tree
41	*Nerium oleander* L.	Apocynaceae, 2	shrub
42	*Nyctanthes arbortristis* L.	Oleaceae, 2	tree
43	*Ocimum basilicum* L.	Labiatae, 2	herb
44	*Ocimum sanctum* L.	Labiatae, 2	shrub
45	*Ocimum sanctum* L. var. *tenuifolium*	Labiatae, 2	shrub
46	*Pilea microphylla* (L.) Leibm.	Urticaceae, 2	herb
47	*Pisum arvense* L.	Leguminosae, 2	climber
48	*Plumeria obtuse* L.	Apocynaceae, 2	tree
49	*Polyalthia longifolia* Benth. & Hook. f.	Annonaceae, 2	tree
50	*Psidium guyava* L.	Myrtaceae, 2	tree
51	*Rosa* spp.	Rosaceae, 2	shrub
52	*Epipremnum aureum* Linden & Andre	Araceae, 1	climber
53	*Tabernaemontana coronaria* R. Br.	Apocynaceae, 2	shrub
54	*Tagetes* spp.	Compositae, 2	herb
55	*Tecoma gaudichaudi* DC.	Bignoniaceae, 2	shrub
56	*Thevetia nerifolia* Juss.	Apocynaceae, 2	tree
57	*Vinca rosea* L.	Apocynaceae, 2	shrub

2 = diot plant, 1 = monocot plant, g = gymnosperm

Table-2. Habit analysis and taxonomic analysis of the concerned flora

Habit Analysis								
Tree: Shrub: Herb: Vine: Epiphyte :: 32:30:166:16:0 :: 2: 1.88: 10.38: 1: 0; % values – Tree:13.11%, Shrub: 12.29%, Herb: 68.03%, Vine: 6.56%, Epiphyte: 0%								
Taxonomic Analysis								
Total no. plants: 244 (Vascular Plants + Bryophytes)		Family:Genus:Species :: 71:154: 244 :: 1: 2.17: 3.44				Coefficient of Generic Diversity (total) = 100 * G/S = 100* 154/244 = 63.12		
Dicotyledons: 178		Family:Genus:Species :: 50: 109: 178 :: 1: 2.18: 3.56						
Monocotyledons: 53		Family:Genus:Species :: 11: 35: 53 :: 1: 3.18: 4.82						
Pteridophyte:10		Family:Genus:Species :: 7: 7: 10 :: 1: 1: 1.43						
Bryophyte: 3		Family:Genus:Species :: 3: 3: 3 :: 1: 1: 1						
Dicot : Monocot Ratio		Dicot Fam : Monocot Fam :: 50:11 :: 4.55: 1				Species quota for each family (total)	Species quota for each genus (total)	Genus quota for each family (total)
		Dicot Genus : Monocot Genus :: 109 :35 :: 3.11: 1						
		Dicot Spp. :Monocot Spp. :: 178:53 :: 3.36: 1						
% Values	Total Angiosperms	Dicotyledons		Monocotyledons		244/71 = 3.44	244/154 = 1.58	154/71 = 2.17
	Fam: 61	50	81.97 %	11	18.03 %			
	Gen: 144	109	75.69 %	35	24.31 %			
	Spp: 231	178	77.06 %	53	22.94 %			

Table-3. Ten dominant families of different forest flora in India

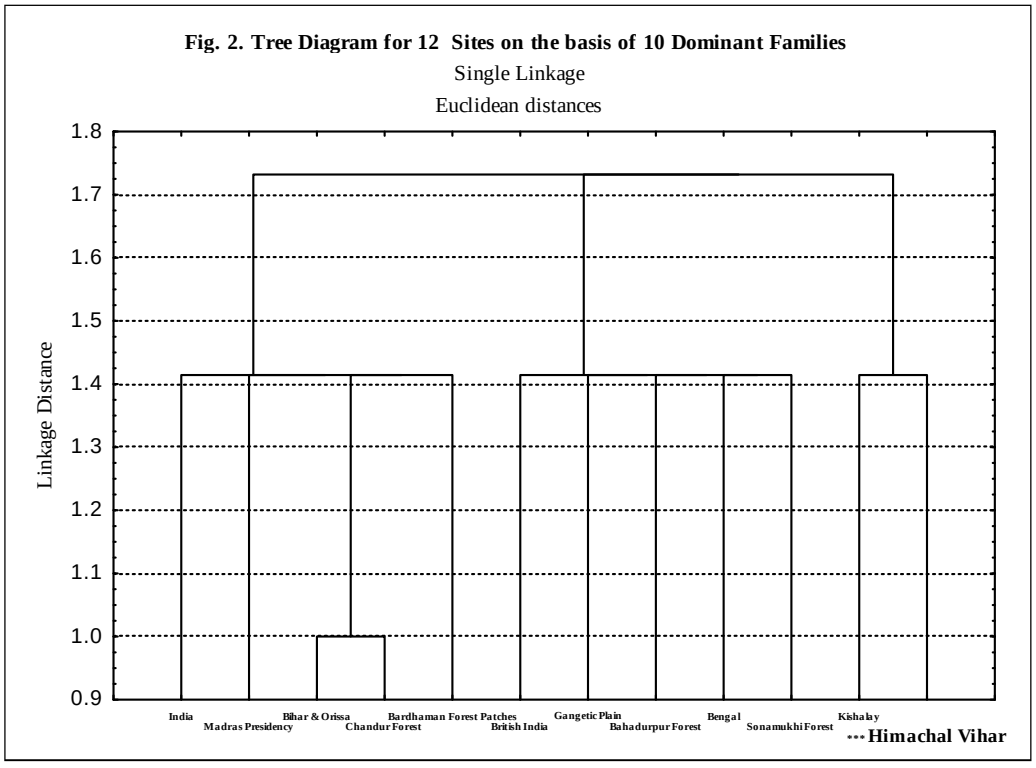
Himachal Vihar	Kishalay Boys' Home Campus[5]	Bardhaman Forest Patches[6]	Sonamukhi Forest[7]	Chandur Forest[8]	Bahadurpur Forest[9]
Compositae	Euphorbiaceae	Leguminosae*	Leguminosae*	Leguminosae*	Leguminosae*
Leguminosae*	Leguminosae*	Gramineae	Graminae	Euphorbiaceae	Euphorbiaceae
Graminae	Compositae	Rubiaceae	Compositae	Acanthaceae	Verbenaceae
Cyperaceae	Verbenaceae	Euphoprbiaceae	Euphorbiaceae	Amaranthaceae	Gramineae
Scrophulariaceae	Graminae and Solanaceae	Compositae and Cyperaceae	Acanthaceae	Malvaceae	Rubiaceae
Solanaceae			Amaranthaceae	Cucurbitaceae	Malvaceae
Rubiaceae	Araceae, Malvaceae and Urticaceae	Acnthaceae	Convolvulaceae	Rubiaceae	Compositae
Euphorbiaceae	Apocynaceae and Rutaceae	Combretaceae and Malvaceae	Verbenaceae	Verbenaceae	Cyperaceae
Labiatae			Rubiaceae	Asclepiadaceae	Amaranthaceae
Cucurbitaceae, Verbenaceae		Apocynaceae	Cypreraceae	Urticaceae**	Urticaceae**

Bengal[10]	Gangetic Plain[11]	Bihar and Orissa[12]	Madras Presidency[13]	British India[14]	India[15]
Leguminosae*	Gramineae*	Leguminosae*	Leguminosae*	Orchidaceae	Leguminosae*
Gramineae	Leguminosae *	Gramineae	Gramineae	Leguminosae *	Compositae
Cyperaceae	Cyperaceae	Cyperaceae	Rubiaceae	Gramineae	Scrophulariaceae
Compositae	Compositae	Compositae	Acanthaceae	Rubiaceae	Labiatae
Orchidaceae	Scrophulariaceae	Euphorbiaceae	Euphorbiaceae	Euphorbiaceae	Acanthaceae
Euphorbiaceae	Malvaceae	Acanthaceae	Orchidaceae	Acanthaceae	Rubiaceae
Urticaceae **	Acanthaceae	Rubiaceae	Compositae	Compositae	(only six dominant families were obtained from literature)
Rubiaceae	Euphorbiaceae	Orchidaceae	Cyperaceae	Cyperaceae	
Scrophulariaceae	Convolvulaceae	Labiatae	Labiatae	Labiatae	
Convolvulaceae	Labiatae	Scrophulariaceae	Asclepiadaceae	Urticaceae **	

*Leguminosae *sensu lato* (consisting of Papilionaceae, Caesalpiniaceae and Mimosaceae)

** Urticaceae *sensu lato* (consisting of Urticaceae *sensu stricto,* Moraceae and Cannabinaceae)

Fig. 1. A view of river Poiri



function as 'intermediate disturbance' and contribute to increase in species richness, lending support to the **"Intermediate disturbance hypothesis"**[7]. Numerical poverty in trees in the site will result in warming, desiccation and other problems, so planting more and more tree species in the site is the must.

Note:

The taxonomic reconnaissance has been performed in the site is under stringent anthropogenic modification and manipulation. During the constructional work it is not possible to consider the ecological and botanical health of the site. Trees and shrubs also are not protected from ecological interest. Only weeds and some planted plants dominate the area. So the result should be taken with a pinch of salt as it relates to an anthropo-influenced site rather than a natural community.

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