

REVIEW ARTICLE

Biodiversity of Medicinal Plants in Bangladesh: Prospects and Problems of Conservation and Utilization

M. M. Rahman and M. S. A. Fakir*

Department of Crop Botany, Bangladesh Agricultural University, Mymensingh, Bangladesh.

Accepted: 25 January 2015

Abstract: Bangladesh contains about 5,700 species of higher plants being situated in a larger part of South-Asian center of plant genetic diversity. Of which 260 species are cultivated and the rest of the species are virtually left on growing in natural vegetation in forests and in village thickets. Chittagong Hill Tracts possess the largest tropical rain forest of Bangladesh, which includes a vast amount of plant resources. Majority of the tribal communities of the country live in this area and depend on the plant resources for their food, fuel, fruit, vegetables and medicine. The use of wild plants forms part of their traditional or indigenous systems of knowledge and practice that have accumulated and developed over generations. The widely used medicinal plant species are – Neemada (*Buddleja asiatica*), Mondessa (*Campanumoea celebica*), Kanphutki (*Cardiospermum halicacabum*), Pahari bichuti (*Cnesmone javanica*), Pidaghi (*Cratoxylum sumstranum*), Madanmasta (*Dehaasia kurzii*), Chotrapata (*Laportea crenulata*), Mughal mani gach (*Nelsonia campestris*), Kulla (*Desmos longiflorus*) etc. Also, a vast majority of forests of Bangladesh lies in Sylhet division in the Northeast Bangladesh Ecological Zone located on a series of low hills on the southern and southeastern parts of Habiganj and Moulavibazar districts. Sylhet forests alone have 790 species of flowering plants distributed in 95 families. The most significant fact is that 25 of 95 families in this region are each represented only by a single taxon. Plant species which are becoming rare in Sylhet Region are: Kumbhi (*Carea arborea*), Kalija (*Cordia dichotoma*), Pani-hijal (*Salix tetrasperma*), Kurta (*Plaquium polyanthum*) etc. Of

these wild and semi-wild plant species, medicinal and aromatic plants have been used over the millennia for human welfare in the promotion of health and as drugs and fragrance materials. In Bangladesh, the importance of medicinal plants needs no mention. Even today, use of medicinal plants in primary health care systems is very important, especially in remote rural communities and poorly accessible areas. Wild collections of herbs mainly by the poor are a livelihood activity and often a major source of cash income for these groups. Ayurvedic and Unani companies (phytopharmaceuticals) use large number of medicinal plants species as traditional medicines since ancient times. Most important medicinal plants are: *Terminalia arjuna* (Arjun), *T. chebula* (Hartaki), *T. bellirica* (Bohera), *Aegle marmelos* (Bael), *Withania somnifera* (Aswagandha), *Cassia angustifolia* (Sonapata), *Saraca asoca* (Ashok). But unfortunately, the loss of habitats and overharvesting has threatened the availability of the medicinal plants that will undermine the productivity in herbal medicines and will ultimately lead to irreversible biological losses and a high socio-economic price. Considering the threats from the loss of plant species, the Botanical Garden of Bangladesh Agricultural University has strengthened collection and conservation of threatened medicinal plant species of Chittagong Hill Tracts (CHT) and Sylhet Forests. In Bandarban (CHT), out of targeted 37 species, a total of eight plant species have so far been identified and located with the help of the local tribal herbal practitioners. The species

are: *Fernandoa adenophylla*, *Cratoxylum sumstranum*, *Phlogacanthus curviflorus*, *Hedyotis scandens*, *Breynia retusa*, *Laportea crenulata* and *Gynura nepalensis*. The rest 29 species have not yet been located in natural habitats. Repeated search are being made with the help of the local people and the herbal practitioners to detect their occurrence in natural habitat. In Sylhet forests, a total of 29 species have been collected out of targeted 45 species, and 16 other species have not yet been collected due their disappearance from the locality. Some of the species are: *Olea dioica*, *Alphonsea ventricosa*, *Atropa beladona*, *Canarium bengalense*, *Pajnelia longifolia*, *Cryptoronia paniculata*, *Vernonia arborea*, *Cinchona officinalis*.

Keywords: Medicinal plants, Biodiversity, Conservation, Utilization.

INTRODUCTION

Bangladesh being situated in a sub-tropical zone constitutes a larger part of South-Asian center of plant genetic diversity, sharing with India. It is rich in field crops, fruits, nuts and forest plants covering a wide array of species, genera and families with enormous genetic diversity. About 5700 species of higher plants have been recorded so far, and of these, some 160 species are used as crops (Mondal, 1990). The rest of the species are virtually left on growing in natural vegetation in forests and in village thickets, which have been an important source of numerous non-wood forest products, like fruits and nuts, medicine and aromatics, fuel, fodder, bamboo, rattans, palms, and ornamentals. Some 60 species of both minor and underutilized fruit and nut species are common in the forests and the village thickets. More than 500 species of medicinal plants have been listed from the undergrowth vegetation of the forests and village groves. There are at least 18 species of bamboo and 8 species of rattans occurring both wild in the forests and cultivated in rural households (Banik, 1990; Alam, 1988). About 29 species of

plants grown in wetlands are significant in rural economy for providing fodder, fuel, mat, thatching materials and fencing (Basu and Manna, 1997). Numerous other wild resource species, e.g. orchids, bromeliads, anthuriums, heliconias, bulbs, cacti and succulents are also available in the forests.

Of these wild and semi-wild plant species, medicinal and aromatic plants have been used over the millennia for human welfare in the promotion of health and as drugs and fragrance materials. According to the World Health Organization (WHO), medicinal plants form the basis of traditional and indigenous health systems used by the majority of the population of most developing countries. In recent years, there has been a growth of interest in traditional medicine, in part driven by the interest in complementary medicine in industrial countries, and in part resulting from the interests of the international pharmaceutical industries. Modern pharmacopeia still contains at least 25% drugs derived from plants and many others which are synthetic analogues built on prototype compounds isolated from plants. China, India, Sri Lanka and a few other countries have officially recognized the use of traditional medicines in health care delivery systems. The system of Unani and Ayurvedic Medicine was also brought under the National Drug Policy of Bangladesh in 1982 to ensure availability, commercial manufacturing and marketing of quality Unani and Ayurvedic Medicine and Drugs (Ahsan *et al.*, 1997).

In Bangladesh, the importance of medicinal plants needs no mention. Medicinal plants have been used in Bangladesh by a large number of industries and companies. Pharmaceutical companies use medicinal plant materials for the isolation of single purified drugs, e.g. digitoxin extracted from *Digitalis*, vincristine from *Catharanthus roseus*, senna from *Cassia senna*. Ayurvedic and Unani companies

(phytopharmaceuticals) use large number of medicinal plants species as traditional medicines since ancient times. Most important medicinal plants are: *Terminalia arjuna*, *T. chebula*, *T. bellerica*, *Aegle marmelos*, *Withania somnifera*, *Cassia angustifolia*, *Saraca asoca*.

Even today, use of medicinal plants in primary health care systems is very important, especially in remote rural communities and poorly accessible areas. Wild collections of herbs mainly by the poor are a livelihood activity and often a major source of cash income for these groups. Wild medicinal plants, therefore, play an invaluable role in the health services and the very livelihood of majority of the rural population. The system of Unani and Ayurvedic medicine was also brought under the National Drug Policy of Bangladesh in 1982 to ensure availability, commercial manufacturing and marketing of quality Unani and Ayurvedic Medicine and Drugs (Ahsan *et al.*, 1997).

The loss of habitats and overharvesting has threatened the availability of the medicinal plants that will have a direct effect on the lives of poor people, particularly the poor women as they are directly involved with the management of daily household affairs relating to food, family health care and nutrition, treatment and income etc. If the situation continues unabated, the decline of diversity in medicinal plant genetic resources will undermine productivity in herbal medicines that will ultimately lead to irreversible biological losses and a high socio-economic price. So, immediate attention is most needed to save the medicinal and aromatic plant genetic resources in protected areas and regenerate and multiply them in farmers'/users' field to enhance biodiversity and to sustain and support the century old traditional medicinal heritage of Bangladesh. Considering the threats from the loss of plant species, particularly with

changing concept after the proclamation adopted in the Convention of Biological Diversity (CBD) in 1993, many universities, research institutes and NGOs in both developed and developing countries have strengthened *ex-situ* (off site) conservation of rare and endangered plants through botanic gardens, arboretum, herbarium, field gene-banks and seed banks in order to save them from extinction. These institutes are not only cultivating and maintaining most of the germplasm of wild and semi-wild species in their *ex-situ* gene-banks for conservation, but also providing facilities for education and research with ready access to a wide range of plant genetic materials which is not possible with remote and dispersed population. In addition to collection and conservation activities, these institutes are also involved in cultivation and utilization of rare and endangered species and species of local importance at village levels involving local people/farmers based on their local knowledge and cultural diversity.

An inexpensive and sustainable method of plant conservation and cultivation could be established through outreach activities at village levels by building a new capacity with little efforts and inputs if an interactive networking is developed with the resource poor farmers. Cultivation of medicinal and aromatic plants in their home gardens and in agro-forestry systems can directly contribute to the economic betterment of the rural people through providing the resource poor with multiple sources of food, fruit, herbal medicine and income. This program will also help increase biodiversity in the farmers' field that will help pressure off the forests.

Overview of medicinal and aromatic plants

The forests and the village thickets have always been the major sources of medicinal and aromatic plant genetic resources. Wild species with enormous genetic potentials are the fundamental basis of food security and health. In

Bangladesh, Chittagong Hill Tracts possess the largest tropical rain forest of Bangladesh, which includes a vast amount of plant resources. A total of 700 plant species are known to be used as medicine by Tribal people for treatment of some 302 ailments (Uddin, 2006). Majority of the tribal communities of the country live in this area and depend on these plant resources for their food, fuel, fruit, vegetables and medicine. The use of wild plants forms part of our traditional or indigenous systems of knowledge and practice that have accumulated and developed over generations. A good number of wild plant species that occur naturally in the wild have been the major sources of vegetables. These are, among others- Ghamani gach (*Archidendron bubalinum*), Danti (*Baliospermum montanum*), Barojangali (*Boehmeria malabarica*), Janggali shak (*Ampelgynonum chinense*), Hamussa gach (*Breynia retusa*), Ludi sola (*Byttneria pilosa*), Saing maning kak (*Evolvulus nummularius*), Kaowatuti (*Fernandoa adenophylla*), Ataiho koga (*Hedyotis scandens*) etc. Majority of the tribal people also use some wild plants as folk medicine (Uddin, 2006). This is a diverse system specific to ecosystem and ethnic community. Folk medicines are used for home remedies, food and nutrition related weaknesses and common ailments. The widely used medicinal plant species are: Ban-jamir (*Acronychia pedunculata*), Noga Kola (*Alphonsea ventricosa*), Jangli-badam (*Alseodaphne petiolaris*), Ban Kamla (*Atalantia monophylla*), Ori Gab, Gulul (*Diospyros rammiflora*), Ban Bakul (*Drypetes assamica*), Thisuru (*Garcinia lanceaefolia*), Sumomukhi (*Homalium nepalense*) (Bangladesh National Herbarium, 2006).

A vast majority of forests of Bangladesh lies in Sylhet division in the Northeast Bangladesh Ecological Zone located on a series of low hills on the southern and

southeastern parts of Habiganj and Moulavibazar districts. Small patches of hill forests are also situated in the northeastern part of Sylhet district. On the other hand, the northern part of Sylhet and Sunamganj district has extensive tracts of freshwater swamp forests reaching up to Garo Hills. Broad-leaf evergreen trees in association with some deciduous species are found on hills while swamp forest species are typical of low-lying areas. Sylhet forests alone have 790 species of flowering plants distributed in 95 families (Alam, 1988). The most significant finding is that 25 of 95 families in this region are each represented only by a single taxon. This fact indicates the urgency that the representative populations of the plant species are to be maintained and conserved with maximum protection in order to save them from extinction from the forests. Plant components which are becoming rare in Sylhet Forest Region are: Kumbhi (*Carea arborea*), Kalija (*Cordia dichotoma*), Pani-hijal (*Salix tetrasperma*), Kurta (*Plaquium polyanthum*), etc. Majority of the rural poor, particularly the tribal communities of the country living in this area depend on these plant resources for their food, fuel, fruit, vegetables and medicine.

Sal Forests in plain land are composed of many medicinal and aromatic species of plants of diverse habits extending from trees and shrubs to herbs and climbers. The medicinal tree species are: Hartaki (*Terminalia chebula*), Bohera (*T. belerica*), Arjune (*T. arjuna*), Ashok (*Saraca indica*), Kurchi (*Holarrhena antidysentrica*), Parul (*Stereospermum suaveolens*), Palash (*Butea monosperma*), Muchkundo/Moos (*Pterospermum acerifolium*), Chal-mugra (*Hydnocarpus kurzii*) Sona (*Oroxylon indicum*), Kharajora/Bijal-ghata (*Litsea monopetala*), Neem (*Azadirachta indica*), Rakto-chandan (*Pterocarpus santalinus*), Ganiari (*Premna integrifolia*), Bael

(*Aegel marmelos*), Bhela (*Semicarpus anacardium*), Barun (*Crataeva nurvala*), Sonalu (*Cassia fistula*), Chatim (*Alstonia scholaris*). Among the climbers, the species of medicinal importance are: Bhui-kumra (*Ipomea digita*), Gulancha (*Tinospora tomentosa*), Shayma-lota (*Ichnocarpus frutescens*), Ananta-mool (*Hemidesmus indicus*), Kumari-lata (*Smilax zeylanica*), Shotomuli (*Asparagus recemosus*), Gandhabhadulia (*Paederia foetida*), Peepul (*Piper longum*), Choi (*Piper chaba*), Alkushi (*Mucuna pruriens*), Makal (*Hodgsonia macrocarpa*), Nata (*Caesalpinia bonduc*), Telakucha (*Coccinea cordifolia*), *Dioscorea spp.* etc. The forests and village groves are also rich in magnificent and luxuriant growth of undergrowth vegetation. The Burma type, the Tidal forests and the low level plain "Sal" forests of Bangladesh have such undergrowth vegetation of medicinal importance. The most important undergrowth medicinal herb species are: Berela (*Sida cordifolia*), Bhringoraj (*Wedelia calendulacea*), Kontakari (*Solanum xanthocarpum*), Punarnaba (*Boerhaavia diffusa*), Ashwa-gandha (*Withania somnifera*), Sarpa-gandha (*Ravolfia serpentina*), Josti-madhu (*Glycyrrhiza glabra*), Kalo-megh (*Andrographis paniculata*), Brahmi-sak (*Herpestis monniera*), Pudina (*Mentha spicata*), Apang (*Achyranthus aspera*), Bach (*Acorus calamus*), Ekangi (*Zingiber zerumbet*) etc. There are also some other important shrub species, like Basak (*Adhatoda vasica*), Nishinda (*Vitex negundo*), Akando (*Calotropis procera*), Indrojob (*Wrightia tinctoria*), Sona-mukhi (*Cassia angustifolia*), Dhutura (*Datura metel*), Gajo-peepul (*Scindapsus officinalis*), Olat-kamboal (*Abroma augustifolia*), *Cassia senna* etc. More than 500 species of medicinal plants have so far been listed by the Bangladesh National Herbarium (BNH) from the undergrowth vegetation of the forests and village groves.

Importance of Medicinal and Aromatic Plant Genetic Resources

Wild and semi-wild medicinal and aromatic plant species have been used over the millennia for human welfare in the promotion of health and as drugs and fragrance materials. According to the World Health Organization (WHO), medicinal plants form the basis of traditional and indigenous health care needs used by the majority of the world's population. This trend of using medicinal plants does not occur only in developing countries but also present in developed countries as well. In recent years, there has been a growth of interest in traditional medicine due to increase in interests in complementary medicine in industrial countries as well as the interests of the international pharmaceutical industries. Modern pharmacopeia still contains at least 25 % drugs derived from plants and many others, which are synthetic analogues built on prototype compounds isolated from plants (Silva, 1997).

Two of the largest users of medicinal plants are China and India. Traditional Chinese Medicine (TCM) uses over 5,000 plant species; India uses some 7,000 species. In China, sales of traditional medicines have more than doubled in the last five years. Use of Traditional Chinese Medicine- Ayurveda, Unani and Sidda has also been growing at a rapid rate in Western countries. In Britain the use of TCM has increased tremendously, especially for the treatment of eczema- an estimated 1.0 million TCM prescriptions were written in 1995 and the number of TCM doctors has doubled in the past five years. China has about 2,50,000 traditional medical doctors, and in 1990, TCM doctors used some 7,00,000 tones of plant materials. India has about 4,60,000 traditional medicine doctors, and export trade in medicinal plants in it has risen almost three times during the last decade, and it is booming. Latin Amer-

ica, home of a third of the world's plants, has also a long-standing tradition of use of plants as medicine, especially among the indigenous peoples. Nearly 2,000 species used in the Colombian Amazon for medicinal purposes. The use of herbal remedies is also booming in developed countries. In Germany, over 80% of all physicians regularly use herbal products. Indeed, most of Europe (except Britain and Ireland) has never lost its herbal tradition. In USA, herbal remedies are worth \$1.6 billion, and it is rising. The situation is similar in Japan (Suk, 1998).

In Bangladesh, medicinal and aromatic plants have been used in Ayurvedic and folk medicine since ancient times. Even today, use of medicinal plants in primary health care systems is very important, especially in remote rural communities and poorly accessible areas. In many parts of the country, particularly in adjoining forest area, wild collections of herbs mainly by the poor are a livelihood activity and often a major source of cash income for these groups. Wild medicinal plants, therefore, play an invaluable role in the health services and the very livelihood of majority of the rural population. Given the importance of herbal medicines, the Government of Bangladesh has brought the system of Unani and Ayurvedic Medicine under the National Drug Policy in 1982 to ensure availability, commercial manufacturing and marketing of quality Unani and Ayurvedic Medicine and Drugs (Ahsan *et al.*, 1997).

Depletion of medicinal plant species

The bulk of the medicinal and aromatic plants are still wild harvested and only a very small number of species is cultivated. The over-exploitation and destructive harvesting of medicinal plants in the wild by the escalating human populations have lead many plant species to become rare and some

are on the point of extinction due to degradation and loss of habitats. Bangladesh statistics show a total forest area of 1,559 sq km or about 12.8 percent of the total land area (BBS, 1994). However, estimates of other sources reveal that the forest area of Bangladesh shrank from 16.5 % in 1971 to 6.0 % in 1982. A recent study however shows that the forest area does not exceed 5 -6 % of the total land area. An estimated 73,000 hectares of Bangladesh forest have been lost through encroachment for agriculture and aquaculture during the last two decades. It is also estimated that a loss of about 8,000 hectares of forests occurs annually due to industrialization and urbanization. A number of papers reported that herbalists now having to walk increasingly greater for herbs that once grew almost outside the door. Data on threatened species are scarce but a large number of medicinal plants are reported to be disappearing rapidly in Bangladesh due to destruction of natural habitats (FAO, 1984). It has been reported that 24 vascular plant species have been threatened in Bangladesh of which 1 species is extinct/endangered, 21 species vulnerable, 1 rare and 1 indeterminate (Walter and Gillett, 1998). Some 45 forestry species are currently threatened with extinction (Khan, 1991; Haq and Banik, 1992). Some medicinal plants have also been reported as endangered by Dr. N. Ahmed (Pers. comm.). The species are *Sagittaria platyphylla* (Kawatukri), *Zingiber spectabile* (Bonada), *Vitex trifolia* (Sagar nishinda), *Melastoma melabathricum* (Bon tejpata), *Leea alata* (Bon chalida). The Bangladesh National Herbarium has very recently listed 106 plant species as endangered (Khan, 1991), of them, some 35 plant species have been mentioned for medicinal purposes. It has also been known from personal communications that some other important wild medicinal plant species are now at risk of being lost in all or

part of their distribution ranges because of reduction in their population numbers due to habitat destruction and over collecting. The species are: *Aglaia roxburghiana* (Pironga), *Arbus preicatorius* (Rati), *Bixa orellana* (Doigota), *Caesalpinia bonduc* (Nata), *Ipomoea digita* (Bhuikumra), *Mollotus philippinensis* (Sinduri), *Piper chaba* (Choi), *Vetiveria zizanioides* (Ghandhabena), *Terminalia belerica* (Bohera), *Terminalia chebula* (Haritaki), *Terminalia arjuna* (Arjune), *Holarrhena antidysentrica* (Kurchi), *Rauwolfia serpentina* (Sarpagandha), *Litsea monopetala* (Kharajora) etc.

The threats from the loss of medicinal plant resources

The loss of habitats and overharvesting has threatened the availability of the medicinal plants that are used as the first and last resort for health care by many rural populations. The loss of medicinal plant resources and biodiversity will have a direct effect on the lives of poor people, particularly the poor women as they are directly involved with the management of daily household affairs relating to food, family health and nutrition, treatment and income etc. In addition, the traditional Ayurveda and Unani physicians also use substantial quantities of medicinal plants who get their supplies mostly from the wild. With the increasing demand for medicinal and aromatic plant species, there is a strong likelihood that the medicinal and aromatic plant species will become rare and ultimately extinct due to exhaustive and destructive collection practices. This decline of diversity in medicinal plant genetic resources will undermine productivity in herbal medicines and the environment that will ultimately lead to irreversible biological losses and a high socio-economic price. So, it is important to ensure that the large diversity of medicinal plants used by people living in different ecosystems, mainly the rural communities and the tribal,

is not jeopardized. Hence, immediate attention is most needed to save the medicinal and aromatic plant genetic resources in protected areas and regenerate and multiply them in farmers'/users' field to enhance biodiversity and to sustain and support the century's old traditional medicinal heritage of Bangladesh. The World Health Assembly has passed a number resolution in response to a resurgence of interests in the study and use of traditional medicine in health care, and in the recognition of the importance of medicinal plants to the health systems of many developing countries (FAO, 1997). In answer to WHO's call, many developing countries have decided to take traditional forms of medicine more seriously and to explore the possibility of utilizing them in primary health care. East Asian countries such as Japan, China, Taiwan and South Korea have officially recognized the use of traditionally inherited medicines and folk medicine in health care delivery systems in their own countries (Suk, 1998).

Enhancement of medicinal plant biodiversity

Collection and conservation of medicinal plants in Botanic Garden

The Botanical Garden of Bangladesh Agricultural University is playing an important role in collection and conservation of rare and endangered plant species, specially the medicinal plants. Germplasm of threatened wild plant genetic resources are collected from different parts of the country according to their distribution sources. Collected seeds are germinated and multiplied for growing plants as live collections in the garden for conservation and future use. The gardens are also involved in species recovery and restoration programme through multiplying and reproducing rare and threatened plant species for reinforcement of reduced populations and for restoration of degraded habitats.

Conservation and cultivation in farmers' homesteads/ fields

The main objective of this activity is the conservation of rare and endangered plant species, and species of local importance through cultivation at home gardens and in crop land through agroforestry systems. Under his program, the local people may be involved through raising awareness and providing necessary seedlings/saplings of rare and locally important medicinal and aromatic plant species for cultivation in their own lands. Cultivation of medicinal and aromatic plant species will directly contribute to the economic benefit of the rural people through earning income by sale proceeds. On the other hand, it will help enrich the biodiversity outside the protected areas, which will intern help pressure off the forests. The cultivation programme may include: *Acorus calamus*, *Aegle marmelos*, *Aloe indica*, *Andrographis paniculata*, *Artemisia nilagirica*, *Asparagus recemosus*, *Azadirachta indica*, *Bacopa monniera*, *Careya arborea*, *Gloriosa superba*, *Helictyres isora*, *Phyllanthus embelica*, *Piper chaba*, *P. longum*, *P. nigrum*, *Rauwolfia serpentina*, *Terminalia arjuna*, *T. chebula*, *T. bellirica*, *Tinospora cordifolia*, *Withania somnifera*, *Woodfordia fruticosa* etc.

Conservation and cultivation through community plantations

Community plantations will have an important bearing especially in reference to the primary health care needs of the country that will help increase the supply of medicinal herbs for traditional medicines. Cultivation of herbal medicines can be undertaken at the community level with the plants listed here: *Aegle marmelos*, *Aquilaria agallocha*, *Azadirachta indica*, *Bixa orellena*, *Casia fistula*, *Cinnamomum camphora*, *C. zeylanicum*, *Holarrhena anti-*

dysenterica, *Hydnocarpus kurchii*, *Litsea glutinosa*, *L. monopetala*, *Madhuca indica*, *Mimusops elengi*, *Phyllanthus embelica*, *Schleichera oleosa*, *Terminalia arjuna*, *T. chebula*, *T. belirica* etc.

CONCLUSION

Bangladesh is enriched with a vast resources of medicinal plants scattered in forests, particularly in village jungles and shrubberies. But unfortunately, widespread habitat loss and overexploitation has threatened the availability of medicinal plants. So, immediate attention is needed to save and conserve the medicinal plants *in-situ* and *ex-situ*. Networking to these effects, involving all the stakeholders, could have a great impact in conservation and sustainable utilization of medicinal plants. Domestication of a wide variety of medicinal plants and their introduction into sustainable agricultural and forestry systems can play a vital role to support the century old traditional medicinal heritage of Bangladesh.

REFERENCES

1. Ahsan ATMK, Shabuddin M, Choudhuri K, Shahriar M, Huda AN and Chowdhury Z (1997) Genetic Resources Conservation and Utilization of Medicinal and Aromatic Plants. Plant Genetic Resources-Bangladesh Perspective. *Proceedings of National Workshop on Plant Genetic Resources*. 26-29 August, 1997. Bangladesh Agric. Res. Council, Farm Gate, Dhaka.
2. Alam MK (1988) Annotated Checklist of the Woody Flora of Sylhet Forests. Bulletin 5. Plant Taxonomy Series, Bangladesh Forest Research Institute, Chittagong, 153 p.
3. Banik RL (1992) Bamboo Cultivation and Management in Bangladesh. Bulletin 1. Bamboo Research Series, Bangladesh Forest Res. Inst., Chittagong.
4. Bangladesh Bureau of Statistics (BBS) (1994) Statistical Year Book of Bangladesh, Ministry of

- Planning, Government of the People's Republic of Bangladesh.
5. Basu SK and Manna MK (1997) Conservation of Some Wetland Species of Socio Economic Importance with reference to West Bengal, India. Programme and Abstract, *9th Biennial 2nd ISMF&MP-Botanical Conference, Bangladesh Botanical Society*, 8-9 January 1997, University of Dhaka, Dhaka.
 6. Bangladesh National Herbarium (BNH) (2006) Traditional uses of ethno-medicinal plants of the Chittagong Hill Tracts. Ministry of Chittagong Hill Tracts Affairs, Govt. of the People's Republic of Bangladesh.
 7. Food and Agriculture Organization of the United Nations (FAO) (1984) *In-situ* Conservation of Wild Plant Genetic Resources: A Status Review and Action Plan. Document by FAO and IUCN, Rome, 83 pp.
 8. Food and Agriculture Organization of the United Nations (FAO) (1997) Selected Plant Genetic Resources Activities of Crop-related Networks, Supported by FAO. CGRFA- 7/97/8.1. Appendix 2, 11-14.
 9. Haq MF and Banik RL (1992) Country Report-Bangladesh. Proceedings of Regional Workshop, Tree Breeding and Propagation, Bangkok, Thailand, 10-14 July 1990. Field Document No. 2 (RAS/88/025):19-48.
 10. Khan MS (1991) Towards Sustainable Development: Conservation of Genetic Resources of Bangladesh. A background paper for National Conservation Strategies- Bangladesh. The World Conservation Union, and Bangladesh Agricultural Research Council. Dhaka, Bangladesh.
 11. Mondal MH (1990) Plant Genetic Resources Activities in Bangladesh. Proc. South Asia National Coordinators Meeting, 21-24 March 1990, held at IPBGR Regional Office for South Asia, NBPGR Campus, Pusa, New Delhi, India.
 12. Silva TD (1997) Industrial Utilization of Medicinal Plants in Developing Countries. Non-Wood Forest Products- 11, Medicinal Plants for Forest Conservation and Health Care, F.A.O, Rome, Italy, 34 p.
 13. Suk KT (1998) TRAFFIC and its Medicinal Plant Work. Proceedings of a Workshop on the Conservation of Medicinal Plants, 25 November, 1998, Seoul, Republic of Korea, 23-24 pp.
 14. Uddin SN (2006) Traditional uses of ethnomedicinal plants of the Chittagong hill tracts (ed. MM Rahman), Bangladesh National Herbarium, Mirpur, Dhaka.
 15. Walter KS and Gillett HJ (1998) 1997 IUCN Red List of Threatened Plants. Cambridge: IUCN, World Conservation Union.