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Folk Taxonomy in Relation to Ethnobotanical Research: A Literature Review

BACHELOR THESIS

Thesis supervisor: Ing. Zbyněk Polesný, Ph.D.

Author: Jiří Lipenský

Declaration

I hereby declare that the bachelor thesis „Folk Taxonomy in Relation to Ethnobotanical Research: A Literature Rewiew ” has been written by myself, I used only initiate sources and literature without any external unauthorized help.

May 15th 2008, Prague **……**

signature

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Abstract: This bachelor thesis is concerned with the problems of folk botanical taxonomies, especially as they relate to ethnobotany and it is conceived as review of literature. It also points out some interesting connections between folk systematics and western science, and suggests some comparation of proposals and findings of various authors. The review consists of these main parts: Short history of plant systematics, folk biological classification, folk biological nomenclature, and correspondence between folk and scientifical classification. Data are collected from several scientific disciplines and synthetise, compare and contraste different authors' views on folk botanical taxonomies. The study of folk taxonomy is important to modern ethnobotanical research, which depends on traditional knowledge especially in tropical environments.

Keywords: folk taxonomy, traditional knowledge, folk botanical classification, lingvistic ethnobotany.

Abstrakt: Tato bakalářská práce se zabývá problematikou lidových taxonomií, zvláště ve vztahu k ethnobotanice a je koncipována jako literární rešerše. Práce také poukazuje na některé zajímavé souvislosti mezi lidovou systematikou a západní vědou a nabízí určité srovnání návrhů a poznatků různých autorů. Review se sestává z těchto hlavních částí: Krátká historie systematiky rostlin, lidová systematika rostlin, lidové názvosloví rostlin a soulad mezi lidovou a vědeckou klasifikací. Data jsou shromážděna z několika vědeckých disciplín a slučují, porovnávají a staví proti sobě názory různých autorů na lidové taxonomie rostlin. Studium lidové taxonomie je důležité pro moderní ethnobotanický výzkum, který závisí na tradičních vědomostech zvláště pak v tropických oblastech.

Klíčová slova: lidová taxonomie, tradiční vědomosti, lidová systematika rostlin, lingvistická ethnobotanika.

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1 INTRODUCTION

People living in various societies across the world think about living things in the similar special ways that fundamentally differ from the ways of thinking about other non-living objects. This way of thinking can be considered as basis of folk biology, which is the more inclusive area of folk botany. This is field of study of antropology, cognitive sciences, linguistic and interdisciplinary subject of ethnobotany, the study of the relationship between people and plants, the human conceptualisation and use of plants, historically and cross-culturally. The methods of ethnobotany is to integrate natural and social sciences. In the 1970s and 1980s, started more serious studies of ethnobotanical classifitation and folk taxonomy, when Brent Berlin with his colleagues proposed few „universal“ principles of ethnobiological classification. He modified these principles after much controversy in 1992 and part of this bachelor thesis brings a summary of these seven priciples of categorization and five priciples of nomenclature as well. There is comparation between folk and scientifical classification, with regard to mode of subsistence in chapter 4.

2 AIM OF THE THESIS

This bachelor thesis will attempt to provide a brief critical analysis and synthetises data from various authors related to the research of folk classification and taxonomies. It also points out some interesting connections between folk systematics and western science. I would like to develop a good working knowledge of the modern ethnobotanical research by collecting data from several scientific disciplines and compare and contrast different authors' views on folk botanical taxonomies.

3 METHODOLOGY

Major part of the information source for this bachelor thesis I collected from journals articles at JSTORE, EbscoHost, Springer Link, Web of Science and other digital archives. These I supplemented with data from monographs from the National Library of the Czech Republic.

4 REWIEW OF LITERATURE

4.1 Short History of Plant Systematics

4.1.1 Preliterate Systematics

There is very litttle knowledge of this period mostly originated from ancient paintings, drawings or utensils, and our speculations. Preliterate people obviously knew which plants were edible and which were poisonous or medicinal usable.

4.1.2 Ancient Literate

The earliest surviving treatise on plants is Theophrastus's *Historia Plantarum*. Theophrastus (ca. 373-287 B.C.), considered by some botanists as the father of western systematic botany, did not articulate a formal classification scheme; instead he relied on the common groupings of folklore combined with growth form: tree shrub; undershrub; or herb (Stearn, 1992). In his *Enquiry into plants* he begins with the sentence: *"We must consider the distinctive characters and the general nature of plants from the point of view of their morphology, their behavior under external conditions, their mode of generation, and the whole course of their life"* (transl. Morton, 1981).

According to Green (1909) Theophrastus preserved the basic structure of folk plant names in his early nomenclatural studies providing by his ethnobotanical insight historical validation of many of the structural principles shown in this document below. The Theophrastan nomenclature of plants is highly natural (see table 1).

Table 1. Comparison of the Theophrastan and modern nomenclature of plants (Green, 1909).

Theophrastus	**Modern**
Peuce	*Pinus picea*
Peuce Idaia	*P. maritima*
Peuce conophoros	*P. pinea*
Peuce Paralios	*P. halepensis*

The *Materia medica* of Dioscorides was also an important early compendium of plant descriptions (over five hundred); it was in use from its publication in the 1st century until the 16th century, but during the Dark Ages it was copied and recopied and the figures redrawn so many times that they bore little resemblance to the original. It recognized some genera such as Aloe (Mayr, 1982).

4.1.3 Medieval "Dark Ages"

The Bishop of Regensburg, Albertus Magnus (1193 - 1280), prepared a manuscript on plants which recognized mono vs. dicots as well as vascular vs. Nonvascular, but it was not widely circulated. Thomas of Sarepba (1297 - 1378) made the first *herbaria* in book form, pressed and dried plants or plant parts being glued onto blank pages (Arber, 1912).

4.1.4 Renaissance

Renaissance began in Italy and is known as the beginnings of modern science. This period was important to plant taxonomy especially because of Johannes Gutenberg (1400 –1468), a German goldsmith and printer who is credited with introducing to Europe movable type printing (around 1439), which had been invented centuries earlier in China and Korea. This important fact made knowledge available to almost all people and botanical-medical books called *herbals* of Otto Brunfels (1464-1534), Jerome Bock (1489-1554), Leonard Fuchs (1501-1566) became popular (Arber, 1912).

4.1.5 Early Metodists

Later influential Renaissance books include those of Caspar Bauhin (Swiss) and Andrea Cesalpino (Italian). Bauhin described over 6000 plants, which he arranged into 12 books and 72 sections based on a wide range of common characteristics. He is also credited with modern concept of genera and species. Cesalpino based his system on the structure of the organs of fructification, using the Aristotelian technique of logical division. He tryed to base classification on logic rather than utilitarian concepts. In the late 17th century, botanist and natural theologian John Ray who listed over 18,000 plant species in his works, is credited with establishing the monocot/dicot

division. French botanist Joseph Pitton de Tournefort used an artificial system based on logical division which was widely adopted in France (Mayr, 1982).

4.1.6 Linnaean period

Linnaeus (1707–1778) was a Swedish botanist, physician and zoologist and is considered the father of plant taxonomy . His *Species Plantarum* (1753) is the starting point for modern taxonomy. Linnaeus also developed a Sexual System of classification which was based on the numbers of reproductive parts and described 100's of species. There seems to be some equivalence of folk taxonomy and Linnaeus taxonomic system. It is perhaps an unintentional bit of western systematic ethnocentrism to attribute the "invention" of our current binomial system of nomenclature to Linnaeus (or to Bauhin) if in so doing one is suggesting a radical break with folk tradition. It is more close to the facts to observe that Linnaeus and his predecessors formally codified a system of nomenclature present in the folk systematics of earliest prescientific man and still recognized in the natural folk biological systems of classification found in the languages of preliterate peoples today (Raven, Berlin, Breedlove, 1971).

4.2 Folk Biological Classification

In the study of classification, one is concerned with discovering those principles by which classes of organisms are naturally organized in the preliterate mind (Berlin, 1973). Folk classification is defined by the way in which members of a language community name and categorize plants and animals (Brown, 2000). Folk systematics is subject concerned with the elucidation of those general principles which underlie prescientific man's classification, naming, and identification of living things. The subject is part of the more inclusive area of folk science, the aim of which is to describe the nature of primitive knowledge of the natural world. Berlins framework based on cross-language evidence with regard to general principles of folk biological classification and nomenclature published in 1972, (Berlin, Breedlove, and Raven, 1973, 1974) suggest some important proposals and findigs. One of these findigs is that prescientific man's classification of his biological universe is quite developed and highly systematic. The primitive natural systematist is apparently as much concerned with bringing classificatory order to his biological universe as is his western counterpart. Objective biological discontinuities recognized by primitive man are, for the most part and with explainable exceptions, identical at some level with those recognized by western

science. The principles which form the basis of folk biological classification seem to be ones which arise out of the recognition of groupings of organisms formed on the basis of gross morphological similarities and differences. Only rarely is classification based primarily on functional considerations of the organisms involved, (for example their cultural utility). In the folk botany of the Tzeltal, a group of Mayan horticulturalists can be shown to have any cultural significance less than half of the named folk generic classes of plants. Studies among the Aguaruna Jivaro of the rain forests of north-central Peru suggest the same findings (Berlin, 1973). On the other hand Berlin's pioneering work proposes ethnobiological generalizations on the basis of comparative evidence extracted solely from small-scale agrarian societies. Further published data show that Berlin's generalizations do not neatly extend to noncultivators (Brown, Anderson Jr., Berlin, Boster, Schadeberg, and Visser, 1986).

4.2.1 Folk Taxonomies

Taxonomic hierarchies (from the Greek word taxis ‘to arrange’) indicate how humans and cultures classify the phenomena around them.There are differences between different cultures, or between classifications done in particular cultures and scientific classifications. Such classificatory structures or naming systems of phenomena used in everyday speech have generally been termed folk taxonomies (Conklin, 1962; Lounsbury, 1964). Some authors agree on a definition of a folk taxonomy as a system of monolexemically labelled folk segregates related by hierarchic inclusion (Conklin,1962). But not all the segregates, or categories, included in such taxonomies are monolexemically labeled (Berlin, 1968). Folk taxonomy according to Brown is a term which reffer to the hierarchical structure, organic content, and cultural function of biological classifications that ethnobiologists find in every society around the world (Brown, 2000).

4.2.2 Folk Taxonomic Ethnobiological Categories

Berlin postulated that the basic organizing principle of folk biological classification is taxonomic, whereby recognized groupings (hereafter called *taxa)* of greater and lesser inclusiveness are arranged hierarchically. The taxa which occur as members of the same folk ethnobiological category are always mutually exclusive. Furthermore, it appears that in natural folk taxonomies most taxa are members of just five ethnobiological categories that are logically comparable to the ranks of western systematics (kingdom, phylum, class, order, family, genus and species). Berlin *et al.'s*

ethnobiological categories are hierarchically arranged in levels of inclusion, from most general to most specific as well. These are the *unique beginner (kingdom), life form, generic, specific,* and *varietal.* A sixth category is called *intermediate* and contains taxa which fall hierarchically between the life form and generic categories (Berlin, 1973). Relationships between ethnobiological ranks and levels of taxonomic inclusion are ilustrated in figure 1. Cecil H. Brown notes that biological classes of the same rank exhibit nomenclatural, biological, taxonomic, and psychological characteristics that distinguish them from classes affiliated with other ranks. Unique beginner, life-form and generic members are usually labeled by primary lexemes, whereas specific and varietal rank members are usually labeled by secondary lexemes (Brown, 2000). According to antropologist Scott Atran rank allows generalizations to be made across classes of taxa at any given level. For example, the living members of a taxon at the generic-species level generally share a set of biologically important features that are functionally stable and interdependent (homeostasis); members can generally interbreed with one another but not with the living members of any other taxon at that level (reproductive isolation). Taxa at the life-form level generally exhibit the broadest fit (adaptive radiation) of morphology (e.g., skin covering) and behavior (e.g., locomotion) to habitat (e.g., air, land, water). Taxa at the subordinate folk-specific and folk-varietal levels often reflect systematic attempts to demarcate biological boundaries through cultural preferences.

System of rank is not simply a hierarchy, because in many domains there is hierarchy without rank, but only in the domain of living kinds is there always rank. Ranks and taxa are of a different logical order. Hierarchy, that is, a structure of inclusive classes, is common to many cognitive domains, including the domain of artifacts. For example, chair often falls under furniture but not vehicle, and car falls under vehicle but not furniture. But there is no ranked system of artifacts: no inferential link, or inductive framework, spans both chair and car, or furniture and vehicle, by dint of a common rank, such as the artifact species or the artifact family. Biological ranks are second-order classes of groups (e.g., species, family, kingdom) whose elements are first-order groups (e.g., lion, feline, animal). Ranks seem to vary little, if at all, across cultures as a function of theories or belief systems. In other words, ranks are universal but not the taxa they contain. Ranks represent fundamentally different levels of reality, not convenience. (Atran, 1998).

Folk classification, like professional biologist classifications, are strictly hierarchical: every plant or animal belongs to one and only one genus; every genus belongs to only one life-form; every life-form is either a plant or an animal; plants and animals are living things, and every object is either living thing or not. All this gives people´s intuitive biological concepts a logical structure thet

is different from the one that organizes their concepts, such as human-made artifacts. Whereas people everywhere say that an animal cannot be both fish and fowl, they are perfectly happy with saying for example, that a wheelchair can be both furniture and vehicle, or that piano can be both music instrument and furniture. And this in turn makes reasoning about natural kinds different from reasoning about artifacts. People can deduce that if a trout is a kind of fish and a fish is a kind of animal, then a trout is a kind of animal. But they do not infer that if a car seat is a kind of chair and a chair is a kind of furniture, then a car seat is a kind of furniture (Pinker, 1994).

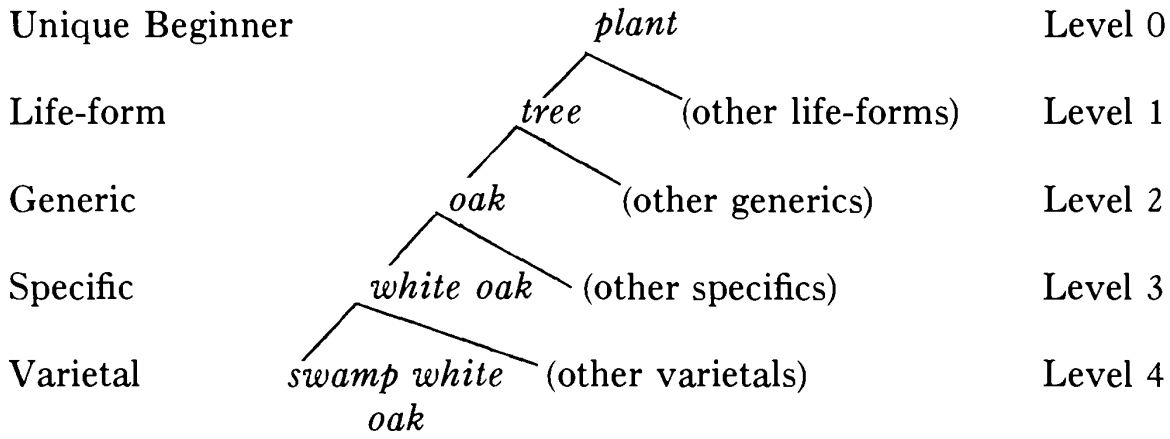

Figure1. Ethnobiological ranks and levels of taxonomic inclusion with sample botanical classes from American English (Brown *et al*., 1986).

4.2.2.1 The Unique Beginner Rank (Kingdom)

The *unique beginner* is a distinctive category in that it has but one member, that being the taxon which includes all other taxa. The terms *living things* or *plants and animals* are often used to refer to this taxon in American English folk biology (Berlin, 1973). Taxa of the category *unique beginner* can be and most often are linguistically unlabeled (Berlin *et al*., 1973). The implication of Berlin, Breedlove, and Raven's ubiquitous "covert" unique beginner is that people globally, if not universally, conceptualize living things in terms of the dichotomy "plant-animal." The point is that people everywhere can make the distinction and often do, but that does not mean that they make it taxonomically (Brown, 1974).

4.2.2.2 Life Form Rank

Members of the category *life* form are relatively stable across cultures and represent most encompassing classification of organisms into groups that are apparently easily recognized on the basis of numerous gross morphological characters. Taxa of this category are few in number, usually somewhere between five and ten, and among them include the majority of all taxa of lesser rank. Such terms as *tree, vine, herb, fish,* and *bird* refer to examples of commonly recognized life form taxa in most folk taxonomies (Berlin, 1973).

Folk botanical life-form terms are added to languages in a highly regular manner. The first life-form to be lexically encoded is always "tree" and the second, a small herbaceous plant class (GRERB). The addition of "bush," "vine," and "grass" follows with "vine" always preceding "grass." (Witkowski and Brown, 1977). However, different cultures may group things quite differently (Berlin, 1992). Size of folk botanical life-form vocabularies is positively correlated with both societal complexity and botanical species diversity. These findings are similar to those discovered by Berlin and Kay (1969) in their study of "basic color terms" in languages. The distributional pattern described by Berlin and Kay attests to implicational universals in color terminology. Similar constraints upon the co-occurrence of folk botanical life-form categories exist and implicational universals are found to pertain to botanical terminology as well.

Scott Atran propose these findings: Folk botanical life-forms appear to represent a holistic appreciation of the local flora (including its relationship with the local fauna) that is compatible with humankind's usual existence. They seem to reflect gross morphological patterns that subsume any number of generics that play similar roles in the economy of nature seen from a phenomenal perspective, that is, within the (nondimensional) local ecology we are normally compelled to deal with (Atran, 1985). Cecil H. Brown has isolated properties of folk botanical life-forms determined through comparison of data from 29 languages which usually, but not always, characterize them. They are:

(1) Life-form labels are usually used to name individual plants rather than collectivities of plants. Thus terms equivalent to the English *crop, foliage, hedges, brush,* and the like usually are not found as life-form terms.

(2) A small number of distinctive features pertaining to the form of the whole plant (gross morphology) are the usual criteria by which the plant is identified by use of a life-form label (Berlin, 1976).

(3) Usually no characteristic part of a plant constitutes the criterion by which the plant is identified by a life-form term. Thus words equivalent to the English fruit, flower, and tuber, for example, usually are not found as life-form terms.

(4) Usually no characteristic function or use (or total lack thereof) of a plant constitutes the criterion by which the plant is identified by a life-form term. Thus terms comparable to the English herb (medicinal), vegetable (edible), and weed (total lack of use), for example, usually are not found as life-form labels.

(5) Seasonal habits of plants usually do not constitute the criteria by which they are identified by life-form terms. Thus words equivalent to the English perennial and annual, for example, usually are not found as life-form terms.

(6) Usually the life stage of a plant does not constitute the criterion by which it is identified by a life-form term. Thus words equivalent to the English seedling and sprout, for example, usually are not found as life-form terms. Occasionally, however, a life-form label can be alternatively used in a manner that seems to refer to life stages of plants. In Huastec, for instance, the life-form d'ohol (herb) is used to refer to any young or stunted tree no more than two feet or so in height.

(7) Usually the environment or location in which a plant grows does not constitute the criterion by which it is identified by a life-form term. Thus expressions comparable to the English desert shrubs, tropical plants, and aquatic plants, for example, usually are not found as life-form labels (Brown, 1977).

4.2.2.3 Generic Rank

Generic taxa is the most common and can be recognized by linguistic, taxonomic, botanical, and psychological criteria. Folk genera frequently do not correspond to scientific genera but may correspond to Linnaean species or families. Some generic taxa are subdivided into taxa of *specific*

rank (Berlin, 1976). In contrast to life form taxa, which refer to the largest groupings of organisms distinguished by multiple characters, members of the ethnobiological category *generic* refer to the smallest discontinuities in nature which are easily recognized on the basis of large numbers of gross morphological characteristics. Folk generic taxa are the most numerous in any folk taxonomy that has been more or less fully described. Examples of folk generic taxa in American English folk botany would be those classes referred to by the names *hickory, maple, tuliptree,* and *cottonwood,* all of which are included in the life form *tree.*

Taxonomically, the majority of all generic taxa in any natural folk taxonomy are included in one of the recognized life form taxa. There are, nonetheless, generic classes which are aberrant in some fashion or another, which prohibits their includsion in one of the major life form classes. In Tzeltal, the cactus *pehtak (Opuntia* sp.) is one such example. Possessing characteristics unlike any other grouping of plants in the area inhabited by the Tzeltal, it is considered a conceptual isolate. Aberrancy of a generic may, at times, be due to the fact that it possesses characteristics of two life form taxa simulteneously. In Aguaruna Jivaro, for example, members of the generic taxon *uwi (Clusia* sp.) are considered neither to be kinds of *numi* 'tree' nor kinds of *daek* 'liana,' by virtue of the simulteneous tree-like and liana-like stem habit found in members of this class, a commonly seen strangler. Finally, the majority of all generic taxa in folk taxonomies are monotypic and include no taxa of lesser rank. Polytypic generic taxa almost invariably refer to those classes of organisms which are important culturally (Berlin, 1973). There are isolated branches or *unaffiliated genera,* that is, not every genus node is related to an intermediate or life-from. These are typically forms that differ considerably in their appeareance or are important because they are cultivated (Berlin, 1992).

The generic categories may not be the fundamental building blocks of folk biological classification as Berlin has proposed. Rather, a plausible argument that specific classes typically arise before generic ones can be based on (I) knowledge of the nature of the folk biological taxonomies of hunter-gatherers and (2) an understanding of the constraints on the development of polysemy and overt marking in language in general. Most biological categories labeled by foragers are terminal generics bearing a one-to-one relationship to scientific species. With a transition from foraging to farming, terms for some of these classes expand in reference to cover multispecies generic categories. Thus, ironically, terms for *generic* classes expand referentially to other *generic* classes. Another ironic aspect of this development is that type-specifics before referential expansion are *generic* classes, at least in terms of Berlin's framework, but after expansion are *specific* categories. When a monomially labeled generic becomes a specific (i.e., type-specific) through

expansion of reference, the only change involved is that the class becomes subordinate to a polytypic generic category. The constituency of the class does not change-no member referents are lost and no new ones are added. Given this, it seems more appropriate to identify the monomially labeled terminal category involved as a *specific* class than as a generic one. Expansion of reference may then be described as a process in which a monomial term for a specific category referentially expands to cover a more comprehensive generic category of which the specific class is a member. One possible objection to this terminological change is that in Berlin's original scheme specific classes, with the exception of the type-specific, are always binomially labeled. According to Berlin the first biological classes to develop in languages are always generic. After generic categories are encoded, classes of either the life-form rank or the specific rank or both may emerge (figure 2). On the other hand in Browns framework classes of the specific rank developmentally precede those of the generic rank. This is strongly indicated by the fact that specific classes are ubiquitous in taxonomies of foragers while generics (i.e., polytypic generics) are very rare. If folk taxonomies of foragers are understood as the starting point in ethnobiological nomenclature growth, then specifics are necessarily developmentally prior to generics (figure 3), (Brown *et al*., 1986).

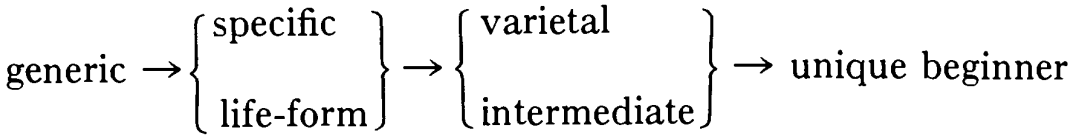

Figure 2. Berlin's sequence for the addition of nomenclatural categories to languages (Berlin, 1972).

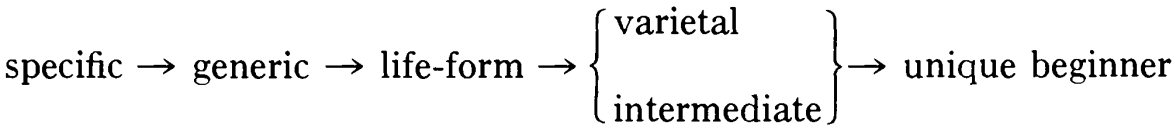

Figure 3. Revised sequence for the addition of nomenclatural categories to languages (Brown *et al*., 1986).

4.2.2.4 Specific and varietal Rank

Taxa which occur as members of the *specific* and *varietal* ethnobiological categories differ from both life form and generic taxa in several respects, the most important of which appears to be

that such taxa are conceptually distinguished on the basis of very few morphological characters. As will be seen in the section on nomenclature, a single, multivalued character, such as color or size, is often sufficient to differentiate two or more folk specifics of the same folk genus. Generally, specific taxa in folk taxonomies occur in sets of two or three members. It is quite rare for a set of specific taxa to exceed ten; those that do are invariably organisms of supreme cultural significance. Varietal taxa, as might be expected, are rare in all folk taxonomies. Examples of specific taxa in American English folk botany would be those categories labeled by such names as *white oak* and *sugar maple*. Varietal taxa may be seen in the names *baby lima bean* and *butter lima bean. Intermediate* taxa taxonomically include two or more generic taxa ind it is relatively rare in folk taxonomies and when such taxa are found, they most commonly are not labeled by an habitual expression. The rarity of intermediate taxa in folk systematics, but more importantly, the fact that they are not named, casts doubt as to whether our current knowledge empirically justifies establishing an ethnobiological category of this rank (Berlin, 1973).

4.2.3 Berlin *et al.´s* General Principles of Classification in Folk Biology

In 1973 Berlin with his colleagues postuled his general principles of classification, these are:

(1) In all languages it is possible to isolate linguistically recognized groupings of organisms of varying degrees of inclusiveness. These classes are referred to here as *taxa* and can be illustrated by the groupings of organisms indicated by the names *oak, vine, plant, red-headed woodpecker,* etc., in English.

(2) Taxa are further grouped into a small number of classes known as taxonomic ethnobiological categories. These ethnobiological categories, definable in terms of linguistic and taxonomic criteria, probably number no more than five. They may be named as follows: unique beginner, life form, generic, specific, and varietal. A sixth category, called intermediate, may be required as further research is carried out on ethnobiological classification.

(3) The five universal ethnobiological categories are arranged hierarchically and taxa assigned to each rank are mutually exclusive, except for the unique beginner of which there is only one member.

(4) Taxa of the same ethnobiological category characteristically, though not invariably, occur at the same taxonomic level within any particular taxonomic structure. The taxon which is a member of the category unique beginner occurs at level zero. Life form taxa occur only at level one. Generic taxa characteristically occur at level two, but if not, always occur at level one. Specific taxa characteristically occur at level three, but if not, always occur at level two and are immediately included in a generic taxon which occurs at level one. Varietal taxa, if present, characteristically occur at level four, but if not, at level three and in this case can be shown ultimately to be included in a generic that occurs at level one. The relationship of these proposed ethnobiological taxonomic categories and their relative taxonomic levels in any particular taxonomic structure can be seen in the idealized schematic diagram in figure 4. Taxa assigned to each of the fundamental ethnobiological categories characteristically exhibit linguistic and/or taxonomic features which allow for their recognition. In addition to what has already been said, the following general tendencies should be noted:

(5) In folk taxonomies it is quite common that the taxon found as a member of the category unique beginner is not labelled linguistically by a single habitual expression. That is, the most inclusive taxon, e.g., *plant* or *animal,* is rarely named.

(6) Taxa which are members of the ethnobiological category "life form" are invariably few in number, ranging from five to ten, and among them include the majority of all named taxa of lesser rank. All life form taxa are polytypic. Life form taxa are labelled by linguistic expressions which are lexically analyzed as primary lexemes and may be illustrated by the classes named by such words as *tree, vine, bird, grass, mammal,* etc.

(7) In typical folk taxonomies, taxa which are members of the ethnobiological category "generic" are much more numerous than life form taxa but are nonetheless finite, ranging in the neighborhood of 500 classes. Most generic taxa are immediately included in one of the few life form taxa. It is not uncommon to find, however, a number of classes of generic rank which are aberrant (in terms of the defining features of the life form taxa) and, as such, are conceptually seen as unaffiliated (i.e., are not included in one of the life forms). Aberrancy may be due to a number of factors but morphological conspicuousness and/or economic importance appear to be the primary reasons involved. Folk generic taxa may be recognized in terms of several criteria, one of the most

important of which is nomenclatural. In general, generic names are labelled by primary lexemes. Examples of typical (versus aberrant) generic taxa are the classes named by the words *oak, pine, catfish, perch, robin,* etc. Examples of generic taxa that often are considered unique are those indicated by the names *cactus, bamboo, pineapple, cassowary, pangolin, platypus,* etc. Finally, as will be shown below, generic taxa are the basic building blocks of all folk taxonomies. They represent the most commonly referred to groupings of organisms in the natural environment, are the most salient psychologically and are likely to be among the first taxa learned by the child.

(8) Taxa which are members of the ethnobiological categories "specific" and "varietal" are, in general, less numerous than taxa found as members of the generic category. Specific and varietal taxa characteristically occur in contrast sets of few members, the most frequent being a set of two classes. Contrast sets of more than two members tend to refer to organisms of major cultural importance and larger sets of twenty or more taxa invariably do. Varietal taxa (i.e., further divisions of specific taxa) are rare in most folk biological taxonomies. Finally, specific and varietal taxa are normally distinguished in terms of features on few, if not a single, semantic dimension, e.g., *red rose* versus *white rose.* Both specific and varietal taxa are linguistically recognized in that they are most commonly labelled by secondary (versus primary, for life forms and generics lexemes. Examples of specific taxa are the classes named by the secondary lexemes *blue spruce, white fir, post oak.* Examples of varietal taxa are the classes labelled by the names *baby lima bean* and *butter lima bean.*

(9) Intermediate taxa are those classes which can be assigned to the ethnobiological category "intermediate." Taxonomically, an intermediate taxon is one which is immediately included in one of the major life form taxa and which immediately includes taxa of generic rank. Such taxa are invariably rare in natural folk taxonomies. These classes are called covert categories and they are not linguistically labelled (Berlin, Breedlove, and Raven, 1968). The rarity of intermediate taxa in folk taxonomies, but more importantly, the fact that they are not named, leads us to doubt whether one is empirically justified in establishing an absolute ethnobiological category for taxa of this rank (Berlin, Breedlove, and Raven 1973).

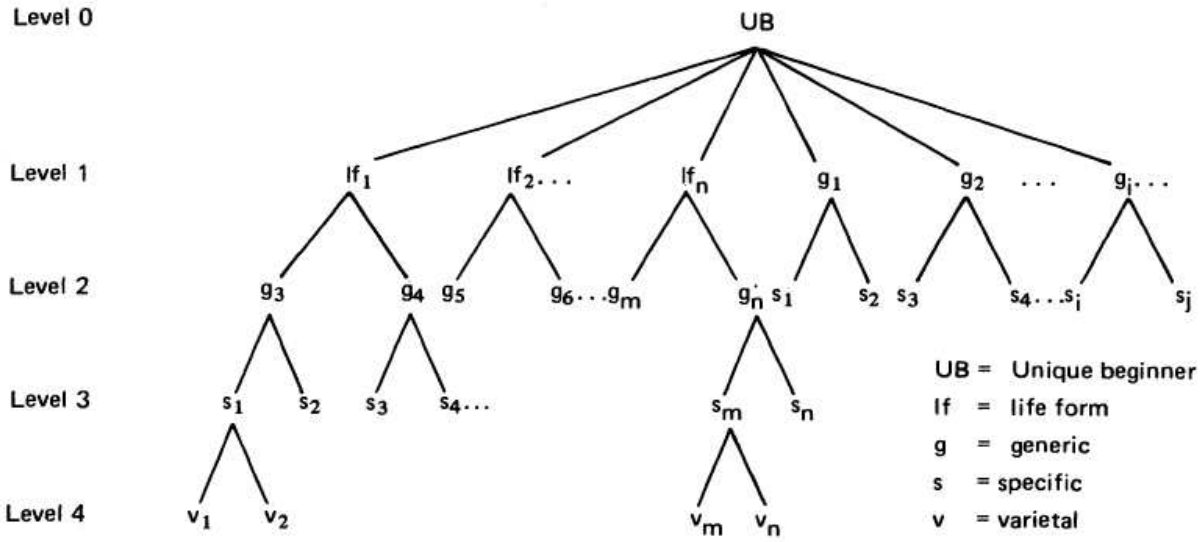

Figure 4. Schematic relationship of the five universal ethnobiological taxonomic categories and their relative hierarchic levels in an idealized folk taxonomy (Berlin *et al*., 1973).

4.2.4 Bulmer´s Principles of Classification

Bulmer´s five major principles of natural taxonomy (1974) coicides closely with Berlin *et al.´s* principles (1973):

(1) Natural taxonomies consist on hierarchically arranged sets of contrasting taxa which are generally, through not necesarilly entirely, mutually exclusive (i.e., taxa of equivalent order do not overlap in content, or overlap only marginall).

(2) All but certain lowest and highest order taxa are ´natural´ ... in that they are percived as actually...multidimensional... and... ´general´ or perhaps even ´abstract,´ in the sense that they are used in many different contexts and indeed spontaneously in the context of discussion of their domain in the abstract, i. e., without immediate reference to utilitarian or other particular contexts.

(3) The names applied to taxa are in a high proportion of cases exclusive to that domain.

(4) The language used in discussion of the relationship of taxa of similar order (i. e.,within the same contrast set) is the language of kingship and descent-´brothers´, ´one father´, ´one lineage´.

(5) Such totemic ... identifications as exist are phrased, if categories rather than individual plants or animals ... are concerned, in terms of taxa within this ´natural system´(Bulmer, 1974, cited in Berlin, 1992).

4.2.5 Summary of Berlin´s Revised General Principles of Ethnobiological Categorization

In 1992 Berlin reformulated his general principles of ethnobiological nomenclature:

(1) In ethnobiological systems of classification, conceptual recognition will be given to a subset of a existing flora and fauna. This subset will be comprised of the biologically most distinctive (hence, salient) species of the local habitat.

(2) Ethnobiological systems of classification are based primarily on the affinities that humans observe among the taxa themselves, quite independent of the actual or potential cultural significance of these taxa.

(3) Ethnobiological systems of classification are organized conceptually into a shallow hierarchic structure.

(4) Recognized taxa will be distributed among from four to six mutually exclusive ethnobiological ranks, with taxa of each rank sharing similar degrees of internal variation and separated from each other by comparably sized perceptual gaps. The six universal ranks are the kingdom, life form, inmediate, generic, specific and varietal. There is some evidence that foraging societies have poorly developed, or lack entirely, taxa of specific rank. No foraging society will exhibit taxa of varietal rank.

(5) Across systems of ethnobiological classification, taxa of each rank show marked similarities as to their relative numbers and biological ranges.

a. Taxa of generic rank are the most numerous in every system, with rare exceptions number no more than five hundred classes in each kingdom, are largely monotypic (roughly 80 percent in typical systems), and , with notable exceptions , are icluded in taxa of life-form rank.

b. Taxa of life-form rank are few in number, probably no more than ten of fifteen, are broadly polytypic, and include among them the majority of taxa of lesser rank. Substantively, life-form taxa designate a small number of morphotypes of plants and animals that share obvious gross patterns of stem habit and bodily form.

c. Taxa of intermediate rank generally group small numbers of generic taxa on the basis of their percieved affinities in overall morphology (and behavior). Intermediate taxa are included in taxa of life-form rank.

d. Specific taxa subdivide generic taxa but are fewer in absolute number. Folk varietals are rare; when they occur, they subdivide folk species. Unlike taxa of superordinate rank, a major portion of subgeneric taxa in ethnobotanical systems of classification is recognized primarilly as a result of cultural considerations, in that such represent domesticated or otherwise economically important species.

e. The taxon marking the rank kingdom in ethnobotanical as well as ethnozoological systems of classifications is comprised of a single member.

(6) Ethnobiological taxa of generic and specific rank exhibit an internal structure in which some members are through of as prototypical of the taxon while others are seen as less typical of the category.

(7) A substantial majority of ethnobiological taxa will correspond closely in content with taxa recognized independently by Western botany and zoology, with the highest degree of correspondece occuring with taxa of generic rank. Taxa of intermediate rank often correspond to portions of recognized biological families. Taxa of life-form and subgeneric rank exhibit the lowest correspondence with recognized biological taxa (Berlin, 1992).

4.3 Folk Biological Nomenclature

Nomenclatural studies are devoted to the description of linguistic principles of naming the conceptually recognized classes of plants and animals in some particular language. Recent research

into the nature of folk biological nomenclature reveals that the naming of plants and animals in folk systematics is essentially identical in all languages and can be described by a small number of nomenclatural principles. There is a fairly close correspondence between the linguistic form of a name for some folk biological taxon and its ethnobiological rank. Linguistically, two basic types of names for plants and animals can be recognized in folk systematics. These forms can be referred to as primary and secondary names. Primary names occur as labels, almost without exception, for generic and life form taxa and, for the unique beginner, when this latter taxon is named. Secondary names are generally restricted to taxa of lesser rank, namely, the specific and varietal forms (Berlin, 1973).

4.3.1 Names for plants and animals

In all ethnobiological lexicons, one may distinguish two types of names for classes of plants and animals. One class comprises forms which are, for the most part, unique, "single word" expressions which can be shown to be semantically unitary and linguistically distinct. Examples of such semantically unitary names in English folk biology might be *oak, pine, maple, rabbit, quail,* and *bass.* A second group of expressions comprises members of the first class in variously modified form, e.g., *post oak, ponderosa pine, sugar maple, cottontail mbbit, blue quail,* and *large-mouth bass.* Psychologically, examples from the first class of terms seem to be more basic or salient than those of the second in much the same sense that the color terms red, yellow, and green are more basic than pale red, yellowish, and bluish green. It will be useful to refer to members of the first set as primary lexemes and to those of the second as secondary lexemes (Berlin *et al*., 1973).

4.3.2 Primary Lexemes

Primary lexemes can be further analyzed semantically. Some are clearly simple expressions which are unanalyzable linguistically, such as *oak* and *pine.* Other primary lexemes are linguistically analyzable and can be illustrated by such expressions as *beggartick, jack-in-the-pulpit, planetree, tuliptree, pipevine, Rocky Mountain bee plant, catfish, bluebird, swordfish,* and many others. Analyzable primary lexemes can be divided easily into two obvious classes. One group, comprising forms such as *planetree, tuliptree, pipeuine,* etc., are distinguishable in that one of the constituents of each expression indicates a category superordinate to that of the form in question, e.g., *tuliptree* is a kind of *tree, planetree* is a kind of *tree, pipevine* is a kind of *vine,* and so on. These expressions are

productive primary lexemes. A second group, comprising forms such as *beggar- t ic k, jack-in-the-pulpit, hensand chickens,* is distinguishable in that no constituent marks a category superordinate to the forms in question. Thus, *beggar-tick* is not a kind of *tick, jack-in-the-pulpit* has little to do with either *jack* or *pulpits, hensand-chickens* does not refer to *poultry*. These expressions are unproductive primary lexemes (Berlin *et al*., 1973).

4.3.3 Secondary Lexemes

Secondary lexemes, like productive primary forms, are identifiable in that one of the constituents of such expressions indicates a category superordinate to the form in question, e.g., *jack oak* (a kind of *oak), Oriental planetree* (a kind *ofplanetree), blue spruce* (a kind of *spruce).* On the other hand, secondary lexemes differ from productive primary expressions in that the former occur only in contrast sets, all of whose members are labelled by secondary lexemes which share the same superordinate constituent. Thus, *jack oak* is unambiguously a secondary lexeme in that (a) one of its constituents, *oak,* labels a taxon which is its immediate superordinate (OAK), and (b) it occurs in a contrast set of whose members are also labelled by secondary lexemes which include a constituent that labels the taxon *oak* (i.e., *post oak, scrub oak, blue oak,* etc.). Productive primary lexemes such as *planetree, tuliptree,* and *leadtree,* however, occur as members of contrast sets of which *some* members are labelled by expressions such as *maple, walnut, elm,* etc. The relationship between these various types of lexemes may be seen as follows (see figure 5); (Berlin *et al*.,1973).

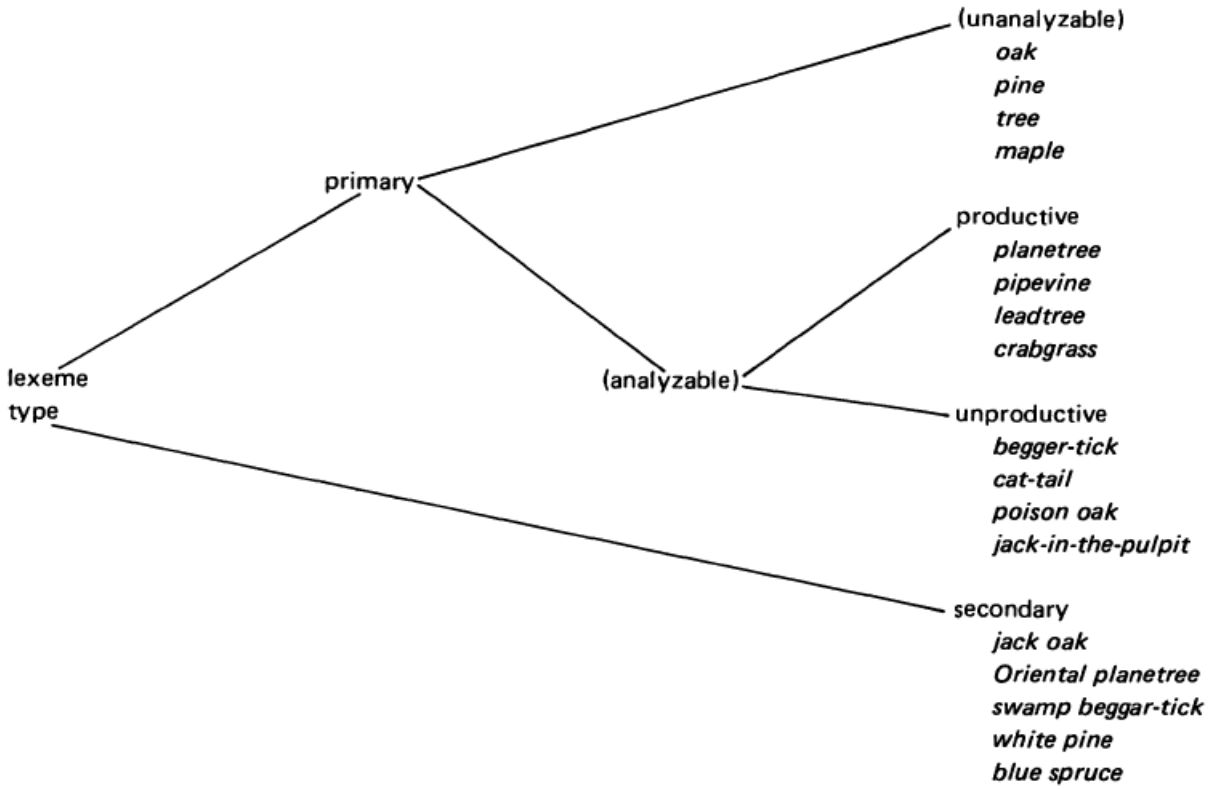

Figure 5. Analysis of lexemes by lexemic type (Berlin *et al*.,1973).

4.3.4 Generic Nomenclatural Properties

The generic level is of particular interest (Rosch, 1973 call this the *Basic level*). Words of this level are typically used to name objects when presented with a specimen, they are the first ones learned by children, they are recognized most rapidly. These words are particularly frequent, and therefore often shorter and morphologically simpler than words on other levels. The generic level has the most members (Berlin, 1992). Generic taxa form the basic core in any folk taxonomy. The labels for taxa of this category are also fundamental and are among the first words in folk ethnobiological lexicon learned by children in preliterate societies. The botanist H. H. Bartlett noted that :"... the concept of genus must be as old as folk science itself..." (Bartlett, 1940), and provided an essentially nomenclatural definition of the concept. Etymologically, it is often impossible to provide linguistic analysis of generic names, a fact that should not be surprising since such names are generally quite ancient. When analysis is possible, it is often the case that the name is descriptive of some quality of the class of organisms to which it refers. Another important phenomenom in the formation of many generic names is also Onomatopoeia, especially of animals such as birds and

frogs whose distinctive calls are often quite characteristically represented. A final linguistic feature of generic names which appears to be widespread in many languages is the use of the generic plus some modifier to refer to some taxon that is conceptually related to the class indicated by the generic name alone. Often the modifier is an animal name as, for example, in Tzeltal where one finds many such pairs. Typical is the pair *ishim* 'corn' and *ishim ahaw,* literally, 'snake's corn' *(Anthurium* spp.), the latter formed on the basis of the presumed similarity of the mature spadix in many members of *Anthurium* to an ear of corn. In English, one finds such pairs as *oak, poison oak; apple, horse apple* (also known as *Bodark* in some dialects); *cabbage, skunk cabbage; cypress, false cypress; orange, mock orange,* and many others. It should be pointed out that none of these superficially binomial expressions are seen as conceptually subordinate to their monomial counterparts. Thus, *skunk cabbage* is not a kind of *cabbage* nor is *poison oak* a kind of *oak.* Each simply shares some characters which are seen to be similar to the monomially designated form (Berlin, 1973).

4.3.5 Life Form Nomenclatural Properties

Members of the ethnobiological category, *life form,* are invariably marked by primary linguistic expressions. These names are often linguistically unanalyzable, suggesting some antiquity. On the other hand, in many preliterate languages, it is not uncommon to find that an identical linguistic expression for some generic taxon also occurs as the label for the life form class as well. Such a term, with two distinct but semantically related meanings, is linguistically *polysemous.* An example of polysemy can be seen in Klamath: *k'osh (Pinus* sp.) is used to refer to pines as well as to the general life form taxon *tree* (Berlin, 1973). Another example is the term: *isnyaaw* 'live oak' *(Quercus AgrifoIia)* used for the concept of *tree* in general in a small comunity of Digueño indians in southern California (Almstedt, 1968). In many Indian languages of the American Southwest, the term for cottonwood, the only deciduous tree which is widely distributed outside the major forests, is also used for *tree,* as well (Berlin, 1973). Brown compiled some iteresting observations about life-form acquisition in his study of Mayan languages:

(1) Many botanical life forms have been acquired by Mayan languages through borrowing. Two types of borrowing occur; (a) that involving an actual life-form term previously unknown to an accepting language and (b) that involving acquisition of a new referent for a term already present in

a language through diffusion of metaphors Mayan acquisition of life forms through type b borrowing has been limited, for the most part, to "vine."

(2) lnnovation of "grerb" life forms by Mayan languages has occasionally involved overt marking. Overt marking of "grerb" entails creation of a compound label for the life form consisting of a term for "tree" and a modifier.

(3) lnnovation of "vine" life forms by Mayan languages has involved use of metaphor. Mayan "vine" terms originally denoted nonbotanical materials, either natural or man made, characterized by length and varying degrees of flexibility. Metaphorical equations underlie use of Mayan words for the latter as labels for "vine." These include "string" = "vine," "rope" = "vine," "tongue" = "vine," "neck" = "vine," and, possibly, "worm" = "vine."

(4) lnnovation of "grass" and "grerb" life forms by Mayan languages has frequently involved expansion of reference. Expansion of reference occurs when a word labeling a certain class develops as a label for a more inclusive class, the latter encompassing the former. In Mayan languages, words for "roofing grass" or "thatch" have become "grass" labels, and words for "weed," "medicinal plant," "underbrush," and "greens" have become "grerb" labels through expansion of reference. These developments do not differ in principle from those described by Berlin (1972), involving derivation of "tree" life forms from generic "tree" categories (Brown, 1979).

Figure 6 presents the developmental sequence for adding folk botanical life-forms to vocabularies predicted from synchronic implicational universals. GRERB designates a category of small herbaceous plants which may include both grasses and herbs. The GRERB life-forms of some languages include only grasses and of others, only herbs. (GRERB is a mnemonic denved from grass and herb.) In the growth of life-form lexicons the inclusive range of this category tends to shrink. The nature of GRERB will be discussed in detail presently.

Stages are identified in the development of life-form vocabularies. Languages totally lacking life-form terms are at Stage 1. Languages at Stage 2 have only a "tree" term. Stage 3 languages add a second term, GRERB. From Stage 4 to Stage 6 three other terms, "bush," "vine," and "grass," are added. The lexical encoding of "grass" at Stage 5 or 6 usually results from the dinsion of the GRERB class into "herb" and "grass." Certain en- coding options are associated with Stages 4-6 resulting in three possible paths for adding botanical life-forms (Brown, 1977).

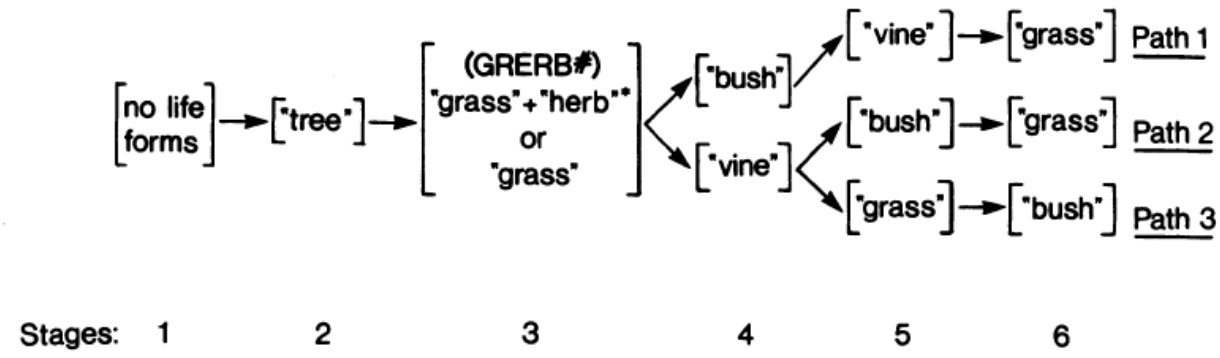

Figure 6. Lexical encoding sequence for folk botanical life forms (showing three possible paths for adding life form terms), (Brown, 1977)

Note: "tree" larger plant (relative to the plant inventory of a particular environment) whose parts are chiefly ligneous (woody).

"herb" smaller plant (relative to the plant inventory of a particular environment) whose parts are chiefly herbaceous (green, leafy, nonwoody). (This definition provides for the inclusion of grasses within the class. However, unless otherwise indicated, "herb" is used to refer to a class so defined, but excluding grasses.)

"bush" plant of intermediate size (relative to the plant inventory of a particular environment) whose parts are either ligneous or herbaceous.

"grass" smaller herbaceous plant (relative to the plant inventory of a particular enuronment) with narrow, often bladelike or spear-shaped, leaves. "vine" plant exhibiting a creeping or twining or twisting stem habit, whose parts are either ligneous or herbaceous (Brown, 1979).

4.3.6 Specific Nomenclatural Properties

According to Berlin is the structure of specific names in folk systematics linguistically binomial. (with one singular, but explainable exception). The generic name is formally modified by an adjective which usually designates some obvious morphological character of the plant class (color, texture, size, location...etc.). Berlin shows examples in Tzeltal such as *saki1 ishim* 'white

corn' and *tsahal ishim* 'red corn,' which typify the binomiality of specific names. In folk taxonomies are also found monomial specific names but the monomial specific is usually polysemous with its superordinate generic. Such monomially designated specifics are considered to be the best known or most widely distributed members of a particular folk genus. Example in Tzeltal is custard apple *k'ewesh* (Annona spp.) which includes at least three specific taxa. One of these type specific is labeled *k'ewesh* (A. cherimola) due to its wider distribution. In Aguaruna Jivaro, appears to be the rule with polytypic generic taxa which denote wild plants. An example can be seen in the generic *kamancha* (Bactris spp.), which is also the most important specific member due to its frequency. (Berlin, 1973).

4.3.7 Varietal Nomenclatural Properties

The nomenclatural characteristics of varietal names trivially differ from those of specific names. It has been mentioned that varietal taxa are distinctly rare in natural folk taxonomies. Such names refer exclusively to those taxa of major cultural importance such as plants (rarely animals) that have been under intense domestication and that are represented by morphologically distinct forms. Linguistic properties of varietal names are formed by the addition of an attributive to the specific name. Berlin´s example from Tzeltal is the specific name for common bean *shlumil chenek'* (Phaseolus vulgaris), is further divided into the two color varieties *tsahal shlumil chenek'* 'red common bean' and *ihk'al shlumil chenek'* 'black common bean (Berlin, 1973).

4.3.8 Nomenclatural Properties of the Unique Beginner

The unique beginner, the most inclusive taxon in a folk taxonomy, is usually unlabeled, but it does not means that domain of 'plant' or 'animal' is not recognized conceptually. There are various descriptive devices can be utilized to refer to these broad classes.In Tzeltal, the domain of plants is referred to as those things "that grow from the earth but do not move," contrasting with the domain of animals, a class of beings which "move by their own power." In many American Indian languages, the contrasting kingdoms are indicated grammatically by affixes which occur with names indicating 'animalness' or 'plantness.' If the unique beginner is named, it is often the case that the term employed is polysemous. For example, the term for 'tree' in Aguaruna Jivaro is *numi* and the domain for plants as a whole is designated by the expression *numi aidau*, literally, 'all (classes) of trees.' In in many modern languages, the term 'plant' may be seen to have two meanings as well. In

Spanish, *planta* can be used to refer to the major division as a whole but its usual meaning is 'herbaceous plant.' Also in English (and in other languages inclusive Czech), where the primary meaning of *plant* is 'small, herbaceous, leafy thing,' is in everyday speech extended to trees and shrubs. Sometimes is the name for the unique beginner compound of two or more life form names. In ancient Sumerian, the notion of 'plant' was indicated by a compound expression including the terms for 'tree,' 'grass,' and 'vegetable.' Another example come from Latin, where the terms 'tree' and 'herb' *(arbor et herba)* were commonly joined to designate the more general concept. In modern folk English systematics there is no single common expression, for both biological kingdoms united. The expression *living things* is not used much and label *plants and animals* is a linguistic compound (Berlin, 1973).

4.3.9 Berlin *et al´s* General Principles of Ethnobiological Nomenclature and Folk Taxonomy

In 1973 Berlin with his colleagues postuled his general principles of nomenclature:
It seems likely that the vast majority of primary lexemes, as defined in the discussion above, refer to biologically natural groupings of organisms that can be referred to as folk genera. A much smaller number of primary lexemes refer to groupings larger than folk genera and appear to label such higher order taxa as *tree, bush, vine, grass, fish, bird, snake, "land mammal,"* and the like. Such groupings can be referred to as life forms. In some naturally occurring biotaxonomies, the complete set of organisms being classified may be recognized conceptually and referred to by a primary lexeme, e.g., *plant* or *animal.* An all inclusive named category of this sort, though rare in most systems we know of, would be known as the unique beginner. In contrast to the kinds of taxa marked by primary lexemes, secondary lexemes generally label classes of organisms of lesser inclusiveness than either folk genera or life forms. Such groupings could be called folk species and, more rarely, folk varieties, depending on the degree of specification indicated linguistically. The relationship between these conceptual categories and the names by which they are referred can be stated as a set of four general nomenclatural principles which are subject to verification and modification by further research in any folk taxonomy of plants and animals:

(1)Some taxa marked by primary lexemes are terminal or immediately include taxa designated by secondary lexemes. Taxa satisfying these conditions are generic; their labels are generic names.

(2) Some taxa marked by primary lexems are not terminal and immediately include taxa designated by primary lexemes. Taxa satisfying these conditions refer to life form categories; their labels are life form names.

(3) Some taxa marked by secondary lexemes are terminal and are immediately included in taxa designated by primary lexemes. Taxa satisfying these conditions are specific; their labels are specific names.

(4) Some taxa marked by secondary lexemes are terminal and are immediately included in taxa which are designated as well by secondary lexemes. Taxa satisfying these conditions are varietal; their labels, varieta names (Berlin *et al*., 1973).

4.3.10 Summary of Berlin´s Revised General Principles of Ethnobiological Nomenclature

This is a summary of Berlin´s (1992) general principles of ethnobiological nomenclature:

(1) Taxa of the ranks of kingdom and intermediate are generally named. There is growing evidence that some covert life-form taxa may also be found. When such taxa are labeled, they often show polysemous relations with taxa of subordinate rank.

(2) Names for plants and animals exhibit a lexical structure of one of two universal lexical types that can be called primary and secundary plant and animal names. These types can be recognized by resource to linguistic, semantic, and taxonomic criteria. Primary names are of three subtypes: simple (e.g., *fish*). productive (e.g., *catfish*), and unproductive (e.g., *silverfish*). Secondary names (e.g., *red maple, silver maple*), with generally specifiable exceptions, occur only in contrast sets whose members share a constituent that refers to the taxon that immediately includes them (e.g., *maple*).

(3) A specifiable relationship can be observed between the names of taxa and their rank. Life-form and generic taxa are labeled by primary names; subgeneric taxa are labeled, in general, with secondary names.

(4) There are two well-understood conditions under which subgeneric taxa may be labeled by primary names, although these two conditions do not account for all of the empirically observed data. The first condicion (4a) occurs when thw name of the prototypical subgeneric is polysemous with its superordinate generic. Disambiguation of polysemy is accomplished by the optional occurence of a modifier glossed as ´genuine´ or ´ideal type´. The second condition (4b) occurs when of the nonprototypical subgenerics refer to subgeneric taxa of great cultural importance.

(5) Ethnobiological nomenclature is semantically active in that the linguistic constituents of plant and animal often metaphorically allude to morphological, behavioral, or ecological features that are nonarbitrarily associated with their biological referents (Berlin, 1992).

4.4 Correspondence of Folk and Scientific Classification

Can one also observe substantive correspondences between folk and scientific systems of classification? If such substantive correspondences exist, they might reveal aspects of the natural world which are in some sense 'natural' and which are apparently perceived as the same by persistent observers of nature everywhere. There is at present a growing body of evidence that suggests that the fundamental taxa recognized in folk systematics correspond fairly closely with scientifically known species (Berlin, 1973).

4.4.1 Units of Comparison

One of the difficulties in any comparison concerns the units of analysis to be considered. In the case of western systematics, the selection of the basic unit is straight forward-it must be the species. In folk systematics, it now appears useful to focus on the folk genus as the primary unit. One can recognize at least three logical types of correspondence between the two systems. These three types of correspondence will be referred to as one-to-one correspondence, over-differentiation, and under-differentiation.

The first type of mapping, one-to-one correspondence, can be observed when a single folk generic taxon refers to one and only one scientific species. The common willow *tok'oy* in Tzeltal folk botany would be in one-to-one correspondence in that it maps perfectly onto the single botanical species *Salix bonplandiana.*

Over-differentiation can be observed when two or more folk generic taxa refer to a single scientific species. An example would be the three Tzeltal generics, *bohch, tsu,* and *ch 'ahko:* all of which denote the various shape varieties of the common bottle gourd *Lagenaria siceraria.*

Under-differentiation can be divided into two easily recognized types. Type 1 under-differentiation occurs when a single folk generic taxon refers to two or more scientific species of the same genus. The Tzeltal generic *ch Ylwet* would exemplify this type of mapping as it refers to at least five species of the genus *Lantana.* Type 2 under-differentiation is recognized when a single folk generic refers to two or more species of two or more scientific genera. This case can be exemplified by the Tzeltal generic *tah* which refers to several species of *Pinus* as well as to at least one species of *Abies.*

The inventory of biological species utilized in any comparison are those-and only those-species which occur in the geographic area of the society being studied. For example, one may observe that a particular folk generic such as *oak* refers to one or more of the species of *Quercus* in the area inhabited by the society under study. In the absolute sense, of course, all folk systems are obviously under-differentiated when the totality of all western systematic knowledge is considered. Such an observation is trivial, however, if one is concerned with evaluating the classificatory treatment of those species for which a particular society has first-hand knowledge. Furthermore, it is obvious that one must restrict one's comparison to those species of organisms which, because of their size, behavior, and significance, are readily observable to the primitive natural historian. It should not be surprising if many algae and fungi are omitted from the classificatory structures of preliterate peoples, nor, for that matter, species of organisms which can be distinguished only on the basis of characters apparent with the aid of a 10X hand lens. The distribution of 471 generic forms in terms of the conventions of one-to-one correspondence, under-differentiation, and over-differentiation can be seen in Table 2.

Table 2. Correspondence of Tzeltal generic taxa with botanical species in the area (which are named in Tzeltal), (Berlin, 1973).

One-to-one correspondence	291
Under-differentiation, type 1	98
Under-differentiation, type 2	65
Over-differentiation	17
N	*471*

Table 2 reveals that a major portion of Tzeltal generics map in a one-to-one fashion onto botanical species. In our inventory of 471 generic taxa, 291, or approximately 61%, show this type of correspondence. Only 17 generic taxa, or 3% of the inventory, are over-differentiated. In most cases, the plants involved here are important cultivated forms which show rather marked morphological differences that partially explain the occurrence of two or more generic folk names for members of the same botanical species. While some 36% of Tzeltal generic taxa are under-differentiated, given our earlier stated conventions, it is of interest to observe that more than 2/3 of these taxa are polytypic, i.e. include folk specifics. In all such cases, the folk species refer to single botanical species as well. (Berlin, 1973)

4.4.2 Mode of Subsistence

Brown noted that folk taxonomies of hunters and gatherers differ from those of small-scale agriculturalists in two major respects: (1) the number of labeled biological classes in evidence and (2) the extent to which these classes are named through use of binomial labels. While hunting and gathering peoples apparently possess sizable inventories of labeled biological classes, the inventories of small-scale agrarian groups tend to be considerably larger. Small-scale cultivators on the average have roughly five times as many labeled plant classes as hunting and gathering groups and nearly twice as many labeled animal categories. A binomial label for a biological class is a composite lexeme consisting of a unitary term for a particular plant or animal category and some sort of modifier. *Blue oak, beefsteak begonia, cutthroat trout,* and *whitetailed deer* are American English examples of binomial labels. Binomial names are very common in folk taxonomies of agrarian peoples and very rare in those of hunters and gatherers. Data presented below indicate that on the average only 3.6% of plant classes and only 7.6% of animal classes in taxonomies of hunters and gatherers are labeled binomially. On the other hand, small-scale agriculturalists on the average have binomial labels for 35.9% of all plant classes and for 31.6% of all animal classes. Binomial names are very common in folk taxonomies of cultivators but very rare in those of hunters and gatherers. The explanatory framework developed to account for these findings proposes that subsistence agriculture creates a diversity of ecotypes which supports a range of wild organisms considerably greater than that found in the habitats of foragers. While this diversity provides small-scale farmers with the opportunity to expand their traditional knowledge of and interest in wild

plants and animals, it is not the cause of the enhanced importance of wild organisms for agriculturalists. Small-scale agriculture supports population densities many times greater than those permitted by a hunting and gathering way of life. However, a liability of subsistence farming is that crops are susceptible to periodic failure. On the other hand, the food supply of foragers consists of wild plants and animals that are naturally resistant to drought and disease, so that these organisms rarely, if ever, "fail." In addition, given the low population densities of hunting and gathering societies, even in times of scarcity food acquisition need not entail exceptional effort. In contrast, when crops fail severely, the dietary needs of the vastly denser populations of agrarian societies can be met only through highly intensive exploitation of wild plants and animals. This is facilitated by the local biological diversity created through subsistence farming. Small-scale agriculturalists, then, are virtually required to have an extraordinarily broad traditional knowledge of wild plants and animals in their habitats that can be utilized as food (Brown, 1985).

4.4.3 Taxonomic Mechanisms to Identify Plants

Berlin argues that the categorization of taxa is based primarily on observed morphological and behavioral affinities and differences among the recognized taxa. Human beings cannot construct the order in nature, but can only discern it in contrast to social constructions of beauty, ritual, and social organization (Berlin, 1992) while Ellen (1993) and Morris (2000) suppose that the cultural importance of organisms is not accounted for adequately in Berlin's universal categories, and that folk classification systems will reflect the use and value placed on plants and animals which differ across cultures. Folk science as an applied science that is rarely truly theoretical. Folk biological classification is a special purpose classification that is driven by utilitarian (Hunn 1982), and social (Ellen 1993) concerns. According to Morris ethnoscientists have underestimated the relevance of practical interests in the structuring of folk taxonomies, for utility is a major factor in classification of plants. He also stated that interest in morphology is focused on the parts of the plants that are utilized, such as the leaves and roots for medicines (Morris 2000). There are more multifarious mechanisms (e.g., universal taxonomy, utilitarian, morphological, ecological), which provide a robust systematic classification and diverse taxonomy for plants (Newmaster, Subramanyam, Balasubramaniyam, and Ivanoff, 2007).

5 CONCLUSION

Plants and animals are special kind of objects. For a mind to reason intelligently about them, it shout treat them differently from rocks, islands, clouds, tools, machines and money. Even today, professional taxonomist rarely contradict indigenous tribes when they classify the local species, because of the intuitive conviction that living things have a hidden essence and are governed by hidden processes (Pinker, 1994). There is an instinctive need to structure phenomena in taxonomic hierarchies, with the members of each taxon sharing essential properties. This often goes against superficial visual similarity. Young children think that nonvisible internal parts are particularly important for the behavior of an entity and members of the same taxon have nonobvious things in common Keil (1989), Gelman, Coley, & Gottfried (1994). This is cognitive essentialism and categories defined are by these essential properties are called natural kinds.

Modern ethnobiology looks at the widespread regularities in the classification and naming of plants and animals among peoples of traditional, nonliterate societies. These regularities persist across local cultures, societies, environments, and languages.

There are at least five, perhaps six, taxonomic ethnobiological categories which appear to be highly general if not universal in folk biological science. They may be named as unique beginner, life form, generic, specific and varietal and intermediate. The categories are arranged hierarchically and taxa assigned to each rank are mutually exclusive. The naming of taxa which occur as members of the ethnobiological categoriescan be reduced to a small number of nomenclatural principles which are essentially identical in all languages. (Berlin *et al*.,1973). This suggests that members of different cultures universally use similar classificatory procedures to understand the natural order and can recognize and name a grouping of organisms quite independently of its actual or potential usefulness or symbolic significance in human society. People anywhere in the world use similar perceptual strategies to select characters which are most informative. Folk taxonomy is not only the non-scientific classification, it is also important to modern ethnobotanical research, which often depends on traditional knowledge especially in tropical environments where local people are apt to recognize a vast number of organisms.

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