

Biodiversity, Biocleansing and Anthropogenic Activities on the two Tourist Beaches of Raigad, Maharashtra, India

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ABSTRACT

Sandy beaches play an important role in tourism by their recreational value and maintain ecological balance in coastal environment. They provide nursery ground to floral, faunal diversity and also livelihood to local villagers by tourism. In the present study two rural, tourist beaches of Raigad, Maharashtra, i.e. Revdanda and Kashid, selected for their sand dune flora, fauna and anthropogenic activities study. A field survey is carried out in the month March to September 2021 and 52 sand dune plant species with 5 avifaunal species are recorded from the study sites. The various biocleansing agents and their feeding activities were noted. During survey, different anthropogenic activities are recorded and found that plastic and alcoholic beverages waste is major problem on both beaches. The present study highlights the importance of biocleansing agents regarding recreational values of beaches, and also brings attention towards anthropogenic activities of study sites. The present study recommended that, urgent steps taken against beach pollution and prevents its negative impacts on coastal ecology.

Key words : Sand dune flora, Biocleansing, Anthropogenic activities, Pollution, Beach.

Introduction

Worlds 70% ice free coastlines are composed by sandy beaches, globally used for recreation and tourism industry and also supports various coastal activities of human (McLachlan and Defeo, 2018). The coastal states economics dependent on income generated through beach tourism (McLachlan *et al.*, 2013). In comparison with other marine ecosystems like coral reef, mangroves, swamps, rocky shores; sandy beaches are main centre of recreational attraction (Defeo *et al.*, 2021). Besides of vast ecological and economical importance, many urban, semi urban beaches are facing human disturbances (Harris

et al., 2015; Schlacher *et al.*, 2016). Though, the tourism is good for economic developments, it destroys beach biodiversity (Mahanti and Kumar, 2017).

The Indian coastline is about 7516.6 Km. in length, of which Maharashtra has 720 km. long coastline. The beach and adjacent coastal region of the Maharashtra is known as 'Konkan', which is the part of the 'Western Ghats' one of the world Biodiversity hotspots and UNESCO World Heritage Site (Myers *et al.*, 2000). Raigad (previously 'Kolaba') is the most industrialized coastal district of Konkan region, near one of the biggest cities in the world Mumbai. These two beaches are near to famous tourist and capital city of Raigad district 'Alibaug'.

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Revdanda village has *Koli, Agri* fisherman communities. Revdanda had also some historical importance from the era of 'Chhatrapati Shivaji Maharaj' Empire to recent Jews, Russian and Portuguese history. Revdanda beach (RB) and Kashid Beach (KB) are 16 km away from each other and well connected by road. Kashid beach (KB) is white sand beach nearly 35 Km. away from the Alibaug, district city and is a famous tourist destination. The various water sport activities, white sand, rocky patches, strong waves make both beaches a great recreation point and attracting lots of tourist. The Revdanda and Kashid both beaches shows sand dune floral and faunal diversity which provides good platform for the ecological studies, impacts of anthropogenic activities and climate change impacts. There is very less scientific information available regarding to geomorphology, biodiversity, biocleansing and impacts of anthropogenic activities. the present study highlights the ecological importance, anthropogenic activities and biodiversity of RB and KB for their conservation and sustainable management.

Materials and Methods

Revdanda and Kashid are two sandy beaches situated at 18°33'26.99"N 72°55'15.71"E and 18°27'10.48"N 72°54'03.75"E and has 4350 m. and 3319 m. length respectively. The field survey was carried out in the month March 2021 to September 2021. The major coastal sand dune flora on sandy beach and avifauna of both RB and KB are listed. The feeding habits of common crow and Ghost crab as a biocleansing agent on both beaches are documented in the morning and evening time of day (07-09 AM Morning and 03-06 PM Evening). The major visible anthropogenic activities by the local peoples, restaurants owners, tourists and fishing communities are noted down and photographed.

Results and Discussion

The survey was conducted for two beaches, i.e. RB and KB and flora and avifauna was documented. A total of 52 plant species belonging to 29 families were found during the survey (Table 1). The dominant coastal sand dunes species recorded are *Ipomoea pes-caprae* (L.) R. Br., *Crotalaria verrucosa* L., *Casuarina equisetifolia* Forst., *Pedaliium murex* L., *Sesuvium portulacastrum* (L.) L., *Aeluropus* spp., *Sida cordifolia* L. (Plate 1) etc. The members of family

poaceae, asteraceae, fabaceae and lamiaceae are dominant. The faunal diversity of RB site is more than KB site, i.e. 52 and 21 species respectively. The larger tourist number and direct accessibility in KB site are responsible for decreased number of sand dune flora and avifaunal diversity. In study sites, five avifaunal species (Table 2) were recorded.



Plate 1. Major sand dune flora at KB and RB sites. A. *Ipomoea pes-caprae* (L.) R. Br., B. *Pedaliium murex* L. C. *Sesuvium portulacastrum* (L.) L. D. *Crotalaria verrucosa* L.

In the documented avifauna from RB site (Plate 2), the *Corvus splendens* (common crow) are most commonly seen on the beach. *Bubulcus ibis* (Cattle egret) and *Ardea alba* (great egret) are seen morning time i.e. 06-09 am. The *Alcedinidae* (Kingfisher) seen once at RB site during evening. The *Actitis hypoleucos* (sandpiper) seen at evening time. The flocks of *B. ibis*, *A. alba* and *A. hypoleucos* are making very beautiful scenery at beach in morning and evening time.

The two species of crabs *Ocypode brevicornis* (Ghost crab) and *Uca* (Fiddler crab) are found in RB site. The feeding habitat of ghost crab and fiddler crab are act as natural biocleansing of beach. The *O. brevicornis* and *Uca* are feeding on dead fishes, shrimps and small insects on beach thrown by waves and waste thrown by fishermen. The stray dogs (*Canis lupus familiaris*) and cat also help in biocleansing process seen on RB and KB site by feeding on fishing waste, dead fishes, crabs and domestic household waste thrown by locals. During the survey of RB and KB sites, it is noted that, both the sites are affected with various anthropogenic and natural activities (Plate 3). In which major threat is due to anthropogenic activities, thus the factors re-

Table 1. Coastal sand dune flora of RB and KB sites, Raigad

No.	Name of Species	Family	Locations	
			RB	KB
1	<i>Acalypha indica</i> L.	Euphorbiaceae	+	-
2	<i>Aeluropus</i> spp.	Poaceae	+	+
3	<i>Ageratum conyzoides</i> L.	Asteraceae	+	-
4	<i>Alternanthera sessilis</i> (L.) R. Br. ex DC.	Amaranthaceae	+	+
5	<i>Ammannia baccifera</i> L.	Lythraceae	+	-
6	<i>Borreria articularis</i> (L. f.) F.N.Will.	Rubiaceae	+	-
7	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	+	-
8	<i>Brachiaria distachya</i> (L.) Stapf.	Poaceae	+	+
9	<i>Calotropis gigantea</i> (L.) R. Br	Apocynaceae	+	+
10	<i>Cassia tora</i> (L.) Roxb	Fabaceae	+	+
11	<i>Casuarina equisetifolia</i> Forst.	Casuarinaceae	+	+
12	<i>Canavalia rosea</i> (Sw.)DC.	Fabaceae	+	-
13	<i>Chenopodium album</i> L.	Amaranthaceae	+	-
14	<i>Chromolaena odorata</i> (L.) R. King & H. Robi	Asteraceae	+	-
15	<i>Clerodendrum inerme</i> (L.) Gaertn	Lamiaceae	+	-
16	<i>Cocos nucifera</i> L.	Arecaceae	+	+
17	<i>Colocasia esculenta</i> (L.) Schott	Araceae	+	-
18	<i>Coccinia grandis</i> (L.) Voigt	Cucurbitaceae	+	-
19	<i>Crotalaria verrucosa</i> L.	Fabaceae	+	-
20	<i>Croton bonplandianus</i> Baill.	Euphorbiaceae	+	+
21	<i>Cyperus rotundus</i> L.	Cyperaceae	+	+
22	<i>Dactyloctenium aegyptium</i> (L.) Willd.	Poaceae	+	+
23	<i>Digitaria ciliaris</i> (Retz.) Koeler	Poaceae	+	+
24	<i>Eclipta prostrata</i> (L.) L.	Asteraceae	+	-
25	<i>Eleusine indica</i> (L.) Gaertn.	Poaceae	+	+
26	<i>Fimbristylis dichotoma</i> (L.) Vahl	Cyperaceae	+	-
27	<i>Ipomoea pes-caprae</i> (L.) R. Br.	Convolvulaceae	+	+
28	<i>Lantana camara</i> L.	Verbenaceae	+	+
29	<i>Launaea procumbens</i> (Roxb.) Ramayya&Rajagopal	Asteraceae	+	+
30	<i>Launaea sarmentosa</i> (Willd.) schultz-bip.exKuntze	Asteraceae	+	-
31	<i>Mollugo disticha</i> (L.) Ser	Molluginaceae	+	-
32	<i>Morinda citrifolia</i> L., nom. cons.	Rubiaceae	+	-
33	<i>Oldenlandia biflora</i> L.	Rubiaceae	+	-
34	<i>Opuntia</i> spp.	Cactaceae	+	-
35	<i>Perotis indica</i> (L.) Kuntze	Poaceae	+	-
36	<i>Pedaliium murex</i> L.	Pedaliaceae	+	-
37	<i>Physalis minima</i> L.	Solanaceae	+	-
38	<i>Pongamia pinnata</i> (L.)Pierre	Fabaceae	+	+
39	<i>Premna obtusifolia</i> R.Br.	Lamiaceae	+	-
40	<i>Rothia indica</i> (L.) Druce	Fabaceae	+	-
41	<i>Senecio bombayensis</i> N.P. Balakr.	Asteraceae	+	-
42	<i>Sesuvium portulacastrum</i> (L.) L.	Aizoaceae	+	-
43	<i>Sida cordifolia</i> L.	Malvaceae	+	+
44	<i>Tephrosia purpurea</i> (L.) Person.	Fabaceae	+	-
45	<i>Terminalia catappa</i> L.	Combretaceae	+	-
46	<i>Thespesia populnea</i> (L.) Soland. ex Correa	Malvaceae	+	+
47	<i>Tridax procumbens</i> L.	Asteraceae	+	+
48	<i>Vernonia cinerea</i> (L.) Less.	Asteraceae	+	-
49	<i>Vitex agnus-castus</i> L.	Lamiaceae	+	-
50	<i>Waltheria indica</i> L.	Malvaceae	+	+
51	<i>Ziziphus jujube</i> Miller	Rhamnaceae	+	-
52	<i>Zoysia matrella</i> (L.) Merr.	Poaceae	+	+
	Total		52	21

Table 2. Biocleansing agent diversity from the study sites.

No.	Scientific Name	Common Name
Avifauna		
1	<i>Corvus splendens</i>	Common crow
2	<i>Bubulcus ibis</i>	Cattle egret
3	<i>Ardea alba</i>	Great egret
4	<i>Alcedinidae</i>	Kingfisher
5	<i>Actitis hypoleucos</i>	Sandpiper
Crabs		
6	<i>Ocypode brevicornis</i>	Ghost crab
7	<i>Uca</i>	Fiddler crab
Animals		
8	<i>Canis lupus familiaris</i>	Dogs

sponsible and their negative impacts on beach environment are discussed in Table 3.

It is observed that both beaches recreation value is important for the tourism and socio-economic development of local inhabitants. Hence, the maintenance and long term conservation of sand dune plant diversity, faunal diversity and beach ecology which is responsible for aesthetic value of both beaches are needed. The sustainable tourism initiatives are required for beach tourism. The factors that are responsible for the beach pollution require strict legal actions and strong policies for coastal biodiversity protection.

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Table 3. Major anthropogenic activities at RB and KB sites.

No.	Factor	Source	Category	Impact
1	Plastic bottles	Restaurant, Tourist	Non-Degradable	Toxic
2	Polythene Bags and dishes	Restaurant, Tourist	Non-Degradable	Toxic
3	Beer and Alcohol (Tin)	Tourist	Non-Degradable	Toxic, Anti-Social
4	Beer and Alcohol (Glass)	Tourist	Non-Degradable	Toxic, Anti-Social
5	Domestic waste	Local villagers	Degradable	Toxic, Anti-Social
6	Fishing waste	Fisherman	Degradable	Loss of Beautification.
7	Fishing Net	Fisherman	Non-Degradable	Negative Effect on growth of CSD flora and fauna
8	Coconut husk	Restaurant	Degradable	Loss of Beautification.
9	Oil	Water sport owner	Non-Degradable	Toxic, Negative Effect on CSD flora and fauna
10	Drainage	Local villagers	Degradable	Effect on CSD flora and fauna, Loss of Beautification
11	Dead animals,birds	Natural, Local villagers	Degradable	Toxic, Disease causing pathogen in air, Loss of Beautification
12	Wooden logs	Natural	Degradable	Loss of Beautification



Plate 2. Avifaunal and faunal diversity at RB and KB sites A: *Bubulcus ibis*, B: *Corvus splendens* C: *Alcedinidae* D: *Ardea alba* E: *Actitis hypoleucos* Crabs F: *Uca*, G: *Ocypode brevicornis*, H: Stray Dogs

Conflict of Interest:

Authors have no conflict of interest.



Plate 3. Anthropogenic activities at study area; A: Fisherman waste at RB, B: Domestic waste at RB, C: Plastic waste at KB, D: Restaurant waste at KB, E: Petroleum waste at KB, F: Alcoholic waste at RB.

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