Island Communities

Biorepositories of Traditional Medicine, Culture and Diversity

by Edgar DaSilva*, Murukesan V. Krishnapillai and Pier Giovanni d'Ayala

Abstract

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 (UN, 2005) 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.

Introduction

There are rich traditions of the use of medicinal plants in every continent (Moran, 1996). 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" as nothing more than "old wives' tales", approximately 74 percent of the pharmaceuticals were obtained these same plants credited with ethnomedicinal uses (Farnsworth et al., 1985) and in need of conservation (Gurib-Fakim, 2004).

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 (Terralingua, 2004). "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." (Terrawatu, 2004). 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. 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.

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 Madgascar 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,

Former Director, Division of Life Sciences, UNESCO and Member of INSULA's Board of Directors, Dr. ***Edgar DaSilva*** is currently Professor Extraordinary in the Department of Microbial, Biochemical and Food Biotechnology at the University de Vrystaat in South Africa and visiting Professor at Osaka University in Japan. He was educated at the University of Bombay, and later did research and teaching at academic institutions and universities in Norway, Finland and Sweden.

Contact: International Scientific Council for Island Development (INSULA), c/o UNESCO, 1 rue Miollis, Paris 75015, France
E-mail : e.dasilva@wanadoo.fr

Murukesan Krishnapillai currently holds the position of Agriculture Researcher with College of Micronesia USDA Land Grant Programs at Yap Island Campus. He possesses 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 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 elimination of burrowing nematodes and groundwater quality studies in Yap Island.

Contact: Agricultural Experiment Station, College of Micronesia-FSM, Yap Site, P.O. Box 1226, Colonia, Yap, FM 96943, Federated States of Micronesia
E-mail: AESyap@mail.fm

Pier Giovanni d'Ayala is Sicilian, he graduated from the University of Palermo where he got a degree in chemistry and later a PhD 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 VII (Vincennes). In 1973, he joined UNESCO where he was responsible for several multidisciplinary research programmes. He went into retirement in 1992 and dedicated himself to the success of INSULA, to the creation of which he had contributed in 1989. Since 1995 he is the General Secretary of INSULA.
E-mail: email: pg.d-ayala@unesco.org

* Corresponding Author.

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 (GEF, 2003).

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 (Ibrahim, 2003). 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. (FAO, 1996). 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 (Gurib-Fakim, 2004).

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 (Stévart, 1999)[1].

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 (Martins et al., 2003).

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 (FAO, 1995). Aromatic and fragrant species such as Eucalyptus citriodora, the ginger lily – Hedychium coronarium, wild ginger – Zingiber zerumbet and cardamom – Elettaria cardamomum exist.

Table 1. **Traditional medicinals of plant and marine origin used in African and Indian Ocean Islands**

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* 743)
	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[2]	*Adansonia digitata*	Fulani	Bombacaceae	Urogenital infections
	Calotropis procera	Fulani	Asclepiadaceae	Sinusitis, influenza[3]
	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

Kammoe (1999), DaSilva (2003); Prelude Medicinals Database[4] (2005)

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 (Abbas et al., 1992). 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 (Al-Saleh et al., 1997).

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 (NCCAH, 2004).

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 (Taha and Alsayed, 2000).

Asia

Singapore and the Maldives are island countries in Asia. The former is a member of the Alliance of the Small Island States (AOSIS) and like Bahrain in the Arab world, has a well developed market economy. Activities concerning the inventorization and use of elsewhere (Chin, 1998) are not covered in this review.

Some 122 medicinal plants in the Maldives were catalogued in 1992 (MoFA, 1992). In 2001 several hundred plants with medicinal properties were reported (UNEP, 2002). Several plants e.g. Plumeria spp. constitute a source of fragrances and perfumes. UNDP/GEF[5] 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 (MHAHE, 2002).

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 result from 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 (Akkelidou et al., 2004)[6].

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.

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 (Granda et al., 1995). 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 Euro-

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

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

pean-Trinidadians and Toboggans has been the subject of a detailed survey in the control and treatment of diabetes in Trinidad and Tobago (Mahabir and Gulliford, 1997). 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.

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 (Lans et al., 2000, 2001). More recently, there has been an assessment of medicinal herb use amongst asthmatic patients in a Trinidadian healthcare facility (Clement et al., 2005).

Dance is an art form in Yap. Through dance, legends are passed down, history is recorded and entertainment is created. The dances of Yap are raucous, colourful and well-orchestrated. Dancers perform a traditional dance dress.

This region is a natural treasury of numerous cultures, cultural legacies, languages, social customs, and a wealth of floral and faunal biodiversity that is a resource base of alternative, folkloric and traditional plant-based medicines. Verbal pharmacopoeias of varied philosophies and practices in traditional medicine have been transmitted from generation to generation and are still in the contemporary practice of Aboriginal and Maori medicine. The therapeutic use of medicinal plants elsewhere in the Pacific regions for the maintenance and sustenance of human health resources has found favor with occidental lifestyles.

The Pacific region with widespread geographic and geological diversity in terrestrial and marine environments is naturally endowed with a diversity of endemic, rare, endangered and threatened plant and marine species. This valuable bioresource is constantly at risk of irreparable loss that accrues from exposure to the growth and expansion of the tourist industry in search of newer havens conducive to corporal and mental relaxation. Fragile natural ecosystems in the Pacific island states are susceptible to imminent disruption and destruction. Furthermore, small size, limited natural resources of economic significance and geographical isolation, have a limited range of options in overcoming their vulnerability in a worldwide market-oriented economy. Of economic significance for the sustenance and development of several Pacific island communities, traditional intellectual property concerning medicinal plant resources is tapped as an alternative resource to the rising costs of commercialized healthcare and globalizing market-economy pressures.

Traditional intellectual property has been accumulated through the experiences of self-taught village practitioners and observations of rural users of medicinal plants in the past and present generations. Today, this traditional knowledge is an active contributor to the understanding of contemporary cultural heritage and societal practices concerning the conservation of health and human resources through the use of medicinal plants in the Pacific island countries (DaSilva et al., 2004)

Africa

Information and published reports of medicinal and ornamental plants concerning African island communities (and especially the Cape Verdean islands), for some reason, is scarce or not easily available even though their use is widespread throughout the islands and islets of Cape Verde, Comoros, Guinea-Bissau, Sao Tome and Principe, and Seychelles.

A popular herbal tea amongst rural folk in the islands of Cape Verde is that of the herb – cidreira (Micromeria forbesii). Such traditional use constitutes an alternative livelihood option for rural entrepreneurs – especially women, well versed in the art of gathering, documenting, processing and selling medicinal plants in the competitive markets of Praia. Such activity is testimony to the oft repeated and incontestable observation that rural and village women possess more cultural knowledge of the soft technologies in the rearing and the use of medicinal herbs than men who are more proficient in the use of hard technologies involved

in cropping systems and animal husbandry production systems.

Yling-ylang – an important component of essences and perfumes, clovers, and vanilla are of significance in the market economy of Comoros which ranks amongst the world's top two or three producers of scents and spices. These valuable exports in the foreign-exchange earnings of Comoros, though significant, are nevertheless vulnerable to the varying market demands and climatic influences such as cyclonic and marine pollution disasters.

The aqueous extracts of Tchunfki – the local name for Securidaca longipedunculata, are used in religious rites by the Balanta people in the island community of Guinea-Bisseau (Samorini, 1996). This plant used either singly or in combination with other plants in the African continent – for example in Ethiopia by the Shimsha people against tuberculosis and gonorrhea, in Malawi to induce 'spiritual possession' (Hargreaves, 1986) and in South Africa by the Ikung people 'as medicine for people possessed by evil spirits' (Winkleman and Dobkin de Rios, 1989) – has been reported as extremely toxic leading to death (Samorini, 1996).

The situation with Madagascar and Mauritius is more promising. Plants of food value and income (inclusive of aromatic spices and scents) are many (Walter, 2001). Bakerella hoyifolia and Erythroxylum laurifolium possess economic potential as herbal remedies. Examples are: the fruits of Cycas officinalis (Comoros), Lodoicea maldivica (Seychelles), wild coffee Coffea vaughanii (Mauritius); the Malagasy clove - Syzygium aromaticum (Madagascar); cinnamon – Cinnamomum aromaticum (Seychelles) and vanilla – Vanilla planifolia (Madagascar, Comoros and the French territory of Réunion).

The ornamental plants Hibiscus liliiflorus and Trochetia boutoniana (Mauritius), the fern tree Cyathea sp., Ficus sp., various orchids and the aquatic plant Aponogeton sp. (Madagascar) are important sources of foreign-exchange income. Annual exportation of some 276 000 ornamental plants has been estimated at US$100 000. The national ornamental plant income amounts to 40 percent. The occurrence and identification of over 600 aromatic and medicinal plants in Mauritius and Rodrigues Island along with their corresponding ethnobotanical, phytochemical, relevant pharmacological and antimicrobial data have been inventoried and compiled within the framework of collaboration by the University of Mauritius, the Indian Ocean Commission and the European Union (Gurib-Fakim et al., 1994).

Exportation of medicinal plants from Madagascar has been documented for Drosera madagascariensis, Centella asiatica, Catharanthus roseus, Eugenia sp. Harongana madagascariensis, Hazunta sp. Medemia nobilis, Voacanga thouarsii, Satrana madinika, Moringa sp. and Prunus africana. In 1993, exportation of 300 tons of Prunus africana bark was estimated at US$1.4 million and exportation of Catharanthus roseus roots and aerial parts amounts to 1000 tons.

In Sao Tome and Principe, traditional healers use a variety of medicinal plants to combat a number of ailments such as common colds and sinusitis (Table 1). Traditional stew intakes use several different aromatic and medicinal plants in the daily sustenance of good health and a good-feel healthy status. Izaquente prepared from the seeds of Treculia Africana - African breadfruit is one such example that is used to treat coughs, fever and anemia. Medicinal plant products have long been used as antimalarials by traditional healers. Extracts from medicinal plants have been examined for their antimalarial protection against Plasmodium falciparum and P. berghei (Madureira et al., 1999). Other plants such as Pycnanthus angolensis and Morinda citrifolia used in traditional medicine have also been assessed for their antimalarial activity (Ancolio et al., 2002).

In Seychelles, there exist several medicinal and ornamental plant species of potential market significance. Endemic plants with medicinal properties are Erythroxylon sechellarum, Plectranthus aromatica, Lodoicea maldivica and Secamone schimperiana. Market-oriented ornamental plants are Begonia sechellensis, Impatiens gordonii, Dracaena reflexa, Angraecum eburneum and Vanilla phalaenopsis. About 350 medicinal and aromatic plants (Hamdy, 2004) found in the Indian Ocean islands of Comoros and Seychelles have been described with their distribution, pharmacology, chemistry and use in traditional medicine along with the chemical formulae of the active compounds (Gurib-Fakim and Brendler, 2004). An inventory of 59 medicinal plants in Comoros exists in the Prelude[4] database. An FAO estimate indicates that there are 250 to 500 plants with curative properties in the Seychelles which after survey and analysis could necessitate the establishment of a national data bank concerning species distribution, chemical and pharmaceutical properties and ethno-botanical knowledge. Plants that are categorized as of 'endangered status' resulting from over-harvesting and market exploitation in the Indian Ocean islands are: Dracaena draco (Cape Verde), Catharanthus coriaceus (Madagascar), Lodoicea maldivica and Toxocarpus schimperianus (Seychelles).

Arab States

Recently at the Bahrain Garden Fair (BGF) the beauty of the Bahrain rose was in prominence in a traditional Arabic courtyard. On-site workshops in the fair's rose garden at the Bahraini international centre, focused on Achafas - professional braiders demonstrating their skills by braiding girls' hair with rose buds and materials, and women grinding petals for use in the making of rose water, medicinal herbs and perfumes (Torr, 2005). Another feature of the fair was the revela-

in Paris, France. This hybrid rose in shades of yellow and pink was named as the Oasis of Bahrain by Her Highness Shaikha Sabeeka bint Ibrahim Al Khalifam, chairwoman of the Supreme Council for Women.

Currently, assistance is being provided to

- Aid farmers in Bahrain in building up a complete floriculture system, including cut and potted flowers, and bedding plants for exhibition and export purposes as well as to meet domestic demand during the winter season.
- Help vegetable growers to expand flower production for increased income. The project goal is to establish Bahrain as a production center for cut flowers and potted flowers in the Middle East.
- Conduct large-scale cultivation for floral demonstrations.

A garden emphasizing clean and green biotechnologies sponsored by the Gulf Petroleum Industrial Company (GPIC – Bahrain) ensures the safe local cultivation and protection of important Bahraini medicinal plants and herbs. Moreover, in cooperation with the Bahrain Centre for Studies and Research (BCSR) field and laboratory studies focus on 1) the efficacy of folk herbs and medicinal plants used locally and in indigenous bedouin medicine, and 2) their nutritional content and contribution in relation to health and nutrition (BCSR, 2005).

Asia

The Maldives naturally endowed with a richness of biodiversity and currently is a favorite holiday spot for tourists in search of mental and physical calm. Maldivian traditional medicine or Dhivehi Beys practiced for centuries in the nation's atolls once was the only form of treatment in the conservation of human health. Current popularity and preference for their remedial use results from the historical interactions between and with the ancient Indian, and Chinese traditional healers that drew upon their cultural heritage and rituals as a means of maintaining their good health and daily good-feel status. The practice of Maldivian traditional medicine, influenced to some extent by Ayurvedic practice, has its origin the Unani school of medicine. Transmitted from generation to generation and practiced on a family-based level by both holy men and women known as fanditha, there is a natural dying out of the traditional occupation that is characterized by inadequate monthly income for self-sustenance. Moreover, atoll communities taken in by the phenomenon of globalization and the tourist trade exercise a preference for the more efficient allopathic medical care as modernization of lifestyles takes hold in private and public life sectors.

The World Health Organization initiative (WHO, 2002) to revive traditional medicine and maintain Nature's laboratories of bush medicines helps to safeguard against the loss of Dhivehi medicine. To avoid the loss of valuable traditional knowledge available only in a verbal context, efforts are being made to produce written texts for use in traditional medicine course work and to accompany the conservation of medicinal plants that are endangered by over-exploitative market forces or by eventual extinction (MCST, 2001)[9]. Other initiatives focus on documenting details concerning dosage, deciphering and establishing the relevant chemical formulae of the plant curative principles and the purity of traditional remedies. The cataloguing of medicinal plants and herbs in Dhivehi Beys, the establishment of a national herbarium of traditional plant-based remedies, and the development of skilled human resources in the areas of botany, pharmacology, other forms of traditional medicine are foreseen (MCST, 2001; MCCA, 2005).

Fisheries and marine produce constitute a major source of income for the Maldivians. A modest foreign-

that of shark liver oil (from Centrophorus granulosus or Centrophorus scalpratus), the traditional uses of which have been as a lubricant in the tanning and textile industries (squalene oil)[10], as an ingredient in the cosmetics and skin healing products and as a remedial in the healing of wounds, irritations of the respiratory and gastrointestinal tracts and general debility (Vannuccini, 1999).

Europe

Cyprus has a rich heritage in the use of aromatic, culinary and medicinal plants in everyday life. Recent excavations at the Pyrgos-Mavroraki site near Nicosia included clay perfume bottle fragments that contain 14 perfumes of varied fragrances and ten odor essences. (Viegas, 2005). Fragrances of cinnamon, laurel, myrtle, anise, citrus bergamot and pine have been identified.

Several species of flora of Cyprus have been used in their wild form as a source of aromatic oils and plant medicines. Salvia fruticosa and Sideritis cypria are medicinal plants that are used in tea preparations to treat sore throats. Four species of Teucrium that are used in the island's traditional medicine have been studied for their essential oil content and nature (Arnold et al., 1991). Origanum dubium and Thymus capitatus are well-known sources of plant aromatics that are used in Cypriot cuisines. The aromatic leaves of the latter species yield oil that is medicinal in nature and that is also used in the preparation of cosmetics and perfumes. Other aromatic plants are Capparis spinosa that is of medicinal and culinary significance; and, Laura nobilis which is used in the preparation of cosmoceuticals. In the early 1990s, the Ministry of Agriculture, Natural Resources and Environment launched a project for the "Development and Cultivation of Aromatic and Medicinal Plants" (Walter, 2001). Aromatic and medici-

nal plants of economic significance as new industrial crops are conserved and maintained in the botanical gardens of the Athalassa government nursery. In current times, the rising cost of allopathic healthcare is paralleled with the market demand for prescription-free phytopharmaceuticals from medicinal plants and herbs that are increasingly being regarded as new industrial crops[6] (Akkelidou et al., 2004).

The Maltese islands constitute an apt example where medicinal plants are widely used in everyday life as part of culinary practice and folk medicinal remedies (Lanfranco, 1992). Buzbiez (Foeniculum vulgare) and Fidloqqom (Boragio officinalis) commonly known as fennel and borage respectively are two such examples. Several examples of folklore medicinal herbs in the Argotti Herbarium of the University of Malta have been exhibited for public viewing as a means of sustaining private, public and pursuit scientific interest in the medicinal flora of Malta (Table 3). Research studies indicate that several aromatic and medicinal plants in Malta are of potential significance in socio-economic context of the island.

Latin America and the Caribbean

The Caribbean region known for its calypsos and cricketing excellence is comprised of many small islands that are diversity-rich in plant genetic resources. There are many botanicals of socio-economic significance. Aromatic, medicinal, spice and ornamental species are widespread throughout the region and are conserved and maintained either in well-established national botanical reserves or gene banks of plant genetic resources (Table 2). Other natural products are edible, non-edible and essential oils.

Antigua and Barbuda participated in a sexennial project on the economic biology of under-exploited tropical plants (EUBTROP) two decades ago with a focus on the development of herbaria; databases; phytochemical studies on medicinal plants to safeguard against the loss of traditional knowledge and medicine; and, to explore through research underutilized plant resources for their economic potential as sources of food and medicines (OAS, 1990). Today, the import, market availability and monitoring and sale of medicinal plants with local and scientific names are regulated by the country's Pharmacy Council. The conservation and maintenance of ornamental and medicinal plants is foreseen for continuation in the rehabilitation of the 112-year old Botanical Garden.

Several medicinal plants are of tourist interests and export significance. Dried bark of Croton eleuteria used in the preparation of digestive teas and exported to Italy occurs in abundance in the Eleuthera Island of the Bahamas. A source of cascarilla – a spicy resin and a fragrance, it is used in infusions to treat coughs and other ailments. Kalanchoe tea derived from Kalanchoe pinnata and Gamalamee 21 Gun Salute Bush Tea - the aphrodisiac bush tea or tourist tea obtained from Bursera simaruba are popular with tourists.

As a result of the 1989 political landscape change in Europe, Cuba embarked on the establishment of 8000 organic gardens and over 200 green-based biotechnology institutes to help sustain urban agriculture and ensure national food security. The success of the province of Cienfuegos as the 'urban agriculture' capital of Cuba results from the nation-wide provision of accessible low-cost quality-controlled biofertilizers, insect biocontrol agents and biopesticides. One amongst the few countries in the world with a command-market economy in lieu of a free-market economy, Cuba has a beehive biotechnology industry that results from some 220 biotech institutes[12] and research centres with 30,000 plus workers that produces about 200 biotechnology products for export to over 50 countries. Similar success is envisaged with the research being conducted with traditional medicinal plants (Acosta de Luz et al., 2000; Fuentes Fiallo, 2001).

In the Caribbean region a variety of herbal teas that are recommended or administered by curanderas who are generally well-meaning women believed to possess some acquired spiritual healing power in the use of herbal-based medicinal balms and rub-on potions. In village and tribal

Table 3. **Research studies on medicinal plants in Malta**[11]

Scientific name	Research-targeted Molecule(s)	Remarks
Ecballium elaterium	Cucurbitacins	Of significance in inhibiting ovarian and stomach cancer cell growth
Crataegus monogyna	Oleanolic acid	Potential Angiotensin-converting enzyme inhibitor
Drimia maritima	Glycoside	Only Maltese plant that was exported; Used in cardiac malfunction; Now an endangered species as a result of loss of rural areas to urban development; successfully regenerated through micropropagation
Cucurbita maxima	Essential oils	Anthelminthic agent in canine treatment of significance in veterinary medicine
Nerium oleander	Glycoside	Used in cardiac malfunction
Erica multiflora	Glycolic acid identified as active diuretic component	Used in traditional medicine as an astringent, urinary antiseptic and diuretic; skincare health products now being developed containing glycolic acid
Hyoscyamus albus	Hyoscyamine alkaloids	Used as a sedative, pain killer; authorized medical approval required prior to use
Momordica charantia	Lectins	Effective against gastrointestinal infection; reported to possess anti-cancer (breast) properties
Capparis spinosa	Secondary metabolites flavonoids, terpenoids	Possesses culinary and medicinal properties

(a) CARAPA[13] activities

Year	Location	Theme	Remarks
1998	Trinidad & Tobago	*To Rescue a Caribbean Heritage*	Creation and sustenance of an awareness of traditional medicinal heritage in the Caribbean region focusing on: • documentation of herbal medicines • value and varieties of alternative medicine • uses and benefits of alternative medicine and traditional healing practices in healthcare • medicinal and culinary plants as new market products
1999	St. Croix, US Virgin Islands[14]	*Utilizing Medicinal Plants to Add Value to Caribbean Agriculture*	Development of national policies to: • maintain and safeguard indigenous plant biodiversity of economic potential • develop technologies conducive to production and commercialization of medicinal and culinary plants • support exploratory efforts with a focus on identifying traditional medicinal plants and their uses in the health and agricultural sectors
2000	Jamaica	*Caribbean Herbs in Health Promotion*	Focus on Ethnomedicine and Medicinal Plants to facilitate: • exploration of academic-industry interaction and investment • regional and international exchanges in ethnomedicine through electronic means • emergence and recognition in the Caribbean of a regional WHO Collaborating Centre for the Americas for ethno-medicine and medicinal plants
2001	St. Lucia	*To Integrate Herbal Medicine into Mainstream Healthcare*	Focus on harmonizing herbal medicine into mainstream healthcare emphasizing: • the value of medicinal plants in mainstream healthcare • herbal medicine healthcare used traditionally in the Caribbean for several decades • education for pharmacists and the general public
2003	Suriname[15]	*Integrating Herbal Medicine into the Healthcare System*	Development of healthcare an marketing strategies in the Caribbean with focus on: • Sustainable production of good quality medicinal plants • Promotion of research in the efficacy of medicinal plants • Delivery of plant medicinal healthcare
2005	St. Lucia *Advancing Caribbean Herbs in the 21st Century* Focus on the science and commerce of Caribbean herbs: • legal issues in trade of herbs • herbs and their marketing • Caribbean herbal in industry • Education and herbal medicine		

(b) Entrepreneurial activities

Several entrepreneurial and small business activities have emerged in the Caribbean region e.g. :
- Blue Mountain Aromatics (Jamaica): herbal bath and therapeutic oil products
- Caribbean Herbal Business Association (CHBA) established in Grenada in 2003 and based in Trinidad and Tobago (www.caribbeanherbs.net)
- Cher-Mere (Trinidad and Tobago): body- and healthcare products, fragrances and essences
- De La Grenade Industries (Grenada): nutmeg-, spice- and pepper-based products
- EXPROECO (Dominican Republic): trade with neem-based products
- Eden Herbs (St. Lucia): Caribbean tradition of using natural herbal remedies in healthcare and beauty enhancement (*www.edenherbs.com/*)

(c) Educational activities

Awareness, conservation and rational use of medicinal plants is being promoted through educational activities and exhibitions e.g.
- Summer Course: *The Caribbean Medicinal Plants-Ethnopharmacy, pharmacopoeia, regulation and folk practices* (The Université des Antilles et de la Guyane, French West Indies, July 1 -13, 2002)
- *Treasures of the Caribbean*: Exhibition in the Natural Products Expo (London, UK, 2003)

promotes Caribbean herbal products aims at creating new herbal markets in Europe; and emphasizing the wealth of the botanical base and market potential of the Caribbean traditional; medicinal industry
- Commissioning of the preparation of a pioneer text: *Handbook of selected Caribbean Herbs* – Phase I (CHBA, 2004)
- Research assessment of the extent of use of herbal remedies by asthmatic patients and determination of factors influencing decisions by patients to use such remedies (Faculty of Medical Sciences, University of the West Indies, Trinidad – Clement et al., 2005)

communities, such incomprehensible 'divine gifts' are associated with brujas with witches who may engage in rituals and secretive practices in treating illnesses and diseases that do not respond to the folk medicinal therapy administrations of the curanderas. In the Dominican Republic, several varieties of herbal teas with specific recipes for preparation are marketed to treat cancer, diarrhea, and stomach pain.

Grenada as the world's second largest producer of essential oils derived from the seeds of the nutmeg tree, Myristica fragrans accounts for some

25 percent of the world production and around 40 percent of the country's export revenue. In the last two decades, there has been a downturn in exports and foreign-exchange earnings that results from decreased world demand for raw nutmeg and market competition with other producing countries. In Jamaica, Pimenta racemosa, an ingredient of perfumes is used as a flavouring agent in cooking and as body tonifier in baths. On the other hand, Grenada's vast natural resource of virtually untapped indigenous medicinal plants, herbs and ornamentals provides opportunities for market diversification e.g. with cinnamon, cloves and cocoa. Furthermore, the establishment of a banana tissue culture laboratory a decade ago is of potential economic relevance in the production of edible vaccines.

Trinidad and Tobago, by virtue of its peoples, its diverse societal customs, and proficiency in the use of traditional medicinal knowledge, is the natural repository of cultural inheritances from early African, Chinese, European, Indian and Middle Eastern migrants. This legacy of medicinal knowledge is evident in the large number of endemic naturalized medicinal and aquatic plants that are of contemporary economic and landscaping significance in market-oriented activities and the development of ornamental ponds.

Facilities for the conservation, maintenance and evaluation of aquatic, cosmetic, medicinal, and ornamental plants of economic significance have been established in Trinidad and Tobago. These are managed and monitored by the Ministry of Agriculture, Land and Marine Resources (MALMR) in an interactive and 'networking' mechanism of conservation of plant genetic resources in several institutional, academic and commercial facilities such as the ministry's agricultural services, the Eastern Caribbean Institute of Agriculture and Forestry (ECIAF), the Cocoa Research Institute, Caroni Ltd. and the University of the West Indies. Activities of field genebanks are carried out within the facilities of the MALMR, the UWI and Caroni Ltd.

MALMR has several important ongoing plant biodiversity programs such as 1) the development and maintenance of a germplasm bank of spices and herbs; 2) development and maintenance of floriculture germplasm to feed 'cut flowers' market demand; 3) ex-situ conservation of endangered and rare medicinal plants; 4) landscape management; and 5) initiation of public awareness programs to inculcate an appreciation of green box technology in the conservation and management of the environment.

In recent times the Caribbean region has witnessed a number of initiatives in relation to medicinal plants that range from a series of stock-taking and forward-looking international conferences to some entrepreneurial initiatives and educational activities (Table 4).

The Pacific

Traditional herbal medicines have been used in all the Pacific islands since time immemorial, and, have been recognized as part of the culture and way of life. Examples of area locations of the culture, customs and traditional resource management practices of the Pacific island communities are: 'Mo' areas in the Republic of the Marshall Islands, 'ra'ui' in the Cook Islands, 'tabu' areas in Fiji and 'tapu' and 'fono' areas in Niue. These traditional area locations are repositories of rich medicinal plant diversity that are harnessed to conserve the healthcare needs of the island communities in the Pacific region (UNEP, 2005).

Kava in the Pacific island countries is widely consumed as a medicinal, a ceremonial drink and as an anti-stress beverage. Prior to the ban of kava in Europe and the USA (DaSilva et al., 2004) annual revenue of export sales in the Pacific region amounted to € 50 million p.a. In Vanuatu, Kava foreign-exchange amount to 20 per cent. Kava-kava is of ceremonial, social, ritual and health significance in island culture is widely consumed throughout the Pacific island communities. Offered as a mark of warm welcome of neighbouring tribal chiefs, kava has been used as a ceremonial drink at village weddings, as a beverage that tones down in tensions in conflict situations resulting in the inducement of empathy and goodwill and as a folk medicine that makes the unbearable bearable.

Medicinal plants and herbal remedies aka as bush medicines are widely popular with the middle-income strata of the populations of the island communities as in the Caribbean region.

Traditional Yapese food dishes made out of tender coconut leaves (Murukesan Krishnapillai)

Traditional Sakau preparation in Pohnpei. Sakau, a Micronesian variant of Polynesian kava is prepared from the root of the pepper plant by pounding the plant root upon a basaltic sakau stone that often rounded river rocks (Courtesy Dana Lee Ling)

Resort to their use notwithstanding the availability of public and private health systems arises from a variety of factors with traditional beliefs and cultural influences being the most prominent (Janska, 2005).

The importation of traditional plants, in addition to Fijian traditional medicines, for use by ethnic communities is permitted, certified and governed by the Pharmacy and Poisons Act of Fiji. Updates of health legislation focus on the monitoring of potential dangers that arise from the uncontrolled quality, remedial efficiency, and safety of herbal medicines.

Fiji in reducing its heavy reliance on fuel oil and a fluctuating medicinal market has embarked market diversification in using processed coconut oil as a source of cheaper and cleaner biofuel-biodiesel. Similar initiatives have also been made in Papua New Guinea and Vanuatu.

In Kiribati, farmers between 46 and 55 years of age are categorized as 'unimwane' or 'old men and heads of households'. Women as household heads and seaweed farmers are few. Many male farmers adopt a somewhat casual or recreational attitude towards seaweed farming since it is 'te kakakibotu' or 'the act of ridding oneself of boredom'. (Bergschmidt, 1997[16]).

In the Marshall Islands there is concern that there is a decline in the practice and use of traditional plant medicine which results from the spread of globalization and the introduction of clinical pharmacy and occidental heathcare products and techniques. To safeguard against the loss of tradtional knowledge women through their newly formed Marshall Islands Society for the Protection and Promotion of Traditional Medicine have undertaken the production of a herbal chart; and the documentation of local practices used in the treatment of bone fractures, reproductive problems and oither ailments.[17]

Seaweeds as a source of nutraceuticals (e.g., Laminaria), cosmoceuticals (e.g., Asparagopsis, Palmaria, Chondrus), agroceuticals (e.g, Fucus, Laminaria), biotechnological products (e.g, from shell money and jewellery from mollusc shells. Overharvesting of the mollusc shells endangers their availability and damages the environment, notwithstanding that this resource provides village women with income to meet their family and domestic responsibilities.

"This work should also stimulate interest in research into the cultural significance of shell money, and help women in Langalanga who are currently looking for ways to develop a museum and conserve valuable artifacts of the shell money trade. Another need identified in the case study is for research into how women in Melanesian culture can develop and maintain successful small businesses."[20]

Conclusion

The biocultural and socio-economic diversity of medicinal plants and herbal medicine results from the continuing belief and reliance of middle- and low income strata of rural urban societies in the age-old curative properties of traditional plant medicine that is practiced worldwide in island communities. For example, the reliance of people in the Indian Ocean islands and elsewhere on herbal medicine is borne out to some extent by research that tends to validate the use of some local ethnobotanical preparations. On the other hand, calm and relief may be due to the result of a psychological state rather than to the presence of a pharmacological substance. However, as the application of medicinal plants increases worldwide by the use of novel herbal essences and healthcare balms and lotions and notwithstanding their appreciation in idioms and verses, there is need for more pharmacological knowledge and research and caution concerning the use of medicinal plants (Table 5).

Again, there are some hundred different orchids and amongst that are sources of valuable natural products such as antimalarials and scents such as Cribbia confusa with its strongly

Table 5. **The Socio-Cultural Appreciation and Caution of Traditional Medicine and Healers**

Source	Quotes of Appreciation and Caution
African proverb	Do not adore the smoothness of the bitter-apple; it is acrid inside When a knowledgeable old person dies, a whole library disappears
Amelia Simmons	Garlics, though used by the French, are better adapted to the uses of medicine than cookery
Attributed to Avicenna	There are no non-healing herbs – only the lack of knowledge
Apocrypha, *Ecclesiasticus,* Chapter 38	Honor the healer for his services, for the Lord created him. His skill comes from the Most High, and he is rewarded by kings. The healer's knowledge gives him high standing and wins him the admiration of the great. The Lord has created medicines from the earth, and a sensible man will not disparage them.
Benjamin Franklin	Much virtue *(is)* in Herbs, little in men.
Bible Psalm 51;7	Purge me with hyssop, and I shall be clean: wash me, and I shall be whiter than snow
German Proverb	The garden is the poor man's apothecary.
Hilda Leyel (leading expert on herbalism)	Botany and medicine came down the ages hand in hand until the seventeenth century; then both arts became scientific, their ways parted, and no new herbals were compiled. The botanical books ignored the medicinal properties of plants and the medical books contained no plant lore
Hippocrates	Let thy kitchen be thy apothecary; and, Let foods be your medicine.
James Duke M.D.	An old-fashioned vegetable soup, without any enhancement, is a more powerful anticarcinogen than any known medicine
Maori saying	Hold fast to the treasures of the ancestors For they are that have been handed down to us by God
Oliver Goldsmith	Aromatic plants bestow No spicy fragrance while they grow; But crush'd or trodden to the ground, Diffuse their balmy sweets around.
Oliver Wendell Holmes Sr.	I firmly believe that if the whole materia medica could be sunk to the bottom of the sea, it would be all the better for mankind and all the worse for the fishes
Palauan proverb	Like the breadfruit of Kayangel, just one rotten piece will spoil the whole bunch.
Samoan saying	The strangers' treatments will work for the strangers' illnesses and the Samoan treatments for the Samoan illnesses
Samuel Butler in poem *Hudibras* English poet and satirist	Learn'd he was in medic'nal lore, For by his side a pouch he wore, Replete with strange hermetic powder That wounds nine miles point-blank would solder.
Qur'an, Surah XVI: 68 – 69	Thy Lord taught the Bee To build its cells in hills, On trees and in man's habitations; Then to eat of all The produce of the earth . . . From within their bodies comes a drink of varying colors, Wherein is healing for mankind
Vedas: Hymns of the Atharva-Veda[21]	"This herb, born of honey, dripping honey, sweet honey, honied, is the remedy for injuries; moreover it crushes insects"
William Shakespeare	Trust not the physician, His antidotes are poison

scented flowers. The investigation of the medicinal value of orchids as a source of traditional medicines (Kong et al., 2003) is of concern to conservationists who fear that these plants will soon be considered as endangered species as a result of demands in the expanding markets of new sources of plant medicines.

Similarities exist in the use of plant medicines across geographical distances as women 'doctors' are more engaged than their male counterparts in the practice of Aboriginal, African and Caribbean island traditional medicine. As concerns modern diseases like HIV/AIDS, traditional healers are in demand which eventually adds to their attainment of high social status in urban societies.

Traditional medicine is an integral and indisputable component of the daily economic, political and culture life of Pacific islanders (Parsons, 1985) It constitutes the response of simple island communities cut off from the mainstream of advanced technologies and medical care to illnesses that interfere with social, economic, political and religious activities. Finau (1994) in his consideration of traditional medicinal knowledge used in treating illnesses within the social and physical environments of a society identified the following three precepts in the practice of traditional medicine of the Pacific islands:

- Social interactive communication and acceptance through the use of time-honored rituals that reinforce social relationships and strengthen bonding between related and diverse groups (Parsons, 1984),
- Interactive bonding through 'gifts' of financial significance bestowed before, during and after treatment; and which in some cases provide livelihood means for families (Finau, 1981),
- Reliance on a verbal pharmacopoeia and storehouse of traditional knowledge about plants, animals, beliefs, seasons, religions etc that perpetuates and that reinforces the importance of these parameters in society and the interrelationships of its constituents (Whistler, 1985).

In comparison to the regions of the Caribbean and the Pacific islands, documented information and reports concerning the African islands and the Maldives (Table 1) are scanty, scarce, and inaccessible. Landlocked developing countries in the African and Asian continent seemingly fare much better in coverage by the public and technical press. Notwithstanding that small islands like those found in the Indian Ocean and elsewhere are often portrayed as attractions of

is no doubt that there is much in terms of the medicinal value of vegetal and marine resources that merits technical assessment and scientific research. On the other hand, random collection and indiscriminate use by many of the local people of the available medicinal flora for immediate financial gain contributes to the possibility of extinction of many endemic plants notwithstanding they are being a source of bioactive molecules. Furthermore, the degree of the richness of natural biodiversity on many of these island communities though common is still unknown as they have not been thematically inven-

Perhaps, the 2001-2010 Decade for African Traditional Medicine by the Summit of the Organization of African Unity (OAU) may help focus attention on the health of African and Asian island populations endowed with dependence on traditional medicine and medicinal plants notwithstanding their marginalization and vulnerability in geographical location, globalization and lack of Nature's bestowal of natural resources of economic significance. The Mauritius Declaration (UN, 2005) furthermore draws attention to the important role of culture and resilience-building in the sustainable

their diverse communities. The use of green box –based biotechnologies provides island communities opportunities for the sustenance of bioproductivity of medicinal plants in their aquatic and terrestrial environments; for maintaining the stability of their socio-cultural traditions; for resilience-building capacities to safeguard against economic vulnerability and climatic disasters; and for improving gender equitability in the use of skilled and non-skilled human resources in island employment, labour and management schemes.

References

Agoas, J.A., Al-Oqlah, A.A. and Mahasneh, A. M. 1992. Herbal plants in the Traditional Medicine of Bahrain. Economic Botany, Vol. 46 (2): 158-163.

Acosta de Luz, L., Fuentes Fiallo, V.R., Martin, G., and Rodriguez Ferradá, C. T. 2000. Agricultural Investigations in species of frequent us in the traditional medicine. I. Llanten Plantago major L.). Revista Cubana de Plantas Medicinales, Vol. 5(1): 6 – 9.

Agrelico, D., Papadopoulos and Chimonidou, D. 2004. Report from the Republic of Cyprus. Nicosia. (http://www.enica.net/reports/cyprus.pdf)

Al-Saleh, G.F.S., Gamal El-Din, A.Y., Abbas, J.A. and Saeed, N.A. 1997. Phytochemical and biological studies of medicinal plants in Bahrain: The family Chenopodiaceae – Part 2, International Journal of Pharmacognosy, Vol. 35: 38 -42.

Ancolio, C., Azas, N., Mahiou, V., Olliver, E., DiGorgio, C., Keita, A., Timon-David, P. and Balansard, G. 2002. Antimalalarial activity of extracts and alkaloids isolated from six plants used in Mali and Sao Tome. Phytotherapy Research, Vol.16: 646 – 9.

Arnold, N., Bellomaria, B., Valentini, G. and Rafaiani, SM. Comparative study on essential oil of some Teucrium species from Cyprus. Journal of Ethnopharmacology, Vol. 35 (2): 105 – 113.

Bahrain Centre for Studies and Research. 2005 (http://www.bcsr.gov.bh/english/index.php)

Bergschmidt, H. 1997. Seaweed production in Kiribati: a new cash crop. Bulletin Vol. 10, No. 3. pgs. 10-12, September 15

(http://europa.eu.int/comm/development/body/publications/fish/pe099710.pdf)

Chin, W.Y. 1998. A Guide to Medicinal Plants (1998 Report). Published 1992, First Edition. ISBN 9971883031; SB 012414, pgs.160.

Clement, Y.N., Williuma, S.F., Aranda, D., Chase, R., Watson, N., Mohammed, R., Stubbs, O and Williamson, D. 2005. Medicinal Herb Use among Asthmatic Patients Attending a Specialty Care Facility in Trinidad. BMC Complement. Altern Med. Vol. 5: 3 (pdf pages 1 -8).

DaSilva, E. J. 2003. Biosciences and Biotechnologies for Sustainable Development of Island States in Africa and the Arab States. INSULA, February Year 12 No. 1 ISSN 1021 -0814. pgs 27 – 34.

DaSilva, E.J., Murukesan, V. K., Nandwani, D., Taylor, M. and Josekutty, P.C. 2004. The Pacific islands: a biotechnology resource bank of medicinal plants and traditional intellectual property. World Journal of Microbiology and Biotechnology, Vol. 20 (9): 903-934.

FAO. 1995. Conservation and Sustainable Utilization of Plant Genetic Resources in Indian Ocean Islands. Sub-regional Synthesis Report. Annex 1 of the Report of the Sub-Regional Preparatory Meeting for Eastern Africa and Indian Ocean Islands, Nairobi, Kenya 12 - 14 September.

FAO. 1996. Mauritius Country Report to the FAO International Technical Conference on Plant Genetic Resources (Leipzig, 1996). (http://www.fao.org/WAICENT/FaoInfo/Agricult/AGP/AGPS/pgrfa/pdf/mauritiu.pdf)

Farnsworth, N. R.,Akerele, D., Bingel, A.S.,Soejarto, D.D. and Guo, Z.G. 1985. Medicinal Plants in Therapy. Bulletin of the World Health Organization, Vol. 63: 965 – 981.

Finau, S.A. 1981. Traditional medicine in Tonga: a preamble to a Pacific model. Fiji Medical Journal, Vol. 9 (8/9): 93-99.

Finau, S.A. 1994.Traditional Medicine in the Modern Pacific: A Dilemma or a Blessing? In: Morrison, J., Geraghty, P. and Crowl, L. (eds.), Fauna, Flora, Food and Medicine: Science of Pacific Island Peoples, Vol. III, pgs.. 47-64. (Suva) Institute of Pacific Island Studies. ISBN982-02-0106-3.

Fuentes Fiallo, V.R., Méndez, G., Hernandez, C.M.L., Rodríguez Ferradá, Soler, B.T., González, R. and Lopez, A. 2001,. Dynamics of monthly and daily accumulation of alkaloids and flavonoides in Incarnata passiflora L. Revista Cubana de Plantas Medicinales, Vol 6:(3): 105 – 111 , ISSN 1028-4796 on-line

Global Environment Facility (GEF). 2003. Integrated Participatory Ecosystem Management in and around protected areas, Phase I (http://thegef.org/Documents/Project_Proposals_for_Endorsem/Cape_Verde_-_Integrated_Participatory_Ecosystem_Management.pdf)

Granda, D.C., Towers, M.G.A., Fernández, L. and Sánchez, D.D. 1995. Metabolic alterations in patients dealt with low oral doses about amidarona. Cuban Magazine of Infirmary. September – December.

Guirib-Fakim, A. 2004.The Utilization and Conservation of Medicinal Plants in Mauritius. HerbalGram, Vol.64: 34 – 43.

Guirib-Fakim, A., Gu_ho, J., Sewraj, M.D. and Dulloo, M.E. 1994. Plantes medicinales de l'ile Rodrigues. Edition de l'Ocean Indien, Mauritius, pgs 589

Guirib-Fakim, A. and Brendler, T. 2004. Medicinal and Aromatic Plants of Indian Ocean Islands: Madagascar, Comoros, Seychelles and Mascarenes. Medpharm Scientific Publishers. Stuttgart, ISBN: 3-88763-094-7. In: Hamdy (2004).

Hamdy, R. C. 2004. Book Review –Medicinal and Aromatic Plants of the Indian Ocean Island. Southern Medical Journal, Vol. 97 (11) November: 1136.

Hargreaves, B. J. 1986. Plant induced spirit possession in Malawi. Society of Malawi Journal, Vol. 39: 26 -35.

Ibrahim, Y. 2003. Ecosystèmes Forestières des Comores: Biodiversité, principales menaces, perspective de mise en valeur –Le cas de la Forêt du Kartala dans île de Ngazidja ; In : Proceedings of the Regional workshop on Invasive Alien Species and Terrestrial Ecosystem Rehabilitation for Western Indian Ocean Island States- Sharing Experience, Identifying Priorities and Defining Joint Action, Seychelles, October 13 – 17, 2003 Ed. Muremootoo, J.R. (http://www.gisp.org/downloadspubs/AISworkshops.asp) pgs.160 plus annexes 1 – 10 (pgs 1 –xlvi).

Janska, E. 2005. Traditional Medicine in Trinidad and Tobago (http://www.ias.unu.edu/research/traditional-medicine.cfm)

Kanvinde, H. S. 1999. Maldivian Gender Roles in Bioresource Management RAP Publication 1999/15. ISBN: 974-680-163-5
(http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/005/AC792E/AC792E00.HTM)

Kong, J.M., Goh, N.K., CHia, L.S. and Chin, T.F. 2003. Recent advances in traditional plant drugs and orchids. Acta Pharmacologia Sinica, Vol. 24: 7 – 21.

Lanfranco, G. 1992. Popular Use of Medicinal Plants in the Maltese Islands. INSULA, No. 1, pgs. 34 – 35.

Lans,C., Harper, T, Georges, K. and Bridgewater, ER. 2000. Medicinal plants used for dogs in Trinidad and Tobago. Preventive Veterinary Medicine, Vol. 45:201 – 220.

Lans, C., Harper, T, Georges, K. And Bridgewater, E.R. 2001. Medicinal and ethonveterinary remedies of hunters in Trinidad. BMC Complementary and Alternative Medicine, Vol. 1: 10(17 pgs in pdf format).

Mahabir, D. and Gulliford, M.C. 1997. Use of medicinal plants for diabetes in Trinidad and Tobago. Pan American Journal of Public Health, Vol. 1: 174 -179.

Madureira, M.C., Martins, A.P., Gomez, M., Nogoueira, F., Antunes, A., Proença da Cunha, A. and Rosário, , V. E.

1999. Validation of Medicinal Plant Products used as antimalarials in Traditional Medicine of the Democratic Republic of São Tomé and Principe. In: Proceedings of First International Meeting of the Research Initiative on Traditional Anti-Malarials (RITAM), Moshi, Tanzania December 8 – 11, pgs, 57
(http://www.mim.su.se/english/partnerships/ritam_program.pdf)

Martins, A.P., Salgueiro, L.R., d Cunha, A.P., Vila, R., Canigueral, S., Tomi, F. and Casaniova, J. 2003. Chemical Composition of the Bark Oil of Cedrela odorata from S. Tome and Principe. Journal of Essential Oils Research, Vol. 15: 422 - 424

Ministry of Communication, Science and Technology (MCST) . 2001. In: S & T Master Plan
(http:www.mcst.gov.,v.Downloads/doucuments/S&T//Part2-07Health.pdf)

Maldives Common Country Assessment (MCCA). 2005. Presentation at the 7th Conference of Parties (COP7). (202.1.199.67/intranet/unrc/ CCAmaldives-draftver6-29-1-02.pdf - 20 Mar 2005).

Ministry of Home Affairs, Housing and Environment (MHAHE). 2002. National Biodiversity Strategy and Action Plan of the Maldives.
pgs 110. (http://www.mv.undp.org/perojects/environment.ibasbook/NBSAP.book.pdf)

Ministry of Fisheries and Agriculture (MoFA).1992. Catalogue of Plants, Male', Republic of Maldives

Moran, K. 1996. Compensating forest-dwelling communities for drug the work of the Healing Forest Conservancy. Unasyvla, Issue no.186, pgs. 564.

National Council for Culture, Arts and Heritage (NCCAH). 2004. Seminar on Traditional Medicines and Herbs, 29/12/2004, Doha, Qatar
(www.apctt-tm.net/business/display.jsp?id=1628)

Organization of American States (OAS). 1990. Economic Biology of Underutilized Tropical Plants. Regional and Scientific Developed Program, Washington, D. C. pgs.39.

Parsons, C.D. 1984. Idioms and distress: kinship and sickness among the people of the Kingdom of Tonga. Culture, Medicine and Psychiatry, Vol. 8(1): 71-93.

Parsons, C. D., 1985. Healing Practices in the South Pacific. Institute of Polynesian Studies, Brigham Young University-Hawaii. ISBN-0939154560.

Prelude Medicinals Database. 2005. (http://www.metafro.be/prelude?set_language=en&cl=en)

Samorini, G. 1976. An African Kykeon? Eleusis, No. 4. pgs 40 – 41.

South Pacific Regional Environment Program (SPREP). 2002. Women making money in the Solomon Islands.
(http://www.sprep.org.ws/publication/webpage/001annual_report2002/
WomenmakingmoneyintheSolomonIslands.htm)

Stévart, T. 1999. Les orchidées de São Tomé et Principe. Canopée, No. 15 pgs. 3 – 4.

Taha, A. and Alsayed, H. 2000. Brine shrimp bioassay of ethanol extracts of Sesuvium verrucosum, Salsola baryosma and Zygophyllum quatarense medicinal plants from Bahrain. Phytotherapy research , Vol. 14: 48 – 50.

Terralingua. 2004. Global Source Book on Biocultural Diversity. Draft version available at
http://www.terralingua.org/GDBBCD.htm

Terrawatu. 2004. Bridging Indigenous and Modern Worlds (http://www.terrawatu.org/pages/front.htm)

Torr, R. 2005. Bahrain - a rose by any other name..! Daily Gulf News, VI: XXVII, No. 345. Friday 4 March.
(http://www.gulf-daily-news.com/Story.asp?Article=105810&Sn=BNEW&IssueID=27349)

United Nations (UN). 2005. Mauritius Declaration (Outcome of International Meeting to Review the Implementation of the Programme of Action for the Sustainable Development of Small Island Developing States), Document A/Conf 207/L.6, Port Louis, Mauritius, January 14.

UNEP. 2002. Maldives State of the Environment Report. ISBN: 92-807-2140-2. pgs 86.

UNEP.2005. Pacific Environment Outlook. UNEP/SPREP Special Edition for the Mauritius International meeting for the 10-year Review of the Barbados Programme of Action for the Sustainable Development of Small Island Developing States authored by M. McIntyre (SPREP) and Edited by S. Heileman (Consultant). pgs 91;

Vannuccini, S. 1999, Shark Utilization, Marketing and Trade, ISBN: 9251043612m pgs 407.

ISSN:04299345 (http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/005/x3690e/x3690e00.htm)

Viegas, J. 2005. Ancient Perfumery Found in Cyprus. Discovery News, March 10
(http://dsc.discovery.com/news/briefs/20050307/perfumery.html)

Walter, S. 2001. Non-wood Forest Products in Africa: A Regional and National Overview. (http://www.fao.org/documents/show_cdr.asp?url_file=/DOCREP/003/Y1515B/y1515b08.htm).

Whistler, W.A. 1985. Traditional and herbal medicine in the Cook Islands. Journal of Ethnopharmacology, Vol. 13(3): 239.

Winkleman, M. and Dobkin de RIOS, M. 1989 Psychoactive properties of Ikung Bushmen Medicine Plants. Journal of Psychoactive Drugs, Vol. 21: 51 -59.

World Health Organization (WHO). 2002. WHO Traditional Medicine Strategy 2002 – 2005, 62 pgs. Geneva, Switzerland: WHO/EDM/TRM 2002.

Notes

[1] Further information may be obtained from:
a) Stevart T. 1998. Etude sur les orchidées de São Tomé et Príncipe. Mémoire de licence, Université libre de Bruxelles, Laboratoire de botanique systématique et de phytosociologie, 117 p. + 191 p. annexes.
b) Stevart T. 1999.Rapport de mission sur les orchidées de São Tomé et Príncipe. Projet ECOFAC (Conservation et utilisation rationnelle des écosystèmes forestiers d'Afrique centrale), AGRECO-GEIE, Bruxelles, 364 p.

[2] Guinea Bissau land-bounded on the north by Senegal, on the east and south by Guinea, and on the west by the Atlantic Ocean includes about 60 offshore islands amongst which are the nearby Bijagós (Bissagos) Archipelago and other islands in the Atlantic and amongst which are encountered the Orange National Park, the Joao Vieira & Poilao National Park and the Cantanhez protected area. Guinea-Bissau is included in this article as it is a member of the Small Island Developing States Network (SIDSNET) and of the Alliance of Small Island States (AOSIS).

[3] Several plant species (1) – Cassia sieberiana (Family name (FN): Caesalpiniaceae), local name (LN): Sambasintche-andje); (2) – Dichrostachys glomerata (FN: Mimosaceae; LN: Burle); (3) – Entada abyssinic (FN: Mimosaceae; LN: Fulani) and (4) – Erythrina senegalensis (FN: Mimosaceae; LN: Fulani) are used in treatment of sinusitis and influenza.

[4] Prelude (Programme for Research and Link between Universities for Development), recognized by UNESCO and updated January 26, 2005, is an initiative of the Belgian Directorate Generale for Development Cooperation (DGDC) in collaboration with the Belgian Royal Museum for Central Africa (RMCA) that concerns the use of plants in traditional human and veterinary medicines; and which is linked to the proprietary database software www.metafro.be of the Metadata African Organization. The Prelude database deals with the use of about 1.900 plants in traditional veterinary and human medicine in more than 13000 recipes from Sub-Saharan Africa.

[5] The National biodiversity and Action Plan of the Maldives was developed by the Ministry of Home Affairs, Housing and the Environment (MHAHE) with support from the United Nations Development Programme (UNDP) and the Global Environmental Facility (GEF) within the framework of the following projects:
a) National Biodiversity Conservation Strategy and Action Plan and Report to the CBD including Clearing Housing Mechanisms (CHM) – project No: 649; and,
b) Atoll ecosystem-based conservation of globally significant biological diversity in the Maldives' Baa Atoll – project No: 1044

[6] Report from the Republic of Cyprus in framework of INFORRMa-IENICAb project funded under the Fifth Framework Programme by DG XII of the European Commission.
a) INFORRM = Industry Network for Renewable Resources and Materials
b) IENICA = Interactive European Network for Industrial Crops and their Applications

[7] 'El Proyecto Mediano TRAMIL-UNEP titulado: Conservación de la Bioversidad e Integraciòn del Conociemento Tradicional de Plantas Medicinales a las Politicas de Attención Primaria de Salud en Centroamerica y Caribe' es ejecutado por enda-caribe, través del Programa TRAMIL (GFL/2713-01-4356)'.

[8] Recognized as a UNESCO World Heritage Site of historical, cultural and architectural significance.

[9] The Asian Development Bank provided assistance in 2000 towards the preparation of the Master S&T plan that was finalized in draft form in 2001 for consideration of deliberation and adoption.

[10] Squalene is used as a bactericide, an intermediate in the manufacture of pharmaceuticals and aromatics. Nowadays it is extensively used as an additive in pharmaceutical preparations, cosmetics and health foods. As squalane it is also used in skin care products, as it is a natural emollient and is considered to be efficient in healing wounds and in preventing the multiplication of bacteria

[11] Adapted from Research reports – Aromatic and Medicinal Plants, Institute of Agriculture, University of Malta (http://www.home.um.edu.mt/ioa/amp.html)

[12] Does not include Centre for Genetic Engineering and Biotechnology (CIGB) a globally recognized institute at Havana as one of the world's best biopharmaceutical research institutes outside the US and Europe, and which has a staff of about 700 people nor the Centro Nacional de Biopreparados (BIOCEN), Instituto Carlos D Finlay, Centro de Inmunoensayo (CIE), and the Centro de Inmunologia Molecular (CIM). BIOCEN for example, markets 55 products complying with ISO standards. Four production facilities of the Finlay institute supply Cuba and customers from developing countries with vaccines and sera and there are 82 CIE labs; some of them located in the former Soviet Union, Ghana, Brazil and Colombia. Moreover, Cuba through a generous biennial donation to UNESCO makes possible the award by UNESCO of the Carlos Finlay Prize in Microbiology – the only prize in the UN System for this discipline.

[13] The Caribbean Association of Researchers and Herbal Practitioners was established in 1998 to ensure that all Caribbean national authorities recognize that some medicinal plants possess
• therapeutic properties in treating and preventing disease in humans and animals
• support the emergence of a safe sustainable medicinal

- summary plant products
- encourage and promote research education and training in the domain of Caribbean herbs.

[16] The US Virgin Islands has Observer Status in AOSIS and SIDS.

[17] Landlocked by Guyana, Brazil, and French Guiana and with northern frontier open to the Atlantic Ocean, Suriname is member of The Alliance of Small Island States (AOSIS) – a coalition of small island and low-lying coastal countries that share similar development challenges and concerns about the environment, especially their vulnerability to the adverse effects of global climate change. It functions primarily as an ad hoc lobby and negotiating voice for Small Island Developing States (SIDS) (which includes Suriname as a member) within the United Nations system.

[18] The Secretariat of the Pacific Community (SPC) – with its headquarters in Noumea, New Caledonia and its regional office in Suva, Fiji, is the premier regional technical and development organization of the Pacific islands. Since its inception SPC has carried out several science and technology programmes amongst which seaweed farming figures prominently. Information on the advances made in seaweed farming in Fiji, Kiribati, Papua New Guinea, Samoa, Tonga and Vanuatu may be obtained from offices in New Caledonia and Fiji at spc@spc.int

[19] Shell money called tafuliae results from a lengthy labour intensive process that involves the making up of of 10 colours. The red-lipped rock oyster called romu (Chama pacifica) provides red coloured disks. The small white shell known locally as kee (Beguina semi-orbiculata) when heated gives orange disks. Black disks are obtained from the horse mussel shells called kurila (Atrina vexillum); and thick white disks are obtained from a cockle (Anadara granosa).

Traditional knee-length Hibiscus plant-derived skirt worn by Yapanese women.

[20] Quotation by SPREP Coastal Management Advisor Mary Power, SPREP is coordinating the Solomon Islands Women in Fisheries Project that is being carried out by the Environmental Concerns Action Network of the Solomon Islands (ECANSI) with Canadian government funding provided through the Canada-South Pacific Ocean Development Program. "The goal of the project is to understand the important issues of sustainable management, conservation and development of marine resources currently faced by the women," See also (SPREP, 2002).

[21] The Vedas which were composed about 1500 BC and written down about 600 BC speak of. Hymns of the Atharva-Veda. Extracts from the ritual books and the commentaries. In Sacred books of the east. Trans. Maurice Bloomfield, 1847 vol. 42: VII-56, VIII-7. www.sacred-texts.com