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A READER IN ETHNOBOTANY AND PHYTOTHERAPY

Miroslav Horák et al.

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I really appreciate the invaluable assistance of my colleagues and co-workers, whose enthusiasm in collaborating on this book is greatly valued. Special thanks are due to Ing. Verter Nahanga, Department of Regional and Business Economics, Faculty of Regional Development and International Studies, Mendel University in Brno, for his patient language amendment of the text. I would also like to express my gratitude to prof. MVDr. Ivo Pavlík, CSc., Department of Territorial Studies, Faculty of Regional Development and International Studies, Mendel University in Brno, who provided use-ful comments and helped me a lot in the process of editing. Many thanks also to Prof. Peter Jackson, Department of Ethnology, History of Religions and Gender Studies, Stockholm University, for his critical suggestions. The support given by the Mendel University in Brno is also acknowledged. Finally, I must cordially thank my wife, who supported and encouraged me in spite of all the time the preparation of this book kept us apart.

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Preface to the First Edition

S. Komárek

I am very pleased to write a short preface to the remarkable book on ethnobotany and phytotherapy, or culturally different ways of relating to plants. The book is edited by my former Ph.D. student and an enthusiastic associate, Miroslav Horák. His dissertation was on the alternative phytotherapeutic treatment of drug addiction in the Peruvian Amazon based on long-term fieldwork represented a promising invitation.

People's relationship with plants is the most fundamental aspect that has constituted and continues to constitute the world, although in somewhat alienated environment of cities we rarely see them directly. Higher plants, the only significant autotrophs on the planet, are feeding all of us, for the most part serve as a source of clothing and pharmaceuticals, their scent and beauty accompanies us from the cradle to the grave.

Of course, they also have their shadowy and dark side and former deliberate folk poisoning belongs to it as well – today, we tend to poison each other with words and deeds without their contribution. Also, in our country ethnobotany had been of exclusive importance for a long time – even the Mattioli herbarium is for the most part composed of folk evidence and folklore. In the South Bohemian countryside, I experienced a decline of ethnobotany and ethnozoology in my grandparents' generation.

Folk interpretation does not distinguish between therapeutic and magical applications – both merge into one; and it is after all a matter of taste and tradition that we understand the results of science, be it the administration of penicillin in the treatment of angina or the explosion of the atomic bomb, as "technical" operations that do not surprise us. The world as a whole is big, and plants are its strong subsection.

I would like to wish the editor and his diverse team of writers much success, good health, and enthusiasm to further work in this field.

Prague, 28. 5. 2014

Prof. RNDr. Stanislav Komárek, Dr.
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Editor's Comments

The authors responsible for the chapters are listed under the title of each chapter. The references are listed as they appear in the databases Reference Manager (Thomson Reuters, Philadelphia) as imported from Web of Science (Thomson Reuters, Philadelphia) and PubMed (Medline, NLM Bethesda). Some journals are cited with abbreviated titles, some in full, as available in the sources' databases. These differences were left in the format of the database.

This book is meant as a reader in ethnobotany and phytotherapy, which should serve students and scholars as an introduction to the field and a reference material. It is not to be used in place of professional medical advice from a certified health practitioner. The authors do not recommend any specific medical treatments or natural health practitioners.

Glossary of Acronyms

A.D.	Anno Domini (Medieval Latin, in the year of the Lord) Used to indicate that a time division falls within the Christian era
alt.	Altitude
A/N	Author's note
B.C.	Before Christ
CAP	Common Agricultural Policy
CEMAT	Mesoamerican Center for Research on Appropriate Technology, Guatemala
CETA	Center for Theological Studies of the Amazon, Iquitos, Peru *(Centro de Estudios Teológicos de la Amazonía)*
c.f.	"Compare" (from the Latin *confer*)
COECO	Colombian Ecological Communities Corp., Bogotá
CSI	Cultural Significance Index
DAOM	Doctoral Program in Acupuncture and Oriental Medicine
Ed.	Editor's note
e.g.	For example (from the Latin *exempli gratia*)
EMA	European Medicines Agency
GACP	Good Agricultural and Collection Practice for Medicinal Plants
GMP	Good Manufacturing Practice
Ibid.	Repeated reference
i.e.	"In other words" or "that is" (from the Latin *id est*)
IHEAL	Institute for Higher Education in Latin America
INI	National Indigenous Institute, Mexico
IPS	Health Providing Institutions, Colombia *(Instituciones Prestadoras de Servicios de Salud)*
kg.ha^{-1}	Application rate or crop yield (kilograms per hectare)
mamsl	Meters above sea level
MAPs	Medicinal and Aromatic Plants
No	Number
n.d.	No date
NDGA	Nordihydroguaiaretic acid
para	Paragraph
pers. comm.	Personal communication
P.ha^{-1}	Dosage of phosphorus per hectare
PSO	University of Nariño Herbarium, Colombia
RCI	Relative Cultural Importance Index
SCI	Science Culture Index
SK	Shipibo-Konibo native group of the Ucayali Valley, Peruvian Amazon
sp./spp.	Species singular/plural
ssp.	Subspecies

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1 INTRODUCTION

Horák, M.

"Plant use makes no sense without understanding the culture in which it is used."

B. C. Bennett

This book is a result of long-term cooperation among specialists from various scientific fields such as biology, anthropology, psychology, philology, botany and ecology. All of them are interested in studying the relationship that exists between people and plants, focusing primarily on how plants are used, managed and perceived in different cultures and societies.

The content of this book is divided into seven chapters, starting with the introduction and description of the methodological framework. Each chapter contains original contributions from authors who have done research in a particular region in Europe, America, Africa or Asia. The book is finished by an overview of authors' profiles focused on future plans in research and fieldwork.

This publication would not have been possible without the financial support of Mendel University in Brno. The book provides texts to university students, offering them a rich study material for improving their academic reading skills and learning scientific terminology.

Regarding the form of contributions, we have decided to use the standard structure of the scientific paper, making the content easily accessible and understandable for students and researchers. So, the result is close to a compendium of texts collected from authors from different countries such as the United States, Peru, Colombia, Mexico, South Africa, France, and the Czech Republic. They have different writing styles and scientific approaches, more so than in a book written by a single author. The editor of this book ended up with this particular group of scholars thanks to the very good personal relations established during his doctoral studies.

However, the scope of all the contributors is identical, though, as mentioned above, some of them are also interested in other topics, such as agriculture, medicine, history and arts.

The sections of the book are quite accurately organized geographically, but there is an obvious focus on the American continent, especially South America. The remaining continents Europe, Africa, and Asia are only introduced by one primary contribution, because it was never the editor's intention to provide a global guide of ethnobotany. We are rather determined to publish the first book on ethnobotany and phytotherapy in the Czech Republic.

1.1 History of Ethnobotany

Ethnobotany is the scientific study, which was established as a combination of ethnology (study of culture) and botany (study of plants). Researchers approach the subject from two perspectives – the practical or utilitarian and the philosophical. Notable definitions of the discipline stress the research of the interrelationship/interaction of man and the plant world (Jones, 1941; Ford, Jones, 1978; Schultes, Von Reis, 1995); the influence of plants on human culture (Balick & Cox, 1997); or the complete registration of the uses and concepts about plant life in primitive societies (Berlin, 1992; Schultes in Plotkin & Famolare, 1992: 7–13).

The term "ethnobotany" was used for the first time in 1895 by John William Harshberger while he was teaching at the University of Pennsylvania (Harshberger, 1895). However, the history of the field began long before that, and practical interests in ethnobotany go back to the beginning of civilization when people relied more on plants as a way of survival. The first humans were practicing ethnobotanists, who had to classify plants into categories and distinguish those species that were beneficial from those that caused harm (Choudhary, Singh & Pillai, 2008: 39).

Theophrastus (ca 370–285 B.C.), the father of botany, described the uses of plants and established generic names of economically important species (e.g. *Crataegus*, *Daucus*, and *Asparagus*)

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that are still commonly used. Caius Plinius Secundus, better known as Pliny the Elder, recorded information about cultivating medicinal plants in his "Natural History" (Bennet, 2013).

In 77 AD, the Greek surgeon Dioscorides published "De Materia Medica", a catalogue of approximately 600 plants from the Mediterranean, also containing the information on their actual use, especially for medical purposes, gathering, toxicity, and edibility (Dioscorides 2000). Dioscorides also stressed the economic potential of plants, thus anticipating the founding of Economic Botany concerned with their value (Wickens, 2004). Nevertheless, the herbal did not venture into the field until after the Middle Ages, even though it remained the standard reference point for nearly 1,500 years.

Unlike their predecessors who repeated what was known in the 16th century, European herbalists recorded new observations on the use of plants. In 1542, Leonhart Fuchs, a Renaissance artist, catalogued 400 plants native to Germany and Austria in his "De Historia Stirpium", followed by John Ray's "Historia Plantarum", where the first definition of "species" was provided, and Carl von Linné's "Species Plantarum", including information on about 5,900 plants (Fuchs, 1551; Ray, 1686; Linnaeus, 1797).[1]

Linné, whose Latinized name is synonymous with modern taxonomy, is famous for inventing the binomial method of nomenclature, where all species get two part name (genus, species) (Loonen, 2008).[2] He also published detailed observations on plant use by the Sami people in Lapland, pioneering modern ethnobotanical study (von Linné, 1971).

The peak of botanical exploration ocurred in the 19th century, the era of Alexander von Humbolt and Captain James Cook's discoveries in the South Pacific. English botanist Richard Spruce, one of the great Victorian botanical explorers, spent 15 years exploring the Amazon (mostly in Brazil). His collections form an important ethnobotanical resource indexed at the Royal Botanic Gardens, Kew, and London, which started to operate during the period too.

Botanical specimens from North and Central America were collected by British botanist and early American archaeologist Edward Palmer, a field assistant for the Bureau of American Ethnology (McVaugh, 1956). Notes on aboriginal life and indigenous plant use in North America are also among unpublished post-Walden writings by Henry David Thoreau (Thoreau, 1906).

The field of so-called "aboriginal botany", concerning all forms of plants used by indigenous people for food, medicine, clothing etc., was founded after the data was collected. The term was used for the first time in 1874 by Stephen Powers. A crucial part of the study in this field was folk classification, which refers to how members of a language community name and categorize plants. Native nomenclature often says a lot about the plant's characteristics, growing or effects (whether it is poisonous or nutritive, or purgative, astringent, sedative, or without any active principle) (Powel, 1877: 419).

A publication by Leopold Glueck, a German physician working in Sarajevo, is considered to be the first modern ethnobotanical work. He studied the traditional medical uses of plants done by rural people in Bosnia from an emic (originated from *phonemic*) view (Cunningham, 2012).[3]

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1 Recording plant uses was not just a European activity. Martín de la Cruz authored the 16th century Aztec herbal that became known as the "Badianus Manuscript". His discussion of 251 therapeutic and psychoactive Mexican plants was the first written herbal from the New World. Hipólito Ruíz López and José Antonio Pavón y Jímenez collected botanical specimens in the viceroyalty of Peru and published them in "Flora Peruviana et Chilensis" (1798–1802). Chinese, Arab, and Indian texts, generally less-well known in the Western World, are equally rich in plant use lore. However, the study of rich historical material is usually an objective of historical economic botany, not ethnobotany (Bennet, 2013).

2 The post-Linnean botanists did not limit their research to taxonomy, e.g. Alphonse de Candolle wrote a classical work on the origin of cultivated plants (de Candolle, 1885).

3 "Emic and etic are technical terms proposed by the linguist Kenneth Pike (1967), originally derived from the suffixes of the words 'phonemic' and 'phonetic'; the former refers to any unit of significant sound in a particular language and the latter refers to the system of cross-culturally useful notations that represent these vocal sounds (McCutcheon, 1999)."

At the beginning of the 20th century, Harsberger's neologism "ethnobotany" was adopted, although it was only a semantic substitution. The paradigm shift which led to a more methodological and conceptual approach evolved progressively. The beginning of ethnobotany as an academic discipline is deeply connected with its founding father, biologist Richard Evans Schultes.

Firstly, ethnobotany became more ecological, focusing on relationships, interrelationships, and interactions. Researchers started considering plants as integral parts of the ecosystem in which they are found. Secondly, ethnobotany has become cultural, and the scientists now attempt to understand plant use from the cultural perspective. Finally, Ford & Jones (1978) redefined the discipline's scope from "man" to "people" and Cotton (1996) employed the less pejorative term "traditional" instead of "primitive".[4]

The current framework of ethnobotany emphasizes different skills that are required from the scientist: botanical training necessary for the identification and preservation of plant specimens, anthropological training that helps the researcher to understand cultural concepts, linguistic training that allows the field-worker to transcribe local terms and understand native morphology, syntax and semantics (Choudhary *et al.*, 2008: 39).

The investigation of utilitarian features of plants has dominated current research agenda. Ethnobotany as a discipline is currently oriented towards the exploration of new plant resources, collecting of genetic materials, drug discovery or plant-derived medicines and products development (Balick & Cox, 1997; Plotkin *et al.*, 1992; Todelo in Schultes & Von Reis, 1995: 75–92). The cultural meaning of plants is seldom investigated. For this reason, the main aim of this book is to contribute to the research on social and cultural aspects of the plant use.

1.2 Phytotherapy – Defining the Discipline

Eichele (2010) defines phytotherapy as the use of plants or plant extracts that are usually not part of a healthy diet for medicinal purposes. It refers to traditional medicinal or folk medicine practice, also known by other terms such as herbalism, botanical medicine, medical herbalism, herbal medicine, and herbology (Kadiri, Adekunle & Ayodele, 2010).

Phytotherapeutic agents are herbal preparations regularly marketed as standardized products in liquid, solid or viscous form.[5] They consist of complex mixtures of one or more plants which contain active ingredients, plant parts or plant material in the crude or processed state. Sometimes, fungal and bee products are included, as well as minerals and certain animal parts.

The agents are usually prepared by maceration, percolation, distillation (volatile oils) or evaporation of the solvents, and later administered in a highly concentrated form so as to ensure their therapeutic effect.

Phytotherapy or herbal medicines always play an important role in traditional medicine, and nowadays its importance is again increasing. Plants still make an important contribution to primary health care. According to the World Health Organisation (WHO), because of poverty and lack of access to modern medicine, about 65–80% of the world's population living in developing countries in Africa, Asia and Latin America depend essentially on traditional medicine based on the plants use (Shirwaikar, Verma & Lobo, 2009).

Many patients also prefer herbal medicines because of their good tolerability. However, the concept that herbal drugs are safe and free from side effects is not always true, because

4 "An important question is whether there is a fundamental difference between the way traditional people use plants and the way modern societies use them. I contend that this distinction is artificial. Etymologically, there is no reason to restrict ethnobotany to traditional societies. The prefix 'ethno' refers to any people or cultural group not just traditional societies (Bennet, 2013)."

5 Currently there are several regulatory models for herbal medicines available: prescription drugs, over-the-counter substances, traditional medicines and dietary supplements (Shirwaikar, Verma & Lobo, 2009).

they can contain hundreds of constituents, some of which are very toxic (e.g. pyrrolizidine alkaloids) (EFSA, 2011).

In comparison with well-defined synthetic drugs, active standardization, stability and quality control may not be easy because the active principles of herbal drugs are frequently unknown. Well-controlled double-blind clinical and toxicological studies to prove their efficacy and safety are rare.

Security concerns are usually caused by a lack of effective quality control in the context of a growing, largely unregulated market. Other concerns are the consequence of using herbal products and conventional medicines simultaneously (drug-drug interactions), self-administration/medication (excessive ingestion, insufficient knowledge about the constituents and the dose of the drug, causing unexpected side effects), exposure to potentially toxic phytoconstituents and contaminants, and omission of alimentary restrictions.

However, modern herbal medicinal products attempt to fulfil high standards and are subject to many clinical development plans. Organizations like the European Scientific Cooperative on Phototherapy (ESCOP) aim at advancing the scientific status of phytotherapy. The monographs produced by ESCOP are considered as established sources accepted by European regulatory authorities.

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2 METHODS OF ETHNOBOTANICAL RESEARCH

Horák, M.

Plant identification in ethnobotany includes methods which the field of investigation borrowed from various disciplines such as botany, anthropology, linguistics, ecology, genetics and economics. Field-work, participant observation, random screening, questionnaire, interview, taxonomic collecting (sampling by botanical family) are the most typical, although the range of methods can be wider (Martin, 2004).

An interdisciplinary approach is the main contribution of ethnobotany in documenting traditional indigenous botanical knowledge. Among the publications where integrative approaches and basic theories are explained, one finds the seminal works of Conklin (1967) and Berlin, and of Breedlove & Raven (1973). Hypotheses linking ethnobotany, ecology and evolution are included in Johns (1996). Some authors (Phillips & Gentry, 1993a, 1993b; Reyes-García *et al.*, 2006; Galeano, 2000) stress the necessity for the use of quantitative techniques. However, the requirement for quantification is a relatively old idea in ethnobotany (Kroeber, 1920; Albuquerque, 2009), and its importance is growing along with the recognition of ethnobotanical research in global strategies of biodiversity conservation.

One study, showing how local knowledge can be measured, analysed documents from ethnobotany (64 articles and reviews and 4 books published between 1995 and 2009 in total) that used quantification. It showed the nature of quantitative research and the use of quantitative indices (a total of 87 different quantitative techniques were recorded based on the two central issues) (Franco *et al.*, 2011: 211–230).

The quantitative approach is needed to address issues such as the species extinction, depletion of natural resources, and impacts of the use of plants. But ethnobotany is also popular among scientists who are interested in ethical and social implications and who prefer qualitative methods because they provide solutions to complex social or environmental problems. A combination of both approaches, strengthening the interdisciplinary character of the discipline, is necessary, if ethnobotany is to respond to the growing demand for highly efficient solutions and generate any general principles. Moreover, the same theme can usually be examined using both methods (de Albuquerque & Hanazaki, 2009: 653–656).

Using a quantitative approach, the researcher can examine the variables (e.g. age, gender, occupation) that influence knowledge about plants in any given community. But this kind of research also has its limitations on the study of sample sizes. Also, the accuracy, reproducibility, and comparability of the results may represent a serious issue (Reyes-García *et al.*, 2006).

Current work in ethnobotany involves three main types of research: descriptive, causality, and diagnostic, each of them based on different techniques. In the first category, the administration of semi-structured interviews is commonly used because in this way data about the plants of a given community can easily be collected (Kadiri, Adekunle & Ayodele, 2010).

A significant factor in descriptive research is the clarity of the inclusion criteria of the interviewees (e.g. age, sex, ethnicity, type and stage of disease, the subject's previous treatment history, and the presence or absence of other medical conditions). Their main advantage is that they allow a rapid inventory of useful flora in the area. However, without an adequate theoretical background, they tend to present relatively weak scientific reflections resulting from generalization.

The second category, causality studies, is focused on the determination of factors that could explain the use and knowledge of plants (Galeano, 2000; Phillips & Gentry, 1993a,b). Although they can be relevant in ecological or anthropological hypothesis testing, causality studies usually suffer from a small number of participants and the application of inadequate analytical tools.

The third category, diagnostic studies, deals with the efficiency and validity of methods and techniques; it is quite new to ethnobotanical investigations (Reyes-García *et al.*, 2006). Safety research is an example of this and is based on the combined information obtained

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from a systematic reading of the literature. It searches for laboratory-based pharmacological studies prioritizing plants for further research, etc. (Willcox *et al.,* 2011). In this kind of research, critical reflections on the methods used and the basic design of the study must be carried out; otherwise the results may be incorrect.

Recent work in ethnobotany has focused on confronting so-called cultural significance indices (CSI) or relative cultural importance indices (RCI), such as "use value" to calcu-late the value of each plant species to human groups.[6] These approaches can provide data amenable to hypothesis-testing, statistical validation, and comparative analysis (Da Silva, 2006). On the other hand, measuring local experience with diversity indices suggests that all species have equal local importance, which can be misleading without accurate data analysis (Hoffman & Gallaher, 2007).

In recent years, there has also been a proliferation of texts focusing on the methodology of ethnobotanical research (Martin, 2004; Cotton, 1996; Alexiades & Sheldon, 1996). Scientific writing manuals recommend authors not to cite second hand references and encourage them to consult the source directly (Kida, 2006). Mcclatchey (2006) warns against the identification of biological material problems; problems originating in contextualization of research; language problems, etc. Theoretical problems on which any project is based must be also considered.

The absence of a coherent and unifying theory in ethnobotanical papers is well known, despite the fact that many are available, e.g. plant apparency theory (Phillips & Gentry, 1993a, b), theory of evolution (Heinrich *et al.,* 2006), etc. Also, simple faults in methodology sometimes spoil very good and inspiring ideas, and together with over-simplified interpretations of results represent one of the most common mistakes of that authors make.

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6 Value is conceived here as a non-monetary concept (A/N).

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3 EUROPEAN PLANTS

3.1 Introduction to Medicinal Plants of Europe

Růžičková, G.

Medicinal, aromatic and spice plants are a specific group of plants in Europe, and their cultivation has a long tradition in the continent (Ministry of Agriculture of the Czech Republic, 2012). It is estimated that the European herbal industry processes approximately 200 species of medicinal and aromatic plants (MAPs), mainly from field crops (Spychalski, 2013). However, the number of plants used in physiotherapy, and in the culinary, cosmetic and food industries is much higher and reaches 2 000 species. Europe is one of three-trading centers of MAPs in the world, beside the American and Asian markets, whilst Central Europe is the most important import market (EUROPAM, 2010; Ministry of Agriculture of the Czech Republic, 2012).

In Europe, due to climate and soil conditions, Mediterranean as well as Central and East European countries are the best localizations for growing herbs. The total area of MAPs covers approximately 70 000 hectares (Spychalski, 2013; Ministry of Agriculture of the Czech Republic, 2012). Poland, Germany, France, Great Britain, Italy and Spain are the most important traditional European importers and exporters of MAPs. Also, Bulgaria, Romania, Hungary and Albania belong to the 12 most significant exporters in the last decade. Germany is an important axis of medicinal plant trade and supplies in Europe, especially as it connects Southeast European markets with central and Western Europe (Hartman, 2007; Spychalski, 2013).

The processors prefer cheaper raw material in homogeneous batches. This situation limits the level of breeding, seed management and innovations in the growing technologies in European countries (EUROPAM, 2010; Ministry of Agriculture of the Czech Republic, 2012).

Regardless of the method of cultivation, a long tradition of high scientific and technological level can be found in the European environment. The most important cultivated European species are caraway (*Carum carvi*), coriander (*Coriandrum sativum*), fennel (*Foeniculum* spp.), milk thistle (*Silybum marianum*), anise (*Pimpinella anisum*), wormwood (*Artemisia* spp.), chamomile (*Matricaria recutita*) and St. John's Wort (*Hypericum perforatum*), sage (*Salvia officinalis*), peppermint (*Mentha x piperita*), lemon balm (*Melissa officinalis*). In general, the current situation in the EU can be described as follows – the MAPs are grown and collected in the eastern and southern European countries. Whereas, advanced countries in western and northern Europe process these plants (Ministry of Agriculture of the Czech Republic, 2010; Bauer, 1999).

Currently, we can observe the rebirth of the use of medicinal plants world-wide. European scientific teams verify the empirical knowledge of traditional medicinal species systematically and try to find new plants and their active substances. The cultivation of wild plant species is important as well as the breeding and development of modern agro-technologies (Palas, 2014). In the case of wild plant species used in therapy, and in the cosmetic and food industry, the principles of sustainable collection practices have to be respected (WWF Hungary and TRAFFIC, 2012). For processors, to ensure the required and consistent quality of herbal substances (preparations), it is necessary to follow good agricultural and collection practices for medicinal plants (GACP), as well as the concept of good manufacturing practice (GMP) for the manufacture, processing, packaging and storage of medicinal plants (EMEA, 2006).

This chapter summarizes the production of medicinal, aromatic and spice plants in chosen European countries over the last ten years. Tab. I shows the most cultivated and collected species from the group of MAPs in chosen European countries from 2010–2013.

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I: *Production of MAPs in chosen European countries*

Country	Plant species	Area in hectares
Austria	Pumpkin (*Cucurbita pepo*), caraway (*Carum carvi*), parsley (*Petroselinum crispum*), fennel (*Foeniculum vulgare*), milk thistle (*Silybum marianum*), St. John's Wort (*Hypericum perforatum*) and coriander (*Coriandrum sativum*). **Wild species:** mountain pine (*Pinus mugo*)	17 720
Bulgaria	Coriander (*Coriandrum sativum*), lavender (*Lavandula angustifolia*), fennel (*Foeniculum vulgare*), Damask rose (*Rosa damascena*). **Wild species:** rose hip (*Rosa canina*), black elder (*Sambucus nigra* and *S. ebulus*), stinging nettle (*Urtica dioica*), wild berries.	83 199
Czech Republic	Milk thistle (*Silybum marianum*), caraway (*Carum carvi*), poppy straw (*Papaver somniferum*), ergot (*Claviceps purpurea*), fennel (*Foeniculum vulgare*), coriander (*Coriandrum sativum*), chamomille (*Matricaria recutita*), peppermint (*Mentha x piperita*), lemon balm (*Melissa officinalis*). **Wild species:** black elder (*Sambucus nigra*), stinging nettle (*Urtica dioica*), rose hip (*Rosa canina*), birch (*Betula pendula*), linden flower (*Tillia* spp.), St. Jon's Wort (*Hypericum perforatum*), horsetail (*Equisetum arvense*), raspberry and blackberry leaves (*Rubus* spp.).	7 225
Finland	Caraway (*Carum carvi*), dill (*Anethum graveolens*), parsley (*Petroselinum hortense*), garlic (*Allium sativum*), sea buckthorn (*Hippophae rhamnoides*), coriander (*Coriandrum sativum*), peppermint (*Mentha x piperita*), nettle (*Urtica dioica*) and Rhodiola rosea. **Wild species:** nettle (*Urtica dioica*), birch (*Betula* sp.), bearberry (*Arctostaphylos uva-ursi*), erica (*Calluna vulgaris*), juniper (*Juniperus communis*), yarrow (*Achillea millefolium*), goldenrod (*Solidago virgaurea*).	17 230
France	Lavandin (*Lavandula x intermedia*), lavender (*Lavandula angustifolia*), clary sage (*Salvia sclarea*), ginkgo (*Ginkgo biloba*), thyme (*Thymus vulgaris*), parsley (*Petroselinum crispum*), basil (*Ocimum basilicum*). **Wild species:** daffodil (*Narcissus* spp.), oak moss (*Evernia prunastri*).	54 700
Germany	Parsley (*Petroselinum crispum*), chives (*Allium schoenoprasum*), marjoram (*Origanum majorana*), dill (*Anethum graveolens*), chervil (*Anthriscus cerefolium*), sweet basil (*Ocimum basilicum*), celery (*Apium graveolens*), coriander (*Coriandrum sativum*), caraway (*Carum carvi*), chamomile (*Matricaria chamomilla*), mint (*Mentha x piperita*), thyme (*Thymus vulgaris*), lemon balm (*Melissa officinalis*), St. John's wort (*Hypericum perforatum*), purple coneflowers (*Echinacea* spp.), valerian (*Valeriana officinalis*), plantain (*Plantago lanceolata*), sage (*Salvia officinalis*), fennel (*Foeniculum vulgare*), milk thistle (*Silybum marianum*), seabuckthorn (*Hippophae rhamnoides*).	10 149
Greece	Garlic (*Allium sativum*), saffron (*Crocus sativus*), oregano (*Origanum vulgare* spp. *hirtum*), clary sage (*Salvia sclarea*), gum mastic tree (*Pistacia lentiscus* var. *chia*), mountain tea (*Sideritis* spp.). **Wild species:** oregano (*Origanum* spp.), thyme (*Thymus* spp.), chamomile (*Matricaria chamomilla*), mint species (*Mentha* spp.), mountain tea (*Sideritis* spp.), sage (*Salvia fruticosa*)	5 247
Italy	Parsley (*Petroselinum crispum*), basil (*Ocimum basilicum*), bergamot (*Citrus bergamia*), peppermint (*Mentha* x *piperita*), bergamot, chamomile (*Matricaria recutita*), lavender (*Lavandula angustifolia*), lavandin (*Lavandula* x *intermedia*), liquorice (*Glycyrrhiza glabra*), St. John's wort (*Hypericum perforatum*), myrtle (*Myrtus communis*), curry plant (*Helichrysum italicum*), immortelle (*Helichrysum stoechas*).	3 300
Latvia	Culinary species, caraway (*Carum carvi*)	6 500

I (continued): Production of MAPs in chosen European countries

Country	Plant species	Area in hectares
Netherlands	Caraway (*Carum carvi*), flaxseed (*Linum usitatissimum*), chervil (*Anthriscus cerefolium*), celery leaves (*Apium graveolens*), lovage (*Levisticum officinale*), parsley (*Petroselinum crispum*), foxglove (*Digitalis lanata*), purple cone flower (*Echinacea purpurea*), valerian (*Valeriana officinalis*).	2 884
Poland	Chamomile (*Chamomilla recutita*), peppermint (*Mentha piperita*), valerian (*Valeriana officinalis*), St. John's wort (*Hypericum perforatum*), milk thistle (*Sylibum marianum*).	35 000
Romania	Coriander (*Coriandrum sativum*), caraway (*Carum carvi*), fennel (*Foeniculum vulgare*), aniseed (*Pimpinella anisum*), hop (*Humulus lupulus*), lemon balm (*Melissa officinalis*), peppermint (*Mentha* x *piperita*), sage (*Salvia officinalis*), marigold (*Calendula officinalis*), purple coneflower (*Echinacea purpurea, E. angustifolia*), globe artichoke (*Cynara scolymus*), plantain (*Plantago lanceolata*), milk thistle (*Silybum marianum*). **Wild species:** linden (*Tilia* spp.), rose hip (*Rosa* spp.), hawthorn (*Crataegus* spp.), sea buckthorn (*Hippophae rhamnoides*), black elder (*Sambucus nigra*), St' John's wort (*Hypericum perforatum*).	12 000
United Kingdom	Borage (*Borago officinalis*), parsley (*Petroselinum crispum*), coriander (*Coriandrum sativum*), chamomile (*Matricaria recutita*), lavender (*Lavandula angustifolia*), mint (*Mentha spicata*). **Wild species:** black elder (*Sambucus nigra*), bog myrtle (*Myrica gale*).	6 495

Source: Kathe *et al.*, 2003; Seidler-Lozykowska, 2012

Summary

Cultivation of MAPs is a "healthy" alternative to traditional production-intensive agriculture, as well as a means of environmental protection and restoration of landscape. An important option is the use of MAPs for plant protection or as a stimulant of plant growth and development. This is an opportunity for MAPs, considering the EMA (European Medicines Agency) documents, like adopting internal guidelines of the association of growers to provide improved qualitative factors. Development of MAPs depends on the provisioning policy, the availability and development of mechanization (especially harvesting machinery) and on the selection of proper varieties, as well as on the respect for the natural habitats of wild plant species which have to be collected sustainably. Promotion, advertising and education also contribute a lot in this sector. The main risk for the development of MAPs is the importation of lower quality drugs.

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3.2 Medicinal Plants of Central Europe

Růžičková, G.; Kocourková, B.

Abstract

Medicinal plants cultivated and collected from wild nature in Central Europe play an important role in human life, and they are a regular part of people's everyday activity. Medicinal plants reach the market from three sources in Central Europe – from natural habitats (wild collected species), from cultivation, and from imported species. This text discusses the advantages and the problems of the cultivation and the wild collection of medicinal plants, as well as the current state and conditions of production of raw materials in the main Central European countries. The chapter includes detailed information about important European species – caraway (*Carum carvi* L.), chamomile (*Matricaria recutita* [L.] Rausch.), fennel (*Foeniculum vulgare* Mill.), and milk thistle (*Silybum marianum* [L.] Gaertn).

Keywords: medicinal plants, Central Europe, wild plants, cultivation, *Carum carvi, Matricaria recutita, Foeniculum vulgare, Silybum marianum*

Introduction

Herbs are still an important source of human and veterinary medicines, cosmetics, and seasonings. Historically, their collection, preparation and application were accompanied by a certain aura of mystery, and were grounded in religion and magic (Anglielczyk, 2011).

Nowadays, we can observe a change in a lifestyle of young people living in villages and small localities, which leads to traditional knowledge related to medicinal plants being forgotten. New generations find employment in cities, and move away from traditional forms of land farming. The multigenerational family model is increasingly becoming less frequent. All these factors cause the traditional use of plants and the rich customs associated with them to fall into oblivion (Szot-Radziszewska, 2005).

Political and economic changes, which have taken place in the late twentieth century in Central Europe, as well as a departure from central management policy in favor of local governments, have affected the life conditions of many people inhabiting non-industrialized regions or localities far from big cities. The proportion of unemployed and of people without the right to claim social assistance benefits has increased. Analysing the demographic situation, it appears that such people are of working age, and are physically fit, but are not capable of finding their place in the new reality. Agriculture on small surface areas has become unprofitable in a free market economy, as prices of agricultural products have to be competitive (Wolanski, 2013). Agriculture in Central Europe has become intensive and is now oriented to the production of the main commodities. The concept of reformed Common Agricultural Policy "towards 2020" (CAP) can contribute more to developing intelligent, sustainable and inclusive growth. The CAP must also take greater account of the wealth and diversity of agriculture in EU Member States. It can give a chance to traditional, local and sustainable production (European Commission, 2014).

Medicinal plants come to the market from three sources in Central Europe – from natural habitats (wild collected species), from cultivation, and from imported species (Ministry of Agriculture of the Czech Republic 2012). In comparison with other crops, MAPs are grown in confined areas ranging from a few square meters to thousands of hectares; the extent of cultivation depends on the needs of the processors (Ministry of Agriculture of the Czech Republic, 2012). Small-scale cultures reach at most 1 hectare (marshmallow – *Althaea officinalis*, pot marigold – *Calendula officinalis*), medium-scale cultures range from 1–5 hectares (marjoram – *Origanum majorana*, german chamomile – *Matricaria recutita*) and large-scale cultures cover more than 5 hectares (caraway – *Carum carvi*, milk thistle

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– *Silybum marianum*) (Nemeth, 2012). A great diversity is typical for MAPs and their growing guarantees an agro-ecological effect (species diversity within crop rotations). Also, the social and economic effect is significant. On the other hand, the cultivation of MAPs is very demanding; it requires higher proportion of manual labor. However, with MAPs, there is a limited use of mechanized technologies and a limited means of plant protection. The harvest and post-harvest treatment is labour-intensive (the most common basic treatment is drying) (Ministry of Agriculture of the Czech Republic, 2012).

The spectrum of wild species, collected from nature, is typical for individual countries and comes from past traditions. The raw material is cheap. However, there are some problems related to the collected drugs. The charges are small; it is difficult to record the documentation, and the plant material is heterogeneous. There is a risk of misidentification and pollution. In addition, the risk of attenuation of plant populations and the erosion of natural habitats has increased in general in the world (Nemeth, 2012). So there are many motivating factors for growing wild species. In the last decades, some important species were introduced in Central Europe (*Matricaria recutita, Tanacetum vulgare, Claviceps purpurea, Achillea collina, Verbascum phlomoides*) and many species are now in the process of the introduction (*Harpagophytum procumbens, Artcostaphyllos uva-ursi, Adonis vernalis, Artemisia annua, Verbena officinalis, Vitex agnus-castus*) (Nemeth, 2012).

Material and Methods

In Poland, MAPs are grown on more than 35 000 ha, of which 20 000 hectares are intended solely for the pharmaceutical and cosmetic industry, and the number of producers fluctuates at about 20 000 farms per year. They operate specialized and controlled plantations, according to the requirements set by contracts with food processing companies. The plantation area is 0.5–2.5 ha, depending on the species produced, and in the case of specialized farms, it reaches 6–10 ha. Approximately 70 species of medicinal plants are planted. The dominant species in Polish farms are milk thistle (*Sylibum marianum*), chamomile (*Chamomilla recutita*), caraway (*Carum carvi*), lovage (*Levisticum officenale*), peppermint (*Mentha piperita*), valerian (*Valeriana officinalis*), St. John's wort (*Hypericum perforatum*), and thyme (*Thymus vulgaris*). The plant processing companies purchase the vast majority of the material produced. Two thirds of the organized production is sold on the domestic market, and the remaining third is exported, mainly to European Union countries (Seidler-Lozykowska 2012; Spychalski 2013).

Hungary mainly produces poppy (*Papaver somniferum*) for the pharmaceutical industry. Other species include dill (*Anethum graveolens),* coriander *(Coriandrum sativum),* caraway (*Carum carvi),* fennel *(Foeniculum vulgare),* peppermint *(Mentha x piperita),* lemon balm (*Melissa officinalis*), milk thistle (*Silybum marianum*), valerian (*Valeriana officinalis*), savory (*Satureja hortensis),* thyme *(Thymus vulgaris),* chamomile *(Matricaria recutita),* oregano *(Origanum* spp.), St.John's Wort (*Hypericum perforatum*), aniseed (*Pimpinella anisum*), *etc*. (FDA, 2004; Bernath & Nemeth, 2014). 60–70% of medicinal plant species (120–130 species) come from natural habitats. The main collected species are black elder (*Sambucus nigra*), stinging nettle (*Urtica dioica*), horsetail (*Equisetum arvense*), chamomile (*Matricaria recutita*), chestnut (*Aesculus hippocastanus*), and rose hip (*Rosa canina*) (Bernath & Nemeth, 2014). Hungary annually exports about 214 MAPs species (FDA, 2004).

Slovakia produces cultivated medicinal plants on approximately more than 2 000 ha and poppy on 1 500 ha. The main species are milk thistle (*Silybum marianum*) – 600–1 000 ha, plantain (*Plantago lanceolata*), chamomile (*Matricaria recutita*), pot marigold (*Calendula officinalis*), lemon balm (*Melissa officinalis*), peppermint (*Mentha x piperita*), sage (*Salvia officinalis*), sea buckthorn (*Hippophaë rhamnoides*), caraway (*Carum carvi*), and spice pepper (*Capsicum annuum* var. *longum*). The area of marjoram (*Origanum majorana*) has decreased considerably. The main collected species are rose hip (*Rosa canina*), chestnut (*Aesculus hippocastanum*), black doder (*Sambucus nigra*), linden (*Tilia cordata* and *Tilia platyphyllos*), yarrow (*Achillea millefolium*),

agrimony (*Agrimonia eupatoria*) and wild thyme (*Thymus serpyllum*) (Habán & Otepka 2011; Habán *et al.,* 2014).

The most commonly grown MAPs species in the Czech Republic are poppy for poppy straw, milk thistle (*Silybum marianum*), caraway (*Carum carvi*), ergot (*Claviceps purpurea*), coriander (*Coriandrum sativum*), fennel (*Foeniculum vulgare* var. *vulgare*) and chamomile (*Matricaria recutita*). The most commonly collected species in the Czech Republic are rose hip (*Rosa canina*), stinging nettle (*Urtica dioica*) and black elder (*Sambucus nigra*). In 2011, medicinal plants were cultivated on 4 063 ha with the production of 3 381 t and a yield 0.83 $t.ha^{-1}$. In 2012 the production area increased to 4 177 ha. According to the association PELERO CZ, milk thistle (*Silybum marianum*) helped increase the area of medicinal plants in the Czech Republic. The spice plants were cultivated on 4 525 ha with the production of 3 635 t and a yield 0.80 $t.ha^{-1}$ in 2011. In 2012, spice plants were cultivated on 3 887 ha. The main species in this group is caraway (*Carum carvi*), which is an individual item in the research of the Czech Statistical Office (Ministry of Agriculture of the Czech Republic 2012).

Results and Discussion

Caraway (*Carum carvi* L.)

Caraway belongs to the family Apiaceae. It is one of the oldest plants used as a spice and medicine. It is grown for its aromatic fruits – achenes. To a lesser extent, the leaves are used in cooking as seasoning for salads, soups and sauces. Caraway is a desired cash crop, and its cultivation has a long tradition in European countries, except the Mediterranean.

Botany

Caraway is a facultative biennial herb with a taproot. The biennial form is found most often; one-year caraway grows in warmer areas (Southern Europe). A form with reduced length of the growing season (winter caraway) was obtained by means of plant breeding. The stems are straight, 30–120 cm high, sparsely branched, smooth or slightly corrugated. Ground and lower stem leaves are petiolate, with a narrowly elliptic blade, pinnatisect with linear segments. Upper-stem leaves are smaller and more simply structured, sessile to long. Flat inflorescence consists of umbels composed of 8–11 umbellets with 15–18 flowers (Fig. 1). The flowers are usually bisexual, rarely only male, usually white, rarely pink. The fruits are achenes (Fig. 2) of elliptical or ovoid shape, squeezed at the sides, with a thin splitting carpophore. Seeds are crescent-curved and pointed, with 5 raised ribs (Růžičková *et al.* 2012). It grows wildly in meadows, pastures and other grassy areas, on boundaries and edges of roads, in ditches, on rocky slopes and in fallows.

Cultivation

Caraway prefers semiarid areas with medium to light moist soils rich in nutrients, with soil acidity of pH 6–7.5. Caraway is an undemanding plant, but it needs a lot of light. For the biennial form, light influences the formation of vegetative organs and the foundations of generative organs in the first year (Procházka & Vrzalová, 1988).

As for water, caraway is very demanding during both vegetation years. Total rainfall affects the yield and the distribution of yield potential. Therefore, the harvest yield varies over the years depending on the weather. The best cultivated areas in terms of caraway production are low-lying areas in potato-growing regions where seed potatoes are not grown and also in marginal areas of beet-growing regions (Vaculík *et al.,* 2009).

1: *Caraway umbels*

Source: Králík, J.

The Composition of Caraway Achenes

The most important caraway ingredient is an essential oil, which makes up 3–7% of total weight. The use of this essential oil depends on its composition. The main component and also the carrier of odour is (S)-(+)-carvone (50–80%), while about 50% of the essential oil consists of (R)-(+)-limonene and other terpenes. During maturation, the proportion of carvone increases and the share of limonene decline. The drug also contains oil (10–18%), proteins (20%), carbohydrates and flavonoids, calcium, potassium, magnesium, phosphorus and β-carotene (Růžičková *et al.*, 2012).

2: *Caraway achenes*
Source: Šmirous, P.

Use and Effects

Aromatic achenes (Fig. 3) are used as seasoning for the preparation of pastries, meat dishes, cold meats and cheeses, as well as for the production of liqueurs. Caraway is used in pharmacies and traditional medicine, as it soothes adverse digestive tract mobility, prevents excessive gas, and bloating, and stimulates endocrine glands. It increases milk secretion and promotes expectoration of mucus in respiratory diseases. It can be also used to modify the unpleasant taste or smell of drugs.

In pharmacies, caraway is used for the preparation of aromatic oils, syrups and medicinal teas with anticonvulsant, bactericidal and fungicidal properties. As part of grassland growth, caraway increases the dietary value of animal feed. Seeds, oil cake and straw are highly prized animal feed supplements that support the production of milk, increase the digestibility of nutrients, reduce the flatulent effects of other feed, increase appetite and have a positive effect on overall metabolism and health. It is not suitable for dairy cows due to an unpleasant smell that it adds to the milk, and it is poisonous to birds. Caraway is also an important plant for grazing bees. Caraway roots and leaf rosettes are used mainly in the northern part of Europe as a vegetable containing vitamin C.

3: *Caraway achenes*
Source: Růžičková, G.

Chamomile (Matricaria recutita [L.] Rausch.)

Nowadays, chamomile is the most favored and used medicinal plant throughout the world. Phytotherapeutically, its inflorescences are useful and a substantial part of their curative effects is determined by its essential oil content and composition (Salamon, 2007; Singh, *et al.* 2011).

Botany

Chamomile belongs to the genus *Asterales*, to the Asteraceae family. Chamomile root is thin, winding, creepy, and short, branching at both lengths. The above-ground portion grows 0.10 to 0.90 m high, according to growing conditions. The leaves are alternate; they consist of close threadlike segments. The stem is branched. 100 or more flower heads (anthodia) are gradually created on one plant (Fig. 4). The outer line consists of a series of tongue-elongated, white pistillate flowers (12–18). Tubular bisexual flowers are spirally placed inside the anthodium and gradually develop. After fertilization, 0.7 to 1.5 mm long and 0.3 mm thick achenes develop. The weight of 1000 achenes is 0.046–0.052 g. (Salamon 2007). The whole plant contains essential oil. Essential oils in different parts of the plant have different compositions and effectiveness. In the anthodia, the essential oil is formed in essential oil ducts and glandular trichomes (Slavík & Štěpánková, 2004).

Many varieties of chamomile, which differ in content and composition of active substances, have been created thanks to varying environmental conditions (Salamon, 2007; Gosztola *et al.* 2010). Motl *et al.*, (1977) classified chamomile into five chemotypes with different efficiencies (Tab. II).

4: *Chamomile anthodia*
Source: Kralík, J.

II: *Basic types of chamomile according to the predominant component of essential oil*

Type	Main component	Main essential oil comp.	Occurrence
Chemovar A	bisabololoxids (mostly A)	Azulene	Czech Republic, Hungary, Poland, Germany
Chemovar B	bisabololoxide	Azulene, cis-en-in-dicycloether	Argentina
Chemovar C	α-bisabolol	No azulene or just traces	Bulgaria and some German varieties
Chemovar D	α-bisabolol and bisabololoxide 1 : 1	Moderate or lower amount of azulene	Serbia, Croatia, Macedonia
Chemovar E	α-bisabolonoxide A		Bulgaria, Turkey

Source: Motl *et al.*, 1977

Cultivation

Chamomile is a very adaptable plant, but its yields and in particular the composition of its essential oil depends on environmental conditions (Fig. 5). Chamomile is not demanding as for the warmth, it germinates at a temperature of 6–7 °C. Adult plants can withstand frost up to –30 °C. Chamomile emerges 7–10 days after sowing, after 30–40 days the leaf rosette which has up to 40 leaves is formed, and the plant begins to develop flowers. The optimum temperature during flowering is 19–21 °C. Rainfall during flowering is not welcome because it affects the possibility of harvest. Chamomile requires light for germination, which must be respected when preparing the soil. During the short-day period of the year, the plant has a bush-like character and a more uniform formation of inflorescence. The strength and composition of light are of great importance.

5: *Chamomile in double rows*
Source: Kocourková, B.

Light affects the amount of flowers, the drying ratio and the composition of the essential oil (Rumińska, 1983; Salamon, 2007, 2009). Highest yields are obtained on neutral to alkaline soils (pH 7.3 to 8.1). Chamomile thrives on light, but also on heavy soils. Nitrogen affects the overall content of essential oil and the formation of bisabololoxides (Letchamo, 1993). Potassium has a direct effect on the essential oil content; it increases the share of chamazulene

in the essential oil and the creation of bisabololoxides. Phosphorus decreases the content of bisabolol, but increases the total oil content. The recommended dose of nutrients per ha is 20–40 kg of N, 15–20 kg of P and 66–100 kg of K according to the reserves in the soil. Chamomile (*Matricaria recutita* L.) may be considered as an economic crop for improving water use efficiency (Seidler-Lozykowska, 1999, 2000; Baghalijan *et al.*, 2011).

Chamomile Drug Composition

The chamomile drug is found in the flower heads with stems not exceeding 20 mm. The identified substances contained in chamomile are essential oils (usually 3–15 $ml.kg^{-1}$), coumarins, and flavonoids. The distilled oil is dark blue, green or yellow, depending on the prochamazulene content. Matricin as prochamazulene in chamomile oils is transformed to the blue-colored artifact chamazulene during the distillation process (Franz *et al.* 1986). The main components of the essential oils are (-)-α-bisabolol, bisabololoxide A, B, (-)-bisabolonoxide A]. Another component of the essential oil is chamazulene formed from matricine during steam distillation (Gosztola *et al.*, 2010; Rahmati *et al.*, 2011). The classification into these chemotypes was made by Motl *et al.* (1977) and later by Franz (1982, 1989a). A-bisabolol—(pro) chamazulene population was identified on the Iberian peninsula, while mixed populations containing chamazulene, bisabolol, and bisabololoxides A/B are most frequent in Central Europe, and prochamazulene-free bisabolonoxide populations are indigenous to southeast Europe and Asia Minor (Franz, 2000).

Effects

The drug has anti-inflammatory, antispasmodic and carminative effects. It is used in the form of infusions, tinctures, extracts, and as part of products for gastrointestinal complaints (gastritides, enteritides, colitis, flatulence, spasms) and menstrual problems. It can be used in steam inhalations for asthma, hay fever, catarrh and sinusitis. Externally, chamomile drug can also be used for baths, rinses, compresses or ointments for treating wounds (Wichtl & Bisset, 2001; Franke *et al.*, 2005).

The anti-inflammatory and anti-allergic activity is mainly caused by apigenin, chamazulene, cis-en-in-dicycloether and (-)-a-bisabolol (Orav *et al.*, 2010). Antiulcer activity has been demonstrated for (-)-a-bisabolol. Chamomile essential oil also has antifungal and antibacterial effects on Gram-negative bacteria. An anticonvulsant effect was observed with flavonoids, especially apigenin (Wichtl & Bisset, 2001). Chamomile is also used to treat patients given to the fury. Chamomile essential oils contain substances that may be responsible for allergic reactions. A number of publications and web resources describe the manifestation of allergic contact dermatitis caused by sesquiterpene lactones.

In a few cases, allergic reactions to chamomile were reported. The suspected allergen, sesquiterpene lactone anthecotulid, occurring in *Anthemis cotula* L., generally does not occur in the genus *Matricaria*. Chamomile is non-toxic, its use is not addictive and it does not have significant adverse effects. Long-term use could, however, lead to the failure of mucous membranes (Franke *et al.*, 2005).

Fennel (Foeniculum vulgare Mill., Apiaceae)

Fennel is mainly cultivated as a spice and medicinal plant for aromatic fruits (the achenes, Fig. 6), but also as a fresh herb (as a culinary herb) and as a flowering herb (for the distillation of essential oil). Two main types of fennel are cultivated: bitter fennel (*Foeniculum vulgare* var. *vulgare* Mill.), and sweet fennel, which prevails in Asia (*Foeniculum vulgare* var. *dulce* Mill.). Both types differ in essential oil content and composition, and in the color and size of the achenes (Růžičková & Kocourková 2012; GRIN Database 2014; Mansfeld Database, 2014). The achenes have a camphoric, anise-like odor with a slightly bitter-sweet taste.

In cookery, a vegetable, Bolognese fennel, is used [Foeniculum vulgare var. azoricum (Mill.) Thell.]. It has thick fleshy petioles.

Fennel probably originates in the Mediterranean area, and it is one of the oldest domesticated plants. It was cultivated in many countries from Europe to the Far East, and in sub-Saharan Africa. Fennel is a plant of warm regions in the temperate zone, typified by the Mediterranean climate. Fennel spread to other regions, including colder locations, through the selection and conversion. In Central Europe, fennel was introduced in medieval times (in South Moravia, south Slovakia, and Hungary) (Slavík, 1997). The largest areas of cultivation occurred between 1925 and 1938. After the 2nd World war, the area of cultivation decreased. In the 1970, south Moravian fennel was very famous and fetched a good price on the market (Růžičková, 2005).

6: *Fennel achenes*
Source: Růžičková, G.

Botany

Fennel is a biennial to perennial plant with an erect stem, 500–2000 mm in height, rounded, slightly longitudinally striped, and branched. The leaves have cased petioles, 30 –60 mm long, which are oblong, triangulate, and 3–4 × pinnatisect. The narrow, long, lined to thread-like segments 5–50 mm long are strongly aromatic. Inflorescences are umbells; they are flat, 150 mm in diameter, and contain 4–30 umbellates (Fig. 7). Individual flowers are bisexual, small, and yellow, without covers. The calyx is missing. Fennel flowers from July to September. The fruits are double achenes, oblong, ovate, with 5 ribs, 8 mm in length. The fruit's aroma is strong; the taste is spicy and slightly sweet (Slavík, 1997).

7: *Fennel umbels*
Source: Růžičková, G.

Agroecology

Fennel is cultivated as an annual to perennial plant in temperate zones. The optimal day temperature is 15–20 °C and optimal precipitation is around 400–750 mm during the vegetative period. It germinates at +6 to +8 °C. In the flowering period, it needs day temperatures above 20 °C. It is possible to cultivate fennel in many types of soil, from heavy clays to light sandy soils, from stony hills to river floodplains. Fennel tolerates mild alkaline soils (pH 6.5–8.0) but does not tolerate salinity. In the conditions of Central Europe, fennel needs deep loamy soils with a high content of calcium and other nutrients, and with good water balance (Růžičková, 2005).

Technology of Cultivation

European varieties used for the production of seeds are cultivated as biennials to perennials, maximally for four years of cultivation. Fennel is not in demand as a fore crop. Alfalfa, sunflower and all *Umbelliferae* plants are not suitable. The best fore crops are root crops

fertilized with animal fertilizers, as well as cereals. Recommended regions for fennel in Central Europe are the warmest regions (maize production regions). Seeds are sown in March–April, in rows of 0.45–0.60 m, the sowing rate is 10 kg.ha^{-1}, with seed depth of 20–30 mm.

The seeds germinate and emerge in 14–30 days, depending on soil moisture. Fennel flowers from July to September. One year old plants die after the first long-term frosts. The following year it starts to grow early in the spring, formats the stem in the beginning of May, flowers at the end of June, and its fruits mature in September. Fennel stays on the plot for 2–3 years. Fennel requires a good level of mineral fertilizing, mainly phosphorus. It is possible to fertilize it with P and K in doses of 46–65 kg P.ha^{-1} and 50–83 kg K.ha^{-1}. In spring, fennel can be fertilized with an additional dose of nitrogen: 40–60 kg N.ha^{-1}. When the stem is forming, the ammonium form of nitrogen can be added (20–30 kg N.ha^{-1}). In the second year, the dose of nitrogen shall be around 60–80 kg.ha^{-1}. Registered pesticides can be used for the regulation of weed infestation, pathogens and insect attacks (Růžičková, 2005).

Harvest and Postharvest Treatment

The fruits mature heterogeneously; the achenes break down. The harvest has to be started when the umbels of the first order are mature, they have a grayish green color, and 2/3 of umbels are mature. Freshly harvested seeds have to be cleaned and dried at a max. temperature of 35 °C, with moisture approximately at 10%. The yield ranges from 0.4–0.9 t.ha^{-1} in the first year, 0.6–1.3 t.ha^{-1} in the second year and 0.2–0.9 t.ha^{-1} in the third year (Růžičková, 2005).

Active Substances and Quality

The fruits contain the essential oil (1–6%) with the following main compounds: trans-anethol (50%), fenchone (10–20%), limonene (30–10%), α-phellandrene (3–11%), α-pinene (12–16%), α-thujene, β-pinene, methylchavicol, myrcene, and 1,8-cineole (Růžičková, 2005).

In Central Europe, the content of the essential oil in fennel varies from 0.7–2.5% and in flowering fennel from 1–3.7%.

Use and Properties

Fennel is used in the preparation of bread, pastry, soups, salads, minced meat, and fish. It is also used in the production of the liqueurs, herbal teas, confectionery, food supplements, perfumes, and herbal soaps. The seeds play a role in veterinary medicine. Fennel canopies are important for bees. Fennel has carminative, antimicrobial and antioxidant properties. It is used traditionally as a digestive, in case of stomach problems, and is widely used in pediatrics and folk medicine (Růžičková & Kocourková, 2012).

Milk thistle (Silybum marianum [L.] Gaertn.)

Milk thistle is an annual or biennial plant, native to the Canary Islands. It grows as a wild plant in southern Europe, western Asia and northern Africa (Hassan El-Mallah *et al.*, 2007). Milk thistle is produced for the content of the silymarin complex in its fruits (achenes) (Habán, 2009; Abenavoli *et al.*, 2010). The fruits also contain an important amount of fatty oil (Moudrý, 2011).

Botany

Milk thistle belongs to the *Asteraceae* family. The stem is 0.30–2.50 m in height. Plants have a taproot; the stem is branched in the top part. The leaves are alternate; ground leaves form the rosette. The leaves have typical white spots and thorny edges. The inflorescences – anthodia are individual, erect, and with long stems, 3–7 cm in width (Fig. 8). The flowers are tubular, white to light violet (Slavík & Štěpánková, 2004). The parts of the plant that are used

are the fruits (achenes) without the silver pappus. The achenes are 5–7 mm long, 2–3 mm in width, and 1.5 mm thick. The fruit surface is shiny; the color is brownish black to greyish brown. Freshly-ground achenes have a cocoa flavour and a fatty, bitter taste (Habán *et al.* 2009). Milk thistle flowers from July to September (Slavík & Štěpánková, 2004).

8: *Detail of milk thistle anthodium*
Source: Růžičková, G.

Cultivation

Milk thistle is grown commercially mainly in Germany, China, Argentina, Romania, and Mediterranean countries (Abenavoli *et al.,* 2010). Recently, the area of milk thistle cultivation increased in Bulgaria, Poland and Czech Republic (Andrzejewska *et al.,* 2011; Koláčková *et al.,* 2014). While in some states of North- and Central America, Africa, Australasia and in the Middle and Near East, milk thistle is considered a problematic invasive weed (Fig. 9) (Holm *et al.,* 1997).

9: *Field with milk thistle*
Source: Růžičková, G.

Milk thistle grows successfully on a range of soil types, from sandy soils to much heavier clay soils (Karkanis *et al.* 2011). An environment with rich soil humus, with neutral soil alkalinity and with a sufficient amount of moisture, is optimal. Shallow, gravel, sandy soils with high acidity, as well as dry southern slopes without enough water are not suitable (Moudrý, 2011). Leguminous plants, organically fertilized crops and cereals are appropriate fore crops. The sowing rate ranges 5–8 kg.ha^{-1}, but other authors recommend higher rates, of up to 12–24 kg.ha^{-1} (Andrzejewska *et al.*, 2011). The moment of sowing depends on the weather and can be performed from March to April, when the soil temperature reaches min. 5 °C. The depth of swing should be 2–3 cm (Spitzová, 1985), the plant density is recommended between 0.30 × 0.30 m to 0.40 × 0.40 m. The number of plants per 1 m^2 should range from 6–12. The methodology of the Agriculture Research Institute in Kroměříž recommends the application of 45–60 kg N, 17.5 kg P and 33.2 kg K per hectare. Andrzejewska and Skinder (2006) found that the yields of milk thistle grown in monoculture were about 40% lower than the yields obtained in crop rotation. Furthermore, yields recorded in the agro ecological conditions of South Slovakia were from 0.5 to 1.7 t.ha^{-1} (Gromová, 1997; Habán, 2004), 0.55–1.68 t.ha^{-1} in Poland (Andrzejewska *et al.*, 2011) and 0.5–1.2 t.ha^{-1} in Czech Republic (Koláčková *et al.*, 2014). Andrzejewska and Sadowska (2007) found that the content of silymarin is mostly correlated with weather conditions during the vegetation period and also with the time of sowing (Andrzejewska *et al.*, 2011).

In higher localities and in rainy weather, the anthodia are attacked by fungi *Alternaria* and *Botrytis* during the period when they form achenes. These fungi cause necrosis of the top parts of the plants; the achenes are turn pinkish, do not mature or suffer from white mould (Fig. 10). The yield decreases (Spitzová, 1985).

10: *Milk thistle achenes*

Source: Koláčková, P.

Severalvarieties of milk thistle have been developed. The silymarin content most often ranges from 1.0% to 3.0% of achene dry matter but can exceed 8%. Efforts should be made to develop varieties with high-silymarin content (Karkanis *et al.*, 2011). Polish, Slovakian and Czech results show the average content of silymarin in the achenes to be 1.55–2.4% (Andrzejewska *et al.*, 2011; Habán *et al.*, 2009; Koláčková *et al.*, 2013).

Active Substances

The seeds of milk thistle contain silymarin (Karkanis *et al.*, 2011), and a mixture of numerous flavonolignans – silibinin A and B, isosilybin, silychrystin and silydianin (Sanchez-Sampedro *et al.*, 2005). The seeds also contain oil in amounts of 20–30% (w/w) (Růžičková *et al.* 2011; Ahmand *et al.*, 2007). The oil of Milk thistle achenes of various origins mainly contains linoleic acid (51–66%), as well as oleic acid (16–25%) (Růžičková *et al.*, 2011; Koláčková *et al.*, 2013).

Use and Properties

The seeds contain the highest amount of silymarin, but the whole plant is used medicinally. Young fleshy stems are traditionally eaten by Arabs living in Israel, and its sprouts, which are rich in antioxidants, have been used as a traditional medicine for diseases of the liver and biliary tract (Vaknin *et al.*, 2008). This active substance positively affects liver tissue; helps treat diseases of the gall bladder, including hepatitis and cirrhosis. It protects the liver against intoxication by mushroom toxins and alcohol, as well as snake poison and pest bites (Habán 2009; Abenavoli *et al.*, 2010). Milk thistle has an antioxidant effect;

it supports gallbladder function, eases digestive problems, and helps against depression and fatigue (Racz *et al.,* 1990; Pares *et al.,* 1998; Bruneton, 1999). Fatty oil is a side-product used for cosmetic production and animal feeding. In addition, it has also been tested as an alternative source for fuel production. According to recent studies, its oil can be used for the production of biodiesel (Fadhil *et al.,* 2012).

Summary

Central European countries are a traditional production region for medicinal plants cultivated on large areas or collected from wild natural habitats. The quality of the medicinal properties of the plants mainly depends on the content of secondary metabolites, which are influenced by the interaction of many factors, including environmental factors, agrotechnology, and genetic background (variety). Agronomists are interested in the highest yields and prices for their products. Today, under European medical legislation, medicinal products containing herbal substances/preparations must fall within one of the following three categories to reach the market: a product for "traditional use" (this has a simplified registration procedure), a product for "well-established use", and a product authorised after official evaluation.

To use medicinal plants and products derived from them in the therapy of many diseases is trendy, and phytotherapy has recently experienced a renaissance. On one hand, consumers and patients want high quality products with a standardized amount of active substances, produced under strict conditions; on the other hand, the ecological and technological requirements of individual species of medicinal plants have to be respected. The production of medicinal plants can be successful only when the relevant purchasing price is guaranteed, and farmers or collectors benefit from this activity. It is widely known that prices paid to farmers for their production has not change in the past twenty years in most Central European countries, but prices of other products have greatly increased. The processors have other problems, e.g. many legislation problems and strict conditions regarding safety, critical and control points, GACP, and traceability. They are dependent on their own buying stocks, or else they have to buy raw material worldwide from the other processors. Raw material from Central Europe is purchased by 3–5 main buyers in Germany, Poland and Hungary. These companies sell the product to processors in all European countries. There is another issue to discuss – the profession, "collector of plants", is not officially recognized in many countries. Together with low prices, lack of interest, and higher age of local inhabitants, the number of collectors decreased dramatically in the last 5 years, for example in South Europe. Typical collectors are vulnerable groups of people – elderly women with basic or middle education, women on maternity, seniors, as well as people who live in the country and who have low income. Recent studies confirm deep knowledge about plants, their cultivation, collection and use in some regions of Central Europe. Also, in some localities, traditional knowledge and habits are passed down from generation to generation, but in some regions, traditions related to plants and their uses have been lost.

The principles of sustainable collection of wild plant are paramount in regions where local plant populations are endangered by large-scale collection, e.g. in Southern European countries. Some studies in Poland, Hungary, Czech Republic and Slovenia do not confirm such a threat to the main collecting species (*Sambucus nigra, Rosa canina, Urtica dioica, Lamium album, Equisetum arvense, Thymus serpyllum, Matricaria recutita*).

The cultivation and collection of medicinal plants should be a part of the agricultural and cultural heritage and activities of local populations with relevant inputs and incomes for farmers, collectors and producers.

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3.3 Medicinal Qualities of Garlic

Sapáková, E.

Abstract

Garlic (*Allium sativum* L.) has been used for its medical properties for thousands of years. However, investigations of its medical substances are relatively new. It has a broad spectrum of actions such as antibacterial, antiviral, antifungal, and antiprotozoal. It also has positive effects on the cardiovascular and immune systems. This review aims to address the historical use of garlic and its sulfur chemistry, and to provide a brief summary of its botanical properties.

Keywords: garlic, medical properties, therapeutic effects

Introduction

Garlic is one among the oldest cultivated plants in the world. It belongs to the large botanical species of the genus *Allium*. It was known to protect against diseases and epidemics. In the past, garlic was taken as a spice, a vegetable, and a medicinal plant. It has been used in fresh and dried forms, as an essential oil and in various extracts, by the food industry, canning industry, and manufacturers of pharmaceuticals and cosmetics. In its long history, it has gained both admirers and opponents. People have always loved garlic, mainly for its medicinal properties. Garlic gives a unique flavour to dishes and has been known for its very distinctive aroma which penetrates all body fluids.

The Taxonomy and Botanical Properties of Garlic

Garlic belongs to the botanical genus *Allium*. It includes about 700 botanical species, according to estimates by a Swedish botanist P. Wendelbo. Most of them come from countries in Asia and Europe continents. A few species come from the Americas and a few from North Africa. In Australia, *Allia* does not occur at all. The areas with the largest number of species are found in a geographic belt situated around latitude 37 north and from the Mediterranean sea to Iran and Afghanistan (Mann, 1952). The region with particularly a high diversity of species of the genus *Allium* is located in Iran, northern Iraq, Afghanistan, Kazakhstan and western Pakistan. The number of species decreases towards the center of diversity. The greatest loss of the species is on the southern boundary of this area. This is due to the significant climate change in the Himalayas and the northern Indian plains. In smaller quantities, the species of the genus *Allium* grow in northern Gaza. One or two species grow well in the subarctic zone. The other less important center of species' diversity is located in the west of North America. The species also grow in the highlands and mountain areas. Several species of the genus *Allium* are found outside the main centers in the highlands and mountains in the tropics and subtropics such as Sri Lanka, Ethiopia, and Central America (southern Honduras, western Guatemala and southern Mexico) (Block, 2010). The species of the genus *Allium* are highly adaptable. They are able to adapt to different environmental conditions. The main species of the genus *Allium* grows in open, sunny, and rather dry places. The representatives of the genus are characteristic of members of the plant communities of steppe, semi-desert, dry mountain slopes, cliffs, coastal cliffs, and sunny Mediterranean forest steppe. Garlic (*Allium sativum* L.) is a permanent crop. The plants grow according to type, and their height ranges from 0.30 to 0.60. Garlic multiplied by generative methods is unknown with long-term cultural cultivation. Related species retain the ability to reproduce vegetatively and generatively. The main parts of garlic are root, corm, leaves, collateral buds, stem, and inflorescence (Brodnitz *et al.*, 1971). The stem is located at the basal part of the plant, which is considerably shortened below the soil surface (Fig. 11). This is referred to as root and corm. In mature bulbs, a new corm of garlic is separated by a cork layer from the old one. After peeling off a clove, it characteristic track remains on the old

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one, which differentiates each of the botanical forms. Not only the number of cloves but also the construction of the number of bulb leaves can be seen according to the tracks. The shape of an inverted cone acquires its height as the stem growing. The leaves initiate in the growth cone and its center. Fundamental leaves can be seen under the microscope as the circles with increased marginal areas form later in the leaf sheath. The inner part of the circle extends into the leaf blade. The upper part of the stem expands on the both sides, which means upwards and sideways (Fritsch *et al.,* 2002). The space inside the circular leaf bases grows and thus gives rise to new leaves. Garlic is a formed fibrous root system (Fig. 11). Winter varieties with wide leaves (type U) consist of a considerably shortened fibrous root system. The forms requiring irrigation create a shallow, fibrous root system. In winter varieties, root development is stopped in early June and later in northern areas. The roots develop stronger and deeper in forms with narrower leaves that interrupt their development at the end of June. Garlic leaves are bifacial with parallel veins. The leaves are developed in varying numbers (4–16). The first leaf is stiffer, shorter, and more upright with a darker color. The leaf has to break through the soil. The emergence of the leaf occurs fairly soon. The color of the leaves is typically green, and turns to light green, sometimes (Brewster, 1994). The leaves are flat and striated. The shape may be wider or narrower. The upper part of the leaf is peaked with a thicker sheath on the basal side. The flower stem occurs in almost all cultivated species of the genus *Allium* grown from root corm. Flower stem consists of one node extending between the last leaf and the spathe. A fully developed flower stem can reach a height of more than 1 m in species of the genus *Allium*. The flower stem is cylindrical, solid, and leafed up to one third. The inflorescence is topped by the umbel protected by the spathe, which is composed of membranous bracts. The flowers are only about 4–6 mm long, having six stamens and petals. Garlic sticks are about 2 mm long (Kamenetsky *et al.,* 2006). They are accompanied by fibrous bodies, filaments, and species-specific sheaths. These flowers are sterile, and the number of somatic chromosomes is 2n = 16. In the basal part of the umbel, the bulbils are formed. They are vegetative organs and have nothing to do with sexual propagation (Fig. 11) (Lesna *et al.,* 2004). If many bulbils are produced, they tend to be small. If few bulbils are produced, they can grow quite large. The bulbils can be used for the reproduction. The color of their tunic is the same as the color of garlic's tunic. According to Lužný and Vaško (1982), garlic can be divided into three groups in terms of flowers:

1. Garlic which does not form flower stalks – *Allium sativum subsp. vulgare* (softneck) white in color.
2. Garlic which produces flower stalks – *Allium sativum subsp. sagittatum* (hardneck) blue, purple or pink in color. This group consists of flower stalks and bulbils. According to the number of bulbils and their size, it can be divided into two groups:
   - Garlic consisting of many small bulbils in the umbel.
   - Garlic forming a small number of large bulbils.
3. Garlic incompletely projecting into a flower – the umbel with bulbils may remain closed, as a "false stem". In extreme cases, they remain inside the garlic bulb. At one stalk, several bulbils can be created. The flower is not usually developed. The rate of development varies significantly even with the same clones. The storage organ of garlic is a morphologically metamorphosed leaf. There are 4 types of bulbs:
   - Covering (*Bulbus tunicatus*) – making up slightly pulpy bases leaves widely adjoining to the corm and lying close to each other (onion).
   - Scaly (*Bulbus squamous*) – with a tapered corm adjoining pulpy scaly leaves (lily – *Lilium*)
   - Composed (*Bulbus compositum*) – the corm consists of membranous scales with collateral buds (garlic)
   - Full (*Bulbus solidus*) – with a single leaf (wild garlic)

Garlic has a compound bulb consisting of easily separable, and shuttle, curved sickle cloves growing from a common corm. There can be from 1–50 cloves. They are the supply and reproductive organs.

11: *The stem of garlic with leaves, root and bulbils*
Source: Author's Archive

Origin and Extension

Garlic is one of the oldest cultivated vegetables. Its positive effects on the human organism have been known for several millennia. It comes from Central Asia. From there, it was spread to the Mediterranean and throughout Europe, the Far East, China, Korea, and Japan. It was used mainly as a spice and medicinal plant (Fritsch *et al.*, 2002).

The remains of garlic have been found in caves inhabited ten thousand years ago. The first written mention of this herb was written on a Sumerian cuneiform clay table from the period around 3000 BC. Garlic was also found in the oldest medical text called the Ebers papyrus dating from around 1500 BC. The entire ancient world from Spain to China loved garlic. More than any other nation, the Egyptians were fond of this medicinal plant, and believed that the plant helped prevent disease, and increase strength and endurance. Over the centuries, the upper class returned to use garlic, but only for medical reasons (Fritsch *et al.*, 2002). The English herbalist of 17th century Nicholas Culpeper recommended this herb in cases such as rabid dog bite or bites by other venomous animals, as well as for killing intestinal parasites in children, releasing mucus, clearing the head, and curing plague (Brewster, 1994).

Alexander Fleming discovered penicillin in 1928, and this was the starting point of antibiotics. Since World War II, garlic was replaced by penicillin-based drugs sulfates. Nowadays, the herbal doctors recommend garlic for colds, coughs, flu, bronchitis, ringworm, intestinal parasites and cardiovascular disease. The therapeutic effects of garlic are shown in Tab. III.

III: *The therapeutic effects of garlic*

Disease	Treatment with garlic
Gastric ulcers	two garlic cloves per day is an effective prevention against infection caused by *Helicobacter pylori*
Stroke and heart attack	daily consumption of garlic reduces the risk of heart attack by up to 24%
Cancer	diet containing lots of garlic significantly reduces the possibility of developing stomach cancer
Diabetes	garlic reduces blood sugar in humans and animals
Saturnism	garlic helps the body to excrete lead and other toxic heavy metals
Leprosy	garlic has been used in the treatment of this disease, improving health significantly
AIDS	the use of garlic leads to significant improvements in immune reactions, which are weakened by the disease

Source: Author's Archive

Medicinal Properties of Allium sativum

The most important compounds with therapeutic and beneficial nutritional properties are the sulfur-containing compounds, carbohydrates, vitamins, hormonal agents, ferments, antibiotics, sulfur-free antibiotics, and microelements. The content of individual compounds in garlic differs considerably depending on variety, soil, weather, and fertilization treatment. Yoshida *et al.* (1998) and McKenna *et al.* (2002) stress that the sulfur content varies in different varieties, in a range of more than 100%. The sulfur content is proportional to the antibiotic or other therapeutic efficacy. The sulfur compounds include alliin which is the starting material of sulfur bonds in garlic. Rees *et al.* (1998) speak about alliin, which is derived from the amino acid cysteine. Alliin is ineffective as a pharmaceutical substance. It forms bunches of white, soft, odorless crystals, which are soluble in water, but not in organic solvents. There is no allicin in garlic. According to Hassan (2004), it develops from alliin by conversion of the enzyme alliinase which is present in almost all species of the genus *Allium*, and with some other plants. Allicin is an extremely unstable, slightly yellowish oily liquid, with garlic's smell and pungent taste; it is optically inactive, and when mixed with organic solvents, it is slightly soluble in water at 10 °C. According to Jamison (2003: 541–546), it is the main carrier of a number of the active antibiotic properties of garlic. Its antibiotic activity depends on the presence of oxygen. The reduction is significantly inactivated. Allicin proves to be important in many of the health effects of garlic. Hassan (2004) argues that the anti-cancer effect of garlic might be shared between allicin and other unidentified compounds. Garlic contains about 1% of alliin, which is converted enzymatically by allicinase into allicin and other sulphur-containing compounds.

Kasuga *et al.* (1999) stress that garlic is effective in lowering serum glucose levels in STZ-induced, as well as alloxan-induced diabetic rats and mice. Most of studies show that the garlic reduces blood glucose levels in diabetic mice, rats and rabbits. Augusti (1996) and Sheela (1992) consistently show that S-allyl cysteine sulphoxide, (allicin), a sulphur-containing amino acid in garlic (200 mg/kg body weight), has the potential to reduce the diabetic condition in rats almost to the same extent as glibenclamides and insulin. Sheela (1992) and Sheela (1995) stress that aged garlic extract is also effective in preventing adrenal hypertrophy, hyperglycemia and elevation of corticosterone in mice made hyperglycemic by immobilization stress.

Song & Milner (2001) show that as little as 60s of microwave heating or 45min of oven heating can block garlic's ability to inhibit in vivo binding of mammary carcinogens

[7,12-dimethylbenzene (a) anthracene (DMBA)] metabolites to rat mammary epithelial cell DNA. Allowing crushed garlic to "stand" for 10 minutes before microwave heating for 60 seconds prevents the total loss of anticarcinogenic activity. Their studies show that this blocking of garlic's ability is consistent with inactivation of alliinase. These studies suggest that heating is likely to destroy garlic's active allyl sulfur compound formation that may relate to its anticancer properties. Gorinstein (2007) reviewed that the contemporary data concerning atherosclerosis and the protecting properties of garlic. Recent advances in basic science have established a fundamental role for inflammation in mediating all stages of this disease from initiation through progression and, ultimately, to the thrombotic complications of atherosclerosis. These new findings provide important links between risk factors and the mechanisms of atherogenesis and garlic properties. Eisenbarth *et al.* (2003) confirm that numerous *in vitro* studies have demonstrated the ability of garlic to reduce the the risk of atherosclerosis: total cholesterol, LDL, triglycerides, oxidized LDL. The positive influences of garlic on plasma lipids, proteins, antioxidant activity, and some indices of blood coagulation are dose-dependent. Arguably, garlic is likely to be a valuable component of atherosclerosis-preventing diets only in optimal doses. Jelodar *et al.* (2005) further stress that many recently published reports show that the garlic possesses plasma lipid-lowering and plasma anticoagulant and antioxidant properties and improves impaired endothelial function. Ali and Thomson (1995) examine the effect of the consumption of a fresh clove of garlic on platelet thromboxane production.

A group of male volunteers aged 40–50 years participated in the study. Each volunteer consumed one clove (approximately 3 g) of fresh garlic daily for a period of 16 weeks. Each participant served as his own control. Thromboxane B_2 (TXB_2, a stable metabolite of thromboxane A_2), cholesterol and glucose were determined in serum obtained after blood clotting. After 26 weeks of garlic consumption, there was an approximately 20% reduction of serum cholesterol and about 80% reduction in serum thromboxane. Kiesewetter (1991) agrees that there is no change in the level of serum glucose. Thus, it appears that small amounts of fresh garlic consumed over a long period of time may be useful in the prevention of thrombosis. Garlic also contains a variety of vitamins and trace elements (Tab. IV).

IV: *The content of main vitamins and microelements in fresh garlic in mg/100g*

Vitamin	mg	Microelement	mg
Vitamin A (retinol)	0,085	Ca	50–90
Vitamin B_1 (thiamin)	0,003–0,280	P	390–460
Vitamin B_3 (nicotinic acid-PP factor)	0,12–4,0	K	100–120
Vitamin B_5 (pantothenic acid)	0,25	Na	10–22
Vitamin B_6 (pyridoxine)	0,03–0,08	Mg	43–77
Vitamin C (ascorbic acid)	0,03–66,5	Al	0,5–1
Vitamin E (tokoferol)	0,1	Ba	0,2–1
Vitamin H (biotin)	0,00022	Fe	2,8–3,9

Source: Authors' Archive

Summary

Garlic (*Allium sativum*) is one of the most popular plants used worldwide to reduce various risk factors associated with antibacterial, antiviral, antifungal, and antiprotozoal properties. Garlic is one of the plants most commonly used in modern medicine. Garlic is a permanent crop. Plants grow according to type and their height varies from 0.30 to 0.60 m or more. The most important compounds with therapeutic and beneficial nutritional properties are sulfur-containing. Aged garlic extract is also effective in preventing adrenal hypertrophy,

hyperglycaemia and the elevation of corticosterone in mice made hyperglycemic by immobilization stress. It appears that a small amount of fresh garlic consumed over a long period of time may be useful in the prevention of thrombosis. Numerous *in vitro* studies have confirmed the ability of garlic to reduce the risk of atherosclerosis: total cholesterol, LDL, triglycerides, oxidized LDL. The positive influences of garlic on plasma lipids, proteins, antioxidant activity, and some indices of blood coagulation are dose-dependent.

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4 AMERICAN PLANTS

4.1 PLANTS OF SOUTH AMERICA

4.1.1 Traditional Indigenous Medicine of the Peruvian Amazon and its Potential for Psychological Treatment and Personal Growth

Kavenská, V.

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Keywords: traditional indigenous medicine, ayahuasca, psychological treatment, shamanic tourism, benefits, risks, motivation

Abstract

This contribution explains the context and basic principles of traditional medicine of the Amazon. In particular, it focuses on the hallucinogenic vine ayahuasca, traditionally used by indigenous communities in the Amazon as a tool for healing, establishing contact with spiritual life, and for many other purposes. In the last decades, there is rapidly growing interest in ayahuasca observed among people from other cultures (Europe and the US in particular), who come to the Amazon to undergo the ayahuasca ritual. This contribution demonstrates ayahuasca's psychotherapeutic potential, and shows the possibilities of ayahuasca in structured therapeutic community for drug addicts (Takiwasi). There are potential benefits and risks for individuals undertaking ayahuasca expeditions on their own ("shamanic tourism"). The motivation of these individuals is mentioned in the text.

Traditional Medicine of the Peruvian Amazon

The traditional medicine of the Peruvian Amazon belongs to the area known as "shamanism". Interest in this phenomenon in recent decades has increased among the general public and among professionals. It was first mentioned in the scientific research by researchers such as Lévi-Strauss, Mircea Eliade or Michael Harner. Other important factors are represented by the psychedelic movement, books by Carlos Castaneda and also due to the rapid dissemination of information across cultures, and the reduction of travel costs. Michael Harner (Nicholson, 1987) assumes that this interest is related to the necessity for free spiritual growth.

The word "shaman" probably originated in the Tungusic languages, in East Siberia, and means "The one who knows". It was used to describe a religious specialist who goes into trance and communicates with "spirits" in order to recover souls, ensure fertility, and to protect or accompany the souls of the dead (Bowie, 2008). In the Peruvian Amazon, this professional is usually called a medicine man, vegetalista or curandero (from the Spanish word "curar" – to heal). Because the name "curandero" predominates in South America, we will prefer it in this article.

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The most important role of the shaman is healing. Its nature is not always exclusively magical. It is also based on knowledge of plants and animals, medicinal effects, massage, etc. Arguably, some people have assumed that most diseases are spiritual (Eliade, 1997).

Traditional medicine of South America has several major characteristics:

1. To ensure that someone becomes a real shaman, he or she must pass through shamanic training and an initiation processes. The anthropological literature describes the process of "initiation" to become a curandero professional (Eliade, 1997; Luna, 2002; Grof, 2006; Bowie, 2008). It is mainly based on personal experience and long-term isolation in the jungle (so-called "diets"), as well as an "initiation crisis" (often in the form of illness) or the experience of a symbolic death.
2. With the use of local plants for diagnosis and treatment of the diseases (Llamazares & Sarasola, 2003). In the shamanism of the Amazon, plants are considered "spirits-teachers" with the ability to "teach" people drinking their extracts, in particular through altered states of consciousness (Aedo, 2009). The contents revealed by plants are not considered a deviation from reality, but the authentic fact, that would otherwise remain hidden in normal waking consciousness. Arguably, the altered state of consciousness must be extended for it to be observed (Vitebsky, 2006).
3. There is also another specific approach to understanding disease identified in the Amazon. However, the approach does not distinguish between physical and mental illness and is perceived as an inseparable complex (Mabit, 1997; Bowie, 2008; Gómez, 2009; Grof, 2009). Disease is seen as a distortion within the organism or a disruption of balance between the organism and its surroundings. This imbalance is likely to be caused by various factors (Gómez, 2009), e.g. God's intention, karma (the concept of cause and effect), enchantment or bewitchment, personal history, including energy injuries or traumas, or by the interruption of contact with a spirit.
4. The treatment of disease usually occurs in altered states of consciousness of the healer, the sick person, or both. This change of consciousness is likely to be induced in different ways, the most frequent of which is the use of psychoactive plants, hallucinogens in particular.

Ayahuasca

The most common hallucinogen used for medicinal purposes in the Amazon is ayahuasca. On the coast of Peru, the traditional administration of the hallucinogenic San Pedro cactus (*Echinopsis pachanoi*) is widespread.

Ayahuasca (*Banisteriopsis caapi*) is a hallucinogenic vine growing in humid areas in the South American tropics and subtropics (Fig. 12). It is used in combination with other plants in the form of a tea known under the same name as the vine itself. According to the often quoted archeological evidence by Naranjo (1986), the history of ayahuasca use on the South American continent is more than 2,000 years long.[7] During this time, ayahuasca was considered sacred by local tribes and played a central role in their lives. It serves as a tool for prevention diagnosis and treatment of diseases; for communication with gods and the spirit world; for identification of malicious agents responsible for disease; and for improving hunting techniques and understanding the fundamentals of the indigenous social system, including its religious background (Schultes & Hofmann, 1996; Luna, 2002; Dobkin de Rios & Rumrrill, 2008).

The preparation process and use of ayahuasca are strictly formalized and controlled by a number of ceremonial regulations (Furst, 1996). Ayahuasca may contain different

7 However, there is no valid indication of ayahuasca use (Brabec de Mori in Labate & Jungaberle, 2001: 24) (Ed.).

,ingredients, and, therefore, have a different chemical composition. The most frequently-used combinations in Peru are a mixture of the ayahuasca plant (*Banisteriospis caapi*) and chacruna (*Psychotria viridis*). Chacruna is a source of DMT, a substance belonging to the group of tryptamine hallucinogens, that is also naturally excreted in the human brain, e.g. in connection with the sleep cycle, production of dreams, during mystical experiences or spontaneous psychosis (Smythies *et al.* in Narby, 2006; Luke, 2011). The ayahuasca vine provides monoamine oxidase inhibitors (IMAO) – beta-carboline alkaloids harmine, harmaline, and tetrahydroharmine, which allow DMT to take effect in the body (McKenna, Towers & Abbott, 1985). These alkaloids consumed alone at sufficiently high doses produce hallucinogenic effects too.

12: *Ayahuasca vine growing in the Takiwasi Center, Tarapoto – San Martín, Peru*
Source: Author's Archive

The effects of ayahuasca usually manifest on the physical, psychological and spiritual levels. Research on the physiological effects demonstrate that the use of ayahuasca is safe (Callaway *et al.*, 1999), and there is a minimum risk of psychological damage or of the emergence of addiction (Gable, 2007). The most frequently reported subjectively perceived physical symptoms include dizziness, feelings of weakness, tingling, nausea, increased sensitivity, palpitations, light tremors, feeling cold or hot, dry mouth and self-regulation mechanisms – vomiting and diarrhea (Riba *et al.*, 2001; Giove, 2002; Melho, 2006; Horák, 2013).

On the psychological level, changes are found in cognitive functions. It is common to perceive vivid and vibrant colors, lights, images, cross-perception (synesthesia), additional dissociation, confusion and altered perception of time and space (Melho, 2006; Horák, 2013). Research on the impact of long-term use of ayahuasca on cognitive functions does not confirm any deterioration in cognitive or other psychological functions, but, on the contrary, shows better results in comparison with the control group (Grob *et al.*, 1996; Callaway *et al.*,

1999). The psychotherapeutic effects of ayahuasca are particularly valuable. In the scientific literature, there is information on the positive effect of ayahuasca in the treatment of depression (Mercante, n. d.), alcoholism and drug addiction (Grob *et al.*, 1996; Winkelman, 2002; McKenna, 2004; Mabit, 2007; Viegas, 2009; Gonzaga, 2009; Kavenská, 2013) and on its anxiolytic effect (Jacob & Presti, 2005).

Approximately 30% of people describe deep spiritual experiences during the ayahuasca use (Dobkin de Rios & Rumrrill, 2008). Common acute symptoms include a feeling of cosmic consciousness, and a connection with the transcendent, respect for life and the sacred, and a feeling of harmony and unity with the world (Giove, 2002; Villaescusa, 2006; Horák, 2013). These experiences are so intense, and they have such a strong impact, that Krippner and Sulla (2000) even compare ayahuasca sessions to spiritual psychotherapy. It seems that the use of ayahuasca also arouses a long-term interest in spiritual practices (Trichter, 2006–2007).

States induced by ayahuasca are different from psychotic illness or other pathologies. Berlanda and Virgas (2012) declared that there is no deterioration of intellect or of cognitive and executive functions while using ayahuasca (in contrast to the development of pathology). According to some studies (e.g. Bouso *et al.*, 2012), it is even the opposite which obtains. Furthermore, it is essential that the manifested symbols be interpretable, understandable and comprehensible for the subject experiencing them. Arguably, its effect is not perceived as something "outer" and disturbing. These experiences can be integrated and made further transferable.

Psychotherapeutic Effects of Ayahuasca

In recent decades, there has been an increase in information on the psychotherapeutic potential of ayahuasca. Mabit and Sieber (2006) even consider ayahuasca as an accelerator of mental transformation. According to some research, ayahuasca sessions are mainly perceived by the participants as an essential tool for self-discovery (Kavenská, 2013). This occurs through visions, bodily sensations, feelings, thoughts, insights and remembering.

During ayahuasca sessions, we encountered extraordinary psychological experiences, especially with a temporary **reduction of defense mechanisms**. Torres (Mujica, 1997: 33) compares the effects of ayahuasca to dreams, in particular for their potential to "suppress the rational side of patients' thinking." Reference is made in some studies, to the fact that ayahuasca reduces levels of rational criticism. It allows the patient to gain access to other psychological levels, more emotional and less conscious.

Reduction of defense mechanisms thus enables **contact with unconscious or other suppressed contents**. The subjects often re-experience emotionally-demanding events from different life stages and have a chance to reintegrate them in the absence of censorship. Confronting face to face with their traumas and unpleasant experiences, they may **release a strong emotional charge** from these contents, which were previously hidden in the deep layers of unconsciousness, by "getting through" repressed emotions (for example, through crying, vomiting, laughter etc.). The subject experiences a feeling of relief, reconciliation and subsequent integration of already-processed material.

Ayahuasca also helps **to disclose broader context** – for example, what effect should unprocessed topics have on the previous life of a patient and on the development of his problems (Giove, 2002; Kavenská, 2013). This understanding happens because the subject can see what his soul is, and can lead an internal dialogue with himself (Ballón, 1999). This authentic experience of "seeing instead of believing" is different from the experience of being confronted with these contents through another person (e.g. psychotherapist).

Furthermore, ayahuasca allows us to observe reality from new points of view and finding original solutions to problems (Mabit & Sieber, 2006; Mabit, 2002; Shannon, 2002; Frecska *et al.*, 2012). From a Jungian perspective, it is possible to say that produced visions are related to patients' personal and collective unconscious, and they also display aspects of their

shadow (Ojeda, 2002). These shadow aspects are sometimes displayed in the personified symbolic form, e.g. as a struggle with the demon or an aggressive animal.

In addition to these mechanisms, there are also other phenomena which occur during ayahuasca sessions such as knowledge of personal needs, saturation of particular needs, making contact with the body, insight into the situation, corrective experiences of safety, feelings of unity, etc. A frequently observed phenomenon that is paramount from the point of view of patients is a feeling of cleansing at all levels – physical, mental and spiritual.

Ayahuasca sessions are also associated **with the development of patients' spirituality**. The experience of being in contact with the spiritual world, deep spiritual experiences or awareness of the need to develop the spiritual personality happens during sessions (Kavenská, 2013). There are also **extraordinary experiences** of symbolic death and rebirth, which are significant in psychotherapy, because they are subsequently perceived to be significant life milestones (Giove 2002; Villaescusa, 2006).

Therapeutic Community Takiwasi

The Takiwasi Center represents an example of the organized and structured use of traditional medicinal in psychotherapy. Takiwasi is a therapeutic community for drug addicts, founded in 1992 in the Peruvian city of Tarapoto. The concept of treatment in Takiwasi interconnects two basic principles – traditional medicine of the Amazon (shamanism, curanderismo) and modern psychotherapy. Both paradigms are equivalent, irreplaceable and complementary in the treatment model. During the entire treatment time, they are very closely intertwined. The use of plants in Takiwasi relies not only on the knowledge of the effects of specific plants, but also on the way in which they are administered. It is always associated with strict compliance with the rules that are accompanied by the appropriate rituals.

There are over 50 species of plants used in the Takiwasi treatment (Harrington 2008). They are used continuously for the entire treatment period, although, in each stage, some of them dominate. These plants can be divided into three basic categories:

1. Firstly, plants with purging effects serving primarily to bring about physical detoxification. They also have a psychological and energy cleansing effect.
2. Consciousness-altering ayahuasca, administered during sessions, is used here mainly for the psychotherapeutic purposes.
3. Plants administered during retreats in the jungle, aimed at deep psychological work ("plantas maestras").

Hallucinogenic ayahuasca use in the treatment of drug addiction may seem somewhat controversial to the professional public without deeper insight to the topic. Here, the importance of the context in which the substance is used, should be noted. Dr. Mabit (2007), founder of the Takiwasi Center, with a long-standing clinical experience, speaks of the benefits of using ayahuasca to treat drug addiction:

- The visionary effect of ayahuasca permits access to the realities of the invisible world that are made visible or perceptible and are discovered as active elements in the subconscious of the subject. It can be very helpful for patients with low potential for symbolization, and for whom verbal therapies are less effective.
- There is no loss of consciousness while drinking ayahuasca in sessions so that the patient is at the same time the observer and the observed. He can actively intervene in his internal process and thus return to direct protagonist of his treatment. Arguably, this provides him with a notable improvement in self-esteem and a powerful sense of self-confidence.
- Ayahuasca has acted as a revealer of intimate truths without ever violating the intimacy of one's being. It permits the displacement of the life problems of patients into the scenery of the imaginary, where it re-elaborates the intra-psychic conflicts in another way.
- Ayahuasca is focused directly on the transpersonal and trans-generational psychic matrices.

- It generates cathartic physical and psychological effects concomitantly with a re-equilibrium in the autonomous nervous system and reparative effects at the emotional level.
- Many other positive results can be observed. For instance, in the reduction of anxiety, increase in intellectual ability and concentration, stimulation of dream life, identification of the personal "shadow", reduction in projective phenomenon, an increase in tolerance for frustration, improvements in self-esteem or facilitation of the process of differentiation or individuation.
- Results of research (e.g. Aedo, 2009; Giove, 2002; Kavenská, 2013) confirm the potential of ayahuasca for treating drug addicts.

Shamanic Tourism

The number of people who have decided to undergo the experience of traditional medicine of the Amazon "on their own" and travelled alone to the rainforest is rapidly rising in recent years. This phenomenon has grown so much since the 1980's that it is known among anthropologists as "shamanic tourism" (Dobkin de Rios, 1994).

Many studies (e.g. Owen, 2006; Winkelman, 2007; Fotiou, 2010) pointed out how beneficial such experience can be to the participants. However, the prerequisite is to ensure its safe structure, in particular based on the character of a qualified and responsible curandero. Arguably, this framework cannot be taken lightly. For example, Dobkin de Rios & Rumrrill (2008: 88) concluded in their study (interviews with 26 neo-shamans): "Many of these so-called shamans are sociopaths with no experience, individual ability, training or appropriate personality structure for this work." In practice, some clients end up with mental injury. Owen (2006) also speaks about cases of rape and other psychological or physical abuse of people who visited such "shamans".

In order to achieve the objective of this research, 77 respondents were selected; out of which 47 were men while 30 were women. 47 respondents were Czechs while the remaining 30 were from other countries in Europe, South America and the USA. Searching for this experience was mainly motivated by a desire for the treatment of (usually long-term) psychological problems, which some people were unable to "cure" in our society. These included deep depression, suicidal tendencies, anxiety and panic states, different types of dependence (including relational), deep emotional traumas or injuries and the need for coping with death of a close relative. Considering the reason to undergo the ayahuasca experience, the second most stated was the need for self-discovery. Frequently, the need for spiritual development or the desire to clarify the direction of one's life was also mentioned.

Respondents evaluated the experience with ayahuasca as subjectively very significant. In this respect, the greatest benefit was said to be self-knowledge and an overall improvement in relation to oneself (including self-acceptance, love for the other, integration of "inner child", injury, etc.) has been considered. Furthermore, respondents indicated significant changes at the spiritual and relational levels (improved relations with other people, reconciliation, greater sensitivity and empathy, openness to others, greater compassion, separation from the mother). Considering the treatment of mental health problems, respondents indicated positive changes as well, e.g. the disappearance of depression, anxiety, suicidal thoughts or panic attacks. They also reported the release of long-suppressed emotions, the reliving of unconscious memories, abandoning negative patterns of behavior, addressing specific issues of personal history, the healing of trauma, getting rid of the so-called "inner demons" and fear (of death, the future, etc.), psychic cleansing, a sense of clear mind, relaxation and a feeling of serenity. Respondents also reported that the experience with ayahuasca brought them awareness and subsequent change of values and priorities. They know how better to enjoy their life and feel more "enthusiasm" and energy.

Only one of respondents reported a significantly negative experience (related to the personality of the curandero who led the session). Others reported that they neither had a negative experience nor did they consider it significant.

The respondents stated some less subjective significant issues about their experiences such as loss of confidence in the curandero or session organizer, receiving misleading information or exposure to threatening situations. In other words, they mentioned issues such as the threat of assault by locals, dirt, wetness, cold and discomfort during an ayahuasca sessions. They also complained about the quick end of the session, panic in solitude towards the end of the effects after the session, uncontrolled departures of respondents into the forest during the ceremony, ayahuasca sessions on high cliff, combining ayahuasca and the hallucinogenic San Pedro cactus.

Conclusions

It is clear that use of traditional medicine of the Amazon by Europeans is mainly limited to the hallucinogenic vine ayahuasca, which provides a high potential for the treatment of mental health problems and for personal growth. However, it is the context of its use which determines whether there is damage to the patient or not. The ayahuasca session might be only a fascinating aesthetic experience or a real journey into the heart of a person, and only in latter case it will be possible to integrate the experience and bring a real positive impact on the life of the individual.

Another factor that might have a significant impact on this experience could be different historical, cultural and social context. People from the West are likely to understand the lasting knowledge of indigenous Amazonian tribes. Some psychological approaches, such as that of C. G. Jung and his followers, consider the language of soul as universal. All the people on this planet, regardless of their origin or geographical location, have access in their deep psychological structure to the space, where all human experience since prehistory is saved. This area, called as the collective unconsciousness by C. G. Jung (Jung, 2009), is common for all of us and we find complex patterns of basic human experience, so-called archetypes, in this place (Jacobi, 2013). Precisely these archetypes allow mutual understanding and inspiration, as they are equally applicable to all of us – whether a native of the Amazon or an inhabitant of a European city. We could deduce on the basis of this that people from different cultures may understand the symbolic language of the traditional medicine of the Amazon.

Images induced by ayahuasca can be interpreted as any other symbolic material, and it is possible to work with them in similar ways as with dreams or imagination. As V. Kastová (2010) stated, all the images that were produced by us show something about ourselves and our immediate situation. They reveal our current understanding of the world and identity, as well as the possibilities of our current relationships. Moreover, every such self-understanding has its therapeutic aspect.

Evidence about the benefits of traditional medicine of the Amazon is particularly clear in clinical practice. Even though there is not much relevant information on factors that contribute to the treatment of patients, so this remains a bit mystery for us. In practice, we have encountered with patients that were cured, who were significantly and positively influenced by this experience. In my opinion, if there is any practice with therapeutic potential that may serve to improve the quality of human life, it would be unethical not to pay proper attention to it.

Summary

This research focused on the possibilities of applying traditional medicine of the Amazon to psychotherapy. In the first sections, the author defines traditional medicine and describes its main principles. Attention is paid to the hallucinogenic vine ayahuasca, which

is used for the preparation of a tea of the same name. The native tribes have used this tea for millennia, especially for treatment in religious ceremonies. In addition to the description of the chemical composition of ayahuasca and analysis of its traditional forms of application, other results of contemporary research on ayahuasca were presented in this chapter. The author also outlines the possibilities of its psychotherapeutic use and describes the model in detail. Specifically, the author describes how the therapeutic community of Takiwasi, where the plant extract is administered as one of the key pillars of therapy used to treat drug addiction. Furthermore, the issue of shamanic tourism is explained in this chapter, i.e. individual journeys of people from Europe and the USA to the Amazon rainforest for the purpose of undergoing the ayahuasca ritual. Finally, based the study, the motivation of travelers, and the potential benefits and risks of ayahuasca application are discussed in this chapter.

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4.1.2 Medicinal Plants in the Tropical Andean Region. Quinoa (*Chenopodium quinoa* Willd.) and Coca (*Erythroxylum* sp.), millenary treasures for medicinal treatment

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Abstract

The traditional knowledge about plants used in ethnomedicine was generated from millenary praxis and transmitted orally between generations. In this review, we summarize the information reported in ethnobotanical studies of the tropical Andes region to recognize the importance of plants in medicinal treatments and their role in the Andean worldview. The broad traditional knowledge in Andean communities is the ancestral, collective and integral knowledge that allows the use and bioprospecting of biodiversity. The Andean region represents a highly diverse area in terms of culture and plant species; subsequently, the use of medicinal plants differs enormously among and within countries. Andean communities found in plants the treatment of some health and spiritual disorders. Interestingly, some plants showed potential properties that could be deeply investigated, e.g. cancer prevention or treatment. Two millenary and sacred Andean plant species are described in detail due to their potential in medicinal treatments, *Chenopodium quinoa* Willd. and *Erythroxylum* sp. The Andes region has a great wealth of knowledge concerning biological and cultural diversity that should be explored, used and conserved.

Keywords: tropical Andes, medicinal plant, ethnomedicine, traditional knowledge, quinoa, coca

Description of the Tropical Andean Region

South American diversity is strongly influenced by the Andes mountain range, which is better known as the Andean region. The Andes extends from Tierra del Fuego and finishes in Leeward Antilles, and is divided into three sections: Southern, Central and Northern Andes (Josse *et al.*, 2009).

This review will focus on the Northern and Central Andes, known as Tropical Andes. This subregion extends from west of Venezuela and finishes on the border between Bolivia, Chile and Argentina, the subregion area spans 1.542.644 km^2. The tropical Andes region has a high wealth in biological and cultural diversity (Brown & Mitchell, 2000); it contains approximately 100 types of ecosystems that hold about 45.000 vascular plants of which 20000 are endemic. Additionally, the Andean region is the main source of water for many communities (Josse *et al.*, 2009).

Different geoformations, along with varying weather, altitude and geographical locations, have generated a high ecosystem diversity, which has been clustered in five regions, Northern Andes, Yungas, Wet Puna, Xerofitic Puna and Bolivian-Tucuman (Josse *et al.*, 2009). These different biogeographic characteristics along the tropical Andes region play an essential role in an ancestral and modern culture of Andean communities and subsequently, in the traditional knowledge and use of plants according to the Andean world-view.

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Indigenous Communities and Traditional Knowledge in the Tropical Andean Region

There is no unique definition of traditional knowledge, however, from indigenous communities it has been established that "the traditional knowledge is all ancestral wisdom and, collective and integral knowledge that are an essential part of indigenous, Afro-American and local communities, they were built from millenary praxis and an interaction process between human beings and nature, transmitted orally among generations (De la Cruz *et al.,* 2005)." According Nagoya's protocol, traditional knowledge is associated with genetic resources used by indigenous and local communities, regarding the traditional and cultural lifestyle (Greiber, 2013).

The broad traditional knowledge in Andean communities regarding medicinal plants becomes a dynamizing tool for the bioprospection of biodiversity. South America has a unique wealth of traditional knowledge, simultaneously shared among five tropical countries of high cultural and biological diversity (Colombia, Ecuador, Peru, Bolivia, Venezuela), with two cultural groups (Amerindian and no Amerindian). From these countries, Colombia has not been sufficiently explored by ethnobotanical studies (Cámara-Leret *et al.,* 2014).

In Colombia, ethnobotanical research showed that traditional knowledge is deeply established in communities by "curanderos" and women in non-Amerindian families (Toscano González, 2006). Traditional knowledge in indigenous communities responds to a worldview that considers the relationship between culture and nature, therefore, this knowledge contributes to maintaining plant diversity by sustainable use and management of agroecosystems (Rosero, 2006). By extension, in the "*Ese Eja*" indigenous community in Peru, traditional knowledge and conservation areas are at risk as a consequence of diversity and forest disappearance due to external activities (Paniagua-Zambrana *et al.,* 2012).

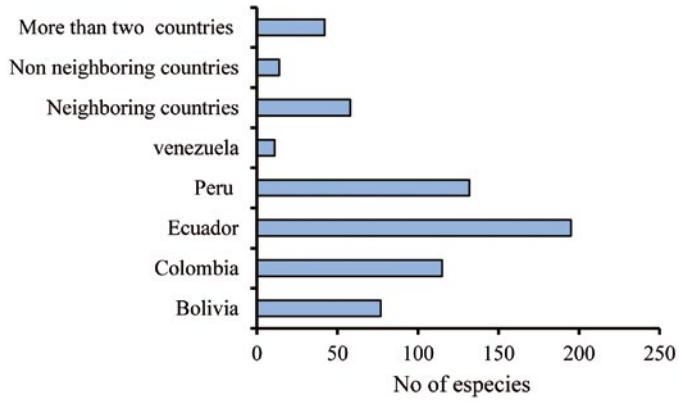
For the Kallawaya culture of the Bolivian Andes, traditional knowledge is constantly revitalized by "curanderos". However, research on medicinal plants is urgent due to their therapeutic potential to improve the quality of life in the communities; it can be done with the integration of a multidisciplinary team including traditional knowledge holders (Vidaurre de la Riva, 2006). In this sense, several ethnobotanical studies have been done in many provinces of Ecuador; however, these reports have not been well diffused, which does not help avoiding loss of traditional knowledge, nor does it help the recognition of Andean resources; their potential and sustainability is at risk. Among the Quechua, Shuar, Oyacachi and Kichwa, many plants are used with a medicinal purpose (De la Torre *et al.,* 2006).

Medicinal Plants Used in Andean Tropical Countries

This review followed several reports about plants used in medical treatments in the Andean region of South-America, as mentioned previously; the Andean region represents a highly diverse area in terms of plant species that are endemically distributed according to microweather created by geographical position. Subsequently, the plant species used in different countries of the Andean region differ enormously and even within the country, the differences not only come from environmental conditions but also are strongly linked to community traditions. We have tried to summarize the results of some studies about ethnomedicine in the Andean region of Colombia, (Angulo *et al.,* 2012; Cadena-González *et al.,* 2013, Rosero, pers. comm.), Peru (De Feo, 1992; Monigatti *et al.,* 2013), Ecuador (Tene *et al.,* 2007), Venezuela (López-Zent, 1993) and Bolivia (Macia *et al.,* 2005). The numbers only correspond to publicly available reports. However, many results were not accessible online and it is important to keep in mind that extensive areas and communities have not yet been registered by ethnobotanical studies.

Around six hundred species were reported from selected ethnobotanical studies which were distributed as follows (Fig. 13), more than one hundred species were reported in several countries and most of them were found in neighboring countries, e.g. Colombia-Ecuador, Ecuador-Peru, etc. This was followed by species that were simultaneously used in more than two countries and finally, by species that were reported in non-neighboring countries,

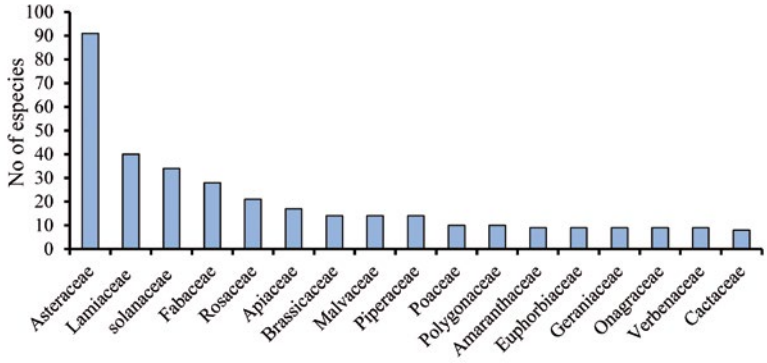
e.g. Colombia-Bolivia, Venezuela-Bolivia, etc. The values observed independently in each country represent medicinal plants registered in the available reports.



13: *Number of species used in ethnomedicine in the Andean region of Venezuela, Peru, Ecuador, Colombia and Bolivia*
Source: Authors' Archive

With respect to species used in several countries, most of them are introduced species, such as *Apium graveolens* L., *Foeniculum vulgare* Mill., *Taraxacum officinale* F. H. Wigg., *Melissa officinalis* L., *Mentha piperita* L., *Rosmarinus officinalis* L., *Linum usitatissimum* L., *Cymbopogon citratus* (DC.) Stapf., *Ruta graveolens* L. and *Urtica urens* L. These species are recognized for their content of chemical compounds that are useful for medical treatments. *Equisetum bogotense* Kunth, *Equisetum giganteum* L. and *Chenopodium ambrosioides* L. are native species that are used in several countries. *Equisetum* species are used to treat disorders in the renal-urinary system and skin infections, and in Bolivia, they are used as part of Andean offerings. *Chenopodium ambrosioides* L. is mainly used for gastrointestinal problems and against intestinal parasites.

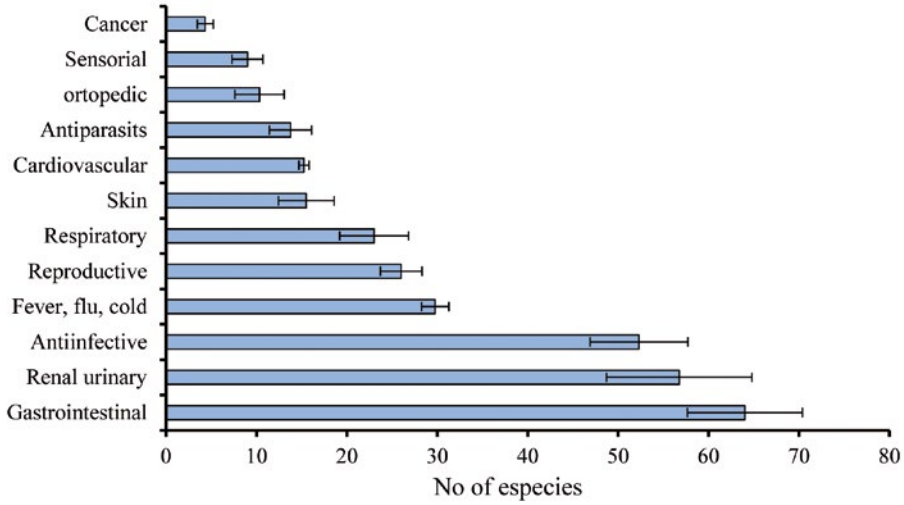
Reported species were identified as members of 116 botanical families, and the most representative was the *Asteraceae* family with nearly one hundred species, followed by *Lamiaceae*, *Solanaceae*, *Fabaceae* and *Rosaceae,* which have more than 20 species (Fig. 14). The members of *Asteracea* family are abundant due to their cosmopolitan character and herbaceous habit. Their phytochemical components make them more used than others (Rosero, pers. comm.).



14: *Number of species according to the botanical family used in ethnomedicine in the Andean region of Venezuela, Peru, Colombia and Bolivia*

Source: Authors' Archive

Andean communities find in plants the treatment of many health and spiritual disorders; this knowledge is strongly linked to traditions, ancestral legacy and to social conditions. Because some families live far from cities and towns, the access to hospitals or health centers is limited. Plants are used as a preventive treatment, during the symptomatic phase of the disease as a first treatment or as a treatment for ailments or minor infections. This is visible according in the number of species used to treat gastrointestinal and renal-urinary disorders, infected tissue (or to protect), fever, flu and cold (Fig. 15).



15: *Number of species used to treat health disorders and in Andean offerings in the Andean region of Bolivia, Peru, Colombia and Ecuador.*

Source: Authors' Archive

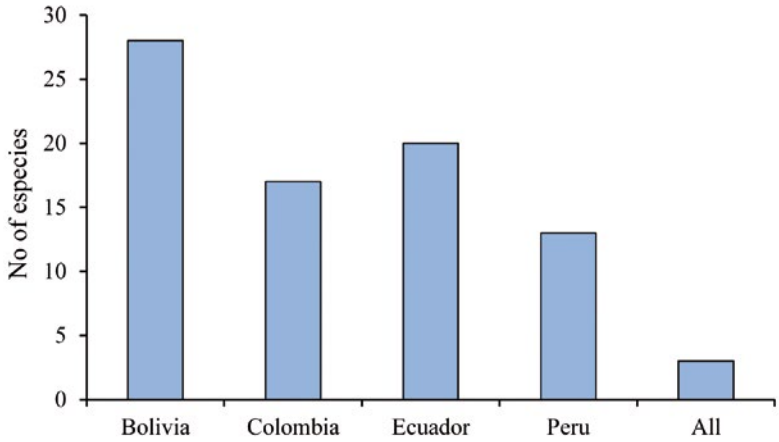
These disorders are mainly treated or prevented using different preparations and include several modes of use. Some examples of gastrointestinal disorders treated by plants are digestive problems, diarrhea, stomach complaints. Plant preparations are also used as preventive treatments for stomach ulcers, amongst others. With respect to the renal-urinary system, plants are used to treat kidney/urinary inflammations, some of them have diuretic properties, etc. Some plants are used as disinfectants of wounds, and of internal and external infections. Fever, flu and cold are commonly treated by plants.

A smaller number of species is used to treat reproductive and respiratory disorders. However, these plants are strongly appreciated because they are used to treat frequent ailments (during the menstrual period) or minor affections.

Few species have been registered to treat cardiovascular, orthopedic, sensorial disorders and cancer; plants are mainly used to prevent these diseases or as simultaneous treatment. Interestingly, the reported species to treat or prevent cancer show potential properties that could be explored and used in cancer treatments. Some of these species have been the subject of cancer research; it is the case of *Aloe vera* L. (El-Shemy *et al.,* 2010), *Annona muricata* L. (Hamizah *et al.,* 2012), *Petiveria alliacea* L. (Urueña *et al.,* 2008), *Bryophyllum pinnata* (Lam.) Oken. (Mahata *et al.,* 2012), *Crotalaria* sp. (Govindappa *et al.,* 2011), *Foeniculum vulgare* Mill. (Devika & Mohandass, 2014), *Marsdenia condurango* Rchb. (Sikdar & Khuda-Bukhsh, 2013), *Uncaria tomentosa* Wild. ex Roem.& Schult. (Rinner *et al.,* 2009) and *Myroxylon balsamum* L. (Barberena *et al.,* 2004), all of which contained compounds against tumour cells. Three species were reported in the ethnobotanical studies for which, however, there were no research

reports regarding their anti-cancer properties: *Echeveria quitensis* Kunth-Lindl., *Prestonia mollis* Kunth and *Althernanthera lanceolata* Benth-Schinz.

Finally, most of the plants used to treat spiritual disorders "espanto" or "susto" and in Andean offerings were identified as native species and were different according to the country (Fig. 16). Thus, endemic plants of specific Andean regions are used for this purpose. Only three species were used in all countries, *Brugmansia sanguinea* (Ruiz & Pav.),*Rosmarinus officinalis* L. and *Ruta graveolens* L. *Rosmarinus officinalis* L. and *Ruta graveolens* L. are burned as incense. *Rosmarinus officinalis* L. is specie introduced from Península Ibérica-Western Mediterranean, *Ruta graveolens* L. is an introduced species from the Canary Islands in Mediterranean Europe and *Brugmansia sanguinea* (Ruiz & Pav.) is an important native South American species.



16: *Number of species used to treat spiritual diseases and Andean offerings in the Andean region of Bolivia, Peru, Colombia and Ecuador.*

Source: Authors' Archive

Quinoa (*Chenopodium quinoa* Willd.), the Mother of Grains and its Potential as Medicinal Plant

Quinua or Quinoa is the seed of the plant *Chenopodium quinoa* Wild. It is called "the Mother Grain" (*La Madre de los Granos*) by the natives of the Andean region (Cusak, 1984). *Chenopodium quinoa* is a dicotyledonous plant and is botanically classified in the family *Chenopodiaceae,* genus *Chenopodium* (Giusti, 1970). The diversity in the uses of the quinoa plant and its wild relatives (*C. carnosolum, C. petiolare, C. pallidicaule, C. hircinum, C. quinoa* subsp. *melanospermum, C. incisum*) are well known to Andean farmers. The farmers distinguish between species and ecotypes, and give them specific uses in food preparation, medicine, ritual events and processing (Mujica & Jacobsen, 2006). Today, thanks to Andean communities, quinoa is known, used and cultivated in different parts of the world due its great potential in human diet, in disease treatment as well and alternative to contributing to the global food security.

Incas and previous cultures considered quinoa as a sacred food and also used it for medicinal purposes. Thus, the use of quinoa in traditional medicine has been known since ancient times. In the communities of the Altiplano and valleys, "Kallawaya" (which in Aymara means carriers of medicinal herbs) healers make multiple uses of the quinoa grain, stems, and leaves for healing and even magical purposes. The modes of preparation and application vary for internal and external use. According to traditional medicine, quinoa stems

and leaves increase the quality of blood. The leaf is used as a poultice to heal sore throats and anginas, another leaf preparation is used to purify the stomach, dislodge phlegm and bile and remove nausea and heartburn. An infusion of the leaves is used to treat urinary tract infections as a laxative. The fresh leaf of quinoa "chiwa", consumed either as a soup or a dessert, is a remedy against scurvy and other illnesses or diseases caused by vitamin deficiency. It is a proven remedy against anthrax, herpes, urticaria, and other skin conditions (Zalles & De Lucca, 2006). The quinoa grain can be used to combat liver disease and is applied to sprains, fractures and dislocations due to its composition that includes a lot of alkaline substances, and it is used as a paste by mixing it with alcohol or brandy. It is also recommended as a refrigerant, a diuretic and to prevent colics. It is an anti-blennorrhoeal remedy and is also used in the treatment of tuberculosis and pneumonia (Pinto *et al.,* 2010; Zalles & de Lucca, 2006). A decoction or poultice made from the fruits is applied to wounds and bruises. Water from a cooked grain cures liver abscesses, internal secretions, and catarrhal afflictions. In addition, the water is also used in washing ears when one is experiencing pain, noise and deafness. According to Kallawaya healers, it is a mild laxative, it is good for insomnia, it combats dandruff and is a good hair tonic (Pinto *et al.,* 2010). A good sudorific is produced by cooking five tablespoons of quinoa seeds in two bottles of water that is sweetened with honey or molasses; this is used against bronchial disorders, colds, cough and inflammation of the tonsils. Quinoa soup with ullucu (*Ullucus tuberosus*), chopped quinoa or quinoa chicha, immediately increase the milk supply of lactating women (Zalles & De Lucca, 2006).

Additionally, particular benefits of quinoa are given by their high nutritional value. The key feature of quinoa is that its grain, leaves and inflorescences are all sources of high quality protein (12.9–21.9%, depending on the variety), balanced amino acid spectrum which include a high lysine and methionine content, carbohydrates (77.6%), lipids (6.5%), a wide range of vitamins antioxidants (Vega, 2010); it is also rich in dietary fibre (Ando *et al.* 2002) and its mineral nutrient contents (K, Ca, Mg, P, and Fe) are much higher than those of conventional cereals (Konishi, 2004). This composition gives quinoa a medical and nutraceutical potential, the dietary fiber (6% of the grain's total weight) promotes intestinal transit, regulates cholesterol, stimulates the development of beneficial bacterial flora and helps prevent colon cancer; it is ideal for helping to eliminate toxins and waste products that can damage the body. Quinoa does not contain gluten, meaning that it can be used for coeliacs; so far studies have found that regular consumption of quinoa improves the small intestine of the coeliacs and returns their intestinal villi to normal, much faster than with a simple gluten-free diet. Finally, two important phytoestrogens – daidzein and cenisteina – can help prevent osteoporosis as well as favor adequate metabolic activity and proper blood circulation (FAO, 2011).

Coca (*Erythroxylum* sp.), Sacred and Medicinal Plant

Coca in the broadest sense refers to two closely-related plant species: *Erythroxylum coca* Lam. and *Erythroxylum novogranatense* (Morris) Hieron, which are botanically classified in the family *of Erythroxylaceae* and genus *Erythroxylum*. Each of them has two varieties. *Erythroxylum coca* var. *coca* "Bolivian" or "Huánuco coca" and var. *ipadu* "Amazonian coca", *Erythroxylum novogranatense* var. *novogranatense* "Colombian coca" and var. *truxillense* "Trujillo coca". Among these varieties are important differences in their stem and leaf anatomy, ecology, geographical distribution, and breeding relationships, as well as in the methods of their cultivation and utilization (Hegnauer, 1981; Plowman, 1984).

Cultivated coca was domesticated in pre-Columbian times. It has played an integral and cultural role in different communities of South American for thousands of years, where it serves as a crucial symbol of cultural identity (Allen, 1986). In addition, its use persists today in several parts of the Andes, in Colombia, Ecuador, Peru, Bolivia, Argentina, and in the western part of the Amazon Basin (Plowman, 1986).

Coca is used mainly by chewing the leaves. However, among communities, this mode of use has some minor variations. Coca is always dried before use; this facilitates the rapid release of the chemical constituents from the leaves while chewing. The dried leaves are placed in the mouth one, or a few, at a time and slowly moistened with saliva; coca is never chewed, but rather the moistened quid of leaves is sucked upon to extract the juices, which slowly trickle into the stomach. Traditional rituals frequently accompany this act (Plowman 1986; Allen 1981). In South America, a number of words are used specifically to denote coca chewing: *mambear* (Colombia); *chacchar*, *acullicar*, *pijchear* (Peru, Bolivia); *coquear* and *mascara* (general) (Powman & River, 1983).

The coca plant shares its name with the chemical compound cocaine; all the cultivated cocas contain the alkaloid cocaine and differ appreciably in the content of minor alkaloids and other chemical constituents (Bohm *et al.*, 1982). The leaves contain protein (20.28 g/all values in 100g of dry matter), with lysine as the limiting amino acid; β-carotene (3.51mg); vitamin E (16.72 mg); trace amounts of vitamin D; calcium, (990.18–1033.17 mg) at two different laboratories; iron, (29.16–29.16 mg); zinc, (2.71–2.63 mg); and magnesium, (225.19–196.69 mg). Cocaine is the principal alkaloid, with a concentration of (0.56 g); other alkaloids have also been identified. Coca leaves do not provide nutritional benefits when eaten in the recommended quantities, and the presence of absorbable cocaine and other alkaloids may be potentially harmful; hence leaves cannot be recommended as a food (Penny *et al.*, 2009).

Coca is a powerful plant in medicinal treatments, especially to protect and ensure health. In internal medicine, coca is taken as an infusion and chewed as a quid. Probably, the most important medicinal use of coca is for gastrointestinal disorders, mainly dysentery, stomachaches, indigestion, cramps, diarrhea, stomach ulcers and other painful conditions. Coca is used for treating symptoms of altitude sickness or *soroche*, which include nausea, dizziness, cramps and severe headaches. It is also commonly used for toothaches, rheumatism, hangovers and numerous other ailments, taken cither internally or applied as a plaster or poultice (Plowman, 1986).

Recently, coca has been studied for possible applications in modern medicine. The therapeutic applications include treating painful and spasmodic conditions of the entire gastrointestinal tract; as a substitute stimulant for coffee in persons who suffer gastrointestinal problems from its use or who are overly dependent on caffeine; as a fast-acting antidepressant and mood elevator without toxic side effects; as a treatment for acute motion sickness; as adjunctive therapy in programs of weight reduction and physical fitness; as a symptomatic treatment of toothache and sores in the mouth; as a substitute stimulant to wean addicted users of amphetamines and cocaine, which are more dangerous and have higher abuse potential; and as a tonic and normalizer of body functions (Weil, 1981; Plowman, 1979). However, the importance of coca in medicinal treatments has to be elucidated, especially due cocaine production and consumption, which give a negative view of the coca plant. In the light of this situation, a better understanding of the cultural and biological aspects of traditional coca consumption is urgent.

Summary

In this review, we summarize the information reported in the ethnobotanical studies of the tropical Andes region in order to recognize the importance of plants in medicinal treatments and in the Andean worldview. The tropical Andean region formed by Andes of Colombia, Venezuela, Ecuador, Peru and Bolivia, represents a culturally and biologically diverse area, thus, the use of medicinal plants differs among and within countries. Andean communities use plants in the treatment of many health and spiritual disorders. Among reported medicinal plants, *Chenopodium quinoa* Willd. and *Erythroxylum* sp. are millenary and sacred Andean species that have a high potential in medicinal treatments and they are also used in rituals. This review shows that the Andean region has a great wealth of traditional knowledge and biological diversity that should be explored, used and conserved.

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4.1.3 Red and Black. Medicinal Properties of Two Major Amazonian Colorants in Peruvian Folk Medicine

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Abstract

Red and black represent not only revolution and obscurantism in Stendhal's famous novel, but also the two colors that characterize the appearance of Amazonian indigenous people during festivals, war campaigns, and everyday life. The juice of unripe fruits from the *Genipa americana* tree provides a dark blue to black color and the seeds of the *Bixa orellana* shrub provide a orange color to red color. Field research and published data collected by other researchers in the Peruvian Amazon demonstrate that these two plants are very popular and used in medicine, both widely grown in mestizo and native rain forest villages. Achiote is mainly applied as a tonic for the digestive tract, a pain reliever for headaches, fever, liver disease, malaria, skin disorders and conjunctivitis. Huito is mainly used to treat skin problems, respiratory diseases, anemia and inflammatory diseases of female genital organs.

Keywords: *Bixa orellana, Genipa americana*, Peruvian Amazon, natural colorants, folk medicine

Introduction

Genipa americana and *Bixa orellana* are the most commonly used plant colorants in the Amazon. They are mainly applied to the human body, either painted onto the skin or in the form of ornaments. They are also widely used as medicinal plants, and their application to the body is not only decorative and symbolic, but also has protective and therapeutic significance.

The Amazon Basin is the place of origin of both plants. However, their long cultural history spreads not only around this region, but all over tropical America. Schultes and von Reis report (1995:153) that achiote, as well as cassava, pineapple and peanuts, were grown before the arrival of Europeans in the lowlands of South America. There is evidence that they have been used for thousands of years.

This chapter provides an overview of how both plants are used for therapeutic purposes in the folk medicine of the Peruvian Amazon – among the urban and mestizo population, as well as in indigenous communities. The chapter very briefly outlines their cultural use and deliberately does not deal with contemporary research on content substances due to limited space and to the lack of conclusive analysis, examinations, and tests, in particular in the case of huito.

Methodology

This chapter is based on a combination of data from my field research and information on the two colorants found in the ethnobotanical literature on the Peruvian Amazon. An overview of the research is comprehensive, however, only the part of the data from my field research has been processed.

All ethnic groups mentioned in this chapter live in the Peruvian Amazon. If no ethnic group is designated, it means that it is a folk medicine used by the mestizo population in the rain forest area of Peru, either in rural communities or cities.

Research was conducted among the following ethnic groups: Ocaina (Ampiyacu River basin, Loreto, Peru) in the years between 2005 and 2007, Shipibo (around the lake Yarinacocha, Ucayali, Peru) in the years 2007, 2008, 2009 and 2010, Quichua (Tigre River basin, Loreto, Peru) in 2007. More so, the study was carried out among the mestizo population

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in Pucallpa and its surroundings, in Iquitos and its surroundings, and in the Tigre River basin between 2002 and 2010.

This study uses participant observation research method. I was present during preparations as well as applications of both plants, whether as colorants or as medicines; I conducted semi-structured interviews, which I recorded, and study "walks" through the rainforest and around villages and farmsteads, during which informants showed me the plants and explained their collection and uses.

Achiote/*Bixa orellana*

Bixaceae

This is a shrub or tree grows mostly from 3 to 6, maximum 10 m in height and its bark contains a color of a liquid orange. The leaves of the plant are ovate with a round, heart-shaped base and a pointed tip. The flowers with five petals may be white or pink. The fruit capsules are red, reddish-brown or green in color and are bi-valved (i.e. with two halves that fit together) and covered with soft bristles. It contains several dozen seeds covered with bright red, bitter aril that is initially fleshy, but hardens on drying. Capsules (Fig. 17) grow in clusters and can be easily opened (Škrabáková, 2013: 61).

17: *Capsule of Bixa orellana. The seeds provide brightly red dye used mainly for decorative purposes. Quistococha, Peru, 2011.*

Source: Author's Archive

In the Peruvian Amazon, the plant is commonly known as achiote, achote, acote and of course under innumerable native names. This chapter also describes the way achiote is called by mentioning ethnic groups, if the name is available. The Shipibo call this plant atase, masce, oshin mashe (Brack Egg, 1999: 70), joshin mashe (Arévalo Valera, 1994: 266), the Cocama rucu (Brack Egg, 1999: 70), rucu teweyun, the Quichua manturu, the Ticuna uxta (Barclay Rey de Castro, 2008:2 3), the Amahuac mashú (Brack Egg, 1999:70). Among Ocaina the plant is called ñoñoya and its fruit ñonoo.

Achiote is grown for ritual, ornamental, food, cosmetic and therapeutic purposes in all warm regions across the globe. It has been widely used since pre-hispanic times. The ancient Maya used it as food coloring and a spice, in body painting and the coloring of textiles and other artifacts; achiote was even used in their famous murals. The plant is highly recognized in the Amazon, and life would be unimaginable without it since achiote pervades all spheres of local culture. Indigenous people in the Amazon make ornaments on the body when they go hunting, visit their forest garden or on an expedition into the forest. They believe that the drawings will protect them from being attacked by animals, bites and evil spirits. In order to obtain a color that is so characteristic of the people of the Amazon, the seeds are soaked in water. In addition, most commonly, the fruit is opened, and the sticky aril is applied directly. Painting the face and body red is not done for purely decorative purposes, but also serves as a protection against sunburn. The color applied to the skin and at the same time operates as repellent (Škrabáková, 2013: 63, 64).

A team of researchers led by Silva Delgado (1999: 13) reported that the Ocaina use achiote to treat tuberculosis. Aril covering the seeds is diluted with water, and one glass is taken daily, until there is an improvement. During the treatment, neither do the patient allowed to have any sexual intercourse nor to eat fish and spicy food. According to the same authors, the Bora people use three glasses of water with macerated leaves to treat fevers. An identical prescription is used in case of measles (Delgado & Hermann, 1999: 16–17). Achiote is also part of the herbal mixture used by the Bora women in preparations of warm sitz baths for relieving perineal pain in the postpartum period. Here, acchiote leaves are used with the leaves of the following plants: *Piper peltata*, *Pouteria caimito*, *Citrus paradisi*, *Crescentia cujete*, *Persea americana*, *Psidium guajava* and *Mangifera indica*. Five leaves from each plant are boiled for an hour in five liters of water (Delgado & Hermann, 1999: 18). According to Silva Delgado and his team, the leaf buds have antiseptic and antipyretic properties and are effective against dysentery, venereal and liver diseases (infusion). The leaves are used as a gargle for tonsillitis (infusion). The flower infusion has a laxative effect. Conjunctivitis is treated with irrigations from young leaves and twigs macerated in water. Crushed leaves in the form of compresses are applied to the head in migraines. A root tea is taken to treat malaria (Delgado & Hermann, 1999: 43).

According to Alarco de Zadra (2000: 4), the plant has astringent, diuretic and aphrodisiac properties and acts against fever and dysentery. According to the same author, "it also acts against genitourinary system diseases and prostate problems. It is applied in case of venereal diseases such as skin infections, fever, and epilepsy. Achiote is also used to prevent scars after skin ulcers, burns and in the treatment of leprosy and smallpox. The Shipibo use this plant in eye infections." Alarco de Zadra furthermore shows that body painting serves as a protection against insect bites.

The author provides the following prescriptions: The infusion from a handful of leaves boiled in 1 liter of water is used as a gargle to treat the oral cavity and throat inflammation. To make an infusion against bronchitis: 1 gram of seeds is dropped into a cup of boiled water and after a while is drunk. Burn ointments: seeds are grounded, rubbed in fat and warmed up.

The Cocama macerate leaves overnight in water, which is later applied to the inflamed skin sites. Likewise, vaginal douches are carried out in unspecified problems with the female reproductive system using the same liquid, where leaves were macerated overnight. This liquid is also applied for conjunctivitis. Patients flush their eyes and wash their head with it. During the treatment, the patient must stay away from direct sunlight, fire, and he

or she is not allowed to eat chili, rice and corn. If vomiting occurs, it is recommended to drink half a cup of a very concentrated infusion of the leaves twice a day.

A concentrated infusion of the leaves is also taken for 10 to 15 days in cases of malaria. At the same time it is prohibited to eat chicken and pork meat, fat and spicy food. Only green bananas and baked fish are allowed. Aril of the seeds is applied to the cold sores until they dry out and stop hurting. During the treatment, the patient must not remain in the sun, take a bath, eat fat, chili, rice, corn and predatory fish ("the fish, which have teeth"). Only banana and the grilled boquichico fish (*Prochilodus nigricans*) may be eaten. Manuel Vásquez Murayari provided all of the recipes listed (Barclay Rey de Castro, 2008: 23).

Pascual Aquituari within the ethnic group shared a recipe for red eyes- a twig from the shrub that is broken early in the morning, because during that time it has all its energy and liquid, which is later dropped into the eyes. Cold sores are cured using the same diet. The juice of grapefruit and salt are added to the aril paste. The cold sore must be treated with a laugh, in order to avoid infection (Barclay Rey de Castro, 2008: 24).

Brack Egg provides the following medicinal use: the juice of crushed leaves is taken in cases of hematemesis and diarrhea. It is also possible to drink an infusion of leaves and seeds that are used in cases of poisoning by bitter cassava. The fruit can be consumed in this case too. Without a prescription it is indicated for hemorrhoids, tonsillitis, and ulcers. In the case of headaches, crushed leaves are applied in a compress to the forehead. If respiratory disease is present, an infusion of seeds and leaves is taken. Liver disease is treated by decoction from young leaves or seeds. Infusion of the leaves is used to treat kidney pain. Macerated leaves are used in the treatment of skin inflammation and vaginitis. The diuretic root decoction is administered in cases of malaria and asthma. Other indications are high blood pressure, fever, burns, and conjunctivitis. Brack Egg (1999: 70, 71) also points out that an infusion of the seeds or leaves is cardiotonic.

Mestizo woman Noeli Napo Lancha from the Manchuria village on the Tigre River specifies that the leaves are picked, macerated in water, then strained, and the liquid is taken in cases of fever and headache. According to Rosa Andrade Ocagane, the Ocaina picks young twigs, insert them into the water, which thickens and is later dripped into the eyes in unspecified eye disorders. The seed dye is used as a sun protector.

Mejia and Rengifo (2000) provide the following recipes: skin inflammation – leave from 9 to 12 leaves in 1 liter of water overnight and then rinse the affected areas; vaginal antiseptic and healing agent – leave from 9 to 12 leaves in 1 liter of water overnight and then perform vaginal lavage; hepatitis – drink infusion of leaf buds; vomiting – 3 cups of infusion 3 times per day (one cup = 3 leaves) (Mejia & Rengifo, 1995: 15).

Arévalo Valera (1994: 166) indicates that the Ashaninka, Shipibo-Konibo and Yine people from Peru rubbed dye on their face and arms to protect against sun and mosquitoes, as well as for beautification during the traditional festivals (Fig. 18).[8]

If the sand or other small particles get in the eye of a person, place strips of inner bark in boiling water and after cooling, wipe the eye carefully and catch impurities. In order to normalize digestive system function after stressful situations, half a glass of the bark or leaf decoction is given 2 to 3 times per day along with leaves of *Melissa officinalis*, and flowers of *Tagetes* spp. extract and *Rosa* spp.

According to the people of the Amazon, achiote also has magical properties. Manuel Vásquez Murayari (Cocama) indicates a procedure that wards off evil spirits: leaves are put into a large vessel and, at night, when everyone is sleeping, the whole house is sprayed with the water and two leaves are suspended in nets. Before a man goes to a funeral, he bathes in the extract of leaves. Using plants (without providing an exact prescription) protects small children from so-called mal aire

8 Arévalo Valera collected the ways of use of achiote among the Amahuac in Pariamanu native community in Madre de Dios (A/N.).

(Barclay Rey de Castro 2008: 24).[9] Pascual Aquituari (Cocama) indicates that a twig of the shrub with fruits is placed in the door, to protect the house from invasion by Tunchi (Ibid.).[10] Arévalo claims that the Shipibo use achiote to repel erotic dreams. For those who have an excessive amount of sex dreams, the smoke of burned leaves is said to help (Arévalo Valera, 1994: 166).

18: *Asháninka man painted with natural dyes obtained from Bixa orellana (red) and Genipa americana (black). Nueva Shahuaya, Peru, 2008.*
Source: Author's Archive

9 In the Peruvian Amazon, mal aire is a common disease that mainly affects children. It is caused if a person is being blown by bad air, e.g. by the breath of a supernatural being or spirit of a man, who died an unnatural death (A/N). For other culture-bound syndromes, see chapters 4.1.4 and 4.1.5 (Ed.).
10 Tunchi is the ghost of a dead person, a lost soul that runs through homes to scare people and cause them disease.

Results

The parts of the shrub most commonly used for medicinal purposes are leaves, aril, twigs, buds and root. Based on the collected materials, achiote is mostly used in diseases related to the liver – hepatitis and malaria; to the eyes – conjunctivitis, red eyes, dirt; to the stomach – as a digestive tonic; and in headaches, fevers and a broad spectrum of skin problems.

Huito/*Genipa americana*

Rubiaceae

It is a fast-growing tree that can reach a height of 15–20 meters. Its trunk is straight, slender and cylindrical. The crown is rounded and highly set. Leaves are large, opposite, and obovate, with well-marked venation. Flowers are large, and yellow or white colored. The fruit is a grayish brown thick-skinned berry 5–8 cm in diameter; they may be wrinkled after maturing, but this does not detract from the quality of the fruit; it has an unusual aroma of the light-colored flesh that has a sweet taste. The tree sheds its leaves during long periods of drought (Škrabáková, 2013: 135).

In Peru it is commonly known as huito, huitoc, uvito, wito, witu and it also has names in the native languages of the Peruvian Amazon – the Quichua and Cocama call it yanipa, the Ticuna genipapo (Barclay Rey de Castro, 2008:105), the Ocaina call the plant juraavuro and huito ready for painting juraavu, the Shipibo-Konibo names are lana, launa, nandi (Brack Egg, 1999: 220) or nane (Arévalo Valera, 1994: 201).

Huito is one of the most popular trees in the Amazon. It has many ethnobotanical uses. Jams, syrups, cold drinks, ice-creams, compotes, salads, jellies, wines and liqueurs are produced from its edible fruit. In Peru, the huitoshado or huitochado – brandy made from sugar cane loaded with fruit pieces and flavored with honey from wild bees – is very popular. It is believed that the drink strengthens organism, and relieves it from the inner cold. In addition, it has even been reported that it counteracts sexual dysfunction to the elderly people.

Its famous blue-black color is provided by the juice made from the smashed seeds of immature fruits that oxidize in the air and immediately begin to turn blue (Fig. 19). The juice itself is slightly gray and invisible on the skin. That's why the indigenous people, when painting patterns on their body, add colorant to the liquid, such as a mud, charcoal or another dye. The ornaments on the body turn black within a few hours and can last up to three weeks. The color is used to dye artifacts – hammocks, textiles, clothes or wicker works. Indigenous people of the Amazon use it mostly in ritual body painting for ceremonial occasions.

The fruits are the favorite food for both animals and fish, because trees usually grow by the water. The fishermen use the fruits as bait. The wood is used to make household utensils and artifacts (Škrabáková, 2013: 138, 139).

Alarco de Zadra (2000: 125) indicates that the juice of the immature fruit is not only used as a repellent, but alo ward off insects, but also against fever and as sun screen. It also helps with psoriasis and skin infections. "The Shipibo apply the heated juice of the fruit to skin affected by mycosis. Sugar from the fruit is administered in cataracts and in cases of hazy vision. A root decoction is used to cleanse the organism (Ibid.)." The author also provides a prescription in case of snakebite: it is recommended to drink the fruit juice after it is dissolved.

19: *Unripe fruit of Genipa americana. The juice from its seeds provides dark blue or black dye. Yarinacocha, Peru, 2011*
Source: Author's Archive

Brack Egg (1999) indicates a large number of therapeutic applications for this plant. In the case of respiratory tract inflammation, a syrup from boiled fruits is applied. Eating of ripe fruits is recommended for bronchitis. Without indicating what part of the plant should be used, or how it should be processed, Brack Egg reports that *Genipa americana* are used for hair loss, contusion or urticaria. A juice made from the fruit is taken internally for endometrial cancer and anemia. It serves as a diuretic and digestive. According to Brack Egg, the syrup from boiled fruits is used in inflammations of the respiratory tract and of the female reproductive system: vaginal infections are treated by vaginal lavage with an infusion of fruits and seeds. Fruits macerated in alcohol help in cases of asthma, and rheumatism. They are also eaten as an aphrodisiac. The juice of the immature fruit is used to treat mycosis. An infusion of fruits is taken in cases of diarrhea; a bark infusion is used to treat bleeding. An infusion of the leaves is used as contraception and the infusion of the ripe fruit as an abortifacient. Seeds, crushed in water, cause people to vomit. In the case of snakebite, the juice is drunk with water (Brack Egg, 1999: 221).

Silva Delgado and his team indicate that fruit eating helps with coughing up phlegm. Pieces of immature fruit are applied on the rotten teeth. An infusion of the fruit is used against diarrhea and the fruit syrup is used in cough treatment (Brack Egg, 1999: 63).

Mejia and Rengifo indicate the following therapeutic applications for the plant: a bark decoction (50 grams in 1 liter of water) is taken in cases of bleeding or pellagra. A cup is used 3 times per day. The juice of the ripe fruit is drunk throughout the day. 3 teaspoons of the fruit syrup are used in cases of anemia, bronchitis or to improve digestion. Lavage with a ripe fruit infusion is performed in case of vaginitis and endometrial cancer. An infusion of immature fruits and leaves causes abortion. An infusion from immature fruits is only used externally to irrigate and cover wounds, because of its healing and antifungal

properties. The root of the tree has a cleansing effect. According to the authors, the prescription should be as follows: 10 g of grated root is boiled in 1 liter of water; the liquid is drunk on an empty stomach. Seeds are applied in cases of dandruff and hair loss – they are crushed, boiled, and the liquid is later massaged into the hair every day for two months (1995: 107).

The Quichua use huito in healing newborns' umbilical stump. Niver Atahualpa Hualinga has indicated that the bark and fruits are used, but it is not specified how. Another Quichua, Joaquín Coquinche Sahua, claims that huito may cause so-called "cutipa",[11] if a pregnant woman did not paint herself with huito or if, when she was young, she climbed a lot in this tree. In this case, the plant causes that the umbilical stump of her baby not to heal well. In this case, a so-called patarashka[12] of the huito leaves is prepared, and it is applied warm to the navel. The bark powder can be used as well (Barclay Rey de Castro, 2008: 106).

According to two Cocama women, Janeth Murayara and Elda Chávez Chota, huito is used to prevent anemia. The immature fruit is cut into small pieces, dropped into water and when it comes to a boil, young leaves are added and then boiled for 15 minutes. In order to ensure that the infusion is not too bitter, two cups of sugar cane juice are poured into the pot. A small glass is taken every morning before bathing. Furthermore, the Cocama use huito in case of bronchial disorders in children – ripe fruits are boiled for two hours, then honey and beaten eggs are added, and the mixture is boiled for another 15 minutes. A spoon is used every morning. Grated immature fruit is applied together with a plant called verbena (probably *Verbena officinalis*) to the body in case of itching. Another prescription indicated by the Cocama women is used in rheumatism. It includes the following ones: ripe fruits are chopped into pieces, loaded into sugar cane brandy called aguardiente, and then the vessel is carefully sealed and buried for 8 days in the ground where they macerate. If someone has been sick for two or more months, he takes a small glass every day in the morning. During the treatment, it is prohibited to remain in the rain, have sexual intercourse, eat chili, sour or spicy food and predatory fish. The Cocama apply the fruit cortex to burns. The inner part of the cortex is grated, and the juice is carefully put on affected places using cotton wool.

To get pregnant by an animal is also considered a "diagnosis" in the Amazon. It occurs due to carelessness. For instance, when a woman is taking a bath during menstruation; the anaconda may enter her body or an animal in human form shall pass itself off as her husband, when he works in the garden or gathers fruits in the forest. When this happens, a woman drinks the juice from grated fruits, and she is not allowed to eat certain types of fish in the process (Barclay de Rey, 2008: 106, 107).

In the Amazon, there is a feared parasitic catfish from the *Trichomycteridae* family called candiru, which can enter the urethra of people, particularly women. According to folk medicine, half a glass of the juice from grated immature fruit (mixed with lukewarm water) is given to the woman, and the rest is used for vaginal douches. This cure usually expels the fish and kills it (Škrabáková, 2013: 136). The Cocama also use the same prescription without vaginal douches (Barclay de Rey, 2008: 107).

The Achual-Shuar people apply the fruit pulp to an aching tooth to relieve from pain, and they do so all week in preparation of pulling out the tooth (Schultes & Raffauf, 1990: 384 in Estrella, 1995: 268). Duke and Vasquez (1994: 79) also report that the flesh of immature food is used in rotten tooth extraction among the Achual living on the Pastaza River.

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11 "Cutipa" can be translated as "evil eye". It is a punishment for treating plants, animals, or things (in particular sacred) badly or against the rules. Only plants, animals, or things that may cause cutipa (A/N). For further information see chapter 4.1.4 (Ed.).

12 Patarashka is anything that is wrapped in leaves, and thus roasted on a fire and embers. It is mainly food – there is patarashka from fish, meat, and other foodstuff such as rice, cornflour, etc. prepared. In case of the preparation of remedies, the source of an active substance (bark, leaves, etc. of a given plant) is wrapped in leaves – the leaves of the plant called bijao are used most frequently (A/N). For further information on patarashka see chapter 4.1.4 (Ed.).

The same authors indicate that the Achual and the mestizo population in the surrounding of Iquitos apply an infusion of fruits and seeds for vaginal douches in female reproductive tract infections.

Estrella (1995: 268) indicates that the major diseases treatable by huito are diarrhea (infusion of immature fruits), bleeding (bark decoction), skin infections and anemia. Tournon (2006: 100) claims that the Shipibo use the bark decoction or an infusion of the fruits to treat digestive diseases and diarrhea. The Shipibo call this plant nane, and the Shipibo shaman Guillermo Arévalo Valera mentions several prescriptions. In the case of ascites, 2 to 3 teaspoons of the juice from the pulp are used together with the juice from the yushin huaste piri piri (*Cyperus* sp.). An unspecified amount of juice from grated fruits is taken together with the juice from another *Cyperus* species called the baque cahuanti huaste piri piri or the tea from leaves, to operate as an abortifacient. The juice from the pulp is applied on inflamed skin or itchy areas of the body for relief. In the case of measles, 4 teaspoons of juice from the grated fruit applied 3 times per day. If cough or bronchitis occurs, either the juice of the bark or ripe fruit boiled together with lemon juice, honey or sugar is given (Arévalo Valera, 1994: 201, 202).

Niver Atahualpa Hualinga from the Quichua ethnic group reports that the mother[13] of huito is a spiritual being living on the shores of lakes, and for this reason the tree most frequently grows next to lakes. The mother of huito is in contact with the black anaconda. Therefore, a person turns black, if smeared with the juice from the grated fruit of huito (Barclay Rey de Castro, 2008: 106). A body that is painted with huito is also used as protection. Tenninson Murayari Silvano and Jarmen Luis Ahuanari do Santos (the Cocama) indicate that the juice from crushed leaves is applied or painted on the children's body to protect them against disease.

Results

The data collected for this study has provided evidence that seeds, immature and ripe fruits, leaves, bark and root are used for medical purposes. The plant is frequently used in respiratory tract conditions – cough, sputum, bronchitis, asthma; in skin problems – bruises, rashes, healing of burns and newborns' umbilical stumps; in dandruff, hair loss, diarrhea, vaginal infections or even in endometrial cancer, anemia and cleansing the body. In almost all the cases, we find that authors report abortifacient effects of the fruit. However, they disagree on the way they are applied.

Conclusion

Beyond their cultural and symbolic significance, both plants are used to treat a wide range of disorders and are considered to be very strong plants with magical properties. Red (*Bixa orellana*) and black (*Genipa americana*) colorants possess a crucial cultural significance among the native population. In addition to the symbolic meaning of body painting and ornaments, the coloring has also practical and beneficial health effects. It protects against sun damage and insects, as well as various skin problems and diseases. As indicated by my research and data collected by other researchers in the Peruvian Amazon, both trees prove to have wide therapeutic application. Some of the medicinal properties have already been confirmed by contemporary research.

13 In the Peruvian Amazon, it is believed that plants have souls – protective beings called "mothers" of plants (A/N).

Summary

I have demonstrated in this chapter a wide range of medical applications of two tree species of the Amazon, whose reputation is known well beyond the limits of this region, because they provide colorants, without which life in the Amazon would be hard to imagine.

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4.1.4 Ethnobotany of the Shipibo-Konibo

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Abstract

This chapter is on the ethnobotany of the Shipibo-Konibo (SK) native group of the Ucayali Valley, Peruvian Amazon.

It is divided in two parts.

The first part presents the Ucayali Valley natural setting, several important concepts of the SK on their vegetal world. Jacques Tournon is the author of this first part. The human and the natural settings are presented. Important SK concepts about the plant world are explained.

The second part is based on ethnobotanical qualitative and quantitative investigations in two Shipibo-Konibo communities of the Ucayali. It presents the results of botanical and ethnobotanical inventories of four hectare plots representative of different forest ecosystems present in the SK community lands. This part is the result of a team work from 1991 to 1996, with J. Tournon, Francisco Enocaise, Rafael Urquia Odicio, Rita Riva Ruiz, and six students of the Universidad Nacional del Ucayali in Pucallpa: Samuel Caúper Pinedo, Catalino Cumapa, Carlos Etene Etene, Grober Panduro Pisco, José Sanchez Choy, Marcos Tenazoa Vela.

Keywords: Shipibo-Konibo, Peruvian Amazon, cultural concepts, medicinal plants, tree resources

Introduction

The Ucayali, one of the major western tributaries of the Amazon, is a white water river with variations in water level from 9 to 10 meters between high and low waters. Its waters are neutral and rich in minerals in suspension, which has two effects:

1. Abundance of aquatic life;
2. Abundance of fertile sediments deposited by the Ucayali waters when the water level decreases.

At present, various native groups, among them the Shipibo-Konibo with about 35 000 speaking individuals, live in the valley of the Ucayali and its main tributaries, in the town of Pucallpa – Yarinacocha and the "Canta Gallo" district in Lima.

The SK ethnobotany has been studied by a number of investigators (Tessmann, 1928; Arévalo Valera, 1994; Tournon, 1980, 2002, 2006). Many plant species known and used by this native group have been identified and studied. However, it is surprising to see that field ethnobotanists may still find new or little described plant species that are important in the SK culture and daily life. One reason could be that the floodable ecosystems, "tahuampa" in local Spanish, *taxbá* in the SK language, are difficult to prospect, another reason is that many vines are important for the SK, but their botany and taxonomy are less known than those of other life-forms such as trees and herbs (A. Daza, pers. comm.).

Another opened research domain is the activity and the toxicity of the majority of the SK medicinal plants and active plants.

In the habitat of the Shipibo-Konibo, several factors may determine the vegetation structure and biodiversity. The characteristics of the forest ecosystems to which the SK have access depend on three factors:

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1. The duration of flooding by the Ucayali, in the rainy season, which in general extends from November to April;
2. The type of soil, if it flooded it can be with more silt or sand;
3. The history of the forest, if it is a primary or secondary forest.

In this chapter, plants will be presented with their local names in Shipibo-Konibo language in italics, and in local Spanish. They are classified by botanical families, genus and species in alphabetical order.

First Part

This first-part treats of the Shipibo-Konibo cultural concepts in the plant world.

Plant Nomenclatures

The Peruvian Amazon is a multilingual region and two plant nomenclatures were utilized by our informants (Tournon, 2002, 2006).

1. Shipibo-Konibo nomenclature:

The SK language belongs to the "pano" language family, together with Cashinahua, Cashibo-Cacataibo, Sharanahua. Some 20 pano languages are known (A. M. d'Ans, P. Deléage, Ph. Erikson, P. Valenzuela).

Our inventories have been done mostly with the cooperation of SK speaking "comuneros". We found that they could name almost all the trees of these plots in their language.

2. Local Spanish nomenclature

Moreover, many SK informants also know trees by the local Spanish names which are used by the rural population, foresters and loggers. These local names are formed with Spanish, Quechua and Tupi word roots.

Plant Classification Systems

Such systems can be put in evidence by a questionable set of inclusions and exclusions in the questions of the ethnobotanist to the informant.

Brent Berlin (1992) underscores nomenclatural and classification systems based on plant morphologies. They are arborescent systems with at least three taxonomic levels: lifeforms, folk genera, and folk species. Some systems have been described with five levels, with an intermediate level between life form and popular genus. B. Berlin shows that there is an additional popular variety level included in the popular species level for very important agricultural plants as maize, cereals, peas, manioc, bananas. He also shows that each level has its morpho-linguistic characteristics.

An ethnobotanical classification system based on morphology as the ones described by B. Berlin was found in the case of the Shipibo-Konibo.

The three classical life-forms are:
Shobi or herb,
Jiwi or tree,
Nishi or liana.

Two additional life-forms have been proposed (Tournon, 2002, 2006):
Nepax for floating plants as nympheas, water hyacinth (*Eichhornia crassipes*).
Manish for big herbaceous plants that may grow under trees, in general the big Monocotyledona: Aracee, Musaceae, Zingiberaceae, and also spiny Dicotyledona. *Manish* connotes vegetation difficult to walk in, as is illustrated in many SK narrations, where the hero loses his way in *manish* (Tournon, 2013).

Specialized Classification Systems

Other plant classification systems can be found, which are not based on morphology but on other criteria such as the types of uses.

Rao is an important word in the SK language. Its first meaning is "medicinal plant", but its semantic field is broader and includes not only the curative plants, but also toxic plants, psychotropic, ethotropic[14] and "magical" ones, in general all products that have a power, a biological or cultural activity (Arévalo Valera, 1994; Tournon, 1983, 1984, 1986, 1995, 2002, 2006). The rao play an important role in the SK life and culture since they are not only therapeutic and etiologic but are also used to change and control human behaviors.

The Rao: A Unique Substance and Several Modes

We can say that *rao* plants have one substance and two modes:

1. A material mode, a biological being with roots, leaves, chemical and pharmacological properties and activities.
2. A spiritual mode with a rao spirit or yoshin, which can have a therapeutic or an etiologic effect on human beings and appears to the onanya or the meraya, literally the one who knows and the one who meets the spirits.

The Rao and Its Material Mode

The rao in their great majority are of vegetal origin, however a few are of animal or mineral origin. Several studies and inventories of *rao* have been published. The number of vegetal *rao* identified at least at the taxonomic level of family and genus is estimated at 350 (Tournon, 2006).

The Rao and Their Spiritual Mode

Rao spirits may affect human beings and their well being, whether therapeutic or etiological. Health symptoms can be attributed to etiological spirits.

An example is that several big trees which have a negative power, have *koshi yoshinbo* which can affect human health.

It is the case of catahua or *aná* (*Hura crepitans*). It can cure Leishmaniasis, poison fish or kill enemies.

The giant tree (*Ceiba pentandra* (L.) Gartn., Bombacaceae), in local Spanish lupuna, in SK *xóno, is a* "master plant" or *ibo jiwi*. Its spirit has hallucinogenic powers and knowledge. When taking its bark juice with tobacco, it is necessary to diet. The lupuna has special powers: it is thought that walking nearby is dangerous, so that a father must pronounce the phrase: "Do not take the *yoshin* of my son."

Aya huma or *ino xatan* (*tigre/Calabaza*), *Couroupita* spp., Lecythidaceae, is also an impressive giant tree. With pyxidium fruits weighing several kilos hanging thirty meters high, its material mode is obviously dangerous, and its spiritual mode must follow of course.

All these trees with strong spirits can affect loggers who must utter propitiatory sentences to protect themselves from their malevolent powers. The father of a newborn should not enter the forests where these trees grow and should stay in his house respecting a kind of "couvade" or their children fall ill (Tournon, 2002).[15]

14 From *ethos* in Greek, behaviour (Ed.).

15 "Couvade" is a term coined by anthropologist E.B. Tylor in 1865 to refer to certain rituals that fathers in several cultures adopt during pregnancy (Doja, 2005) (Ed.).

During the ayahuasca session, the medicine men or shamans, *onanya* and *meraya*, invoke therapeutic *rao yoshinbo*. (Tournon, 1991b) The *rao* can be therapeutic, *jakon rao*, or etiologic, *jakonma rao*, depending on the *onanya* and *meraya*.

Ibo Rao, Master Plants

Onanya and *meraya* invoke the spirits of these trees, *ibo yoshinbo* or "master plants", during their therapeutic sessions.

Guillermo Arévalo (1986), a well known therapeutist, *raomis*, specialist of the *rao* in their material form, and *onanya* for their spiritual form, gives a list of "plantas maestras":

"It is possible to add leaves, flowers, bark or roots of the plants that you wish to experiment in the ayahuasca and chacruna preparation. These master plants or 'plantas maestras' have superior spirits:

1. Master plant hallucinogens: Toe, Marosa, Chiri-sanango, Sanango, Tabaco, Soija, Marco-huasca, Camalonga, etc.
2. Master plants that provoke dreaming: Chuchuhuasi, Chullachaqui, Lupuna, Piñón blanco y negro, Remocaspi, Sonarara, Huayracaspi, Pinshucaspi, Alcanforcaspi, Yayo, Catahua, Copaiba, Palo de rosa, Palisangre, Pishcohuayra, Sangre de drago, Caupari, Ishpingo, Ojé, etc.
3. Master plants for love (puzangas), fishing and hunting: Renaco, Suelda con suelda, Uña de murciélago, Motelo-huasca, etc.

In general, all kinds of plants can be added. Each has its own spirit, even if some are inferior. Likewise, metals, stones and vegetal perfumes can be secondary additives."

Two native SK concepts: *rao meramis* and *iribana* illustrate the existence of the two *rao* modes, material and spiritual, in one substance, Baruch Spinoza sensu (Morgan, 2006).

Rao meramis

The *rao meramis* is a *rao* category. The verb *merati* can be translated as "to meet", "to fall in love". The suffix *mis* means a custom or capacity to accomplish something. For example, a person who knows the *rao* plants will be called a *raomis*, a fisherman successful in harpooning the paiche or *wame* (*Arapaima gigas*) will be called a *wamemis*. Literally a *rao meramis* is a *rao* who can meet people.

The two modes of a *rao meramis*, spiritual and material, may produce different effects:

Wapan is a shrub considered as a *rao meramis* (Arévalo, 1994: 121).

We collected two sentences: *wapan rao meramis riki* (the plant *wapan* is a *rao meramis*) and *wapanma mera joni* (the plant *wapan* meets people), which seems equivalent.

At the question: *"Jawekeska isinman ikiki noa raometiki wapama min ea yoitiki?"* or "Can you tell me which type of disease the *wapan* can cure?" a medicine man of Caimito, Imiria lake, answered:

"Mapon chexai jawen pei biax motsax boshoiki wapan noa meraronki noa jaskatai": "when the *wapan* has met us, and we have a headache, its leaves are collected, crushed and we moisten our head with them."

Nibi saya is another *rao meramis*, a shrub identified as *Cestrum megalophyllum* Dunal, Solanaceae (Tournon, 2006). When we asked about its activity, the answer was:

"Nibi saya riki porokan chexai, kinani ika jakonribi, jaska akin meramis iki nibi saya, jawen pei motsax jan nashiyokin": "the *nibi saya* is good to relieve stomach pain and vomiting, one should bathe with its crushed leaves." (Tournon, 1990, 2002)

These phrases show that the *rao meramis* can have two actions. The first one produced by its spiritual mode is etiologic. The second produced by its material mode is therapeutic, curing the symptoms produced by its spiritual mode (Tab. V).

The Irabana

The syndrome irabana is another illustration of the two modes, material and spiritual, of a *rao* substance (Tournon, 1990, 2002). It is an unintentional secondary *rao* effect, produced by a SK medicine man (*onanya, meraya*) during a *rao* therapy as shown in the following sentences:

The *iribana* can produce digestive symptoms: *nato joninra kinanai kanachiari irabaxon*: this person vomits because of *irabana* from *kanachiari*.

The *irabana* does not seem to affect the medicine man or the patient, but a third person who is close to them during the therapy: *Irabana merayanin niwe shatea niskanax rao niwe pikotai:* the *irabana* is produced by the *meraya* when his air and sweat are cut.

The *irabana* effect is even stronger when the medicine man is following a diet (*samá*) with a strong *rao*, such as *kanachiari* o toe, *oni* o ayahuasca, *chuyachaki* o chullachaqui, with which he is acquiring his power:

Eara kanachiarin nashiai, jawen koshibi: I bathe with the plant "toe" and take its power.

The *irabana* is produced without the medicine man's will:

Ja yobekanra, onanyaninra, merayaninra irabanke akaskinmabi: the medicine men –produce the *irabana* without willing it.

This makes it comparable to the "evil eye" (*el mal ojo*), the famous syndrome present in the Mediterranean countries.

These concepts may be difficult to understand for the non-SK, but they show how the SK culture has developed logic of animism.

V: *Effects of the two rao modes*

rao	Material mode	Spiritual mode
Therapy with the onanya-meraya	+	+
Rao meramis effect	+	-

Source: Authors' Archive

Rao Categories and Nomenclature

A *rao* is in general named by its activity: "activity + rao".

For example *chixó rao*, is a plant actively against *chixó* or diarrhea, *yona rao* is active against *yona or* fever, *xeno rao* for dermatosis, *oko rao* for cough.

In some cases the *rao* specifiers do not refer to the therapeutic activity, for example, *samon rao*, where *samon* is a big fly or horse-fly, "una ronsapa", is a plant which has no use related to these Diptera. Another example is that of the *bari rao*, *bari* is sun, which designates a number of botanical species of different "life forms": *jihui, tree,* and *xobi*, *herb.* It is obvious that these plants do not cure either the sun or sunburns, but they have a showy yellow-gold blooming.

Within this double nomenclature system a *rao* category can correspond to several plant species, for example, *chixó rao* can designate several species used to treat diarrhea, etc. Inversely, plant specie which has several uses may have different names according to these uses, e.g. *chixó rao* and *poko rao, for* diarrhea and intestinal pain.

Rao species can also have their own name without any reference to use; such is the case of *Hura crepitans* (Euphorbiaceae) called *aná* in SK, catahua in local Spanish. It is a dominant tree of the riverine forests and is very important in the SK culture. It is also called *peke rao* where *peke* is the leishmaniasis or "uta". It can cure snake and "isula" bites (ant, *Paraponera clavata*). Its sap is first extracted and then refined by fire. The product looks like a milky liquid which is applied over the bite swelling. A diet of 2 or 3 days must be respected, the fish piraña, carachama, chiu-chiu, yambina, and saltón must not be consumed, game meat, chili, fat, and sexual relations should also be avoided.

Its very toxic sap is used as an ichtyocide: "To a bucket of its sap is added a handful of ashes to facilitate fermentation, it is ready after macerating two days; no pregnant or menstruating woman should participate in the fishing party."

This impressive tree may be also an etiological agent, and its spirit, *yoshin* or *ibo*, can produce the SK syndrome *kopia*, "cutipado" in local Spanish (Tournon, 2002). We see that it can be both etiologic and therapeutic.

The plants named *rao* are not only medicinal, but can have other types of activities: poisonous, psychotropic, ethotropic.

Poisonous Rao

The word *rao* was initally translated as poison; we saw that it was the case of *Hura crepitans* sap.

Other plants are utilized as fish poisons:

"Barbasco", *warawasko, Lonchocarpus nicou* (Aubl.) DC., and "sacha barbasco": *Tephrosia toxicaria* Pers. (Fabaceae).

Huaca, *marax*, *Clibadium surinamse* L. (Asteraceae).

Psychotropic Rao

These *rao* are used by the "shamans", *onanya* and *meraya*, during their therapeutic sessions. The famous ayahuasca hallucinogenic drink, *oni* or *nishikon* in SK, is prepared with the vine *Banisteriopsis* spp., Malpighiaceae and the shrub *Psychotria viridis*, Rubiaceae (Spruce, 1873; Friedberg *et al.*, 1984; Rivier & Lindgren, 1972). It has now been vulgarized and commercialized in neo-shamanism.

Ethotropic Rao

They are used to affect and change human behaviors. For example, they can be used to control people and seduce them; they are called "puzangas" in regional Spanish and *noi rao* in SK. Others are used as tranquilizers, e.g. several women told us that they could calm down a jealous and violent husband, *tsokas bene*, with a *tanti rao*. A lazy man who does not like to work in the garden can be stimulated with a *rayati rao*. An awkward fisher or hunter ("afasi" or *yopa*) can be cured with a *mechati rao*. These behavior problems are cured *benxoti*, like an ailment such as fever or diarrhea, by a *rao* (Tournon & Silva, 1988).

Other *rao* are used to control human reproduction, to provoke or avoid pregnancy, *tooti rao* or *totima rao*.

Conclusions of the First Part

Two ethnobotanical systems have been brought to the fore:

1. A taxonomic system based on plants morphology.
2. A *rao* system based on plants uses and activities.

The *rao* has two modes of existence: material and spiritual.

Two categories of human agents can deal with these two modes:

The *raomis* are the herbalists, "experts" in the biological and pharmaceutical properties of plants. They collect *rao* plants, prepare products: solutions, decoctions, macerations, steam baths…

The other agents deal with the spirits of the *rao*. They are called in the SK language: *onanya* from the verb *onanti*, to know; *meraya* from the verb *merati*, to meet, to encounter. This verb is very strong since it can also be translated as "to fall in love".

Onanya and *meraya* have been labelled "shamans", the denomination of Siberian medicine men, which has been popularized by anthropologists.

These agents invoke the spirits of the *rao* and other spirits or *yoshin*, as well as those of the Incas. Invocations of these *yoshin* are supposed to be therapeutic. This is shown

in the invocations called "icaros" in the Peruvian Amazon (Illius 1987). In an icaro, the *onanya Nete Vita*, of the Caimito community of Imiria Lake, there are twenty plants invoked, either giant trees such as lupuna, catahua, ayahuma or biologically active species, the majority of which contain alkaloids (Tournon, 1988). In this icaro chant the plant species that have a strong spirit are that have power in the material world.

The presence of the two *rao* modes, material and spiritual in a *rao* substance may have a synergic effect on the therapeutic activity of the *rao*. A patient who takes a decoction of a *rao* plant will be more positively affected if he knows that the *rao* has a strong spirit, which has been invoked by the *onanya* or the *meraya*.

Second Part: Different Forests, Different Tree Resources

The Shipibo-Konibo communal lands of the Middle and Upper Ucayali include important extensions of forest. In this second part, we shall examine the tree diversities, the knowledge and the resources of SK communal forests.

To know more about the tree resources present on the communal lands of the SK: medicines and *rao*, handicrafts, house constructions, canoe and boat constructions, we did qualitative and quantitative tree inventories on plots chosen in several types of forest. These systematic inventories provide many botanical and ethnobotanical data on the relations of the SK riverine people and the vegetal world.

In the rainy season, the Ucayali waters can produce floods that can last up to six months and reach several meters. In the riverine floodable forests, the trees have to withstand immersion. They have developed biological adaptations, their rizosphera and the plantlets have adapted to it. Another adaptation is the mayor fructification at the end of the rainy season, with the dispersion of fruits and seeds by water currents. The presence of both floodable and non-floodable lands, promotes biodiversity. "Many botanical genera have distinct species in both ecosystems, this situation gives an excellent opportunity for phylogenic and biochemical studies (Goulding, 1993: 80)."

This means that inventories must take in account the existence of floodable and non-floodable ecosystems. Moreover, secondary forests are also present on communal lands, and their tree composition and resources must be studied and compared to those of the primary or almost primary forests.

Methods

The botanical and ethnobotanical inventories of the four plots were done in the framework of the RENACO Project (1991–1996) financed first by UNESCO and later by the DG 11 of the European Commission. It was done in association with the National University of Ucayali in Pucallpa.

The RENACO Project included Dr. J. Tournon, responsible for the team, and forestry technician Francisco Enocaise, who was an excellent informant on timber woods. Regarding their characteristics and uses in house and canoe construction, agronomy students of the National University of Ucayali in Pucallpa (SK or not) have done crucial work: Carlos Etene Etene, Rafael Urquia Odicio, Samuel Caúper Pinedo, Marcos Tenazoa Vela, Catalino Cumapa, José Sanchez Choy, Grober Panduro Pisco, and Pr. Rita Riva Ruiz administradora.

Four hectare forest plots were chosen on SK communal lands of the Middle and Upper Ucayali. On each plot, the RENACO team collected and numbered botanical samples of trees with trunks of more than 10 cm in diameter at breast height, and they were numbered. The samples were sent to the Department of Forest Sciences, National Agrarian University – La Molina, for identification. Most samples were identified by Doctor C. Reynel and A. Daza, at the family and genus levels and many at the species level.

Descriptions of the trees, their names, their cultural importance, uses and possible resources for communities were elicited from local informants. This information was numbered and put into three lists for each plot.

Several ethnobiologists used quantitative methods to quantify the trees and resource diversity of the Amazonian native communities (Philips, 1993, 1994, 1996).

Results

Communal forests can either be flooded or non-flooded lands, the floods can be of variable intensities and durations. Some higher and older terraces are not flooded and are acid and poor in minerals. Community forests can have different histories, they can be primary or secondary, having been logged or not.

These different factors of forest variation have determined the choice of the four hectare plots, 5, 2, 3, 7, with increasing flooding.

Plot 5

Plot 5 is on the in the communal lands of Amaquiria, Upper Ucayali, Iparia district (9° 29′ 12; 74° 7′ 30).

It was chosen on a non-floodable terrace, in a forested area labelled "bosque de altura" in local Spanish or *manán níi* in SK.

The soil is leached; it is acid, pH = 4, and deficient in exchangeable ions, since it is not flooded. It does not receive the annual alluvial silt deposited by the Ucayali subsidence.

Its structure is that of a primary forest. RENACO has counted 532 individual trees with more than 10 cm at breast height; 75 individuals have been identified at least at the level of the botanical family and genus.

Plots 2 and 3

Plots 2 and 3 are on the communal lands of Nueva Betania, Middle Ucayali (8º 23′ 32.8, 74º 18′ 28.5), on alluvial, neutral soils with pH = 6.3–6.6, rich in exchangeable ions. In general, they are flooded between January and March by 0,50–1 m of water. In 1992 and 1994, the floods were stronger, and several trees had disappeared.

Plot 2 is in the forest that Francisco Enocaise and other foresters labelled "bosque primario descremado" or "skimmed primary forest". Some seven years before the inventory, it was logged of its most valuable trees (*Cedrela* spp. and other Meliaceae). It has 532 individual trees.

The importance of the Lecythidaceae is due to the abundance of *Grias neubertii* individuals.

Plot 3 was chosen in a secondary forest a few hundred meters away from plot 2, to compare the tree species and resources between a secondary and primary forest. Plot 3 is a fifteen year old secondary forest. Before the abandonment of a "chacra" in 1980, maize, rice, manioc and bananas were cultivated there for three years.

483 individual trees were counted, and 40 species identified. As expected, it is less diverse than its neighbouring plot 2 forests.

Comparing its floral composition with that of plot 2, we note the dominance of typical fast-growing colonizing species: *Cecropia engleriana*, *C. ficifolia*, *Capirona decorticans*, *Guazuma crinita*, *G. ulmifolia*, *Solanum grandiflorum*.

We note the presence of a *Citrus* sp. which was planted before the abandonment of the plantation, and survived 13 years in the fallow.

Plot 7

Plot 7 is close to plots 2 and 3 on the communal lands of Nueva Betania.

It is one-hectare rectangle, 200 m long and 50 m wide, parallel to the shore of a community lake.

It tends to be flooded by the Ucayali's waters from November to April up to 3–5 meters, therefore much more than plots 2 and 3. This ecosystem is called locally a "tahuampa", or *níi taxbá* in SK. Plot 7 has hardly been disturbed by man.

Several authors have shown the importance of these "tahuampa" forests (Fig. 20) as fishing resources (Goulding, 1980). The Characidae fish species feed on the numerous fruits hanging or dropping from trees (Arecaceae, Fabaceae, Sapotaceae) and vines. However, few quantitative vegetation inventories of these "tahuampa" forests have been carried out.

Plot 7 has 516 individual trees distributed in 38 botanical families.

20: *Tahuampa, Grober and Francisco*

Source: Authors' Archive

Native SK Knowledge on the Tree Diversity

The Amazonian natives are said to have deep knowledge of their vegetal environment. The quantitative inventories permit us to test this statement.

Plot 5: number of unknown trees: 26 of 517
Plot 2: number of unknown trees: 2 of 532
Plot 3: number of unknown trees: 3 of 483
Plot 7: number of unknown trees: 23 of 516

The number of trees unknown by informants is very small for the four plots. The difference between the number of unknown trees on plots 5 and 7 can be caused by the difference in the informants' knowledge or by the greater biodiversity of these plots.

Botany and Ethnobotany of the Four Plots Inventoried

In general, the plant species classified in a given botanical family have many similar biological properties and, therefore, similar potential uses in common. This is why we chose the botanical family level to analyse the SK ethnobotany of these four plots and their resources.

In the case of the pharmacologically active components of the Brazilian flora, O. Gottlieb (1982) demonstrated that active compounds are present in *Magnoliiflorae* spp. This is also true in the neighbouring families of the Gentianiflorae-Lamiiflorae-Solaniflorae-Asteriflorae.

Among the SK, *rao* are found in species of the families Apocynaceae, Rubiaceae, Solanaceae. Biologically and pharmacologically active components of the Brazilian flora are also well represented in the SK *rao*. (Tournon, 2002).

Divergences between O. Gottlieb's results on Brazilian flora and results on the SK *rao* come principally from the presence of many Monocotyledonas among the *rao*: 12 Araceae, 5 Commelinaceae, 14 Cyperaceae, 5 Liliaceae and Iridaceae, 5 Zingiberaceae.

Resources other than medicinal plants are also related to several botanical families:

- edible fruits with Cecropiaceae, Fabaceae, Moraceae, Sapotaceae;
- valuable timber wood with Fabaceae, Meliaceae, Myristicaceae.

The presence or absence of a botanical family implies the presence or absence of the type of vegetal resources and uses, since plant species belonging to the same botanical family generally have common biological properties. In addition, they often have the same uses: pharmaceutical, handicraft, alimentary, valuable timber, and valuable firewood.

These correlations justify the choice of botanical families to analyse the ethnobotanical data of the four plots 5, 2, 3, 7.

The data collected by the RENACO team were first put in lists of numbered individual trees, one list for each plot. From these lists, we extracted information for each botanical family present in the four plots.

The following synthetic information is given for each of the four plots 5, 2, 3, 7 (see Tab. VI):
Number of individual trees present. It measures tree density.
Number of botanical families present. It measures tree biodiversity.
Number of species or morphospecies present. It is another measure of the tree biodiversity.

VI: *Number of individual trees, botanical families numbers, species and morphospecies numbers for the four plots: 5, 2, 3, 7*

Plots	Tree numbers	Botanical family numbers	Species and morphospecies numbers
5	517	29	120
2	532	22	75
3	483	18	40
7	516	38	155

Source: Author's Archive

Commentaries

Plots 5, 2, 7 can be considered primary forests and have comparable individual tree numbers and botanical families. Plot 3 has less individual trees and less botanical families than plot 2, which is to be expected from a fifteen year old secondary forest.

In Tab. VII, the list of 49 botanical families inventoried on the four plots is included, as well as the number of individual trees of each botanical family present in each plot. They give important data about the four plots resources.

VII: *Number of individual trees in all the botanical families present in the four plots*

Plots	5	2	3	7
Anacardiaceae	0	1	9	1
Arecaceae	0	1	0	0
Annonaceae	26	17	0	11
Apocynaceae	0	2	1	22
Araliaceae	1	0	0	0
Asteraceae	0	0	1	0
Bignoniaceae	2	0	0	0
Bombacaceae	19	104	4	17
Boraginaceae	3	0	3	0
Burseraceae	52	0	0	0
Cecropiaceae	10	6	281	4
Celestraceae	0	0	0	6
Chrysobalanaceae	1	14	0	14
Clusiaceae	6	0	0	6
Combretaceae	3	8	2	2
Elaeocarpaceae	3	0	0	8
Erythtroxylaceae	0	0	0	1
Euphorbiaceae	24	16	17	27
Fabaceae	44	47	59	92
Flacourtiaceae	9	0	0	17
Hippocrateaceae	1	0	0	1
Icacinaceae	0	0	0	2
Lauraceae	33	13	4	27
Lecythidaceae	10	186	12	5
Malpighiaceae	0	0	0	1
Marcgraviaceae	0	0	0	3
Melastomaceae	0	0	0	3
Meliaceae	32	19	0	7
Meliosmaceae	0	0	0	3
Menispermaceae	0	0	0	1
Monimiaceae	3	0	0	1
Moraceae	32	27	43	11
Myristicaceae	61	3	0	0
Myrsinaceae	0	0	0	1
Myrtaceae	6	0	0	9
Nyctaginaceae	6	6	0	10
Olacacaceae	0	5	0	5
Polygonaceae	0	10	3	38
Rosaceae	0	0	0	2

VII (continued): Number of individual trees in all the botanical families present in the four plots

Plots	5	2	3	7
Rubiaceae	4	0	14	8
Rutaceae	1	3	2	0
Sapindaceae	0	1	1	15
Sapotaceae	31	2	3	48
Simaroubaceae	3	0	0	0
Solanaceae	0	3	0	1
Sterculiaceae	16	0	13	0
Verbenaceae	1	0	0	0
Violaceae	3	0	0	1
Vochysiaceae	0	0	0	1

Source: Author's Archive

Some botanical families are well represented on the four plots; this is the case of the Bombacaceae, the Fabaceae, the Lauraceae, and the Moraceae. Other families are abundant on some plots and almost absent on other plots. For example, the Apocynaceae are important for their biological activity, and they are present on plots 3 and 7, and absent on plots 5 and 2. Polygonaceae represented by the Triplaris genus is abundant on plots 2 and 7 and absent on plot 5, as *Triplaris* spp. grows with its feet in the water. On the contrary, Burseraceae, with the genus *Protium*, is abundant on the non-floodable plot 5.

Lecythidaceae has 186 *Grias neubertii* on plot 2, Myristicaceae 61 *Iryanthera* and *Virola* spp. on plot 5. These distributions may be a sign of management by man.

Arecaceae, Rosaceae, Simaroubaceae, Solanaceae, Verbenaceae, Violaceae, Vochysiaceae have few individual trees.

These differences have consequences for the resources available to SK communities. It shows the importance for a community of having several types of forest on their lands.

Resources and Uses of the Different Botanical Families

In what follows, we present the ethnobotanical information gathered for the botanical families of Tab. VII, in alphabetical order, omitting only the families that have very few representatives: the Arecaceae, Rosaceae, Simaroubaceae, Solanaceae, Verbenaceae, Violaceae, and Vochysiaceae. For a given family, the results differ among plots 5, 2, 3, and 7.

Anacardiaceae

The family Anacardiaceae is present on the plots with two species: *Spondias mombin* and *S. taperiba*.

Spondias mombin, "ubos" in local Spanish, *xexon* in SK, is present on P2, P3, and P7. It is a spontaneous and important native fruit tree; its fruit juice is excellent. It is an important food resource for the native fauna, in particular for the tortoise "motelo" (*Geochelone denticulate*, Testudinidae). It is also a *rao*: "The bark decoction is ingested to treat internal infections, in particular those of the feminine sexual organs. It is also a *totima rao* or anticonceptive plant; a spoonful is ingested every morning during the month, followed by food diet and sexual abstinence; also a *kinanti rao* or emetic and a *chixó rao* or anti-diarrheal, it is ingested and after five minutes warm water is drunk to fill the stomach." The informant gives other details on the dosis for children and adults, showing the precision of the *raomis* recipes.

One specimen of *Spondias taperiba* was seen in the plot 3. This species was introduced from Asia to South America where it is cultivated for its fruit. The individual must be a surviving tree from past cultivation.

Other use: wood is used for laminates. We hope that these precious trees do not all end up as plywood.

Apocynaceae

This is a pharmacology important family with active alkaloids.

The family is absent of plot 5.

Plot 2 has two individuals: *Peschiera van heurckii* Allorge is a shrub or small tree named, "sacha sanango", "huayra sanango" in local Spanish, *wano xaka* or *niwe sanango* (viento/sanango) in SK.

The *raomis* make a solution of its bark for body strengthening; it is a *koshi rao*. It is drunk four or five times and should be followed by a one month diet: no fats or sweets, and sexual abstinence. It is also an *ochiti mechati rao*. Its latex with water is given to the dog once so that it will be a good hunter.

The second Apocynaceae present on plot 2 is an *Aspidosperma* sp. It is a *jonon rao* (collared pecarry/*rao*). Its bark is rasped, mixed with fish mazamorra[16] and given to eat to the hunting dog, which is afterwards thrown into water, three times, so that its body is cleaned and the dog becomes a super peccary hunter.

Plot 3 has an Apocynaceae named *awa jonra* (tapir semen), that could be a Lacmellea. Its latex is cooked and a plastic mass is obtained that is used to mend holes in canoes and boats.

On the plot 7 there are several *Himatanthus tarapotensis*, "bellaco caspi" in local Spanish, *sokoba* in SK (Fig. 21). It is a *rao*. Its bark is scraped and diluted with water, a half glass is drunk to treat "el mal de gente" or "shitana". Bark and leaves are also used in steam baths.

Lacmellea floribunda has edible sweet fruits named *keo* in SK.

Bombacaceae

The Bombacaceae trees are very spectacular. Several are giants that dominate the forests. Seven species were found on all four plots, and are economically important for the communities.

The balsa tree, *Ochroma pyramidale* of Amazonian origin, is internationally-known. It is named "topa" in local Spanish, *moxó* in SK. Aside from its use to make dolls and other handicraft objects, it is used to make rafts, and house staircases. It is a *rao*: its charcoal is put on deep cuts and wounds.

There are three *Quararibea* sp., "zapotillo", *níii ison xoma* or "seno de mono", two on plot 5 and one on plot 2. It is a tree with many uses:

1. Its fruit is edible for man, primates, deer, peccaries, tapirs, motelo tortoises and parrots;
2. Its wood is heavy; it is commercialized and also used to make beams for rural houses ("vigas, soleras, caibros, culatas").

On plot 2 *Quararibea asterolepis* has been identified. It is a *rao*. "Its rasped bark is put in aguardiente. The maceration fortifies the body and increases sexual power. The preparation is left buried fifteen days near where people walk, thus it takes their energy. Afterward, it is drunk every morning during a week. It is accompanied by a bath in a river or a lake, when the river grows, allowing one to take the strength of the guayaba branches and trunks. Fifteen days of diet and sexual abstinence must be respected."

Two Pseudobombax are present, one on plot 5 and another on plot 7.

They are called "punga, punga de altura" in local Spanish, *ponka* in SK, on plot 5. "Punga de bajeal" or "punga blanca" or *joxo ponka* on plot 7.

16 Mazamorra (from Spanish, Moors' dough) is a traditional maize-based Latin American food (Ed.).

21: *Apocynaceae, Himatanthus tarapotensis; sokoba, socoba*

Source: Authors' Archive

Two Pseudobombax are present, one on plot 5 and another on plot 7.

They are called "punga, punga de altura" in local Spanish, *ponka* in SK, on plot 5. "Punga de bajeal" or "punga blanca" or *joxo ponka* on plot 7.

On plot 5, its fruit is said to be eaten by man and mammals such as paca, agouti, tapir, deer and peccary. Its timber wood is light; it floats, and so is used to make canoes and paddles.

The Pseudobombax present on plot 7 is an interesting *rao*: "La flema del fruto se toma con tabaco; es una planta maestra, *ibo rao*, se dieta 2 años, luego se puede curar enfermedades psíquicas, virotes, dolencias del cuerpo," which can be translated to mean "its mucus is ingested with tobacco; it is a master plant or *ibo rao*, which needs a two-year diet but then gives the power to treat psychological disorders, pains and other health problems attributed to wichtcraft darts."[17]

In "Illustrated guide to the trees of Peru", one can read on page 496: "3 species recorded in Peru: 1) *P. marginatum*… in lowland nonflooded forests below 500 m alt. 2) *P. munguba*… on periodically flooded sites below 500 alt. 3) *P. septenatum*… in periodically flooded forest below 500 m alt. So that it can be inferred that the "punga de altura" is *P. marginatum*, the "punga de bajial" would be *P. munguba* or *P. septenatum*.

Ceiba pentandra, the famous "lupuna", *xóno* in SK, is present on plots 2, 3 and 7. Its giant trunk is commercialized by the plywood industry. Its spirit or *ibo* has much power, and rituals should be respected to avoid its malevolent effects:

No pregnant woman must approach the lupuna, its "mal aire la puede cutipar con diarrhea y vomito blanco." The translation of this phrase is difficult because it includes the two SK concepts, which are general to the Peruvian Amazon: "el mal aire", literally bad air, *niwe* in SK and "cutipar" or copy, which are etiological factors (Tournon, 2002). "Bad air produces diarrhea and white vomiting."

The *xóno ibo* can "cutipar", i.e. knock down a pregnant or nursing woman who approaches a lupuna, or a baby brought by his father near a lupuna, and they must be cured by an *onanya* or a *meraya* with ayahuasca.

Septotheca tessmannii Ulbr., "utucuru" or *otocoro* in SK, is abundant on plot 2. Its bark is dried for two weeks and the resulting powder is mixed with the clay for ceramics, to prevent breakage in the fire. Its wood is used in the construction of houses.

Burseraceae

All Burseraceae collected belong to the genus *Protium*: "38 species in Peru, nearly all restricted to lowland rain forest…; *Protium opacum* in non-flooded rainforest up to 1000 m altitude." (Pennington *et al.* 2004: 402) All twenty-one Protium trees were ionn plot 5, the only non-flooded plot.

Two species present on plot 5 were identified: *Protium puncticulatum*, *Protium neglectum*.

The species are rich in oleoresins; they are named "copalillo" or "little copal" and have properties close to those of the copal. Copal has been used by many American native groups for illumination before the diffusion of electricity and is still used in healing and religious ceremonies.

SK craftwomen use *Protium oleoresin* to varnish ceramics;

1. *Sempa* is used to create a waterproof coating on the inside of the ceramics;
2. *Yomoxó* is used to waterproof the outside and make it shiny.

Two copalillo native categories were found:

Yomoxó or *kikinma yomoxó*, literally *yomoxó* of no superior quality, or "copalillo" in regional Spanish. "It is not the real copal, its resin is not abundant and is powdery."

1. It is used to varnish and paint ceramics and wooden objects. Ceramics are not heated much, so that when pieces of copal are introduced, they do not set on fire; then with a spatula and a rag, the interior is impermeabilized. To paint an object, the copalillo resin is fired, and its vapor is directed and concentrated on the piece of wood to protect it against the "alquitrán": canoe, paddle, part of the house, and a piece of fabric;

17 "Virote" or "tsentsak" are invisible pathogenic projectiles or magical darts utilized in indigenous and mestizo shamanic practices for the purposes of sorcery and healing throughout much the Amazon Basin. For further information see Beyer (2009) (Ed.).

2. The resin is set on fire to give light;
3. The smoke of copal is considered a *rao* to treat nauseas, the patient sits down for one hour in a closed space; the copal is set on fire and the patient inhales the smoke;
4. Protium has a fruit with a fleshy taste, it is the favorite food of the nocturnal (*Aotus* spp.) and diurnal monkeys (*Ateles paniscus*, *Lagothrix lagothricha*, *Cebus* spp., *Alouatta belzebul*), of parrots, aras, peccaries, and tapirs;
5. Its wooden beams (soletas, caibros, vigas, travesanias), last for 5 years, made into canoes, it floats and lasts two years; it is also commercialized in the plywood industry; and it makes good firewood, and good coal.

Another species, *Protium puncticulatum*, is also a *koshi rao*. The word *koshi* means strong. Thanks to its "muscular roots" it fortifies the body and increases sexual power. The preparation is left buried for fifteen days "near where people walk", and in this way it takes their energy. After it is drunk every morning during the week, it is accompanied by a bath in a river or lake, and when the river grows, one can acquire the strength of the guayaba branches and trunks. It is followed by fifteen days of diet and sexual abstinence.

Cecropiaceae

The *Cecropia* spp. are the first trees to colonize river banks, their large leaves can be seen by the travelers along the Ucayali. So that it is not surprising to see so many of them on plot 3, which is in a riverine secondary forest, with 181 individuals of the *Cecropia* genus. The neighbouring plot 2, which is in the primary forest, has no more than six Cecropia trees; they do not stand in the shade of the successional trees. The trunk shelters symbiotic ants.

Two species, *Cecropia engleriana* and *Cecropia ficifolia* are present on plots 2 and 3. Both are named "cetico" in local Spanish, *bokon* in SK.

Cecropia engleriana Snethlage, *bokon* or *taxbá bokon* (bajeal/cetico), is used as *matsi jikia rao*, where *matsi jikia,* literally the "cold enters", designates several forms of rheumatism: the bark is cooked and the whole body is washed with the cold decoction; this is followed by a week diet avoiding salt, fat, chili (ají, *Capsicum* sp.), and sexual abstinence must be respected.

Its fruits are eaten by humans and bats, and are used by children as baits for bagres (*Pimelodus* sp.).

Its gelatinous trunks and branches are used to move and roll trunks.

Cecropia ficifolia Snethlage, *shiari* in SK. An informant explained how it is used to make ropes: "Its outer bark is scraped with a machete, its inner bark is taken out and put in sheets that are struck and whitened in water, and they are twisted to make straps for harpoons and bows."

Plot 7 has a *Cecropia membranacea* Trecul, "cetico colorado" or *báwa tae* (parrot/foot). Its fruits are eaten by different categories of fish: cahuara (*Oxydoras* sp., Doradidae, Siluriforme), bagre (*Pimelodus* sp., Pimelodidae, Siluriforme), sardinas (*Triportheus* sp., Characidae, Characiformes), lisas (*Hoplias* sp., Erythrinidae, Characiforme), but not the boqui chico (*Prochilodus* spp., Prochilodontidae, Characiforme).

These details show demonstrate the impressive knowledge of SK informants regarding their ecology.

Pourouma cecropiaefolia Mart., "sacha uvilla" or *níi xankon* grows on plots 5 and 7. Its fruit is sweet and is very appreciated the SK communities and in Pucallpa. In the woods, it is eaten by monkeys, agoutis, pacas, deer, tapirs, and parrots. Ropes are made of the bark fibers; they are used for bow strings to shoot arrows at the water turtle "taricaya" (*Podocnemis* sp., Pelomedusidae).

Chrysobalanaceae

Chrysobalanaceae with *Licania arborea*, *L. blackii*, *L.brittenia*, *Hirtella triandra*, *Coupea* sp. are present on plot 5. In local Spanish, these species are called "apacharama", and in SK *mei*, which can be translated as "mixed because they are mixed with clay to make the ceramic mass: The bark is burnt, ground to powder with a stone and mixed with clay to form a half humid mass, so that the ceramic will resist being heated." The explanation is that their bark is rich in silica powder, which avoids the shrinking and breaking of ceramics.

On plot 7 we found a *Licania* sp., *wanin kaya rao* (pijuayo/alma/rao). This *rao* has two applications:

1. To treat tumours, a resin is applied with tobacco;
2. *Onanya rao* or "plant to know", its resin is smoked with tobacco and absorbed with saliva, one has to follow a diet for six months in the woods. This interesting information points to an as yet unreported hallucinogen.

Combretaceae

The genus *Terminalia* is found on the plots 2, 3 and 7.

On plot 3, *Terminalia oblonga* was identified; in the Peruvian Amazon, it is named "yacu shapana", the Quechua name formed by yacu: water, and shapana: moving, it moves in the water, in SK it is *yonshin* or *awa pishi* (tapir/ribs). Uses:

1. Its decoction is used to dye textiles, women's *chitonti* are dyed in brown-black;
2. Its wood is valued and used to make canoes, boats, and rafts.

Terminalia oblonga R. et Steudel was seen on plot 7, where it was called "palo rosa de bajeal" (Palo rosa: *Aniba rosaedora*), *taxbá kinxon* in SK. Its wood is aromatic.

Euphorbiaseae

One *Shiringa* sp. tree was founded on plot 5, *shirinka* in SK, according to SK comuneros[18], it has several uses:

1. Its latex is industrialized;
2. Its nut is eaten by agouti (añuje), paca (majás), parrots, and tucan;
3. Handicraft, necklaces are made with its seeds;
4. Its wood floats, but has no commercial value;
5. Good as firewood, average as coal.

On plots 5 and 7 we found *Croton matourensis* Aubl. named *báwan chitari* (parot/cinnamon), with aromatic wood. It is economically important, as its timber is hard and resistant, and it is a fast growing tree. This species is dominant on a plot on the campus of the National University of Ucayali (Sanchez & Tournon, 2000).

Several trees identified as Euphorbiaceae by the RENACO team and the botanists of the National Agrarian University – La Molina were recognized and named, but not given uses by SK informants:

Hieronyma alchornoides M.Arg., "itahuba", *xawan pechi* (tipo de guacamayo/ala) in SK.
Sapium sp., named "caucho masha", "shiringa rana" are present on plot 5.
Other Euphorbiaceae trees were not recognized by informants:
Aparisthium cordatum, "zancudo caspi".
Hieronyma alchornoides M.Arg., "itahuba" in local Spanish.
More Euphorbiaceae are present on plot 7, but no uses were recognized:
Hieronyma alchornoides M.Arg., "itahuba" in local Spanish.

18 In this context, "comunero" is a Spanish term which means "member of a community" (Ed.).

Mabea maynensis M.Arg.; in SK: *joxo wanin kaya rao* (white/Pijuayo/spirit/*rao*).

Sapium sp.; "caucho masha", *xóko in SK* , its white latex is oxidized in contact with air and becomes yellow with a pungent smell.

Drypetes amazonicus Sleumer, *janín bexpe* in SK or "eyes deep in their sockets".

The Euphorbiaceae family has many individual trees and species on the four plots, but appears they are little known and used in the communities.

Fabaceae

Fabaceae are well represented on the four plots, which demonstrates the adaptive potential of this family. Many Fabaceae genus and species are important in the human ecology of the SK and in their daily life.

The Inga genus is very diversified; 50 species have been reported in Peru (Reynel & Pennington, 1997). It is present on the four plots. The fruits of several species are eaten by humans, those of all species by primates (monkeys and tamarins) and birds.

Here, we consider the *Inga* spp. found on the four plots:

Plot 5

Inga marginata Willd (*I. semialata*), "shimbillo", *shipin xenán, moka xenán* in SK. Use: the fruits are eaten by man and the Callitrichidae monkeys. Informants call both genus *Callitrix* and *Saguinus* "shipi" or "pichico" in local Spanish.

Inga cf. *marginata*, is called shimbillo de altura and *manán xenán* in SK. It is multi-use:

1. *Rao*: its resin is a cicatrizing agent, after cutting the bark one waits for the exudation of its resin, which is then put on a piece of cotton and applied to the wound;
2. Its fruit, pítima, is not edible by man;
3. As with all Inga species, its firewood is good and yields good charcoal.

Plot 2

Inga thibaudiana DC., "shimbillo", *xopon xenán* (lana/shimbillo) in SK, has fruits that are eaten by man, monkeys Cebidae, Callitrichidae, parrots; it makes good firewood.

Inga cayennensis, fruits eaten by monkeys Cebidae, Callitrichidae and birds.

Inga alba, its fruits are said to be eaten by monkeys and birds.

Plot 3

Six *Inga edulis* Mart. were found on plot 3. We can suppose that they come from domesticated ones, cultivated before the fallow. They are named "guabas" in local Spanish; *bana xenán* (cultivated/ Inga) or *wishkonti xenán* in SK.

Other Inga species were found on plot 3 and classified by D. C. Reynel:

Inga cf. *leiocalycina*, also named "shimbillo" in Spanish, and is called *marin xenán* or "shimbillo de agouti" (*Dasyprocta* sp.) in SK.

Inga lopadadenia, "shimbillo" in Spanish is named *poapoari xenán* in SK.

Four *Inga ruiziana* G. Don, "shimbillo" in Spanish, two of them were named *poapoari xenán* and two *moka xenán* or "hot, pungent shimbillo".

Inga semialata, "shimbillo" and *shipin xenán or tamarin shimbillo*, which is said to be edible by man and by tamarins or *shipi* (Callitrichidae).

Plot 7

Plot 7 is in a "tahuampa" forest, where other Inga species are present:

Inga nobilis Willd., is called: *koman xenán* or "shihuahuaco" Inga, where shihuahuaco is *Dipteryx micrantha*.

Inga cf. *brachyrhachis* Harms, is called also: *koman xenán*. Its fruits are eaten by the primates Cebidae and Callitrichidae.

Two more *Inga* sp. have not been identified. They are called *jenen xenán* or "yacu shimbillo" (water shimbillo), they are eaten by parrots and the squirrel monkey *Saimiri sciureus*, frailecillo, *wasa* in SK. Another one is named *kapabo xenán* or "squirrel shimbillo" and *ochitinin mechati rao* or "good hunting dog *rao*".

"The bark juice is added to mazamorra, then the dog should be put to bathe in the river. This Inga fruit is said not to be edible."

This long review shows the great botanical diversity of the *Inga* genus. A total of five different *Inga* spp. Were found on the four plots.

In local Spanish *Inga edulis* is named "guaba", the other Inga are all named "shimbillo", only two names compared to the 9 names found in SK. In B. Berlin's ethnobiological classification system (1992), *xenán* is the generic or folk generic taxa. *Bana xenán, kapabo xenán, moka xenán, shipin xenán, wishkonti xenán, xopon xenán, koman xenán, jenen xenán* are the folk specific taxa. However, as seen in Tab. VIII, the correspondence is not always perfect between the SK specific taxa and the Linnean botanical species.

VIII: *Inga species present in the different plots*

Plots	Inga spp.	Spanish names	Shipibo-Konibo names
5	I. marginata, I. semialata	shimbillo	*shipin xenán, moka xenán*
2	I. thibaudiana, I. alba	shimbillo	*xopon xenán*
3	I. edulis	guaba	*bana xenán, wishkonti xenán*
7	I. brachyrhachis	shimbillo	*kapabo xenán*

Source: Authors' Archive

More Fabaceae genus and species are culturally and practically important.

Copaifera reticulata: "a unique species recorded from Peru; the notable character of this genus is the trunk containing liquid oleoresin… it provides good timber for construction and furniture and the liquid oleoresins are used for varnish and in medicine." (Pennington *et al.*, 2004: 273–274)

"Copaiba", in local Spanish, is an important medicine among the Spanish speaking "mestizos" and the Shipibo-Konibo. In SK it is named *piní rao* (tiredness/*rao*) or *ochitinin piní rao* (dog/tiredness/medicine).

We found one *Copaifera reticulata* on plot 5 and three on plot 7. Called "copaiba" or "copaiba masha", *kopaiba jiwi, bonshish* in the Middle Ucayali, *matis siwati* in the upper Ucayali, it is a valuable and multiusage species.

On plot 5 its resin is used to disinfect and cicatrize superficial wounds. On plot 7 it is said to be a *piní rao* (tiredness *rao*) active on convulsive cough and bronquitis and alleviates fatigue. Its bark is scraped and the juice is taken, but not the inner bark's yellow sap. Another recipe is to cook the bark with tobacco leaves, a glass of this decoction is drunk three times a week, following a diet: "no sex, no sugar, no fat". The precision of the recipe must be respected.

It is also used as an *oko rao* to treat convulsive cough. It is an expectorant that cleans the lungs. Also the bark is cooked with five tobacco leaves and ingested; a quarter of this decoction can be drunk three times a day, followed by five days of diet (sex, sugar, fat).

Its timber has commercial value.

Other species of this large family were found:

On plot 5: *Ormosia* sp., "chontaquiro de bajeal, chonta caspi", *wanin jiwi* in SK. Its hard wood is used to make the structural beams of houses.

On plot 7: *Piptadenia* sp., "pashaco", *síki* in SK. Its light wood is used for house construction and to make furniture, and canoes.

Fabaceae, *Swartzia myrtifolia* J.E. Smith, is an *ochitinin piní rao* and used like *Copaifera reticulate*.

Pterocarpus is an important Fabaceae genus for the local people. It is a master plant, *ibo rao*, *onanya* and *meraya* learn from it.

Pterocarpus spp. are present on plot 2, named in local Spanish "palo plata" for the shape of its fruit, "cuclliqui caspi", "uchupa caspi" in quechua and *ko'xon tama, onban, awa pishi* in SK. Their red resins are a known medicine or *rao*: an intense red aqueous solution of its bark is prepared, it is used for the "patco", mouth infection of the infant, it is also antitussive and ingested every morning, twice a week, with much water, without salt. Several *Pterocarpus* spp. have anti-inflammatory properties.

On plot 7 a *Pterocarpus* sp. is also present; two additional medical uses are given: the sieved fresh bark and the red resin are used against "cólera"[19] and for vaginal ailments.

Myroxylon balsamum (L) Harms, the Peruvian balsam is a famous product. Its gum was and is still a popular home remedy to alleviate a cold. Its essential oil is used in perfumes and cosmetics; it contains vanillin, coumarin, cinnamic and benzoic acids.

It is present on plot 2, called "sajino caspi" in local Spanish and *jonon rao* in SK, which means peccary medicine. Its bark is scraped, mixed with "mazamorra de pescado" and given to the hunting dog, which is then thrown into the water, so that it eliminates what is bad in its body and becomes an excellent peccary hunter.

Flacourtiaceae

There is a *Laetia* sp. on plot 5 that was unknown to the informants.

All other Flacourtiaceae are on plot 7.

Two *Casearia aculeata* Jacquin are present, "timareo" in local Spanish or *bawá bero* (parrot/eye). Its fruits are eaten by birds and fish: "sardinas" (*Triportheus species*), "palometas" (*Mylossoma* spp., Characidae), "lisas" (Anostomidae, Characiforme). It is appreciated for its slender and straight trunks of the trees, and makes planks that can last long years.

Another tree is named *washmeman ewa* (algodón/tremendo) for the same species.

The species *Prockia crucis* L. was identified. The thorns of its trunk can provoke foot infections if you step on them, as does the bagre flipper. Leaves and bark of this same tree are put on the infection, which subsides immediately, hence it is called *tonónman rao* (bagre/medicina); it also cures other infections, as well as swellings of the stomach and kidneys.

Here we have an example of the "signature theory": the thorns of this plant can produce an infection that can be cured by the leaves and the bark of the same plant.

Another Flacourtiaceae is the species *Banara guianensis* Aubl., in SK: *takon chimapo* (unchala, orn./ceniza). This *rao* cures children fevers, its "macollo" or fresh leaves are put in water, the liquid is taken 3 times a day; the mucilage of the inner bark is applied on the eyes to treat "eye film", an eye syndrome. One has to avoid exposure to direct sunlight and not be exposed to smoke from burning wood during the treatment.

Lauraceae

This is a very seductive botanical family, all of its species have rich aromas, and some of their essential oils are used in medicines and are *rao*. These species give valuable commercial and aromatic wood, very appreciated for furniture making.

In local Spanish the Lauraceae is named "moena", *yonó* in SK.

The rose wood, "palo de rosa", Aniba rosaedora had been over-exploited during the 1950s and 1960s for its high-valued essential oil. It has become very rare in the Peruvian Amazon in recent times. It has disappeared from the Ucayali Valley, but it is said that a new generation has grown in distant tributaries.

19 For culture-bound syndromes see chapter 4.1.5 (Ed.).

Plot 5

Ocotea sp., "moena de altura", *manán yonó* in SK.

Several uses have been identified:

1. Monkeys and birds eat its fruit, and once they have fallen off the trees, it is eaten by pacas, agoutis, and deer;
2. Its timber wood is of first quality: It is used for construction and for making canoes, which may last 8–10 years.

Nectandra sp., moena, moena amarilla (yellow laurel), in SK *panshin manán yonó* has the same uses as the former *Ocotea* sp.

Plot 2

Ocotea sp., "moena de bajeal", *taxbá yonó* in SK. Uses: timber wood for house building, beams and planks. *Rao*: its resin is mixed with fish "mazamorra" (boiled maize) and given to dogs so to make them good peccary hunters.

Nectandra longifolia is another "moena de bajeal": *taxbá yonó* in SK.

Plot 3

Ocotea sp., "moena de altura", *manán yonó* in SK.

Uses:

1. Fruit eaten by monkeys, pacas, agouti, deer, and birds such as parrots and tucan;
2. White timber wood excellent for construction and building canoes that float and can last 8–10 years. It is also sawed and commercialized.

This moena, a "moena amarilla", *panshin manán yonó*, looks the same as the plot 5 Nectandra and has the same uses:

1. Its fruit is eaten by monkeys and birds, such as parrots and tucan, and once it has fallen off the trees by pacas, agoutis, and deer;
2. Timber wood of first quality, which floats, can be used for house beams, and for canoes that last 8–10 years.

Plot 7

Plot 7 in a flooded forest o "tahuampa" has several Lauraceae, some of the genus and species present are different from those of plots 5, 2 and 3.

Nectandra longifolia and *Licaria* cf. *triandra* are called "cunchi moena", *cunchi* or *bagre* is the fish *Pimelodus blochii* (Pimelodidae, Siluriforme), and *tonón yonó* where *tonón* designates the same fish in SK. It is a *ronon rao* (snake/medicine) used to treat snakebites, "without pain or infection"; the bark is scraped, and the juice is mixed with mud and applied onto the bite. Its fruits are eaten by small birds and fish, fishing is good under this tree and the fish pick up its perfumed taste. The wood is commercialized.

An *Ocotea* sp., "moena de bajeal", *taxbá yonó in SK*, is another *ronon rao* (snake/medicine): leaves and bark are crushed in a recipient; twenty glasses of water are added, then it is sieved, a half glass is drunk until the pain disappears, and the bite is healed.

A diet must be followed: no fat, chili, nothing acid, and sexual abstinence during one week.

Its wood is used to make canoes.

Nectandra cf. *pulverulenta* is another "moena de bajeal", *taxbá yonó* in SK.

Uses: good timber for building and planks.

Two *Endlicheria* spp.: *Endlicheria krukovii* (Sw.) Kostern, named *ochitinin piní rao*, and *Endlicheria dysodantha* (R.etP.) Mez., named *manxaman kawati* were identified.

Lauraceae, ver *Aniba puchury-minor*; its name in SK is *manxaman kawati* (garza/puente, asiento). It is a *mechati rao* used to become a good fisherman and hunter. Daniel Maynas

narrates how his father-in-law gave him this *mechati rao*, so that he could feed plenty of fish to his family (Tournon 2013). Thanks to its essential oils, it is a good fire-lighter.

Ocotea cymbarum, was identified, but it was unknown to informants.

Lecythidaceae

This is a family of giant and impressing trees. One is the *Bertholletia excels*, which yields the Brazil nuts. It does not grow near the river Ucayali but can be found in the Purus district of the Department of Ucayali.

Several individual trees of the genus *Eschweilera* were found on plots 5 and 7.

Plot 5: *Eschweilera coriacea* (A.P.DC.) Morii is named "machimango" in local Spanish, *ison chomo* (monkey/Calabaza), *joxo ison chomo* (monkey/calabaza blanca) and *shinon rao* (monkey/*rao*) in SK.

The following uses were identified:

1. Long fibers are taken off its bark and used to tie up and carry loads;
2. Its timber wood is commercial and enter the lumber industry, it is used for inner house planking, and ceiling construction;
3. Its fruit, a globular pyxidium, is eaten by the tapir.

"17 species (of *Eschweilera*) recorded from Peru… *Eschweilera coriacea* grows in lowland rain forest on both periodically flooded and not flooded land below 500 m alt.; the wood of several species is used for heavy construction (Pennington *et al.*, 2004: 572)."

Another Lecythidaceae, probably another *Eschweilera* sp. with an elongated pyxidium, is named "machimango colorado" in local Spanish and *ison chomo* or *joshin ison chomo* (monkey pitcher, red monkey pitcher) in SK. Its uses are the same as those of *Eschweilera coriacea*.

Plot 7 has another *Eschweilera* sp., named also "machimango blanco" or *ison chomo* in SK.

Meliaceae

Among the most precious woods of the Amazon are those of the family Meliaceae:

Mahogany (*Swietenia macrophylla* G. King) is one of the highest priced red woods found on the international market. It was once common in the Peruvian Amazon, but has been overexploited. Nowadays, it has become very rare near rivers and roads, and new earth roads are opened every year to reach new mahogany patches.

The *Cedrela* spp., "cedro tropical" or *konxan* in SK, have a rose-colored wood that looks more attractive to some than the intense red-colored mahogany. Unfortunately, they are following the same fate as the Swietenia. Agroforestry and cultivation are possible solutions.

Several other *Meliaceae* species are very valued, but they do not grow in patches as mahogany and "cedro" do: they were still present on the plots in 1993–1996.

Plot 5

Several *Guarea kunthiana* A. Juss. trees were found, with aromatic bark (*inin shaman*). Named "requia" or "requia de altura de hojas grandes" in local Spanish and *xóro, manán xóro* (altura/requia), *pei bexe xóro* (hojas/chicas/requia) in SK.

Its wood is used for construction and has a high commercial value.

Two *Trichilia* species were found.

Trichilia maynasiana (DC) Pennington; *inintani* or "with a light aroma". It is named uchu "mullaca" in Quechua Spanish; in SK it is *pokoti, yapá pokoti*, where *yapá* is a tree name and *pokoti* means coloring dye.

Plot 2

Trichilia poeppigii, "remo caspi blanco" in local Spanish, *joxo yapá, taxbá pacho, taxbá yonó, joxo yapá* in SK. It is multi-use:

1. Bands are made with its scraped bark that is applied on inner or outer pain, for five nights, with the appropriate diet and sexual abstinence;
2. Its bark is cooked with "tinte caspi" and "goyava", the solution to dye material dark brown, *kampan pokoti*;
3. As timber wood for construction;
4. Its trunk buttresses are used to make paddles, which are light and resistant.

Plot 7

Several *Trichilia* spp. were identified on the "tahuampa" plot 7.

Trichilia maynasiana C. DC., already seen on plot 5, named remo caspi, in SK *yapá*.

A species not found on plot 5: *Trichilia pleana* (Jussieu) C.DC.; named "remo caspi negro" in local Spanish, in SK *wiso yapá* (black/yapá).

Uses:

1. The bark decoction is used to dye materials;
2. As timber for construction.

According to Brent Berlin's folk classification system, it is possible to distinguish a folk generic name: *yapá* and two folk specifics, *josho yapá* and *wiso yapá*.

Several *Guarea kunthiana* A. Juss. are used as "para para", *winin rao* (erección/*rao*) in SK for erection. Its maceration in alcohol is taken twice a day, followed by a week diet without salt, sugar, or fat.

Moraceae

The Moraceae family is very important for the human ecology of the Ucayali providing many vegetal resources to man and to the fauna of the Amazon.

Let us consider first the genus *Ficus*, in the rainy season, Ficus fruits are an abundant food resource for the fish that enter the "tahumpas" or flooded forests.

Several *Ficus* species are present on the plots 5, 2, 3, 7.

Ficus insipida or *Ficus maxima* found on plots 5 and 2. These giant trees with their glittering silvery leaves always impress the river traveller. They are locally called "ojé", *xomí* in SK. Both have medicinal latex (Fig. 22).

Both have latex used as medicine. The anti-parasitary or anti-helmintic activity of its abundant latex was well documented. Its latex, *bepon* in SK, is gathered in a recipient, sugar and alcohol are added. After two days the solution can be used: one takes a spoonful every morning during a week, dieting fat, chili, fermented manioc masato (Hansson *et al*., 2005).

On plot 2, *Ficus maxima*, Miller was identified. It is called: "ojé de bajíal", *taxbá xomí* (bajeal/ojé) or *oi xomí* (lluvia/ojé) in SK.

It is a poly-use *rao*:

1. *Matsi jikia rao* and *yoran chexai rao* are used to treat body pains and rheumatic symptoms;
2. *Kinanti rao* or antivomiting medicine;
3. *Mechati rao*, to be a good hunter or fisherman;
4. *Rayati rao* to be hard working.

On plot 3, a *Ficus americana* Aubl. was identified, named "renaquilla" in local Spanish, *xoná* in SK.

This *rao* is used to cure injuries, hernias and colds; its bark is rasped, boiled water is added to dissolve the dye. It is taken three times a day before meals, until full recovery. The diet should be followed: no pork fat, no chili, nothing acid or sweet, and sexual abstinence during one month.

22: *Moraceae, Ficus sp., Yarinacocha in February*
Source: Authors' Archive

On plot 7, a *Ficus trigona* L.f. was identified, named "renaco, yacu renaco" in local Spanish and *xoná* in SK. It is a master plant, an *onanyati rao*. With the power of this *rao*, the *onanya* or medicine man sings "huarmi ikara" or "icara de mujer" and invokes the master spirit, *ibo*, of the *xoná*, Ficus, which makes its house in the *Ficus trigona* giant roots.

On plot 5, a *Brosimum guianensis* was identified; "cumaceba masha", *koman tsewe* (panguana/cortado) or *kikinma koman tsewe* in SK.

It is a tall multi-use tree:

1. As *rao*, it treats the symptom "frío" or cold, its bark is macerated in a bottle with alcohol that is buried eight days, a glass is drunk every day in the morning before bathing;
2. Its hard and tough wood is used to make spears to fish big animals such as paiches (*Arapaima gigas*), and súngaros (Pimelodidae, Siluriforme);
3. Heavy and durable, it is used to make beams that can last twenty years, to make "bateas" where manioc is crushed, and it is also commercialized in the parquet industry;
4. Its fruit, called *páma*, looks like a red cherry, and is sweet.

On plot 2, *Clarisia biflora* R. & P. was identified, its trunk has horizontal rings; it has white latex and red roots. It is named "mashonaste", "caucho masha", *awa jonra* (tapir/sperm) in SK. Its latex is used to caulk canoes. As *niwe rao*, its latex is said to treat male sexual dysfunction, one spoonful a day.

Its wood is commercialized in the community.

On plot 7, *Clarisia* sp. is present, "mashonaste de bajeal" or *awan jonra* (tapir/sperm) in SK, with abundant white latex and red root. It is said to increase a man's fertility: its latex is warmed and drunk with a one week diet. It has edible fruits too.

Plot 3 is invaded by *Artocarpus altilis*, a native of Polynesia. Its chestnuts are a precious alimentary resource for humans in times of food scarcity, when banana plantations are flooded (Tournon, 2002).

On plot 3, we found a *Batocarpus orinocoencis* Karsten, which is a tall tree that can reach 35 meters, called "mashonaste del bajeal" and in SK *bepon jiwi* (latex/tree), *awa jonra* (tapir/semen); its latex is cooked into a black paste, which is used to caulk boats and canoes.

A number of other Moraceae tree species called "chimicua" in local Spanish, *páma* or *ino meken páma* (jaguar/hand/páma) in SK, produce tasty cherry like fruits for humans, mammals and birds: *Perebea mollis* on plot 2, *Dorstenia* sp., *Perebea mollis*, *Perebea guianensis* and *Sorocea* sp. on plot 3, *Naucleopsis glabra*, *Pseudomeldia laevigata*, *Sorocea* sp. on plot 5.

Moraceae is a family tree that gives many resources to Ucayali communities, and it is well-represented on the four plots 5, 2, 3, 7.

Myristicaceae

The two genera *Virola* and *Iryanthera* are abundant on plot 5. Their red wood is highly valued in Lima, where it is sold as mahogany, but less so in Pucallpa, where it is attacked by "polilla", a small Lepidoptero, which lays its grubs in the wood.

Two types of cumala are present: red cumala or cumala aguanillo (aguano is a name for mahogany), and white cumala. They are both *Virola* spp.

Virola calophylla, "cumala aguanillo" in local Spanish or *joshin tawa* in SK, is a *xaté rao*: its red sap is repeatetly applied with cotton on wounds to cicatrize them.

The white cumala, *joxo tawa*, is used the same way.

There have been reports that Peruvian native groups north of the Amazon, such as the Witoto, Bora, and Muinane, prepare hallucinogens with *Iryanthera* and *Virola* species in the form of pellets that are snuffed (Schultes & Raffauf, 1995; Schultes *et al.*, 1978). This use was not found among SK informants. The SK are specialists of the ayahuasca drink, *oni in* SK, which is prepared with various *Banisteriopsis* spp. and with *Psychotria viridis*, a Rubiaceae.

Nyctaginaceae

Neea floribunda Poeppig & Endl. is a small tree present on plots 5 and 2, named "muesque" in local Spanish, *meske* or *pei bexe meske* (hoja/chica/muesque) in SK. It is a *rao meramis*: it reduces stomach pain, poro chexai, and to alleviate the pain one can take a steam bath of its leaves, another way is to grind its leaves and apply them to the stomach. One can also massage the stomach with a decoction of its leaves.

Its fruits and those of *Neea spruceana* are ecologically important being an important food resource for fish.

Present on plot 5 *Neea parviflora* P.et Ex., "yanamuco", is used to blacken teeth; the treatment may last two months.

Neea spruceana Heimerl, "muesque" in local Spanish or *meske* (hand/injured), is present on plot 2. The mature fruits are used to paint faces for Carnival. It is used also to hook fish as "sardinas" (*Triportheus* species), "palometas" (*Mylossoma* spp., Characidae), and "lisas" (Anostomidae, Characiforme).

Polygonaceae

This family is well-represented on plots 2 and 7 with the genus *Triplaris*, "tangarana" in local Spanish, *janin* in SK. It grows in riverine and floodable habitat; no *Triplaris* was found on plot 5. It is very visible in the garden because of the "hollow, ant-infested branches, large, conspicuous inflorescences and pinkish clusters of 3-fruit wings (Penninton *et al.* 2004: 138)." The triplaris species have hollow stems which shelter symbiotic ants *Pseudomyrmex triplarinus*. Their sting is very painful, and they are very agile.

Three Triplaris species have been identified: *Triplaris peruviana*, *T. poeppigiana* Wedd., *T. aff. punctata* Standley.

The SK informants distinguish four types of "tangarana": black, white, yellow and red. *Triplaris peruviana* may be *wiso janin* or "black tangarana". It is possible that this distinction is based on the color of the Pseudomyrmex ant and not on the color of the tree.

The "tangaranas" are medicines: *rayati rao* and *mechati rao.* The bark is cooked and given to the young people to drink so that they will be more active and hard-working and also good hunters and fishermen; it is purgative. The therapy may also include steam baths.

Rubiaceae

Capirona decorticans is an economically important species: it is fast-growing; its timber wood is hard, heavy and lasting. It provides the best fire wood, which is commercialized in Pucallpa-Yarinacocha. It is present on the plots 5, 3, 7.

On plot 5, there is one "capirona de altura", named áxo and nawa witash (mestizo/pierna) in SK. It is also a *rao*: it helps cicatrization, its bark is scraped and the juice is applied to wounds, stains, skin burns, acne, micosis, 2 or 3 times a day till healing; also, the juice is drunk to cure chixó *rao* or diarrhea, one glass a day for two days.

Plot 3: Fifteen *Capirona decorticans* individuals were seen in this secondary forest plot. They have several uses:

1. *Rao*, it is used to treat skin problems as burns, skin spots, micosis, its bark is scraped and the juice is collected, two or three times a day until curing.
2. *Chixó rao*, to stop diarrhea, a half glass of the bark juice is taken every day for two consecutive days.
3. The capirona firewood is considered the best in Pucallpa-Yarinacocha, and it gives good charcoal.

Plot 7 has four *Capirona decorticans* considered as *rao*: a decoction of the bark is used as a disinfectant and cures skin burns and other problems: the "barro", the "espinilla".

The use of capirona bark juice can be explained by the "theory of signatures", the bark being perceived as skin and called in SK: *xaka* or *jiwi bichi*. But capirona has been shown to be active pharmacologically (Odonne, 2010).

Present on plot 7, *Palicourea punicea* (R. & P) DC., *chirapanin rao* (rainbow/*rao*) is a good example of *rao meramis*: it provokes infections that are cured with a solution of its leaves in water or a "patarashca" of leaves and bark of the same *Palicourea* species.[20]

Rutaceae

On plot 5, we found a very aromatic tree, *Zanthoxylum riedelianum* Engl., called "hualaja" in local Spanish and *chana itsa jiwi* (bird paucar/odor/tree). Its trunk and its main branches are covered with thorns. No users were found.

On plot 3, a Citrus tree was found that probably had been planted in the garden that preceded this secondary forest.

Sapindaceae

This family appears to specialize in "jungle Viagras".

Two genus and species are sexual stimulants: *Cupania* sp. and *Talisia* sp. are present on plot 7. They are named "para para", in SK *koshiti rao* (strong/*rao*), *ochitinin winin rao* (*rao* of dog erection), *wanin jiwi* (pijuayo palm/tree) perhaps because of the pijuayo bark's hardness. This viagra is prepared to put *Cupania* root and bark in alcohol. It is ingested twice a day, followed by a bath and accompanied by a diet of salt, sugar, and fat.

20 "Patarashca" is a regional word, to prepare a patarashca of the leaves you put them between banana leaves or "platanillo" (*Heliconia* sp.) leaves, warm it up on a fire until the leaves' juice flows out. This juice is used (A/N).

Its very hard wood used for parquets, house constructions, axe handles, arrows.

On plot 5, we found *Allophylus divaricatus* Radlkofer, *awakan rao* (sacha vaca/*rao*) in SK. Its fruit is edible. The informant did not say if it is also a Viagra.

Sapotaceae

Sapotaceae are abundant on plot 7 where we found 48 trees within the genus *Manilkara* and *Chrysophyllum*. Their fruits are an important food resource for fish, in particular for the Characiforms that enter and fatten up during the "tahuampas", when the Ucayali is high.

The informants distinguish two kinds of *Manilkara*, the red (*M. bidentata*) and the white, "quinillas" in local Spanish, in SK *téxo* and *moshi téxo* (crushed/quinilla).

The genus *Manilkara* has several uses:

1. It is ecologically important, as it produces fruit in December–January, which is eaten by primates Cebidae (maquisapas, coto monos) and Callitrichidae (frailecillos, pichicos de barba blanca), birds (parrots), and fish. Most fruit trees that are "tahuampas" trees are mature in December–January–February and are disseminated by river currents;
2. The red Manilkara is a valuable heavy timber wood, much commercialized in Pucallpa. The white kind does not last as long as the red kind and is not used for house poles;
3. Medicinal use: the latex of the white quinilla, *moshi rao*, is used as a *chixo rao* or medicine to treat diarrhea, a spoonful of its latex is given to infants.

The fruits of *Chrysophyllum* sp., "caimitillo" or *keo* in SK, are edible for man, monkeys and birds, they mature in January. Paddles are made of its wood, which is durable and light.

Sterculiaceae

Sterculiaceae tree species are fast colonizers.

A few are present on plots 5 and 2, none on the "tahuampa" plot 7. Two species were found which have economic importance:

On plot 5, *Theobroma bicolor*, called "cacahuillo", *níi torampi* in SK. It was utilized in Ancient Mexico to produce chocolate, along with its cousin *Theobroma cacao*. In South America, it has been described as early as 1808 by Alexander von Humboldt and Aimé Bonpland.

Local informants distinguish the "macambillo" of the "cacahuillo" of plot 5, *chaxon rexkan* (deer/nose, mucus) in SK, which could be another *Theobroma* sp. 8 species are recorded from Peru (Pennington *et al*., 2004). This "macambillo" has the same uses as *Theobroma bicolor*:

1. It has a sweet fruit eaten by man, monkeys, tapir, paca, agouti, collared and white-lipped peccaries, deer, and the tortoise *Geochelone denticulate*;
2. Fibers are extracted from its bark to make ties and bonds ("huato").

Another species is *Herrania* sp., called "huacapú" or *wakapo* in SK.

Uses:

1. Its fruits are eaten by birds such as paujil, pava, pucacunga, and tucán;
2. Heavy and durable wood for fork beams, posts, and for parquet industry.

On plot 2 we saw *Guazuma ulmifolia*, "bolaina negra" or *xeshta* in SK. It is a commercial tree which grows fast and produces white timber wood after 4–5 years.

Its wood is used for: planks, for construction, wall linings, partition walls, and floors. Children eat the fruit, grown-ups use them to perfume alcohol and tobacco.

Conclusions

The first part of this chapter considers various aspects of SK culture that relate to plants, e.g. how a *"meramis"* tree can be used in its material form to treat symptoms produced by this same tree in its spiritual form. Also, how an *"onanya-meraya"* may intervene in a healing

process invoking the help of plant spirits. This presentation of SK animism is necessary to understand the second part.

The second part is based on the data and results of the RENACO project. The RENACO team with the National University of Ucayali and the help of local informants has done field inventories of the trees present on four plots chosen in different ecosystems of SK communal lands.

A first result of these inventories is the deep knowledge of the SK informants concerning the trees present on their communal lands.

The botanical and ethnobotanical informations on the trees present on each plot have been analyzed on the basis of their classification in botanical families.

All trees inventoried on the four plots belong to fourty-nine botanical families, which show the tree diversity of the Ucayali Valley. Twenty families include trees most important for the life and the economy of the SK communities: medicines, edible fruits, woods for handicrafts, house and boat construction, and commercial timber wood. Some trees species are not directly utilized by the SK, but are food resources for mammal game and for fish. The precision of the SK informants show the SK's great interest and knowledge on the terrestrial and aquatic ecosystems in which they live.

To conserve these resources, the communities must make a priority of conserving the forest ecocsystems in which these botanical families and species are present. A policy of biodiversity protection is imperative to protect them in the current context of massive deforestation, where illegal logging tends to predominate and eliminate trees that are important for the life of the communities.

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4.1.5 Use of Medicinal Plants by Colombian Indigenous Communities Case Study: Pastos Indigenous Community and the Páramo Vegetation in La Ortiga – Resguardo del Gran Cumbal (Nariño)

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The authors are grateful to the indigenous people of Resguardo del Gran Cumbal, for allowing them to complete their work on this research.[21]

Abstract

For ages, medicinal plants have played an essential role in the treatment of physical and spiritual diseases of Pastos indigenous people; the experience of their use and management by traditional communities is based on the empirical assessment, which comes from the accumulated experiences of their ancestors. However, this knowledge is impoverished by the appropriation of foreign technologies and the progressive loss of cultural roots. This study is based on the application of behavioral-verbal techniques on the indigenous community located in páramo "La Ortiga". A dialogue with the "taitas" and healers was established through research-action-participation, allowing the observation of their socio-cultural practices and the identification of 98 species used by the natives as traditional medicine. 78 of these species are administered exclusively for medical purposes, 4 for magical-ritual purposes and 16 are used in both ways. The species were recognized in four types of agroecosystems: orchard, farm (*chagra*), ruderal and páramo, in an altitudinal range between 3,200 to 4,000 mamsl, with four categories of management: wild, tolerated, stimulated and cultivated. We determined the use of 94 plants with potential to treat digestive, liver, kidney, urinary, respiratory, muscular, eye, and nervous system diseases identified; there are both internal and external therapies used depending on the illness to be treated. Moreover, we found that the magic-ritual species are used to prevent and alleviate spiritual-cultural diseases such as "espanto", "malviento" and "malora". They also serve in sacrifices and in protection against evil spirits. The main characteristic of these species is their aroma, which emanates during the entire phenological cycle. In addition, we created a local herbarium of identified species, giving their scientific and local names, information on parts used, forms of use and admixtures (substances of vegetable or animal origin). This herbarium currently serves of the resguardo's health service providers who use traditional medicine.

Keywords: ethnobotany, Pastos indigenous people, páramo, medicinal plants

Introduction

The Cumbes or Cumbas, belonging to the Pastos people, are considered to be the ancestors of the Cumbales, and appear to be Chibcha descendants. Beyond linguistics, there is archeological evidence of this based on excavations of stylized representations of the Chibchas. According to Carchi pottery, the beginning of Pastos culture occurred during the Tuncahuán, the Ecuadorian prehistoric period known through archaeological remains. This assumption is reinforced by the presence of the petroglyph called "Piedra de los machines" in which, in addition to the "Sol de los Pastos", appear a couple of individuals pertaining to

21 *Resguardo* is a legal term for which I, following J. Rappaport (1997), hesitate to provide an English gloss (like "reservation") to avoid misidentification of this specifically Colombian institution. It is a very different kind of entity than a North American reservation (Ed.).

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Chibcha culture. The petroglyph (Fig. 23) is located in the vereda Tasmag, Machines sector, Resguardo del Gran Cumbal (Guerrero, 1998).[22]

The relationship between culture and nature is part of a world-view in which cultural diversity contributes to sustaining plant diversity through social practices concerning the use and management of agroecosystems (La Rotta, 1988). This valuable knowledge about people and their relationship with the environment changed over time and has been documented in ethnobotanical research (Schultes, 1941; Hernández, 1980; Cerón, 1995). One of the main subjects of ethnobotany is the study of traditional medicine. Traditional ways of treating disease involves the use of plant extracts or of their active principles in satisfying primary health-care needs (Bermúdez *et al.,* 2005). These plants can also be used in modern medicine since they are a direct source of therapeutic agents. Moreover, they are used as raw material for the manufacture of more complex synthetic drugs, and the chemical structure of their active principles can serve as a model for synthetic drug development (Akerele, 1993).

23: *Petroglyph of the Cumbe tribe belonging to the Pastos culture*
Source: Authors' Archive

In Colombia, some studies have focused on both black and indigenous communities in different regions of the country. Studies of the Cuna and Wounaan del Choco indigenous people (Forero, 1980), the Tukuna, who live along the Loreto-Yacú river in the Amazon (Glenboski, 1983), the Miraña indigenous community (La Rotta, 1988), the afro-colombian community from the Bajo Calima, lower basin of the San Juan river in the Valle del Cauca (Forero, 1995), among others, have allowed the description of hundreds of species, the recording of their names and semantics in indigenous languages, Spanish names, uses

22 *Vereda* is a subdivisional administrative part of a municipality in Colombia (Ed.).

and management, techniques of planting, harvesting, the ecological relations of each species and their importance in different aspects of the culture. These ethnobotanical studies have also allowed the recognition of the significance of plants within a medical tradition. The Inga midwives, paediatricians (*tocadoras*) and herbalists (*yerbateras*) are able to provide primary care for most common diseases, as well as maternal assistance from the first few months of pregnancy and during childbirth, through the use of these plants (Tafur-Giraldo, 2000: 8–9). The taitas use medicinal plants to treat different diseases, and for ritual-religious purposes, as well as for spiritual health. This is an exclusive characteristic of their work (Rodriguez-Echeverry, 2010).

Research on the biological activity of medicinal and narcotic plants has highlighted the high ethnopharmacological variety of Colombia in comparison to the rest of American tropics (Schultes & Raffauf, 1986). This knowledge of medicinal plants continues to show its potential in modern medicine, and the pharmaceutical industry must encourage its recovery and promotion in communities, by recognizing their effective therapeutic components, thereby contributing to their preservation (Zuluaga-Ramirez, 2005).

In the Nariño department, located in the south of Colombia, there is a diversity of ecosystems inhabited by black and indigenous communities. These communities have provided data for several ethnobotanical studies on the use of plants; both wild species and plants manipulated in agroforestry gardens (Knight, 1995), as well as plants used in common medicine (Valenzuela & Ramirez, 1996; Mallama *et al*., 2001; Moncayo & Zambrano, 2005). For these communities facing the socio-economic issues of the region, plants serve as an alternative to official health care.

This study focused on gathering information about the use of medicinal plants by Pastos indigenous communities located in the páramo La Ortiga, Resguardo del Gran Cumbal, Nariño – Colombia.

Methodology

The indigenous *resguardo* Gran Cumbal is located in the municipality of Cumbal between geographical coordinates 0°55′ north latitude and 77°49′ west longitude, department of Nariño, in southwest Colombia, in the great mountain massif called "Nudo de los Pastos". This *resguardo* has a population of 13,819 indigenous people, distributed in eight *veredas*. The main organization for the exercise of power within the indigenous population is represented by the authority of Cabildo (Plan de Desarrollo del Resguardo del Gran Cumbal, 1998; Esquema de Ordenamiento Territorial Municipio Cumbal, 2002).

Research was conducted in the páramo "La Ortiga" located in the *vereda* Quilismal, applying descriptive and analytical methods proposed by Martin (1995). The verbal cooperation of the taitas and *curanderos* (people with experience and wisdom) was indispensable for the development of this study, as was the "Dialogue of Knowledge" based on research-action-participation in the community. Direct field observations were conducted among the indigenous people. The information on each specimen was collected using botanical and ethnobotanical tabs as suggested by Forero *et al.* (1995).

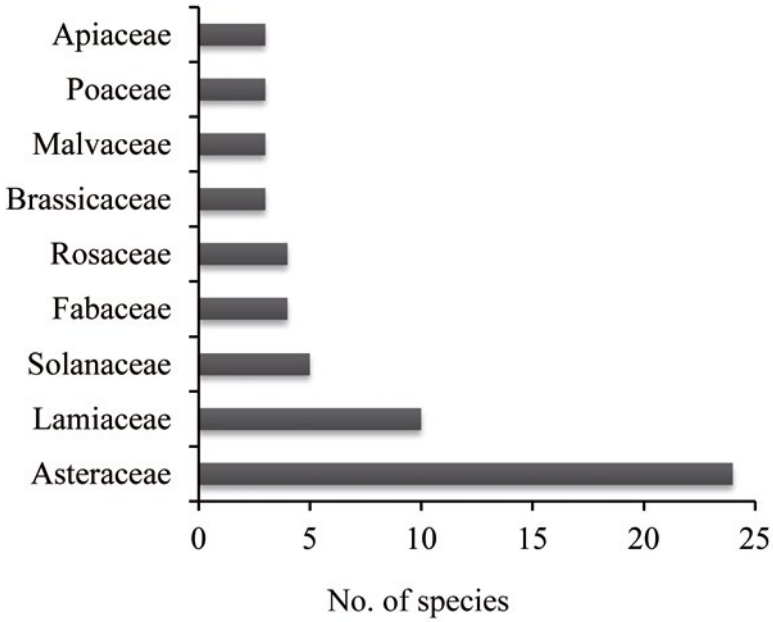
The botanical material was determined using taxonomic keys, thanks to identification by specialists, drawing comparison with specimens from the collections of the University of Nariño Herbarium (PSO).

Results

Taxonomic Determination

41 plant families were identified in total. 98 species are used in the ethnomedicine of the indigenous communities. Magnoliophyta are grouped in 36 families with 93 species, in accordance with the classification system of flowering plants (Cronquist, 1978). The most representative families by number of species were Asteraceae, Lamiaceae, Solanaceae,

Fabaceae, Rosaceae, Brassicaceae, Malvaceae, Poaceae and Apiaceae (Fig. 24). Among the Pinophyta: Cupresaceae and Pinnaceae – each one with 1 species; Pteridophyta: Lycopodiaceae and Adiantaceae each one with 1 species; and Tallophyta with 1 Lichenes.



24: *Distribution of species used in ethnomedicine according to plant family*
Source: Authors' Archive

Management System of Medicinal Plants

The indigenous communities recognize four types of agroecosystems: orchard, farm, ruderal and páramo, located in an altitude range of 3200–4000 mamsl on the fringes of subpáramo and páramo and are distributed as follows:

Between 3200–3400 mamsl, 75 native and introduced species were found in orchard, farm and ruderal agroecosystems. The indigenous population lives in this area, therefore, interaction with medicinal plants is extensive.

In the altitude range 3401–3600 mamsl, only 1 species was found because this is a transition zone that is regenerating after heavy human intervention.

Between 3601–3800 mamsl, 16 wild plant species were found living in an agrosystem relatively undisturbed by human activity.

Finally, 6 wild species characterized by unique adaptability were found between 3801–4000 mamsl. These species need to be collected, transported, dissected and preserved. The plants were determined as follows: *Huperzia attenuata* (spring) Trevis, *Culcitium reflexum* H.B.K., *Niphogeton dissectus* Macbride, *Ranunculus gusmanii* Humboldt ex Caldas, *Hesperomeles heterophylla* (R&P) Hook and *Valeriana plantaginea* H.B.K. (Fig. 25).

According to the management categories classification proposed by Sanabria (2001) we found that 29 species are wild, 23 tolerated, 3 encouraged and 43 cultivated.

25: *Several species of medicinal plants distributed in the páramo zone.*

Dictamo *Ranunculus gusmanii* H. ex Caldas | Deditos *Huperzia attenuata* (Spring) Trevis | Anicillo Niphogeton dissectus Macbride

Source: Authors' Archive

Categories of Medicinal Plants Administration

Species Used for Medicinal Purposes

Tab. IX contains the information on parts used, preparation/administration, local use and association; the latter refers to the integration with other plants or other elements within the processes of traditional indigenous medicine treatment.

IX: *Methods of medicinal species administration*

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
1	*Abutilon striatum* var. *thompsonii* Dick.	Leaves and flowers	Put leaves and flowers in a bowl with water and let it stand overnight outside the house/bath	Rheumatism	
2	*Achillea millefolium* L.	Fresh leaves	Boiled/oral administration	Abdominal and muscular pain caused by the cold	Chapil (Fermented extract of panela sugarcane *Saccharum officinarum* L.)
3	*Adiantum* sp.	Leaves and stems	Decoction/oral administration	Waist pain caused by affection of the kidneys	
4	*Alnus jorullensis* H.B.K.	Leaves	Poultice	Abdominal pain, diarrhea caused by cold; rheumatism, anti-inflammatory	Chicken fat

IX (continued): Methods of medicinal species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
5	*Aloysia triphylla* (L'Herit) Britt.	Leaf, stem, flower	Boiled/oral administration	*Nervios* , stomach pain	
6	*Alternanthera lanceolata* (Benth) Schinz.	Leaves and stem	Liquefied/mouth	Headache and cough	
7	*Ambrosia arborescens* Mill.	Leaf, flower, seed	Seed in decoction/oral administration; flower boiled/oral administration; fresh leaf/external route	Anger or rage *(colerin)* ; abdominal pain during menstrual period; nosebleed	
8	*Anetun graveolens* L.	Flower, leaf	Infusion/oral administration	Affections of the digestive system and liver	
9	*Artemisia* sp.	Leaves	Infusion/oral	Indigestion, constipation	
10	*Avena sativa* L.	Inflorescence	Boiled/oral administration	Irritation of kidneys	Linaza *Linum usitatissimum,* grama *Cynodon dactylon* L., papa china *Colocasia esculenta* (L .) Schott
11	*Baccharis floribunda* H.B.K.	Leaves, stem	Decoction/oral administration	Diarrhea (*soltura*)	
12	*Baccharis latifolia* H.B.K.	Leaves, stem	Decoction/oral administration	Diarrhea	
13	*Bellis Perennis* L.	Flower	Decoction in milk/oral administration	Pulmonary edema, cough	
14	*Bidens andicola* H.B.K.	The entire plant	Decoction/external route	Baths for rheumatism	
15	*Bidens bipinnata* L. var. cynapiifolia (H.B.K). Maza.	Leaf and flower	Decoction/external route/bath; infusion/oral administration	Pain of the body and itch *(picones)* ; nervios	
16	*Bidens pilosa* L.	Flower	Infusion/oral administration	*Nervios* (tranquilizer)	
17	*Borago officinalis* L.	Flower	Decoction/oral administration	Laxative after childbirth	
18	*Bromus pitensis* H.B.K.	Flower	Boiled/oral administration	Irritation of the liver	
19	*Brugmansia aurea* Lagerhem.	Leaf	Poultice	Anti-inflammatory (blows and wounds)	

IX (continued): Methods of medicinal species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
20	*Brugmansia sanguínea* (R&P) Don.	Leaf, flower, fruit	Roast slightly *(soasada)* : extract/external administration	Anti-inflammatory (blows or wounds); treats *"la circa"* (indigestion, dizziness, vomiting)	
21	*Calendula officinalis* L.	Flower	Infusion/oral administration; decoction/oral administration; poultice; extract/external route	Gastric ulcer; *nervios;* cicatrizant (blemishes on the skin)	Against *nervios* (Scheper-Hughes 1994: 229-242) together with rosa mosqueta *Rosa* sp.
22	*Chenopodium ambrosioides* L.	Leaf	Extract/oral administration; fried	Anti-parasitic; to increase the appetite	
23	*Chenopodium quinoa* Willd.	Seed	Cooking/food	Helps to heal surgical wounds	
24	*Chuquiraga fruticosa* Just ex Sterd	Leaves, stem and flower	Infusion/oral administration; decoction/oral administration	Affections of the liver; inflammation and stomach pain, menstrual colic	
25	*Coriandrum sativum* L.	Leaf, root	Boiled/oral administration	*Nervios,* increases appetite	White wine
26	*Culcitium reflexum* H.B.K.	Stem, leaf and flowers	Boiled/oral administration	Stomach pain, bodily pain, fatigue	
27	*Cupressus funebris* Endl.	Stems and leaves	Boiled/oral administration	For cough caused by the flu	
28	*Cyclanthera explodens* Naud.	Leaf	Decoction/external administration	To remove blemishes from the skin	
29	*Cynodon dactylon* (L) Pers.	Leaf, stem	Boiled/oral administration	Irritation of the liver, *nervios*	
30	*Dianthus caryophyllus* L.	Flower	Extract/oral administration; Put flowers in a bowl with water and let it stand overnight outside the house/bath	Against *nervios*	Leave overnight together with rosa mosqueta *Rosa* sp.
31	*Espeletia pycnophylla* Cuatr.	Leaves, stem and resin	Poultice	Headache, earache (from a cold), rheumatism, strain, against the cold (diarrhea), healing of wounds	
32	*Eucalyptus globulus* Labill.	Leaf	Boiled/oral administration, bath	Influenza (pulmonary, nasal congestion); anti-inflammatory for muscle pain, rheumatism	Milk
33	*Gasteranthus kuscilabus* L. E. Skoy.	Entire plant liquefied	Boiled/oral administration	Affections of the liver and kidney	
34	*Geum peruvianum* Fock.	Leaf	Boiled/oral administration	*Nervios*	

IX (continued): Methods of medicinal species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
35	*Hesperomeles glabrata* (H.B.K.) Roem.	Stem, fruit	Decoction/oral administration	Affections of the liver	
36	*Hipochaeris sessiliflora* H.B.K.	Root	Latex/external route	To wean a child	
37	*Huperzia attenuate* (Spring) Trevis.	The entire plant	Boiled/oral administration	Affections of the liver and kidney	
38	*Lactuca scariola* L.	Root	Decoction/oral administration	Against *nervios*	
39	*Lathyrus odoratus* L.	Flower	Infusion/oral administration	*Nervios*	
40	*Lavatera arborea* L.	Leaves and flower	Infusion/oral administration	Bodily pain	
41	*Lavatera* sp.	Leaves and flower	Boiled/bath	Anti-inflammatory (wounds)	
42	*Lepechinia vulcanicola* Wood.	Leaves	Lightly roasted/poultice; fresh/poultice; decoction/bath; boiled/oral administration	Bone pain from the cold; earache, headache; anti-inflammatory (blows and wounds); stomachache from the cold	
43	*Lepidium bipinnatifidum* Desv.	Flower, seed	Extract/oral administration; macerated/external route	Commotio cordis; anti-parasitic, anti-inflammatory (wounds)	Against parasites with lemon
44	*Loricaria ilinissae* (Benth.) Cuatr.	Leaves and flower	Boiled/oral administration	Constipation, gastric ulcer	
45	*Matricaria chamomilla* L.	The entire plant	Boiled/oral administration; decoction/external route	Stomach pain; steam bath, inflammation of the womb during pregnancy, after childbirth	
46	*Matthiola incana* R. Brown	Flower	Infusion/oral administration	Against *nervios*	

IX (continued): Methods of medicinal species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
47	*Medicago sativa* L.	Stems and leaves	Extract/oral administration	Extract/oral administration	It is mixed with pigeon egg
48	*Melissa officinalis* L.	Leaves and stem	Put leaves or stems in a bowl with water and let it stand overnight outside the house/bath	*Nervios*	Nettle (*Urtica dioica* L.)
49	*Mentha piperita* L.	Leaves and stem	Infusion/oral administration; fried/food	*Stomachache; "la circa"*	Garlic *Allium sativum* L. and egg
50	*Mentha pulegium* L.	Leaves, stems	Boiled/oral administration	Stomachache from the cold	
51	*Miconia gleasoniana* Wordack.	Leaf	Boiled/oral administration	*Nervios*	Cadillo *Triumfetta* sp., encino *Weinmannia brachystachya* Willd ex Engl.
52	*Minthostachys tomentosa* (Benth) E.Pling.	Leaves and stem	Boiled/oral administration	Stomachache, inflammation, diarrhea in children	
53	*Monnina aestuans* (L.F.) D.C.	Fruit	Extract/external route	Infections of the skin and mouth	
54	*Myrcianthes* sp.	Leaf	Chewing; boiled/bath	Toothache; rheumatism (bone pain)	
55	*Nasturtium officinale* (L)R.B	Leaves, stems	Decoction/oral administration; roasted or heat-dried leaf /external route	Affections of the liver/abdominal pain caused by cold	Linaza *Linum usitatissimum* , anís *Pimpinella anisum* , malva alta *Lavatera arborea* L., malva de olor *Pelargonium odoratissimum* Ait. and pelo de choclo *Zea mays* L.

IX (continued): Methods of medicinal species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
56	*Niphogeton dissectus* Macbride.	Flower, leaf	Boiled/oral administration	Affections of the digestive system and liver	
57	*Niphogeton dissectus* Macbride.	Leaves	Boiled/bath	Anti-inflammatory (wounds)	
58	*Passiflora cumbalensis* H.B.K.	Flower	Infusion/oral administration	*"Espanto"* (indigestion, diarrhea)	Limon *Citrus limon* (L.) Burm.
59	*Pelargonium grandiflorum* Willd.	Flower	Fresh/inhalation	Headache	It is mixed with milk or administered separately
60	*Pelargonium odoratissimum* Ait.	Leaves, flower	Boiled/oral administration	*Nervios*	
61	*Pentacalia stuebelli* (Hier). Cuatr.	Leaf, flower	Boiled/oral administration	Abdominal pain, affections of the liver	
62	*Physalis peruviana* L.	Fruit	Decoction/external route	Blurred or reddened eyes	
63	*Pinus patula* L.	Leaf, stem	Infusion/oral administration	Headache, influenza	Milk
64	*Plantago* sp.	Leaf, root	Boiled/oral administration; macerated/external route	Back pain, waist pain, anti-inflammatory	Papa china *Colocasia esculenta* (L.) Schott, linaza *Linum usitatissimum*
65	*Ranunculus gusmanii* Humboldt ex Caldas	Leaf	Macerated/external route; boiled/oral administration; extract/oral administration	Rheumatism; liver and kidney; anti-parasitic	Alcohol of 90º with lemon *Citrus limon* (L.)
66	*Rosa* sp.	Flower	Put flowers in a bowl with water and let it stand overnight outside the house/bath	*Nervios* , irritated eyes	
67	*Rosmarinus officinalis* L.	Leaves and stem	Boiled/oral administration	Against stomachache from the cold, sore arms and feet	Chapil and panela (heated up juice of sugarcane *Saccharum officinarum* L.)
68	*Rumex acetosella* L.	Leaf, stem	Macerated/external route	Disinfectant for wounds	
69	*Rumex crispus* L.	Leaf, inflorescence	Boiled/internal route	*Colerin,* depression, discouragement *(tristeza)*	
70	*Ruta graveolens* L.	Leaf, flower	Roasted, macerated/oral administration; infusion/oral administration	Abdominal pain and inflammation; menstrual colic	Warm egg
71	*Salvia leucantha* Cav	Leaves and flower	Infusion/oral administration; boiled/oral administration	Cough, headache, abdominal pain during menstrual period	
72	*Salvia macrostachya* Kunth.	Leaf	*Soasada* /poultice	Diarrhea from the cold	Marco *Ambrosia arborescens* Mill., chapil
73	*Sambrucus nigra* L.	Leaves	Decoction/bath	Bone pain	
74	*Satureia nubigena* (Kunth) Briquet	The entire plant	Boiled/oral administration	Stomachache	
75	*Solanum nigrum-americanum* (Mill.) Schultz.	Leaf, stem, fruit	Boiled/external route	Anti-inflammatory (blows and wounds)	

IX (continued): Methods of medicinal species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
76	*Solanum tuberosa* L.	Flower, tuber	Boiled/oral administration	Abdominal pain and irritation of kidney	Rosa mosqueta *Rosa* sp.
77	*Sonchus asper* (L) Hill.	The entire plant	Decoction/oral administration	*Nervios* (tranquilizer)	
78	*Sonchus oleraceus* L.	Stem and leaves	Extract and latex/external route (massage)	Abdominal, back and waist pain caused by affection of the kidneys	
79	*Spilanthes americana* (Mutis) Hier.	Leaf, flower	Infusion/oral administration; chewing	Stomachache, irritation of the liver; flower against the toothache	
80	*Tagetes zipaquirensis* H.B.K.	Stem, leaf, flower	Boiled/external route; boiled/oral administration;	Rheumatism; flower to regulate the menstrual period	Against rheumatism: Cipres *Cupressus funebris* Endl., pino *Pinus patula* L., eucalipto *Eucalyptus globulus* Labill., matico *Lepechinia vulcanicola* Wood. and chapil
81	*Taraxacum officinale* Weber.	Leaf, root	Raw/internal route; roasted, macerated in infusion/oral administration; decoction/oral administration	Diarrhea; irritation of kidneys; affections of the liver	Limón *Citrus limon* (L.)
82	*Thymus vulgaris* L.	Leaves, stem and flower	Stomachache, flatulence, abdominal pain caused by the cold		
83	*Triumfetta* sp.	Fruit	Boiled/oral administration	*Nervios*	

IX (continued): Methods of medicinal species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
84	*Tropaeolum* sp.	Leaf	Poultice/external route; boiled/oral administration	Eye irritation; affections of liver and kidney, abdominal hernia	Chapil
85	*Urtica dioica* L.	The entire plant	Extract/oral administration; put plants in a bowl with water and let it stand overnight outside the	*Colerin* ; *nervios*	Rosa mosqueta *Rosa* sp.
86	*Urtica urens* L.	Leaf, stem	Extract/oral administration; decoction/bath	*Nervios* ; bone pain caused by the rheumatism	
87	*Vaccinium floribundum* H.B.K.	Fruit	Extract/oral administration	Anemia and weakness	
88	*Vaccinium floribundum* H.B.K.	Leaf, stem and flower	Extract/oral administration	Hemorragia (heart attack or myocardial infarction), *nervios* (nervous system)	
89	*Vicia faba* L.	Leaves	Cooking/food	It is consumed as stew when there is a lack of appetite in pregnant women	Berro blanco *Nasturtium officinale*
90	*Viola odorata* L.	Flower	Infusion/oral administration	*Nervios*	
91	*Viola tricolor* L.	Flower	Infusion/oral administration	*Nervios* , headache	
92	*Weinmannia brachystachya* Willd ex Engl.	Stems and leaves	Boiled/oral administration; boiled/bath	*Nervios* ; to avoid baldness	

Source: Authors' Archive

Species used for magical-ritual purposes

These species are occasionally used as prevention and relief from culture-bound syndroms such as “espanto”, “malviento”, “malora”, and as propitiatory offerings and protectors. The characteristics regarding parts used, preparation, local use and associations are detailed in Tab. X. The major characteristic of these species is their aroma, which emanates throughout their phenological cycle, especially during flowering.

X: *Methods of magical-ritual species administration*

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
1	*Achillea millefolium* L.	The entire plant	Decoction/blood circulation	Home and farm protector, to prevent witchcraft and to cure	Gallinazo *Tagetes zipaquirensis* H.B.K., guanto and plants from warm climates
2	Alonsoa meridionalis var *lactea* (L.F) Ktze.	Flower, leaf, stem	Macerated/external route; decoction/bath	*Malviento;* people possessed by spirits (*enduendado*)	Yerbaverde *Anagallis* sp. and ruda *Ruta graveolens* are mixed with chapil
3	*Ambrosia arborescens* Mill.	Leaf, flower, seed	Decoction/blood circulation; fresh leaf/mild hits to the body made by the traditional healer, who uses magical-ritual plants for this purpose; the procedure could be considered as a ritual to treat diseases *(barrida)*	Protector against spirits, curse; *malviento*	
4	*Anagallys* sp.	Leaf, stem	Macerated/external route	*Espanto/malaire*	Ajo *Allium sativum L.* mixed with chapil
5	*Baccharis floribunda* H.B.K.	Flower	Perfuming with incense *(saumerio)* /external route	*Malaire, espanto, cueche, malora*	
6	*Baccharis latifolia* H.B.K.	Leaves and flower	Perfuming with incense/external route	*Malaire, espanto, cueche, malora*	
7	*Bidens pilosa* L.	Leaves, stem and flower	Decoction/blood circulation	Protection against enemies, spirits, and curses	Gallinazo *Tagetes zipaquirensis* H.B.K., chilca negra *Baccharis floribunda* H.B.K., guasca tigre and yage (species found in warm climates)
8	*Brugmansia aurea* Lagerhem.	Leaf		Symbol of protection against evil	

X(continued): Methods of magical-ritual species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
1	*Achillea millefolium* L.	The entire plant	Decoction/blood circulation	Home and farm protector, to prevent witchcraft and to cure	Gallinazo *Tagetes zipaquirensis* H.B.K., guanto and plants from warm climates
2	Alonsoa meridionalis var *lactea* (L.F) Ktze.	Flower, leaf, stem	Macerated/external route; decoction/bath	*Malviento;* people possessed by spirits (*enduendado*)	Yerbaverde *Anagallis* sp. and ruda *Ruta graveolens* are mixed with chapil
3	*Ambrosia arborescens* Mill.	Leaf, flower, seed	Decoction/blood circulation; fresh leaf/mild hits to the body made by the traditional healer, who uses magical-ritual plants for this purpose; the procedure could be considered as a ritual to treat diseases *(barrida)*	Protector against spirits, curse; *malviento*	
4	*Anagallys* sp.	Leaf, stem	Macerated/external route	*Espanto/malaire*	Ajo *Allium sativum L.* mixed with chapil
5	*Baccharis floribunda* H.B.K.	Flower	Perfuming with incense *(saumerio)* /external route	*Malaire, espanto, cueche, malora*	
6	*Baccharis latifolia* H.B.K.	Leaves and flower	Perfuming with incense/external route	*Malaire, espanto, cueche, malora*	
7	*Bidens pilosa* L.	Leaves, stem and flower	Decoction/blood circulation	Protection against enemies, spirits, and curses	Gallinazo *Tagetes zipaquirensis* H.B.K., chilca negra *Baccharis floribunda* H.B.K., guasca tigre and yage (species found in warm climates)
8	*Brugmansia aurea* Lagerhem.	Leaf		Symbol of protection against evil	

X: (continued): Methods of magical-ritual species administration

#	Species	Parts used	Preparation/Administration	Local use	Relationship with other species and admixtures
18	*Salvia macrostachya* Kunth.	Leaf	Fresh/external route	*Espanto, malaire*	Ajo *Alliumsativum* L., ruda *Ruta graveolens* L., chapil
19	*Tagetes zipaquirensis* H.B.K.	Stem, leaf, flower	Decoction/blood circulation	As a protection for the house, against curses	Chilca negra *Baccharis floribunda* H.B.K, paripacunga *Bidens bipinnata* L. var. *cynapiifolia* (H.B.K).Maza.
20	*Valeriana plantaginea* H.B.K	The entire plant	Macerated/external route; decoction/baths	*Malaire* and *espanto* ; as propitiatory offering to bring good luck and protection against enemies, spirits, and bad energies	chonduro, espingo, pepa voladora (seeds to be bought, originally from warm climate) and chapil

Source: Author's Archive

Additionally, thanks to the identified species, a local herbarium was prepared, giving for species information on its local and scientific name, parts used, local use, method of use and admixtures (substances of plant or animal origin). This herbarium currently serves to promote traditional medicine at the IPS Resguardo.

Discussion

Cumbes from the "La Ortiga" páramo know how to use and administer 98 medicinal plants, including plants used for magical-ritual purposes, thanks to their experience in páramo ecosystem plant resources management.

These species are distributed throughout the indigenous management systems of orchard, farm, ruderal and páramo. The management of vegetation in these systems is determined by climatic factors and altitude range. Sanabria (2001) reports similarly on Andean verticality in Tierradentro traditional agroecosystems (Cauca – Colombia).

The sociocultural and economic dynamics in the páramo agroecosystem are based on factors such as land use, farm location, agricultural calendar, cultivated native, introduced and wild plants, land tenure and socio-political organization.

Our results suggest that the use of plant resource potential is widely spread in the páramo ecosystem. The ethnomedicinal knowledge of traditional medical healers (*curanderos*) or members of some families helped us gather information on 98 plants used to treat body, digestive, liver, kidney, urinary, respiratory, muscular, eye and nervous system diseases. These diseases are associated with cultural symptomatology such as pain and upset stomach, waist and back pain, irritation, diarrhea and "nervios".[23]

The affections are treated internally by oral administration of infusions, decoctions, extracts, roasted and macerated plants; and externally, in the form of baths, poultices and massage. Stem, leaf, flower, fruit, roots and seeds are used, as well as the substances secreted by plants (latex, resins), depending on the affection. Research carried out by Moncayo & Zambrano (2005) demonstrated similar results in the farming communities in the Casabuy,

23 Nervios refers to a culture-bound syndrome, which is reported to be *bound* to the Hispanic *culture* and closely resemble panic attacks (Wolf Dresp, 1985) (Ed.).

Hato Viejo and Sanchez subdivisions (*corregimientos*) of Chachagüi municipality, Nariño department, which reaffirms the validity and cultural importance of medicinal plants, corresponding to the treatment of diseases on the physical level. They argued that dosage and posology vary according to the plant used, the disease being treated and the patient category (children, adults and pregnant women).

It is important to highlight that a large number of medicinal species belong to the Asteraceae family (23), which is probably due to their cosmopolitan character and herbaceous habit, as well as to their phytochemical components. Similarly, La Torre & Ceroni (1997) in the ethnobotanical studies they carried out in the páramo and montane forest in Yanacancha – Peru reported that the plants used there are primarily of herbaceous type and belong to the Asteraceae family. Moncayo & Zambrano (2005) have further affirmed that this family has the largest number of species of medicinal use.

The magical-ritual category, represented by Asteraceae, Lamiaceae and Solanaceae family, is characterized by plants issuing strong and penetrating odors. These plants are usually used in the treatment of culture-bound syndromes such as "espanto", "malviento", "malaire", "malora", "entundado", "cueche" and "chutún" causing mental and bodily harm. Its local explanation is based on the presence of supernatural beings, considered as owners of particular, sacred and spiritual sites. Beck & Ortiz (1997), researching on medicinal plants and knowledge of traditional healers in Awá indigenous communities from the Esmeraldas and Carchi province, in the Chocó phytogeographic region, in Ecuador, found that some medicinal plants are used ritually in healing ceremonies to treat diseases like "chutún". Chutún is described as an anthropomorphised animal, which enters the body of people when they are wandering through the woods. It is potentially harmful for those who violate the rules in relation to the supernatural. Its symptoms are a headache and a feeling of intense cold.

Considering the use of wild plants in páramo (3600–4000 mamsl), people prefer to visit traditional healers, because they know about their ecological and biological characteristics.

Many of the species we found are considered rare in Colombian folk medicine, but they could contribute significantly to therapy, as well as to the preservation of the social, regional and national heritage. Here it is worth noting *Culcitium reflexum* H.B.K., *Espeletia pycnophylla* Cuatr., *Vaccinium floribundum* H.B.K., *Lepechinia vulcanicola* Wood., *Satureja nubigena* (Kunth) Briquet., *Ranunculus gusmanii* Humboldt ex Caldas, *Geum peruvianum* Focky and *Weinmannia brachystachya* Willd ex Engler.

Moreover, *Salvia macrostachya* Kunth.in H.B.K., which was reported to be a vulnerable species, because its geographic distribution has decreased significantly, was found under cultivation in the orchard agroecosystem. This plant, which is used for medicinal and magical-ritual purposes, is considered to be paramount by the community; the natives thus contribute to the conservation of this species.

Summary

The use of medicinal plants by the communities is based on the empirical assessment that comes from their ancestors' experience. While applying the behavioral-verbal techniques on the indigenous communities living in the páramo "La Ortiga", we held a dialogue of knowledge with the "taitas" and healers, and this allowed us to observe their cultural practices and to identify 98 species used by the natives in their traditional medicine. The species recorded are of great value, considering the physical and spiritual health of the indigenous people in the páramo "La Ortiga", Resguardo del Gran Cumbal. This information, which has been transmitted orally from generation to generation, and it currently forms part of this publication, and constitutes the local herbarium, supports the traditional medicine practiced at the IPS Resguardo.

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4.1.6 Ethnoecology as a Tool for the Memory Construction, Integrity of Knowledge and Local Sustainable Development in the Vaupés Department (Colombia), Northeast of the Colombian Amazon

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Abstract

Medicinal plants have played an important role in the management and treatment of disease since the beginning of human existence. In this sense, indigenous cultures have acquired a broad knowledge of traditional medicine by their constant interaction with the environment, healing diseases over thousands of years. The Vaupés department is very diverse, biologically and culturally; approximately 85% of the population is indigenous. Unfortunately, throughout history, different processes have led to an acculturation of indigenous communities in this area, resulting in the loss of knowledge and of the original practices of traditional medicine, including ancient transfer models. Currently, traditional healers in the Vaupés (and Colombia in general) see the need to transmit their knowledge to future generations, to strengthen the transfer systems, to rejuvenate their identity, as well as to integrate them into models of local sustainable development. We would like to contribute to this process of memory recovery and knowledge revival.

Keywords: traditional medicine, Vaupés – Colombia, ethnoecology, memory, local sustainable development

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Introduction

Colombia has broad natural, cultural and epistemological diversity. The biological diversity of the country represents 10% of the planet's (Hernández, 1993). This is the result of its location in the tropics, along with a variable topography and watershed areas that constitute drainage areas and fertile soils that are optimal for agricultural and biological distribution. Its variety of landscapes and diverse ecosystems make Colombia a gene bank of wild and domesticated organisms and cultures.

The Vaupés, located in the northeast of the Colombian Amazon, is one of the most culturally-diverse regions in Colombia. By Act 2 of 1959, the entire department was established as a forest reserve of the Colombian Amazon. It is also considered a *Gran Resguardo Indígena* with 85% indigenous population. The remaining 15% are white, mestizos and blacks (Perdomo 2004). This territory includes 32 ethnic groups (Da Cruz, 2007) who speak 18 languages in total. The Vaupés is a conserved and isolated area, rich in knowledge, world views, beliefs and traditions that have been acquired by indigenous communities over many generations. They have their own sense of bio-cultural conservation and protection.

The purpose of this article is to establish a philosophical and epistemological basis for implementing of ethno-ecological research supporting local sustainable development and common welfare, highlighting the importance of memory and the recovery of knowledge. Our methodology was based on participant observation, interviews with traditional

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healers, fieldwork and assistance in various practices related to traditional medicine (*medicina ancestral*).

Historical Issues

Since the beginning of the free market, large-scale demand for minerals and aquaculture resources, extensive farming, mega-projects, patenting seeds and gene banks, among others, have become part of the business process and of the models for global development (Fajardo, 2011). Consequently, societies have undergone changes in perception caused by the dominant idea of "modern life", linked to the exploitation of nature.

The Vaupés is a department in which the state is largely absent, due to its geographical position; it has no ground infrastructure connecting it to the center of the country; its waterways have numerous rapids and falls, making the passage of large vessels impossible. Its ancient soils originated in the Guiana Shield, have few nutrients, and allow low levels of food production, causing vulnerability in the population's food security, nutrition and health, in a time of vanishing cultural practices and knowledge regarding wild rain forest resources.

The different processes of conquest, colonization, evangelization and extractivism that swept over this region since the 16th century have generated the loss of traditional medicinal knowledge, including knowledge about biological resources such as yagé [*Banisteriopsis caapi* (Spr. Ex Griesb.) Morton], about building traditional housing and ceremonial infrastructure such as the *maloca*, and about the role of *payé* or shaman as backbone of traditional medicine and ancient social organization. European cultures considered these traditions and characters as the product of "evil". Consequently, numerous indigenous people were murdered, enslaved and evangelized. The decrease of the pre-Columbian population and the magnitude of loss of ancestral ecological knowledge remain unknown.

Though some key elements of local traditional medicine were lost, other processes, such as the migration of slaves or settlers, prompted an exchange of wisdom with indigenous people. The wisdom comes from different cultures and it increased mixed peasant-indigenous ethnobotanical knowledge for the curing of exogenous diseases such as influenzas, sexually transmitted diseases, pains, etc. Culture turns out to be a dynamic process in which the intercultural operates as an engine for both the generation and loss of knowledge and practices driven by different historical pressures.

Currently, the western health system dominates the traditional one. Unfortunately, in such a vast, untouched territory without roads or services, the conventional health system in the Vaupés presents numerous difficulties (Clavijo, 2011): **1)** difficult access to geographic locations distant from health centers; **2)** the population lacks economic resources to pay for health services; **3)** lack of efficient and appropriate treatments; **4)** lack of specialized medical training, especially in the field of tropical medicine, preventive health care and public health; **5)** insufficiencies in the knowledge of health care providers; 6) irregularity in the services provided in communities and remote locations; 7) insufficiency and poor management of transportation systems, etc. It is here where the revitalization, strengthening and appropriation of traditional medicine play an important role in addressing medical issues and in recovering cultural identity and significance.

Memory: Traditional Medicine in the Vaupés

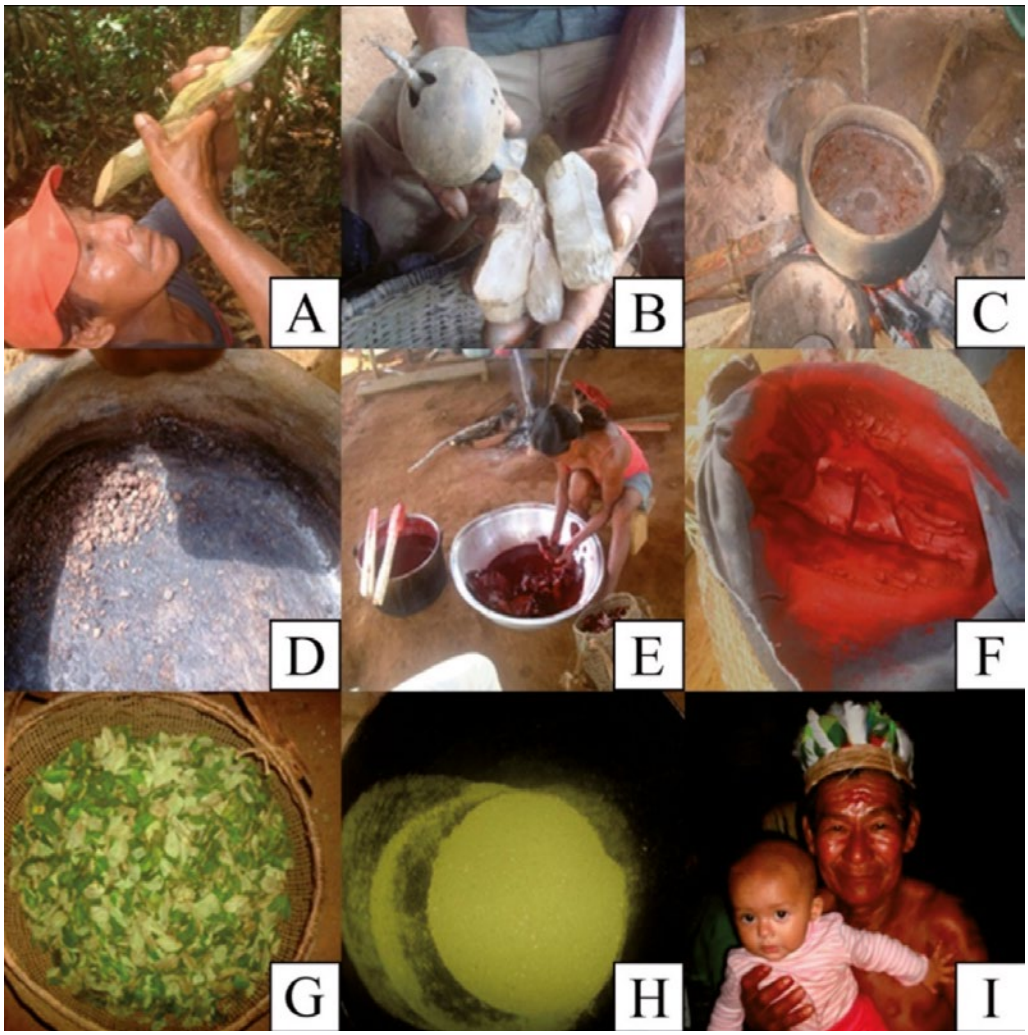
Traditional medicine has its technology and history. Myths and stories about the creation of healing originated in the everyday community life and social structures. Healing with plants and prayers, as well as the roles and functions of different protagonists, play a key role in indigenous medicine and social organization (Fig. 26). After living together (including our one-year old daughter Juana Isabella) for a year with the indigenous people of the Vaupés and establishing relations of friendship and trust with the healers of the Macaquiño community, it was possible to record a narrative that sums up the traditional medicine,

customs and ancestral social organizations in the Vaupés [source: Rafael Fernández, traditional healer, 75 years old with the vital energy of a 20-year-old man, (Fig. 26)]:

"In the past, the indigenous population of the Amazon lived in a maloca where they shared food and the fermented beverage 'chicha' to learn the family tradition. In the middle of the family there were the payé and the healer, who were the most influential people within the maloca. There was also a dancer (danzador), a carrizódromo (musician), and spiritual leader (rezador) who protected the lands and families. The payé taught and healed sick people. Young people who followed his lessons had to comply with the rules he made. The course would have between five and ten people. These students stayed with the payé fulfilling diets and orders. Later they continued with other more profound courses. The healer was the one who taught traditional medicine; patients were sent to him by the payé, who discovered the origin of disease. The healer prescribes which plant should be taken by the patient and the dosage. The danzador is an enthusiastic character who also gives lessons to participants. This course requires diets, punctuality, waking up early and restricted food. Also much respect, and the ability to withstand the yagé and sexual abstinence. The carrizodromo is a friend of all the children and young people. Anyone can visit him and ask questions to learn about the carrizo.[24] *He does not require many diets, only a willingness to learn and to be responsible for completing tasks that have been already set. The religious leader (rezador) is another very important person within the family and the maloca. The good development of children, a good atmosphere in the community, success in fishing and hunting, depends on him; if he is in a good mood, there is an abundance of food, if not there will be shortages. The knowledge of our grandparents was transmitted in the center of the maloca, once a young man has passed the Yurupary ceremony (the history of the origin, culture, social organization and transition to adulthood in northwestern Colombian Amazonia). When the period of diets begins, he bathe early in the morning, inhales chili, avoids eating smoked food, frightening noise and contact with menstruating women. When theses rules are followed, the knowledge is transmitted to the young people, and they can become healers, or prayers, and practise healing methods (payelogía), dances, or herbal medicine. Dosages and diets are the same as those practiced for the funeral ceremony of Mavichicury. An evil was created in the form of a poison to kill humanity without exception, but fortunately, the remedies were also created. Yavina, the younger brother of Mavichicury, died from poisoning by the specialist of poisons called Tepatete, creator of evil and death.*[25] *Yavina created and introduced all remedies from wild plants and plants planted around the house, he created an antidote, an antivenom against snake bite, medicine against headaches and other pains. He also taught how to fight against evil, and how to avoid bad spirits, tigers and other spirits. He taught us how to pray for childbirth, so the children will develop normally; for food, to keep us healthy and have good teeth. This is why in the Vaupés we pray for all those who are born. It is a kind of vaccine. Otherwise, we would suffer from fever, headache and dental pain. Nowadays we still have drugs and some prayers. We hardly use antidotes, because venom is currently decreasing. The jungle is very nice, beloved by its owners, such as spirits, tigers, mosquitos, chameleons and many more. They produce evil for the human beings of the Vaupés. If it comes from another place, it could be that it does not do any harm to the person, but eventually something will happen. That is why Yavina left us a remedy and a prayer. The prayer has to contain a serious invocation regarding the person we pray for."*

Memory as a cultural claim allows to legitimize forms of decolonization of being and historical knowledge (Quijano, 2007). It is necessary to recognize and relearn the history of Native American cultures in order to reclaim their past, present and future. This is where education plays a fundamental role for the family, for the society, both local and global. It is the engine of cultural tradition, and each culture contains different models of knowledge transfer. Memory also has to be a strategy for strengthening social organizations and territorial defense.

24 *Carrizo* is an indigenous wind instrument used in traditional ceremonies and dances (A/N).
25 For further reading on religious thought of Vaupés Amazonian societies, see Goldman (2013) (Ed.).



26: *Traditional practices and medicines used by the Macaquiño traditional healers (Vaupés)*
A. Bejuco estrella (Aristolochia trilobata I (A. Durior)) used for cleaning eyes by healer Raúl Fernández, 68 years old.
B. Quartz and special maracas used in the past by the payés for the detection and cure of diseases.
C. Preparation of Virola theiodora, a potent psychoactive.
D. V. theiodora powder.
E. Preparation of Carayurú (Arrabidaea chica) used for self-protection and body painting.
F. Carayurú paste ready to be used.
G. Leaf of Erythroxylon coca var. ipadu.
H. Mambe: Erythroxylon coca var. ipadu powder.
I. Intercultural relationship, healing and knowledge transfer (Right: Traditional healer Rafael Fernández; left: Juana Isabela Beltrán Castro from Bogotá DC).
Source: Author's Archive

Ethnoecology as a Tool for the Memory Revival

According to Da Cruz (2007), ethnoecology is a science that comprises *"the interdisciplinary study of how nature is perceived by a particular group of people through a set of beliefs and knowledge, and how through these images such human groups use and manage their local natural resources".* Ethnoecology includes subdisciplines such as ethnobiology, ethnobotany, ethnozoology, ethnoentomology (Toledo, 1990), and more recent agroecology (Toledo & Barrera-Bassols, 2008). Ethnobotany is the part of ethnoecology concerning plants (Martin, 1995).

Local communities have a wealth of traditional knowledge (Alexiades, 1999); these include beliefs, traditions, and customs, as well as social aspects of modes of living, models of knowledge transfer, and social or community organizations, which are necessary for the survival of the people. In addition, they are key elements of their identity, autonomy and well-being. For many years, these values have contributed to the conservation of our landscapes, and drainage areas, and to extensive gene banks, as well as healthy food, and traditional medicine, which are essential for health and food security. Much knowledge and many practices have provided useful tools for the development of modern knowledge. Science should understand and recognize indigenous science. Modern ethnobotany allows an interconnection between the modern and rural and indigenous science, as well as the interaction of culture with local sustainable development.

Integrity of Knowledge? Intercultural Dialogues

The "knowledge dialogue" turns out to be an important intercultural tool (Zuluaga, 2006; Acosta *et al.,* 2007; Toledo, 2009; Pérez & Argueta, 2011) that allows people to get to know each other as human beings. In addition, it establishes a network of understanding, comprehension and interpretation of life, cosmology and socio-cultural changes in the world around us; to reflect and become conscious, discover needs, problems, strengths and solutions in everyday life. Thus, it generates alternatives and decisions which are projected into a common welfare in harmony with nature. In this way, the knowledge dialogue represents an intercultural, interethnic, and interdisciplinary core, as well as interinstitutional framework, which allows greater effectiveness in construction processes, as it takes into account memory as the basis of epistemological and cosmogonic freedom.

In this way, memory is imbued with the history of the earth and of organisms, and allows us to understand who we are, where we come from, what ecological role we fulfill and where we are going. In order to make appropriate decisions on the local and regional levels regarding different environmental, socio-cultural, economic and political aspects, the knowledge dialogues turn out to be an essential tool for reflection, awareness and coordination. Through memory and knowledge dialogue we rise to new global adaptations allowing a harmonic evolution and preservation of the human species and biota (Toledo, 2009). This is how the importance of knowledge dialogues as a tissue of local sustainable development is being highlighted.

From Local Sustainable Development to Well-being

Local sustainable development must be constituted through the knowledge dialogue and memory construction, as well as planning strategies that subtract the immediate social needs in sovereignty, food security, health, sanitation and well-being (Hourtart, 2010; Gudynas, 2011). Encouraging local development helps magnify the global development; it is the beginning of separating us from the dominant modern system that is situated in systemic crisis (Hourtart, 2010) and of guiding us toward integral local autonomous systems with multidimensional and sustainable ecological projections. Arguably, if there are efficient and sustainable local economies/exchanges, the global economy/exchange may be optimal and permanent.

Local sustainable development is an integral and holistic way, which aims at meeting the following objectives: **1)** the protection, restoration, and conservation of landscapes, knowledge, transfer models, and traditional practices; **2)** the proper management, use, and utilization of genetic resources, soils, and watersheds to establish a balance between territory-society; **3)** strengthening social aspects such as education, health, social/community organization, interculturally, policy, as well as the economy, favoring the common good over that of individuals; **4)** the proper investigation of life and territory within an integral context; **5)** the conceptual and methodological advancement of knowledge by technological tools; **6)** the creation and strengthening of economic and political models for local sustainable development. Moreover, objectives also include prioritizing use value over exchange value, and consolidating life plans and policies that allow welfare, authenticity and autonomy of communities and improve their well-being.

We conclude this contribution with a phrase that can guide us to well-being: *"Without nature, there is no culture, without culture, there is no society, and without society, there is no sustainable development or well-being."* This is the reason the revival of bio-socio-cultural memory of local communities plays a fundamental role in holistic learning about our past and present, and in adaptation to a self-sufficient and sustainable future.

Summary

Ethnoecology is the science that integrates various aspects of reality in different periods, world views and life projections. In the context of the Vaupés, ethnoecology is sought to be an innovative strategy for the revival of historical, biocultural and collective memory of the indigenous people. It integrates the knowledge of modern and traditional science, in order to achieve the self-sufficient and local sustainable development and well-being of indigenous communities and society in general. In addition, ethnoecology establishes a harmony of different natural, cultural, social, political, economic, and psychological dimensions by new strategies for strengthening the traditional knowledge and innovation of indigenous/modern science.

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4.2 PLANTS OF CENTRAL AMERICA

4.2.1 A Short Essay on Ethnobotany in Mexico and Central America

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Abstract

This paper deals with a brief historical sketch of ethnobotany and the use of some medicinal plants in Mexico, and in a broader sense, in so-called Mesoamerica and some areas of Central America (especially Guatemala and Belize). Particular attention is paid to the fact that ethnobotany is not only part of ethnoscience, but also of ecological anthropology and political economy, and it is also associated with multispecies ethnography, in which plants and other organisms (e.g. mushrooms) become equal subjects of anthropological research, like animals in human animal studies. The paper focuses primarily on Mexico, where ethnobotanical research has its roots in early colonial times. It outlines some aspects of similarly-focused researchers in Guatemala and Belize, which is primarily bound with different Mayan groups. In conclusion, it concentrates on a particular perspective that ethnobotanical and ethnopharmacological research offers in this area.

Keywords: Mexico, Mesoamerica, multispecies ethnography, peyote, mobile medicine

Introduction

The goals of ethnobotanical research vary in different national contexts (McClung de Tapia, 1990: 141). However, ethnobotanical studies undoubtedly occupy an important place in Mexican science (Gómez-Pompa, 1993: 87; García de Miguel, 2000; González Costilla, 1991, etc.). Ethnobotanical studies have also been more connected with *multispecies ethnography* in recent years, and have become part of it. If we accept the Tsing's notion that "human nature is an interspecies relationship", thus "plants must be key players, too", because "a new generation of ethnobotanists sees plants as social beings with agentive efficacy" (Kirksey & Helmreich, 2010: 553).

As plants are increasingly used in the pharmaceutical industry, genetics and other fields, some authors bring ethnobotany into the territory of political economy and political ecology (e.g. Hayden, 2003, in her study of bioprospecting in Mexico, or Escobar, 1999, in his study of techno-nature on the Colombian coast). Many Latin American countries such as Mexico, Guatemala, Peru, Bolivia, and Colombia are in this sense an ethnobotanical paradise, or laboratory, and some of them can be considered to be a sort of cradle of like-minded researchers.

Mexico

The origins of "ethnobotany"[26] and "scientific" interest in the plant kingdom are to be found in Mesoamerica (especially in central Mexico among the Nahua/Aztec-speaking

26 The North American botanist John William Harshberger (1869–1929) coined the term *ethnobotany* in 1895 to mean "the study of plants used by primitive people" (Balick & Cox, 1996).

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population) in association with the institution of the *tlamatine*[27], the scholar-philosopher, who on the basis of experiments examined the organic and inorganic natural world, i.e. rocks, trees, herbs, roots, etc (León-Portilla, 2002: 88).

We owe the first published scientific account of American plants to the Sevillian physician, botanist and father of the pharmacology Nicolás Monardes (1493–1588) who wrote the first treatise on medicinal plants of New Spain in three parts called *Medical study of the products imported from our West Indian possessions*[28] in 1564, 1569 and 1574. His work is notable for the fact that he did not go to New Spain (today's Mexico). He described the plants that came into his hands, and which he grew in a botanical garden, founded for this purpose. This work gave the first time description of allspice (*Pimenta officinalis*), sassafras (*Sassafras albidum*), and salsify (*Tragopogon porrifolius*), but probably the most famous plants described by Monardes are tobacco (*Nicotiana*), pineapple (*Ananas comosus*), guayaba (*Psidium guajava spp.*), and coca (*Erythroxylum coca*). Due to his excellent description of these new plant drugs, Monardes is considered to be one of the most famous pioneers of American pharmacognosy (Gómez-Pompa, 1993: 90).

Before Monardes, a scientific treatise appeared that way perhaps even more important and that dealt with the flora of the New World, especially Mexican. Its authors were two native (Mexican) *tlacuils*[29]: the native physician Martín de la Cruz and the translator Juan Badiano (1484–1560) and their joint Latin work called The *Libellus de Medicinalibus Indorum Herbis* ("Little Book of the Medicinal Herbs of the Indians"), which was published in 1552 and is now better known as the *Badianus manuscript* (or the *Codex Cruz-Badiano*, or the *Codex Barberini*[30]). The work of these scholars educated in the Real Colegio de la Santa Cruz de Tlatelolco[31] forever changed the world of pharmacy because it contained descriptions of 185 different American plants and of their therapeutic uses. The *Libellus* documents the encounter between indigenous Mesoamerican and European medicine. Although this pioneering work remained hidden in private European libraries into the 20th century[32], today it is the basis for the study of Mexican medicinal plants of the distant past and of the present as well. Contemporary medicine uses, for example, the plant called *cihuapahtli* (from *cihuatl* – woman, and *pahtli* – medicine), now known as *zoapatle*, which de la Cruz cites and mentions its effects of facilitating labour. A recent study conducted by Dr. José Luis Mateos from the Mexican Social Security Institute revealed that *zoapatle* contains a powerful oxytocic, which induces the contraction of the uterus. But it can be said that all the Mesoamerican wisdom contained in this codex was and is inherited by the Mexican organic chemists of this century, who have excelled in the international arena with their research on natural products.

In this historical review, I necessarily have to be mention one more important work, written by the famous Franciscan missionary Bernardino de Sahagún (1499–1590). In

27 Etymologically speaking, this is a derivative of the word *tlaiximatini*, which is a composite term meaning "one who knows right" (*-imatini*), face or nature (*ix-*), things (*tla-*). The opposite of this character is a fake doctor, magician (*nahual*) who deceives people and knows the harmful herbs, is a sorcerer divining from strings. (León-Portilla, 2002: 88–89) Thus the beginnings of the ethnobotany are linked with the duality of differentiating between knowledge based on experiment and method, and knowledge based on magic and spells.

28 The Spanish original *Historia medicinal de las cosas que se traen de nuestras Indias Occidentales*.

29 This word is derived from Nahuatl *tlacuihcuilō* or *tlahcuilō* meaning originally the "styling stone or wood" and later came to refer to what we now call the scribe, painter, writer or scholar.

30 This name comes from the Italian cardinal Francesco Barberini (1597–1679), who owned of the manuscript in the early 17th century.

31 This educational institute was founded by the learned Franciscan missionaries in 1533, and their pupils were mainly descendants of pre-colonial Aztec nobility.

32 This book, with highly developed artwork, appeared in the Vatican Library in 1925.

a twelve-volume monumental work known today as the *Florentine codex*[33] we also find a number of records on agriculture and botany of pre-Hispanic native cultures, although this work is aimed at a complete description of Aztec history and life (religion, philosophy, folklore, trade, etc.).

It is likely that these works influenced Emperor Felipe II to finance one of the most important botanical expeditions of the era: the expedition of Francisco Hernández de Toledo (1514–1587), a general protophysician of the Indies, Islands, Mainland and the Ocean. The expedition began in 1571, and its main objective was to write a natural history of New Spain and study indigenous medicine in all its aspects, and describe Hispanic culture, history and political conditions in the new territories (Somolinos, 1971; Lozoya, 1982). Hernández traveled for seven years collecting and classifying specimens, interviewing indigenous people through translators and conducting medical studies in many parts of Mexico, and he collected much ethnobotanical information. The final product of his work consisted of 22 beautiful hardcover books (Gómez Pompa, 1993: 91).[34]

The decline of the Spanish empire, which began in the 17th century, caused the next important stage in the evolution of Mexican botany in the late 19th century (1890), when the National Health Institute (*Instituto Médico Nacional*) was founded in order to study medicinal plants scientifically. The National Medical Institute started a herbarium that is the precursor of the current National Herbarium of Mexico. During its existence, the Institute was one of the most renowned scientific centers and one of the most notable biologists in the history of Mexico worked there. Alfonso Luis Herrera (1868–1942) published the *Latin American pharmacopoeia* (*Farmacopea latino-americana*) in 1921 containing all known information about medicinal plants, their use, chemical composition, dosage, etc.

Monardes' *Historia medicinal* and the *Libellus* are also ethnobotanical treasures with which today's professional scientists work intensively. However, until the 1970s, the botanical as well as anthropological literatures generally lack discussions concerning the definition and application of specific concepts of ethnobotany.[35] The strongest development of Mexican ethnobotany probably began with the publication of the *Exploración etnobotánica y su metodología* by Efraím Hernández Xolocotzi (1970). Although this work does not bring anything new in terms of defining ethnobotany, it differs from the previous ones. In order to introduce the reader to the use of plants for local farmers, the author tells a series of anecdotes collected at various locations in the Latin America. Unlike his predecessors, who tend to submit long lists of plants, Hernández's work is based on in-depth field research on the interaction between the local population and local plants.

Hernández X. is considered today as the founder of modern Mexican ethnobotany, which has its origin in the Commission for the Study of Dioscorea (*Comisión de Estudios sobre Dioscoreas*), whose administrator was Hernández X. The work of the Commission of Dioscorea has its most important antecedent in the book called *Southeast natural resources and their utilization* sponsored by the IMERNAR publisher under the supervision of Enrique Beltrán (Beltrán, 1959). In this work, Hernández X. describes the slash-and-burn system

33 The Florentine Codex was a 16th-century ethnographic research project in Mesoamerica by Franciscan friar Bernardino de Sahagún. Sahagún originally titled it: *La historia universal de las cosas de Nueva España* (The universal history of the things of New Spain). The final version of the Florentine Codex was completed in 1569 and this work is one of the most monumental works dealing with Indian culture. Sahagún is also considered by some authors as the pioneer of American anthropology (León-Portilla, 1999).

34 Parts of Francisco Hernández's extensive descriptions of his findings were published in a translated collection entitled *Plantas y animales de la Nueva España, y sus virtudes por Francisco Hernández, y de Latín en romance por Fr. Francisco Ximenez* (México, 1615). More details about the history of Hernández's works see Gómez Pompa (1993: 91–92).

35 One exception is Manuel Maldonado-Koerdell (1940), "who explicitly stressed the need for ethnobiological studies, which go beyond the classification of data in terms of western botanical or zoological nomenclature, to study biological elements as a function of human groups" (McClung de Tapia 1990: 142–143).

and considerable knowledge of Mayan peasants. This work laid the foundations of Mexico's current ethnobotanical and ethnoecological school.

Generally speaking, the growth of interest in ethnobotany coincides with the impact of ethnoscience[36], even though the ethnoscientific approach has never been popular among the Mexican scientists. Development of ethnobotany in the 70s was related to the general development of former Mexican society, which was based on social inequality. Thus, ethnobotanical researchers joined in the majority of current left-wing oriented politics of the *indigenism* (*indigenismo*) based mainly on the National Indigenous Institute (*Instituto Nacional Indigenista*, INI). Many anthropologists and sociologists carried out long-term field research for the INI, which enabled them to explore traditional native knowledge in its own cultural and historical context. This implies an emic approach which transcends the observation of biological phenomena, to include relevant aspects of social organization, socio-economic and political variables, belief systems and the articulation of the local population with national level society, among others (McClung de Tapia, 1990: 143–144).

If one of the objectives of ethnobotany is the research of plants for medicinal purposes, let's look briefly at the diseases from which Mexican Indians suffered. The sources I mentioned above contain information on these diseases: e.g., fevers, pulmonary tuberculosis, diarrhea, intestinal parasites, hemorrhoids, rheumatism, diseases of bones and joints (arthritis and gout), cough, hepatitis, deafness, skin problems (scabies, boils) and eye diseases (glaucoma, conjunctivitis and cataracts) seem to be the most frequently suffered ailments among the Aztecs. However, there is no record of devastating epidemic foci until the sixteenth century, when smallpox, measles, leprosy and typhus produce high mortality among Indians, as syphilis did among Europeans. Thus was forged the myth of genocide in Central Mexico, which evokes an indigenous expulsion from "Eden", coinciding with Spanish colonization (Treviño, 2000; Madaleno, 2007: 65; Carsi, 2008).

Regarding native (central Mexican) medicinal plants, some wild plants were used in both past and present, and are found in some ethnobotanical fieldworks, such as the *axihuitl* (*Eupatorium aschembornianum*) and *tequequetzal* (*Selaginella lepidophylla*) for treating urinary tract infections. The *axihuitl* is a traditional plant of Tepoztlan that is used to heal wounds of all kinds. It indicates that *axihuitl* is also used in gastrointestinal problems such as peptic ulcers, etc. (Madaleno, 2007, Miranda Lara, 2008). The *tequequetzal* has also been used as an herbal medicine. An infusion (tea) is made by steeping a tablespoon of dried material in hot water, and the tea is used as an antimicrobial in cases of colds and sore throat (Curtin & Moore, 1997).

A separate chapter of Mexican and Mesoamerican ethnobotany is the research on sacred hallucinogenic mushrooms, which in Mexico is associated primarily with the Mazatec Indians in Oaxaca. In 1936, North American linguist Robert J. Weitlaner (1883–1968) encountered magic mushrooms for the first time in the country of the Mazatecs in Oaxaca. "Papa Weitlaner" with his daughter Irmgard and his future son-in-law John Bassett Johnson (1915–1944) "became the first outsiders permitted to attend—though not participate in—an all-night curing ritual in which mushrooms were eaten" (Furst, 1976: 75). After returning from the field, only Johnson published a detailed study in 1939 for the Gothenburg Ethnographical Museum called *The elements of Mazatec witchcraft*. He "discovered" the practices of shamans or curers, who use mushrooms primarily for the purpose of divining the cause of an illness, and also confirmed that not just one but several kinds of intoxicating mushrooms were known to the Mazatecs (Johnson, 1939: 119–149).

In August 1938, a month after the Weitlaner-Johnson experience at Huautla de Jiménez, Richard Evans Schultes (1915–2001), considered the father of modern ethnobotany, and his

36 The basic objective of ethnoscience is to understand how people develop with different forms of knowledge and beliefs, and it focused on the ecological and historical contributions of people have been given. It is based on increased collaboration between social sciences and humanities (e.g., anthropology, sociology, psychology, and philosophy) with natural sciences such as biology, ecology, or medicine (Ingold 2000).

colleague Blas Pablo Reko received from Indian informants in the same village specimens of three different species they were told were revered by the people for their visionary properties. Schultes took careful notes of their morphology and in 1939 published the first scientific description of these mushrooms. In 1956, a distinguished French mycologist, Roger Heim, director of the Museum d'Histoire Naturelle in Paris, identified one as *Psilocybe caerulescens*, another was identified by Harvard mycologist Dr. David Under as *Panaeolus campanulatus*, subsequently redefined as *P. sphinctrinus*, and the third by Dr. Rolf Singer as *Stropharia (Psilocybe) cubensis*. Furst (1976: 76) stressed the most significant "psychotropic" impact for its relative cultivation on the domestic front.[37]

A wide range of ethnobotanical and ethnopharmacological research has long been carried out in northern Mexico and in the southwest of the United States. The studies have focused on at least two species or organisms, which have much broader geographic and "ethnocultural" overlap. Somehow, the native "king" among native cactuses in northwestern Mexico is undoubtedly peyote (from the Náhuatl *peyotl*), which is a small, spineless cactus (*Lophophora Williamsii*), which grows wild in the Rio Grande Valley, in the Chihuahuan desert and southward. From earliest recorded time, peyote/peyotl has been used by indigenous people, such as the North American Tonkawa, the Mescalero and Lipan Apache, who were the source or first practitioners of the peyote religion in the regions north of present-day Mexico (Opler, 1938; La Barre, 1960). They were also the principal group to introduce peyote to newly-arrived migrants, such as the Comanche and Kiowa from the Northern Plains. The religious, ceremonial, and healing uses of peyote may date back 2,000 years (Schultes 1938). The use of peyote for religious purposes is probably associated today with the Yutonahua Huichols who also associate with micro-cactus with their famous story of creation. However, they do not think that something is given once and for all, but view it as a process that must be continually renewed. The Huichols therefore set out each year for a journey to the mythical land, Wiricuta, lying in the desert region of San Luis Potosí in Central Mexico, where they enter through the gate to the sacred place where peyote grows more (Pinkson, 1998). As one Huichol *mara'akame*[38] says: "Peyote is everything, it is the crossing of the souls, it is everything. Without peyote nothing would exist" (Schaefer & Furst, 1997: 52–53).

The second organism that is in the environment of northern Mexican Indians and that is associated with shamanic ecstasy, is the fly agaric (*Amanita muscaria*), which occurs in the vast territory from Siberia[39] to Australia, New Zealand, South Africa, South America, etc. One of the cardinal questions of Mesoamerican ethnobotany remains whether the fly agaric was a sacred mushroom for the Maya people. It seems that the K'iche'-Maya of the Guatemalan highlands are evidently well aware that *A. muscaria* is no ordinary mushroom, as it relates to the supernatural, given that they named it *cakuljd ikox* (*cakuljd* = lightning, *ikox* = mushroom) (Lowy, 1974: 188–191). *A. muscaria* is thus related to the K'iche'-Maya Lord of Lightning, *Rajaw Cakuljd*, who also directs the dwarflike rain bringers, formerly called chacs, but now Christianized as *angelitos*, little angels (Furst, 1976: 74).

37 In the Czech Republic this mushroom, which is also found in some areas of Amazonia, is known as the *lysohlávka kubánská* or also the *límcovka kubánská* and its cultivation is still illegal. More details about the ethnobotany of the Mazatecs, see chapter 4.2.2.

38 The Huichol term for shaman meaning both curing, singing shaman and sacrificing priest (Furst 1976: 100).

39 *Amanita muscaria* was widely used as an entheogen ("generating the divine within") by many of the indigenous people of Siberia. In western Siberia, the use of *A. muscaria* was restricted to shamans, who used it as an alternative method of achieving a trance state. In eastern Siberia, *A. muscaria* was used by both shamans and laypeople alike, and was used recreationally as well as religiously(Nyberg, 1992: 71–80).

Central America

To investigate the biological and cultural diversity of Central American countries (Guatemala, Belize, Honduras, El Salvador, Nicaragua and Costa Rica), ethnobotanical surveys were conducted, e.g. in Guatemala detecting about 700 plants of medicinal use. Although, there have been several initiatives to systematize the ethnobotanical knowledge of Guatemala in the past, only the Centro Mesoamericano de Estudios sobre Tecnología Apropiada (CEMAT) carried out an extensive project from 1976 to 1988 to study the systematic use of medicinal plants for agricultural and therapeutic purposes (Cáceres & Girón, 2002: 42). Mayan regions of highland Guatemala are a great place for ethnographic research for mobile medicine. Maya mobile medicine occupies an interstitial space; opposite (or beside) "traditional" indigenous Maya healing and "modern" Western biomedicine, where it neither seeks authorization nor legitimacy from either, but has fashioned a space between them. The mobile medical illustrations analyzed in this investigation show a remarkably consistent structure (vis-a-vis constituent parts) across disparate health care salespeople, languages, products, and contexts. All events begin with a quiz, whereby the health care salesperson holds up each local plant on display and asks onlookers for its name and natural habitat. In addition to engaging the audience, this affirms onlookers' own Maya botanical and pharmacological knowledge, locating the source of natural medicines within the "local" and the "known". Following these engaging exchanges, a metonymic device is introduced, which will stand in during the medical demonstration as a metaphorical surrogate for the human body (Harvey, 2011: 51–58).

As in Guatemala, ethnobotanical research in neighboring Belize is mainly connected with the knowledge of the Mayan Indians. However, unlike Guatemala, we have at our disposal archaeological rather than ethnographic data – e.g. a diversity of tree species used for daily household needs was found in the archaeological reserve El Pilar in "forest gardens" in northeast Belize, etc. (Ross, 2011: 75).

The region known today as Mesoamerica or part of Central America (which includes Central and Southern Mexico, Guatemala, Belize, El Salvador, Honduras, northern Nicaragua and north-western Costa Rica), has been the source of genetic resources in modern agriculture for many fruits and vegetables (Hoyt 1992). Seeds have been found for many species of squash and pumpkins 6,000 years BC in ancient settlements of Mesoamerica. These seeds provide a somewhat conserved history of agriculture and the development of cultures in the New World (Cutler & Whitaker, 1967). For example, research shows that seeds of *Cucurbita pepo* (Cucurbitaceae) were consumed with sugar obtained from the action of an enzyme. The food called "Fricassee" is still consumed by natives in Mexico and Guatemala, with the only difference that sugar is now obtained from sugar cane (*Saccharum officinarum*), a well-known plant, which was introduced from New Guinea (Davidse *et al.*, 1994), by the Spanish colonizers (MacVean & Pöll, 2002: 225–226).

Conclusion

Ethnobotanical research is now an integral part of a series of ethnographic researches and has a broad social and cultural outreach. In this brief conclusion, I will focus on at least two of them: firstly, the use of plants may be of considerable emancipative importance in some areas of Latin America (Southern Mexico, Mayan areas of Guatemala, native areas of Ecuador, Peru or Bolivia, etc.); and secondly, cognitive research studies once again are at the foreground, for example, the relationship between individual tastes, cognition and illness experience.

The knowledge of the properties of herbs and of ancestral indigenous medicinal practices was more common in antiquity, and today are the privilege of women therapists. It seems that the study of the relationship between man and plants offers a wide scope, especially in Mexico, and perhaps even more so in Guatemala in areas with denser Mayan settlement. Harvey's recent study about mobile medicine in the highlands of Guatemala (2011) opened

the way for future research. This can be viewed not only as an attempt to draw attention to "the existence of 'other' public health modalities, suggesting that not only in Guatemala but globally what is needed is a reconsideration of the very nature of what constitutes public health, access to health care, and who gets to define them", but also as a certain contribution to the study of women's ethno-emancipation movements in part of the Latin American subcontinent. Hovewer, this was not the primary intention of Harvey, to get the knowledge of the native medicine ("ethnobotany", "ethnopharmacology", etc.) to outsiders often through aboriginal women who are becoming more of a part of official medicine.[40]

With respect to research on human cognition, taste and experience with illness, David Casagrande examined these issues among the Chiapas Tzeltals in Southern Mexico. Casagrande focused primarily on bitterness and found that this "was probably not correlated with any particular class of illnesses because there is not enough resolution in human taste to discriminate the diversity of chemicals that taste bitter". Casagrande's hypothesis is based on the *prototype theory*[41] which verifies that the role of taste is more likely mnemonic and that this theory "may offer a way to understand how human cognition and communication function in attempts to reduce informational complexity and reconcile the very different domains of plant classification and illness experiences." (Casagrande, 2000: 66) However, as was already stated above, the greatest prospect of future researches will be multispecies ethnography oriented research.

Summary

Firstly, this article engages in a brief outline of ethnobotanical studies, including the current context of multispecies ethnography. It mostly deals with the historical development of this research in Mexico starting from the institution of the *tlamatine*, then through the research of scholars of the 16th century (Monardes, Hernández de Toledo, and the others) up to the modern ethnobotanists (e.g., Opler, Schultes, Furst, Pinkson, etc.). The next section is devoted selectively to certain aspects of ethnobotany and ethnopharmacology, especially in Guatemala and Belize. In conclusion, I point out some future research prospects in the field of ethnobotany, focusing among others on emancipation movements in the context of gender studies and on the use of some cognitive methods.

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40 In my latest field research in Guatemala in 2005, I visited several times the pharmacy with many native remedies, owned by the winner of the Nobel Peace Prize (the K'iche' Indian woman Rigoberta Menchú Tum) which is located on a busy square of the Guatemalan capital (Ciudad de Guatemala). Besides this official pharmacy, Mayan women sell their products made from plants to markets (*tianguis*) in many Guatemalan and Southern Mexican towns and villages.

41 Prototype theory is a mode of graded categorization in cognitive science, where some members of a category are more central than others (Rosch, 1973).

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4.2.2 Sacred Journey into the Presence of God. Ritual Use of Sacred Mushrooms among the Mazatecs of Oaxaca, Mexico

Minero Ortega, F.

Abstract

This chapter attempts to demonstrate why some Mazatecs of Oaxaca in southern Mexico practice nightly healing rituals during which they eat *Psilocybe* mushrooms to experience a "sacred journey". It aims to explain the ritual process and the aspects of ensuring its effectiveness. In addition, the chapter describes how, by means of the "sacred journey", the Mazatecs gain the knowledge necessary to resolve their health-disease or spiritual conflicts.

Keywords: shamanism, entheogens, healing rituals, treatment

Introduction

The Mazatecs are indigenous people who live in the Sierra Madre Oriental in the northern state of Oaxaca. Their territory is known as the Sierra Mazateca.[42] Mazatec people use several varieties of "sacred mushrooms" (*Psilocybe* spp.) for ritual and therapeutic purposes. The ritual is known as "velada" (night vigil) and it is performed by a *chota chinée* in Mazatec language, in Spanish "gente de conocimiento" (wise men) or "sabio" (a wise one).[43]

To understand the process of healing with "sacred mushrooms", it should be noted that night vigils or "veladas" constitute a central part of the worldview and religious life of these people. According to the Mazatecs, the universe is made of a duality containing a physical dimension, what we see, and we can touch, which is named *Je'so'nde*, this world, and a part that we cannot touch or see with the naked eye, known as *Ri' ingo so'nde* or other world. They also consider that a human being is composed of two parts: the physical body called *yao' na*, my body, and *sen,* image or spirit, which is called *sen'na*, my spirit, and *sen'ni chin Na*, the spirit that God gave us. They also distinguish between the corporeal and spiritual aspects of disease. The latter is more complex, since an emotional imbalance or a difficult problem can be considered as a disease, i.e. anything that threatens the physical and emotional stability of a person (Incháusetgui, 1994; Minero, 2012; Perez, 2006).

Mazatecs consider *sen* as the subtle part of a person, which has the power to come out of their body, leave it and travel while asleep. It is also possible to provoke this detachment during the "sacred journey" by ingesting *Psilocybe* or other entheogens.[44] It is with this notion where the healing power of the ceremony lies. If we conceive that human being has a spirit with the ability to move freely outside the body, then the "sacred journey" can be successfully carried out or how they perceive it: "you can stand before the sacred presence of God".

In order to develop this research, the ethnographic method was applied, during several periods of fieldwork between 2007 and 2012 in the Huautla de Jiménez municipality and its communities. A number of other municipalities were also included, e.g. Santa María Chilchotla, San Antonio Eloxochitlán, San Miguel Huautepec and San José Tenango, mostly belonging to the Mazateca Alta.

42 The Sierra Mazateca is divided into three areas: "Mazateca Alta" and "Mazateca Media" in the Sierra Madre Oriental and "Mazateca Baja" in the Tuxtepec valley and the lake area of Miguel Alemán Dam in southern Mexico.

43 The *chota chinée* are male and female, but in this chapter I speak generally of wise men. The generic term is *chota chinée* (wise men and women) (A/N). However, the most famous Mazatec *chota chinée* was a woman, María Sabina. For further reading on her healing practices, see Horák (2006) (Ed.).

44 *En·theo·gen* (god within; god- or spirit-facilitating) a psychoactive sacramental; a plant or chemical substance taken to occasion primary religious experience (Ruck *et al.,* 1979: 145–6).

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There were various techniques applied, e.g. participant observation, in-depth interviews and life stories, when it was possible to attend the velada. This research was also made possible thanks to the long-term cooperation of many participants: the *chota chinée* (wise men), their family members and persons who participated in veladas and ingested "sacred mushrooms". After the ethnography was completed, the information was classified and analyzed using a qualitative approach to achieve the description and interpretation of "sacred mushrooms" consumption during night vigils.

Velada and Healing

Night vigils (*veladas*) and "sacred mushrooms" form a fundamental aspect of Mazatec culture and identity, and they are considered to effective to treat serious diseases that have not been cured with allopathic medicine;[45] to trace missing persons or objects; to inquire into peoples' future with the aim of changing their destiny, or as the Mazatecs say, "to straighten the fate"; and learning how to solve difficult problems (Boege, 1988; Flores, 2003; Hernández, 1998; Minero, 2012).

In order to perform the ceremony, it is necessary that a *chota chinée* determine it the nature of the case merits it. Within the Mazatec cultural tradition, mushrooms are neither ingested for recreation nor for curiosity. They do so exclusively in cases of extreme necessity and nightly rituals under the supervision of the *chota chinée* (Fig. 27).

One of the main functions of the velada is to meet the goals set in the beginning, i.e. to achieve the knowledge necessary to resolve the conflict. This is attained through the ingestion of "sacred mushrooms" and experiencing an ecstatic trance or "sacred journey" that for the Mazatecs connotes a "sacred journey to the path of God" or "to stand before the sacred presence of God symbolically" (Minero, 2012).

The ritual process to perform a night vigil consists of three stages: one that precedes the ceremony, called purification, the velada itself, and a later stage that involves certain restrictions. In general, all night vigils share a particular structure: initiation, development and completion (Minero, 2012). However, the events that arise during their development are very different from one another, since each ritual is performed for various reasons. On the following pages, I will unfold the stages of purification, night vigil and restrictions.

Purification

The Mazatecs who wish to have access to the velada and communicate with God must obey certain rules and principles. They must be purified physically and spiritually, i.e. to liberate their thoughts of all prejudice, remove all physical and symbolic burdens (*carga*) to be able to "travel" freely, without any bounds or fears.

Sexual abstinence is a primary requirement. When the "sacred mushrooms" are ingested for the first time or the case is severe, it must be followed for fifty-two days prior to the velada. However, if it is for the second or third occasion, only four days are necessary (Inchaustegui, 1994; Hernández, 1998; Minero, 2012).

Another requirement is a diet in which one avoids eating black beans. Because the color blocks the desired illumination; spicy or irritant foods; red meats, especially pork; eggs, since sometimes they are used as offerings, for cleansing (*limpia*) or egg reading (*lectura de de huevo*), which is a way of divination. Finally, one should not drink alcohol or coffee. Likewise, on the day of the velada, a person has fast in order to be allowed to ingest "sacred mushrooms" and so that they can take effect more rapidly.

45 Allopathic medicine and allopathy are terms coined in the early 19th century by Samuel Hahnemann, the founder of homeopathy, as a synonym for mainstream medicine (Whorton, 2004: 18) (Ed.).

27: *Chjon chinée, wise woman in front of her altar before the velada*
Source: Minero, F. 2010

Velada

The ritual process of the velada begins from the moment in which the participants enter house of the *chota chinée*. While waiting for the opening of the ceremony, the *chota chinée* talks with participants and advises them not to be afraid of asking questions for clarification. The *chota chinée* also gives them the full confidence that he will guide them and help them during the ritual and healing process.

The nightly ritual is formally started when the *chota chinée* lights the fire in his incense burner and in which he puts a piece of copal. With this act, he engages in communication with God, invokes him and asks for the permission to carry out the work, supplicates help for the healer and participants, raises the problem that has brought them together and explains his intended objectives for the ritual (Estrada, 1986; Minero, 2012; Wasson, 1983). Then, he turns off the electric light in the room, leaving only the candle lit altar. Then the *chota chinée* assigns each person with a single ration of "sacred mushrooms" according to their physical and spiritual characteristics (Fig. 28).

When the ingestion is finished, the *chota chinée* smudges participants, spreads fresh "San Pedro"[46] in the form of a cross on the joints of their hands, behind the knees, on their ankles, navel and back. Finally, he appeals to them to strike up their own conversation with God, to explain him their problems to him and ask for the help.

In this first stage of the ritual, after the ingestion, petitions are carried out to God, to the beings of nature, to the Catholic saints, to the spirits of deceased relatives and *chota chinée*. Personal communication with God must be established, as well as the reason for the ceremony and its objectives must be clear from the beginning. After this, the *chota chinée* turns off the candle light (*veladora*) with a flower from his altar. From this moment, everything is left in total darkness (Estrada, 1986; Hernández, 1998; Minero, 2012).

28: *Psilocybe caerulescens var. mazatecorum. The Mazatecs affectionately call them "holy children" (niños santos).*
Source: Minero, 2010

46 "San Pedro" is a mixture of tobacco (*Nicotiana rustica*), lime and garlic, which serves as a protective amulet.

Then the *chota chinée* begins to pray Catholic prayers to intercede before God for the participants; but they must also pray, if they have ingested "sacred mushrooms". Those who accompany them must pray as well, even if they have not eaten mushrooms, because they are precisely there to help in the healing process of the patient.

Once the *chota chinée* has agreed to the "sacred journey" through the ingestion of "sacred mushrooms", he begins to check the patient's body to locate the disease; when he finds a problem area in the body, he gives a massage, symbolically removes the disease and ejects it out the door. Only in severe cases does the *chota chinée* ask for assistance from the companions. As soon as the occasion calls for it, he performs the cleansing of the patient with some flowers from the altar (Fig. 29).

It is worth mentioning that everything performed during the ritual and healing process of the velada is indicated by God during the "sacred journey", and the same is true regarding what has to be undertaken to restore the balance of the patients. The Mazatecs consider that if you do not carry out the orders, it is as if you were playing with God and the mushrooms. Then the entire ceremony will be in vain, and there will be no beneficial results. In the worst case, it could be counterproductive.

During the "sacred journey", it is sometimes indicated that it is necessary to visit an allopathic physician or that a surgical intervention should be performed. Other times, in the most drastic cases, God indicates during the "sacred journey" that the patient will die, and the only thing that remains to do is to wait for death.

It is essential to highlight the work of the *chota chinée*, since he or she can "rub", "suck" or remove the evil; this is why, during the ceremony, they put into practice their knowledge and skills to cure and remedy the ills that affect their patients (Cortés, 1986; Minero, 2012; Villanueva, 2007; Zolla, 1994).

The *chota chinée* regularly ingests "sacred mushrooms" together with a sick person. So they are both "traveling" to the "other world", where the past, present and future meet; he ascends into heaven or descends into hell to investigate their doubts and diseases (Eliade, 1960). At other times, it is only the patient who chooses to ingest them, and the *chota chinée* guides them through the ceremony and their journey; on other occasions, only the *chota chinée* does so and indicates the events of their journey to them.

In this regard, I have obtained very interesting testimonies, e.g. from one woman, a resident of the Río Santiago community in the Huautla de Jiménez municipality, who told me that she was very sick, and her body was paralyzed. In order to help her, they organized a velada, but she was unable to swallow the mushrooms because her body did not respond. The *chota chinée* recommended putting them in a little aguardiente and then placed them with a handkerchief upon the temples of the sick. According to the informant, the "sacred mushrooms" entered her body, and she started to feel the effect. In this way she managed to see the causes and origins of her disease.

I also obtained several testimonies about distant healing practices, in which the patient is unable to be present at the ceremony; in this case a garment of the patient, or a picture or some other personal object, is requested. The name of the person is pronounced and interceded for in the "other world", to get God to rid the person of the disease. This is precisely due to the concept of person, in which personal objects, e.g. photos, contain or absorb the vital substance of human beings (Fagetti, 2007; Minero, 2012).

In some ceremonies performed in more severe cases, singing, percussion and dance occur spontaneously. During the "sacred journey", the *chota chinée* performs a song that is almost always accompanied by percussion made with his body. These sounds are sometimes dynamic.

When the velada is developed, and all the actions indicated during the "sacred journey" are completed, the intensity and rhythm of the ceremony gradually slows down and both the participants and the *chota chinée* experience some lethargy. Participants note that their perception is changing and slowly returning to their ordinary state of consciousness.

Sometimes the *chota chinée* performs patient cleansing, on other occasions, he or she smears them with a little bit of fresh tobacco (*Nicotiana rustica*) on the joints. Other times he gives them tobacco to smoke or sprays water on their faces (*soplar*). All of this aims to return their spirit from the places that they have visited during the "sacred journey". Finally, the *chota chinée* tells them that they must rest and encourages them to pay attention to their dreams. Once the rest of the night or early morning has elapsed, they discuss their dreams, because they think that they have something to learn from them.

The following morning, the participants of the velada meet in front of the altar, and they are asked what they dreamed of while asleep. Answering helps them interpret their dreams; in the case of a negative omen, the *chota chinée* proceeds to perform cleansing, or readings of an egg, copal or pure beeswax candles, to each participant, or to the sick. After the specialized reading, using any of these methods of divination, he or she makes a San Pedro amulet and gives it to each of them; he or gives instructions for each case.

29: *Altar with some ritual objects: San Pedro, chicken eggs, beeswax candles, cocoa, copal*
Source: Minero, 2010

Subsequent Restrictions

After completing the first velada, changes or restrictions in social behavior are required. One of these includes four days of sexual abstinence after the night vigil. The family members of the patient must also comply with this rule. Otherwise, it may hinder the healing process.

Another restriction is to avoid leaving the house or to do so only if it is very necessary. The Mazatecs believe that once the "sacred mushrooms" enter the body, they remain inside for four more days. Thus, the spirit is still weak or sometimes it finishes assimilating what

has happened during the "sacred journey". It can also suffer from shock or fear (*susto*). Therefore, the spirit might leave the body, leaving the person unprotected (Minero, 2012).

In severe cases or if necessary, more ceremonies are performed (Fig. 30). Under such circumstances, we are talking of a long-term ritual and healing process in order to heal the sick in a kind of treatment with its respective instructions that must be fulfilled precisely. Sometimes more ceremonies are performed because there were no answers to what the person wanted to learn during the first session, and it is necessary to delve into further investigation. However, all of this depends on the particular case.[47]

30: *Wise woman and patient after the velada performing a strenghtening ritual at the Cerro de la Adoración (Nindó Tocoxo)*

Source: Minero, 2010

47 For further reading on traditional indigenous medicine of the Mazatecs in Spanish, see Biblioteca Digital de la Medicina Tradicional Mexicana (2009).

Conclusions

The sacred character ascribed to *Psilocybe* mushrooms by the Mazatecs demonstrates the great difference in the meaning of consumption by people according to their culture, universe of symbols and meanings shared by group members. We must also consider that there are people who even when they are attached to the local culture, do not share the same meanings, ideas and religious beliefs.

Finally, it is for this reason that the entheogenic experience of the Mazatecs is not comparable with what individuals from other cultures may experience. It is during the "sacred journey" when the difference between various notions of "sacred mushrooms" consumption becomes more noticeable.

Derived from all this, many people are unaware that the ritual process of the velada is approximately nine days long: four days prior to the session, then the day of the first ingestion, and then four days after the night vigil. This is one of the essential characteristics of the therapeutic process that is divided into the three phases mentioned above: purification, the velada and further restrictions. However, the majority of foreigners that arrive to undergo this experience practice only the night vigil. Those who meet all the requirements of the ritual find it easier to have access to the "sacred journey", and communicate with God. They will also gain the knowledge they seek by ingesting the sacred substance.

In the same way, I think that the Mazatecs's perception of the "sacred mushrooms" and their ritual framework are something that most of people outside their culture are unable to share and much less understand. Despite the enigmatic nature of this experience, most scholars in the social sciences and humanities seek to understand this kind of practice, which they refer to as subjectivity, holiness and imagination. We could find explanations for many issues that are in the focus of anthropological inquiries.

Summary

The Mazatecs strongly believe that the ingestion of "sacred mushrooms" favors a journey to the presence of God and that it is He who sets out the knowledge necessary to resolve their conflicts and diseases. During the "sacred journey", the stimulus-response relation is not only caused by ingestion of mushrooms, but all the elements that constitute the velada play an important role; and what happens affects both the change in the perception of reality and the modification of bodily behavior. At the same time, it is the primary role of the *chota chinée* to assist the patient in the search for answers and to interpret the "sacred journey" successfully.

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4.3 PLANTS OF NORTH AMERICA

4.3.1 Sacred Plants of Native North America

Horák, M.

Abstract

In this chapter, the use of some plants for spiritual and ceremonial purposes by the Native North Americans is described. The geographic context is continental North America north of the Rio Grande River. The chapter is divided into an introduction containing broader information about traditional ceremonies, followed by the characteristics of sacred plants. Finally, the chapter concludes with a summary and discussion.

Keywords: sacred plants, North America, indigenous people, First Nations

Introduction

Various plants are used by the indigenous cultures of North America for ceremonial, ritual and usually also medicinal purposes. Basically, four of them are considered sacred: sweet grass, tobacco, cedar and sage, each one representing a part of the so-called "medicine wheel". According to Dapice (2006), the "medicine wheel" also symbolizes the stages of life (birth, youth, adult, death), seasons of the year, elements of nature (fire, air, water, and earth), totem animals (eagle, bear, wolf, buffalo), four parts of a person (physical, mental, emotional and spiritual), and four directions.

The medicine wheel embodies sweet grass, which is connected to the North and it is used by indigenous people for ritual cleansing. Tobacco is considered sacred by the most First Nations peoples.[48] It represents the East, and it is used for the offering of the Pipe to the four directions, e.g. during Lakota traditional ceremonies (P. B. Steinmetz, 1990). Cedar, the South, is commonly used for purification. In the form of tea, it also serves as a source of vitamin C found in the needles and bark of the tree. Sage, the West, has been used for preventing infections because of its strong antibacterial qualities (Tilford, 1997: 128), as a treatment for headache (Kay, 1996: 106) or as a foot deodorant (Camazine & Bye, 1980). The Cahuilla, Costanoan, Diegeño, Kawaiisu, and Maidu tribes of California used sage seeds to clean and heal their eyes (Beck & Strike, 1994). There are also two other plants that are important from the religious point of view discussed below, creosote bush and peyote.

The previously mentioned plants are used traditionally during ceremonies for smudging, healing circles, sweat lodges, and pipe ceremonies. Of course, each tribe has its own distinct practices and ceremonial protocols. Religious ceremonies usually contain healing features as well. The healing arts are holistic, and they integrate practices such as traditional ceremonies, rituals and herbal medicines focusing on the whole person – the body, mind and spirit (Horn & Horn, 2000).

In a ceremony called smudging, traditional healers using firing techniques, may burn herbs in an abalone shell to purify people and places. The most common herb used in smudging is white sage (*Salvia apiana*), but cedar and sweet grass are used as well. The shell represents water, the first of four elements of life. During the ceremony, people put their hands in the smoke and carry it to their body, especially to areas that need healing (Struthers, Eschiti & Patchell, 2004).

Healing circles are similar in their form similar to group therapeutic sessions common in psychotherapy, and are deeply rooted in the traditional practices of indigenous people, most notably among the Ojibwe and Lakota in Canada. Frequently used at gatherings, healing circles allow participants to speak to their community and to heal their physical, emotional and spiritual wounds. A symbolic object, often an eagle feather, may be given to

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a person who wishes to speak, and then it is passed around the circle in sequence to others who wish to speak. Currently, healing circles are used as part of complementary therapies, e.g. for people living with HIV or cancer (Rutledge & Walker, 2012).

Bucko (1999) provides one of the most comprehensive books on the ritual of the sweat lodge, first reported in the seventeenth century. Sweat lodges have been reported on Huron archeological sites. Similar structures have been identified at other historic and prehistoric Iroquoian sites. These findings suggest the considerable antiquity and cultural importance of this practice. The distribution of sweat lodges is Pan-American (MacDonald 1978).

Paul Kirchoff, a German anthropologist most noted for defining and elaborating the culture area of Mesoamerica, a term he coined, also documented another type of sweat lodge, *temazcal*, which originated among pre-hispanic indigenous people in Mesoamerica (Tonatiuh & Contreras, 2001). However, profound ethnohistorical accounts, while available, are circumspect and scarce.

Historically, the sweat lodge was a place of spiritual encounter, including prayer, healing and seeking spiritual guidance and power. Of course, on the physical level, its primary function was purification (Stebbins, 2013: 163–165; Steinmetz, 1984: 47).

In recent decades, the sweat lodge, especially its Sioux version called *inip*, became popular among non-native inhabitants of the American West (Weil 1982). Various authors report on transpersonal experiences induced by sweat lodges among non-native practitioners (Bruchac, 1993; Hibbard, 2007; Paper, 2012). For a personal experience from ethnomedicinal point of view, see Aung (2006).

Another important native tradition is represented by the pipe ceremony, which plays a key role in the spiritual and social life of many indigenous tribes. The use of pipes and tobacco by the natives of North America has been the focus of numerous studies by archaeologists and ethnographers. Mitchem (1991) provides a brief history of tobacco grown by many Native Americans who otherwise did no gardening.[49] Historically, mythology and symbolism of the sacred pipe are included in a comprehensive work by Paper (1988).

According to Winter (2000) tobacco has been used as an offering in prayers, as a sacred marker to keep evil spirits away, and as a purification agent in healing. Watts (2001: 37) reports on smoking tobacco in a sacred pipe ceremony as part of the sweat lodge. Steinmetz (1990: 55) provides a profound religious study of the sacred pipe ceremony among the Ogalala Lakota. Waldram (1997) focuses on the role of the pipe in symbolic healing and seeking a way to regain and promote the heritage and identity of indigenous people.

There are also many other traditional herbs with no mind-altering effects smoked in a pipe instead of tobacco or as mixtures, e.g. bayberry (*Myrica cerifera*), bearberry (*Arctostaphylos uva-ursi*), mugwort (*Artemisia Vulgaris*), and many other plants indigenous to the local area. For example, Moerman (1986) documented the use of the inner bark of redosier dogwood (*Cornus sericea* L. ssp. *sericea*) among the Apache, Cheyenne, Dakota, Montana Indians, Ojibwa, Potawatomi, Omaha, Ponca, and Thompson.

Characteristics of Sacred Plants

Tobacco

Tobacco (*Nicotiana* sp.) is a tall perennial herbaceous flowering plant that belongs to the Solanaceae or nightshade family. There are more than 70 species of tobacco, but only

48 "First Nations", most often used in the plural, has come into general use replacing the deprecated term "Indians" for the indigenous people of the Americas. A more recent trend is for members of various nations to refer to themselves by their tribal or national identity only, e.g. Mi'kmaq, Potawatomi, Ojibwe etc. (Moerman, 2009).

two tobacco species are used to obtain the raw material for tobacco products (cigars, cigarettes, snuff, snus, pipe tobacco etc.), *Nicotiana tabacum* L. and *Nicotiana rustica*.

Euro-American domestic tobacco is derived from *N. tabacum*, which originated in the Caribbean; it is the most important tobacco species in modern agriculture and international trade. It is the world's most widely-cultivated non-food crop and its performance under different soil and climate conditions meets the demand in many markets (Winter, 2000: 93).

In Eastern and Central North America, the native tobacco is *N. rustica* (Paper, 2007). This tobacco species is used widely since the 16th century. Ironically, northern First Nations were introduced to tobacco, not by their southern neighbours, where *N. rustica* originated, but through trade with Europeans (Collishaw, 2009).

There is a written record that Spanish colonists in the late 1400s and early 1500s encountered the Taino, Maya and other local tribes growing it. Nowadays, tobacco is still cultivated by indigenous people in South America and in the southern part of North America, the Caribbean, southern Arizona, and South Texas (Winter, 2000: 93).

Chemical analysis of residue extracted from stone pipes and pipe fragments excavated at sites in the South Pacific Northwest Coast of North America demonstrate that hunter-gatherers smoked tobacco by at least AD 860 (Tushingham *et al.*, 2013).

The tobacco plant, Nicotiana, shares its name with the chemical compound nicotine derived from the name given to tobacco by Jean Nicot de Villemain, who in 1560 brought its seeds and leaves as a "wonder drug" to the French court.[50] The plant was first considered decorative, and then as a cure for migraines and other diseases. Finally, it became a common snuff used by the rich. The 19th century was the age of the cigar, and the 20th century saw the rise of the manufactured cigarette.

The real danger of tobacco did not become clear until it was separated from its religious roots and linked to the secular world of commercial exploitation. However, religious proscriptions did not prevent recreational use. Native people currently suffer the ensuing morbidity and mortality produced by consumption of commercial tobacco which represents "everything that is wrong with Euro-American culture, including greed, dishonesty, theft, drug addiction, and a hedonistic value system at its worst." (Winter, 2000: 368)

Cedar

Cedar is a species in the genus *Thuja*, in the family Cupressaceae. It is one of the most important Native American ceremonial plants, used by many tribes (e.g. Mi'kmaq, Potawatomi, Makah, and Cheyene) as an incense and aromatic detoxifier (Gilmore, 1991; Hart & Moore, 1992; Tallbull, 1993).

There is some potential confusion here about the terms used to name plants, mainly because in some areas, junipers are known as "cedar" – as in the case of desert white cedar (*Juniperus monosperina*). Altough *J. monosperina* was also used as a cleansing herb, in the Eastern U.S. it was its relative, Eastern red cedar (*J. virginiana*), which was used ceremonially (Geniusz, 2009).

Another species (*Thuja plicata*), also known as Western red cedar, or Californian incense cedar (*Libocedrus descurrens*), was used in smudging ceremonies in spite of juniper varieties (Densmore, 1974).

Cedar plays an integral role in the spiritual beliefs of First Nations in the Pacific Northwest, where people burn it for purification in much the same way as sage (see below). Salish and Tlingit shamans in British Colombia often had cedar "spirit assistants" and "guard figures" to protect them, and the trees were honoured with offerings and prayer (Stewart, 1995:84).

49 "Catlinite pipes and other red stone pipes have been found in Andena perior sites dating more than 3000 years old (Sigstad, 1973)."

Rhind (2013: 192) reported on the possible analgesic and anti-inflammatory properties of yellow cedar (*Thuja occidentalis),* useful for muscular and joint pain, and frequently applied as dressing for wounds.

The essential oil from *J. virginiana* is antiseptic, expectorant and mucolytic. Nowadays, it is widely used in the fragrance industry – this is also the reason why Virginian cedar crossed cultures and transcended time, with as much relevance as in ancient Egypt (Ibid.).

Sage

True sages are in the genus of *Salvia*, which includes *Salvia officinalis* (garden sage) and *Salvia apiana* (white sage), also called California white sage or sacred sage. Salvia varieties have long been acknowledged as healing herbs, reflected in the fact that its genus name is derived from the Latin root word "salvare", which means "to heal" or "to save". However, there are also other herbs called "sage" that come from a completely different Asteracea family, genus *Artemisia*. e.g. so-called New Mexico sage (*Artemisia tridentata*), and the sage from Dakotas or grey sage (*Artemisia ludoviciana*) (Chevallier, 1996).

All of these plants have been used for medicinal and religious purposes. Burning "smudge sticks" (harvested sage stems tied together) in smudging ceremonies serves as ritual protection against evil spirits, negative thoughts and feelings (Gilmore, 1991; Kindscher, 1992).

Sage is probably the most important plant of the Cheyenne (Hart & Moore, 1992: 90). In the Sioux nation, it is used for keeping sacred objects like pipes or peyote wands safe from negative influences. Ojibwe people used the root as an anti-convulsive, on wounds to stop bleeding, and as a stimulant. The Potawatomi burned the plant to smudge and also used it as a poultice on long-standing sores (Johnston, 1990; Mayrl, 2003; Morgan & Weedon, 1990).

Sweet grass

Sweet grass (*Hierochloe odorata*) is, together with tobacco, cedar, and sage, one of the four original sacred plants used by First Nations for ritual cleansing. It is an aromatic herb found from Alaska to Labrador, south to Oregon, Nevada, Arizona, New Mexico, South Dakota, Pennsylvania, and Eurasia (Hitchcock *et al.,* 1969; Cronquist *et al.,* 1977).

In the Great Lakes region, sweet grass was historically referred to with the Latin name *Torresia odorata*. There is also a western species of sweet grass (*Hierochloe occidentalis*) (Harrington, 1954; Jepson & Hickman, 1993).

Sweet grass has religious significance for some Native American peoples, e.g. Ojibwe, who use it in prayer, smudging or purifying ceremonies (Densmore, 1974). To prepare sweet grass for burning, usually it is braided after softening in warm water and drying in the sun. Sweet grass braids smoulder and do not produce an open flame when burned. The smoke from burning sweet grass is fanned on people, objects or areas. Individuals usually smudge themselves with the smoke, washing the eyes, ears, heart and body (English, 1982).

The long leaves of sterile shoots are used by Native Americans, e.g. Mohawk, in making baskets (McMullen *et al.,* 1987). Its use in pipe-smoking mixtures has also been reported, where sweet grass is combined with plants such as red osier dogwood (*Cornus serieca*) or bearberry (*Arctostaphylos uva-ursi*) (Wonderle,y 2010; Wyman, & Harris, 1941; Pavesic, 2000: 327).

Foster & Duke (1990) documented that sweet grass tea was used for coughs and sore throats, chafing, venereal infections, and as an eyewash. Coumarin, the chemical compound present in the roots of *H. odorata*, displays interesting pharmacological properties,

50 For further details about the chemical compounds of tobacco, see Rodgman, Perfetti (2008: 727). An interesting analysis of the additives used in tobacco products and their toxicity is included in Narby (1999: 219–221).

which have been found to be useful in antitumor and anti-HIV therapy.[51] (Musa *et al.*, 2008; Angerer *et al.*, 1994; Kostova, 2006)

Creosote Bush

Creosote bush or chaparral (*Larrea tridentata*) is an evergreen resinous shrub which grows in the warm deserts of the southwest United States. It is from four to eight feet tall and has small, dark green leaves and brittle stems. It covers hundreds of square miles in the desert plains and slopes of southern California and Arizona, up to an elevation of five thousand feet (Carter *et al.*, 1997; Palacios & Hunziker, 1972).

The creosote bush is sometimes erroneously referred to as Greasewood, since scientists prefer not to confuse it with two other plants of the same name, *Sarcobatus vermiculatus* and *Atriplex* sp. (Wagner & Aldon, 1978).

Whatever common name is preferred, *L. tridentata* goes back a long time. Creosote bush was recovered from Late Archaic deposits in Hinds Cave, southwestern Texas (Dering, 1979). The fruit was found in Fresnal Shelter near Alamogordo, New Mexico (Minnis, 2004). Complete branches were noted from the Tres Metates rockshelter in Presidio County (Dering, 2006) Hunter *et al.* (2002) discovered its fragments in the Tinajas Altas Mountains, southwestern Arizona. When radiocarbon-dated, these pieces confirmed that the plants had established themselves near the Lower Colorado River more than 5000 BC.[52]

L. tridentata is considered sacred, especially by the Pima tribe, a group of Indigenous Americans living in an area of central and southern Arizona. The Pima believed it was the first plant given to them by the Earth Maker as a gift to help the people to maintain their health. Curtin (1984) mentions that the Pima prepared a decoction of the resin to treat colds. Orally administered infusions were also used by this tribe to treat various forms of gastric upset. The powder made from the leaves was applied on the skin and feet as a deodorant.

The Cahuilla of Palm Springs, California, as well as the Hualapai located in northwestern Arizona, inhaled the steam rising from boiling the leaves as an effective decongestant (Watahomigie *et al.* 1982: 28; Hepburn 2012).

Current medicine considers the medicinal qualities of the creosote bush plant as somewhat controversial. Although its constituent nordihydroguaiaretic acid (NDGA) has been reported to possess antioxidant/free-radical scavenging properties and it was proposed as a treatment for cancer, its effectiveness has not been demonstrated in clinical trials (Pelton & Overholser 1994).

Moreover, oral chaparral and NDGA have been associated with cases of hepatitis, cirrhosis, liver failure, renal cysts, renal cell carcinoma, and renal failure (Batchelor, Heathcote & Wanless, 1995; Gordon, 1995; Heron & Yarnell, 2001; Katz & Saibil, 1990; Murthy & Smith, 2010; Smith *et al.*, 1994).

It has been also demonstrated that the chemical compounds found in creosote are toxic to herbivores, and they inhibit the growth of other plants around it (Lira-Saldivar *et al.*, 2006; Mabry *et al.*, 1977).

51 Coumarin (or benzopyrone) is found naturally, although it can be synthetically produced as well. It has a distinctive odour which led people to use it as a food additive, in certain perfumes and fabric conditioners. (Floch, 2002) Due to concerns about coumarin as a potential liver and kidney toxin, its use as a food additive is much restricted, although it is perfectly safe to eat foods that naturally contain the compound (Ehrenforth *et al.*, 1999; IARC 2000: 193–225).

52 *L. tridentata* is a remarkably long-lived plant. One specimen was found to be 12,000 years old (Hunter *et al.*, 2002: 530).

Peyote

Lophophora is a flattened globose plant which belongs to the family of Cactaceae. It natural habitat is the Chihuahuan Dessert area extending from north/central Mexico up to southern Texas (Terry, 2008a, 2008b, 2008c).

Although Czech cacti specialist Vlastimil Hambermann reported in 1975 about *L. fricii* and *L. jourdaniana*, according to the CITES Cactaceae Checklist, the standard of the Washington Convention, genus *Lophophora* (Cactaceae) contains two species only: *Lophophora williamsii* (known as peyote), and *L. diffusa*.[53] (Hunt, 1992)

The phytochemical study of the species determined significant chemical differences among species. The predominant alkaloid in *L. fricii* is non-psychoactive pellotine, the same as in *L. diffusa* – not mescaline, the most abundant peyote alkaloid in *L. williamsii*.[54] (Starha in Grym, 1997)

Mescaline is one of the oldest psychoactive agents known to people. Native American deification of peyote is thought to be about 10,000 years old (Walter & Fridman, 2004: 336).

Radiocarbon dating, thin-layer chromatography and gas chromatography–mass spectrometry analysis of peyote buttons uncovered in Shumla Cave on the Rio Grande in Texas indicated that native North Americans used peyote since at least 5,700 years ago (El-Seedi *et al.*, 2005).

The oldest sacramental use of peyote in North America is considered to be the peyote pilgrimage of the Huichol Indians of Central Mexico to Wirikuta, "the field of flowers", to gather the cactus and return with it for ceremonial and medicinal use. It may have been in place as early as 200 A.D. (H. Smith & Snake, 1996). Several other Mexican tribes, e.g. the Tarahumara, Cora, and Tepehuán also have a historical relationship with peyote (Noyola, 2008; Artaud, 1976; Benciolini, 2012; Stewart, 1987: 30–42).

There is also some evidence of pre-Columbian use of peyote by the Aztecs, who considered the cactus magical and divine. Peyote then spread from Mexico to North America to other Native American groups, who used it for medicinal and religious purposes. The major diffusion northward of peyote's use occurred in the mid-nineteenth century, when it spread into the Great Plains through the Mescalero Apache and other tribes (Hultkrantz, 1997; Opler, 1938).

In his ethnographic study, Weston La Barre describes how simultaneously with peyote's rapid diffusion, Native American cultures all over the western states were being destroyed and dismantled. Ironically, the deculturizing activities of American soldiers and settlers, stealing traditional customs and practices, contributed to their reinvigoration and to the sacrament's being spread quickly throughout the region (La Barre, 1975: 110–11).

In the last decades of the 19th century a new religion based on the ritual consumption of peyote formed in Oklahoma, whose structure and content drew upon earlier ceremonies from northern Mexico and theologies from the southern Plains cultures. On October 1918, under the leadership of Quannah Parker and others, the Native American Church was formally adopted and achieved legal definition (Gray, 2010: 259–273).

Currently, peyotism is practiced in more than 70 different Native American Tribes and the estimates of current membership range from 250,000 to over 400,000 (Smith & Snake, 1996; Steinmetz, 1990: 85).

53 There are tens, may be hundreds, of names used in the *Lophophora* genus (e.g. *L. koehresii*) and its taxonomy is in dire need of revision and clarification. Acclaimed Czech Lophophora specialists, Ing. Rudolf Grym, accepts the more conservative classification including four previously mentioned designations (Grym, 1997).

54 The relationship between the mescaline content and morphology of Lophophora is unknown, because *L. williamsii* specimens with no mescaline content were also found (Aragane *et al.*, 2011).

Summary

In this chapter, an overview of sacred plants used for religious purposes was presented. An introduction containing a general description of traditional ceremonies (smudging, healing circles, sweat lodges, and pipe ceremony) was followed by an overview of the four original sacred plants used by First Nations (tobacco, cedar, sage, sweet grass). The creosote bush and peyote were included in this section because they deserve special attention not only for their religious, but also medicinal properties.

Discussion

Various authors (Robbins *et al.,* 2011; Watts, 2001) discuss the possibilities of traditional medicine in treating in the drug addiction, reconsidering their potential in prevention and intervention programmes. An insight into the social and cultural background of North American sacred plants use supports our hypothesis that there are still many opportunities for further applied research in this field, which could be beneficial in decreasing the impact of lifestyle diseases on the efficiency of health care system.

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5 AFRICAN PLANTS

5.1 Southern Africa: The Forgotten Cradle of Psychoactive Healing Plants

Sobiecki, J. F.

Abstract

This paper summarizes and contextualises the history of psychoactive plant research in South Africa as well as the recent advances made in the field. Hypothesized mechanisms by which African psychoactive plants heal the mind are highlighted. Key areas requiring further research include: the indigenous cultural understandings of mental illness and psychoactive plants, the role of psychoactive plants in the spiritual practices of southern African traditional healers, the influence of various psychoactive plant species used in traditional formulas, the use of African psychoactive plants in treating drug addiction and the folklore and mythology relating to indigenous psychoactive plants.

A Historical Perspective on Global and Southern African Psychoactive Plant Research

Psychoactive or psychotropic substances can be defined as chemical substances that are used for the modification of the emotional, intellectual and behavioral function of humans (Werry and Aman, 1993). They affect the mind-mental processes as well as the other activities of the nervous system. Psychoactive substances can be classified according to their action (e.g. stimulants) or by their therapeutic use (e.g. antipsychotics) (Ibid.). Plants manufacture an array of psychoactive chemicals that exert a multitude of psychoactive effects ranging from those acting as sedatives, euphoriants, stimulants, sopoforics (inducing sleep), through to hallucinogens, antidepressants and memory enhancers (Sobiecki 2002). Throughout history, humans have co-evolved and experimented with medicinal plants, administering them in numerous ways through for example: eating, steaming, bathing, applying through oils, incisions or enemas, injecting and smoking amongst others. In so doing, these traditional societies came to recognize those plants with psychoactive properties, incorporating them into all aspects of life from hunting, sorcery through to healing psychospiritual illness and curing disease. Thus, the actions of psychoactive plants have been important in sustaining the health and well-being of humankind — though the rich diversity of their uses has receded with the turn of the modern day consumer culture.

Psychoactive plants have had a long history of study in Europe and the Americas, yet the paradox is that Southern Africa, with its rich psychoactive flora and cultures has largely been neglected in the academic research of psychoactive plants — that is, until very recently (Sobiecki, 2014a). Numerous reasons for this lack of attention to Africa's psychoactive flora have been proposed, including: researcher bias concerning substance use (Winkelman & Dobkin de Rios, 1989), a lack of attention by researchers to the region's psychoactive flora (De Smet, 1996), the overlooking of more subtle psychoactive effects of traditional plants medicines (Sobiecki, 2008) and the loss of indigenous knowledge concerning psychoactive plant use due to acculturation. Other factors such as cultural prejudice and the failure to effectively interpret African traditional medicine concepts have been highlighted as influencing the study of traditional medicine in South Africa (Sobiecki, 2014a), and which is included in this chapter.

An interesting example of such cultural factors influencing the study of psychoactive substances in South Africa, is the political history of the region and the immediate and continued conflict experienced from the time of the arrival and meeting between the European colonialists and the indigenous people of southern Africa. Colonial beliefs constructed

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and framed African traditional healing practices and traditional medicine as primitive, unsophisticated and satanic, (Croucamp, 2001:1), which would have negative repercussions for the study of Southern African ethnomedicine practices (Sobiecki, 2014a:4). After having attacked and subjugated the indigenous South African people, the apartheid system would cause a social rift between white and non white people that would have obvious consequences not only in terms of social separation but also in terms of research. Thus, together with the factor of the global stigma on psychoactive substance use, there also existed a racist element in South African society that would predictably polarize race relations and traditional and western medicine practices, and that would skew and bias research being generated, then from mostly white western scholars. This is indicated by the fact that the majority of ethnobotanical studies from South Africa in the last three decades have focused on medicinal plants (16%) and food plants (20%), with only a few (7%) relating to the category "Magic, ritual and customs" (Liengme 1983). It is this last category that appears to be rich in plant species with reported psychoactive uses and effects (Sobiecki, 2008, 2012), and which deserves much more thorough attention and research.

For these reasons, the erroneous belief grew over time that Africa was poor in psychoactive and particularly visionary plants, and this belief lay dormant and unchallenged until a recent revival in study of these plants by some researchers (Sobiecki, 2014b). This renewed interest in psychoactive plant use in southern Africa has come from a few anthropological studies and a great impetus in phyto-pharmacological work being done on screening southern African plants for psychotropic activity, with promising new findings and research directions resulting (Sobiecki, 2014b). The anthropologically focused studies from southern Africa include: a re-appraisal of the San Bushmen's' use of psychoactive plants (Mitchell and Hudson, 2004), the role of psychoactive plants in dreaming in Xhosa traditional medicine practices (Hirst, 2005), and preliminary inventories of psychoactive plant use (van Wyk & Gericke, 2000; Sobiecki, 2002). Sobiecki (2002) documented over 300 species of plants that are reported as having psychoactive uses in traditional southern African healing practices, for example, from treating conditions such as insomnia to convulsive conditions such as epilepsy. Other reviews have indicated the significant role that psychoactive plants have in the traditional spiritual practices of the indigenous people of southern Africa; namely in Southern Bantu traditional divination (Sobiecki, 2008) and the healing initiation process of Southern Bantu speaking diviners (Sobiecki, 2012). The phytopharmacological research has identified plants with efficacy for treating epilepsy, for example, *Searsia dentata* (Thunb.) F.A. Barkley, and in depth chemical investigations are being done on plants such *Boophane disticha* (L.f.) Herb (Sobiecki, 2014a), for future application in medicine. A review on the history and potential future direction of psychoactive plant research in southern Africa has been presented (Sobiecki, 2014b).

However, despite these endeavors, the anthropological and ethnobotanical studies focusing on psychoactive plant use from southern Africa are still rare, and therefore, it can be said that psychoactive plant use appears to be a neglected area of ethnobotany in southern Africa. Research initiatives are urgently needed to catch up with the rest of the world in terms of applied ethnobotany and neuroscience related research, for example, on the role of psychoactive plants in treating drug addictions and treating mental illness such as depression and stress disorders, which is burgeoning in the USA and Europe, see e.g., The Multi disciplinary Association for Psychedelic Research—MAPS and the Beckley Foundation.

The Role of Psychoactive Plants in South African Traditional Medicine

Around 1998 I became curious as to whether the indigenous South African traditional healers were using visionary (psychedelic) plants as part of their spiritual healing practices. This initiated me on a 15 year fieldwork journey into the mostly black African locations and central Johannesburg to investigate this problem question. What I slowly discovered with interviewing traditional healers, was that the indigenous South African people hold

great value in using psychoactive plants for promoting health and well-being, and I began to understand their cultural and therapeutic significance. I was taught by a number of southern African traditional healers that there are two broad categories of psychoactive plants; those with subtle actions that slowly open dreams, intuition and sensitivity such as *ubulawu*, and then the stronger acting visionary or "hallucinogenic" plants that are used specifically for divination in Southern African traditional medicine (Sobiecki, 2008, 2012). It became apparent that a rich diversity of psychoactive plants are being used by thousands of indigenous Southern African people daily to open dreaming, and to treat various nervous system conditions such as insomnia, headaches, epilepsy and mental illness/disease, as well as in traditional spiritual healing practices such as prayer and divination, with the purpose to connect with ones deceased ancestors through the deeper self.

One of the more commonly known and widely used of the psychoactive plant medicines in South Africa is *ubulawu*. The following paragraph on preparation and administration methods is derived from Sobiecki (2012).

"The term *ubulawu* (Xhosa) refers to the use of specific roots, stems and sometimes barks of subtle acting psychoactive plants that are ground and made into a cold water infusion that is churned with a forked stick to produce foam. This foam production is typical of *ubulawu* preparations. *Ubulawu* preparations, used in the initiation of Southern Bantu diviners, are typically drunk as an infusion until the initiate's stomach is full and he or she is ready to vomit. Vomiting is then induced usually in the morning on an empty stomach. The vomiting of this compound is referred to as *ukugabha* (Xhosa) or *phalaza* (Zulu). These mixtures are typically used for good luck, by kneeling on the ground while churning the infusion and talking and praying to ones ancestral family. It is also customary that the foam produced from whisking the preparation is used to wash the body, normally late in the evening. Both vomiting and washing with the foam are used "to remove ritual impurity" (Hirst, 2005). The *ubulawu* foam is also eaten by initiates on an empty stomach in the morning or evening to enhance dreaming. Differences in administration of *ubulawu* exist depending on the cultural group in question."

In addition to the use of *ubulawu* in removing ritual impurity, the main reported use of these medicines is to open the initiates or patients mind to ones ancestral spirits. My late mentor, Mrs. Letty Maponya, taught me that the main importance of using *ubulawu* is to clean the body (the lungs and stomach of mucus) so as to produce clearer thinking and relaxation and in this way the mind is more receptive to spiritual connection. Numerous mechanisms have been identified and proposed by which this may occur (Sobiecki, 2012). As a summary, the mechanism of vomiting has a physiological affect on cleaning the stomach and lungs of mucus that has an effect of increasing clarity of thought and dreams (in the same way that *vamana* emesis therapy is used in Ayurvedic (Indian medicine) (Sobiecki, 2012), while the process of diaphragmatic breathing with the vomiting process also promotes the activity of the parasympathetic nervous system that relaxes the person (Lambrecht, 2014). Furthermore, I hypothesize that many of the *ubulawu* plants also contain subtle acting psychoactive chemicals that have either intuition and sensitivity enhancing properties or relaxing and grounding effects on the mind, depending on what is needed. In this way, plants with similar effects are used together in *ubulawu* formulas to gain a desired effect (what is called phytochemical synergy), most often to initially open the initiates mind and thereafter to ground the mind once the lessons are learnt. This indicates the use of a sophisticated technology of phytochemical synergy by southern African traditional healers to facilitate a psycho-spiritual healing process.

Through the drinking of the *ubulawu* infusion prior to vomiting and eating of the foam at night, the psychoactive chemicals in the plants enter the body system, thereby having psychoactive effects on the nervous system. In summary, both the process of vomiting with the *ubulawu* medicines together with the psychoactive chemicals in the medicines encourage relaxation, enhanced awareness and dreaming that is used to encourage a psycho-spiritual healing and transformation process for healer initiates. The process of churning

the medicines is also a meditation support as it encourages focused attention and repetitive rhythmic action that facilitates mindfulness.

Numerous species are combined and used as *ubulawu* "lucky medicines" and such culturally defined terms are often apt metaphorical indicators of the biological and psychological effects of the plants, and in the case of *ubulawu*, "lucky" referring to the positive feelings of clarity of thought, dreams, mood upliftment and increased energy. In this way vernacular plant names and traditional medicine concepts should not be overlooked or prejudiced as superstitious or "primitive", which I have argued, often occurs in western academic research (Sobiecki, 2014a), but can be seen as mnemonic devices as they can, in addition to directly indicating plant actions, also hold cultural information such as myths around plant uses that can allude to or indicate medicinal plant actions if translated and understood correctly for what they symbolize.

With regards psychoactive plant actions and mechanisms, another interesting means by which, I propose *ubulawu* medicine preparations heal, is through promoting a cathartic process, similar to that of using ayahuasca, that results in a psycho-spiritual cleansing process of toxic emotions, past trauma or difficult life events, except in the case of *ubulawu* is without the overt visionary component. This emotive and cathartic process of using both ayahuasca and *ubulawu* may involve and promote neural plasticity events that could partly account for how these medicines work in positively effecting behavioral change and healing.

While conducting the research on psychoactive plants and undergoing South African traditional medicine training, I became aware of, and what I hypothesize as, a cross cultural sequence of using psychoactive plants as a means of treating and healing psycho-spiritual illness in traditional medicine systems from around the world. Jauregui *et al.* (2011) outlines that South American *curandero* healers use four categories of psychoactive plants as part of their initiation namely those for: **1)** purification and cleansing species; **2)** sensitivity and intuition; **3)** strengthening; and **4)** protection and defense. I have noticed a very similar sequence of plant use in the initiation of Southern African indigenous traditional healers, which is being investigated further. I hypothesize the sequential use of healing initiation plants by Southern African traditional healers and South American *curandero* healers holds important keys to the healing of consciousness, and is one of the areas we will be exploring through the Khanyisa Healing Garden project occurring in South Africa outlined in the Future Research Perspectives section.

Summary

Research findings reveal that there is widespread reliance on psychoactive plant medicines by the indigenous people of southern Africa to communicate with their ancestral spirits through dreams and heightened intuition, and to treat psycho-spiritual illness and nervous system disease. Much is still to be learnt from the traditional healers of Southern African regarding their worldview and their botanical, diagnostic, methodological and healing knowledge regarding the use of psychoactive plants in treating mental illness and other nervous system conditions. A great deal of this healing knowledge is being lost at an alarming rate with the dying of South African traditional elders and healers who are not passing on their healing wisdom to the younger generation, who have lost interest in traditional values. Thus, it is critical that this indigenous knowledge is documented and preserved for future application in medicine and healing before it is lost entirely. Aspects identified as requiring further study include: the indigenous cultural understandings of mental illness and psychoactive plants, the role of psychoactive plants in the spiritual practices of southern African traditional healers, the influence of various psychoactive plant species used in traditional formulas, the use of African psychoactive plants in treating drug addiction and the folklore and mythology relating to indigenous psychoactive plants.

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5.2 The Intersection of Culture and Science in South African Traditional Medicine[55]

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Abstract

Traditional African medicine often carries with it a perception and stigma of being irrational and ungrounded in scientific method in academia. One reason for this common prejudicial view of traditional African medicine is the failure to effectively interpret African traditional medicine concepts, as these are often metaphorical descriptions of the biological and psychological effects of plants or combinations of them used in the traditional medicine preparations. When translated into other languages such as English, these metaphorical descriptions of medicinal plant use can seem to incorrectly reflect mysticism and/or superstition with no scientific basis. This difficulty in interpreting cultural descriptions of medical phenomena, together with the fact that there are hardly any academic papers engaging the science of South African traditional medicine in the biological sciences, is an indication of the disconnection between the humanities studies and the biomedical studies of South African traditional medicine. This paper investigates some popular examples of spiritual plant use in traditional South African medicine using phytopharmacological studies together with anthropological fieldwork methods, demonstrating the empirical basis for use of some plants in divination (by producing clarity of thought or dreams). The examples also reveal the phytochemical and biomedical foundations of the South Bantu speaking traditional healers' explanations of why and how various spiritually used plants have medicinal value. The challenge for scientists (such as botanists) is to effectively translate and interpret cultural and language based descriptions of spiritual medicinal plant use made by indigenous people while recognizing and discarding cultural prejudices that prevent a more comprehensive and integrated understanding of the science that intersects and forms the basis of many, though not all, cultural healing practices.

Keywords: South African traditional medicine, African medicinal plants, science of healing, psychoactive plants, phytochemical synergy

South African Traditional Medicine

The World Health Organization (WHO 2008), defines traditional medicine as:

"The health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral-based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to diagnose, treat and prevent illnesses or maintain well-being."

Traditional medicine is by no means an alternative practice in South Africa, with an estimated 72% of the Black African population in South Africa relying on this form of medicine,

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accounting for some 26.6 million consumers (Mander *et al.*, 2007). These consumers encompass a diverse range of age categories, education levels and occupations. The value of the trade in raw medicinal plant materials in South Africa is estimated to be approximately R520 million per year (in 2006 prices), with the traditional medicinal plants and products trade in South Africa estimated to be worth R2.9 billion per year (Mander *et al.*, 2007).

Scientists have taken advantage of the region's immense botanical diversity with South African research institutions being at the forefront of phytopharmacological studies of South African plants with the aim of developing new allopathic medicines (Light *et al.*, 2005). These studies focus predominantly on screening and isolating phytochemicals for specific pharmacological actions. This has resulted in an increasing trend in validating traditional medicine claims from scientific studies, especially for plants with traditional uses for physical ailments, such as plants with antibiotic properties used for infections. One example is the pharmacological validation of uterotonic compounds and activity of *Rhoicissus tridentata* that is traditionally used in pregnancy to augment labor (Brooks & Katsoulis, 2007). However, the same research validation has not yet occurred for the majority of plants used for spiritual healing in South African traditional medicine. One reason for this may be because the psychological effects from the internal administration of psychoactive plants in humans are more difficult to test, assess and interpret using the scientific method than those producing physical effects. However, I argue in this paper that a more prevalent reason is the culturally ingrained prejudice against traditional medicine and its associated religious or spiritual plant use, which is often deemed irrational, non-empirical and unscientific.

Medicinal plant use in South African traditional medicine occurs on a sliding scale from physical to spiritual uses. There are polar extremes of plants used only externally and exclusively as charms for magical purposes, while others have only physical uses. However, for numerous plants that are administered internally for spiritual healing purposes in South African traditional medicine, there exist mutually inclusive physical, psychological and spiritual therapeutic effects, as in the case of *ubulawu* plant mixtures (Sobiecki, 2012). This overlapping physical and spiritual medicinal plant use coincides with the African worldview of the co-existing and inter-dependent relationship between the physical and spiritual nature of sickness, medicines and existence (Petrus & Bogopa, 2007).

One aim of this paper is to investigate examples of spiritual plant use in traditional South African medicine using phytopharmacological studies and anthropological methods. Therefore, it is relevant to include some of the most significant spiritual beliefs held by the indigenous Southern Bantu speaking (hereafter referred to as Southern Bantu for brevity) people of South Africa and how they relate to their spiritual use of medicinal plants.

Some Important Traditional Cultural Beliefs of the Southern Bantu Speaking People

Bantu refers to the 300–600 ethnic groups in Africa of speakers of Bantu languages, distributed from Cameroon East across Central Africa and Eastern Africa to Southern Africa (Lewis 2009). A large proportion of the indigenous ethnic groups in South Africa are represented by the Southern Bantu; the Bantu languages spoken in the southern African region (Nguni, Sotho-Tswana, Venda), which also includes languages of Mozambique (Tsonga) (Van Warmelo, 1935).

One of the most important of the traditional beliefs amongst the Southern Bantu people is the belief in the immortal ancestors who influence and direct the affairs of the living and to whom propitiatory practices such as food and drink are offered (Hammond-Tooke, 1937). Ill-health and misfortune are believed to often stem from ancestral wrath, witchcraft or ritual pollution (Hammond-Tooke, 1998), but often also point more deeply to disturbed social relations.

In southern Africa there are two main types of traditional health practitioners: the herbalist (Zulu *inyanga*; Xhosa *ixhwele*; Tsonga *nyanga*; Sotho *ngaka*) and the diviner (Zulu *isangoma*; Xhosa *igqirha*; Tsonga *mungome*; Sotho *selaodi*) (Sobiecki, 2012). The diviners are considered to be the spiritual specialists and use divination to communicate with their ancestral spirits to diagnose their patients' misfortunes or medical conditions (although both types of practitioner use plant medicines for spiritual healing). It is the work of the traditional Southern Bantu diviner to apply or recommend the appropriate action in the form of counseling, prescribing medicines and/or instructing on ritual ceremonies. Southern Bantu diviners develop an extensive knowledge of human disease and treat a variety of conditions using natural medicines. Petrus and Bogopa (2007: 7) explained that "there is an acute awareness, among African societies, of the three-dimensional nature of human beings, as simultaneously, biological, social and spiritual beings… and that humans exist in three interrelated worlds: the human, nature and supernatural worlds." As an example of this worldview, the Southern Bantu diviner will prescribe plant, mineral or animal based medicines, often in a ritualized context of use, to either, for example drink, vomit, bath or sprinkle with around the home for physical, psychological and spiritual medicinal effects or spiritual protection. In these ways the traditional healer aims to rectify imbalances on the physical, spiritual or social (inter-personal) level, and thus the traditional diviner-healer can be said to be practicing holistic medicine in that the approach addresses the whole of the person and his/her relationships to society and the environment. Thus, the authentic African traditional healer plays a vital role in health care where people accept and believe that nature, humans and spirits are not separate but are all within the world, and use medicines in order to influence these forces on the physical, psychological and spiritual/transpersonal levels.

Research Methodology

In this paper I provide literature evidence on, and a critique of, the prejudicial assessments of South African traditional medicine occurring in the academic literature and mass media.

I further investigate some popular examples of spiritual plant use in traditional South African medicine using phytopharmacological study findings together with anthropological research methods such as participant observation and interviewing. These examples of spiritual plant use were part of my anthropological fieldwork observations primarily between 2008 and 2012 with a key research informant, Mrs Maponya, a Northern Sotho traditional healer who has been my long-term and credible research informant since 1998. I initially used structured and semi-structured interviewing with her and 18 other traditional healers on their use of plant medicines in traditional healing. Later, as my relationship with her and other traditional healers developed and trust was established, my fieldwork was based more on unstructured interviewing and participant observation in helping to prepare medicines for her patients. This became more routine as part of my formal apprenticeship training process with her in 2012 to learn South African traditional medicine. Detailed notes were made routinely after each day's work. Informal conversations often led to key insights into the cultural understandings of use of traditional medicine and their significance. Mrs Maponya's knowledge of spiritual plant use has been invaluable in contributing to my understanding of the physical and spiritual aspects of traditional South African medicine in the ethnobotanical research field (Sobiecki, 2008, 2012). Study aims were described and verbal informed consent was obtained from all the traditional healers I interviewed. Having observed, experienced and noted the uses and effects of some popular spiritually used plants, I analyzed these experiential reports in context of phyto-pharmacological studies done on these particular plant species, and combined the findings presented in this paper.

Prejudicial Assessments of African Traditional Medicine and the Disconnection between the Cultural and Biomedical Studies of African Traditional Medicine

From an anthropological point of view I argue that one of the problems with many of the ethno/phytopharmacological research publications is that indigenous knowledge regarding traditional medicine understandings is rarely given mention and integrated into the ethno/phytopharmacological research outputs. This gives the impression that the indigenous cultural use of plants is, by and large, incidental, anecdotal and ultimately insignificant. However, for example, a recent research paper has indicated complex therapeutic processes and psychoactive mechanisms involved in ritual plant therapy in southern African traditional healing. This paper suggests that these processes cannot be understood by focusing solely on the plants' phytochemical actions, but also need to incorporate the interacting dynamics of ritual, phytochemical synergy of the plant mixtures used and the psychology of the medicine user (Sobiecki, 2012). While many universities in South Africa are involved in pharmacological or chemical studies involving indigenous plants and seek novel chemical products for pharmaceutical drug development, there is a paucity of research focused on the intersecting cultural (ritual) use of South African medicinal plants. This was previously highlighted in Liengme's (1983) survey of ethnobotanical research in South Africa, which showed that the majority of studies of indigenous plant use have focused on medicinal plants (16%) and food plants (20%), with only a few (7%) relating to the category "Magic, ritual and customs" (Dold & Cocks, 1999).

This lack of research on the cultural and spiritual aspects of South African medicinal plants is exacerbated by the continuous and entrenched view in the biological sciences that African traditional medicine is unscientific or irrational, as the following excerpt (Taylor, Rabe, McGaw, Jäger & van Staden, 2001: 24) suggests:

"The rational use of traditional medicine is also not well-defined, and often relies on ritual, mysticism and intangible forces such as witchcraft, with some aspects based on spiritual and moral principles which are difficult to rationalize."

I argue that this common misperception of the supposed irrational aspects of traditional medicine has its origins partly in the "the colonial constructions of Africa's 'otherness' and essential "primitiveness" that persists today" (Croucamp, 2001: 1). "Colonial attitudes towards indigenous southern Africans expressed themselves, in part, in the invalidation and distortion of the traditional public domain. To a large degree, this involved the denigration of the diviner (Ibid.)." "Early colonial views ranged from describing southern Africans as entirely without religion, to denouncing diviners as 'pillars of Satan's kingdom'. The 'religion' of the colonialists was often contrasted with the 'superstition' of southern Africans (Ibid.)." Furthermore, "The way colonialists conceptualized Africa's 'otherness' has leaked into the nomenclature and the expectations of anthropology and historiography." (Croucamp, 2001: 3) I would argue that these perceptions have also leaked into society as a whole.

It is easy to see how such prejudicial views on African traditional healers can creep into sensational mass media. For example, in the National Geographic documentary series "The Witchdoctor Will See You Now" (Crick, Griffiths & Payne, 2011) there is an almost exclusive focus on unusual and apparently magical traditional African rituals of bloodletting and animal sacrifice that appear to be sensationally framed without truly engaging the indigenous understandings of what these and other more common traditional medicine practices mean. In the series, frontman Piers Gibbon takes the stance that "it's important to keep an open mind and take a closer look at things that may be alien to us in the West." (Dunbar-Curran, 2012, para 18) However, such superficial and sensational media stories focusing on traditional medicine only reinforce the fears and doubts regarding traditional

medicine in the public eye and mind, doing little to provide an impartial and balanced view of all aspects of traditional medicine in operation within traditional healing.

Prejudicial views can also commonly be found in academic literature relating to the supposed "unscientific" diagnostics or practice of traditional medicine, and the toxicity issues leveled at traditional medicine. For example, the suggested distinction between Western and traditional medicine, with Western medicine seen as scientific and traditional medicine as non-scientific, is articulated by Bruce (2002: 162) who states, in a paper entitled "Differences between Western and traditional approaches", that:

"Modern or Western medicine is dominant in Western societies and is firmly rooted in a scientific paradigm; medical science is used to explain the cause of disease using a biomedical practice model. Traditional medicine operates within an indigenous, spiritual realm, which explains the cause of disease as social and psychological conflicts or imbalance."

I argue that this is a grossly polarized view, and the suggestion made (that there is no scientific basis to the practice of African traditional medicine) is a false construction. Southern Bantu traditional healers typically assess patients by diagnosing medical signs and symptoms based on repeated observations, and prescribe medicinal plants that have replicable effects and results correlated with the presenting symptoms. This diagnostic system is based on testing such plant therapies for observed and replicable effects for many generations, thereby demonstrating the underlying scientific method involved with such medicine practices. However, this diagnostic aspect of African traditional healing is often not acknowledged or studied by Western practitioners or researchers who often focus more on the conspicuous ritual aspects of traditional medicine. This focus is indicated in Bruce (2002: 163) who stated: "In protecting against disease and other forms of adversity, traditional approaches include certain rituals, performed at significant events during one's life stages" without mention being made of established medicinal plants being used as protection from disease.

Another biased academic focus is the issue of the safety and efficacy of African traditional medicine. It is doubtlessly true that if African traditional medicines are to be manufactured and sold as products safety and efficacy needs to be standardized. However, concerns regarding toxicity issues are usually leveled only at traditional medicines, while similar concerns are not mentioned in relation to biomedicine, although these concerns do in fact exist. Bruce (2002: 162), while purporting to address the common elements in Western and African traditional healing practices, instead highlighted the dangers of toxic plants used in African traditional medicine and provided statistics of traditional medicine related deaths in South Africa caused by plant toxins. However, no such mention is made of the existence of adverse drug reactions and toxicity resulting from the use of Western medicines. This is despite the fact that research suggests that "adverse drug reactions (ADRs) from Western pharmaceuticals are one of the leading causes of morbidity and mortality in health care." (Alomar, 2013: 2) According to Alomar (2013) in 2000 The Institute of Medicine, located in the United States (US), reported that between 44 000 and 98 000 deaths occur annually as a result of medical errors. Of this total, an estimated 7000 deaths occurred due to ADRs (Alomar, 2013). Not mentioning the impact of Western drug toxicity in papers addressing the scientific validation of traditional medicine introduces an unbalanced and biased focus on the issue of toxicity that pertains to both systems of medicine but that is usually highlighted only in relation to traditional medicine practices.

Fennell *et al.* (2004: 205) also stated:

"The prescription and use of traditional medicine in South Africa is currently not regulated, with the result that there is always the danger of misadministration, especially of toxic plants."

This quotation implies that regulatory standards are the mechanisms by which toxicity issues are prevented in Western medicine. However, this is an erroneous view, owing to the fact that despite the well know regulatory frameworks in place within Western/biomedicine, study figures indicate there is a trend of increasing death and injury resulting from adverse drug reactions in biomedicine (Alomar, 2013). Thus, toxicity from drug side effects is a major and growing issue in Western scientifically based medicine. Fennel *et al.*'s, (2004) statement quoted above also assumes that Southern Bantu traditional healers are not aware of toxicity issues. However, this has not been my observation over 14 years of fieldwork experience with South African traditional healers. In fact, traditional healers have reported methods to prepare medicines which nullify toxins, or prescribing particular dosages for limited time periods to prevent toxicity.

Other obvious prejudicial viewpoints have been noted within the literature. For example, Bruce (2002: 162) stated: "The absence of sophisticated technology is characteristic of (the healers') practice: herbs, plants and plant products, animal products and spiritual resources are used to prevent and treat disease." What she fails to mention is the complex phytochemical synergistic actions of traditional medicine preparations skillfully employed by the authentic Southern Bantu traditional healers in treating various diseases and illness, and the sophisticated psychoactive mechanisms involved with the use of ritual plant therapy in their healing initiation process (Sobiecki, 2012).

The prejudicial viewpoints mentioned above are only some of many examples of the limiting and polarized beliefs afforded traditional medicine. These beliefs have been carried into the academic research field without a true and thorough assessment of the scientific principles in operation in traditional medicine. However, as some researchers have pointed out, "the reason that various ethnomedicines have not been scientifically validated for safety and efficacy is mostly attributable to the lack of collaboration between biomedical scientists and traditional healers" (Chinsembu, 2009: 1), rather than being because the treatments or processes lack scientifically verifiable mechanisms of action.

I was unable to find many academic papers including "science" and "South African traditional medicine" in the title, keyword or abstract search terms by screening the biological sciences databases such as Science Direct, Sage, Cabi, Wiley and Scopus. (A notable exception is Green's (2012) paper focusing on the contradictions in the debate on traditional medicines and the sciences in relation to HIV.) This paucity of research is an indication of the disconnection between the humanities studies (cultural explanations) and the biomedical studies (biochemical explanations) of South African traditional medicine. These findings may be due to the ingrained cultural prejudices discussed above as well as difficulties in decoding cultural and language based meanings, rather than the underlying scientific validity of these cultural practices.

In the context of such ingrained culturally conditioned prejudice against African traditional healing as unscientific, the following examples demonstrate that African traditional medicine concepts are often metaphorical descriptions of the biological and psychological effects of plants or combinations of plants used in traditional medicinal preparations. These concepts are thus culturally encoded in the language used by indigenous people and are therefore masked. Thus, the view of traditional medicine as irrational is often based on failing to correctly interpret, and therefore misunderstanding, these culturally defined metaphorical descriptions of plant use.

Some South African Traditional Medicine Examples and Their Cultural and Scientific Basis

This section provides some popular examples of plants used for spiritual healing purposes in South African traditional medicine and discusses their interrelated pharmacological, psychological and spiritual healing dynamics. I have documented these dynamics as part of my anthropological fieldwork studies.

Mlomo Mnandi "Sweet Mouth"

On one occasion while visiting Mrs Maponya, I mentioned that I was feeling under stress as a result of the day's activities. She offered me some short stick-twigs called *mlomo mnandi* (meaning "sweet mouth" in Zulu) on which to chew. She remarked that I should just chew on them as if they were gum. I did so and found the taste peculiarly sweet. After some time talking to her, I felt more relaxed, and what started off as an anxious conversation ended with laughing and joking. Later, at home, I researched the botanical meaning of *mlomo mnandi*, discovering that it is referred to *Glycyrrhiza gabra L.* or licorice in Western cultures. Licorice is a well-known tonic plant used in Europe and America for fatigue, adrenal exhaustion and to improve vital energy (Vanrenen, 2000). When I relayed this information to Mrs Maponya the next time I saw her, she was unsurprised and said that the plant is often used before meetings to "make one talk nicely, that is to have a sweet mouth" (i.e. to open communication). Subsequently, I have repeatedly used this licorice powder in stressful situations. In my experience it has a distinctly uplifting psychoactive and tonic effect that promotes relaxation and improved communication.

The scientific mechanism underpinning this use is the energy and mood boosting actions of tonic plants such as ginseng and licorice through the action of triterpenoid saponins that stimulate production of hormones by the adrenal glands (Chevallier, 1996; Vanrenen, 2000). In Ayurveda or traditional Indian medicine, licorice is reported as "nourishing the brain, promoting contentment and harmony. It improves voice, vision, hair and complexion and gives strength" (Frawley & Lad, 1993: 127). "Sweet mouth" is thus a good example of an indigenous metaphorical term used to describe the medical application of the licorice plant.

Imphepho: African Incense of the Ancestors

Imphepho (the flowers of the everlasting family *Helichrysum*) is an important and widely used plant that is used as ritual incense in South African traditional medicine (Fig. 31). Bundles of the dried flowers are often seen on the medicinal plant markets in Johannesburg where they are sold to the public and to healers alike. The dried flowers and stems are often burnt by diviners to invoke the ancestral spirits while practicing divination for clients. In 2010, while conducting a public workshop on ethnobotany, a colleague and I burnt a large bundle of *imphepho* in a room with attendants. The smoke filled the room and we inhaled the smoke and talked about its use. Within a short time, the group became quiet and meditative and an atmosphere of calm prevailed. Having noted its calming effects among the group, we discussed its ritual use and we made a connection with the use of frankincense, the resin obtained from trees of the genus *Boswellia*, that has been used since antiquity in various religious ceremonies in Christian churches (Moussaieff *et al.*, 2008). Frankincense has been shown to have an anxiolytic (anxiety reducing) psychoactive effect in studies conducted by the Johns Hopkins University (Ibid.). Likewise, the psychoactive chemistry of *impepho* has been indicated in phytochemical studies, where Stafford, Jager and van Staden (2005) determined the GABA-receptor binding effect of extracts from various *Helichrysum* species used in South Africa. GABA is a significant inhibitory neurotransmitter chemical responsible for relaxation. Thus, there is an empirical basis that, at first hand, is not apparent to the use of *imphepho* and frankincense alike for spiritual healing purposes. The inhalation of these plants' psychoactive chemicals promotes a calm and relaxed state of mind that is conducive to religious and spiritual practices such as praying. Other South African plants, such as *Boophane disticha* (L.f.) Herb, that are used for "invoking the ancestors" or "arousing the spirits" (Sobiecki, 2008) have sedative effects and narcotic alkaloids have been isolated from the bulbs (Watt & Breyer Brandwijk, 1962). A similar example relates to *ubulawu* plant preparations, which are used by Southern Bantu diviners to open a connection to the ancestral spirits. These plant preparations have sensitivity and intuition enhancing psychoactive effects (Sobiecki, 2012). Thus, the hypothesis can be made that the African cultural

descriptions of "arousing or invoking the spirits" are often metaphorical indicators for the relaxing and mind-opening actions and effects of South African psychoactive plants.

31: *Burning of Helichrysum flowers, used as a purifying ritual incense in South African traditional medicine, next to the important psychoactive medicinal plant Boophane disticha, whose scale leaves have uses as a wound dressing and the bulb of which is used in careful dosages (due to narrow and what can be fatal toxicity ranges) to induce visions for divination purposes by South African traditional healers.*

Source: Author's Archive

Ubulawu Spiritual Medicines and Luck

Closely related to this use of *impepho* to invoke and connect with the ancestral spirits is the use of *ubulawu*. The term *ubulawu* refers to traditional South African plant preparations for "cleaning the body" and to "bring luck". These preparations are made mostly from the roots (e.g. *Silene bellidioides* Sond.) and stems (e.g. *Helinus integrifolius*, Lam., Kuntze.) of various plants (Sobiecki, 2012). These ingredients are ground and made into cold water infusions that are churned with a forked stick to produce foam (Fig. 32). Both the foam and liquid of *ubulawu* preparations are drunk as part of vomiting (emesis) therapy by diviners and laypeople alike (Ibid.).

32: *White and red ubulawu preparations used in the initiation healing process of South African traditional healers.*
Source: Author's Archive

The psychoactive effects and possible chemistry of various *ubulawu* plant species has been recorded. For example, Triterpenoid saponins are confirmed to be in popular *ubulawu* species such as *Agapanthus campanulatus* F.M. Leight. and *Maesa lanceolata* Forssk (Hutchings *et al.*, 1996).

While the "cleansing" effect of *ubulawu* preparations is evident, their reported ability to "bring luck" is less evident. Mrs Maponya explained that *ubulawu* is important, in the first instance, to "clear the lungs" to enable her "inner vision" so as to remember her dreams (Sobiecki 2012: 219). In this way "*ubulawu* will connect you with your ancestral spirits, to give you what you need, they open your way, and in this way all the plants can give you spiritual help." (Ibid.) This aspect of *ubulawu* is similar to *vamana* (emesis) therapy in Ayurvedic medicine, which aims to remove the body of excess mucus and water (*kapha*) that collects on the lungs and "disturbs the mind and clouds the senses." (vide Frawley 2000: 156) The physiological mechanism of this use of emetics was elaborated by a pharmacist colleague who explained that the reported clarity of thought and improved dreaming could be due to the medicines having a highly effective expectorant effect, removing viscous mucus and other impurities (e.g. carbon) from the lungs; thereby allowing more oxygen to enter the lungs and, possibly, increasing the functional surface areas of the blood-air barrier which would result in an overall increase in cognitive abilities as more oxygen would be reaching the cerebral cortex (Florczak, pers. comm., March 2012). Accordingly, I suggest that it is possible that *ubulawu* preparations "bring luck" in the sense of enabling the user to attain a positive frame of mind that comes from the feelings of well-being and of clarity of thought resulting from the consumption of psychoactive chemicals contained in the plants and the use and effects of emesis therapy. Thus, the culturally defined term "bringing luck" could be further investigated as a metaphorical indicator of psychoactive plant effects used by Southern Bantu traditional healers and laypeople to connect with their ancestral spirits.

Discussion

The popular examples in this paper highlight the fact that there is a scientific basis to many African traditional medicine practices. However, this topic is rarely explored in the academic literature. This indicates an apparent disconnection between the humanities and biomedical studies of African traditional medicine. This disconnection is partly attributable to the difficulty in effectively translating and interpreting the nuances of African cultural and language based descriptions of spiritual medicinal plant use and its effects. It is also partly attributable to the ingrained cultural prejudice of traditional medicine as being unscientific or "irrational" evident in societal dialogue, mass media and academia.

In this paper, I investigate some popular examples of plants used for spiritual healing purposes in traditional South African medicine using phytopharmacological study findings and the anthropological participant observation method. Through so doing I demonstrate that African traditional medicine concepts are often metaphorical descriptions of, for example, the psychoactive actions and psychological effects of plants or combinations of plants used in traditional medicinal preparations. In the example above, the description and use of *ubulawu* plant species as "bringing luck" is a metaphorical description of the psychological effects (clearer thinking and insight, revelatory dreams and good feelings) resulting from the consumption of psychoactive chemicals contained in the plants and the use of emesis therapy. Thus, such cultural descriptions of spiritual plant use are often fitting indicators of psychoactive and other medicinal plant actions. In other words, the metaphors associated with the spiritual use of plants in South African traditional medicine are clues to actual phytopharmacological effects. These metaphors should not be considered evidence of the spiritual phenomena reported, but instead read as clues to phytopharmacological actions leading to changes in mood and states of consciousness (like sedative hypnotics) that can then be researched further. Researchers who collect descriptions of the effects of plants used during traditional spiritual practice may unwittingly be collecting indicators of phytopharmacological actions. This possibility could be tested and harnessed more effectively as these metaphorical indicators of phytopharmacological actions could have application in the field or in screening the literature to identify medicinal plants with specific actions. Multi-disciplinary research that makes use of a combination of phytopharmacological data and anthropological methods can test the frequency of these culture-bound metaphorical indicators that are analogous to medicinal plant actions.

Furthermore, analyzing the Southern Bantu speakers' cultural explanations of spiritually used plants in relation to the phytopharmacological studies conducted on these plants can also demonstrate the empirical basis for use of some plants in divination (by producing things such as clarity of thought and dreams), while simultaneously revealing the phytochemical and biomedical foundations of the African traditional healers' explanations of why and how various spiritually used plants have medicinal value. Therefore, scientific (phytopharmacological and phytochemical) studies can be used to support the culturally defined descriptions and explanations of spiritual plant use. For example, the recently verified psychoactive relaxing properties of *imphepho* (Stafford *et al.*, 2005) are conducive to promoting an altered state of consciousness that facilitates its traditional spiritual uses.

In addition to the metaphorical indicators of phyto-pharmacological actions, the spiritual explanations of medicinal plant use should also be considered for their literal spiritual meaning. This is because Southern Bantu traditional healers are aware of and report that any medicinal plant has physical characteristics of use (e.g. burning the *imphepho* plant), corresponding psychological effects (e.g. from inhaling the smoke from the *imphepho* plant that contains psychoactive chemicals), and *spiritual* effects (e.g. the use of *imphepho* to connect with one's ancestral spirits). Thus, the Southern Bantu traditional healers consider the related physical, psychological and spiritual effects of plant medicines to be mutually inclusive of one another. Such a model of medicinal plant use is reminiscent of the African worldview of the "three-dimensional nature of human beings, as simultaneously, biological,

social and spiritual beings" (Petrus & Bogopa, 2007: 7). This also indicates that science (the biological aspect) is implicitly considered a component of sickness, healing and the human being. Scientific explanations are therefore shared with the social and spiritual aspects believed to be operating in reality.

The examples of culture bound metaphorical indicators of phytopharmacological actions mentioned in this paper are not isolated, with many more South African traditional plant medicine examples existing. Yet, despite this, and the need and value of understanding these cultural uses, sensitivity and respect should be observed in recording indigenous knowledge, especially in relation to those plants that are used in the initiation of traditional healers. Some of these plants cannot be divulged in public but only through training. To demonstrate one further example, there is a plant species that is used as a red *ubulawu* medicine in the initiation process of Southern Bantu diviners that has a vernacular name that indicates the sound of a beating heart. This medicine has other reported uses for palpitations elsewhere in Africa, indicating possible anti-arrhythmic and hypotensive actions. I have experienced the relaxing effects of this medicine and have also experienced what felt like a lowering of heart rate when using the medicine as part of my training apprenticeship. This could be another likely example of where the vernacular meaning of this plant's name is a metaphorical indicator of the plant's pharmacological actions.

The challenge for scientists (such as botanists etc.) is to engage traditional medicine practices with a mind open to the fact that there may be many more scientifically valid processes occurring beneath the surface of ritual appearances. Scientists therefore need to effectively translate and interpret the cultural and language based descriptions of indigenous people's spiritual plant use, where rationality and empirical soundness is not always immediately evident, but is indeed often present. This aligns with the idea driven by the Royal Society in the UK of a Science Culture Index (SCI) "in which all cultures are seen to contain perspectives and practices that can be seen as forms of science literacy, that includes, e.g., trial and error, the use of evidence to plot relationships of cause and effect, curiosity leading to experiments with substances and the development of technology and recipes (Croucamp, pers. comm., September, 2013)."

Combining anthropological, ethnobotanical and phytopharmacological research can help to counter the traces of academic prejudices with regard to the empirical basis and medicinal effectiveness of traditional African medicine. This multi-angled approach will also allow a deeper understanding of holistic medicine and the therapeutic mechanisms that occur in traditional medicine systems from around the world. Cultural prejudices exist in varying degrees among most, if not all, members of society due to vestiges of cultural conditioning. However, it is important to try to avoid these in research if we are aiming to obtain a more comprehensive and integrated understanding of science and medicine that intersects and forms the basis of many (though not all) cultural healing practices.

Summary

South African traditional medicine is often perceived as being unscientific, unsophisticated and "primitive". Research findings show that this is often due to prejudice and erroneous cultural beliefs that negatively affect the study of traditional medicine, as well as the failure to adequately interpret the concepts of African traditional medicine. These are often metaphorical descriptions of the biological and psychological effects of plants or combinations of them used in the traditional medicine preparations. Correct interpretation of the symbolic models and language used in various holistic medicine traditions can demonstrate the empirical basis for the use of many plants in spiritual healing practices such as divination (e.g., by producing clarity of thought or dreams, etc.) and medicinal plant actions. By bridging the cultural meanings and models of traditional medicine together with their corresponding phytochemical/biological studies can provide a more holistic understanding of traditional medicine and its effectiveness in treating various conditions including mental illness.

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6 ASIAN PLANTS

6.1 Herbs of the Traditional Chinese Medicine

Amirova, E.

Abstract

Chinese herbal medicine represents one of the largest and extensively studied contributions of traditional Chinese medicine. The fundamentals of Chinese herbal medicine are built on extensive, centuries-long exploration, research and analysis that focused on healing and restoration of energy. Chinese herbal medicine is not restricted to plants and includes a wide variety of naturally occurring materials that individually or in combination have therapeutic effects that help balance and maintain health, and offer multiple approaches and modalities to treatments of particular diseases or medical conditions.

Keywords: Chinese herbal medicine, clinical applications, concurrent use

History of Chinese Herbal Medicine

The herbal medicine and culture of China draw on a rich and extensive history of empirical observation. Through the process of trial and error, generations of healers have determined that hundreds of native Chinese herbs have therapeutic properties, supporting overall health and targeting specific diseases. Ancient artifacts and documents illustrate the development and evolution of Chinese herbal medicine, as they have adapted to Chinese culture and epidemiology; unfortunately, many of the sources dated between 1066–221 B.C. were either damaged or destroyed over the years (Chen, 2012).

One of the earliest and most fundamental texts of Chinese herbal medicine is the *Shen Nong Ben Cao Jing* (Divine Husbandman's Classics of the Materia Medica). According to the legend ascribed in the text, Shen Nong (The Divine Farmer) first introduced agriculture and animal husbandry in China. It is also stated in the *Master of Huai Nan* that Shen Nong "tasted a hundred herbs and came across seventy poisonous herbs each day" (Wu 2005). The *Shen Nong Ben Cao Jing* is a compendium of 365 herbs, with information about their temperature, taste, toxicity, dosage, and forms of delivery (Chen, 2012).

The expansion of trade and commerce between China and neighboring countries led to the introduction of novel herbs in China, which found medicinal use over time. These herbs are documented in the *Ben Cao Jing Ji Zhu* (Collection of Commentaries on the Classic of the Materia Medica), written by Tao Hong-Jing in 480–498 A.D. The *Ben Cao Jing Ji Zhu* is the second oldest known text of Chinese's herbal medicine. It contains descriptions of 730 herbs, as well as information about the identification and preparation of herbs (Ibid.).

The Tang dynasty (618–907 A.D.) is a significant period in the history of Chinese civilization. China underwent tremendous progress and growth in medicine and culture. Many classic texts were written during this era, such as the *Tang Ben Cao* (Tang Materia Medica), written 657–659 A.D. This text is also known as the *Xin Xiu Ben Cao* (Newly Revised Materia Medica). The *Kai Bao Ben Cao* (Materia Medica of the Kai Bao Era), written by Ma Zhi in 973–974 A.D., was the most comprehensive source of information about herbal medicine during the Song dynasty, with descriptions of 983 herbs. The period between 1057 and 1060 A.D., the *Jia You Ben Cao* (Materia Medica of the Jia You Era) was written by Zhang Yu-Xi and Su Song, which included details of 1082 herbs. The *Jing Shi Zheng Lei Bei Ji Ben Cao* (Differentiation and Application of Materia Medica), written by Tang Shen-Wei in 1082 A.D., merged references from other texts and expanded the overall Chinese herbal compendium to 1558 herbs. During the Ming dynasty, Li Shi-Zhen wrote one of the most important texts of Chinese herbal medicine in 1578 A.D., the *Ben Cao Gang Mu* (Materia Medica). Li Shi-Zhen

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devoted his entire life to studying herbal medicine, and compiled the text over 27 years, collecting descriptions and illustrations of 1892 individual herbs and 11000 herbal formulas.

Nomenclature of Chinese Herbs

The majority of Chinese herbal medicines comprise botanical specimens. However, the term is inclusive of a wide variety of naturally occurring materials such as animal parts, insects, shells, and minerals. As a whole, this collection of therapeutic substances is called "Chinese Herbal Medicine", even though "herbs" are not only plants and botanicals (Chen, 2012). In modern usage, the naming of herbs involves the Chinese character, the pinyin transliteration, pharmaceutical or Latin name, the common English name, and Japanese and Korean names for some herbs (Bensky, 2004).

Herbs can receive their names from their unique physical appearance. For example, Niu Xi (*Radix Cyathuale seu Achyranthis*) translates as "cow knees", since it has large joint-like structures that resemble cow knees; Long Yan Rou (*Arillus Longan*), "dragon eye meat", refers to the meaty part of the Longan fruit that looks like the eyes of a dragon. In addition, the color of the herb can provide information about its therapeutic attributes, as well as indicating the quality of the herb for purchasing or pharmaceutical use. Therefore, color is an essential factor in the traditional nomenclature of herbs (Chen, 2012). The following are examples of the names of herbs according to their colors.

Red herbs are denoted by hong (red), chi (bright red), or zhu (dull red). For instance, Hong Hua (*Flos Carthami*) is "red flower", Chi Shao (*Radix Paeoniae Rubrae*) is "bright red peony", and Zhu Sha (*Cinnabaris*) is "dull red sand". Red herbs are associated with Fire, the Heart, blood, and spirit (Shen), which is housed within the Heart. Many red herbs are known to invigorate the blood, regulate menstruation, clear heat, calm the mind, and stop bleeding (Holmes, 2002). Yellow herbs are huang (yellow) or jin (gold). For instance, Huang Bai (*Cortex Phellodendri*) means "yellow fir". Da Huang (*Radix et Rhizoma Rhei*), translates as "big yellow", and Jin Yin Hua (*Flos Lonicerae*), or "golden silver flower". Per Holmes (2002), yellow herbs are associated with Earth (the element) and the Spleen and Stomach organs. They strengthen the Spleen and transform dampness. White herbs are called bai (white) or yin (silver). Bai Shao (*Radix Paeoniae Alba)* translates to "white peony", and Yin Guo Ye (*Folium Ginkgo*) is "silver fruit leaf". White herbs are associated with Metal (the element), the Lungs, and the Qi, and are known to treat various respiratory conditions (Chen, 2012; Holmes, 2002). Qing denotes blue-green herbs. Qing Pi (*Pericarpium Citri Reticulatae Viride*) means "blue-green peel" and Da Qing Ye (*Folium Isatidis*) means "big blue-green leaf". Blue-green herbs are associated with Wood (the element) and strongly moves the Liver Qi (Holmes, 2002). Herbs that are green are referred to as lu. Some green herbs are Lu Dou (*Semen Phaseoli Radiati*) "green bean" and Lu Cha (*Folium Camelia Sinensis*) "green tea". Black herbs are associated with the Water element, and, therefore, with the Kidney organ, Yin, and Essence. Black-colored herbs contain hei or wu in their names, such as Hei Dou (*Semen Glycine Max*) "black bean", Hei Zao (*Fructus Jujubae*) "black jujube", and Wu Yao (*Radix Linderae*) "black medicine" (Holmes, 2002).

Nomenclature can also be founded on smell and taste. A distinctive fragrance or odor can be a determinant factor in the naming of some herbs. Xiang ("fragrant") describes herbs that are aromatic. For example, Mu Xiang (*Radix Aucklandiae*) means "fragrant wood", and Jiang Xiang (*Lignum Dalbergiae Odoriferae*) means "descending fragrance". Other examples include Yu Xing Cao (*Herba Houttuyniae*) or "fish smell herb", which has a unique fishy odor, and Bai Jiang Cao (*Herba cum Radice Patriniae*) or "rotten paste herb".

Classification of Chinese Herbs

Texts will often categorize herbs as superior, medium, or inferior in grade, based on determinants such as a therapeutic index and potential side effects. Herbs of superior grade have high therapeutic action, little or no side effects, and may be taken safely for a long period.

Some examples of superior herbs are Ren Shen (*Radix Ginseng*), Gan Cao (*Radix Glycyrrhizae*), Da Huang (Radix Rehmanniae), Shi Hu (*Herba Dendrobii*), Ba Ji Tian (*Radix Morindae Officinalis*), Huang Qi (*Radix Astragali*), and Gou Qi Zi (*Fructus Lucii*). These herbs are suitable for general medicine as well as a food-grade use. Herbs of medium quality have therapeutic benefits with possible side effects, requiring supervision and prescription from a knowledgeable practitioner. Such herbs include Gan Jiang (*Rhizoma Zingiberis*), Ma Huang (*Herba Ephedrae*), Dang Gui (*Radix Angelicae Sinensis*), Bai Shao (*Radix Paeoniae Alba*), Wu Zhu Yu (*Fructus Evodiae*), and Hou Po (*Cortex Magnoliae Officinalis*). Lastly, the inferior grade herbs have a greater likelihood of side effects compared to therapeutic benefits, especially if not properly processed. These herbs must be administered under the strict supervision of a professional. Some examples include Fu Zi (*Radix Aconiti Lateralis Praeparata*), Ban Xia (Rhizoma Pinelliae), Da Huang (*Radix et Rhizoma Rhei*), Gan Sui (*Radix Euphorbiae Kansui*), Ba Dou (*Fructus Crotonis*), and Wu Gong (*Scolopendra*) (Chen, 2012). Commonly, texts will classify herbs based on their primary therapeutic action, the original source of the substance, or the zang (viscera) and fu (bowel) organs to which the medicinal is directed.

Growth and Harvest of Chinese Herbs

Climate, geography and timing of harvest are significant factors that influence the quality of Chinese herbs, being heavily dependent on environmental conditions. For some herbs, the optimum quality is reached if grown in a humid climate while some thrive best in a dry desert. Some grow only in northern or southern climates, and others are best harvested during long hot summers, or in the middle of cold winters. The timing of the harvest considerably affects the potency of herbs, as plants go through seasonal changes of growth, maturation, blossoming, fruiting, withering and dormancy, since the specific part of the plant depends on the developmental cycle.

For instance, in harvesting Chinese herbs that comprise the entire plant, it is best to collect the specimen immediately prior to the blooming of flowers. If leaves are the targeted medicinal component, they are harvested immediately before or during flower blooming, when the leaves contain the highest level of active ingredients and have the greatest aroma. Flowers are best harvested while in bloom when they are the desired component. Meanwhile, seeds and fruits are collected from the early to the middle stages of fruit development. The barks are best collected in spring and summer, when plant growth insures that the maximum level of nutrients is circulating within the bark of the tree. Lastly, roots should be harvested during the dormant phases of late winter or early spring, when all nutrients are stored within the roots (Chen, 2012).

Preparation and Processing of Chinese Herbs

Preparation and processing are crucial components in the practice of Chinese herbal medicine. Although some herbs are used while fresh or in their original form, most require processing before use to obtain maximum availability of active ingredients. Moreover, each specific method of preparation has a purpose that affects the herb's overall therapeutic impact and effectiveness (Ibid.). In addition, the various preparation methods can modify the nature of the herb, adapting them to the requirements of the specific formula or patient. Traditionally, the seven main purposes of preparing and processing herbs are "to enhance or alter therapeutic actions, to minimize loss of active components, to maximize extraction of constituents, to reduce side effects and/or toxicity, to increase surface area and facilitate extraction, to prevent spoilage and prolong shelf life, to clean herbs prior to ingestion" (Sionneau, 1995; Chen, 2012). Some herbs only required simple procedures such as washing, drying, or cutting, whereas others required more complex treatments. These include pulverization, cutting, and defatting (Sionneau, 1995).

Characteristics of Chinese Herbal Medicine

A defining property of Chinese medicine is that it allows for precise differentiation of the symptoms and patterns of disease that is treated in accordance with the properties of individual herbs. With this system, a unique formula can be constructed with herbs that are selected for their specific characteristics and functions, which address the particular symptoms and patterns that have been identified. Here, the term "characteristics" refers to a set of values that describe thermal properties, taste, direction, channel affiliations, and toxicity of each herbal substance. Characteristics of herbs are strongly related to the herb's functions, and vice-versa (Chen, 2012).

Six primary tastes can be defined when describing the characteristics of herbs – pungent, sweet, sour, salty, bitter and bland, in addition to the two minor tastes, aromatic and astringent. Each taste has a unique effect, and herbs with similar tastes can have some common functions. Meanwhile, herbs with several tastes can exert more complex or multiple therapeutic effects. Pungent herbs disperse and activate both Qi and blood, and are, therefore, considered Yang in nature. The pungent taste is associated with the Lung organ and Metal element. Sweet herbs have a tonifying, nourishing, harmonizing, moderating, or moistening effect, and are Yang in nature. They are associated with the Spleen organ and Earth element. Herbs with a sweet taste primarily address conditions of deficiency, such as that of the Qi, blood, Yin or fluids, while also having the ability to alleviate acute pain or mental and emotional distress. Meanwhile, herbs with a sour taste have a stabilizing, astringent, and cooling effect, are Yin in nature and are associated with the Liver organ and Wood element. The sour taste addresses disorders of fluid leakage and discharge, more especially with long-term deficiency. These herbs are usually given with caution to patients presenting pain. Salty herbs have a softening, dissolving, cooling, descending, and moistening effect, are Yin in nature, and are associated with the Kidney organ and the Water element. These herbs are especially useful for treating hardness, accumulations, masses and swellings, and can be cautioned in the conditions of leakage and discharge. Herbs with a bitter taste have a draining, cooling, drying, and descending effect, are Yin in nature, are associated with the Heart organ and Fire element, and are used to treat excess heat, fire, damp-heat, accumulations, and rebellious Qi. Bitter herbs are cautioned in cases of Spleen Qi deficiency and deficiency-type cold patterns. Lastly, the bland taste has a draining, diuretic effect on water, which is considered Yin in nature, and can be useful for addressing water accumulation with edema (Holmes, 2002).

Temperature is an important defining feature of Chinese herbs, and it describes the so-called thermal property of the herb in terms ranging from cold, cool, and neutral, to warm and hot. The main traditional treatment, according to classic texts, is, "Cold disease must be warmed, and hot disease must be cooled" (Chen 2012). Accordingly, colder herbs are usually used to address disorders of heat, such as fever or sore throat. Likewise, herbs of warm or hot temperature treat disorders that are cold in nature, such as abdominal coldness with pain, or cold extremities. Neutral herbs are used for hot or cold disorders (Ibid.).

Another parameter that is considered in Chinese herbal medicine is the direction of the herb, which refers to the guiding affinity of the herb to certain areas of the body. Disorders can be characterized with a direction that is upward, such as coughing or vomiting, descending (diarrhea, prolapse), inward (common cold transforming to pneumonia), or outward (perspiration). Similarly, herbs have their own dynamicity, and the strategic use of herbal directionality can be used to counter the direction of the disease condition. In addition, herbs with a particular directional affinity can be used as a guiding herb within a formula in order to focus the therapeutic effect on the affected area (Chen, 2012). Herbs can also have an affinity towards certain channels, especially treating those signs and symptoms that are unique to the meridian (Holmes, 1995).

Overall, it is essential to consider the thermal property, taste, direction and affected channels when designing and prescribing herbal formulas to patients, as well as to identify

the correct pattern of the disease. For instance, selecting the correct taste with the wrong temperature or channels for a specific patient or disease will likely result in ineffective treatment (Chen, 2012).

Clinical Applications of Chinese Herbal Medicine

The practice of Chinese herbal medicine is a delicate combination of art and science, using both rational and intuitive approaches to treatment. Although traditional Chinese medicine offers multiple approaches and modalities for the treatment of disease, any curative effect requires a thorough understanding of the disorder that is specific to the patient, an accurate differential diagnosis, and precise prescription of herbs.

When constructing herbal formula, it is essential to select the most appropriate herbs while taking into account any cautions and contraindications, the appropriate dosage, and any suitable methods of preparation. Commonly, Chinese herbs are prescribed as a formula, though they may be prescribed as a single herb (Chen, 2012). The dosage is another critical, yet variable, factor in Chinese herbal medicine, usually based on the patient's physique, constitution, severity of symptoms, and duration of illness. Due to these factors, many medical books do not give specific dosage amounts; rather, dosage ranges are given (Hsu, 1986).

Concurrent Use of Herbal Medicines and Pharmaceuticals

The modern global practice of medicine is now at a crossroads, at which patients are being treated simultaneously with both Western and Chinese medicine (Chen, 2012). For instance, it is now somewhat common for patients to take herbal therapies or supplements with prescription pharmaceuticals. As the public becomes increasingly open to adding herbs and supplements to their lifestyle regimen, both patients and health professionals must be aware of potential adverse drug-herb interactions. Thus, safety has become a major point of discussion in the field of alternative medicine. Although herbs are classified and distributed as dietary supplements, it must be taken into consideration that herbs, if used incorrectly, like any other substance, may have an adverse effect on patients. Therefore, a well-qualified practitioner of Chinese herbs is the safest route of access to herbal therapy (Ibid.).

Summary

In the modern global practice of medicine as a whole, Chinese medicine has become increasingly recognized and followed due to its versatile and extensively studied approach to maintaining health. Currently, it has been observed that patients are more commonly being treated simultaneously with both Western and Chinese medicine. As the public becomes progressively open to innovative alternative medicine, both patients and health care professionals must be aware when unconventional treatment and mainstream treatment are being combined. As a major aspect of Chinese medicine, Chinese herbal medicine is a delicate combination of art and science, which uses rational and intuitive approaches to create "smart" supplemental or herbal extract treatments to prevent diseases and to restore the body's energy balance. The knowledge and implementation of Chinese herbal medicine remain of crucial importance in the development of the field of modern medicine, and further understanding and determination of its effectiveness and potential are needed.

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7 SUMMARY: PROFESSIONAL PROFILES AND FUTURE RESEARCH PERSPECTIVES

Abstract

This chapter contains the professional profiles of all contributors participating in the preparation of this book. There are 17 researchers from various academic degrees and nationalities, who have carried out fieldwork in their respective area of interest. Scholars from Colombia, USA, Peru, Czech Republic, Mexico, South Africa and France cooperated with the editor during a one-year long period. Some chapters were written in languages like Czech and Spanish. Those chapters written in other languages were translated to English.

Maria Gladis Rosero Alpala, Biolo. MsC. (Colombia)

Maria Gladis Rosero Alpala is currently working as a coordinator of the Biodiversity and Environmental Program, Indigenous Organization for Research "Tierra y Vida" – Colombia. She is a member of the Research Group in Neotropical Plant Genetic Resources, National University of Colombia, Palmira – Colombia. From 2006 to the present day, Maria Gladis focuses her ethnobotanical research on the indigenous communities of the Pastos and Quillasingas ethnic groups from the Colombian Andean region. She specializes in the use, management and taxonomic determination of useful plants, as well as in the characterization and evaluation of plant genetic resources in traditional agroecosystems. Her research contributes to the conservation of biocultural heritage of these communities.

Ellie R. Amirova, L.Ac., Dipl. O.M. (Kazachstan, USA)

Ellie Amirova is a DAOM candidate at the Pacific College of Oriental Medicine in San Diego, CA, USA, currently working on developing a new bread product with hypoglycemic Chinese Herbs to prevent Type II Diabetes. Her work is done in collaboration with Saint-Petersburg National research University of Information Technologies, Mechanics and Optics, Russia.

Ing. Leiter Granda Cruz (Peru)

Leiter Granda Cruz is currently studying a Ph.D. in the Department of Crop Science, Breeding and Plant Medicine, Faculty of Agronomy, Mendel University in Brno (Czech Republic). He focuses his research on plant production. His practical and academic experience has been on social and agronomical characteristics of alternative crops that ensure food security, conservation and use of plant genetic resources. His research deals with the published results in his diploma thesis Alternative crops – *Plukenetia volubilis* and *Zea mays* ssp. Peruavian morado.

Biol. Luis Eduardo Forero Pinto, Esp. (Colombia)

In the past five years, Luis Eduardo Forero Pinto has dedicated himself to investigate promising native forages with the students of Animal Science from the National University of Colombia. The aim of his investigation was based on the short-term research on Colombian mega diversity to find edible species. In the area of ethnobotany, he is preparing a book on "Toxic plants of Colombia" (Practical guide for teachers and students of biology, medicine, animal science, veterinary and related areas) and a second text on the "History of Colombian ethnobotany" (Intellectual traditions and research periods). He also carries a community-based participatory research.

PhDr. Marek Halbich, Ph.D. (Czech Republic)

He studied at the Pedagogic Faculty in Ústí nad Labem form 1985 to 1990, and then, studied ethnology at the Faculty of Arts of Charles University in Prague, from 1990 to 1998. He proceeded to the Institute of Ethnology at the Faculty of Arts for his postgraduate studies between 1999 to 2007. In 2007, he concluded his dissertation titled *Tarahumara/Rarámuri in northwestern Mexico: from caves to the ejido*. Since 2002, he has been an assistant professor in the Department of General Anthropology, Faculty of Humanities, Charles University in Prague. He gives lectures on ecological anthropology, anthropology/sociology of tourism, anthropology of sport, linguistic anthropology and Ibero-American studies. He focused above all on the native groups of Mexican northwest and Central America. He carried out his fieldwork in Mexico, Guatemala, Nicaragua, Costa Rica and Panama. In 2012–2014, he carried out several field trips to the east coast of Madagascar, where he studied environmental and social change among the local villages and urban people in the context of post-colonialism.

He currently is processing the materials from his ethnographic field research on the east coast of Madagascar and archival research in the Archives nationales d'Outre-Mer in Aix-en-Provence in France. The result of this research will be a book tentatively titled *Ecological and social change on the east coast of Madagascar in a globalised world* whose due in 2015. In the near future, he wants to deal more with issues related to climate change in the context of ecological anthropology (ethnography of climate change), tourism, focusing on environmental aspects (ecotourism and social change), comparative anthropology of colonialism and post-colonialism in sub-Saharan Africa and Latin America (e.g. land-grabbing, anthropology of poverty, etc.) and on research between human agency and human cognition in the context of multispecies ethnography and overcoming of the dichotomy of nature vs. culture.

Mgr. et Mgr. Miroslav Horák, Ph.D. (Czech Republic)

Miroslav Horák is currently the Head of the Department of Languages and Cultural Studies, Faculty of Regional Development and International Studies, Mendel University in Brno. In his research, he focuses on the efficacy of drug rehab centers in Peru, Nicaragua, and the Czech Republic, comparing treatment in five therapeutic communities: Takiwasi (Peru), Centro de Especialidades en Adicciones (Nicaragua), Renarkon, Sejrek and Center for Social Intervention Kladno-Dubí (Czech Republic). His research deals with published results of his work in the field of drug addiction treatment. In 2013, Dr. Horák published a book titled "The house of song: Rehabilitation of drug addicts by the traditional medicine of the Peruvian Amazon".

PhDr. Veronika Kavenská, Ph.D. (Czech Republic)

Veronika Kavenská is an assistant professor in the Department of Psychology, Palacký University, Olomouc. Her long-term research has been on the issue of ayahuasca application in psychotherapy, shamanic tourism – the potential benefits and risks, and integration of experience with traditional medicine of South America. In 2012, she published a book titled "Traditional medicine of South America and its application in psychotherapy". She is a member of the Czech Society for Analytical Psychology.

Ing. Blanka Kocourková, CSc. (Czech Republic)

Blanka Kocourková is a lecturer and research assistant at Mendel University in Brno, Czech Republic, where she graduated many years ago. She has taught many renowned professionals in breeding, cultivation and processing of this specific commodity. She has been working in the field of medicine, aromatic and spice plants for more than 40 years. During the 1970s and 1980s, she worked in some groups and introduced some important species to

cultivation and improved many agro-technologies (*Mentha x piperita, Foeniculum spp., Matricaria recutita, Valeriana officinalis, Digitalis* spp., *Oenothera biennis, Carum carvi*).

She is a chairwoman of the Association of the growers and processors of medicinal, aromatic and spice plants of the Czech Republic (PELERO CZ, o.s.) where she defends the interests of domestic farmers, seed and breeding companies, and processors. She is also a member of the Czech Caraway Association. She helped to achieve important EU designations (PDOs) for caraway and chamomile ("Czech caraway", "Chamomilla Bohemica").

Lic. Fabiola Minero Ortega (Mexico)

Fabiola Minero Ortega is currently studying a master's degree in Social Anthropology at CIESAS unit Golfo. Her primary areas of interest and research are oriented toward symbolic thinking, traditional medicine and studies on magic and religion among the indigenous people of Mexico. Fabiola focuses on the study of shamanism and ritual use of entheogens among the Mazatec people of Oaxaca, applying a sociopolitical approach that seeks to find a relation between shamanic and political practices.

Bsc. Nohelia Andrea Castro Pineda (Colombia)

Nohelia Andrea Castro Pineda is a graduate student in sociology at Saint Thomas University, Bogotá. She currently works as co-director of the Colombian Ecological Communities Corp. (COECO COLOMBIA). Her main area of interest is the comprehension of social reality by the rural communities of Colombia, with a particular focus on rural development, decision-making and traditional medicine based on memory construction and the integrity of knowledge. Nohelia Castro studies traditional medicine and strengthening of its potential by working with indigenous communities of the Vaupés, Colombia, applying a socio-environmental approach, in which decision-making is focused on the welfare of culture and nature. In addition, she is interested in rural issues, e.g. the use and possession of land and territories.

Ing. Amparo Rosero, MSc, Ph.D. (Colombia)

Amparo Rosero is currently a part-time researcher of the Agriculture Programme at the Indigenous Organization for Research "ORII-Tierra y Vida". She had her academic formation as agronomic engineer and later her master degree in agricultural sciences at the National University of Colombia – Palmira. After being selected by the Ministry of Education, Youth and Sport of the Czech Republic, she studied her Ph.D. in Plant Physiology at Charles University in Prague. Her research has been focused on traditional knowledge in plant use and conservation.

Ing. Gabriela Růžičková, Ph.D. (Czech Republic)

Gabriela Růžičková has an interest in medicinal, aromatic and spice plants. She worked as a pharmaceutical assistant in the early 90s. After her graduation (Ph.D., 2005) at Mendel University in Brno, where she studied the quality of innovation in the production of important cultivated species on optimal agro-technology, she started to work in the commercial sector as head of a quality management lab. She was also responsible for pharmacy. Then she continued in another company as an independent researcher responsible for the development of various types of products with medicinal plants. She got the chance to work at Mendel University in 2007 as a lecturer and research assistant where she co-founded some subjects and solved many scientific and educational projects.

Nowadays, she would like to take other factors into consideration, like the improvement in support for farmers who produce medicinal plants via a broader discussion between a professional association and the Ministry of Agriculture. She would like the consultation

of food and agricultural legislation to be more applicable for the transfer of farmers' and collectors' products to the market and their fair prices. Also, the keeping, training and education of the traditional knowledge about cultivation, wild collection, processing and use of traditional plant species is on the front burner. Gabriela has met many colleagues with similar interests and goals abroad, so she hopes that these topics will allow her to meet other enthusiastic people in collective action in the future. She is a member of domestic and also international professional associations (PELERO CZ, AMAPSEEC) and international research teams.

Bc. Ing. Eva Sapáková, Ph.D. (Czech Republic)

Eva Sapáková is currently a research assistant in the Department of Languages and Cultural Studies, Faculty of Regional Development and International Studies, Mendel University in Brno. She focuses her research on entomology, plant pathology, ecology, medicinal and aromatic plants and plant medicine. In contemporary research, she is concerned with Allium plants, not only in terms of entomology, but also from the viewpoint of the active substances and the possibility to increase their content and further usage in medicine. She also deals with ecological farming and honey production.

Mgr. Ludmila Škrabáková (Czech Republic)

Ludmila Škrabáková is currently working on her doctoral thesis titled "The life of plants in the Peruvian Amazon" at Charles University in Prague. Her scientific work is focused on the medicinal plants of Lowland South America and on the ethnobotanical uses of plants in the production of local artifacts. She is also interested in human-plants and human-nature relations in the Amazonian region in general. She works as the curator of the South-American collection in the Náprstek Museum in Prague.

Jean-Francois Sobiecki, B.Sc. Hons. Ethnobot. (UJ) (South Africa)

The urgency to document and preserve South Africa's remaining indigenous knowledge around medicinal psychoactive plants, together with the great need for natural healing spaces has inspired Jean-Francois to create the Khanyisa Healing Garden.

The aim of this innovative project is to grow and showcase a garden of psychoactive medicinal plants used traditionally in South Africa to treat mental illness and other nervous system conditions, and to document and preserve the dwindling indigenous knowledge of their uses. This unique garden will serve to stimulate research, health promotion education, conservation, and sustainable job creation related to these plants and their associated traditional indigenous knowledge.

In collaboration with the Healing Africa Foundation, Dr. Miroslav Horák from the Department of Languages and Cultural Studies, Mendel University in Brno, the University of Johannesburg Community Engagement, as well as other potential partners the Khanyisa Healing Garden aims to be a exemplary model for the preservation and the viable and sustainable utlization of African indigenous healing knowledge. The vision is that similar gardens can be replicated elsewhere around the world with the aim of sharing indigenous medicinal plant knowledge from different holistic medicine traditions so as to advance our understanding of healing consciousness with plant medicines. This will serve to uplift traditional medicine and local cultural practices that can have future application in the development of medicines, sustainable job creation, healing and societal wellness.

More on the Khanyisa Healing Garden Project and ways to collaborate and support its objectives can be found on the website: http://www.khanyisagarden.co.za and at http://www.healingafricafoundation.org

Jean-Francois Sobiecki is an ethnobotanist, traditional medicines healer and research director at the Healing Africa Foundation and has over 15 years of experience studying South

African and global medicinal plant use. For more information on his work see: http://www.ethnobotany.co.za

Dr. Jacques Tournon (France)

Jacques Tournon has a degree in chemical engineering, and a doctorate in solid state physics. After that, he worked two and half years in the Department of Biophysics, Michigan State University (USA), where he did work on amino acids and protein luminescence and its applications in studying proteins structure. Then he was appointed to the CNRS (Centre National de la Recherche Scientifique). In the beginning, he worked on nucleic acids, but after traveling to Peru he became fascinated by the flora of the Amazon, and the knowledge of the Shipibo-Konibo about it. He dedicated himself to the flora of the Ucayali Valley and the extensive and profound knowledge of the Ucayali natives and "mestizo" inhabitants about their plants and their concepts (*rao*, *noi rao*, *yoshin*, *ibo*...), which are said to be "traditional", but are very modern in many aspects, since the concept of *rao* designates not only medicinal plants but also psychotropic end ethotropic plants. In the early 1980, few scientists with the interests in botany and ethnology had worked on this area (except G. Tessmann in 1928). He worked in collaboration with the Department of Forest Sciences, National Agrarian University – La Molina, Peru, and the Department of Spermatophytes, National Museum of Natural History, Paris.

Bsc. Gabriel David Beltrán Zapata (Colombia)

Gabriel David Beltrán Zapata is currently finishing a master's degree in Sciences, Biodiversity and Conservation at the National University of Colombia with a thesis titled: "Medicinal plants, traditional knowledge and transmission modes in the Macaquiño community, Vaupés region (Colombian Amazon)." He also works as director of the COECO COLOMBIA. His investigation based on the ethnoecology, conservation, agroecology and local sustainable development, represents a defense of the autonomy, identity and well-being of Colombian local communities and societies. Among his projects he is trying to establish a research institute and nature reserve, where it would be possible to investigate alternative strategies of good living without destroying nature and culture. He is also building cooperation in Latin American and other countries around the world.

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