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AGRO-BIODIVERSITY OF BAY ISLANDS

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The Andaman and Nicobar Islands even though possess an apparently uniform tropical humid warm climate, shows considerable variation in the species diversity and vegetation pattern. The occurance of over 2500 indigenous and 500 non-indigenous angiospermic species in these Islands makes it unique to Indian flora. In addition to cultivated species (plantation, fruit and vegetable crops, cereals and pulses. Orchids and medicinal plants etc.), wild relatives of crop plants having agricultural, medicinal and industrial value have an impressive array of diversity. Among these significant species found are : *Pandanus* sps., *Garcinia cowa, Mangifera andamanica, Musa balbisiana* var. *andamanica, Anona glabra, Baccuaria ramiflora,* etc in fruits: *Alternathera sessile, Amaranthus viridis, Vigna marina, Acrosticum aureum* in vegetables: *Oryza inandamanica,* the wild relative of rice: *Areca triandra, Myristica andamanica, Zingiber odoreferum, Piper betle* in plantation and spice crops: *Cymbidium oloifolium, Eria andamanica, Vanilla andamanica* in orchids and *Adena penengiana, Aerva lanata, Ardisia solanacea, Cordia grandis, Cassia alata, Euphorbia hirta* in medicinal plants. As main food source, numerous wild plants like *Colocasia esculenta, Dioscorea glabra, Nypa fruiticans, Calamus sps., Ipomoea aquatica, Tacca leontopetaloids* are directly consumed by many tribals of Andaman and Nicobar Islands.

Key words : Andaman and Nicobar Islands, agri-diversity, wild relatives, tribal food

Out of about 17,000 vascular plant species recorded, India has as many as 5000 endemic species and a significant feature of the Indian flora is the confluence of flora of the surrounding countries like Malayasia, Tibet, China, Japan, Europe and also from distinctly separated continents like America, Africa and Australia. India has 12 biographic zones of which the Andaman-Nicobar zone is one whose flora is unique to India because of tropical humid climate and insular nature of the territory (Rodger and Panwar, 1988). The presence of over 2500 indigenous and 500 non-indigenous angiospermic species within a land area of 8290^2km is significant feature of the Andaman and Nicobar Islands, making them a cynosure not only for plant taxonomists but also for conservationists. The rare and the distinct flora, which evolves through millions of years due to insular nature of the territory, physical isolation between the islands and also from the neighbouring continental landmasses, is unique to India. These two group of Islands, separated by 10° channel even though possess an apparently uniform tropical humid and warm climate, shows considerable variation in the species diversity and vegetation patterns. Though related to mainland (India) flora, the flora of Andaman group shows much closer affinity with the Burmese flora while that of Nicobar have affinity towards the Sundra biographical zone. The Andaman group of Islands are inhabited by the tribes of Negrito stock viz., Jarawas, Sentineles, great Andamanese and the

Onges, on the other hand: Nicobar group of Islands are inhabited by tribals of Mangoloid origin, viz., The Nicobarese and Shompeans. The wide variety of plants in the Island ecosystem has supported human existence and contributed to their wellbeing. The interaction between the tribals and people living in the natural system have helped in maintaining the richness of the societies, communities and genetic materials in both productive systems and wild lands of island tropical environment. The insular nature of territory, physical isolation between the islands and also from the neighbouring mainland through millions of years, has resulted in the revolution of rare and distinct flora, which trhough related to the mainland Indian flora, shows much closer affinity with the Burmese, Malayasian and Indonesian flora. The rich tropical and natural, evergreen vegetation of Andaman and Nicobar Islands can be broadly classified as :

(i) Evergreen forests

These forests represent the climax vegetation with a close compact community of diverse tropical plants. The canopy is closed and consists of three sotreys. The soil is composed of clayey loam with micaceous sandstones below. The vegetation is mainly composed of tall trees laden with linans and other epiphytes. *Dipterocarpus griffithii, Hopea odorata, Plachonia andamanica* occur in the upper storey. The other storey consists of smaller trees like *Baccaurea sapida, Myristica* sps., *Pometia pinnata*. Shrubs like *Cleorodendrum viscosum, Leea indica* etc. and common climbers include *Calamus longisetus, Daemonorops manii*. Epiphytic ferns like *Dendrobium aphyllum* and *D. secundum* are the epiphytic orchids commonly seen.

(ii) Deciduous forests

Such forests occur in undulating ground on hills where the soil is comparatively dry. *Pterocarpus dabergoids* is associated with *Termenalia procera, T. manii* etc. The second storey consists of small trees like *Lannea coromandelica, Sageraea elliptica*. The third storey is represented by *Grewia disperma, Cordia grandis* etc.

(ii) Grasslands

Several disturbed, deforested and denuded hillocks exhibit grasslands with *Imperata cylindrica* and *Saacharum spontaneum* as dominant species. Grasses like *Heteropogan contortus, Chrysopogan aciculatus* and *Eragrostic* sps. are found associated with sedges and ferns. The herbs and undershrubs include *Uvaria lagopodioides, Desmodium heterocarpon* etc.

Hydrophytic vegetation

The scarcity of natural stagnant pools and lakes results in poor fresh water flora in these Islands. *Ipomoea aquatica, Lemma purpusilla, Najas indica, Hydrilla verticillata* are some times seen. Notable fresh water marshy plants are *Blyxa roxburghii, Polygonum barbatum, Hydrophila erecta* (Rao, 1996).

The people of Andaman and Nicobar group of islands have been growing and/or collecting large number of plants or their products from wild habitats for consumption. Consumption of such a large array of plants have been the basis of good stamina and sound health from them since immemorial. This combined with high agro-ecological diversity and population of diverse culture and food habits has made these islands a very rich resource of horticultural (fruits, vegetables, spices, orchids etc), pulses and cereals (cultivated food grains) and medicinal plants.

The diversity of useful vascular plant resources in these islands may conventionally be grouped as :

1. Wild and cultivated fruits
2. Wild and cultivated vegetables
3. Wild and cultivated plantations and spices
4. Cultivated food crops
5. Oilseed crops
6. Wild and exotic orchids
7. Aromatic and Medicinal plants

1. Cultivated and wild fruits

The diverse agro-ecological conditions of tropical and humid climate of these Islands are highly suitable for growing tropical sub tropical fruits.

The cultivated fruits constitute an impressive range and include banana (*Musa paradisiaca*), Papaya (*Carica papaya*), pineapple (*Ananas comosus* L.), mango (*Mangifera indica*), custard apple (*Anona squamosa*), soursop (*Anona muricata*), bullock heart (*Anona reticulata*), passion fruit (*Passiflora edulis*), sapota (*Achras zapota* L.), acid lime (*Citrus aurantifolia* Swingle), jackfruit (*Artocarpus heterophyllus*), sweet orange (*Citrus sinensis*), avocado (*Persea americana*), carambola (*Averrhoa carambola*), bilimbi (*Averrhoa bilimbi*) durian (*Durio zibethinus* Mill), mangosteen (*Garcinia mangostana*), lemon (*Citrus lemon*), bael (*Aegle marmelos*), rambutan (*Nephelium lapaceum* L.), west Indian Cherry (*Malpighia glabra*), guava (*Psidium guajava* L.), pomegranate (*Punica granatum* L.), ber (*Zizyphus mauritiana*), aonla (*Phyllanthus emblica*), cashewnut (*Anacardium occidentale*), jamun (*Eugenia jambolana*) (Singh *et al.*, 1994, 1996, 1997 and 1997).

Besides, a large number of fruits are collected and harvested from the wild habitats or forests. Some of these, which need mention include screwpine (*Pandanus tectorius*), kewra (*P. andaman-ansium*), Nicobar Bread fruit (*P. lerum*), caw phall (*Garcinia cowa*), alligator's apple (*Anona glabra* L.), khatta phal (*Baccuarea ramiflora* Lour), lakoocha (*Artocarpus gomizianus*), gular (*Ficus hispida*), modhuphal (*Salacia chinensis*), wild banana (*Musa balbisiana* var. *andamanica*), wild jamun (*Syzygium claviflorum*), amra (*Spondias pinnata*), wild jamun (*S. jambolana*), lasoda (*Cordia oblique*), dhumiphal (*Nypha fruiticans*), wild passion fruit (*Passiflora foetida*), wild mangoes (*Mangifera andamanica, M. camptosperma* and *M. griffithi*), gnetum (*Gnetum gnemon*), wild lemon (*Atalantia monophylla*), wild amra (*Dracantomelum dao*), wild jackfruit or taung - Peinne (*Artocarpus chaplasha*), ambarella (*Spondias cythera*) (Sreekumar *et al.*, 1986; Vasudeva Rao, 1986; Sreekumar *et al.*, 1996; Singh *et al.*, 1998).

2. Cultivated and wild vegetables

People of Andaman and Nicobar group of islands including local inhabitants and tribals, grow and even collect naturally growing plants or plant products which are eaten or cooked as vegetables. These may be grouped as:

The cultivated vegetable group constitutes bhindi (*Ablmoschus esculentus* (L) Moench.), tomato (*Lycopersicon esculentum* Mill.), chilli (*Capsicum annuum* L.), brinjal (*Solanum melongena* L.), bottle gourd (*Lagenaria siceraria* (Mol) Standl.), pumpkin (*Cucurbita moschata* Poir.), khira or cucumber (*Cucumis sativus* L,), bitter gourd (*Momordica charantia* L.), snake gourd (*Trichosanthes anguina* L.), amaranths (*Amaranthus* sps.), watermelon (*Citrullus lanatus*), lablab (*Lablab purpureus*), radish (*Raphanus sativus*), cowpea (*Vigna unguiculata* (L) Walp.), ridge gourd (*Luffa acutangula* Roxb.), parval or pointedgourd (*Trichosanthes dioica*), tapioca (*Manihot esculenta* Crantz), elephant foot yam (*Amorphophallus campanulatus* Blume), frenchbean (*Phaseolus vulgaris* L.), cabbage (*Brassica oleracea* var. *capitata*), cauliflower (*B. oleracea* var. *botrytis*), knolkhol (*B. caulorapa*), kundru (*Coccinia indica*), palak (*Beta vulgaris* var. *bengalensis*), basella or Poi (*Basella alba*), chinese cabbage (*B. pekinensis*), curry leaf (*Murrya koenigii* L), dhania pathi (*Eryngium foetida* Bieb.), sweet potato (*Ipomoea batarus* (L) Lam.). (Singh *et al.*, 1996; 1996, Shridhar and Sharma 1991).

There are numerous uncultivated vegetables but a few which are consumed as cooked are: madras bhaji (*Alternanthera sessile* L.), kaitali chulai (*Amaranthus spinosa* L.), wild marsa bhaji (*A. viridis* L.), bilaiti kathal (*Artocarpius incissus* L.), kairwal or purple Bauhinia (*Bauhinia variegata* L.), khoja (*Callicarpa arborea* Roxb.), maripatti (*Caryota mittis* Lour.), amaltas or bunder laudi

(*Cassia fistula*), kasondi (*Cassia occidentalis* L.), quail grass (*Celosia argentea* L.), khari phal (*Ardisia solanacea* Roxb.), mitha bhaji (*Champereia griffithiana* Planch.), ghuiyan or arvi (*Colocasia esculenta* Schott.), nali bhaji (*Ipomoea aquatica* Forsk.), podina (*Mentha arvensis*), dhudi kalmi (*Ipomoea alba* L.), kukur jhwa (*Leea indica* Merr.), dalbhaji (*Portulaca capleracea*), star gooseberry (*Saurops androgyms* Merr.), basna (*Sesbania grandiflora*), chowli or sea shore pea (*Vigna marina* Merr.), makoi (*Solanum nigrum*), sensitive pea (*Smithia sensitiva*), drumstick (*Moringa oleifera* Lamk.), khokli or Indian Acalypha (*Acalypha indica*), elephant earn fern or khadibauji (*Acrosticum aureum*), ramdatan (*Smilax zylnica* L.). bara sem (*Canavalia cathartica*) (Sreekumar *et al.*, 1986, Shridhar and Sharma, 1991).

3. Cultivated and wild food crops (cereals)

These constitute the main food items of the populace. It comprised variety of grains such as (i) cereals (ii) pulses (iii) millets.

The cereals are mainly grown in two crop seasons, i.e., rainy season (June to Oct.) and dry season (Nov. to May). The main cereals grown are rice (*Oryza sativa* L.) and maize (*Zea mays* L.). An endemic and wild relative of rice (*Oryza andamanica*) existing in forests of Andaman is under capitative research for the improvement and plant breeding programme. (Ellis, 1987; Ram and Ansari, 1991). The millets and small millets include mandava (*Eleusine coracana* Goertn.), jowar (*Sorghum vulgare* Pers.). In these islands, pulses and legumes are major source of proteins. These are urd, blackgram or mah (*Vigna mungo*), mungo or greengram (*Vigna radiata*), french bean or rajmah (*Phaseolus vulgaris*), horsegram (*Macrotyloma uniflorum* L.), cowpea (*Vigna unguiculata*), ricebean (*Vigna umbellata*), moth (*Vigna acontifolia* Jacq.), arhar/redgram (*Cajamus cajan*) (Gangwar *et al.*, 1990).

Tribal food

Since the tribals of Andaman and Nicobar Islands (Jarawas, Nicobarese, Andamanese, Onges, and Shompeans) are not cultivating pulses and cereals in the field, there are numerous wild food plants used by them. The important plants having more significance in their daily food are:

Bulbs of *Dioscorea glabra*, tubers of *Colocasia esculenta* and *Tacca leontopetaloids*, fruits of *Morinda citrifolia, Nypa fruiticans, Syzygium samaragense, Anona squamosa, Pandanus lerum, Artocarpus incisa, A. integrifolia, baccaurea sapida, Champereia griffithiana, manikara litoralis, Pommetia pinnata, Salacia chinensis, Semicarpus kurzii, Ardisia solanacea, Calamus* spp., *Citrus* spp., *Terminalia catappa, T. manii* and stems of *Flagellaria indica, Celosia argentea, Ipomoea aquatica, Acacua sinuata, Acalypha indica, Alternenthera sessile, Amaranthus spinosa, Areca triandra, Bauhinia purpuea, Blechnum orientale* L., *Callicarpa arborea, Cassia fistula* and *Celosia argentea* etc.

4. Oilseed crops

The farmers of Andaman and Nicobar generally use vegetable oil in various culinary preparations. These include ground nut (*Arachis hypogaea*), sesamum/til or mitha tel (*Sesamum indicum*), sarson (*Brassica campestris*), sunflower (*Helianthus annuus*), coconut (*Cocos nucifera*), oil palm (*Elaeis guineensis* Jacq.) and castor (*Ricinus communis*).

5. Plantation and spice crops

The diverse and typical tropical and humid climate of these islands are highly suitable for growing many plantation and spice crops. The cultivated plantation crops include an imperessive range of high returning crops like coconut (*Cocos nucifera*), arecanut (*Areca catechu*), cashewnut (*Anacardium occidentale* L.), oilpalm (*Elaeis guineensis* Jacq.) while cultivated spices include black pepper (*Piper nigrum* L.), cinnamon (*Cinnamonum zeylanicum*), nutmeg (*Myristica fragrans*), tejpatta/bay leaf (*Cinnamomum verum*),

ginger (*Zingiber officinale*), clove (*Eugenia caryophallata*), coriander (*Coriandum sativum*), turmeric (*Curcuma domestica*). Besides these cultivated species of plantation and spice crops, quite a number of wild relatives of these crops also exist in these islands. Some of these included: wild arecanut (*Areca triandra*), wild nutmeg (*Myristica andamanica, M. glabra, M. glaucescens, M. nicobarica*), *Vanilla andamanica,* collections of wild betle vine (*Piper betle*), wild ginger (*Zingiber odoreferum, Z. spectabile, Z. squarrosum, Z. zerumbet*) (Ellis, 1998; Singh *et al.*, 1998).

6. Wild and exotic orchids

Orchidaceae is one of the largest families of the flowering plants in the islands; nearly 110 orchids are naturalized here. These islands are rich in the stock of orchids available in the wild species; many a wild species, due to their beauty and other blossom characters, stand out conscpicuously as competitors with best hybrids. The native orchids having horticultural and commercial value are : *Cymbidium aloifolium*, SW, *Bulbophyllum lepedium* (BL) J.J. Sm, *Dendrobium secundum* (BL) Lindl., *Denodrobium formosum* Roxb., *Eria andamanica* Hook F., (Tooth brush orchid *Geodorum densiflorum* (Lam.), Schltr., *Malleola andamanica* Balakr. and Bharg., *Philodota imbricata* Lindl., *Rhynchostylis retusa* Bl., *Vanilla andamanica* Rofle. (Rao and Srivastav, 1996).

The introduction of exotic orchids in these islands is very recent. However, Cattleya wine festival, *Dendrobium* hybrids, *Vanda* Miss Joaquim, *Aranda* Peter Wart, *Vanda* Jhon Clubb, *Arachnis* Maggie- oei, *Epidendrum* (Holly cross), *Arundina graminiflora* etc have been successfully introduced in CARI, Port Blair (Sharma *et al.*, 1997).

7. Cultivated and wild aromatic and medicinal plants

Large scale ad true cultivation of aromatic and medicinal plants in these islands is not being done. However, due to suitability of climatic conditions and population of diverse culture and tradition, few of the crops of aromatic and medicinal use are being cultivated on very small scale and to kitchen garden level. The important ones are citronella (*Cymbopogon winterianus* Jowitt.), coriander (*Coriandum sativum* L.), *Dioscorea* spp., jasmine (*Jasminum grandiflorum*), vetiver (*Vetiveria zizanoides* L.), lemon grass (*Cymbopogon flexuosus* Sted Wats), periwinkle (*Catharanthus roseus* L.), sarpagandha (*Rauvolfia serpentine* Benth. Ex. Kurz.), tuberose (*Polianthus tuberosa*), podina (*Mentha viridis*), dhania (*Eryngium foetida*), betle vine (*Piper betel*), tulsi (*Ocimum sanctum, O. basilicum*), champak (*Michelia champaka*), vanilla (*Vanilla fragran*), rose (*Rosa chinensis*), palmarosa (*Cymbopogon martini* var. motia), tejpatta (*Cinnamomum verum*), Euclyptus (*E. citriodora*)

Now-a-days ethnomedicinal botany has been attracting researchers of various desciplines all over the world. It is the inter-desciplinary approach of ethnobotany which deals not only with the plants, used for medicinal purposes but also with socio-economic attributes of particular plant. Rural and tribal people of these islands use plants not only as herb but also in different modes of life for their socio-economic benefits. The rural and tribal people consume a large number of plant species for cure of various diseases and disorders. These plant species having medicinal value are : *Adenia penengiana, Adenostemma lavenia, Aerva lanata, Ageratum conyzoids, Alstonia macrophylla, Alstonia kurzii, Ardisia solanacea, A. oxyphylla, Aristolochia tagala, Blumea balsamifera, Caesalpinia* sp., *Callicarpa longifola, Calophyllum inophyllum, Cassia alata, C. occidentale, Catharanthus roseus, Celosia argentea, Claoxylon indicum, Clerodendron inerma, C. viscosum, C. paniculatum, Cordia grandis, Costus speciosus, Crateva religiosa, Cycas rumphii, Desmodium umbellatum, Dischedia major, Dracaena angustifolia, Eclipta alba, Eria bractescence, Euphoria atoto, E. hirta, Garcinia nervosa, Globa marantia, Glycosmis arborea, Hydyotis biflora, Hibiscus tiliaceus, Gloriosa superba* and *Cassia alata*

(Awasthi and John, 1987; Dagar, 1989; Yoganarasimhan *et al.*, 1983; Anonymous, 1994).

Conservation

The insular species are generally characterised by a small gene pool, reduced interspecific competition, inbreeding and small population size by virtue of which they are more vulnerable to extinction due to habitat destruction. Bay islands being no exception to this, conservation of rare and threatened endemic species as well as exotic and introduced species has become inevitable for ensuring the preservation of species diversity. With the increasing population beyond carrying capacity and recent developmental activities in inhabited islands, several economically important species needs first hand attention for proper handling and timely conservation.

The island ecosystem is one of the fragile system in the world, with unique functions and roles in the context of biodiversity. The wide variety of palnts in island ecosystem has supported human existance and contributed to our well being. The interactions between the island people, tribals and natural system have helped in maintaining richness of the species, communities and genetic materials in both production system and wild landof island environment. However, the rich bio diversity of these islands is being impoverished disastrously along with the over all degradation of island environment due to human actions in last few decades. This fundamental natural wealth is disappearing and the process must be slowed and haltered without delay. Conservation of biodiversity calls for both global attention and promot action at the regional level. Many indigenous societies ahve formulated and established their own traditional conservation methods, including the protection of plants. Apart from other activities CARI has been actively involved in collection, conservation and multiplication of this rich natural wealth having food, fruit, vegetable, spice and medicinal values. Various *in situ* and *in vitro* programmes under various institutional and external funding projects like NATP, ICAR Cess fund, DBT programmes for conservation of bio diversity of islands are being carried out for the last few years.

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