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## Indigenous Concepts of Medicinal Plants in Oaxaca, Mexico: Lowland Mixe Plant Classification Based on Organoleptic Characteristics\*<sup>1</sup>

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### Summary

For the Lowland Mixe of Oaxaca (Mexico), plants are a central part of their medical system. Direct access to the natural environment is - among other possibilities - made feasible by sensory perceptions of plants and plant products. This is interpreted according to cultural expectations. The Mixe judge uses of a plant based on its characteristic smell and taste. These are used in the decision process on whether a plant may be a potential medicinal and for which particular illness it may be used. Generally, astringent drugs (especially the bark of various trees) are valued to treat diarrhea and dysentery, bitter plants being used as supplementary therapy for these indications. Bitter, aromatic and aromatic-bitter plants are valued in the treatment of gastrointestinal cramps and pain. Cough and other respiratory complaints are treated mostly with sweet, sometimes sour drugs. This form of perception is central to the Mixe's medicinal plant concepts while the classification based on the humoral 'hot/cold' dichotomy is of minor importance. Taste and smell properties thus open natural resources to human use. Cultural interpretations of the therapeutic results achieved with these plants are additional criteria for deciding whether the use of a specific plant should be continued and for changes in its use profile.

### Introduction

For the Lowland Mixe of Oaxaca (Mexico), plants are a central part of their medical system. Plants are valued as an immediate treatment, for example for minor injuries or as soon as a skin infection is noticed. Plants also are an important part of the treatment for a large number of systemic illnesses. Our concern for these plants stems from an interest in their pharmacological effects and on bioactive compounds from these plants (BORK et al., 1997; HEINRICH et al., 1992; KUHNT et al., 1995; HÖR et al., 1995), but also from the anthropological questions that arise from the traditional use of such plants (ETKIN, 1988, 1994; HEINRICH, 1994, 1997). We try to understand how cultural interpretations of the biological effects of plants and the effects observable in experimental studies interrelate (HEINRICH, 1996; BORK, et al., 1997). We are interested not only in how a certain culture uses plants as medicines or only in phytochemical and biological-pharmacological studies on plants, but in a truly multidisciplinary approach combining anthropological and biologicopharmaceutical concepts and methods.

Mexico with its enormous biological (RAMAMOORTHY et al., 1992) and cultural diversity is an ideal region for such studies. Traditional medical systems have received considerable attention in recent decades (ARGUETA V. and ZOLLA, 1994). A large number of descriptive ethno-

medical monographs of communities have appeared in the last decade (for example, CASILLAS R., 1990; GREIFELD, 1985; DOW, 1986). Of continuing interest is the history of the indigenous medical systems (VIESCA T., 1986; LOPEZ P., 1992). Several studies focus on the efficacy of indigenous forms of treatment (ANDERSON, 1992; BROWNER, 1988, and references cited) and on the potential side effects of such treatment (TROTTER, 1985). Studies on culture bound illnesses (folk illnesses), which started with the early work of Arthur Rubel in the late fifties and early sixties still are an important focus of research (RUBEL et al., 1985). Of particular interest for our studies is the anthropological research on infectious illnesses prevalent in Mexico and adjacent countries (BURLEIGH et al., 1990; HEINRICH, 1994), but this field still remains to be more fully explored. Recent interest has also focused on patients' and doctors' roles and expectations in clinical settings (FINKLER, 1994; HUNT, 1994), on other aspects of urban Mexican medicine (for example, CALVA, 1996) and on the specific role of women as patients and as health care providers (FINKLER, 1994; PARRA, 1993). The field of ethnobotany is flourishing with many of the studies being conducted by Mexican researchers (AGUILAR et al., 1994, BERLIN and BERLIN, 1996; BYE and LINARES, 1987; CASAS et al., 1994). Comparatively little is known about the relative role of plant based remedies as compared to commercially available pharmaceuticals and on other aspects of pharmaceutical anthropology (VAN DER GEEST et al., 1996; CALVA, 1996).

In the study of the cultural basis of indigenous plant use there have been two main approaches. One line of thought is the cognitive approach exemplified by BERLIN (1992), looking at plants in general from an ethnolinguistic perspective. With such an approach one gets an understanding of the cultural structuring of the natural environment. The other well known concept in medical anthropology holds that the basic classificatory system in most regions of the Americas is the 'hot/cold' system (FOSTER, 1994, and references cited in this work).<sup>2</sup> During the fieldwork with the Lowland Mixe I came to realize that this system is only of minor importance with this group. Instead direct access to the natural environment is usually made feasible by sensory perceptions of plants and plant products. Taste, smell and/or the irritating effect produced by some plants (especially the sap) are thus the basic criteria to decide if a plant may be considered medicinal and for which illness it may be used.<sup>3</sup> While visual and to a lesser degree acoustic perceptions have been discussed in greater detail (HOWES, 1991; STOLLER, 1989), taste and smell have received some attention only in the last few years (LOGAN and DIXON, 1994). They are for example not included in a recent volume on the relationship between humans and nature by ELLEN and FUKUI (1996): On the other hand, the role of olfactory remediation has received renewed attention in medicine and psychology (CLASSEN et al., 1994; MARTIN, 1996).

In this paper the classificatory system of the Lowland Mixe from San Juan Guichicovi is described. The relevance of these data for the study of human sensory perception in particular and for the study of

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<sup>2</sup> In order to differentiate between hot and cold in the context of humoral medical concepts and other hot/cold-concepts the former ones are put in quotation marks ('...').

classificatory systems are discussed. While I draw chiefly on our data on the sensory perceptions of medicinal plants, I will also briefly discuss concepts associated with illnesses and with foods.

The land of the Mixe extends mostly through the cool and humid mountains of the Sierra de Juarez in the Mexican state of Oaxaca, San Juan Guichicovi being the only Mixe-speaking community belonging to the subtropical Isthmus of Tehuantepec. San Juan is the principal community (*cabecera*) of a subdistrict (*municipio*) of the same name. In 1980 20,000 persons were living in the *municipio*, approximately 5,500 to 6,500 of them in the *cabecera* (CENSO GENERAL, 1980: 145-146 and unpublished data). Seventy-five percent of the population in the *cabecera* is considered to be bilingual. A minute fraction of the population speaks only Spanish. The economy is based on subsistence agriculture (chiefly maize) and on the production of coffee and citrus fruit. Another relevant commercial product are *huipiles* (women's blouse) of the Tehuantepec style. They are produced by women and men in the community and are mostly sold to Isthmus Zapotec merchant women who sell these products in numerous communities of the Oaxacan part of the Isthmus and in many other regions of Mexico. No detailed monograph on the lowland Mixe is available. Brief accounts are given by FOSTER (1969) and NAHMAD (1965). The only cultural aspects that have been dealt with in detail are the ritual calendar, still used in some parts of the *municipio* (CARRASCO et al., 1961; LIPP, 1991; WEITLANER and WEITLANER, 1963) and in - some adjoining *municipios* - the relationship of religious ritual and medical concepts (LIPP, 1991).

Mixe belongs to the macro-Mayan stock. No monograph on the ethnolinguistics of lowland Mixe is available. Vowels are generally pronounced as in Spanish. Additionally [ɛ] is used, which is pronounced as a nasalized Spanish [o]. The consonants are pronounced as in Spanish. A glottal stop [ʔ] and palatalized consonants and vowels are frequent (written as [ay], [ky], [my], etc.). In this article the Mixe words are transcribed as used by the bilingual teachers in the community.

There are at least 15 different healers (*pa'am iixyp'*) known in the community. The largest groups are "specialists in home remedies". Other important groups are midwives (*ma uunk wixyp'* or *parteras*), *chupadores* (*pota'ak iixyp'* or *ma'ixyp'* - those who suck), prayer makers (*rezadores*), *espiritistas* and *espiritualistas*. Fairly large differences exist between the various groups of healers.

The "specialists in home remedies" are a group of practitioners who do not consider themselves healers, but who "only give some plants or a *limpia* (ritual cleansing)", if a person is ill. These persons are generally knowledgeable with respect to plants that can be used in the treatment of common, minor illnesses and ailments. Any person who has a 'cooling hand' (*këtoxk*) is capable of performing a *limpia*. If an illness is more severe or difficult to treat, the patient may be referred to other healers especially to those who are ritual specialists. Midwives assist pregnant women, the women in labor and the mother and child in the first few postnatal weeks. Besides practicing empirical forms of

treatment they are also ritual specialists. A few days or weeks after the birth the midwife returns to the home of the mother and the rite *jekëeny tsiiny* (HEINRICH, 1994, 1997) is performed. Many of the midwives have had rather intensive contact with doctors, nurses and midwives of the Mexican national health service and have acquired some basic training in gynecology and pediatrics.

Some groups of healers largely employ symbolic forms of treatment and will not be discussed in detail here: *Chupadores*, who 'suck out' an illness; the *amamabie*; who know how to perform the oracle using maize kernels and the prayer makers (*rezadores*), who ask forgiveness or *nu'ux tak*. In previous decades several other groups of specialists were practicing in the community (bone-setters and *culebreros*-healers of snake bites). None of them was still working at the time of the study.

Recently, travelling salespersons (most of whom speak Mixe), persons with some minimal experience in Western medicine, helpers of the local Roman Catholic priest and of various Protestant groups and some trained nurses are offering their help in case of illness. The differences between these groups and also between the various individuals are enormous. Some (especially of the travelling salespersons and persons with some minimal experience in Western medicine) can only be considered charlatans, but others have a rather sound background in basic medical therapies. In the last ten years there were between one and four medical doctors practicing at the same time. One or two are usually medical doctors sent by Mexican government agencies (IMSS, INI). Some "specialists in home remedies" and travelling salespersons sell pharmaceuticals and advise on their uses. No quantitative data on the importance of these forms of medication as compared to indigenous phytotherapy are available.

## Methods

The data presented here were collected during fieldwork in San Juan Guichicovi which took place over nearly two years. Most of the data on the sensory perceptions of medicinal plants presented here were collected during three shorter stays of 6 to 8 weeks between 1990 and 1994. Specialists in medicinal plants and/or healing rituals were interviewed, and excursions into the surroundings were made with them to collect the plants indicated as medicinal. For each plant detailed information on its uses, preparation, application and concepts associated with the plants was solicited. The healers were observed during their healing sessions and were also asked in open-ended interviews to describe the illnesses and their treatments.

Unstructured interviews and informal discussion on medicinal plants or treatment methods were additionally conducted with a very large proportion of the population (see HEINRICH, 1994). To elicit information on the topics of relevance in this paper the healers were routinely asked "Why is this plant a medicinal and why is it good for treating the illness you mentioned?"

Voucher specimens were collected and identified by comparison with authentic specimens at the National Herbarium of Mexico (MEXU). Some difficult species were identified by specialists on the respective taxa. A complete set of specimens is available at the National Herbarium of Mexico (MEXU) and at the Institut für Pharmazeutische Biologie in Freiburg (Germany).

## Results

### Illness Concepts

Of central importance to the Mixe is the question of the cause or causes of an illness (HEINRICH, 1994). To the Mixe minor ailments, which are of relatively short duration, are of little concern. Such illnesses include superficial cuts and bruises and other minor dermatological conditions, cough and other respiratory illnesses. These diseases are thought to be

<sup>3</sup> The original idea for the above mentioned symposium is based on parallel observations of John Brett and myself in different areas of Mexico. When I met John Brett in 1992 in Mexico City, and heard his talk at the 3rd International Congress of Ethnobiology, I was struck by similarities with respect to the sensory perceptions of medicinal plants between his description of the Tzeltal Maya and my own experience with the Lowland Mixe (BRETT, 1992, 1994; HEINRICH, RIMPLER and ANTONIO B., 1992; HEINRICH and ANTONIO B., 1993; HEINRICH, 1994). We had both noted independently during fieldwork that certain chemosensory properties of plants define them as medicines and these properties give hints to their use in the treatment of certain illnesses. Since we had both worked autonomously (not knowing about the research of the other) in areas quite far apart in Mexico, the coincidence seemed to be more than an accidental 'exception to the established rules'.

caused by natural forces. Cuts, bruises, and burns need no further explanations, since the physical impact on the person is readily noted. In case of colds, the coldness of the season (for example December), the lack of proper clothing, or 'una infección' (an infection, a Spanish loan word in Mixe) are considered as causative factors.

An example of an illness which requires, according to the Mixe, a more detailed understanding of the causes is tsékë'ë ('susto', 'sudden fright') known from many parts of the Americas. This illness is caused by a sudden fright, which may either weaken the person or cause the loss of his or her soul. Another example is *tsu box wiin tooy* (the fever caused by the evil winds of the night). Evil spirits of the night enter the body and may cause severe harm. For many people supernatural beings were and still are of special importance to explain the causation of illnesses, and these beings require the performance of healing ceremonies (see HEINRICH, 1994). These beings are part of the environment as it is perceived by the Mixe. There are powerful places around the village that are appropriate for performing certain healing rituals (especially rites associated with leaving old clothes), because they are associated with such beings. Central to all healing rituals are rites in the church or in front of the house altar.

In other cases direct physical causes are recognized by the Mixe: the heat of the rainy season and especially of the *canicula* (the short semi-dry season between the two major rainy periods) is seen as dangerous and may cause insolation (sunstroke). Spoiled food is also known as a cause of some gastrointestinal illnesses. The Mixe seek an explanation both for the *why* and the *how* a person has been struck with illness, but the humoral 'hot/cold' classification is not employed in the interpretation and search for therapy. There may be one exception: Some people consider the corpse of a recently deceased person to be 'hot' (HEINRICH, personal observation).

These concepts form the basis on which the Mixe develop treatment strategies for curing during an illness episode.

#### Plants in the Mixe Environment

Plants in general are divided into three important groups:

- useful and therefore deserving some sort of management,
- useless and harmless and,
- a small group of plants which are not considered to be useful and that are regarded as dangerous or obnoxious (for example *Mucuna* sp., Fabaceae, because of the itching sensation and the inflammation caused by the hair of the fruit).

Within the first group, plants are assigned a large number of different uses, including food and medicine, in construction, as a toy for children, as shade trees and the like. As a consequence, such plants are often planted in home gardens, protected in the milpa (cornfield), spared from the cleaning of pathways and roads in the community (HEINRICH and ANTONIO B., 1993), or even brought into the community from neighboring communities or from the markets of several cities that serve as points of exchange.

The distinction between the first and the second group of plants may be ambiguous in many cases. Some people consider a certain plant to be medicinal or use it as an infrequently employed food item (for example *quelites*), while others regard the plant as useless. This is especially the case with respect to the numerous weeds in the village. These grow along the paths and streets, on empty lots and spontaneously in yards (for example *Epaltes mexicana* Less., Asteraceae, *Sida* spp., Malvaceae, *Leonurus japonicus* L., *Hyptis verticillata* Jacq., both Lamiaceae) and some of the plants may be kept by a few people who hold them to be medicinal while others do not spare them when weeding.

With respect to the distinction between the first (useful) and the third (dangerous) groups of plants there are a few ambiguous examples, too. *Croton soliman* Cham. and Schlecht., *C. panamensis* (Klotzsch) Muell. Arg. and *Hura polyandra* Baillon (all Euphorbiaceae) are used

as medicinals, but many informants also are afraid of the irritating sap produced by the plants.

In what follows I will concentrate on medicinal plants and only briefly refer to plants used in nutrition, a group which deserves a separate study.

#### Medicinal Plants

Medicinal plants that the Mixe regard as potentially helpful are sought as soon as the person affected notices, for example, an infection or a cut. No healers or ritual specialists are consulted in these cases. They are usually consulted only if supernatural causes are suspected or if the illness is either lasting or painful. Healers perform rites which are appropriate for a certain illness (for example a *limpia* [cleansing ceremony] for *susto*) and recommend the application of a herbal remedy (HEINRICH, 1994). The species used have been described in detail elsewhere (HEINRICH, 1989). A total of 213 plants with 299 different use categories were documented ethnologically and botanically and were identified to the species level. Plants are generally used in the treatment of minor illnesses such as cuts, skin infections etc. The largest group of plants is used for this purpose (72 species). Other important uses are for gastrointestinal conditions (66 species) and for illnesses associated with rise in body temperature (63 species).

Most plants cited as medicinals by the Mixe informants grow in the community or in its immediate surroundings (HEINRICH and ANTONIO B., 1993) and cannot be considered as wild resources (ETKIN, 1988). Most medicinal plants are therefore readily available if they are needed. In order to understand the indigenous criteria that are being used to characterize and select a medicinal plant I did not ask for specific concepts about a medicinal plant<sup>4</sup>, but instead asked "why is this plant useful as medicine". Informants usually referred to properties of taste and smell of a plant and frequently asked me to taste, smell or otherwise try the plants. These properties are also referred to in discussions about the medicinal properties of a certain plant between people in the community. The Mixe distinguish a large number of organoleptic properties of the medicinal plants (Tab. 1). Odor and taste of a plant or its parts are the most important criteria for deciding against what illness a plant may be used.

To treat infections of the skin, plants with any of the qualities summarized in Tab. 1 are used, the only exception being *pa'ak* (sweet). Aromatic (cooling) plants are considered very useful to treat illnesses that are associated with fever (HEINRICH, 1988) and are mostly applied externally (shower bathes, use of liniments and massages using alcoholic preparations of plants). Astringent drugs (especially the bark of various trees) are valued to treat diarrhea and dysentery. Additionally, bitter plants are employed as a supplementary therapy for these indications. Bitter, aromatic and aromatic-bitter plants are valued in the treatment of gastrointestinal cramps and pain. Cough and other respiratory complaints are treated chiefly with sweet and sometimes with sour drugs. A special category is *xajts oo'ts*. The foam that is formed if one rubs the mashed leaves of *xajts oo'ts aats* [*Gouania polygama* (Jacq.) Urban, Rhamnaceae] is seen as a hint of its medicinal properties.

These qualities also guide the search for new medicinal plants. Some of the criteria listed in Tab. 2 are also sometimes used in discussions

<sup>4</sup> In an earlier stage of fieldwork I had asked directly for the humoral qualities of a plant, but with the exception of some recently introduced plants such as Romero (*Rosmarinus officinalis* L., Lamiaceae) - never got meaningful answers. The most frequent answers were 'Quién sabe' (who knows), 'Puede ser algo caliente' (it may be a little hot), or other answers that indicated a lack of understanding of these concepts on the part of the informants.

Tab. 1: Quality of medicinal plants according to Mixe Indian criteria

Quality	Mixe term	Example (plant part used)
aromatic (cooling)	<i>xuup</i>	<i>Siparuna andina</i> (Tul.) A. DC. (leaves), Monimiaceae
astringent	<i>ti'ity</i>	<i>Guazuma ulmifolia</i> Lam. (bark), Sterculiaceae
bitter	<i>ta'am</i>	<i>Calea zacatechichi</i> Schlecht. (leaves), Asteraceae
burning	<i>tsu'tsp</i>	<i>Hura polyandra</i> Baillon (latex of fruit), Euphorbiaceae
foaming (forms foam when rubbed')	<i>xajts oo'ts</i>	<i>Gouania polygama</i> (Jacq.) Urban (leaves) Rhamnaceae
fresh (fresco)	<i>nik'</i>	<i>Peperomia pellucida</i> (L.) Kunth. (aerial parts), Piperaceae
gelatinous	<i>u'ty</i>	<i>Heliocarpus donell-smithii</i> Rose (bark), Tiliaceae
hot (like chile)	<i>jamuump</i>	<i>Capsicum frutescens</i> L. (fruit), Solanaceae
hot (like onions)	<i>jajp</i>	<i>Allium cepa</i> L. (onions), Alliaceae
sour	<i>xun</i>	<i>Citrus limon</i> (L.) Burm (fruit), Rutaceae
sweet	<i>pa'ak</i>	<i>Phyla scaberrima</i> (A.L. Juss) Moldenke (leaves), Verbenaceae

a) Also humid, in this context the term refers to a plant which contains large quantities of sap (for example in the stem or in the leaves).

Tab. 2: Hot and cold categories in Mixe from San Juan Guichicovi

Categories	Mixe terms
hot (caliente)	<i>aan</i>
warm (tibio)	<i>jokx</i>
fresh (fresco)	<i>nik</i>
cold (frío, weather, an object)	<i>tētxk</i>
cold	<i>tsuxt'</i>

a) Also green, used for example if one refers to an animal, that died recently

about medicinal plants (especially *nik* - cold or cooling) and generally refer to the thermal perception a plant produces on the skin. They are listed separately because they do not confer a taste or smell but a temperature concept.

Another important aspect for the Mixe is the physiological effect of a certain plant. Some plants produce irritation of the skin (for example *Croton* spp.) and are consequently used by some people in the treatment of skin infections. Such plants are considered inappropriate for internal use (which would have medically well known and serious toxic side effects). Another group of effects relates to the response of the body to the internal application of a specific medication. If purging is induced this will be seen as a good sign indicating the cleansing of the body. The same is true for preparations that induce sweating or vomiting. But in the latter two cases far fewer plants are known.

#### The Selection of Medicinal Plants

According to JOHNS (1990) the "process by which humans first came to use these economic plants and to avoid others has been lost in history". But there are two instances where one can still observe the

criteria for selecting herbal remedies: the introduction of new plants to an area and the ways people get acquainted with hitherto unknown native medicinal plants.

During my initial fieldwork (1985/86) in San Juan Guichicovi one of the healers introduced a plant which he came to know through healers from the highlands: *Porophyllum ruderale* ssp. *macrophyllum* (DC.) R.R. John (Asteraceae) or *tapahuelo*. The plant was subsequently used to treat *ataques* (various illnesses associated with seizures of the whole body). There seemed to be no taste or smell property that made the plant of particular interest as a medicine. The essential point was the experience other healers from the highlands had with this plant. The plant was therefore grown in his house garden and a few plants later grew in disturbed areas of the community. Interestingly, the use of this plant has since been discontinued and the plant is no longer propagated in the area.

Uses as a purgative are reported for *Hura polyandra* Baillon (*jabilla*, a tree from the Euphorbiaceae) from many parts of Mexico. A single tree was introduced into the community around the turn of the century by a Zapotec trader. The sap of this tree was a good substitute for purgatives known at this time and has very strong physiological effects. It is considered to be *jajp* (hot like chile) and *xun* (sour). I was unable to confirm whether these properties were of any importance in the initial selection of medicinal plants. The plant is now being replaced by magnesium hydroxide. The hard fruits are still used occasionally for wheels of little carts made by boys. These two examples illustrate the importance of experiences people outside the community had with a certain plant in the selection of culturally new medicinal plants and show the dynamics of plant use.

Another example is the subshrub *Russelia sarmentosa* Jacq. (*Aneymats*, Scrophulariaceae). The plant was formerly used to treat malaria and gastrointestinal illnesses. The use seemed to be fairly common several decades ago. When I showed this plant to a middle-aged informant he stated that he did not know it as a medicinal and then went on to try it. Because of the intensely bitter flavor of the leaves he commented that the plant might be good for treating fever. Other examples corroborate the idea that such qualities are of importance for making an initial decision on potential uses of a plant including plants with astringent, aromatic or bitter properties. I have observed several other cases where

unknown plants were judged based on their taste and smell properties, especially for bitter, astringent, and aromatic plants.

Thus there are two relevant ways of becoming acquainted with new medications: the experience of other people, which is adopted, and the exploration of unknown plants, especially based on their taste and smell properties.

### Food

Generally there is no clear concept of a humorally balanced food. The main focus is on the alternative between 'heavy food' (such as meat) and food that is easier to digest. With respect to plants four concepts are frequently used to describe them: sweet, sour, hot like chile, or hot like onion (see Tab. 1). Good food is neither extremely sweet nor extremely sour, but has a mild taste. But it may be rather spicy. There seem to be no elaborate dietary restrictions, for example for pregnant women and ill persons.

### Discussion

Taste and smell provide a direct link between nature and culture and thus allow, for example, the selection of a certain medicinal plant by the lowland Mixe. These organoleptic properties therefore are the link between illnesses as they are perceived culturally and the naturally available medicines. A plant is used and as a result of a continuous evaluation it may be used for longer periods of time or become obsolete as a medicine. Thus, the organoleptic properties open the door for a plant's use, but the continuing use depends on the cultural interpretations of the therapeutic results obtained with the plant. The taste and smell properties accordingly allow the structuring of the botanical environment (compare JOHNS, 1990, for taste properties of food plants). The medicinal flora is thus composed of discontinuous sets of plants, each individual one with properties taken from a limited set of organoleptic alternatives. Based on these properties plants have a certain use value. But taste and smell are not the only criteria used in the initial selection of medicinal plants. The experience of people in other regions may be as important.

Translations of the Mixe terms are used in this paper, but I am aware that a detailed cognitive study of these concepts will still be necessary in order to better understand the delimitations of these concepts.

One of the interesting theoretical results of these data is that they corroborate MOERMAN'S (1996, 1997) proposal that plants are not selected at random, but that there exist criteria for the selection of certain taxa and for rejecting others. Among the families most frequently used in North America are several which are phytochemically well known for being rich in essential oil and/or in bitter compounds and which have yielded medicinal plants used in numerous cultures (for example Lamiaceae, Asteraceae). Such families are widely used among the Lowland Mixe, too.

Two indigenous concepts merit additional discussion on a cross-cultural basis: The concepts of astringency and bitterness. While there is no concise cross-cultural overview of the reasons for the use of a certain medicinal plant or groups of plants available, uses of astringent (or tannin-containing) plants are particularly important in the treatment of diarrhea and dysentery, while bitter remedies are favored for stomach-aches and fever. There may be a third group of plants with a particularly important use: aromatic-sweet ones. Such plants may be of relevance cross-culturally in the treatment of respiratory illnesses. These two or possibly three correlations may have to do with observations made for centuries that such groups of compounds are effective in the treatment of the illnesses mentioned. A detailed cross-cultural analysis of ethnographic data on these concepts may help us to gain a better understanding of how people perceive plants and their properties.

### Conclusions

While there have been a few indications that chemosensory properties of medicinal plants are of importance to indigenous groups of Mesoamerica (see MESSER, 1991; ORTIZ DE MONTELLANO and BROWNER, 1985; LOGAN and DIXON, 1994), the data on the Lowland Mixe are clearly contradictory to the common concept of medicinal plant classification especially in the Americas based on the 'hot/cold' concept. It is intrinsically difficult to prove that a cultural concept does not exist in a region, but the data from the Lowland Mixe indicate that taste and smell properties are far more important than the 'hot/cold' concept. I expect that one of the reasons for our lack of appreciation of taste and smell concepts is the relatively undervalued role of these properties in European-based cultures. Two exceptions are the concepts of 'sweet' and 'bitter', which are used to separate the pleasant from the medicinal or food from non-food.

For the Mixe there also is no common association between illnesses and humoral 'hot/cold' concepts. There are illnesses that are regarded as hot, but this generally refers to their thermal properties. Examples are fever and some forms of dermal infections. Humoral concepts may well become of increasing importance due to the increased contact of the healers and other persons with outsiders (for example during meetings of native medical practitioners from other parts of Mexico organized by the 'Instituto Nacional Indigenista').

There are many cases of a classificatory system based on humoral traditions (for example LÓPEZ A., 1980; FOSTER, 1994; FREI et al., 1998); it is essential for future fieldwork in South and Mesoamerica not to limit the research to the 'hot/cold' system. It will be also of interest to look at the development of classificatory systems during larger time periods to observe changes in the systems.

Data such as those presented here help us (as pharmaceutical biologists) to better understand indigenous concepts of medicinal plants and are important guides for our selection of plants for further evaluating the native pharmacopoeias. As an anthropologist, I am fascinated by the cultural structuring of the botanical environment using pharmaco-botanical and chemical concepts. I think it will be rewarding to look simultaneously at the interface between human beings and their botanical resources from a pharmacological, botanico-chemical, and anthropological perspective.

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### Zusammenfassung

**Indigene Vorstellungen über Arzneipflanzen in Oaxaca, Mexiko: Pflanzenklassifikation der Tieflandmixe auf der Grundlage organoleptischen Charakteristika**

Für die Tieflandmixe in Oaxaca (Mexiko) sind Pflanzen ein zentraler Teil ihres Medizinsystems. Ein direkter Zugang zur natürlichen Umgebung ist - neben anderen Möglichkeiten - durch sensorische Wahr-

nehmungen der Pflanzen und Pflanzenprodukte möglich. Diese werden gemäß der kulturellen Erwartungen interpretiert. Die Beurteilung der Mixe über den Gebrauch einer Pflanze basiert auf ihrem charakteristischen Geruch und Geschmack. Diese werden im Entscheidungsprozess eingesetzt, ob eine Pflanze ein potentielles Heilmittel ist und für welche spezielle Krankheit eine bestimmte Pflanze gebraucht wird. Generell werden adstringierende Drogen (insbesondere die Rinde verschiedener Bäume) der Behandlung von Diarrhöe und Dysenterie zugeordnet, bittere Pflanzen werden als Begleittherapie bei dieser Indikation verwendet. Bittere, aromatische und aromatisch-bittere Pflanzen sollen zur Behandlung gastrointestinaler Krämpfe und Schmerzen hilfreich sein. Husten und andere respiratorische Beschwerden werden meist mit süßen, manchmal sauren Drogen behandelt. Diese Form der Wahrnehmung ist zentral in der Arzneipflanzenvorstellung der Mixe, während die Klassifikation basierend auf der humoralen „Heiß“/„Kalt“-Dichotomie von geringer Bedeutung ist. Geschmacks- und Geruchseigenschaften öffnen somit natürliche Ressourcen zum Gebrauch für den Menschen. Kulturelle Interpretationen der therapeutischen Ergebnisse der eingesetzten Pflanzen sind zusätzliche Kriterien bei der Entscheidung, ob der Gebrauch einer speziellen Pflanze fortgesetzt werden sollte, und bei Änderungen in ihrem Gebrauchsprofil.

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