

**FINAL REPORT**  
**OF**  
**THE PROJECT ENTITLED**  
**“DOCUMENTATION OF MANGROVES AND MANGROVE**  
**ASSOCIATES FROM MUMBAI”**



**SUBMITTED TO**  
**MANGROVE FOUNDATION, MUMBAI**

**JANUARY 2018 – APRIL 2018**

**SUBMITTED BY:**  
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### **Scientific Documentation Team Members:**

- Dr. Suchandra Dutta (PI)
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### **Photographs by:**

- Dr. Suchandra Dutta
- Mr. Kiran Chakral
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### **Volunteers for population study of *Avicennia marina* from Mumbai:**

- SYBSc Botany Students, R. D. & S. H. National College, Bandra (W.), Mumbai

### **Activities conducted :**

- **Visits to suburbs of Mumbai** (Almost once every fortnight on an average) Metropolitan region to document mangroves, mangrove associates and other species (Gorai, charkop, Bhayender, Marve, Manori, Dahisar, Bandra, Esselworld, Naigaon, Vasai, Virar, Bhandup, Airoli, Vikhroli, Nerul, Elephanta islands (January 2018-November 2018) and **collection of mangrove and mangrove associate species** for the purpose of herbarium
- **Visit to places around Mumbai , i. e., Raigad, Ratnagiri and Sindhudurg** (Vengurla, Kille Nivti, Malvan, Tarkarli, Terekholand Panjim) to collect other mangrove species for the purpose of herbarium (with prior permission from funding authority).
- **Scientific study of specimens** to identify them (in the laboratory) based on their **morphological characters** using simple microscope. Only in very doubtful case, anatomical study was performed.
- **Herbarium consultation** at Central National Herbarium, Kolkata; Blatter Herbarium, Mumbai to understand the correct identity of the plants

- Reference to **relevant research papers and original protologue and type specimens** to ascertain the correct identity and **confirm the new taxa**
- Making of **herbarium voucher**

#### Project Outcome:

- **13 species of Mangroves** from Mumbai
- **37 species of Mangrove associates**
- **260 species of plants** belonging to **231 genera and 92 families** from Gorai, Charkop, Bhayender, Marve, Manori, Dahisar, Ghod Bunder, Bandra, Esselworld, Naigaon, Vasai, Panju Island, Virar, Bhandup, Airoli, Vikhroli, Nerul, Elephanta islands (January 2018 - April 2018)
- **1 new subsp., 1 new forma**
- **1 new record for the state of Maharashtra**
- **Documentation of 1 mangrove species which is otherwise very rare in Mumbai**

## **Introduction:**

**MANGROVES – The Life Line of Coastal Cities & A home to many species of Birds and other invertebrates.** Apart from housing a variety of insects, molluscs, crustaceans and reptiles, it also harbors a plethora of birds; both aquatic and tree-dwelling. Some of the commonly found birds here are *Kingfishers, Herons, Storks, Sea Eagles, Kites, Sand Pipers, Bitterns, Egrets, Cormorants, Black winged stilts*, etc. This is because many birds depend on the mangroves for their prey (*Sea Eagles, Kites, Pond Herons, Egrets*, etc) while many thrive on the mangroves since it provides a perfect breeding environment (the likes of *Cormorants and Egrets*). They serve as **breeding ground** for many of the crustacean and other species of animals. These organisms are in turn **food** for many of the birds. They need to be protected to save this ecosystem. Moreover, mangrove belt helps in **checking the inlands from flood.**

There are around **13 species of mangroves** and **37 mangrove associates** reported from **Mumbai**. The dominant species of mangroves are *Avicennia marina* var. *acutissima*, *Avicennia marina* var. *acutissima forma pumila (forma nov.)*, *Sonneratia apetala*, *Avicennia alba*, *Agiceras corniculata*, *Brugueria cylindrica*. *Lumnitzera racemosa*, a very rare mangrove in Mumbai is reported from Gorai and Charkop.

With **the urbanization**, mangrove land is becoming the **target for the land developers**. They deposit construction wastes near the sea which **adversely affect not only the sea and mangroves, it directly affect the livelihood of local Koli people (ref.- personal communication)**

During the present survey in Bandra (W.), we have noticed that the tree species such as *Peltophorum pterocarpum*, *Ficus bengalensis*, *Ficus religiosa*, etc. have proceeded inside the mangrove vegetation. This itself is an indicator of the changing ecosystem of this place.

*Sonneratia alba*, a mangrove species which was not earlier reported from Bandra, is recorded now.

Gorai, Borivli (West) has a rich mangrove vegetation. It is the type location for *Avicennia marina* var. *acutissima* and also for our new taxa *Cistanche tubulosa* sub sp. *palustris*. Near Tarzan Lake, Charkop, Kandivli (West) is the type locality of our new taxa *Avicennia marina* var. *acutissima* forma *palustris*.

Gorai, Dahisar, Lokhandwala mangrove area are being affected by sewage discharge which directly pollute the habitat. It has an adverse effect on the mangrove vegetation. Local people are encroaching the mangrove land for construction activity. Same situation is reported from Mira Road (West). Local encroachers do not allow any outsider to even pass through the area.

**Mangrove tourism** is established in the eastern suburb of Mumbai by the authority. Whereas, in western suburb and New Mumbai no formal mangrove tourism is there. Some of the areas where mangrove tourism can be developed are Bandra (West), Gorai (on the way to Pagoda), Mira road (where people are not allowed by the locals), Virar (West). There are three biodiversity rich lakes is situated in Nerul, Charkop (Tarzan lake) and Lokhandwala lake around mangrove vegetation. Many species of migratory birds are flocking in these lakes, some of these species are rare. **Rough**, one of the very rare species of bird is reported very recently (during bird race organized by R. D. & S. H. National College) from Lokhandwala Lake. Nature lovers have been regularly visiting these areas for bird watching.

Local villagers can be trained in the area of scientific aspects of mangroves and its associated flora and fauna. They may serve as the tour guide. This might sensitise the local people towards the protection of the vegetation, create oneness with their own surrounding thereby checking encroachment for other illegal purpose. A mangrove information centre should be established in the western suburb also. This effort might help to protect these mangrove rich locations by people's participation.

**Eneumeration of Mangroves, Mangrove Associates and other species (Invasive & Cultivated) from Gorai, Bhayender, Marve, Manori, Dahisar, Ghod bunder, Bandra, Esselworld, Naigaon, Panju Island, Vasai, Virar, Bhandup, Airoli, Vikhroli, Nerul, Elephanta islands (January 2018 - April 2018)**

Sr.	Botanical name		Family	Habit
1	<i>Abelmoschus esculentus</i>	Moench.	Malvaceae	Shrub
2	<i>Abrus precatorius</i>	L.	Fabaceae	Climbing
3	<i>Abutilon indicum</i>	Sweet	Malvaceae	Shrub
4	<i>Acacia nilotica</i>	(L.) Delile	Mimosaceae	Tree
5	<i>Acalypha indica</i>	Vell.	Acalyphaceae	Herb
6	<i>Achyranthes aspera</i>	L.	Amaranthaceae	Herb
7	<i>Aegle marmelos</i>	(L.) Correa	Rutaceae	Cultivated tree
8	<i>Aerva lanata</i>	(L.) Juss. Ex Schult.	Amaranthaceae	Herb
9	<i>Aeschynomene sp.</i>	-	Fabaceae	Herb
10	<i>Agave sp.</i>	-	Agavaceae	Herb
11	<i>Aegiceras corniculatum</i>	(L.) Blanco	Myrsinaceae	Tall shrub
12	<i>Alangium salvifolium</i>	(L.f.) Wangerin	Alangiaceae	Tree
13	<i>Aeluropus lagopoides</i>	(L.) Trin. Ex Thwaites	Poaceae	Grass
14	<i>Alternanthera paronychioides</i>	A.St.-Hil.	Amaranthaceae	Herb
15	<i>Alternanthera sessilis</i>	(L.) DC.	Amaranthaceae	Herb
16	<i>Alysicarpus monilifer</i>	(L.) DC.	Fabaceae	Herb
17	<i>Amaranthus viridis</i>	L.	Amaranthaceae	Herb
18	<i>Anacardium occidentale</i>	L.	Anacardiaceae	Cultivated tree
19	<i>Annona reticulata</i>	L.	Annonaceae	Cultivated tree
20	<i>Anona squamosa</i>	L.	Annonaceae	Cultivated tree
21	<i>Antigonon leptopus</i>	Hook. & Arn.	Polygonaceae	Climbing
22	<i>Argemone mexicana</i>	L.	Papaveraceae	Herb
23	<i>Artocarpus hirsutus</i>	Lam.	Moraceae	Cultivated tree
24	<i>Asperagus racemosus</i>	Willd.	Asperagaceae	Climbing
25	<i>Asteracantha longifolia</i>	Nees	Acanthaceae	Herb
26	<i>Asystasia gangetica</i>	(L.) T. Anderson	Apocynaceae	Herb
27	<i>Averrhoa bilimbi</i>	L.	Averrhoaceae	Cultivated tree
28	<i>Avicenia officinalis</i>	L.	Avicenniaceae	Tree
29	<i>Avicennia marina (Forsk.) Vierh. var, acutissima</i> <i>Staph. &amp; Moldenke</i>		Avicenniaceae	Tree
30	<i>Avicennia marina</i>	(Forssk.) Vierh.	Avicenniaceae	Tree

Sr.	Botanical name		Family	Habit
31	<i>Avicennia marina</i> (Forssk.) Vierh. var. <i>acutissima</i> Staph. & Moldenke forma <i>pumila</i> (forma nov.)		Avicenniaceae	Dwarf tree
32	<i>Azadirachta indica</i>	A.Juss.	Meliaceae	Tree
33	<i>Barleria prionitis</i>	L.	Acanthaceae	Shrub
34	<i>Bauhinia racemosa</i>	Vahl.	Caesalpiniaceae	Tree
35	<i>Cynarospermum asperrimum</i>	(Nees) Vollesen	Acanthaceae	Herb
36	<i>Blumea lacera</i>	(Burm.f.)DC.	Asteraceae	Herb
37	<i>Boerhavia diffusa</i>	L.	Nyctaginaceae	Herb
38	<i>Bombax ceiba</i>	L.	Bombacaceae	Tree
39	<i>Borassus flabellifer</i>	L.	Arecaceae	Tree
40	<i>Brassica juncea</i>	(L.) Hook. f. & Th.	Brassicaceae	Herb
41	<i>Bridelia retusa</i>	Spreng.	Euphorbiaceae	Tree
42	<i>Bruguiera cylindrica</i>	(L.) Blume	Rhizophoraceae	Small Tree
43	<i>Cadaba fruticosa</i>	Druce	Capparaceae	Straggling shrub
44	<i>Caesalpinia bonduc</i>	(L.) Roxb.	Caesalpiniaceae	Straggling shrub
45	<i>Calotropis gigantea</i>	(L.) W. T. Aiton	Asclepiadaceae	Shrub
46	<i>Cannabis sativa</i>	L.	Cannabidaceae	Herb
47	<i>Canavelia gladiata</i>	(Jacq.) DC.	Fabaceae	Climbing
48	<i>Canna indica</i>	L.	Cannaceae	Herb
49	<i>Cansjera rheedei</i>	Blanco	Olacaceae	Shrub
50	<i>Capparis sepiaria</i>	L.	Capparaceae	Str. shrub
51	<i>Capparis zeylanica</i>	Wt. & Arn.	Capparaceae	Climbing
52	<i>Carica papaya</i>	L.	Caricaceae	Tree
53	<i>Carrissa carandus</i>	L.	Apocynaceae	Str. shrub
54	<i>Caryota urens</i>	L.	Arecaceae	Tree
55	<i>Cassia fistula</i>	L.	Caesalpiniaceae	Tree
56	<i>Cassytha filiformis</i>	L.	Lauraceae	Climbing parasite
57	<i>Casuarina equisetifolia</i>	L.	Casuarinaceae	Tree
58	<i>Ceiba pentandra</i>	(L.) Gaertn.	Bombaceae	Tree
59	<i>Celastrus paniculata</i>	Willd.	Celastraceae	Climbing
60	<i>Celosia argentea</i>	L.	Amaranthaceae	Herb
61	<i>Cerbera manghas</i>	L.	Apocynaceae	Tree
62	<i>Ceriops tagel</i>	(Per.) C. E. RObin	Rhizophoracerae	Tree
63	<i>Chloris barbata</i>	Sw.	Poaceae	Herb
64	<i>Cicca acida</i>	(L.) Merr.	Euphorbiaceae	Tree

Sr.	Botanical name		Family	Habit
65	<i>Cinnamomum tamala</i>	(Buch.- Ham.)Nees & C. H. Eberm.	Lauraceae	Tree
66	<i>Cissampelos pereira</i>	L.	Menispermaceae	Climbing
67	<i>Cissus quadrangularis</i>	L.	Ampellidaceae	Climbing
68	<i>Cistanche tubulosa</i> (Schenk.) Hook.f. sub sp. <i>palustris</i> (Sub sp. nov.)		<b>Orobanchaceae</b>	<b>Holoparasite</b>
69	<i>Citrus sp.</i>	-	Rutaceae	Tree
70	<i>Cleome rutidosperma</i>	DC.	Cleomaceae	Herb
71	<i>Cleome viscosa</i>	L.	Cleomaceae	Herb
72	<b><i>Volkamaria inermis</i></b>	<b>L.</b>	<b>Verbenaceae</b>	<b>Shrub</b>
73	<i>Clitoria ternatea</i>	L.	Fabaceae	Climbing
74	<i>Coccinia grandis</i>	(L.) Voight	Cucurbitaceae	Climbing
75	<i>Cocculus hirsutus</i>	(L.) Diels.	Menispermaceae	Climbing
76	<i>Cocos nucifera</i>	L.	Arecaceae	Tree
77	<i>Colocasia esculenta</i>	(L.) Schott.	Araceae	Herb
78	<i>Combretum indicum</i>	(L.) DeFilipps	Combretaceae	Climbing
79	<i>Commelina sp.</i>	-	Commelinaceae	Herb
80	<i>Corchorus sp.</i>	-	Tiliaceae	Shrub
81	<i>Cordia dichotoma</i>	G. Forst.	Ehretiaceae	Tree
82	<b><i>Cressa cretica</i></b>	<b>L.</b>	<b>Boraginaceae</b>	<b>Herb</b>
83	<b><i>Crinum sp.</i></b>	<b>-</b>	<b>Amaryllidaceae</b>	<b>Herb</b>
84	<i>Crossandra undulifolia</i>	Salisb.	Acanthaceae	Herb
85	<i>Crotalaria sp.</i>	-	Fabaceae	Herb
86	<b><i>Cuscuta reflexa</i></b>	<b>Roxb.</b>	<b>Cuscutaceae</b>	<b>Parasite</b>
87	<i>Cymbopogon citratus</i>	Stapf.	Poaceae	Herb
88	<i>Cynodon dactylon</i>	(L.) Pers.	Poaceae	Herb
89	<i>Datura metel</i>	L.	Solanaceae	Shrub
90	<i>Delonix regia</i>	(Bojer.) Raf.	Caesalpiniaceae	Tree
91	<b><i>Derris scandens</i></b>	<b>Benth.</b>	<b>Fabaceae</b>	<b>Climbing</b>
92	<b><i>Derris trifoliata</i></b>	<b>Lour.</b>	<b>Fabaceae</b>	<b>Climbing</b>
93	<i>Desmodium sp.</i>	-	Fabaceae	Herb
94	<i>Dioscorea bulbifera</i>	L.	Dioscoreaceae	Climbing
95	<i>Dicliptera sp.</i>	-	Acanthaceae	Acanthaceae
96	<b><i>Dilivaria ilicifolia</i></b>	<b>(L.) Pers.</b>	<b>Acanthaceae</b>	<b>Shrub</b>
97	<i>Diplocyclos sp.</i>	-	Cucurbitaceae	Climbing
98	<i>Eclipta prostrata</i>	(L.)L.	Asteraceae	Herb



<b>Sr.</b>	<b>Botanical name</b>		<b>Family</b>	<b>Habit</b>
99	<i>Enteromorpha sp.</i>	-	Algae	-
100	<i>Eragrostis tenella</i>	Nees.	Poaceae	Herb
101	<i>Eranthemum roseum</i>	R.Br.	Acanthaceae	Shrub
102	<i>Erythrina variegata</i>	L.	Fabaceae	Tree
103	<i>Eugenia jambos</i>	L.	Myrtaceae	Tree
104	<i>Eupatorium sp.</i>	-	Asteraceae	Shrub
105	<i>Euphorbia antiquorum</i>	L.	Euphorbiaceae	Shrub
106	<i>Euphorbia heterophylla</i>	L.	Euphorbiaceae	Herb
107	<i>Euphorbia hirta</i>	L.	Euphorbiaceae	Herb
108	<b><i>Excocaria agalocha</i></b>	<b>L.</b>	<b>Euphorbiaceae</b>	<b>Tree</b>
109	<i>Ficus sp.</i>	-	Moraceae	Tree
110	<i>Ficus benghalensis</i>	L.	Moraceae	Tree
111	<i>Ficus hispida</i>	L.f.	Moraceae	Tree
112	<i>Ficus racemosa</i>	L.	Moraceae	Tree
113	<i>Ficus religiosa</i>	L.	Moraceae	Tree
114	<i>Fleureya interrupta</i>	L.	Euphorbiaceae	Herb
115	<i>Fluggea leucopyros</i>	L.	Euphorbiaceae	Shrub
116	<i>Garcinia indica</i>	(Thouars.)Choisy.	Clusiaceae	Tree
117	<i>Gardenia jasminoides</i>	Retz.	Rubiaceae	Tree
118	<i>Glericidia sepium</i>		Fabaceae	Tree
119	<i>Grangia maderaspatana</i>		Asteraceae	Herb
120	<i>Greviella robusta</i>		Proteaceae	Tree
121	<i>Grewia tiliifolia</i>		Tiliaceae	Tree
122	<i>Haplanthus tentaculatus</i>	(L.)Nees.	Acanthaceae	Herb
123	<i>Helicteres isora</i>	L.	Sterculiaceae	Shrub
124	<i>Heliotropium indicum</i>	L.	Boraginaceae	Herb
125	<i>Hemidesmus indicus</i>	R.Br.	Periplocaceae	Stragglng
126	<i>Hibiscus rosa-sinensis</i>	L.	Malvaceae	Shrub
127	<i>Hibiscus tiliaceus</i>	L.	Malvaceae	Tree
128	<i>Holoptelis integrifolia</i>	L.	Ulmaceae	Tree
129	<i>Hygrophylla serpyllum</i>	L.	Acanthaceae	Herb
130	<i>Hyptis suaveolens</i>	Roxb.	Lamiaceae	Shrub
131	<i>Indigofera sp.</i>	-	Fabaceae	Herb
132	<i>Ipomoea aquatica</i>	Forssk.	Convolvulaceae	Herb
133	<b><i>Ipomoea biloba</i></b>	<b>Forssk.</b>	<b>Convolvulaceae</b>	<b>Herb</b>

Sr.	Botanical name		Family	Habit
134	<i>Ipomea carnea</i>	Jacq.	Convolvulaceae	Shrub
135	<i>Ipomoea littoralis</i>	Blume.	Convolvulaceae	Herb
136	<i>Ipomoea palmata</i>	Forssk.	Convolvulaceae	Climbing
137	<i>Ipomoea rubrocaerulea</i>		Convolvulaceae	Climbing
138	<i>Ipomoea tuba</i>	G.Don.	Convolvulaceae	Climbing
139	<i>Ixora coccinia</i>	L.	Rubiaceae	Shrub
140	<i>Ixora pavetta</i>	Benth.	Rubiaceae	Shrub
141	<i>Kirganelia reticulata</i>	L.	Euphorbiaceae	Shrub
142	<i>Lannea coromandelica</i>	DC.	Anacardiaceae	Tree
143	<i>Lantana camara</i>	L.	Verbenaceae	Shrub
144	<i>Lawsonia intermis</i>		Lythraceae	Shrub
145	<i>Lemna sp.</i>	-	Lemnaceae	Herb
146	<i>Leoneorus sp.</i>	-	Lamiaceae	Shrub
147	<i>Leucaena leucocephala</i>	L.	Mimosaceae	Tree
148	<i>Limnanthemum sp.</i>	-	Scrophulariaceae	Herb
149	<i>Lindernia ciliata</i>	(Colsm.)Pennell.	Scrophulariaceae	Herb
150	<i>Lippia nodiflora</i>	(L.)Michx.	Verbenaceae	Herb
151	<i>Loranthus sp.</i>	-	Loranthaceae	Parasite
152	<i>Ludwigia sp.</i>	-	Onagraceae	Herb
153	<i>Luffa acutangula</i>	L.	Cucurbitaceae	Climbing
154	<i>Lumnitzera racemosa</i>	Willd.	Combretaceae	Shrub
155	<i>Madhuca indica</i>	J.F.Gmel.	Sapotaceae	Tree
156	<i>Malachra capitata</i>	L.	Malvaceae	Herb
157	<i>Mallotus phillippinensis</i>		Euphorbiaceae	Tree
158	<i>Mangifera indica</i>	L.	Anacardiaceae	Tree
159	<i>Manilkara hexandra</i>	Dubard.	Sapotaceae	Tree
160	<i>Manilkara sapota</i>	L.	Sapotaceae	Tree
161	<i>Marselia sp.</i>	-	Marseliaceae	Herb
162	<i>Melochia corchorifolia</i>	L.	Sterculiaceae	Herb
163	<i>Merremia vitifolia</i>	Willd.	Convolvulaceae	Climbing
164	<i>Mimusops elengi</i>	L.	Sapotaceae	Tree
165	<i>Mirabilis jalapa</i>	L.	Nyctaginaceae	Herb
166	<i>Mollugo pentaphylla</i>	L.	Molluginaceae	Herb
167	<i>Morinda pubescens</i>	Sm.	Rubiaceae	Tree
168	<i>Moringa oleifera</i>	Lam.	Moringaceae	Tree

Sr.	Botanical name		Family	Habit
169	<i>Mucuna pruriens</i>	(L.)DC.	Fabaceae	Climbing
170	<i>Muntingia calabura</i>	L.	Muntingiaceae	Tree
171	<i>Murraya koenigii</i>	(L.)Spreng.	Rutaceae	Tree
172	<i>Neolamarkia cadamba</i>	(Roxb.) Bosser	Rubiaceae	Tree
173	<i>Nerium indicum</i>	Mill.	Apocynaceae	Tree
174	<i>Neuracanthus sphaerastachys</i>	Nees	Acanthaceae	Herb
175	<i>Nyctanthes arbortristis</i>	L.	Nyctaginaceae	Tree
176	<i>Ocimum basillicum</i>	L.	Lamiaceae	Herb
177	<i>Oldenlandia sp.</i>	-	Rubiaceae	Herb
178	<i>Operculina turpethum</i>	(L.)Silva Manso	Convolvulaceae	Climbing
179	<i>Opuntia sp.</i>	-	Cactaceae	Shrub
180	<i>Oxalis corniculata</i>	L.	Oxalidaceae	Herb
181	<i>Pedilanthus tithymeloides</i>	L.	Euphorbiaceae	Herb
182	<i>Peltophorum pterocarpum</i>	(DC.) K. Heyne	Caesalpiniaceae	Tree
183	<i>Pentas carnea</i>	Benth.	Rubiaceae	Herb
184	<i>Pentatropis capensis</i>	(L.f.)Bullock.	Asclepiadaceae	Climbing
185	<i>Peristrophe bicalyculata</i>	Nees.	Acanthaceae	Herb
186	<i>Phoenix sp.</i>	-	Arecaceae	Tree
187	<i>Phyllanthus emblica</i>	L.	Phyllanthaceae	Tree
188	<i>Physalis minima</i>	L.	Solanaceae	Herb
189	<i>Porteresia coarctata</i>	(Roxb.)Tateoka.	Poaceae	Herb
190	<i>Pithecelobium dulce</i>	(Roxb.) Benth.	Mimosaceae	Tree
191	<i>Plumaria acutifolia</i>	Poir	Apocynaceae	Tree
192	<i>Polygonum glabrum</i>	Willd.	Polygonaceae	Herb
193	<i>Pongamia pinnata</i>	(L.)Pierre.	Fabaceae	Tree
194	<i>Portulaca oleracea</i>	L.	Portulacaceae	Herb
195	<i>Premna integrifolia</i>	L.	Verbenaceae	Tree
196	<i>Prosopis juliflora</i>	DC.	Mimosaceae	Tree
197	<i>Psidium guajava</i>	L.	Myrtaceae	Tree
198	<i>Pteris vittata</i>	L.	Pteridaceae	Herb
199	<i>Pueraria tuberosa</i>	(Roxb. Ex Willd.) DC.	Fabaceae	Climbing
200	<i>Rhizophora apiculata</i>	Blume	Rhizophoraceae	Tree
201	<i>Rhizophora mucronata</i>	Poir.	Rhizophoraceae	Tree
202	<i>Ricinus communis</i>	L.	Euphorbiaceae	Shrub

Sr.	Botanical name		Family	Habit
203	<i>Rivina humilis</i>	L.	Phytolaccaceae	Herb
204	<i>Rungia pectinata</i>	Nees.	Acanthaceae	Herb
205	<b><i>Salvadora persica</i></b>	<b>L.</b>	<b>Salvadoraceae</b>	<b>Tree</b>
206	<i>Samanea saman</i>	(Jacq.) Merr.	Mimosaceae	Tree
207	<i>Sapindus emarginatus</i>	Vahl	Sapindaceae	Tree
208	<b><i>Scaevola taccada</i></b>	<b>(Gaert.) Roxb.</b>	<b>Goodeniaceae</b>	<b>Shrub</b>
209	<i>Scoparia dulcis</i>	L.	Scrophulariaceae	Herb
210	<i>Senna tora</i>	(L.)Roxb.	Caesalpiniaceae	Shrub
211	<i>Sesamum laciniatum</i>	Klein ex Willd.	Pedaliaceae	Herb
212	<b><i>Sesuvium portulacastrum</i></b>	<b>(L.) L.</b>	<b>Chenopodiaceae</b>	<b>Herb</b>
213	<i>Bryonia laciniosa</i>	L.	Cucurbitaceae	Climbing
214	<i>Sida acuta</i>	Burm.f.	Malvaceae	Herb
215	<i>Sida rhomboidea</i>	Roxb.	Malvaceae	Herb
216	<i>Solanum nigrum</i>	L	Solanaceae	Herb
217	<i>Solanum pseudocapsicum</i>	L.	Solanaceae	Shrub
218	<b><i>Sonneratia apetala</i></b>	<b>Buch. – Ham.</b>	<b>Sonneratiaceae</b>	<b>Tree</b>
219	<b><i>Sonneratia alba</i></b>	<b>J.Sm.</b>	<b>Sonneratiaceae</b>	<b>Tree</b>
220	<i>Sorghum halepense</i>	(L.) Pers.	Poaceae	Herb
221	<i>Sphaeranthus indicus</i>	L.	Asteraceae	Herb
222	<i>Spilanthes calva</i>	DC.	Asteraceae	Herb
223	<i>Spondias pinnata</i>	(L.f.) Kurz.	Anacardiaceae	Tree
224	<i>Sterculia foetida</i>	L.	Sterculiaceae	Tree
225	<i>Sterculia urens</i>	Roxb.	Sterculiaceae	Tree
226	<i>Streblus asper</i>	Lour.	Euphorbiaceae	Tree
227	<b><i>Suaeda fruticosa</i></b>	<b>Hook. &amp; Arn</b>	<b>Chenopodiaceae</b>	<b>Chenopodiaceae</b>
228	<i>Synedrella nodiflora</i>	(L.) Gaertn.	Asteraceae	Herb
229	<i>Syzygium cumini</i>	(L.) Skeels.	Myrtaceae	Tree
230	<i>Tagetes erecta</i>	L.	Asteraceae	Herb
231	<i>Tamarindus indicus</i>	L.	Caesalpiniaceae	Tree
232	<b><i>Tamarix aphylla</i></b>	<b>(L.) Karsten</b>	<b>Tamaricaceae</b>	<b>Tree</b>
233	<i>Tectona grandis</i>	L.f.	Verbenaceae	Tree
234	<i>Tephrosia purpurea</i>	(L.) Pers.	Fabaceae	Herb
235	<i>Teramnus labialis</i>	(L.f.) Spreng.	Fabaceae	Climbing
236	<i>Terminalia arjuna</i>	(Roxb. ex DC.) Wight & Arn.	Combretaceae	Tree

Sr.	Botanical name		Family	Habit
237	<i>Thespesia populnea</i>	(L.) Solan.	Malvaceae	Tree
238	<i>Thespesia populneoides</i>	(Roxb.) Kostel	Malvaceae	Tree
239	<i>Thevetia peruviana</i>	Merr.	Apocynaceae	Tree
240	<i>Thunbergia grandiflora</i>	Roxb.	Meynanthaceae	Climbing
241	<i>Tinospora cordifolia</i>	Miers.	Menispermaceae	Climbing
242	<i>Trema orientalis</i>	(L.) Bluma	Cannabaceae	Tree
243	<i>Tridax procumbens</i>	L.	Asteraceae	Herb
244	<i>Triumfetta rhomboidea</i>	Jacq.	Tiliaceae	Herb
245	<i>Turnera ulmifolia</i>	L.	Turnaceae	Herb
246	<i>Typha sp</i>	-	Typhaceae	Herb
247	<i>Ulva sp.</i>	-	Algae	-
248	<i>Urena sinuate</i>	L.	Malvaceae	Shrub
249	<i>Urticularia sp.</i>	-	Lentibularaceae	Herb
250	<i>Vernonia cinerea</i>	Less.	Asteraceae	Herb
251	<i>Vernonia eleagnifolia</i>	L	Asteraceae	Climbing
252	<i>Viscum album</i>	L.	Viscaceae	Parasite
253	<i>Vitex trifolia</i>	L.	Verbenaceae	Tree
254	<i>Vitis trifolia</i>	L.	Ampelidaceae	Climbing
255	<i>Waltheria indica</i>	L.	Tiliaceae	Herb
256	<i>Wattakaka volubilis</i>	(L.f.) Stapf.	Asclepiadaceae	Climbing
257	<i>Woodfordia floribunda</i>	Salisb.	Lythraceae	Shrub
258	<i>Xanthium strumarium</i>	L.	Asteraceae	Herb
259	<i>Zizyphus mauritiana</i>	Lam.	Rhamnaceae	Tree
260	<i>Zizyphus rugosa</i>	Lam.	Rhamnaceae	Straggling

**Color Code:**

**Red : Mangrove species**

**Blue : Mangrove Associates**

**Green : New Taxa**

**Artificial Key to Mangrove species found in Mumbai:**

- 1. Leaves with spiny margin .....*Dilivaria ilicifolia*
- 1. Leaves without spiny margin.....2
  - 2. Leaves stipulate.....3
    - 3. Flowers single or in the inflorescence... ..4
      - 4. Presence of knee shaped above ground roots, .....*Brugueira cylindrica*
      - 4. Presence of cylindrical stilt roots given out from branches.....5
        - 5. Leaf apex mucronate .....6
          - 6. Inflorescence within the leaf, petals with hair.....*Rhizophora mucronata*
          - 6. Inflorescence below the leaf, petals without hair..... *Rhizophora apiculata*
        - 5. Leaf apex obtuse.....*Ceriops tagel*
- 2. Leaves exstipulate.....6
  - 7. Flowers with inferior ovary, leaves very thick.....*Lumnitzera racemosa*
  - 7. Flowers with superior ovary, Leaves thick but not as much as *Lumnitzera*.....8
    - 8. Fruit curved , horn shaped; flowers in cluster.....*Aegiceras corniculatum*
    - 8. Fruit not curved; flowers either single or on elongated inflorescence axis.....9
      - 9. Pneumatophore pencil shaped, Leaves with white or yellowish hair .....10
        - 10. Leaf apex roundish; stamens slightly exerting from corolla .....*Avicennia officinalis*
        - 10. Leaf apex acute – acuminate, corolla within the corolla.....11
          - 11. Leaf apex acute, Trees tall.....*Avicennia marina*
          - 11. Leaf apex acute – acuminate; Trees tall, medium sized or dwarf.....12
            - 12. Tall or medium sized tree.....*A. marina var. acuminata*
            - 12. Dwarf tree.....*A. marina var. acuminata forma pumila*
  - 9. Pneumatophore peg like, Leaves without white or yellowish tomentum.....13
    - 13. Branches drooping, leaves oblong.....*Sonneratia apetala*
    - 13. Branches not drooping, leaves ovate.....*Sonneratia alba*

## Artificial Key to Mangrove associates found in Mumbai:

1. A parasite.....2
  2. Plant annual, total root parasite, flowers yellow.....*Cistanche tubulosa* ssp. *palustris*
2. Plant climbing parasite.....3
  3. Plant chlorophyllous, green, leafless, aromatic.....*Cassytha filiformis*
  3. Plant achlorophyllous, yellow, non aromatic.....*Cuscuta reflexa*
1. Plant non parasite.....4
  4. Monocotyledonous plant, Leaf with parallel venation.....5
    5. A grass or sedge, leaves linear, flowers minute.....6
      6. Stem roundish.....6a
        - 6a. Leaf margin not spinulose..... *Aleuropus lagopoides*
        - 6a. Leaf margin spinulose.....*Porteresia coarctata*
      - 6.. Stem triangular.....*Cyperus* sp.
    5. Leaves rosette, strap shaped; flowers large, showy white.....*Crinum* sp.
  4. Dicotyledonous plant, leaf with reticulate venation.....7
    7. Plant herb, shrub or tree.....8
      8. Plant herb .....9
        9. Tall erect herb, Nodes spiny.....*Hygrophylla schullii*
      9. Small herb.....10
        10. Leaves not succulent, plant erect.....*Cressa cretica*
        10. Leaves succulent, plant prostrate.....11
          11. Leaves prominently bilobed, flowers large.....*Ipomoea biloba*
          11. Leaves not bilobed, flowers small.....12
            12. Leaves dull green, flowers polygamous.....*Suaeda fruticosa*
            12. leaved shiney green, flowers bisexual.....*Sesuvium portulacastrum*
      8. Plant shrub or tree.....13
        13. Leaves stipulate.....14

14. Flowers unisexual.....	<i>Excoecaria agallocha</i>
14. Flowers bisexual, plant a tree .....	15
15. Flowers drooping , fruits dehiscent.....	<i>Thespesia populneoides</i>
15. Flowers not drooping, fruits indehiscent.....	<i>Thespesia populneoides</i>
13. Leaves exstipulate.....	16
16. Flowers actinomorphic.....	17
17. Tree, flower axillary, solitary.....	<i>Alangium salvifolium</i>
17. Mostly straggling, flowers on prominent inflorescence.....	<i>Salvadora persica</i>
16. Flowers zygomorphic.....	18
18. Leaves trifoliolate.....	<i>Vitex trifolia</i>
18. Leaves simple.....	19
19. Flowers in paniculate cyme.....	<i>Premna integrifolia</i>
19. Flowers solitary or in simple cyme.....	<i>Volkameria inerme</i>
8. Plant a climber.....	20
20. Leaves simple.....	21
21. Flowers with gynoeophore.....	22
22. Plant with thorn.....	23
23. Flowers pink, large.....	<i>Capparis zeylanica</i>
23. Flowers dull white, small.....	<i>Capparis sepiaria</i>
22. Plants without thorn.....	<i>Cadaba fruticosa</i>
21. Flowers without gynophores.....	24
24. Plant with latex, leaves opposite, .....	25
25. Fruits with soft thorny projections.....	<i>Pergularia daemia</i>
25. Fruits without any thorny projections.....	26
26. Flowers greenish yellow in many flowered umbel, leaves larger, non succulent, Fruits woody.....	<i>Watakakka volubilis</i>
26. Flowers cream yellow, inflorescence few flowered, leaves smaller, fleshy,	



fruits non woody.....	<i>Pentatropis capensis</i>
24. Plant without latex.....	27
27. Stem mostly quadrangular, calyx persistent, cover the fruits.....	<i>Operculina turpethum</i>
27. Stem not quadrangular, calyx not persistent.....	28
28. Stem with prominent lenticels, ripe fruits red.....	<i>Tinospora cordifolia</i>
28. Lenticels not so prominent on stem, flowers conspicuous.....	29
29. Corolla tube long, white.....	<i>Ipomoea tuba</i>
29. Corolla tube short, other than white.....	<i>Ipomoea littoralis</i>
20. Leaves pinnately compound.....	30
30. Pods covered with bristles.....	31
31. Inflorescence drooping, flowers dark purple colored.....	<i>Mucuna pruriens</i>
31. Inflorescence erect, flowers light bluish .....	<i>Pureria tuberosa</i>
30. Pods not covered with bristles.....	32
32. Leaves sweetish to taste, seeds red with black eye.....	<i>Abrus precatorius</i>
32. Leaves not sweetish to taste, seeds other than red.....	33
33. Legume elongated.....	<i>Derris scandens</i>
33. Legume broad, ovate.....	<i>Derris trifoliata</i>

## Discussion on the identity of some of the mangroves and mangrove associates from Mumbai:

### Identity of *Avicennia* in Mumbai & discovery of one new taxa:

As per earlier record, there are **four species of *Avicennia***, (namely *A. alba*, *A. marina*, *A. marina* var. *acutissima* & *A. officinalis*) **found along Mumbai coast**. There are many views (of different taxonomists) regarding the identification of *Avicennia* sp. **For the purpose of the current project, I have followed the treatment opted by N. C. Duke (1991).**

The **differentiating characters** among these three species of *Avicennia* are:

- **The leaf shape:** Lanceolate – ovate in *A. alba*, Ovate – elliptic- lanceolate in *A. marina*, Ovate – lanceolate – elliptic in *A. marina* var. *acutissima*
- **The leaf apex** is acute in *A. marina*, acute-acuminate in *A. alba* & *A. marina* var. *acutissima* and rotund in *A. officinalis*
- **Inflorescence** capitate in *A. marina*, *A. marina* var. *acutissima* and *A. officinalis* whereas it is spicate in *A. alba*.
- **Fruit** compressed, oval in *A. marina*, ellipsoid elongated in *A. alba* and compressed, elongate, ellipsoid in *A. officinalis*.

The most commonly found *Avicennia* in Mumbai has ovate – lanceolate leaves with acute as well as acuminate leaf apex. The fruit is beaked, slightly elongated. **The old stem has presence of resinous secretion** . and it is **greenish** when dampened with sea water. **This species is identified as *A. marina* var. *acutissima***

- *Commonly found Avicennia marina* var. *acutissima* is mixed with *A. marina*
- ***Avicennia alba* is not reported from Mumbai** and its surroundings
- *Avicennia officinalis* is found more towards Bhayender, Vasai, Naigaon, Diva- Mumbra area.

**Another common strands of *Avicennia* found towards the sea which is commonly known as dwarf *Avicennia*.** As per ICN every plant must have one and only one name. However, ‘dwarf *Avicennia*’ is not a botanical name. Hence, we chose to study this plant in detail and decide its correct botanical identity. This dwarf variety closely resembles *A. marina* var. *acutissima*.

**The distinguishing characters of this dwarf *Avicennia* are:**

1. Plants **dwarf tree**. Branched. Bark **grey colored** (the bark in *A. marina* var. *acutissima* is greenish when wet)
2. Pneumatophores cylindrical, upto 30 cm in height (above ground)

3. Leaves opposite, petiole 0.3 cm, **ovate – elliptic, length : breadth ratio 2:1, apex shortly acute – slightly acuminate, base attenuate** as against elliptic leaf with acute – acuminate apex & length : breadth ratio 3:2 – 2:1 in *A. marina* var. *acutissima*;
4. **2<sup>nd</sup> and 3<sup>rd</sup> lateral veins arranged alternately** as against opposite in *A. marina* var. *acutissima*.
5. Inflorescence **condensed capitate**. About **7 flowers per inflorescence** as against 11 flowers in *A. marina* var *acutissima*. The **lateral peduncle compressed** as against that of *A. marina* var. *acutissima* where it is elongated.
6. Calyx, corolla hairy outside and glabrous inside. Corolla yellow initially, turning orangish at maturity. Sweetly scented.
7. Ovary conical, hairy at the middle. Stigma 2 lobed.
8. The anatomical structure of the dwarf *Avicinnia* resembles that of *A. marina* var. *acutissima* in its structure of salt gland and inverted T shaped hair.



***Avicennia marina* (Forsk.) Vierh. var. *acutissima* Stapf ex  
Moldenke forma *pumila* (forma nov.)**

**The key to identify the *Avicinnia marina* from its variety and forma is as follows:**

1. Leaf apex acute, Trees tall..... *Avicennia marina*
1. Leaf apex acute – acuminate; Trees tall, medium sized or dwarf.....2
  2. Tall or medium sized tree, 2<sup>nd</sup> & 3<sup>rd</sup> lateral veins opposite to each other  
.....*A. marina* var. *acuminata*
  2. Dwarf tree; 2<sup>nd</sup> & 3<sup>rd</sup> lateral veins alternate ..... *A. marina* var. *acuminata* forma  
*pumila*



*Avicennia marina* (Forssk.) Vierh. var. *acutissima* Staph. & Moldenke forma *pumila* (forma nov.)  
Characteristic features & Holotype

A – Arrangement of lateral veins, B- Inflorescence, C- L. S. of flower, D- position of anther,  
E – Hairytness of calyx & Bract, F- Carpel, G- Fresh & Dry flower, H- Hair on ovary

We identify this dwarf *Avicinnia* as *Avicennia marina* (Forssk.) Vierh. var. *acutissima* Staph. & *Moldenke forma pumila* (forma nov.), Family: Avicenniaceae. **Holotype: SD/FS 002**, collected from Tarzan Lake, Charkop, Kandivli (W.), Mumbai, Maharashtra, India and deposited at Blatter Herbarium (BLAT). The isotypes are deposited at the herbarium of R. D. & S. H. National College (RDNCP) .

**Phenology:** Flowering begins from Mid April and extends up to end of may to beginning of June (varies in different locations); fruiting begins from July and extents up to September.

**Etymology:** the forma ‘*pumila*’ (meaning dwarf) is named after the habit of the plant.

**Identity of *Acanthus ilicifolius* L. (Acanthaceae) found in Mumbai:**

The genus *Acanthus* is described by C. Linnaeus in his *Genera Plantarum* in 1754. In his *Species Plantarum* (1753) Linnaeus named 4 species, two of them belonging to Europe while the other two, namely *Acanthus ilicifolius* and *A. maderaspatensis* are from India.

Jussieu (*Genera Plantarum*, 1789) named the genus *Dilivaria* (But, he did not definitely make any new species, such as, *D. ilicifolia* in this publication. Thus *D. ilicifolius* (L.) Juss is invalid and illegitimate name, though this name has been used by various taxonomists).

Later on, in 1806 Persoon describes *D. ilicifolia* under the genus *Dilivaria* thereby definitely including this species under *Dilivaria*. Thus, the accepted name of this species is ***D. ilicifolia* (L.) Persoon**

**Synopsis Plantarum 2. 1806**

*Acanthus ilicifolius* L. is characterised by the presence of terminal inflorescence. The plants collected by us from Mumbai shows terminal as well as axillary inflorescence.

Molecular treatment of new world and old world plant reveals that *Acanthus* and *Dilivaria* are two different group. Taxonomists have treated the mangrove genus from India under the genus *Dilivaria* Juss.

According to our observation, the commonly known *Acanthus ilicifolius* L. from Bombay coast should be **corrected as *D. ilicifolia* (L.) Persoon (Basionym- *A. ilicifolius* L.)** Type : *Acanthus ilicifolius* L. (LINN 816.6) deposited at Linnaean herbarium.

### **Identity of *Clerodendrum inerme* L.**

A very common mangrove associate *Clerodendron inerme* L. found in almost all locations in our study area. In one of our trips we came across a specimen which shows very thick leaf with axillary flower (which is not a very common occurrence). In the same plant we observe axillary cyme inflorescence. This observation made me inquisitive about the identity of this plant.

Upon literature survey, we came across the genus *Volkameria*. **The differentiating characters of these two plants are :**

1. Terminal inflorescence in *Clerodendrum* vs. axillary and terminal inflorescence in *Volkameria*
2. Persistent, green Calyx cup at the base of the ovary/ Fruit in *Volkameria* vs. Expanded colourful calyx in *Clerodendrum*
3. Green fruit turning brownish in *Volkameria* vs Bright colored fruits in *Clerodendrum*.

The identity of the plant in question is **corrected as *Volkameria inermis***.

**Record of *Lumnitzera racemosa*** from Gorai and Charkop – a rare mangrove species in Mumbai. However, this species is commonly found in Ratnagiri and Sindhudurg district, Maharashtra. This species was reported from Thane coast (Untawale 1994).

**New record for the state of Maharashtra** : *Thespesia populneoides* is reported as new record for the state of Maharashtra from Dahisar (Bhakti complex). It is noted that this species is common in other locations such as Gorai, Charkop, In Vikhroli (Godrej campus), it is planted along with *Thespesia populnea*.

**Identity of *Cistanche tubulosa* (Schenk.) Hook.f.**: *Cistanche tubulosa* (Schenk.) Hook f. is a holoparasite plant growing in desert area. It connects to the root of the host plant (*Salvadora persica*, *Tamarix gallica*, etc.). Its associated flora: *Salvadora persica*, *Avicennia marina* var. *acutissima*, *Avicennia officinalis*, *Asparagus* sp., *Odina wodifer*, *Tinopsis cordifolia*, *Brugeria* sp., *Thespesia populnea*, *Cadabba fruticosa*...etc, growing on saline marshy soil. It can tolerate saline habitat. In Mumbai it is found in Gorai Creek, Borivli (W.) and Charkop .

**The distinguishing characters of this plant are** : The flowers show dominance of **bilobed, trilobed and tetra-lobed condition, 5-lobed condition is occasionally observed**. A single plant can show 2-3 types of stigmas. **Anthers are non-apiculate obtuse and completely attached to the connective** as compared to the typical subspecies ‘tubulosa’ which shows cordate-sagittate type of anthers. **The species is represented by ca. 800 individuals** growing along either side of the roadway, about 2-3km in stretch. Another population at Charkop , Kandivli shows a distinct increase in corolla tube length, i.e., 4.7 cm. long.

**We establish a new subspecies and named this plant as *Cistanche tubulosa* (Schenk.) Hook. f. sub sp. *palustris* (sub species nov.)**

**Phenology:** Flowering begins from December to February and extends up to March and April; fruiting begins from January and extents up to April.

**Etymology:** the subspecies ‘*palustris*’ is named after the habitat of the plant on which it grows as a parasite (Halophytic habitat)

#### **Key to Subspecies:**

Habitat usually sandy, scales alternate and remotely arranged, anthers cordate- sagittate, obtuse, stigma bilobed and placentae four..... ***C. tubulosa* subsp. *tubulosa***

Habitat saline, scales spiral or whorled closely arranged, anthers obtuse, stigma 1-5 lobed and placenta equaling no. of stigma lobes..... **C. tubulosa subsp. palustris**

**Type: SD/HR/KC 180216, collected from Gorai Creek** (about 1 km from Jetty), Borivli (W.), Mumbai, Maharashtra, India , deposited at Blatter Herbarium (BLAT). The isotypes are deposited at the herbarium of R. D. & S. H. National College (RDNCNCP) .



*Cistanche tubulosa* (Schenk.) Hook. f. sub sp. *palustris* (sub species nov.)- Characteristic feature and Holotype

**Identity of Suaeda:** Earlier botanists have recorded *Suaeda maritima* as well as *S. nodiflora* from the saline habitat under mangrove projects. However, we could not find these two species of *Suaeda* during our study. But, **recorded *Suaeda fruticosa*** from Naigaon, Vasai areas. This species shows **3 stigma, and the bract is entire.**



**Spreading habit of *Suaeda fruticosa* Forssk. Ex Gmel**



**Male stage (A) and Female stage of the flower (B)**

**Identification of three lichen species,** namely, *Graphis* sp., *Lecanora* sp. & *Pyxine* sp. from mangrove habitats in **Sindhudurg district**. However, in **Mumbai we could find *Lecanora* sp. in Charkop and Gorai area only.** It gives an indication of its surroundings. For. Eg. *Lecanora* sp. indicates their tolerance to hot, humid and saline air.

***Rhizophora apiculata*** is only found under cultivation and Godrej campus, Vikhroli.

***Scaveola taccada* and *Cerbera manghas*** are recorded only under cultivation (in Mumbai) and are not included in the key.

**Mangroves documented from Raigad, Ratnagiri and Sindhudurg :**



*Rhizophora apiculata*, *Lumnitzera racemosa*, *Kandelia candel*, *Cerbera manghas*, *Sonneratia caseolaris* besides *Avicennia marina*, *A. officinalis*, *Sonneratia alba*, *S. apetala*, *Bruguiera cylindrica*, *Salvadora persica*, *Agiceros corniculata*, etc. from various location in Sindhudurg. *Heritoria* sp. – ‘Sundri’ (species exists in Kille Nivti area at Dongobache rahi sacred grove) but couldn’t locate

**Distribution of Mangrove species in the Mumbai** (Gorai, Charkop, Bhayender, Marve, Manori, Dahisar, Ghod Bunder, Bandra, Esselworld, Naigaon, Vasai, Panju Island, Virar, Bhandup, Airoli, Vikhroli, Nerul, Elephanta islands (January 2018 - April 2018):

Name	Status in the study area	Locations where sighted
<i>Avicennia marina</i>	Common	All locations
<i>Avicennia marina</i> var. <i>acutissima</i>	Very common	All locations
<i>Avicennia marina</i> var. <i>acutissima</i> forma ... ..	Very common	All locations
<i>Avicennia officinalis</i>	Common wherever present	All locations except Bandra, Lokhandwala, Charkop, Gorai, Vikhroli, Nerul
<i>Dilivaria ilicifolia</i>	Common wherever present	All locations except Bandra, Lokhandwala,
<i>Rhizophora mucronata</i>	Occasional	Bandra, Malad, Elephanta, Versova
<i>Rhizophora apiculata</i>	Rare	Found only in cultication
<i>Sonneratia apetala</i>	Common wherever present	All locations
<i>Sonneratia alba</i>	Common wherever present except in Bandra	Elephanta island, Manori, Bandra (only a few plants)
<i>Ceriops tagel</i>	Common wherever present	All locations except Bandra
<i>Brugueira cylindrica</i>	Common wherever present	All locations except Bandra
<i>Lumnitzera racemosa</i>	Rare	Gorai, Charkop
<i>Agiceras corniculatum</i>	Common wherever present	All locations except Bandra

### Future scope:

- **Detailed survey and systematic study** is required to understand the species diversity in mangrove belt in all the districts of Maharashtra.

- Scientific study to **identify plants as invasive species** and how these invasive species are affecting the mangroves. It is necessary to study in detail to delimit the status of mangrove associate and invasive species.

Here for the purpose of this project, we have treated the plants which are found among mangroves as well as in other habitat as mangrove associate. Scientific approach is required to definitely classify the plants as mangrove associates.

There are different views to classify any plants as invasive species. To determine the status of invasive species, more systematic study is required.

- More study is required to **understand if active speciation is taking place** among mangroves, especially for the species like *Rhizophora*
- Detailed study on **pollinator and pollination biology of mangroves**
- **Survey of Lichens , Fungi and Macro and Micro algae** from Mangrove vegetation in Maharashtra

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### **Acknowledgement:**

I am grateful to Mangrove Foundation for financial support for the documentation of Mangroves and Mangrove Associates from Mumbai. Thanks are due to Dr. K. N. Gandhi, Senior Nomenclature Registrar, Harvard University Herbarium, USA for his help in the nomenclature study, to Dr. Subir Bandopadhyay, Central National Herbarium, Kolkata; Dr. R. D. Shinde, Director Blatter Herbarium and Mr. Pravin Kale, Blatter Herbarium, St. Xaviers' College, Mumbai for their help in Herbarium study to establish the correct identity of mangrove and mangrove associates.

## Appendix

While identifying the plants it was found that one must have a basic understanding of the basic morphology. Many of the mis identifications of the past is due to the incorrect interpretation of the leaf shapes (especially in *Avicennia* sp.). Here we followed the descriptions after William Stern (1983) and have appended the guide to the leaf shape along with the plates of the same

### A guide to the leaf shape (Stern, 1983)

Name	Definition
<b>Acicular</b>	Needle shaped. linear, rigid, tapering to a fine point from a narrow base.
<b>Subulate</b>	Awl shaped. linear, very narrow, tapering to a very fine point from a broadish base.
<b>Auriculate</b>	Ear lobe shaped; having two small rounded lobes at the base.
<b>Cuneiform</b>	Wedge-shaped: inversely triangular, with rounded angles
<b>Deltoid</b>	a solid, the transverse section of which has a triangular outline, like the Greek A
<b>Linear</b>	<i>many times longer than broad, approximately parallel sides.</i> length: breadth = 6 : 1 to 3 : 1
<b>Ensiformis</b>	Sword-shaped -Long, quite straight, with the point acute.
<b>Lanceolate</b>	Lens- shaped - Long, wider in the middle. length : breadth = 6 : 1 to 3 : 1
<b>Ob-lanceolate</b>	Top wider than bottom
<b>Oblong</b>	length: breadth = 2: 1 to 3 : 2, the sides almost parallel
<b>Ovate</b>	Oval (egg shaped) , broadest at the lower end, so as to resemble the longitudinal section of an egg. length: breadth = 2: 1 to 3 : 2, broadest below the middle
<b>Obovate</b>	opposite of ovate
<b>Elliptic</b>	Oval, with a short point, elliptical, acute at each end. length: breadth 2 : 1 to 3:2 with sides curved equally from middle
<b>Rotund</b>	Somewhat round, a little inclining to be oblong. length: breadth = 6 : 5 , broadest at middle

Name	Definition
<b>Cordate</b>	Heart-shaped. having two round lobes at the base . the whole resembling the heart in a pack of cards
<b>Spathulate</b>	Spoon-shaped. oblong, with the lower end very much attenuated,so that the whole resembles a chemist's spatula.
<b>Sagittate</b>	gradually enlarged at the base into two straight lobes, like the head of an arrow.
<b>Hastate</b>	abruptly enlarged at the base into two acute diverging lobes, like the head of a halberd
<b>Rhomboid</b>	Diamond-shaped. oval, a little angular in the middle
<b>Lobed</b>	With several points
<b>Hastate</b>	Spear shaped - Pointed, with barbs
<b>Pinnatisect</b>	Cut, but not to the midrib
<b>Peltate</b>	Rounded, stem underneath
<b>Perfoliate</b>	Stem through the leaves

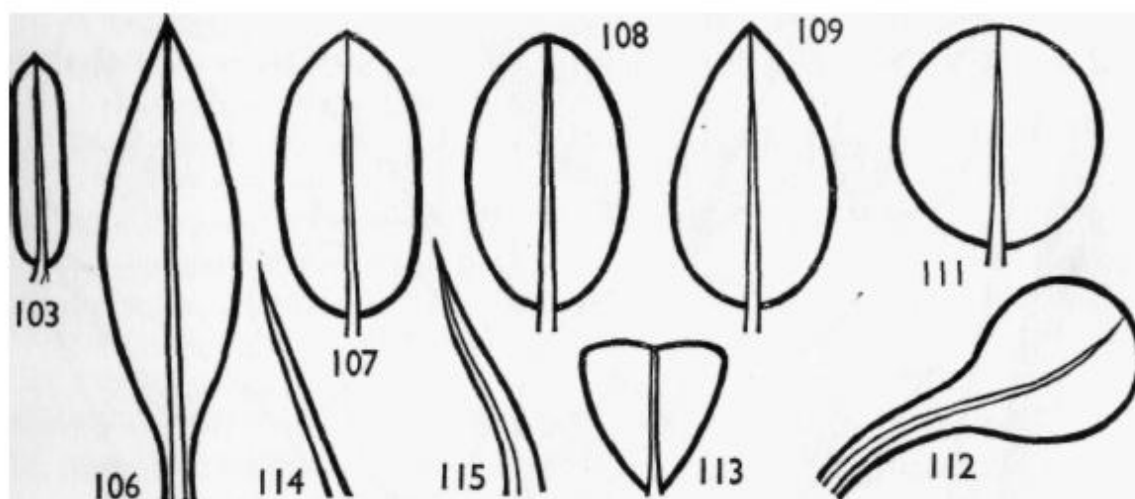


Fig. 21 Outlines of Leaves, etc.  
 103, linearis, sensu Lindleyi (= anguste oblongus); 106, lanceolatus, sensu Lindleyi (= anguste ellipticus); 107, oblongus; 108, ellipticus; 109, ovatus; 111, rotundus; 112, spatulatus; 113, cuneiformis; 114, subulatus; 115, acerosus (after J. Lindley, *Introduction to Botany*; 1832)

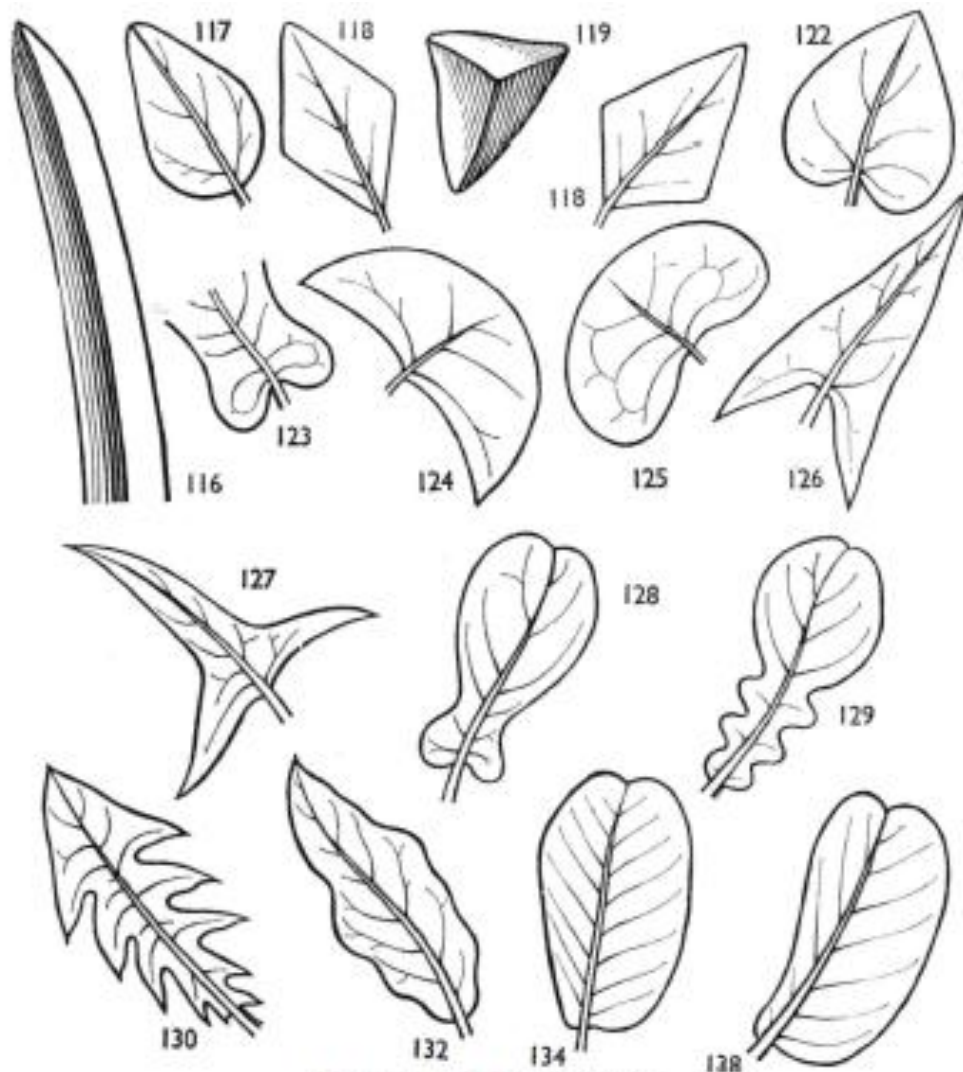


Fig. 22 Outlines of Leaves

116, ensiformis; 117, parabolicus; 118, rhombeus; 119, deltoides; 122 cordiformis; 123, auriculatus; 124, lunatus; 125, reniformis; 126, sagittatus; 127, hastatus; 128, panduratus; 129, lyratus; 130, runcinatus; 132, undulatus; 134, inaequalis; 138, dimidiatus (after J. Lindley, *Introduction to Botany*; 1832)