Traditional Medicine: Swaziland

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Summary

Swaziland, a small country covering 17,400 km^2, has an interesting geographical terrain that encompasses virtually every feature of the African continent. Such diverse terrain is attributed to its range of climate zones: the highveld (with an altitude of 900 -1400 m), the midveld (with an elevation of 400-800 m), the lowveld (with an elevation of 200-400 m) and the Lubombo plateau (with an elevation of 600 m.) provide a rich diversity of flora.

Plants are used extensively in Swazi traditional medicine. In the 1970s, the Department of Chemistry at the University of Swaziland decided to examine the scientific basis for this traditional medical system. In the process of researching drugs derived from medicinal plants, researchers began to understand the important cultural heritage that supported this system.

The work has involved analyses of medicinal plants collected by rural people familiar with the traditional medical system. A key part of the studies are the ethnobotanical surveys of medicinal plants administered by traditional medical practitioners (TMP's) and the taxonomic identification of plant species by taxonomists with the Ministry of Agriculture and Cooperatives. Chemical screening and extraction of possible active constituents is also conducted with TMPs as an integral part of the laboratory team. The benefits are obvious: On the one hand, TMPs help establish the dosage used in the preparation of mixtures; on the other hand, they learn good laboratory practices.

Today, this work is housed in the Swaziland Center for Research in Medicinal and Indigenous Food Plants. As a result of the center's research on medicinal plants, the scientific bases of the use of traditional plants for therapeutic purposes has been established. Among the species of flora studied are plants of pharmacological interest and plants of pest-repellant value. Many of the plants identified occur in abundance in the wild and can be harnessed in a sustainable manner.

In addition, some endangered and commercial species are being propagated with the use of the soil conditioner, eco-agrogel. Three of the plants TMPs have identified as a constituent of a "morning after" contraceptive mixture were sent to the World Health Organization (WHO) Collaborating Center at the University of Illinois (USA) for biological screening. This collaboration complements the phytochemical work. Molluscicidal activities from extracts of plants from Swazi flora have been investigated and propagation studies have been carried out in hopes of fighting an endemic disease called Schistosomiasis, or Bilharzia, that infects 25 percent of the Swazi population. Such plants as *Phytolacca dodecandra* and *Urginea epigea* were identified as indigenous plants with high molluscicidal activities. Work on indigenous food plants begun more recently has focused on collection and propagation of plants with the help of indigenous women who have extensive knowledge of the plants.

Cultivation of medicinal and indigenous food plants using agronomic methods is an important means of preserving germplasm with potential of large-scale production. Ethnobotanical surveys and phytochemical analyses of possible active compounds have been done simultaneously with a study of the socio-cultural beliefs and rituals underpinning the use of plants in traditional medicine. This approach emphasizes the holistic nature of traditional medicine and works towards its integration into a modern health care system.

The propagation of indigenous plants has been carried out in the home of one of the local women and the university nursery. Involvement of traditional practitioners in the collection of medicinal plants and experimental work has been adopted by many African institutions because it is viewed as an innovation that helps cultivate trust between scientists and TMPs. On a practical level, it also helps establish dosage use and proper preparation of the plant mixtures and usage.

Background and Justification

One important element of the center's work is its collaboration among TMPs, rural women and scientists for addressing human health and nutritional needs by developing information systems on medicinal and indigenous food plants. The aim is to establish a scientific basis on the use of indigenous plants, build a training center for scientists, technicians and other support staff, and conserve germplasm of medicinal and indigenous food plants.

Traditional medicine has always been used extensively in Swaziland. Most people consult both TMPs and modern clinics in times of illness. Yet, hardly any meaningful exchange has existed among TMPs, modern medicinal practitioners and scientists. There also has been little interest in medicinal plant research in Swaziland. Recently, conservation of germplasm has received greater international attention with the emergence of biodiversity issues. Swaziland has established a National Environmental Authority that is charged with overseeing environmental conservation matters related to biodiversity.

The center aims at addressing the use of traditional medicine and its alignment with modern health by emphasizing the conservation of plant biodiversity for the purpose of the cultivation of indigenous medicinal and food plants.

The center, through its studies, has increased understanding of the dependence of the Swazi population on the use of medicinal plants in primary health care. While the rich and diverse Swazi flora facilitates this use, documentation of this important resource has been inadequate. Many species are threatened with extinction because they are not harvested in a sustainable manner. There is also a lack of collaborative research among TMPs, orthodox medical practitioners and scientists in Swaziland. As a result, there is a danger of losing the valuable ethnomedical knowledge that the TMPs have concerning the plants and other aspects of the medicinal system that are intrinsic parts of their lives. Absence of records, including information on dosage, is a serious short-coming of traditional medicine. The center concluded that collaborative work between scientists and TMPs could address this problem by enabling the phytomedicine that would emerge to be presented in more potent and replicable dosages.

Schistosomiasis, commonly known as bilharzia, is a widespread disease posing a threat to millions of people. It is endemic in many tropical and subtropical regions. The current estimate of cases of schistosomiasis is 200 million, with incidence of the disease spread over 70 countries. Swaziland is one of the countries where the disease is endemic. In 1978, it was estimated that about 25 percent of Swazis were infected. The disease is caused by flat worms requiring aquatic snails as intermediate hosts for their transmission to humans. The disease, which affects the urino-genital, gastro-intestinal and the hepatic systems of human, is known in siSwati as "Umtfundzangati" or "blood in the urine."

To combat Bilharzia, the center conducted a series of studies examining medicinal plants that potentially could kill the snails carrying the disease. Previous studies showed that many of the plants from Swazi flora used in traditional medicine contained saponins, an ingredient used in detergents. Some saponin-containing plants have proven very toxic to snails that transmit bilharzia to humans.

Recognition of the importance of plant molluscicides for vector control has led to the evaluation of more than 1,000 plant species for molluscicidal activity. Indeed plant molluscicides have many advantages over synthetic molluscicides. They are not as expensive and because they are derived from natural sources the possibility of schistosomiasis-transmitting snails developing resistance to them is lower.

Because saponins are responsible for the molluscicidal properties of most plant molluscicides, the center has been screening indigenous plants in Swaziland that have this property. Some plants that show *in vitro* molluscicidal properties — for example, *Urginea epigea* — offer a promising antidote to this endemic disease.

Another focus of the center has been to examine indigenous plants for the purpose of food cultivation. Many indigenous fruits and vegetables are collected from the wild and used by rural people in Swaziland. There is no adequate record of what is available and many species are becoming extinct because they are not cultivated and protected from indiscriminate harvesting. Their nutritive value is generally unknown. Surveying and phytochemical analysis are necessary to promote their exploitation as sources of food and essential nutrients, especially in rural areas where their use is still prevalent.

Description

Efforts to conserve and utilize medicinal and indigenous plants involve putting together a multidisciplinary team of chemists, taxonomists, health specialists, agronomists and traditional medical practitioners to conduct ethnobotanical surveys, cultivations and phytochemical analyses of plants and to codify all aspects of traditional medicine. Surveys entail field trips to collect plant specimens identified by the healers, gathering of information on diseases for which the plants are used, analyses of their expected side effects, preservation of plant specimens in the herbarium, and the taking of cuttings for propagation and cultivation. For indigenous food plants, field trips focus on collection and propagation of vegetables and fruits that are close to extinction. Cultivation takes place at nurseries in the homes of traditional medical practitioners and the university farm.

Field trips take place concurrently with preliminary chemical analyses for alkaloids, steroids, saponins, tannins. The effort focuses on extraction of possible active constituents following well-known procedures. Recording of socio-cultural beliefs and rituals that accompany the use of the plants occurs during field trips through interviews with the TMPs.

A comprehensive chemical analysis is conducted after the field trip. Plant species are identified using both the siSwati and botanical names to ensure that work is done on the same species used in traditional medicine. Each plant is collected from the wild and dried in open air to remove the moisture without denaturing the chemical constituents. Each dried constituent is successively extracted with dichloromethane, methanol and water at room temperature for 48 hours. The solvents are removed from the extracts at a reduced pressure through a rotavapour. The aqueous extract are sometimes partitioned between n-butanol and water to obtain the n-butanol extract. Phytochemical screenings of the extracts are performed using standard procedures.

The next phase involves a molluscicidal screening carried out in several stages. Aqueous solutions of plant extracts are made at various concentrations and screened for molluscicidal activity against *Bulinus africanus*. Some 400 ml of different concentrations of each extract or chromatographic fractions are placed in beakers followed by 10 snails (*Bulinus africanus*) and a piece of vegetable. Snail deaths are recorded for each beaker after 24 hours and the solutions are replaced with distilled water to see if there is any recovery of "dead" snails within 24 hours. Only snails that do not recover within 24 hours are counted as dead snails.

Molluscicidal screening of *Phytolacca dodecandra* also has been tested. Dried berries are powdered and 10 g of powder are extracted with 200 ml of methanol during 24 hours at 20°C. After filtration, the solvent is evaporated and the extracts are lyophilized and weighed. Quantification of the saponin contents of the extracts are done through HPLC-UV analysis, using five pure bidesmosidic saponins as standard mixtures. These saponins, which have been previously isolated from the plant, are chosen because they are representative of the more abundant aglycones present in *P. dodecandra*.

The center has investigated *Urginea epigea* R.A. Dyer (Liliaceae), which is indigenous to Swaziland for molluscicidal activity. Its bulbs, which contain a great deal of saponins, are used as soap and a remedy for potential headaches. For the study, fresh plant bulbs are collected, macerated in a blender and extracted twice with distilled water for 24 hours at room temperature. Water is removed *in vacuo* to obtain the aqueous extract. A portion of the aqueous extract is dissolved in distilled water and the solution is extracted with n-butanol (BuOH) to obtain a BuOH extract. The solvent is removed *in vacuo* and a BuOH extract is obtained. Fresh leaves are similarly extracted. BuOH extract of the bulb is fractionated over a column of silica gel. Different fractions are then screened for molluscicidal activity. The active fraction is subjected to chromatographic separation to isolate and characterize the bioactive constituents.

The center has conducted other tests to assess antibacterial activity of indigenous plants. The agar-plate technique is used to evaluate the antibacterial activity of some plant extracts. The center also has carried out studies for the cultivation of *Phytolacca dodecandra*, a plant that originated in Ethiopia, where it is commonly known as Endod. It is well known in Ethiopia because of the high detergent properties exhibited by its berries that make it a common soap substitute. The molluscicidal properties of constituents of the berries were discovered in 1965. Since then, the plant has been of great importance for the local control of schistosomiasis.

Destruction of the intermediate host snails represents an interesting alternative strategy for eradicating the disease. Endod is one of the most promising of the plant molluscicides discovered to date. It has low toxicity to non-target organisms and it is biodegradable, unlike synthetic molluscicides that are costly, toxic and not rapidly biodegradable. Such advantages prompted Endod's cultivation to discover the optimum conditions for the production of saponins

Ethnobotanical surveys have been strengthened by the arrival of the Organization of African Unity's (OAU) Scientific, Technical Research Commission team of specialists comprising a pharmacologist, medical doctor, taxonomist and agronomist. They have been joined by counterparts from Swaziland to conduct field work. The visit by the international team included seminars with TMPs and field trips to gather plant records, chemical description of illnesses, local plant identification and treatment and taxonomic identification of plants. The collected plants are pressed, dried and placed in the National Herbarium of the Ministry of Agriculture. A computerized database of Swaziland's medicinal and indigenous food plants has been created.

The results obtained from the phytochemical screenings of medicinal plants showed that they have various secondary metabolites. Most of the plants screened to date contain polyphenols. This concurs with the fact that polyphenols and tannins are ubiquitous in vascular plants. The secondary metabolites found in the plants account for their physiological actions associated with traditional medicine. *P. dodecandra* showed higher growth rates with the addition of eco-agrogel. The result in increased vegetative growth, however, did not produce higher yields of berries or saponin content. Non-treated berries contain higher saponin contents than the berries of plants grown by compost, fertilizer or eco-agrogel. Increased growth rates due to the use of eco-agrogel was accompanied by a decrease in the saponin content of the berries. Researchers also have observed that the saponin content in the extract of the berries is directly proportional to the quantities of the methanol extracts. By simply weighing the standardized methanol extracts, one can get a good idea of the saponin contents of the dried berries.

Propagation studies of medicinal plants should take account of both the vegetative growth and metabolite contents. Specifically, the metabolite content would bear on the dosage of the herbs. Leaf extracts of *Urginea epigea* show a low molluscicidal activity compared to extracts from the bulb. Highest molluscicidal activity is obtained with BuOH extract of the bulb. Column chromatography effectively isolates the fraction of the BuOH extract responsible for the molluscicidal activity.

Partnerships

Collaboration with TMPs could potentially enhance partnerships with Ministries of Health and Social Welfare and Agriculture and Cooperatives. While partnership with the private sector has not started, sugar and pulp companies that own large nurseries have agreed to assist in the propagation of plants.

Partnerships with other countries and international organizations have been established. A link with University of Ghana's Department of Biochemistry involves academic exchanges in which a staff member of the Department of Chemical Pathology visited the University of Swaziland to train technicians in isolating islets of langerhans. The goal is to test traditional medicines used for the treatment of diabetes. As a member of the Inter-Africa Committee on Traditional Medicine and Medicinal Plants, Swaziland is engaged in activities to promote research in these areas under the leadership of the OAU's Scientific and Technical Research Commission.

Replicability

Many African countries have made research and development of traditional medicinal and indigenous food plants a priority. Research material is available and collaboration with institutions within and outside the African continent should enhance this promising trend. Two areas could prompt new policy directions. First, the integration of traditional medicines into mainstream health care remains unresolved in many African countries. Government policies could address this issue in view of the widespread use of traditional medicines by many countries. Research should facilitate the formulation of policies in this regard.

Second, there is a great deal of debate in Africa on international property rights and the implications of the Convention or Biological Diversity on traditional medicine and medicinal plants.

Many African countries need to devise policies dealing with these issues. This project could help focus the debate for appropriate national policies related to these topics.

Lessons Learned

The center combines scientific research on the alleged efficacy of medicinal plants, based on traditional preparations, with studies of the cultural beliefs that underlie the traditional system of medicine. The two approaches cannot be separated, especially in ethnobotanical plant surveys and practical research. Both approaches focus on the alleged therapeutic efficacy of plants through bioassay. The subsequent processes of phytochemical analysis, extraction and isolation of compounds and agrobotanical studies to propagate and conserve the medicinal plants are a second stage. This follows the collection and accurate recording of information about the medicinal use of the plants given by TMPs.

In all these studies, collaboration among scientists and indigenous experts is emphasized. The most important partners are TMPs whose knowledge is the key to ethnobotanical surveys and insights into the medicinal effects of the plants.

An important lesson learned by working with TMPs involves the need to be aware that the spiritual aspect of traditional medicine cannot be separated from the physiological uses of plants.

Drug discovery approached through ethnobotanical knowledge provides information that may not be available through any other approach.

In a more subdued way, the study of indigenous fruits and vegetables also has emerged as an important element in the concern about nutrition and food security in Africa.

The study of *Phytolacca dodecandra* and *Urginea epigea* arose as part of an effort to solve the problem of schistosomiasis that was endemic in Swaziland.

Several resources were brought to bear on the projects. Human resources are the most important. TMPs are marshaled largely through individual contacts. A major obstacle in working with this group is their distrust of scientists. A strong suspicion exists that their knowledge will be stolen and used to benefit scientists and corporations. Such feelings are justified because of past experience and the complexity of issues pertaining to ownership of indigenous knowledge. Difficulty in communication is another obstacle. While such obstacles remain firmly in place, greater interaction and dialogues with TMPs may eventually overcome them. Workshops with TMPs have been conducted and will remain an important component of the project.

Because indigenous food plants have on the whole been neglected in Africa, center studies have depended largely on the knowledge of the fruits and vegetables supplied by rural women. Here again the scientific process followed information supplied by local people. Once the plants were identified, propagation of endangered and commercial species may be enhanced by the use of soil conditioners or such additives as eco-agrogel. Medicinal and food plants are found in the wild and are known to TMPs and to rural populations. Ethnobotanical surveys conducted by rural women, TMPs and an interdisciplinary team of scientists are keys to the entire effort. Collaborative research among people with indigenous knowledge and scientists has led to the realization that bioresources could be harnessed in a sustainable manner.

The OAU's Scientific, Technical Research Commission, the World Health Organization (WHO) and the government of Swaziland would all like to upgrade traditional medicine to a level where it can be used in primary health care. This has led to pronouncements for the mobilization of African scientists in various disciplines to engage in studies of medicinal plants that serve as the basic materials in traditional medicine. More specifically, it has led to the organization of a series of seminars.

The Inter-Africa Committee on Medicinal Plants, whose formation represented a critical decision in strengthening collaboration among African scientists, is currently the main body coordinating medicinal plant research in Africa. One of the committee's main tasks is to ensure that each African country conducts an ethnobotanical survey of its plants and publishes a survey of the results.

The uniqueness of this effort lies in the involvement of traditional healers and others who possess indigenous knowledge of wild edible food plants. While exploring the science of natural products that is universal and transferable to others, we are also focusing on the cultural heritage.

Future Plans

Greater emphasis will be placed on collaboration with other scientists in the biological assay of traditional prescriptions for specific diseases. The center aims at working harder to bring traditional healers closer to scientists by engaging healers in laboratory work and training them as para-toxonomists. The center will also seek to secure stronger government support by highlighting the national importance of the project in health, resource conversation, agriculture, forestry and nutrition.

At the same time, the center will strive to increase greater interdisciplinary collaboration with colleagues in other departments of the university and encourage nongovernmental organizations to join its efforts to meld concerns for rural development and nutrition.

To date, work has been carried out with the Department of Chemistry. With strong support from the government of Swaziland, the project will form the core activities of the Swaziland Center For Research in Medicinal and Indigenous Food Plants, whose facilities are to be built on land given by the government of Swaziland. The center, which has already been given official status by the university senate and council, is designed to be an international center for African researchers engaged in multidisciplinary activities on medicinal and indigenous food plants and traditional medicines. Regular visits by scientists will be an important aspect of the center's activities. It is hoped that a unit for the study of the cultural beliefs that underlie traditional medicine will become an integral part of the program.

Scientists from African research institutions and universities will serve as close collaborators from which to draw expertise to advance the work and share resources, information and other research requirements. TMPs will be a critical source of information and they will be considered part of the scientific research team. Many African universities and research institutions involved in this work are led by the OAU's Scientific, Technical Research Commission. The interest is there but the programs must be strong and innovative. If the center's programmes prove relevant and focused, they should draw support from the scientific community.

External sources of funding for capital building, staff exchange and training, equipment and library resources will be essential. WHO collaborating laboratories that have already provided tremendous assistance in the bioassay of plant extracts will continue to be essential to the overall initiative.

In fact, the center will need external help to achieve many of its goals. An increase in the availability of funding would lead to increased training for building local and continental capacity, attracting high caliber researchers, and allowing for the provision of equipment, books and journals, and computers.

Another important factor in achieving these goals is to improve collaboration with TMPs to enable the center to build a comprehensive data base on medicinal and food plants. This effort would also help create a forum to discuss such critical issues as intellectual property rights, indigenous knowledge, biodiversity and the Convention of Biodiversity in the African context.

A major obstacle standing in the way of success is inadequate funding. As a result, it will be necessary to solicit national government support, tap local resources from the private sector and receive funding from external governmental and nongovernmental sources. In this period of scarce resources, local and international organizations must view the center's work as a national priority contributing to Swaziland's ability to address development problems, especially in the areas of public health and nutrition.

Another major obstacle is the unwillingness of the TMPs to collaborate with others in the scientific community. The sharing of indigenous knowledge is critical for the supply of initial information on the plants to the scientists. It is also critical from the point of view of policy formulation where scientific advice may be given to the government on the integration of traditional medicine into orthodox medicine. In many countries this is still a thorny issue.

Collaboration with other centers of excellence through staff exchange and training, sharing of expensive equipment, and joint publications will be highly beneficial. The center lacks a critical mass of staff required for conducting the multidisciplinary research that is a prerequisite for success. Visiting scientists will help expand the scope of the centre's work.

Problems Faced

Collaboration with TMPs is an essential component of the research. Cultivating mutual respect and trust between scientists and TMPs who possess traditional knowledge is not an easy task. Scientists who aim to relate scientific research to traditional medicine face daunting challenges.

Domestication, for example, of indigenous food plants requires community-based participation, particularly from women. It is a challenge to convince members of the community that indigenous fruits and vegetables are important after years of relying on exotic species. The local food base is also very narrow and must be broadened. The project is popular with all stakeholders but requires the organization of seminars to raise awareness of its relevance and, at the same time, dispel the perception that scientists are out to get rich from the knowledge of the TMPs.

Changing legislation should be part of the program to build TMPs confidence in the scientific community. Abandoning dated legislation, such as the Witchcraft Act of 1901, and passing new legislation to protect TMP traditional knowledge, would help build a better base of support for such projects. Providing channels for the integration of traditional medicine into mainstream health care is one area in which legislation could help.

Impact

Medicinal and indigenous food plants are an important resource in Swaziland and many other developing countries. Judicious applications of the center's research findings will contribute to sustainable development. Training of scientists and technologists and raising public awareness of the importance of this resource also will help promote sustainable development. Because of the availability of the scientific material and involvement of communities, the research will continue as long as sufficient funding is available for the work to be done.

Implementing Institution

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