Genetic Resources of Spices and their Conservation in Bay Islands

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The vegetation cover and forests of our country offer a great diversity of flora, of which the Andaman - Nicobar phytogeographic zone is one, whose flora is interesting and remarkable due to the tropical humid climate and insular nature of the territory. Out of 2,500 species of flowering plants occurring in these islands, about 11 per cent are endemic and another 11 per cent are economically important or useful to mankind. In addition to cultivated spices (black pepper, clove, cinnamon, nutmeg, ginger, chilli and turmeric), wild relatives of spice crops also exist in the fragile island ecosystem. The important genera include *Alpinia, Amomum, Costus, Curcuma, Garcinia, Globba, Hedychium, Kaempferia, Myristica, Piper, Vanilla* and *Zingiber,* of which the maximum diversity is present in the genera *Piper, Zingiber, Garcinia* and *Myristica*. Due to over-exploitation of natural resources, some of the endemic species of these islands are under the threat of extinction. Concerted efforts have already been initiated to conserve the valuable genetic resources of spices for posterity.

Key Words: Bay Islands, Andaman and Nicobar Islands, Conservation, Germplasm, Status, Spices

India is known as 'Land of Spices' to the world. Out of 109 spices listed by the ISO (International Organization for Standardization), about 60 spices are cultivated in India. India is homeland for black pepper and cardamom and secondary centre of origin for cinnamon. India is a major producer for many of the spice crops.

The vegetation cover and forests of our country offers great diversity of flora, of which Andaman-Nicobar phytogeographic zone is one, whose flora is interesting and remarkable due to the tropical humid climate and insular nature of the territory. The Andaman and Nicobar archipelago consisting of about 572 islands, islets and coral reefs, lies in the Bay of Bengal between the latitude of 6° -14°N and 92°-94°E longitude. It is also called Bay Islands. General climatic condition is that of warm and humid tropics with temperature ranging from 22° to 32° C. Mean relative humidity is about 82 per cent with average rainfall varying from 3000-3500 mm.

These islands are unique treasure of beauty and biodiversity with about 86 per cent under forest cover of the total geographical area. These islands harbour 2500 species of flowering plants of which about 11 per cent are endemic and another 11 per cent are economically important or otherwise useful to mankind. Over 150 species of wild relatives of crop plants are reported to occur in this archipelago (Sreekumar, 1997).

Materials and Methods

Botanical explorations were conducted over a period of three years in the forest floor of Andaman and Nicobar group of Islands and information gathered from the tribal groups/local people and literature. An attempt has been made to compile and document the genetic resources of spices with respect to its status, extra-Indian species, utilization and conservation.

Results and Discussion

Status: A wide range of diversity exists in the spices in the form of varieties/cultivars/improved varieties, species and related taxa in the bay islands (Tables 1 and 2). The spice crops that are mainly grown/cultivated in bay islands are black pepper (450 ha), ginger (390 ha), chilli (252 ha), clove (95 ha), cinnamon (53 ha), turmeric (38 ha) and nutmeg (21 ha). Spice crops are cultivated in an area of around 50,000 hectares

Table 1. Status of genetic resources of spices in Andaman and Nicobar Islands

Crop	No. of accessions			
	Wild and related species	Cultivated species/ varieties	Exotic species/ varieties	Total
Black pepper	8	14	–	22
Cardamom	3	–	–	3
Ginger	16	13	4	33
Turmeric	3	2	–	5
Nutmeg	7	1	–	8
Clove	3	1	–	4
Cinnamon	4	1	–	5
Garcinia	10	–	–	10
Bay leaf	–	1	–	1
All spice	–	1	–	1
Tamarind	–	1	–	1
Curry leaf	–	1	–	1
Vanilla	1	1	–	2
Coriander	1	1	–	2

Table 2. Promising germplasm of spices crops cultivated in Andaman and Nicobar Islands

Sl. No.	Crop	No. of germplasm accessions	Varieties/accessions/ species
1	Black pepper	6	*Piper betel* viz., CARI-1 to 6
		14	Varieties – Panniyur-1, 2, 3, 4 and 5, Karimunda, Kottanadan, Sreekara, Subhakara, Panchami, Pournami, P-24, Shimoga, TMV-5
2	Ginger	17	Varieties - IISR-Varada, Rejatha, Mahima, Nadia, Wynad, Jorhat Local, Karakai,, Thing-lai-don, Rio-de-Janeiro, Jamaica, China, Acc. Nos. 204, 35, 27, 3573, 279, 294
3	Turmeric	2	Varieties – GL-Duram III, CLS-22
4	Cinnamon	3	Species –*Cinnamomum cassia, C. burmanii, C. loureirre*

(2001-2002) (Shiva *et al.*, 2003). For many of these crops, wild and related species are found to occur in these islands. The important genera include *Alpinia, Amomum, Curcuma, Garcinia, Globba, Hedychium, Kaempferia, Myristica, Piper, Syzygium, Vanilla* and *Zingiber* (Shiva *et al.*, 2002a). Maximum diversity is represented by *Zingiber* (33), *Piper* (22), *Garcinia* (10), *Myristica* (8), *Curcuma* (5) and *Cinnamomum* (5) (Dagar, 1989; Ellis, 1986; 1988; 1990; Parkinson, 1984; Rao, 1996; Rema and Krishnamoorthy, 2000; Singh *et al.*, 1998; Sreekumar and Ellis, 1990; Subramaniam and Sreekumar, 1998 and Suryanarayana *et al.*, 2001). The status of genetic resources of spices and their related species along with its habit, distribution, status, etc. are enumerated in Tables 1, 2 and 3.

Extra-Indian Species: Apart from this, wild and related taxa of extra-Indian species that are naturalized/introduced such as *Piper clypeatum, P. miniatum, Knema laurina* and *Myristica elliptica* are reported to occur in these islands (Rao, 1996) (Table 4).

Table 3. Genetic resources of spices and related species in Bay Islands

Sl. No	Common/local name	Scientific name	Family	Habit	Distribution	Status
1		*Acorus calamus* L.	Araceae	Herb	Andamans	Introduced
2		*Alpinia manii* King ex Baker.	Zingiberaceae	Herb	Andamans	Endemic
3		*Alpinia phoenicea* Kamph. ex Kurz	Zingiberaceae	Herb	Nicobar Islands	Rare and endemic
4		*Amomum aculeatum* Roxb.	Zingiberaceae	Herb	Andamans	Common
5		*Amomum fenzlii* Kurz	Zingiberaceae	Herb	Nicobars	Endemic
6		*Amomum maximum* Roxb.	Zingiberaceae	Herb	Andamans	Common
7		*Boesenbergia albo-lutea* (Baker) Schl.	Zingiberaceae	Herb	Andamans	Rare and endemic
8		*Boesenbergia pandurata* Roxb.	Zingiberaceae	Herb	Andamans	Rare
9	Bay leaf	*Cinnamomum tamala* (Buch. Ham) Nees & Ebermaier	Lauraceae	Tree	Andamans	Introduced
10	Cinnamon	*Cinnamomum verum* Bercht. & Prest	Lauraceae	Tree	Andaman and Nicobar Islands	Introduced
11		*Cinnamomum obtusifolium* Nees	Lauraceae	Tree	South and Middle Andamans	Rare
12	Coriander	*Coriandrum sativum* L.	Apiaceae	Herb	Andaman and Nicobar Islands	Introduced
13		*Costus speciosus* (Koenig) J.E. Smith	Zingiberaceae	Herb	Andaman and Nicobar Islands	Common
14	Turmeric	*Curcuma longa* L.	Zingiberaceae	Herb	Andaman and Nicobar Islands	Introduced
15		*Curcuma mangga* Val. & Van Zijp.	Zingiberaceae	Herb	Andaman	Common
16		*Curcuma zeodaria* (Christm) Rosc.	Zingiberaceae	Herb	Andaman	Introduced
17	Burmese coriander	*Eryngium foetidum*	Apiaceae	Herb	Andaman and Nicobar Islands	Introduced
18		*Garcinia andamanica* King	Clusiaceae	Small evergreen tree	Andamans	Endemic
19		*Garcinia cadelliana* King	Clusiaceae	Small tree	South Andamans	Rare and endangered endemic
20		*Garcinia calycina* Kurz (Kamorta Islands)	Clusiaceae	Small tree	Nicobars	Rare and endangered endemic

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Table 3 Contd.

Sl. No	Common/local name	Scientific name	Family	Habit	Distribution	Status
21	Cowa-fruit or the cowa mangosteen tree	*Garcinia cowa* Roxb. ex. DC. Prodr.	Clusiaceae	Medium tree	Evergreen forests of Andaman and Nicobar Islands	Common
22		*Garcinia hombroniana* Pierre	Clusiaceae	Small tree	Nicobar Islands	–
23		*Garcinia jelineckii* Kurz	Clusiaceae	Small tree	Nicobar Islands	Endemic
24		*Garcinia kingii* Pierre and Verque	Clusiaceae	Small tree	Andamans	Rare and endangered endemic
25		*Garcinia kurzii* Pierre	Clusiaceae	Small tree	Andaman and Nicobar Islands	Rare and endemic
26		*Garcinia microstigma* Kurz	Clusiaceae	Small tree	Andaman Islands	Endemic
27		*Garcinia speciosa* wall	Clusiaceae	Medium tree	Evergreen and semi-ever green forests Andamans	Common
28		*Garcinia xanthochymus* Hook. f. & Thom.	Clusiaceae	Ever green tree with medium size	Evergreen forests of Andaman and Nicobar Islands	Common
29		*Globba marantina* L.	Zingiberaceae	Herb	Andaman and Nicobar Islands	Common
30		*Globba pauciflora* King ex Baker	Zingiberaceae	Herb	South Andamans	Endemic and rare
31		*Globba versicolor* Sm.	Zingiberaceae	Herb	Andamans	Rare
32		*Hedychium coccineum* Koen.	Zingiberaceae	Herb	Andamans	Common
33		*Hedychium coronarium* Koen.	Zingiberaceae	Herb	Andamans	Introduced
34		*Horsfieldia macrocarpa* var. *canaroides* (King) Sinclair	Myristicaceae	Tree	Andaman and Nicobar Islands	Endemic; rare and endangered
35		*Kaempferia rotunda* L.	Zingiberaceae	Herb	Andamans	Common
36		*Kaempferia siphonantha* King ex Baker.	Zingiberaceae	Herb	Andaman	Endemic; rare and threatened
37		*Knema andamanica* ssp. *nicobarica* (Warb.) de Wilde	Myristicaceae	Tree	Nicobars	–
38		*Knema andamanica* (Warb.) de Wilde ssp. *andamanica* (Warb.) de Wilde	Myristicaceae	Tree	Andaman and Nicobar Islands	Endemic
39		*Mesua manii* (King) Kosterm	Clusiaceae	Shrub	South Andaman	Endemic; rare and endangered
40	Curry leaf	*Murraya koenigii* (L.) Sprengel	Rutaceae	Shrub	Andaman and Nicobar Islands	Introduced and common
41		*Murraya paniculata* (L.) Jack	Rutaceae	Tree	Andaman and Nicobar Islands	Common
42	Jungli- Jaiphal	*Myristica andamanica* Hook. f.	Myristicaceae	Tree	Andaman and Nicobar Islands	Endemic and rare
43	Nutmeg	*Myristica fragrans* Houtt.	Myristicaceae	Tree	Andaman and Nicobar Islands	Introduced
44		*Myristica glaucescens* Jack. var. *andamanica* (Worb.)	Myristicaceae	Tree	Sinclair Islands, Austin-I	Common
45		*Myristica kingii* Hook. f.	Myristicaceae	Tree	Junglebar, Port Blair	–
46	Allspice	*Pimento dioica* (L.) Merill	Myrtaceae	Tree	Andamans	Introduced
47	Betel vine	*Piper betel*	Piperaceae	Climber	Evergreen forests of Great Nicobar Islands	Common
48	Tippili	*Piper longum* L.	Piperaceae	Climber	Andaman & Nicobar Islands	Introduced
49	Black pepper	*Piper nigrum* L.	Piperaceae	Climber	Andaman & Nicobar Islands	Introduced and common
50		*Syzygium andamanicum* (King) Balakr.	Myrtaceae	Tree	Andamans	Endemic and rare
51	Clove	*Syzygium aromaticum* Merr.& Perry	Myrtaceae	Tree	Andaman & Nicobar Islands	Introduced
52		*Syzygium kurzii* (Duthie) Balakr. var. *andamanica* (King) Balakr.	Myrtaceae	Small tree	South Andaman	Endemic; rare and endangered
53		*Syzygium manii* (King) Balakr.	Myrtaceae	Tree	Middle Andamans	Endemic; rare and endangered
54	Tamarind	*Tamarindus indica* L.	Caesalpiniaceae	Tree	Andamans	Introduced and common

Table 3 Contd.

Sl. No	Common/local name	Scientific name	Family	Habit	Distribution	Status
55		*Vanilla andamanica* Rolfe.	Orchidaceae	Climbing herb	Middle, South and Little Andamans	Endemic
56	Vanilla	*Vanilla fragrans* (Salisburry)	Orchidaceae	Climber	Andaman and Nicobar Islands	Introduced
57		*Zingiber odoriferum* Bl.	Zingiberaceae	Aromatic herb	South Andaman (especially Port Blair)	Common
58	Ginger	*Zingiber officinale* Rosc.	Zingiberaceae	Herb	Andaman and Nicobar Islands	Introduced
59		*Zingiber spectabile* Griff.	Zingiberaceae	Aromatic herb	South Andaman and Nicobar Islands	Introduced
60		*Zingiber squarrosum* Roxb.	Zingiberaceae	Herb	South and Little Andamans	Common
61		*Zingiber zerumbet* Rosc. ex Sm.	Zingiberaceae	Aromatic herb	South Andamans (especially Port Blair) and Nicobar Islands	Common

Utilization: Most of the spices and its related species are being utilized by the tribal, local people and settlers for various ailments/purposes (Awasthi, 1987; Dagar, 1989; Rema and Krishnamoorthy, 2000; Singh *et al.*, 1998; Sreekumar, 1993; and Subramaniam and Sreekumar, 1998) (Table 5). Besides, they can also be utilized as potential sources for medicines, salt and pest and disease tolerance/resistance, etc.

Table 4. Extra-Indian spices found only in Andaman and Nicobar biogeographic zone of India

Sl. No.	Spice	Family	Habit	Distribution
1	*Piper clypeatum*	*Piperaceae*	Climber	Malaya
2	*Piper miniatum*	*Piperaceae*	Climber	Malaya, Java
3	*Knema laurina*	*Myristicaceae*	Tree	Thailand, Malaya, Borneo, Sumatra, Java
4	*Myristica elliptica*	*Myristicaceae*	Tree	Malaya, Sumatra, Borneo

Table 5. Spices and related species used by natives for various purposes in Bay Islands

Sl. No.	Spice	Usage
1	*Acorus calamus*	Rhizome-fever; Ornamental
2	*Alpinia manii*	Leaves chewed and sprayed to collect honey by tribals; Ornamental
3	*Alpinia phoenicea*	Ornamental
4	*Amomum aculeatum*	Ornamental
5	*Amomum fenzlii*	Root and flower-gastro-intestinal troubles, (stomach disorders), malarial (intermittent) fever and other fevers; Leaves chewed and sprayed to collect honey by tribals; Ornamental
6	*Amomum maximum*	Ornamental
7	*Costus specious*	Leaves-stomach disorders by 'Shompen' tribal; Rhizome – snake bite
8	*Curcuma longa*	Rhizome powder – wound healing
9	*Curcuma mangga*	Ornamental
10	*Curcuma zeodaria*	Rhizome-cooling; Ornamental
11	*Garcinia hombroniana*	Fruit- edible; Timber
12	*Garcinia microstigma*	Young leaves-cooked and eaten by Burmese
13	*Garcinia* sp.	Root-washing uterus after child birth by 'Shompen' tribal
14	*Garcinia speciosa*	Wood-bridge, house posts and bows
15	*Globba marantina*	Rhizome-Asthma, eyes disorders; Ornamental
16	*Globba pauciflora*	Ornamental
17	*Globba versicolor*	Ornamental
18	*Hedychium coccineum*	Ornamental
19	*Hedychium coronarium*	Rhizome-rheumatic; Ornamental
20	*Kaempferia rotunda*	Tuber powder is used in mumps; Ornamental
21	*Kaempferia siphonantha*	Ornamental
22	*Murraya paniculata*	Timber
23	*Myristica andamanica*	Wood for pulp
24	*Myristica elliptica*	Whole plant-to heal wounds by 'Shompen' tribal

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Table 5 Contd.

Sl. No.	Spice	Usage
25	*Myristica* sp.	Fruit – stomach disorder by 'Nicobarese' tribal
26	*Piper longum*	Leaves-betel by natives
27	*Piper* spp.	Leaves chewed along with the nuts of arecanut by tribals
28	*Syzygium samarangense*	Rheumatic pain (leaves-Joint pains) by 'Nicobarese' tribals; Rhizomes – widely used as anti-arthritic, anti-inflammatory, anabolic and anti-fertility agents.
29	*Vanilla andamanica*	'Pods'- vanillin /flower as cosmetic 'vanilla'
30	*Zingiber odoriferum*	Stem juice-tranquilizer for honey bee
31	*Zingiber officinale*	Rhizome extract used for coughs by 'Nicobarese' tribals
32	*Zingiber spectabile*	Ornamental
33	*Zingiber squarrosum*	Petioles-chewed when thirsty by 'Onges' tribals
34	*Zingiber zerumbet*	Rhizome-hot remedy for cough, asthma, worms, leprosy and other skin diseases; Boiled rhizomes – pulmonary infections; Ornamental; Rhizome is used for cooling also.

Conservation

Due to rapid industrialization, urbanization and other unsustained developmental activities, over-exploitation of resources and felling of trees, many of the species are found as rare and threatened or thinly populated in these islands. Even some of such species of spices are vulnerable or under the threat of extinction.

In this direction, CARI has actively involved in collection and conservation of germplasm using as *ex-situ* and *in vitro* technique. Apart from this, local bodies of Port Blair such as Forest Department, Botanical Survey of India have also taken up necessary steps to conserve them under *in situ* and in the experimental gardens cum arboreta through *ex situ* approach, respectively. The recently concluded "National Symposium on Biodiversity *vis-à-vis* Resource Exploitation: An Introspection "at Port Blair has also highlighted the urgency in conserving the wild flora (biodiversity) of these islands and their sustainable utilization for commercial exploitation (Shiva *et al.*, 2002b) for the benefit of posterity.

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