

TITLE: ETHNOBOTANY AND CONSERVATION OF MEDICINAL PLANTS IN AFRICA: THE WAY FORWARD IN THE NEXT DECADE*

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Introduction

Africa is endowed with a rich biodiversity and the African flora is estimated to have 40,000 plant species. The distribution of biodiversity varies across the continent but most of the rich biodiversity zones are East, West and Central Africa. Most countries of the Continent have a rich cultural folklore. However, ethnobotanical studies and conservation of the rich biodiversity of Africa is still not well studied. Ethnobotanical studies plays a major role in the discovery of medicines, food, insecticides and other natural products. The WHO estimates that about 20,000 plant species are in use in traditional medicines. About 74% of the 121 biologically active plant-derived compounds presently in use worldwide have been discovered through leads from folk or ethnomedical uses of the plants. About 35 - 70,000 species out of the estimated world flora of 250,000 species of higher plants (about 14 - 28%) have been used for medicinal purposes, excluding lower plants, like fungi, algae and bacteria. In China, about 5,000 (14%) out of the estimated flora of 35,000 species are used in traditional Chinese Medicine. In Tanzania, about 1,200 species (about 10%) out of the flora of 12,667 (1122 of which are endemic) are used in traditional medicine. This data indicates the importance of medicinal plants worldwide.

Conservation problem is a major threat to the rich biodiversity of Africa, particularly the medicinal plants. Biodiversity loss implies the loss of useful species for medicine, food or fibre, their pharmacological properties, the knowledge about the uses, aesthetic value, or their capacity to add value to other species through breeding or genetic manipulation. Therefore the need for creating sustainable ethnobotanical studies and conservation plans on medicinal plants for the next decade is paramount.

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ETHNOBOTANY AND MEDICINAL PLANTS

Ethnobotany, Emerging diseases and Options

Although ethnobotany in its wide use means the interaction between man, plants and environment, the term ethnobotany is used here in relation to medicinal plants, their uses and conservation. At the start of the new millennium (21st Century), we see that for a number of diseases and symptoms, improved and satisfactory cures still remain to be sought and developed. These are:

- Viral diseases, e.g. herpes, AIDS, etc
- Diseases of unknown etiology, e.g. arthritis, some cancers, etc.
- Self inflicted diseases, e.g. alcoholism, liver diseases, drug-dependency, obesity, smoking, etc.
- Genetic diseases, e.g. cystic fibrosis, hemophilia, sickle cell, etc.
- The control of symptoms, e.g. pain elevated cholesterol levels, hypertension, etc.

Options

- One of the most promising options to the problem is to dedicate interdisciplinary research into the "sacred" plants of the tropical rain forests.
- Only small percentage of the tropical forests have been investigated for medicinal potential
- Only about 5,000 species of higher plants worldwide have been exhaustively studied as a source of new drugs for human use (Compare with estimated world flora of 250,000 species!).
- Naturally our attention should be directed to this rich biome in the tropical rain forests as a possible source of new plant drugs.

Trends on ethnobotanical and ethnopharmacological studies in Africa

Research and Development on Medicinal Plants in Africa has been on the agenda for a long time. There is a rich ethnopharmacopoeia. The trends can be viewed from the proceedings organized by African scientists, for example:-

- OAU/STRC Inter-African symposia on traditional pharmacopoeia and African medicinal plants: Dakar (1968), Cairo (1975), Abidjan (1979), Kampala (1968), Swaziland (1999). And few more others.
- OAU/STRC Ethnobotanical/ethnopharmacopoeie books.
- Pan-African conference on research on medicinal plants - Ife/Nigeria (1974).
- Symposium on the utilization of African herbal remedies in primary health care Nairobi/Kenya (1979).

- The QAU/STRC/KIPOC Workshop on Medicinal plants and herbal medicine in Africa: Policy Issues on Ownership, Access and Utilization (1998).
- The African Pharmacopoeia Vols. 1&2 (1985; 1994)
- International Conference on Traditional Medicinal Plants, Arusha, Tanzania: (1991).
- And many more others.

These documents and proceedings should form a resource material for review to chart out the vision of African traditional medicine in the next decade.

Tropical Medicinal Resources

Tropical Africa is very rich in medicinal plant resources. These are important for pharmaceutical and health services in 3 ways:-

- Use as direct pharmaceuticals (plant extracts and products).
- Many serve as templates for chemical synthesis of related medicinal compounds.
- May be used to investigate, evaluate or as research tools in drug development and testing process (phytochemical and biological screening).

Ethnobotany and Indigenous knowledge

In Africa, people possess a wealth of information about the uses of plants and management of vegetation. This is traditional or indigenous knowledge and is based on experience and is handed down orally generation after generation.

During the last few decades, the need for a sustainable development has become clear. What is not clear to many is that traditional knowledge can contribute to sustainable development because it is based in their culture and on their long term experiences about use of plants. Because it is the task of ethnobotanists to describe, analyze, and conserve traditional knowledge, ethnobotanists can play an important role in sustainable development.

Degradation of natural vegetation makes it impossible to learn about plants that no longer exist in the area. This loss of information about plants means the loss of information that could be potentially used in sustainable development.

Keeping these problems in mind, ethnobotanists have four goals. First, to conserve traditional knowledge about plants. Second, to raise awareness about its existence and importance for local people and the public. Third, to demonstrate the need for securing

of land tenure system that will maintain sustainable land practice. Fourth, to disseminate this knowledge to scientists, researchers, planners and administrators, so that it can improve research and development and thereby benefit local people and the public.

The role of food and medicine for health care

Today, food and medicine is often the subject of separate studies. It happens even though the role of food in health care is recognized in our own culture. We say: "An apple a day keeps the doctor away". An ethnobotanical survey of medicinal plants will exclude the apple even it is also used profylactic to maintain health. Yet ethnobotanical studies that intergrate use of plants as food and medicine will describe all uses of the plant species.

Etkin and Ross (1982) describe a close connection between food and medicine. They found that the Hausa in Nigeria use 53 species of plants both as food and as medicine for gastrointestinal diseases. As medicine these plants are used individually in a therapeutic context and as food they are consumed by the whole family in a dietary context. By examining the traditional uses and comparing the characteristics with phytochemical constituents and pharmacological properties both uses are combined to a holistic description of the role of these plants for the Hausa to maintain their health.

Such information contributes to health care so it becomes possible to integrate all plant uses, that the local people use to maintain their health. There is a need to integrate use of plants as medicine and food in ethnobotanical work on medicinal plants.

Implementation Strategy for Ethnobotanical studies.

- Establish a human resource training programme for ethnobotanists, botanists, anthropogists, medical doctors, pharmacognosts, phytochemists, agronomists, agrotechnicians and parataxonomists.
- Enhance ethnobotanical research through multidisciplinary approach, networking, information exchange, involvement of all relevant institutions and students at all levels (primary, secondary, colleges and university).
- Strengthen capacity building in infrastructure (buildings), human resource, establish and or enrich herbaria with medicinal and wild food plants, utilities (computers), literature (floristic, taxonomic, ethnobotanical, etcetera), networking and links and, create and, or strengthen libraries.
- Establish Databases for taxonomic, ethnobotanical and indigenous knowledge; ethnobotanical atlases (national, subregional and regional); OAU/STRC ethnobotanical publications and other R&D relevant publications on medicinal plants.

- More aggressive in publications in ethnobotany, flora and taxonomy on medicinal plants; write more books, journals, newsletters and bulletins on African Medicinal Plants.
- Conduct economic mapping to avail information on biodiversity assessment, abundance of medicinal plant species and distribution of biota.
- Solicit Funding more aggressively to promote ethnobotanical studies. Strategies would be to target key words when soliciting funding, such as biodiversity, bioprospecting, medicinal plants research, food plants, food security, nutrition, Gender, indigenous knowledge, Local communities, health care, poverty alleviation; etcetera.

CONSERVATION OF MEDICINAL PLANTS

Definition

Medicinal plants are all higher plants alleged to have medicinal properties. They are important since they have medicinal cure for human suffering and illness, and have monetary value in commerce.

Extinction Rate

It is estimated that about 825,000 species out of 2,500,000 species on planet in low deforestation case or 1,250,000 in high deforestation case would become extinct by the year 2,000 (1991 data). With the extinction of these species, gone forever will be whatever kinds of organism that may be useful in medicine and medical research. Of the 43,000 plant species at IUCN Database, 18,000 species are threatened. It is estimated that no less than 60,000 plants nearly 1 in 4 of the world total, could become extinct by middle of the 21st century. During the first 70 years of the 20th century, about 75 species of plants and animals became extinct because of human activity.

Importance of Conservation

In view of the high extinction rate and the medicinal and monetary value of medicinal plants, their conservation becomes paramount. There are many other uses of plants which call for the conservation of these bioresources.

Global Conservation Strategies and Initiatives for Medicinal Plants

There are two Practical Considerations:

- a. Increasing demand and quality requirement lead to limitation or abandonment of *in-situ* or wild collection of medicinal plants. Also heterogeneity of drug raw material raises problem.
- b. Hence demand and quality lead to need for supply of medicinal plants from cultivation or alternative technology (*ex-situ*). Homogeneity of drug material will be assured through selective and improved cultivation of medicinal plants.

Strategies and Initiatives

1. Medicinal Plants and Law

1.1. Need for Policy framework which is based on biodiversity and socio-economic environment of the respective country addressing issues on Access, ownership and utilization of medicinal plants.

- There should be legislation protecting wild medicinal plant species in terms of collection and trade controls both for domestic and international trade.
- Legislation applicable to medicinal plants from cultivation and / or alternative technology.

1.2 Prospects for Future Legislation. There should be legislation protecting endangered or rare species. Ideally, legislation on the exploitation and management of medicinal plants should address:- Prevention of over-collection, Permits as management instruments, Management plans, Trade controls, License fees, Habitat protection and Artificial propagation.

2. Information Systems and Databases

The science and technology world requires the development of a coordinated network of computer databases. This promotes interchange of information in this interdisciplinary subject (botanists, pharmacologists, phytochemists, clinicians, anthropologists, etc.). Any data base on conservation medicinal plants should include *inter-alia* plant species distribution, abundance, depository of cultivated stock or seed. Prototype standards and precedents are available in literature on these matters. Examples of databases: IUCN Threatened plants database, NAPRALERT (Natural Products Alert), Floras, Inventories, The Nature Conservancy (TNC), Center for Plant Conservation (CPC), Taxonomic Databases Working Group (TDWG), the International Legume Database and Information Service (ILDIS) and World Conservation Monitoring Center (WCMC).

2.1 Database on medicinal plants should contain the following:- Botanical aspects, Ethnopharmacological aspects, Chemical aspects, Agrotechnological aspects, Technolglcal aspects, Chemotaxonomical aspects, Market aspects and Other aspects

3 Agrotechnology

This is domestication strategy of conserving medicinal plants. The process has two different activities:-

- **At the natural site:** Investigation and observation pertaining to systematic botany, climatic conditions, soil properties, plant development, physiology, reproduction, natural propagation and sustainability to pests and diseases.
- **At the cultivation site:** aspects to be studied include propagation methods, genetic improvement, advanced cultural practices, protection against weeds and pests, optimal timings of harvest, advent of mechanization, post harvest treatments, handling of the raw material, quality control and phytochemical analysis.

4 Biotechnology

This is for plant improvement (*ex-situ* conservation) and provides new methods for mass propagation of elite plants. Also for the *in vitro* propagation of plant raw material. This is conventional plant breeding and reflects a set of goals, like: - Selection of desirable traits, Achievement of homozygosity and Introduction of new genes into cultivation

4.1 Plants as Sources of Enzymes

Enzymes serve as catalysts in organic synthesis. The known 3000 bacterial and 60,000 fungal species produce genes with magnificent application. Imagine the immense benefits that the known 250,000 plant genes might provide in the future through scientific investigations. Consider a plant with only 10 different secondary metabolites. When each one is synthesized in 10 biosynthetic steps, then 100 different enzymes are working. Hence, for all plants, at least 25,000,000 highly specific enzymes can be estimated. Hence we have to strive for the protection of every single plant species to conserve its biotechnological potential for present and future generations.

5 Protected Areas

With reduction in the extent of natural vegetation, legally protected areas can be looked upon as the last reservoir of bioresources, including medicinal plants with enormous genetic significance. This requires selection and management of the protected area to ensure the continued maintenance of the medicinal plants they contain. Below are some guidelines for the selection and planning: -

- Review what is known about the distribution of the original and existing vegetation in the targeted area. Rare and endangered species should be emphasized.
- Identify their distribution of abundance.
- Prepare a system-level policy on their utilization and sustainability in the nation's protected area system.
- Publicize the role of the area for medicinal plants.
- Design a system for management of harvesting of products from protected areas.
- Establish research and monitoring programs of medicinal plants in the most important areas.

6 Botanic Gardens (BG)

In the western tradition (16th century) the first botanic gardens were intimately involved in cultivation of medicinal herbs in their faculties of botany, medicine and pharmacy. This link between botany and medicine in Britain existed until the 20th century. Today many botanic gardens have assumed greatly their role in medicinal plants conservation and development. Many botanic gardens specialize in the cultivation and study of medicinal plants. Seed Banks are today considered the most cost-effective method of *ex-situ* conservation of medicinal plant species in BGs. It is estimated that there are only 230 BGs in developing countries out of a world total of over 1400. List of BGs specializing in medicinal plants or with specialized collections of medicinal plants is available from literature. African countries could benefit by learning from the experience of some countries within the region who have developed these strategies and other countries in the world.

Discussion and conclusion

Traditional healers and their medicines are important for health care in Third World countries (Farnsworth et al. 1985). Ethnobotanical studies can contribute to understanding of the traditional medical systems, and thereby assist development of these system to improve health care. Screening of plant species will indicate presence of pharmacological compounds in the medicinal plants and hereby be able to support improved use of these plants within the traditional systems. Despite this and the need for improving health care in these countries, there is little research on traditional health care systems.

It is important to realize the contrasting interest between developing and industrialized countries in that the results of ethnobotanical studies are useful for development of healthcare in developing countries. However, ethnobotanical studies are also done during the search for new pharmaceuticals. It might seem that screening in search for efficient pharmaceutical compounds is a common benefit for all humans, but medicinal needs vary throughout the world.

The major health problems in developing countries are caused by malaria, HIV/AIDS, diarrhoea, tuberculosis, and leprosy, whereas the four categories of new chemical entities acquired through drug development efforts in the USA were analgesics, anti-infectives, cardiovasculars, and psychopharmacas (Mattison 1988 and WHO 1978; cited in Elisabetsky 1991). Hence, development of medicine may not meet the needs of local

people in developing countries even though the research is based on their knowledge. Furthermore price and availability of developed pharmaceutical medicines might exclude them from using it. Therefore Africa must define clearly the way to utilize these plants, possibly as phytomedicines rather than as pure compounds both as a strategic and cost – effective measure.

African traditional medicine abounds in medicinal plants and our people wherever they exist, still rely on herbal medicine. In Africa, up to 80% of the rural population depend on traditional medicine for their day to day welfare, most of which (about 90% in Tanzania) is plant - based. The high demand for medicine plants in traditional medicine coupled with increased biodiversity prospecting in the tropics for drug development expose a big threat to sustainable *in-situ* conservation in Africa. Therefore there is need for a legal framework for the regulation of access, ownership and utilization of Africa's medicinal biota. There is also a need to promote sustainable medicinal plants conservation strategies and programmes which will facilitate better management and harvesting in both *in-situ* and *ex-situ* areas, particularly, those with high biodiversity and endemism. Africa should conserve her rich biodiversity as a matter of urgency and necessity for future medicinal uses and food security.

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