BIO-CULTURAL DIVERSITY AND MEDICINE

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Contents

Summary

The biocultural and socio-economic diversity of medicinal plants and herbal medicine is reflected in the continuing beliefs and reliance of island communities worldwide in the age-old curative properties of traditional plant medicine that is practiced worldwide. These practices are in line with the recommendations The Mauritius Declaration that drew attention to the role of culture and resilience-building in the sustainable development of small island states and their diverse communities. The use of *green box*–based biotechnologies provides island communities opportunities to sustain bioproductivity of their medicinal plants in their aquatic and terrestrial environments; to

maintain the stability of their socio-cultural traditions; and, to further engage in gender equitability in island employment, labour and management schemes.

1. Introduction

There are rich traditions of the use of medicinal plants in every continent. Whilst, more than 80 percent of the people in the developing world rely on plants for their medicinal needs as a consequence of their being closely associated with traditional practices and livelihoods, and, notwithstanding the widespread inclination in the industrialized societies to regard "traditional knowledge" [see also – *Conventional Plant Breeding for Higher Yields and Pest* Resistance] as nothing more than "old wives' tales", approximately 74 percent of the pharmaceuticals were obtained these same plants credited with ethnomedicinal uses and in need of conservation.

2. Biocultural diversity

The wide range of different plant and animal species, ecosystems, cultural traditions and languages that are encountered in the terrestrial and marine environments in all regions of the world constitutes the reality of biocultural diversity. "There is something to learn from the meeting of indigenous and modern worldviews. Time-tested ancient wisdoms combined with modern technologies are proving to create solid foundations for sustainable development projects" that "share the knowledge from this bridge with communities in both developing and developed nations … in an authentic global partnership.". In summary, floral and faunal biodiversity, cultural traditions and socio-economic diversity, linguistic diversity, and diverse ecosystems and environmental niches constitute the bedrock of the interactive bridging of the time-honored indigenous and modern biotechnologies [see also– *Biotechnology and Agrobiodiversity*]. Biocultural diversity in island countries is most often encountered in the traditional use of forest and non-wood forest products as food, ornamentals and medicines.

2.1 Africa

African island communities are encountered in Cape Verde, Comoros, Guinea Bissau, Madagascar, Mauritius, Sao Tome and Principe and Seychelles. The medicinal plants of Madagascar are not dealt with in view of their extensive coverage. The best-known plant is the Madagascar periwinkle - *Catharanthus roseus* that contains the alkaloids vinblastine and vincristine used in anticancer treatment.

The Cape Verde Islands at the crossroads of three continents include 10 islands and 5 islets, divided into the windward islands (Santo Antão, São Vicente, Santa Luzia, São Nicolau, Sal, and Boa Vista) in the Barlavento and leeward islands (Maio, Santiago, Fogo, and Brava) in the Sotavento group of islands which are home to the occurrence and use by rural populations, especially of a wide varied diversity of medicinal plants to treat a variety of ailments such as heart diseases, intestinal and kidney problems, and diarrhea (Table 1). Most medicinal plants are encountered in Santo Antão; and in Santiago and Fogo. Several plants of medicinal importance have been identified.

Comoros benefit from the introduction of some 60 species of ornamental plants in 1870

and yet is at a disadvantage as some of these exotic plants have now a profile of invasive growth. These invasive plants are considered as a menace in overall conservation and management of agricultural resources and the environment in the Comoros islands.

Mauritius like Trinidad and Tobago is the beneficiary of traditional healthcare systems that have their origin in the cultural antecedents of African, Chinese, European and Indian peoples and their spices and medicines that were derived from a variety of aromatic and medicinal plants. Close to 100 endemic medicinal plants, some of which are highly endangered, have been identified and documented in traditional pharmacopoeia. There is concern in relation to the use and conservation of medicinal plants in Mauritius since nearly 30 medicinal plants are endangered, threatened or nearly extinct as a result of over harvesting in the wild.

In Sao Tome and Principe, some hundred different orchids such as *Angraecum doratophyllum*, *Cribbia pendula* are on display in the Bom Sucesso botanical garden of Obo National Park. To counteract the scarcity of information and the frustrations in accessing such information, an undertaken study established a list of the orchids in the archipelago of Sao Tome (100 species) and Principe (65 species) with relevant details concerning their ecology, their distribution and frequency of occurrence.

About 350 folk medicinal and aromatic plants are widely used throughout Sao Tome and Principe in the form of whole herbs, extracts and powders to treat a variety of ailments.

Seychelles is an archipelago comprised of granitic and coralline islands. Seychelles has a rich variety of plant life. Seventy five species of plants are used medicinally. Aromatic and fragrant species such as *Eucalyptus citriodora*, the ginger lily - *Hedychium coronarium*, wild ginger - *Zingiber zerumbet* and cardamom - *Elettaria cardamomum* exist.

Country	**Scientific Name**	**Local Name**	**Family Name**	**Reputed Use against or *as***
Cape Verde	*Borreria verticillata*	Locotane	Rubiaceae	Allergies
	Cymbopogon citratus	Chali	Poaceae	Tension, fevers
	Jatropha curcas	Physic nut	Euphorbiaceae	Purgative, soap
	Psidium guajava	Goibeira	Myrtaceae	Intestinal parasites
Comoros	*Dolabella auricularia*	Sea slug	Aplysiidae	Anti-cancer
	Ecteinascidia turbinata	Tunicate (sea squirt)	Perophoridae	Anti-cancer (*Esteinascidin 7*43)
	Euphorbia prostrata		Euphorbiaceae	*Balm* for vertebral column pains
	Ficus thonningii		Moraceae	*Balm* for vertebral column pains
	Lantana camara		Verbanaceae	Brucellosis; *diuretic agent*

	Sida rhombifolia		Malvaceae	Acne and arthritis
Guinea-Bissau	*Adansonia digitata*	Fulani	Bombacaceae	Urogenital infections
	Calotropis procera	Fulani	Asclepiadaceae	Sinusitis, influenza
	Cochlospermum tinctorium	Djandere	Cochlospermaceae	Liver cirrhosis
	Guiera senegalensis	Fulani (gelode)	Combretaceae	Catarrh, tuberculosis
	Hymenocardia acida	Coron-conde	Hymenocardiaceae	Skin wounds
	Leptadenia lancifolia	safarodje	Asclepiadaceae	Sexually-transmitted diseases
	Parkia globosa	nere	Mimosaceae	Anti-inflammation agent
	Piliostigma thonningii	barquedje	Caesalpiniaceae	Arthritis
	Securidaca longipedunculata	djuro	Polygalaceae	Skin wounds
	Prosopis africana	Tchelem-tchelemadje	Mimosaceae	*Anti-inflammation;* and *anti-arthritic agent*
Maldives	*Ricinus communis*	Aamanaka	Euphorbiaceae	Constipation, diabetes mellitus
	Aerva lanata	Hudhu huypilaa	Amaranthaceae	Urinary infections
	Punica granatum	Annaaru	Punicaceae	Diarrhea, cholera
	Rosa grandiflora	Finifena	Rosaceae	Boils, stress, heart disease
São Tomé and Principe	*Eryngium foetidum*		Apiaceae	Anti-inflammatory agent
Seychelles	*Commelina benghalensis*	Herbe cochon	Commelinaceae	Anti-inflammatory drug to calm abdominal pains and in treatment of dysentery
	Lodoicea maldivica	Double coconut	Arecaceae	*Drug* (not used for several decades)
	Secamone schimperiana	Milkweed	Asclepiadaceae	Pharmacological agent

Table 1: Traditional medicinals of plant and marine origin used in African and Indian Ocean Islands [Prelude Medicinals Database (2005)]

2.2 Arab States

Throughout the first half of the last century, Jidd Hafs was a prosperous village in Bahrain renowned for its extensive date palm groves and the manufacture of medicinal drugs from the buds, flowers, and pollen of palm trees. A survey of herbal and folk medicines indicated that the plant medicinal flora of Bahrain was encountered in 52

species with widespread representation in 29 plant families. From this group, 20 indigenous species were used as traditional medicinal decoctions and infusions to treat wounds, intestinal and respiratory ailments, using the knowledge and skills transmitted in the Bahraini populace from 'generation to generation'. Herbal plants of potential economic significance have been screened for the presence of antimicrobial compounds ranging from alkaloids and anthraquinones to saponins and sterols.

Seemingly, diseases such as stomach ailments resulting from malnutrition and poor diets in the past Bahraini generations have now been replaced by the modern societal scourges of heart disease, diabetes and obesity that have emerged from the drugstore culture, modern lifestyles and fast food intakes

In response to the uncontrolled use of medicinal plant preparations, there is concern for the need of scientific evaluation and assessment of purity. Recently, three halophytic plants from Bahrain *Sesuvium verrucosum, Salsola baryosma,* and *Zygophyllum quatarense* have been tested for their cytotoxic activity.

2.3 Asia

Singapore and the Maldives are island countries in Asia. The former is a member of the Alliance of the Small Island States and like Bahrain in the Arab world, has a well developed market economy. Activities concerning the inventorization and use of medicinal plants of Singapore available elsewhere are not covered in this review.

Some 122 medicinal plants in the Maldives were catalogued in 1992. In 2001 several hundred plants with medicinal properties were reported. Several plants e.g. *Plumeria* spp. constitute a source of fragrances and perfumes. UNDP/GEF assistance has been provided towards the conservation of medicinal plant species (Table 1) and traditional knowledge in Maldivian atolls within the framework that emphasizes the development of a national biodiversity strategy. The Maldives now possesses 500 species of plants that include more than 300 species, which are used in cultural and traditional medicinal practice.

2.4 Europe

In Europe, the occurrence of medicinal plants in the island states of Cyprus and Malta are of significance. In Cyprus, newly initiated studies in the search for new therapeutic principles and the expansion of the pharmaceutical industries are the result of the knowledge of the traditional use of herbs and medicinal plants in ancient times. The listing of about 125 medicinal and aromatic plants provides some justification for the enthusiasms in developing new industrial crops as a source of green and low-cost medicines that stimulate the emergence of new markets of healthcare products.

In Malta, medicinal plants are widely used as part of folk medicinal remedies. Well-known Maltese examples are: *fejgel, faqqus il-hmir,* and *hobbeja*. Within the context of expanding the benefits accruing from biotechnological research in the area of genomic and medicinal technologies, the University of Malta has compiled an electronic inventory of 300 Maltese medicinal and aromatic plants with accompanying text and

images through its Institute of Agriculture.

2.5 Latin America and the Caribbean

There is a wide range of medicinal plants that is used, especially by the rural communities throughout the Caribbean region (Table 2). The most important non-wood forest products are medicinal and aromatic plants, citronella (*Cymbopogon citratus*), and sassafras (*Ocotea pretiosa*) oil. In the Bahamas, the use of indigenous medicinal plants is widespread. Traditional bush medicines are popular in the treatment of common ailments - colds, fevers, and intestinal disorders as well as in the more serious illnesses of the cancers and AIDS.

Cuba has over 1000 species of plants with medicinal properties. Several of these are endemic such as *Rauwolfia linearifolia* which is strictly endemic in Sierra de Nipe and of significance in the treatment of abnormal heart rhythms. Plants containing essential oils and medicinal principles are conserved and maintained in the Instituto de Investigaciones Fundamentales en Agriculturea Tropical (INIFAT), Ministry of Agriculture, Havana; and the experimental station of medicinal plants 'Juan T. Roig' in San Antonio de los Baños Municipality, La Habana Province.

Eighty percent of the Grenadian population uses herbal medicines and aromatic plants that include candlewood (*Amyris balsamifera*), citronella (*Cymbopogon citratus*), rosewood (*Aniba rosaeodora*), sassafras (*Ocotea pretiosa*), common hazel (*Gevuina* spp.), vetiver (*Vetiveria zizanioides*) and *Eucalyptus* sp.

In Santa Lucia, over a hundred plants have been recognized for their medicinal properties and values. Medicinal and ornamental plants are conserved and maintained along with other crops in designated reserves - e.g., the Kingshill Forest reserve in St. Vincent and the Grenadines.

The use of herbs and medicinal plants in the multiethnic societies of the Amerindian tribes – the Caribs and the Arawaks; the Afro- the Indo- and European-Trinidadians and Toboggans has been the subject of a detailed survey in the control and treatment of diabetes in Trinidad and Tobago. Some 100 different medicinal plants were reported to have been used as bush medicines by over 600 people afflicted with diabetes mellitus. An interesting finding of the survey indicated that several medicinal plant remedies used by the Indo-Fijian population in Fiji were also mentioned by the Trinidadian and Toboggans of Indian origin in Trinidad and Tobago thus confirming the strong influence across geographical location of cultural beliefs and traditions in the use of bush medicines.

Island Community	**National Park or Reserve**	**Scientific name**	**Common name**	**Family**	**Reputed use as agent or *against***
Antigua and Barbuda	Botanical Gardens of Antigua and Barbuda ,	*Achyranthes indica* *Aristolochia trilobata*	*man-better-man* *Six sixty-six*	Amaranthaceae Aristolochiaceae	Colds; diabetes and hypertension Fever, diabetes and hypertension

Bahamas	Hydrofora Gardens	*Jacaranda caerulea* *Phyllanthus niruri*	*Cancer Bush* *Chanca piedra*	Bignoniaceae Euphorbiaceae	Skin cancers Laxative, vermifuge
Barbados	Andromeda Gardens	*Croton flavens* *Euphorbia hirta*	*Milkweed*	Euphorbiaceae Euphorbiaceae	Coughs and colds Excrescence
Cuba	INIFAT); and Juan Tomás Roig station for medicinal plants	*Brosimum alicastrum* *Talauma plumieri*	*Caucho macho* *Maranon De La Maestra*	Moraceae Magnoliaceae	Anticancer agent (Uterus) Astringent
Dominica	D'Auchamps Gardens; Botanical Gradens Roseau (?)	*Passiflora lauriflora* *Richeria grandis*	*Cala-basique* *Pomme di Bois bande*	Passifloraceae Euphorbiaceae	Used as sedative Used as Aphrodisiac
Dominican Republic	National Park of Sierra de Bahoruco; Jaragua National Park; Jardin Botanico Nacional Raphael Mocoso Puello[7]	*Boerhaavia erecta* *Hyptis verticillata*	*Patagon* *Herbe au Diable*	Nyctaginaceae Lamiaceae	*Asthma* *Headache*
Grenada	Grand Etang National Park;	*Cassia alata* *Ricinus communis*	*Ringworm bush* *Castor oil plant*	Caesalpiniaceae Euphorbiaceae	Ringworm Laxative; anti-diabetic agent
Jamaica	Hope Gardens	*Euphorbia hirta* *Smilax officinalis*	*Pempe* *Sasparilla*	Euphorbiaceae Smilaceae	Warts Anticancer agent
St.Kitts and Nevis	Brimstone Hill Fortress National Park[8] Botanical Gardens of Nevis	*Asclepias curassavica* *Spondias mombin* *Alamanda cathartic*	*Milky-milky* *Hog plum* *Yellow bell*	Asclepiadaceae Anacardiaceae Apocyanceae	Guineaworm and ringworm Diarrhea and dysentery Skin infections, ringworm
St. Lucia	Diamond Botanical Gardens; Mamiku Gardens	*Exostema sanctae-luciae* *Pluchea odorata*	*Chinchona*	Rubiaceae Asteraceae	Fever Colds
St Vincent and the Grenadines	Kingshill Forest Reserve	*Argemone mexicana* *Jatropha*	*Yellow thistle* *Physic nut*	Papaveraceae Euphorbiaceae	Anticancer agent

		multifida			
Trinidad and Tobago	Ministry of Agri-culture, Land Marine Resources (MALMR)	*Cassia alata* *Momordica charantia*	*Wild senna* *Karilla*	Caesalpiniaceae Cucurbitaceae	Ringworm: Purgative Malaria; diabetes

Table 2: Traditional medicines used in the islands of the Caribbean region

The use of medicinal plants is not confined to humans alone. Ethnomedicines have been used by hunters to treat themselves as well as their hunting dogs. Plant baths and decoctions, in preference to conventional medicines that involve the use of steroids, antibiotics and enzymatic applications (e.g. ananase from the pineapple *Ananas comosus*), have been used in Dominica and Trinidad and Tobago to counteract the ill-effects of external parasites, to treat wounds caused by snakebites, scorpion stings and other similar injuries encountered as occupational hazards, and even to neutralize the demoralizing effects of witchcraft. More recently, there has been an assessment of medicinal herb use amongst asthmatic patients in a Trinidadian healthcare facility.

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[The continuing beliefs and reliance of island communities worldwide in the age-old curative properties of traditional plant medicine are eloquent and undeniable testimony to the biocultural and socio-economic diversity of medicinal plants and herbal medicine - see (a) and (b) below.

a Articles from Books and Journals [Aspects of biotechnology and traditional cultural practices are provided in the list of books and journals cited in (a) and webpages (b) with a focus on the relationship biotechnology and the cultural traditions with accompanying self-explanatory tabulated data and cultural quotations (see Table 5). Biocultural diversity in island countries is most often encountered in the traditional use of forest and non-wood forest products as food, ornamentals and medicines, floral and faunal biodiversity, cultural traditions; socio-economic diversity, linguistic diversity, and diverse ecosystems and environmental niches]

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Biographical Sketches

Edgar DaSilva, a graduate of the University of Bombay in microbiology and chemistry, was awarded, in 1962, the Bachelor of Science Degree (First Class with Honours). In 1966, he obtained the Master of Science Degree, and in 1969 his Doctoral Degree for research studies on the cyanobacteria. As a NORAD Fellow, his research study, on the marine algae at the Norwegian Seaweed Research Institute, Trondheim, Norway, in 1970, was followed by a teaching assignment at the University of Helsinki, Helsinki, Finland. Two years later, he joined the Institute of Physiology, University of Uppsala, Uppsala, Sweden as a UNESCO fellow. He is a former Vice-President of the World Federation for Culture Collections (WFCC), author of several scientific publications, and member of well-known microbiological societies. Moreover, he has also been a keynote plenary speaker at several international events in, Argentina, China, Kuwait, Nigeria, South Africa, Sweden, Thailand, USA, etc. on biopolicy issues in regional co-operation, microbiological education, and on globalization and sustainable development.

At UNESCO since 1974 in various capacities within the Division of Scientific Research and Higher Education and the Division of the Basic Science Dr. DaSilva has been instrumental in the planning and implementation of several UNESCO regional and international programmes in applied microbiology as well as in the development of the global networks dealing with management and use of microbial resources and training opportunities in the fields of marine and plant biotechnology. Moreover he mobilized several extrabudgetary programmes in close cooperation with UNEP and UNDP and Donor Member States for activities in national development in biotechnology and regional cooperation in microbiology.

He also was the Director, Division of Life Sciences that was subsequently transformed into a Section of the Life Sciences within a new Division of the Basic and Engineering Sciences prior to his retirement from UNESCO.

Currently Dr. DaSilva has had teaching assignments as Visiting Professor at the International Centre for Biotechnology (ICBiotech) in Osaka University and its outreach station, and teaching assignments at the UFS, and at the Outreach station of ICBiotech at Mahidol University, Thailand and at the University of the Free State, Republic of South Africa. A fellow of the World Academy of Art and Science and following a keynote lecture to the Biotechnology Division of the Royal Swedish Academy of Engineering Sciences and the Biofocus Foundation, Dr. DaSilva was awarded the Biopolicy Award in 2003

Dr. Murukesan Krishnapalli currently holds the position of Agricultural researcher with the College of Micronesia USDA Land Grant Programs at Yap Island Campus. He possesses a Ph.D. in Plant Science and PG Diploma in Environmental Education and Management besides an International Certificate in ISO 14001 Environmental Management System internal auditing. He worked for environment related projects in New Zealand, Sweden and Seychelles and with the Gujarat Ecology Commission in the World Bank funded Biodiversity Project. Current research interests are on agrobiodiversity conservation, simplified home hydroponics gardens, enhanced production of giant swamp taro through the elimination of burrowing nematodes and groundwater quality studies in Yap islands.

Dr. Pier Giovannid'Ayala is Sicilian; he graduated from the University of Palermo where he got a degree in chemistry and later a Ph.D. in Political Sciences. He came to Paris where he carried out anthropological researches on the maritime world with a special focus on the Mediterranean Sea and gave lectures at the University of Paris VI I (Vincennes). In 1973 he joined UNESCO where he was responsible for several multidisciplinary programmes. Following retirement in 1992 he dedicated himself to the success of INSULA the creation of which he had contributed to in 1989. Since 1995 he holds the office of General Secretary of INSULA.