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DIVERSITY OF ANGIOSPERM FLORA OF KUAKATA NATIONAL PARK, PATUAKHALI DISTRICT, BANGLADESH

M. AZIZAR RAHAMAN[1], MD. AZIZUR RAHMAN[2] AND MOHAMMAD ZASHIM UDDIN[3]
[1]*Wildlife Center, Ban Bhaban, Mohakhali, Dhaka-1212, Bangladesh*
[2]*Department of Botany, Chittagong University, Bangladesh*
[3]*Department of Botany, Dhaka University, Bangladesh*

Abstract

The article mainly highlights the angiosperm diversity of Kuakata National Park (KNP) of Patuakhali district. Angiosperm diversity assessment in the park was conducted in between 2015 and 2016. A total of 265 plant species belonging to 75 families and 204 genera was identified from this National Park. Tree species of the park are represented by 89, shrubs by 45, herbs by 94, climbers by 31 and epiphytes by 6 species. In Magnoliopsida (dicots), Fabaceae is the largest family represented by 14 species, whereas in Liliopsida (monocots), Poaceae is the largest family represented by 13 species. The plant species recorded from the National Park were distributed in different habitats and maximum species were recorded in plantation areas(108) followed by homesteads (61), cultivated land(38), roadsides (35) and mangrove areas (23).The study has reported the presence of medicinal plants, wildlife supporting plants, exotics and invasive plants and rare plants in park. The presence of edible species in the National Park is very rare. The introduction of exotics species into the National Park has been accepted. As the presence of exotics in park, local flora will be faced great challenges in future for their existence. This article also focused conservation values, management concerns and some actions for conservation of angiosperm diversity in the National Park. The present angiosperm diversity assessment in the park is very preliminary and based on this sound conclusion cannot be made yet.

Key words: Diversity, Angiosperm flora, Kuakata national park, Patuakhali district, Bangladesh

Introduction

Kuakata National Park (KNP) is the 12thdeclared National Park of Bangladesh and a part of the Reserved Forest of Patuakhali Coastal Forest Division. Initially it was declared as an Eco-Park in 2005. Later Kuakata Eco-Park was gazetted as a National Park in 2010 (Gazette notification of Ministry of Environment and Forests no. MoEF/Forest Section-2/02/National Park/10/2010/509, Dated: 24/10/2010 as per power given under the provisions of Article 23 (3) of the Bangladesh Wildlife (Preservation) (Amendment) Act 1974). It is situated in the southern part of Bangladesh under Kalapara *Upazila* of Patuakhali district and geographical location is in between including *21°49′16″*N and *90°07′11″*E. The park is bordered by the Bay of Bengal to the east, south and west

[1]Corresponding author : E-mail:alam027456@gmail.com

including the Andharmanik River and WAPDA embankment to the north. The National Park has an area of 1613 ha with Gangamati, Khajura and Kuakata forest beats on the seashore, comprises coastal mangrove plantations (BFD 2012).

Kuakata National Park enjoys tropical maritime climate characterized by high rain during monsoon. The average temperature of KNP ranges between 21.71°C to 29.41° C and average annual rainfall is about 2657 mm/year. The soil of the area consists of calcareous alluvium, acid phosphate soil, grey floodplain and grey piedmont soils. These soils are saline and the P^H values are neutral to slightly alkaline. KNP frequently was affected several serious cyclones during last couples of years. The park area is experiencing rapid erosion mainly at the south and west parts and is more threatened due to regular sea wave actions (BFD 2006).

The diversity of plants is very much essential in shaping of human civilization in recent days. Unfortunately, such diversity has been eroding in alarming rate from the nature before evaluation and documentation. At the end of 19 th century the head of states from all over the world had realized this burning issue. In 1992 world leaders in Earth Summit in Rieo De Janerio formulated biodiversity conservation policy including agenda 21 which had also given importance on the documentation and sustainable utilization of traditional knowledge of plant diversity. After the convention the assessment works of plant diversity in different countries of the world is in progress (Uddin and Abiabdullah 2016). In case of Bangladesh angiosperm diversity assessment of different National Parks and Wildlife Sanctuaries had already been started (Khan *et al.* 1994, Rahman and Hassan 1995, Uddin *et al.* 1998, Uddin and Rahman 1999, Khan and Huq 2001, Uddin *et al.* Uddin and Hassan 2004, 2010; 2011, Uddin *et al.* 2013, 2015, Sajib *et al.* 2015 and Uddin and Abiabdullah 2016). Literature review revealed that so far no work in available on the angiosperm diversity of Kuakata National Park. For the management of the park, baseline data on the angiosperm diversity are essential. In the present study an attempt was taken to achieve the following objectives: (a) to document the angiosperms diversity, (b) to highlights management concerns of the park and (c) to recommend some conservation actions for Kuakata National Park.

Materials and Methods

Extensive floristic survey had been conducted in different seasons of the year of 2015 and 2016 (Hyland 1972, Balick *et al.* 1982 and Alexiades 1996). The study included plantation areas, mangrove areas, cultivated land, roadside and homestead areas. Particular efforts were given to find species of conservation concern including threatened and rare species. Sample size was determined using species area curve or species time curve following Goldsmith and Harrison (1976). Maximum identification of species was done in the field sites and rest of the specimens was collected and processed using standard herbarium techniques (Hyland 1972). Identification was done by consulting

different Floras (Uddin and Hassan 2004, Siddiqui *et al.* 2007 and Ahmed *et al.* 2008a, 2008b, 2009a, 2009b, 2009c, 2009d and 2009e).

The updated nomenclatures of the species are integrated by following Siddiqui *et al.* (2007) and Ahmed *et al.* (2008a, 2008b, 2009a, 2009b, 2009c, 2009d and 2009e). Threatened categories of plants were confirmed with the help of Khan *et al.* (2001) and Ara *et al.* (2013). Some noxious exotic plant species were also identified comparing with the reports of Hossain and Pasha (2004) and Akter and Zuberi (2009). Families were arranged according to Cronquist (1981). Voucher specimens are preserved at Wildlife Center Herbarium (WCH), Bangladesh Forest Department.

Results and Discussion

A total of 265 plant species belonging to75 families and 204 genera was identified from the Kuakata National Park. For each plant species scientific name, local name, family, habit and habitat are presented in Table 1. Among the families, Fabaceae, Poaceae, Caesalpiniaceae, Euphorbiaceae, Malvaceae, Moraceae, Solanaceae, Convolvulaceae, Asteraceae, Apocynaceae, Mimosaceae, Verbenaceae, Amaranthaceae, Cyperaceae, Acanthanceae and Zingiberaceae were found to be most common. By analyzing habit diversity it was found trees by 89, shrubs by 45, herbs by 94, climbers by 31 and epiphytes by 6 species. In Magnoliopsida (dicots), Fabaceae is the largest family represented by 14 species, whereas in Liliopsida (monocots), Poaceae is the largest family represented by 13 species. The plant species recorded from the National Park was scattered in different habitats. Among the habitats, maximum species were recorded in plantation areas (108) followed by homesteads (61), cultivated land (38), roadsides (35) and mangrove areas (23). Most of the plant species in the plantation areas, homesteads and roadsides were introduced by the forest department and local people. The number of edible plants was found minimum in the park.

During the study, much concentration was given in the following habitats: The mangrove plantations were developed all around the National Park. Each year the newly accreted lands facing to the sea were undertaken by the forest department for plantation programs. The top canopy in the mangrove was occupied by *Sonneratia apetala, S. caselaoris, Avicennia officinalis, Excoecaria agallocha* and *Bruguiera gymnorrhiza*. Besides few representations of *Heritiera fomes* and *Ceriops decandra* were also detected in the park. The forest ground was covered mainly by the seedlings of *Ex. agallocha, S. apetala* and *A. officinalis.* In the forest periphery, the bush forming dominant species were *Acanthus ilicifolius, Nipa fruticans* and *Ex. agallocha.* The ground near the intertidal zone was mainly dominated by *Pandanus foetidus, Phragmites karka* and *Saccharum spontaneum.* Most common climbers in the mangrove forest were *Derris scandens, D. trifolia, Ipomoea pes-caprae, Ichnocarpus frutescens* and *Desmodium heterocarpon.* Some members of sedge species including *Cyperus diformis* and *C. kyllingia* were observed in this zone. The banks of the tidal zone were dominated by a good number of tree species

Table 1. Angiosperms diversity of Kuakata National Park.

Scientific name	Family	Local name	Habit	Habitat
Ablemoschus esculentus (L.) Moench	Malvaceae	Vendi	Herb	Homestead
Abroma augusta (L.) L.f.	Sterculiaceae	Ulatkambal	Tree	Plantation areas
Abrus precatorius L.	Fabaceae	Ratti	Climber	Plantation areas
Abutilon indicum (L.) Sweet	Malvaceae	Abtilun	Shrub	Roadside
Acacia auriculiformis A.Cunn. ex Benth. & Hook.	Mimosaceae	Akashmoni	Tree	Plantation areas
Acacia farnesiana (L. f.)Willd.	Mimosaceae	Khaia babla	Tree	Plantation areas
Acacia mangium Willd.	Mimosaceae	Belgium	Tree	Plantation areas
Acacia nilotica L.	Mimosaceae	Babla	Tree	Plantation areas
Acanthus ilicifolius L.	Acanthaceae	Hergoza	Shrub	Mangrove areas
Achyranthes aspera L.	Amaranthaceae	Apang	Herb	Homestead
Adenanthera pavonina L.	Mimosaceae	Raktakambal	Tree	Homestead
Adhatoda zeylanica Mdikus	Acanthaceae	Bashak	Shrub	Homestead
Aegle marmelos (L.) Corr.	Rutaceae	Bel	Tree	Homestead
Aerides multiflora Roxb.	Orchidaceae	Aerid	Epiphyte	Plantation areas
Aerides odorata Lour.	Orchidaceae	Aerid	Epiphyte	Plantation areas
Ageratum conyzoides L.	Asteraceae	Fulkuri	Herb	Roadside
Albizia lebbeck (L.)Benth. & Hook.	Mimosaceae	Kalo koroi	Tree	Roadside
Albizia lucidior (Steud.) Nielsen	Mimosaceae	Koroi	Tree	Homestead
Albizia procera(Roxb.) Benth.	Mimosaceae	Sil-koroi	Tree	Roadside
Allamanda cathartica L.	Apocynaceae	Allamanda	Herb	Plantation areas
Allophylus cobbe (L.) Raeuschel	Sapindaceae	Chita	Shrub	Plantation areas
Alocasia macrorrhizos (L.) G. Don	Araceae	Mankachu	Herb	Homestead
Alstonia scholaris L.	Apocynaceae	Chatim	Tree	Plantation areas
Alternanthera philoxeroides (Mart.) Griseb.	Amaranthaceae	Helencha	Herb	Cultivated land
Amaranthus lividus L.	Amaranthaceae	Gobura notey	Herb	Roadside
Amaranthus spinosus L.	Amaranthaceae	Kanta-nutia	Herb	Roadside
Amaranthus viridis L.	Amaranthaceae	Notey sak	Herb	Homestead
Amorphophallus bulbifer (Roxb.) Blume	Araceae	Oll	Herb	Homestead
Andrographis paniculata (Burm.f.)Wall.*ex* Nees	Acanthaceae	Kalo megh	Herb	Homestead
Annona reticulata L.	Annonaceae	Ata	Tree	Homestead
Anthocephalus cadamba (Roxb.) Miq.	Rubiaceae	Kadam	Tree	Plantation areas

Scientific name	Family	Local name	Habit	Habitat
Aphanamixis polystachya (Wall.) R. N. Parker	Meliaceae	Pitraj	Tree	Plantation areas
Areca catechu L.	Arecaceae	Supari	Tree	Homestead
Artocarpus chaplasha Roxb.	Moraceae	Chapalish	Tree	Plantation areas
Artocarpus heterophyllus Lamk.	Moraceae	Kanthal	Tree	Homestead
Averrhoa bilimbi L.	Oxalidaceae	Bilimbi	Tree	Homestead
Averrhoa carambola L.	Oxalidaceae	Kamranga	Tree	Homestead
Avicennia alba Blume	Verbenaceae	Sada baen	Tree	Mangrove areas
Avicennia marina (Forssk.) Vierh.	Verbenaceae	Moricha baen	Tree	Mangrove areas
Avicennia officinalis L.	Verbenaceae	Kala baen	Tree	Mangrove areas
Azadirachta indica A. Juss.	Meliaceae	Neem	Tree	Homestead
Bacopa monnieri (L.) Pennell	Scrophulariaceae	Brammi	Herb	Cultivated land
Bambusa tulda Roxb.	Poaceae	Mitting bash	Tree	Homestead
Barringtonia acutangula (L.) Gaertn.	Lecythidaceae	Hizol	Tree	Mangrove areas
Bauhinia purpurea L.	Caesalpiniaceae	Kanson	Tree	Plantation areas
Blumea lacera (Burm. f.) DC.	Asteraceae	Kukurmuta	Herb	Cultivated land
Blumea membranacea Wall. *ex*DC.	Asteraceae	Shialutra	Herb	Cultivated land
Bombax ceiba L.	Bombacaceae	Shimul	Tree	Plantation areas
Borassus flabellifer L.	Arecaceae	Tal	Tree	Homestead
Bridelia retusa (L.) A. Juss.	Euphorbiacea	Kata koi	Shrub	Plantation areas
Bruguiera gymnorhiza (L.) Lamk.	Rhizophoraceae	Kakra	Tree	Mangrove areas
Butea monosperma (Lamk.) Taub.	Fabaceae	Polash	Tree	Plantation areas
Caesalpinia pulcherrima (L.) Swartz	Caesalpiniaceae	Radhachura	Tree	Plantation areas
Cajanus cajan (L.) Millsp.	Fabaceae	Orhor	Shrub	Homestead
Calamus erectus Roxb.	Arecaceae	Kadam Bet	Shrub	Plantation areas
Calotropis procera (Aiton) Dryand	Asclepiadaceae	Akand	Shrub	Roadside
Calophyllum innophyllum L.	Clusiaceae	Punnal	Tree	Plantation areas
Calycopteris floribunda (Roxb.) Lamk.	Combretaceae	Guicha lata	Climber	Plantation areas
Carica papaya L.	Caricaceae	Pepe	Shrub	Homestead
Cassia alata L.	Caesalpiniaceae	Dadmordan	Shrub	Roadside

Scientific name	Family	Local name	Habit	Habitat
Cassia fistula L.	Caesalpiniaceae	Sonalu	Tree	Plantation areas
Cassia tora L.	Caesalpiniaceae	Tora	Herb	Roadside
Cassia siamea Lamk.	Caesalpiniaceae	Minjiri	Tree	Plantation areas
Casuarina equisetifolia Forst.	Casuarinaceae	Jhau	Tree	Plantation areas
*Celosia cristata*L.	Amaranthaceae	Morogful	Herb	Cultivated land
Centella asiatica (L.) Urban	Apiaceae	Thankoni	Herb	Cultivated land
Ceriops decandra (Griff.) Ding. Hou	Rhizophoraceae	Goran	Tree	Mangrove areas
Chrysalidocarpus lutescens (Bory) H. Wendl.	Arecaceae	Areca palm	Shrub	Plantation areas
Chrysopogon aciculatus (Retz.) Trin.	Poaceae	Premkanta	Herb	Roadside
Citrus aurantifolia (Christm.&Panzer) Swingle	Rutaceae	Labu	Shrub	Homestead
Citrus maxima (Burm. F.) Merr.	Rutaceae	Jambura	Tree	Homestead
*Clerodendrum viscosum*Vent.	Verbenaceae	Bhant	Shrub	Roadside
Clitoria ternatea L.	Fabaceae	Aparjita	Climber	Homestead
Coccinia grandis(L.) Voigt	Cucurbitaceae	Telakucha	Climber	Plantation areas
Cocos nucifera L.	Arecaceae	Narikel	Tree	Homestead
Codiaeum variegatum(L.)Rumph *ex* A. Juss.	Euphorbiaceae	Patabahar	Shrub	Plantation areas
Colocasia esculenta (L.) Schott	Araceae	Kachu	Herb	Homestead
Commelina benghalensis L.	Commelinaceae	Kanchira	Herb	Cultivated land
Cosmos bipinnatus Cav.	Asteraceae	Cosmos	Herb	Cultivated land
Costus speciosus (Koenig *ex* Retz.) Smith	Costaceae	Keumul	Herb	Plantation areas
Crinum asiaticum L.	Liliaceae	Crinum	Herb	Mangrove areas
Crotalaria pallida Ait.	Fabaceae	Jhunjhuni	Herb	Roadside
Crotalaria juncea L.	Fabaceae	Jhunjhuni	Herb	Roadside
Croton bonplandianum Baill.	Euphorbiaceae	Croton	Herb	Roadside
Cucurbita maxima Duchesne	Cucurbitaceae	Misti kumra	Climber	Homestead
Curculigo orchioides Gaertn.	Liliaceae	Talmuli	Herb	Plantation areas
Curcuma amada Roxb.	Zingiberaceae	Amada	Herb	Plantation areas
Curcuma domestica Valet.	Zingiberaceae	Holud	Herb	Homestead
Curcuma latifolia Rosc.	Zingiberaceae	Sadi	Herb	Roadside

Scientific name	Family	Local name	Habit	Habitat
Curcuma zedoaria (Christm.) Rosc.	Zingiberaceae	Shoti	Herb	Plantation areas
Cuscuta reflexa Roxb.	Cuscutaceae	Shorna lata	Climber	Roadside
Cymbidium aloifolium (L.) Sw.	Orchidaceae	Churi	Epiphyte	Plantation areas
Cynodon dactylon (L.) Pers.	Poaceae	Durba	Herb	Roadside
Cyperus cyperoides (L.) O. Ktze.	Cyperaceae	Sedge	Herb	Cultivated land
Cyperus iria L.	Cyperaceae	Sedge	Herb	Cultivated land
Cyperus kyllingia Endl.	Cyperaceae	Sedge	Herb	Mangrove areas
Cyperus rotundus L.	Cyperaceae	Mutha grass	Herb	Cultivated land
Dalbergia sissoo Roxb	Fabaceae	Sissoo	Tree	Plantation
Datura metel L.	Solanaceae	Dhatura	Shrub	areas Plantation areas
Delonix regia (Hook) Raf.	Caesalpiniaceae	Krishnachura	Tree	Plantation areas
Dendrobium aphyllum (Roxb.) Fischer	Orchidaceae	Dendrobium	Epiphyte	Plantation areas
Dendrobium nobile Lindl.	Orchidaceae	Dendrobium	Epiphyte	Plantation areas
Derris scandens (Roxb.) Benth.	Fabaceae	Kalilata	Climber	Mangrove areas
Derris trifoliata Lour.	Fabaceae	Mellata	Climber	Mangrove areas
Desmodium heterocarpon (L.) DC.	Fabaceae	-	Climber	Mangrove areas
Dillenia indica L.	Dilleniaceae	Chalta	Tree	Homestead
Dioscorea alata L.	Dioscoreaceae	Jora alu	Climber	Homestead
Dioscorea bulbifera L.	Dioscoreaceae	Bon alu	Climber	Homestead
Dioscorea pentaphylla L.	Dioscoreaceae	-	Climber	Plantation areas
Diospyros malabarica (Desr.) Kostel.	Ebenaceae	Deshigab	Tree	Homestead
Dracaena spicata Roxb.	Agavaceae	Dracaena	Shrub	Plantation areas
Duranta erecta L.	Verbenaceae	Katamehedi	Shrub	Plantation areas
Echinochloa colona (L.) Link	Poaceae	Shama grass	Herb	Cultivated land
Eclipta prostrata (L.) L.	Asteraceae	Keshoraj	Herb	Cultivated land
Eichhornia crassipes (Mart.) Solms	Pontederiaceae	Kachuripana	Herb	Cultivated land
Elaeocarpus tectorius (Lour.) Poir.	Elaeocarpaceae	Jalpai	Tree	Homestead
Enhydra variegata L.	Asteraceae	Helencha	Herb	Cultivated land

Scientific name	Family	Local name	Habit	Habitat
Erythrina indica Lam.	Fabaceae	Mandar	Tree	Plantation areas
Eucalyptus camaldulensis Dehnh.	Myrtaceae	Eucalyptus	Tree	Plantation areas
Euphorbia hirta L.	Euphorbiaceae	Dudhia	Herb	Cultivated land
Euphorbia thymifolia L.	Euphorbiaceae	Dudhia	Herb	Cultivated land
Excoecaria agallocha L.	Euphorbiaceae	Gewa	Tree	Mangrove areas
Ficus benghalensis L.	Moraceae	Bot	Tree	Roadside
Ficus benjamina L.	Moraceae	Jir Dumur	Tree	Plantation areas
*Ficus hispida*L.f.	Moraceae	Dewall	Shrub	Plantation areas
Ficus pumila L.	Moraceae	dumar	Climber	Plantation areas
Ficus racemosa L.	Moraceae	Jagya dumar	Tree	Homestead
Ficus virens Ait.	Moraceae	Pakur	Tree	Roadside
Fimbristylis dichotoma (L.) Vahl	Cyperaceae	-	Herb	Cultivated land
Fimbristylis quinopangularis (Vahl) Kunth.	Cyperaceae	-	Herb	Cultivated land
Garcinia cowa Roxb. Choisy.	Clusiaceae	Kao	Tree	Homestead
Gloriosa superba L.	Liliaceae	Ulatchandal	Climber	Plantation areas
Glycosmis pentaphylla (Retz.) DC.	Rutaceae	Datmajan	Shrub	Roadside
Gmelina arborea Roxb.	Varbenaceae	Gamari	Tree	Plantation areas
Gymnopetalum chinense (Lour.)Merr.	Cucurbitaceae	-	Climber	Homestead
Hedyotis scandens Roxb.	Rubiaceae	Bish lata	Climber	Plantation areas
Heliotropium indicum L.	Boraginaceae	Hatisur	Herb	Cultivated land
Hemidesmus indicus (L.) R. Br. *ex* Schott.	Asclepiadacae	Anantamul	Climber	Plantation areas
Heritiera fomes Buch.-Ham.	Sterculiaceae	Sundari	Tree	Mangrove areas
Hibiscus rosa sinensis L.	Malvaceae	Joba	Shrub	Plantation areas
Hibiscus tilliaceus L.	Malvaceae	Bolla	Shrub	Plantation areas
Hodgsonia macrocarpa (Blume) Cogn.	Cucurbitaceae	Makal	Climber	Plantation areas
Holarrhena antidysenterica (L.) Wall. ex Decne.	Apocynaceae	Kurchi	Shrub	Plantation areas
Hopea odorata Roxb.	Dipterocarpaceae	Telsur	Tree	Homestead

Scientific name	Family	Local name	Habit	Habitat
Hoya prasitica (Roxb.) Wall. ex Wight	Apocynaceae	Hoya	Climber	Roadside
Hyptis suaveolens (L.) Poit.	Lamiaceae	Tokma	Herb	Roadside
Ichnocarpus frutescens (L.) W.T.Alton	Apocynaceae	Shamalata	Climber	Mangrove areas
Imperata cylindrica (L.) Raeusch.	Poaeae	Ulu	Herb	Roadside
Ipomoea aquatica Forssk.	Convolvulaceae	Kalmi	Climber	Homestead
Ipomoea batata (L.) Lamk.	Convolvulaceae	Misti alu	Climber	Homestead
Ipomoea fistulosa Mart. *ex* Choisy	Convolvulaceae	Dholkalmi	Shrub	Roadside
Ipomoea pes-caprae (L.) R. Br.	Convolvulaceae	Chagalkhuri	Climber	Mangrove areas
Ischaemum polytrias indica (Houtt.) Veldkamp.	Poaceae	Toto grass	Herb	Cultivated land
Ixora acuminata Roxb.	Rubiaceae	Rangan	Shrub	Plantation areas
Ixora Javanica (Blum) DC.	Rubiaceae	Rangan	Shrub	Plantation areas
Ixora pavetta Andr.	Rubiaceae	Swet rangan	Shrub	Plantation areas
Jatropha gossypiifolia L.	Euphorbiaceae	Lal bharenda	Shrub	Homestead
Justicia simplex D. Don.	Acanthaceae	Jogathmardan	Shrub	Plantation areas
Kyllinga nemoralis (J.R.Forst. & G. Forst.) Dandy ex Hutch&Dalziel	Cyperaceae	Sedge	Herb	Cultivated land
Lablab purpureus (L.) Sweet	Fabaceae	Seem	Climber	Homestead
Lagerstroemia speciosa (L.) Pers.	Lythraceae	Jarul	Tree	Plantation areas
Lannea coromandelica (Houtt.) Merr.	Anacardiaceae	Jiga	Tree	Plantation areas
Lantana camara L.	Verbenaceae	Lantana	Shrub	Plantation areas
Lawsonia inermis L.	Lythraceae	Mehedi	Shrub	Homestead
Leea guineensis G.Don	Leeaceae	Phupharia	Shrub	Plantation areas
Leea macrophylla Roxb.ex Hornem	Leeaceae	Dhol sumundro	Shrub	Plantation areas
Leucas aspera (Willd.) Link	Lamiaceae	Dandakalash	Herb	Roadside
Leucas lavandulaefolia Ress	Lamiaceae	Gaochia	Herb	Roadside
Limnophila indica (L.) Druce	Scrophulariaceae	Pani karpur	Herb	
Limonia acidissima L.	Rutaceae	Koethbel	Tree	Homestead
Lindernia antipoda (L.) Alston	Scrophulariaceae	Lindernia	Herb	Cultivated land
Litsea glutinosa (Lour.) C.B.Rob	Lauraceae	Menda	Tree	Plantation areas
Ludwigia hyssopifolia (G. Don) Excell	Onagraceae	Panilong	Herb	Cultivated land
Ludwigia repens J.R.Forst.	Onagraceae	Mulsi	Herb	Cultivated land
Macrosolen cochinchinensis (Lour.) Tiegh.	Loranthaceae	Porgassa	Herb	Plantation areas

Scientific name	Family	Local name	Habit	Habitat
Mangifera indica L.	Anacardiceae	Aam	Tree	Homestead
Melastoma malabathricum L.	Melastomataceae	Futki	Shrub	Plantation areas
Melia azedarach L.	Meliaceae	Ghora neem	Tree	Plantation areas
Magnolia champaca (L.)Baill. *ex* Pierre.	Magnoliaceae	Cahmpa	Tree	Plantation areas
Mikania cordata (Burm. f.) B.L.Rob.	Asteraceae	Assamlata	Climber	Plantation areas
Mimosa invisa Colla.	Mimosaceae	Bara lajjabati	Herb	Plantation areas
Mimosa pudica L.	Mimosaceae	Lajjabati	Herb	Roadside
Mimusops elengi L.	Sapotaceae	Bokul	Tree	Homestead
Monochoria vaginalis (Burm. f.) C. Presl	Pontederiaceae	Nukha	Herb	Cultivated land
Moringa oleifera Lamk.	Moringaceae	Sajna	Tree	Homestead
Mucuna pruriens (L.) DC.	Fabaceae	Alkushi	Climber	Plantation areas
Murraya koenigii (L.) Spreng.	Rutaceae	Kamini	Shrub	Plantation areas
Musa paradisiaca L.	Musaceae	Kola	Herb	Homestead
Neolamarckia cadamba (Roxb.) Bosser	Rubiaceae	Kadam	Tree	Homestead
Nerium oleander L.	Apocynaceae	Korobi	Shrub	Plantation areas
Nymphaea rubra Roxb. *ex* Andr.	Nymphaeaceae	Lal shaphla	Herb	Plantation areas
Nypa fruticans Wurmb.	Arecaceae	Golpata	Shrub	Mangrove areas
Ocimum terviflorum L.	Lamiaceae	Tulsi	Herb	Homestead
Opuntia dillenii (Ker Gawl.) Haw.	Cactaceae	Phanimansa	Herb	Plantation areas
Oryza sativa L.	Poaceae	Dhan	Herb	Cultivated land
Oxalis corniculata L.	Oxalidaceae	Amrul	Herb	Cultivated land
Pandanus foetidus Roxb.	Pandanaceae	Keya kanta	Herb	Mangrove areas
Panicum notatum Retz.	Poaceae	Panicum	Herb	Cultivated land
Paspalum distichum L.	Poaceae	Gitlaghas	Herb	Cultivated land
Passiflora foetida L.	Passifloraceae	Jhumka lata	Climber	Plantation areas
Polygonum pubescens Blume	Polygonaceae	Bish kata	Herb	Plantation areas
Polygonum hydropiper (L.) Delarbne	Polygonaceae	Lal-kukri	Herb	Cultivated land
Phoenix sylvestris (L.) Roxb.	Arecaceae	Khejur	Tree	Homestead

Scientific name	Family	Local name	Habit	Habitat
Phragmites karka (Retz.) Trin.*ex* Steud	Poaceae	Nol	Herb	Mangrove areas
Phyllanthus emblica L.	Euphorlsiaceae	Amlaki	Tree	Homestead
Physalis minima L.	Solanaceae	Fotka	Herb	Plantation areas
Piper longum L.	Piperaceae	Pipul	Climber	Homestead
Plumeria alba L.	Apocynaceae	Katgolap	Tree	Plantation areas
Pongamia pinnata (L.) Pierre	Caesalpiniaceae	Koroj	Tree	Plantation areas
Pothos scandens L.	Araceae	Batilata	Climber	Plantation areas
Premna esculenta Roxb.	Verbenaceae	Lallong	Shrub	Plantation areas
Psidium guajava L.	Myrtaceae	Piyara	Tree	Homestead
Pterospermum acerifolium (L.)Willd.	Sterculiaceae	Muskunda	Tree	Plantation areas
Rhizophora mucronata Lam.	Rhizophoraceae	Rhizophora	Tree	Plantation areas
Rhynchostylis retusa (L.) Blume	Orchidaceae	Foxtail	Epiphyte	Plantation areas
Ricinus communis L.	Euphorbiaceae	Reri	Herb	Homestead
Saccharum spontaneum L.	Poaceae	Kash	Herb	Mangrove areas
Albizia saman (Jacq.) Merr.	Mimosaceae	Randi korai	Tree	Plantation areas
Saraca thaipingensis Prain	Caesalpiniaceae	Ashok	Tree	Plantation areas
Schumannianthus dichotomus (Roxb.) Gagnep.	Marantaceae	Patipata	Herb	Homestead
Scindapsus officinalis (Roxb.) Schott	Araceae	Money plant	Herb	Plantation areas
Scoparia dulcis L.	Scrophulariaceae	Bandhuni	Herb	Roadside
Sesbania grandiflora (L.) Pers.	Fabaceae	Bakul ful	Shrub	Homestead
Senna alata (L.) Roxb.	Caesalpiniaceae	Dadmordon	Shrub	Roadside
Senna sophera (L.) Roxb.	Caesalpiniaceae	Kalkesunda	Herb	Roadside
Senna tora (L.) Roxb.	Caesalpiniaceae	Chakunda	Herb	Roadside
Perrisetum glaucum (L.) R. Br.	Poaceae	Bajra	Herb	Cultivated land
Sida acuta Burm. f.	Malvaceae	Nakphul	Herb	Cultivated land
Sida cordata (Burm. f.) Borss.Wallk.	Malvaceae	Junka	Herb	Roadside
Smilax ovalifolia Roxb. *ex* D. Don.	Smilaceaae	Kumarilata	Climber	
Siplanthes acmella (L.) Murray not (L.) L.	Asteraceae	Spilanthes	Herb	Cultivated land
Solanum melongena L.	Solanaceae	Begun	Herb	Homestead
Solanum americanum Mill.	Solanaceae	Puti begun	Herb	Plantation areas

Scientific name	Family	Local name	Habit	Habitat
Solanum torvum Sw.	Solanaceae	Gota begun	Shrub	Plantation areas
Sonneratia apetala Buch.-Ham.	Sonneratiaceae	Keora	Tree	Mangrove areas
Sonneratia caseolaris (L.) Engl.	Sonneratiaceae	Soila	Tree	Mangrove areas
Spondias pinnata (L.f.) Kurz.	Anacardiaceae	Amra	Tree	Homestead
Sterculia foetida L.	Sterculiaceae	Jongli badam	Tree	Plantation areas
Sterculia villosa Roxb.	Stercaliaceae	Bsaket badam	Tree	Plantation areas
Steudnera colocasioides Hook. f.	Araceae	Bishkachu	Herb	Homestead
Streblus asper Lour.	Moraceae	Sheora	Tree	Plantation areas
Swietenia mahagoni (L.) Jacq.	Meliaceae	Mehogoni	Tree	Plantation areas
Syzygium cumini (L.) Skeels	Myrtaceae	Kalo Jam	Tree	Homestead
Tabernaemontana corymbosa Roxb. ex Wall.	Apocynaceae	Tagar	Shrub	Plantation areas
Tabernaemontana divericata (L.) R.Br.*ex* Roem & Schult.	Apocynaceae	Tagar	Shrub	Plantation areas
Tamarindus indica L.	Caesalpiniaceae	Tetul	Tree	Homestead
Tamarix gallica L.	Amaricaceae	Nonajau	Shrub	Mangrove areas
Tectona grandis L.f.	Verbenaceae	Segun	Tree	Plantation areas
Terminalia arjuna (Roxb. *ex* DC.) Wight & Arn	Combretaceae	Arjun	Tree	Plantation areas
Terminalia bellirica (Gaertn.) Roxb.	Combretaceae	Bohera	Tree	Plantation areas
Terminalia catappa L.	Combretaceae	Kat badam	Tree	Plantation areas
Terminalia chebula Retz.	Combretaceae	Haritoki	Tree	Plantation areas
Thunbergia latifolia Roxb.	Acanthaceae		Climber	Plantation areas
Thysanolaena maxima (Roxb. *ex* Hornem.) Honda.	Poaceae	Phuljharu	Herb	Cultivated land
Trewia nudiflora L.	Euphorbiaceeae	Pitali	Tree	Plantation areas
Triumfetta rhomboidea Jacq.	Tiliaceae	Banokra	Herb	Plantation areas
Tridax procumbens L.	Asteraceae	Tridhara	Herb	Cultivated land
Typha elephantina Roxb.	Typhaceae	Hogla	Herb	Cultivated land
Woodfordia fruticosa (L.) Kurz	Lythraceae	Dhatri-phul	Shrub	Plantation areas

Scientific name	Family	Local name	Habit	Habitat
Xanthium stromarium L.	Asteraceae	Ghagra	Herb	Roadside
Urena lobata L.	Malvaceae	Banokra	Herb	Roadside
Zingiber montanum (J. Koenig.) Link *ex* A. Dietr.	Zingiberaceae	Paletara	Herb	Plantation areas
Zingiber roseum (Roxb.) Rosc.	Zingiberaceae	Laltara	Herb	Plantation areas
Ziziphus glabrata Heyne ex Roth	Rhamnaceae	Jangli kul	Shrub	Plantation areas
Ziziphus jujuba Mill.	Rhamnaceae	Boroi	Tree	Homestead

such as *Tamarix gallica,Pongamia pinnata, Barringtonia acutangula, Trewia nudiflora,Heritiera fomes, Nypa fruticans, Tamarindus indica, S. apetala, A. officinalis, S. caseolaris, Samanea saman, Albizia procera, Calophylum innophylum, Acacia nilotica, A. farnesiana,Casuarina equisetifolia* and *Rhizophora mucronata.*

One embankment was made on the north site of the National Park to protect Kuakata municipal area from high tidal surges. Besides, many small roads and trails made by encroachers and forest department, and some plantation areas also established inside National Park. Embankment, plantation areas, small roads and trails were planted by the forest department using a number of both native and exotic species. The remarkable species are *Samanea saman, Borassus flabelifer, Phoenix sylvestreis, Casuarina equisetifolia, Acacia nilotica A. farnesiana, A. auriculiformis, A. mangium, Eucalyptus camaldulensis, Albizia lebbeck, Artocarpus heterophyllus, Calophylum innophylum, Nerium indicum, Bauhinia purpurea, Delonix regia, Pongamia pinnata, Dalbergia sissoo, Ficus benghalensis, F. racemosa, Gmelina arborea, Terminalia arjuna, T. bellirica, T. chebula, Butea monosperma, Erythrina indica, Michelia champaca ,Swietenia mahagoni, Excoecaria agallocha, Cassia siamea* and *C. fistula.* Some bushy plants were also found in this sides. The major species are *Ricinus communis, Cajanus cajans, Cassia alata, Calotropis procera, Glycosmis pentaphylla, Clerodendrum viscosum, Datura metel, Hyptis suaveolens, Xanthium indicum, Solanum torvum, Ixora acuminate, Murraya koenigii* and *Ziziphus glabrata.* Many climber species were also ornamented this sides. Most common species are *Mikania cordata, Thunbergia fragrans, Pothos scandens, Hemidesmus indicus, Coccinia grandis, Dioscorea pentaphylla, Hodgsonia macrocarpa, Mucuna pruriens, Ficus pumila, Hedyotis scandens* and *Cuscuta reflexa.*

In the Kuakata National Park, 383 encroachers have occupied of forest land and made homes. Each homestead was planted by a good number of tree species. The appearance of such homestead looks like a segment of mini forest. During our survey *Moringa oleifera, Acacia nilotica, Aegle marmelose, Albizia lebbeck,Albizia procera, Samanea saman, Anacardium occidentale, Annona reticulate, Borassus flabellifer, Anthocephalus cadamba, Aphanamixis polystachya, Areca catechu, Artocarpus chaplasha, Artocarpus heterophyllus, Averrhoa carambola, Azadirachta indica, Bambusa tulda, Citrus maxima,*

Cocos nucifera, Elaeocarpus robustus, Ficus racemosa,Phoenix sylvestreis, Ziziphus mauritiana, Trewia nudiflora, Terminalia chebula, T. bellirica,Tamarindus indica, Syzygium cumini, Swietenia mahagoni, Spondias pinnata, Psidium guajava, Melia azederach, Mangifera indica, Lawsonia inermis, Erythrina indica and *Diospyros malabarica* were recorded.

Aside from plantation areas and homesteads, some areas are used as cultivated land. Local people and encroachers use such land ones in a year for rain fed aman rice cultivation. The most common plants recorded were *Enhydra fluctuans, Eclipta alba, Centella asiatica, Blumea lacera, Tridax procumbe, Heliotropium indicum, Ludwigia repens, Oxalis corniculata, Echinochloa colonum, Oryza sativa, Panicum notatum, Setaria glauca* and *Bacopa monnieri* and also a good number of sedges and grasses. In summer the land was sheltered by a number of herbaceous plants. Among them the common species were *Xanthium indicum, Thysanolaena maxima, Ischaemum indicum, Echinochloa colonum, Sida acuta,Euphorbia hirta, Kyllinga nemoralis, Fimbristylis dichotoma, Cyperus cyperoides, Commelina benghalensis, Blumea membranacea* and *Paspalum distichum.* A rare occurrence of *Typha elephantina* (Hogla) and *Phragmitis karka* (Nol) was also recorded in the wetland.

The four species namely *Tamarix gallica, Calophylum inophylum, Typha elephantina* and *Phragmitis karka* were found to be rare in the National Park. To authenticate their status further comprehensive survey is needed. A good number of medicinal plants were identified which plays important role for the primary healthcare of local people in and around the National Park. Priority should be given for their conservation. The recorded common species in the National Park were *Adhatoda zeylanica, Andrographis paniculata, Achyranthes aspera, Phyllanthus emblica, Ocimum sanctum, Ricinus communis, Azadirachta indica, Aegle marmelos, Alstonia scholaris, Holarrhena antidysenterica, Sonneratia apetala, S. caseolaris, Nypa fruticans, Centella asiatica, Mangifera indica, Scoparia dulcis, Mikania cordata, Ipomoea fistolusa, Terminalia arjuna, T. chebula, T. belliricha, Cassia alata, Diilenia indica, Cynodon dactylon, Colocasia esculenta* and *Ficus racemosa*.

Exotics and invasive species are a component of total floristic composition of the National Park. Some exotics, such as *Acacia auriculiformis, A. mangium, Eucalyptus camaldulensis* and *Cassia siamea* were planted in the National Park area. Invasive species of the National Park were found to be *Eichhornia crassipes, Mikania cordata* (Refugeelota), *Ipomoea fistulosa, Ageratum conyzoides, Croton bonplandianum* and *Xanthium indicum.* Such species are a challenge to the management of the plant diversity of the National Park. A good number of wildlife supporting plant species namely *Sonneratia apetala, S. caseolaris, Avicenneia alba, Ficus benghalensis, F. racemosa, F. virens, Phoenix sylvestreis, Syzygium cummuni, Butea monosperma, Artocarpus chaplasha* and *Tamarindus indica* was recorded from the National Park. Such species play an important role in conservation of biodiversity.

Based on observations and discussion with local people and foresters it is evident that erosion is major threat to the National Park. The south and west sides of the National Park are facing high erosion due to regular sea wave actions. The species planted there are *Acacia nilotica* (Babla), *A. farnesiana* (Khaia Babla), *A. auriculiformis* (Akashmoni), *Pongamia pinnata* (Koroj), *Barringtonia acutangula* (Hizol) and *Trewia nudiflora* (Pitali) all of which are fresh water enduring species. Initially such species were doing better in producing branches and canopy. But their root systems are poorly developed. During high tide period the wave actions made them uprooted easily. Mangrove species like *Sonneratia apetala* (Keora), *S. caseolaris* (Soila), *A. officinalis* (Baen) and *Ex. agallocha* (Gewa) were found to grow well in the intertidal zone because they have strong root systems and can survive with high wave action during rainy season. Facilities and man power of local forest department are not much adequate. Introduction of exotics by forest department is also visible. Grazing by buffalos in the mangrove forest areas, plantation areas and newly accreted lands were also observed.

With the purpose of management of the National Park local knowledge based policy is very essential. During the field trips we discussed with local forest personals, local elites and general people to find some clues for formulating recommendations. The suggestions which are made based on our visit experiences are: to undertake short term and long term management plans, to install geo-tube or geo-bag on the south and west sites for protecting forest degradation and soil erosion, to develop eco-tourism, to ensure security for tourist, to provide visitor use for educational, cultural and recreational purposes at a level which will not cause significant biological or ecological degradation to the biodiversity, to create the sources of fresh water both for human and wildlife, to establish watch towers to enjoy sun rises, sun sets and natural views, to record local knowledge from the elders about nature and adaptation and to record health care knowledge of local people, to create awareness programs about environment, biodiversity and wildlife, to accelerate plantation programs using local species, to provide risk allowance for the people who involved in forest management process, to increase capacity of forest and forest personals, to detect and remove invasive species, to avoid exotics in plantation programs, to arrange traditional knowledge based cultural program, to create traditional medicinal knowledge sharing programs, to relocate encroachers from the park, finally to ensure land ownership and forest territory using GIS map.

The present work on the assessment of angiosperm diversity in Kuakata National Park is the first attempt. The record of total 265 angiosperm species in the park is very preliminary. We expected more angiosperm species yet to be identified. It is not possible to give a concrete conclusion based on such preliminary results. Long term floristic survey is necessary to cover all the component of the angiosperms and also other group of plants.

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