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Medicinal Plants Used by Tribes of Andaman and Nicobar Islands: A Conservation Appraisal

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The present study was conducted to document the indigenous healthcare knowledge of tribes (*Nicobarese*, *Shompens*, *Jarawas*, *Onges*) inhabiting the Andaman and Nicobar group of Islands. Among these, *Nicobarese* use very high number of plant species as medicine. They collect them from surrounding natural habitat but many of these are becoming endangered. Out of these, 39 species belonging to 38 genera under different families are found to be endemic and their population is dwindling sturdily. Of these 17 species were used for curing multiple ailments, 8 species for intestinal disorders, 8 species for malarial fever, four species for 25 families asthma and cough related ailments, and one species each for cancerous blisters, arthritis and allergic ailments. The biochemical activities of these species are worth investigating. Measures of conservation have also been discussed in the present communication. Phytogeography of these species is worth studying to implement management practices for conservation.

Key Words: Andaman & Nicobar Islands, Conservation, Endemic, Medicinal plants, Tribes

Introduction

The Andaman and Nicobar Islands by virtue of unique climatic factors and location are considered as one of the hotspots of the world's biodiversity. Situated between the two major biodiversity hotspots namely the Indian sub-continent and the Malaysia-Indonesian region it is hardly surprising that the islands manifest biodiversity of extraordinary range within a limited geographical area. These islands are situated close to equator and exposed to the oceanic impacts having the tropical humid climate with the temperature ranging between 18^{o}C to 35^{o}C. About 84.4% of the total geographic area of Andaman and Nicobar Islands is under the forest cover. Of the total forest cover, 42.1% area is covered with dense forest, 34.1% by moderately dense forest, and 8.2% by open forest while mangrove constitutes 9.6% of total area (Sankaran *et al.,* 2015). The vegetation pattern includes coastal littoral, mangroves, island deciduous and evergreen forests. Floristically, there are 2654 species belonging to 1083 genera and 237 families. Out of these, 308 species are endemic. The island's tropical forests represent nature's major storehouse of chemicals and pharmacodynamic compounds used in perfumery, cosmetics and pharmaceutical industries. The forest resource of the islands has rich repository of biodiversity of medicinal plants representing a great emporium of ethnobotanical wealth which is the treasured knowledge of six different aboriginal tribes *viz*., *Nicobarese*, *Shompens*, *Jarawas*, *Sentinels*, *Onges* and *Great Andamanese* and *Karen* tribes, latter brought by British from Myanmar and Thailand border areas, settled in North Andaman. Tribals depend completely on forest for their daily needs and also use several plants as medicine. Unfortunately, the traditional healing systems and knowledge of these aboriginals have been largely eroded along with its natural resources, because of the lack of enough support and recognition, as well as the rapid destructions of their habitats through a series of unsustainable developmental activities. The human population is also increasing at an alarming rate and has already crossed island's carrying capacity (Abirami *et al*., 2012). The IUCN has proposed a Medicinal Plant Specialist Group (MPSG) aiming to preserve genetic resources of medicinal plants world over, to promote sustainable utilization of medicinal plants and to raise awareness in the public about the need of conservation of medicinal plants. The folklore medicinal uses of the tribes except for the Sentinels have been documented

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by various workers (Chander *et al.,* 2015a; Chander *et al.,* 2015b; Gupta *et al.,* 2004; Dagar and Dagar, 1996; Dagar and Dagar, 1992; Dagar and Dagar, 1991; Dagar, 1986). There exists wide biodiversity in the distribution of medicinal plants in the island and there are about 71 medicinal plants which are endemic to this island (Dagar and Dagar, 1991). The complete ethnomedicinal uses of the plants by the different tribes of the island are worth to be documented. The bioresources of the medicinal plants are to be conserved and used in a sustainable way as these resources are harvested by the island aboriginals from wild for treatment of their ailments. Study of biogeography of at least some of these species could be useful for further management practices. Hence, a serious attempt needs to be made for the conservation and sustainable use of medicinal plants keeping in view the present situation.

Materials and Methods

The present study was aimed to document the indigenous healthcare knowledge of various tribes of the Andaman and Nicobar Islands. The documented ethnobotanical information of this area was compared with the information on biodiversity and conservation of medicinal plants recorded by various workers (Watt, 1890; Kloss, 1902; Chengappa, 1953; Chak, 1967; Sangal, 1971; Singh, 1975; Bhargava, 1983; Dagar, 1986, 1987, 1991; Dutta *et al*., 1985; Chakraborty & Vasudevarao, 1988; Sreekumar, 1993; Sinha and Rao, 1996; Abirami *et al.*, 2012). In 2013-14, the first author had an opportunity to consolidate most of the research work carried out on medicinal plants in these islands. The third author had an opportunity in recording first-hand information from tribals for his research. The present status of ethnobotanical studies conducted on island flora is presented here as determined by application of International Union for Conservation of Nature (IUCN) conservation categories and criteria (IUCN, 2011).

Results and Discussion

The endemic taxa of these islands comprise 308 species belonging to 187 genera and 74 families. The degree of endemism is estimated to be 10% of the total flora. However, a total of 308 endemic taxa occurring within a small geographical area of 8,249 sq. km. is a significant feature of this peninsular flora (Pandey and Diwakar, 2008). Out of the 64 species which are listed by IUCN under the category of threatened plants, 43 species has been reported as endemic taxa of medicinal plants by Pandey and Diwakar (2008). Thirty nine species belonging to 38 genera under 25 families were found to be rare, threatened, endangered and endemic medicinal plants used by four tribes of Andaman and Nicobar islands and *Karens*, and presented alphabetically in Table 1. Out of these, 10 species are found only in Andaman group of islands, five in Nicobar group of Islands and 24 in both groups of islands. This consists of 16 trees, 11 climbers, 7 herbs and 5 shrubs. Pandey and Diwakar (2008) have also reported 43 endemic species of medicinal plants in the islands.

Ophiorrhizia nicobarica is one of the highly threatened herbs found to have analgesic and anti-inflammatory properties because of presence of biochemical active alkaloids harmalin (Chattopadhyay *et al*., 2007). Detailed work on bioactive compounds has been done by experimenting with lab animals, mice and rats (Chattopadhyay *et al*., 2007). Such work should be taken up in some more species like *Strobilanthes andamanensis* (herb), *Semecarpus kurzii* (tree), *Aristolochia tagala* (climber) and *Dioscorea vexans* (climber).

Seventeen species have been used by these tribes for curing multiple ailments (Table 1). The biochemical active compounds of these species will be of much interest to researchers. *Semecarpus kurzii*, *Alstonia kurzii*, *Aristolochia tagala*, *Myristica andamanica*, *Hedyotis paradoxa*, *Ixora grandifolia* var. *kurziana*, *Glycosmis pentaphylla*, *Lepisanthes andamanica*, *Manilkara littoralis*, *Cyrtrandroemia nicobarica*, *Amomum fenzlii* and *Kaempferia siphonantha* have been used against fever, malaria etc., because most of the time tribal people suffer from fever in these islands. They survive mainly because of application of traditional knowledge associated with these species. Therefore, further research is needed to identify some new molecules to be used in new drug formulations.

Leaves in 31 species, roots in 13 species, seeds in 7 species, bark in 6 species, fruits in 4 species, flower and all parts in 2 species are used for treatment of many diseases (Table 1). This shows that in many species large quantities of leaves are harvested for drug preparation. Roots of as many as 13 species are used for drug preparation; this destructive harvest could reduce the population, thus causes genetic erosion. Barks of six species are removed for drug preparation may also cause death of the plant.

Table 1. Endemic, Rare and Endangered Medicinal plants used by the tribals of Andaman and Nicobar Islands

S. No.	Family	Name	Habitat		Habit	Local name	Used by	Parts used	Ailment	Remarks
			A	N						
1	Acanthaceae	*Strobilanthes andamanensis* Bor	A (E)		Herb		Nicobarese	Leaves	Blood in urine, asthma, cough, bronchial complaints/ abortifacient	
2	Anacardiaceae	*Semecarpus kurzii* Engl.	A	N (E)	Tree	Pep (N) Jugane (O)	Nicobarese, Shompens	Leaves, seeds, fruits.	Injury, malaria fever, allergy, eruption, blisters, cancerous	Pericarp contains acrid juice. Trees with large leaves and orange red fruits seated on fleshy receptacle
3	Annonaceae	*Artabotrys nicobarianus* D. Das	A	N (E)	Climber		Nicobarese	Leaves, bark, seeds.	Stomach pain, fever	
4	Annonaceae	*Orophea katschallica* Kurz	A	N (E)	Tree	Tapilei-alo (N) Tonyoge (O)	Nicobarese	Leaves	Body ache	Used a bee repellent by the tribes
5	Annonaceae	*Uvaria andamanica* King	A (E)		Tree		Nicobarese	Leaves, flowers	Intestinal disorder	Flowers yellow, purple or brown.
6	Apocynaceae	*Alstonia kurzii* H.f.	A	N (E)	Tree	Tacho-roi (N)	Nicobarese Shompens	Leaves, bark, root	Fever, wash uterus after child birth, cure blood clot, internal haemorrhage, malarial fever	Many species of *Alstonia* have medicinal properties and used against treatment of malaria.
7	Arecaceae	*Calamus andamanicus* Kurz A.		N (E)	Climber	Mottabet (N)	Jarawas Nicobarese	Leaves	Used in making shafts.	Stem is used for making baskets
8	Arecaceae	*Daemonorops manii* Becc. & H.f.	A (E)		Tree	Tamoyen (O)	Onges	Leaves, root	To protect female genitals	Vegetative shoot apex is used for medicinal purpose
9	Aristolochiaceae	*Aristolochia tagala* Cham.	A	N	Climber shrub	Kom (N) Punkot (N)	Nicobarese, shompens	Root	Stomach pain, chest pain, fever, poultice in abdomen, skin disease, snake bite, malaria, dyspepsia, flatulent, colic and tonic	Root decoction is used for consumption
10	Dichapetalaceae	*Dichapetalum gelonioides* (Roxb.) Engl. subsp. *andamanicum (*King) Leenh.	A (E)				Shompens	Leaves	Asthma, cough, fever, Shompens use the juice of stem as drinking water	
11	Dioscoreaceae	*Dioscorea vexans* Prain & Burkill.	A	N (E)	Climber	Getti	Nicobarese	Tubers	Arthritis, asthma, eczema, chronic cough, diarrhoea, diabetes, regular metabolic activity	Genus *Dioscorea* is known for the presence of diosgenin which is useful in population control
12	Euphorbiaceae	*Drypetes andamanica* (Kurz) Pax & K. Hoffm.	A (E)			Toirulelu	Onge	Leaves	Chest pain	Used as an antidote for snake bite
13	Euphorbiaceae	*Glochidion calocarpum* Kurz	A	N (E)	Small tree	Angchongsi (N)	Nicobarese, Shompens	All parts	Skin disease, fever, intestinal disorder (diarrhoea and dysentery), febrifuge, wounds, domestic animal diseases	Male flowers with short pedicels, female flowers in clusters, flowers yellow
14	Euphorbiaceae	*Phyllanthus andamanicus* Balakr. & Nair	A (E)		Tree	Dadaura	Nicobarese	Leaves	Leaves are used for diuretic problem	Plant contains alkaloids, flavonoids and triterpenes.

A-Andaman Islands; N-Nicobar Islands; E-Endemic; R-Rare

S. No.	Family	Name	Habitat		Habit	Local name	Used by	Parts used	Ailment	Remarks
			A	N						
15	Hippocrateaceae	*Hippocratea andamanica* King	A (E)		Climber			Root	Ringworm, post-natal, rheumatism	Large climber with small greenish flowers in axillary cymes
16	Icacinaceae	*Codiocarpus andamanicus* (Kurz) R.A.Howard	A	N (E)	Tree	Kamarang	Nicobarese	Leaves	Renovating agent, applied on enlarged scrotum of children	Large tree with whitish longitudinally grooved fruits
17	Loganiaceae	*Strychnos andamanensis* Hill		N (E)	Climber	Lansot	Nicobarese	Leaves	Urinary troubles, constipation, stomach ache related problems	The leaves are pounded and wrapped in a piece of cloth which is dipped in boiling water, the decoction thus prepared is drunk
18	Leeaceae	*Leea grandifolia* Kurz		N (E)	Shrub	Takteyu (N)	Nicobarese	Leaves	Abdominal pain, intestinal disorders	Leaf juice taken internally
19	Asparagaceae	*Asparagus racemosus* Willd.	A		Herb	Kanyaplur/ Kanyammur (K)	Karens	Root	Jaundice	Paste of fresh root with sugar candy diluted with water taken for seven days
20	Myristicaceae	*Knema andamanica* (Warb.) de Wilde subsp. *andamanica*	A (E)		Tree		Nicobarese	Leaves seeds and root	Dysentry, mouth sores, indigestion, diarrhoea	Trees with pubescent leaves, fruits small, sub-globose and tomentose
21	Myristicaeae	*Myristica andamanica* Hook.f.	A	N (E)	Tree	Kinhanmo	Nicobarese	Fruits and leaves, seed, bark	Fever, malaria, stomach trouble	Aqueous extract of the nuts is taken by Nicobarese in stomach trouble. The powder of roasted fruit is mixed in ripe seed oil and applied on the body.
22	Myristicaceae	*Maesa andamanica* Kurz		N (E)	Shrub		Nicobarese, Shompens	Leaves, root	Skin disease	Straggling shrubs with white flowers
23	Passifloraceae	*Adenia penangiana* (Wall. ex.G.Don) de Wilde	A	N	climber	Tincham (N)	Nicobarese	Leaves, flowers, seeds	Body pain, chest pain	Twinner with yellow flowers
24	Rubiaceae	*Ophiorrhizia nicobarica* Balakr.		N (E)	Herb		Shompens	Leaves	Wounds	Herbs with large white flowers
25	Rubiaceae	*Hedyotis paradoxa* Kurz	A	N (E)	Herb		Nicobarese	Leaves	Fever, cuts, wounds	Leaves sessile, flowers dense in cyme
26	Rubiaceae	*Ixora grandifolia* Zall. & Mor. var. *kurziana* (Teysm. & Binn.) H.f.		N (E)	Shrub	Sinkoh	Nicobarese	Leaves	Fever, delivery, stomach ache	Glabrous shrubs with fragrant white flowers in cyme
27	Rubiaceae	*Lasianthus andamanicus* Hook.f.	A	N (E)			Onge	Leaves	Antidote	
28	Rubiaceae	*Psychotria platyneura* Kurz	A	N (E)	Shrub	-	Shompens		General health problem	Rare and endemic
29	Rubiaceae	*Psychotria andamanica* Kurz	A	N (E)	Shrub	-	Nicobarese, Shompens	Leaves bark, root	Body pain, chest pain, general health complaint	Large shrubs with shortly pedicelled flowers in cymes
30	Rubiaceae	*Tarenna weberaefolia* (Kurz) Balakr.	A	N (E)	Tree	-	Nicobarese	Leaves	Skin disease	Small tree with simple leaves and white flowers

A-Andaman Islands; N-Nicobar Islands; E-Endemic; R-Rare

S. No.	Family	Name	Habitat		Habit	Local name	Used by	Parts used	Ailment	Remarks
			A	N						
31	Rutaceae	*Glycosmis pentaphylla* (Retz.) DC.	A	N (E)	Tree		Onge, Nicobarese	Leaves and roots	Fever, snake bite	Unarmed small tree with 3-5 foliate leaves. Roots contain glycosmin
32	Sapindaceae	*Lepidopetalum jackianum* (Hiern.) Radlk.	A	N (E)	Tree	Lamang	Nicobarese	Leaves, bark, root	Conjunctivitis, bath the children to keep them healthy, joint pain	Hut posts, pig trays and fuel are obtained from its wood by Nicobarese. Twigs are used to handle earthen pots on fire during the process of making them pucca which is special art of the Chowra Islanders .
33	Sapindaceae	*Lepisanthes andamanica* King	A	N (E)	Tree	Tong-kal	Nicobarese	Whole plants	Fever, cough	Branches purplish brown to light silvery with many-flowered-panicles
34	Sapotaceae	*Manilkara littoralis* (Kurz) Dubbard	A	N (E)	Tree	Tengevaka (O)	Onge, Nicobarese	Leaves, fruits, bark	Delivery problem, fever	Bark yields a red dye. Fruits are edible.
35	Scrophulariaceae	*Cytandromoea nicobarica* Balakr.	A	N (E)	Herb			Leaves	Jungle fever	Flowers white in clusters, fruits enclosed by calys, seeds numerous
36	Sterculiaceae	*Sterculia parviflora* Roxb.	A	N (R)	tree	Tosamu, Kantisembal,	Nicobarese	Leaves, seeds, fruits	Injury	Small tree with velvetty fruits and black seeds
37	Vitaceae	*Tetrastigma andamanicum* (King) Suess. ex Suess.	A	N (E)	Climber			Leaves	Poultice of leaves applied to boils	Large climbing shrub
38	Zingiberaceae	*Etlingera fenzlii* (Kurz) Škornick. & M.Sabu	A	N (E)	Herb	Jungli adhrak Hami (N)	Shompens Nicobarese	Rhizome	Stomach disorders, fever ; juice of rhizome used in cough, fever, respiratory disorders and skin diseases	Perennial rhizomatous herb with many flowers in spike; common in Great Nicobar Islands
39	Zingiberaceae	*Kaempferia siphonantha* King ex Baker	A (E)		Herb	Cekur	Onge	Rhizomes	Fever, stomach pain	Widely distributed in Little Andaman and South Andaman

A-Andaman Islands; N-Nicobar Islands; E-Endemic

All these plants are medicinally important and used in cure of various ailments. Some of the important medicinal plants *viz*. *Dioscorea vexans* is used in the treatment of blood in urine, asthma and as abortifacient; *Strobilanthes andamanensis* in malarial fever; *Semecarpus kurzii* in cancerous growth, arthritis; and *Aristolochia tagala* for diabetes. Urgent conservation measures need to be taken up to increase their population in native habitat and also helpful in testing biochemically for use in new drug formulations, as these plants are being used for many generations by the aborigines in the treatment of various ailments.

The phytogeographic studies of these 39 species pinpoints to the population dynamics of this genetic wealth in tropical Andaman and Nicobar forests.

Conservation Status

The role of plants, in traditional medicinal floras has been overlooked in most areas in terms of conservation. The ethnomedicinal plant diversity can be scored as locally threatened using the IUCN Categories and Criteria (IUCN 2011). In recent years ethnomedicinal plant diversity of these islands in general is threatened due to natural disaster as well as rapid increase in population and various anthropogenic activities. Hence, there is immediate need to help conserve the existing species.

India has one of the oldest, richest and most diverse cultural traditions associated with the use of medicinal plants. This is also true with Andaman and Nicobar tribes. *Alstonia kurzii* (syn. *Alstonia scholaris*) entered IUCN red data list of threatened species therefore its conservation should be taken up as early as possible by utilizing recent advances in propagation like tissue culture and cryopreservation techniques for increasing the plant population and enriching the habitat. This particular species yields a bitter tonic and expectorant aphrodisiac.

Importance and Need for Conservation

It has been estimated that 75.90% of the rural people in the world, rely on herbal traditional medicine for their primary health care. Consequently, there is a growing interest in medicinal plants and traditional health systems. However, with the increasing use of medicinal plants and also with the accelerating destruction of natural resources, it is evident that the exploration of medicinal plants must be accompanied by conservation measures to preserve their genetic resources and to assist the rural people who have the most direct relation to the utilization of medicinal plants.

Medicinal plants are a major but neglected group of plants for which conservation is a priority. The last few decades have witnessed an unprecedented deforestation resulting in habitat loss and species depletion in tropical countries including India. Depletion of these genetic resources has resulted in significant losses, particularly in the economic productivity and this has already started reflecting in health care services and other plant based industries of biodiversity-rich developing countries.

There is an urgent need to have conservation strategies in Andaman and Nicobar islands. The traditional knowledge on the six ethnic tribes and of *Karens* of these islands should be tapped before it is vanished. This ethnomedicinal wisdom is now fast disappearing due to habitat alteration, urbanization, industrialization etc. Conservation on the rare medicinal plants of these islands should be the top-priority action for the authorities of this territory. Development of conservation strategies for threatened or endangered plants and specific projects needs to be submitted for funding by the appropriate organizations which will help in identifying the plants at risk. For ex-situ conservation field gene banks or herbal gardens needs to be established for saving endemic medicinal plants of Andaman and Nicobar islands. Besides, Medicinal Plants Conservation Areas (MPCA) and ethnobotanical conservation parks in various biodiversity rich sites should also be established.

The 'Green Health Campaign' should be initiated to promote the use of medicinal plants by rural people through nurseries. Villagers should be encouraged to procure seedlings from nearby farms and grow them in their kitchen garden, backyards as fields etc. Such gardens should be planned in Car Nicobar Island and Rutland Island for Nicobar group and Andaman group respectively.

Recommendations

To achieve this goal, the following suggestions and proposals should be implemented in future, to have a complete data on medicinal plants, their bioactive principles, validation of tribal medicine of the island along with their conservation measures.

Phytogeographic studies with special reference to endemic, endangered, rare medicinal plant species

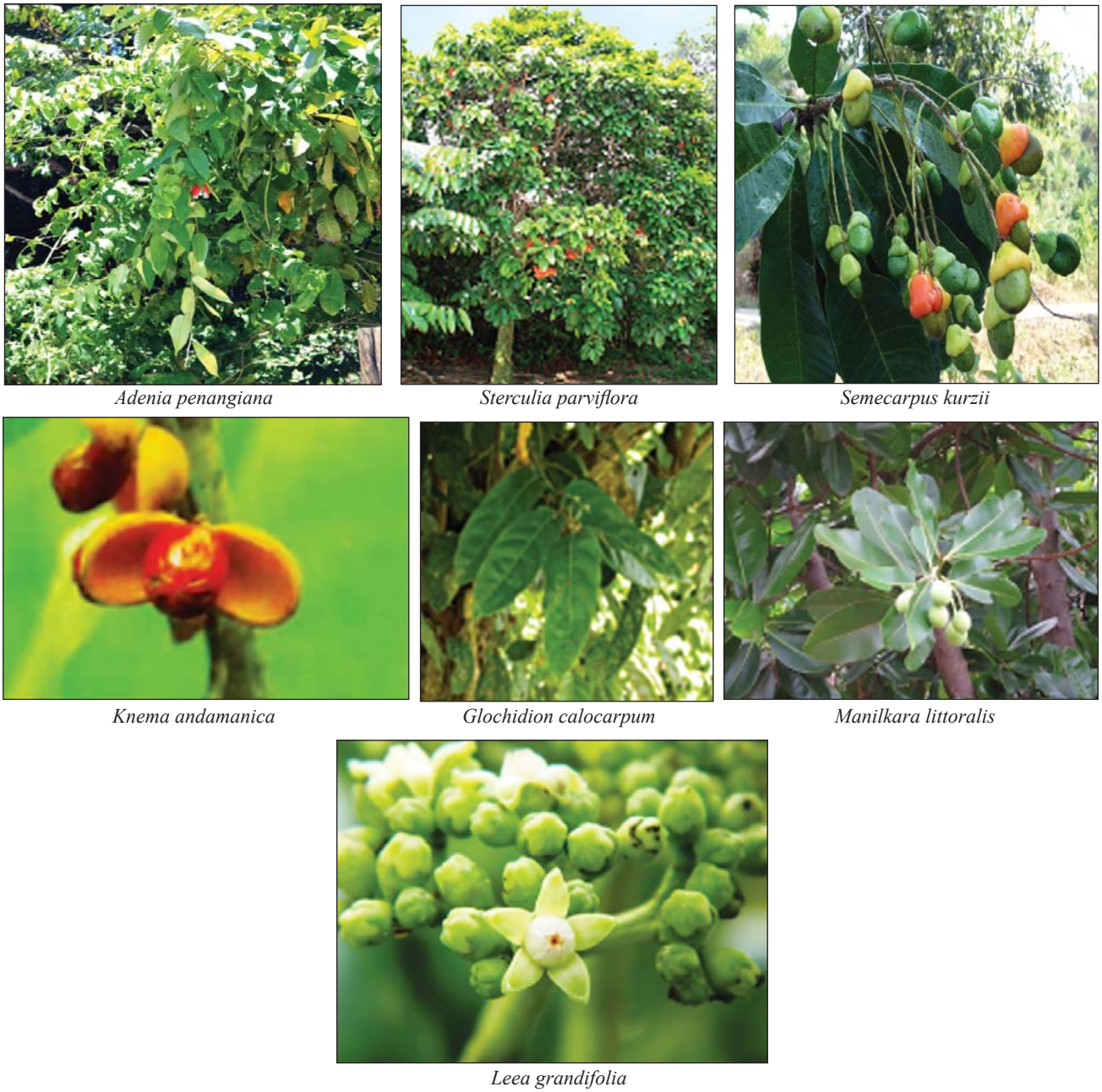

Fig. 1. Some endemic medicinal plants used by tribes of Andaman and Nicobar islands

should be taken up in Andaman and Nicobar islands for conservation and management planning.

Formulate a multidisciplinary, multi-institutional and action-oriented research programme to develop strategies for conservation of traditional life, knowledge system and resources utilization pattern by the tribals. More focus should be given on the under-explored areas/tribes for ecologically sound and economically sustainable utilization of local resources.

A network on the database of medicinal plants used by tribes of Andaman and Nicobar Islands should be developed for updating/reviewing the existing literature.

Survey and documentation of ethnomedicinally important plants should be carried out especially among the primitive and less-known tribes like *Shompens*, *Onges*, *Jarawas* and *Sentinelese* (if possible) etc. and their safety and efficiency needs to be tested for validation of claims.

MPCA and ethnomedicinal plants gardens could be set up, at least and one each in the settlement areas of *Onges*, *Nicobarese*, *Shompens*, *Great Andamanese* and *Karens*. This would help them in the conservation and sustainable utilization of the natural resources in their own surroundings. To start with, it is suggested that the medicinal plant gardens should be established at Dugong Creek for *Onges*, at Strait Island for *Great Andamanese* at Great Nicobar, near Campbell Bay National Park for *Shompens*, one each at Car Nicobar and Teressa in the Nicobar group of islands for *Nicobarese*, one in North Andaman at *Karen* community settlement.

Germplasm collections of medicinal plants in these islands could take up in network mode in collaboration with ICAR-National Bureau of Plant Genetic Resources, New Delhi, Directorate of Medicinal and Aromatic Plants Research, Anand, Botanical Survey of India (BSI), Central Island Agricultural Research Institute (CIARI), and Regional Medical Research Centre (RMRC) Departments. CIARI can liaison with the A&N Agriculture Department for the multiplication and distribution of medicinal plants to the tribal farmers/ users.

Creation of two divisions (Ethnopharmacology and Phytochemistry), either in CIARI or in RMRC would be helpful to study pharmacological and toxicological actions of plant derived-drugs and their formulations. Phytochemistry will be carried out to study the active constituents and validation of tribal claims, formulate new drugs and to do phytochemical screening to find out therapeutic efficacies, safety, etc.

For micro-propagation of medicinal plants, a cryo-preservation unit, field genebank etc. should be set up preferably in CIARI.

'Field Gene Banks' needs to be established mainly for 'betel vines' (in Great Nicobar) 'wild gingers' (in Rutland), wild species and aromatic plants (in Dhanikari) and wild mangoes (in Chidiatapu and Mt. Harriet).

Eco-rehabilitation and genepool development of selected endangered/threatened medicinal plants can be carried out. Medicinal plant conservatory can be set up with all modern amenities such as glasshouses/ greenhouses, net house etc. Bonsai (trees in trays) on rare/endangered medicinal tree species could be displayed in the conservatory. This miniature/dwarf plants would represent huge tree species of medicinal value, which are scattered in the interior forest of these far flung islands. It would aid to study and understand, to a certain extent, the morphological and other features of trees pooled out in a minimum space, helping scientists/ researchers /nature-lovers who get seldom opportunities to study them in nature due to lack of sufficient time and inaccessibility of their original habitats.

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