General Principles of Classification and Nomenclature in Folk Biology

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Since about 1954, modern field research has been carried out by a number of ethnographers and biologists in an effort to understand more fully the nature of folk biological classification. Much of this work has been devoted to studies dealing with the naming and classification of plants and animals in non-Western societies. It has now become apparent that several important and far reaching generalizations can be formulated which promise to throw considerable light on prescientific man's understanding of his biological universe.

THE STUDY of man's conceptualization of his natural and social environments has always been a major concern for ethnography. Surely, one of ethnography's major contributions to social science theory has been the systematic revelation of man, the classifying animal. However, the richness and diversity of man's variant classifications of experience have often led ethnographers to emphasize the differences between cultural systems of knowledge at the expense of noting what may be equally revealing similarities.

In the last several years, a number of scholars have become involved in the detailed study of folk biosystematics, prescientific man's classification of his biological universe. From this work, it has become apparent that, while individual societies may differ considerably in their conceptualization of plants and animals, there are a number of strikingly regular structural principles of folk biological classification which are quite general. If the patterns which have been observed continue to be confirmed by further research, their study promises to reveal important aspects of man's conceptual organization of the natural world.

Here, we present evidence in support of several hypotheses which deal with various aspects of folk biological classification and nomenclature. The number of societies which have been studied in sufficient detail so as to allow one to make comparative inferences is small. Nonetheless, we feel that the data that have been collected to this point are sufficiently clear as to merit their presentation at this time.

These principles can be summarized as follows:

(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.[1] 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 1.

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

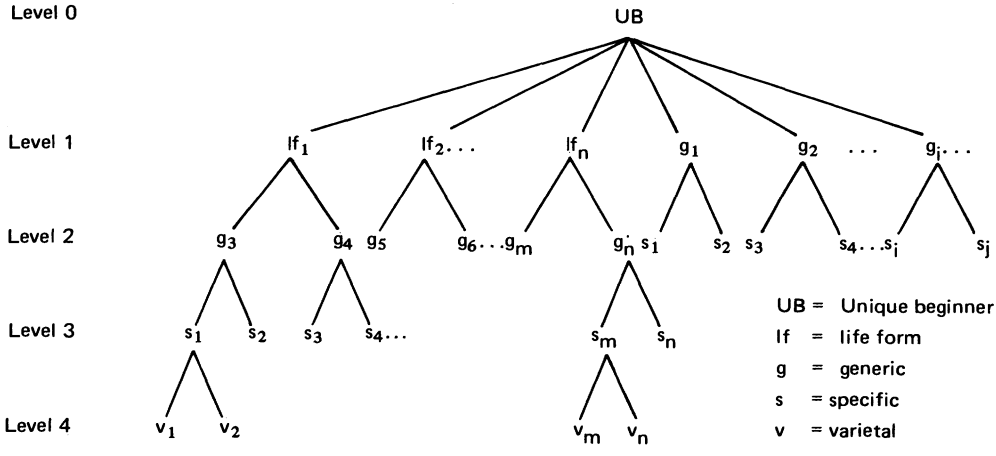


Figure 1. Schematic relationship of the five universal ethnobiological taxonomic categories and their relative hierarchic levels in an idealized folk taxonomy.

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 (see Stross 1969 and n.d.).

(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[2] 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. We have found such taxa to be invariably rare in natural folk taxonomies, and, when evidence has been presented which unambiguously demonstrates their existence (see Berlin, Breedlove, and Raven 1968) the classes are not linguistically labelled. As a consequence, we have referred to such classes as covert categories.

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. The question can only be resolved by further research.

NAMES FOR PLANTS AND ANIMALS

In this section we will discuss the relationship of the formal linguistic structure of plant and animal names and the cognitive status of the taxa to which such names apply. While no isomorphic correspondence is claimed to exist between nomenclature (i.e., names given to classes of plants and animals) and classification (i.e., the cognitive relationships that hold between classes of plants and animals), the overwhelming body of evidence now in hand suggests that nomenclature is often a near perfect guide to folk taxonomic structure. Furthermore, when nomenclature fails to mirror accurately the taxonomic status of a particular biol-

ogical class, it can usually be shown that the class in question is undergoing semantic change.

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 rabbit*, *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.

Types of 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 *beggar-tick*, *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*, *pipevine*, 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-tick*, *jack-in-the-pulpit*, *hens-and 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*, *hens-and-chickens* does not refer to *poultry*. These expressions are unproductive primary lexemes.

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 of *planetree*), *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.[3]

The relationship between these various types of lexemes may be seen as follows[4] (see Figure 2).

Ethnobiological Nomenclature and Folk Taxonomy

In work done thus far on ethnosystematics, it seems likely that the vast majority of primary lexemes, as defined in the discussion above, refer to biologically

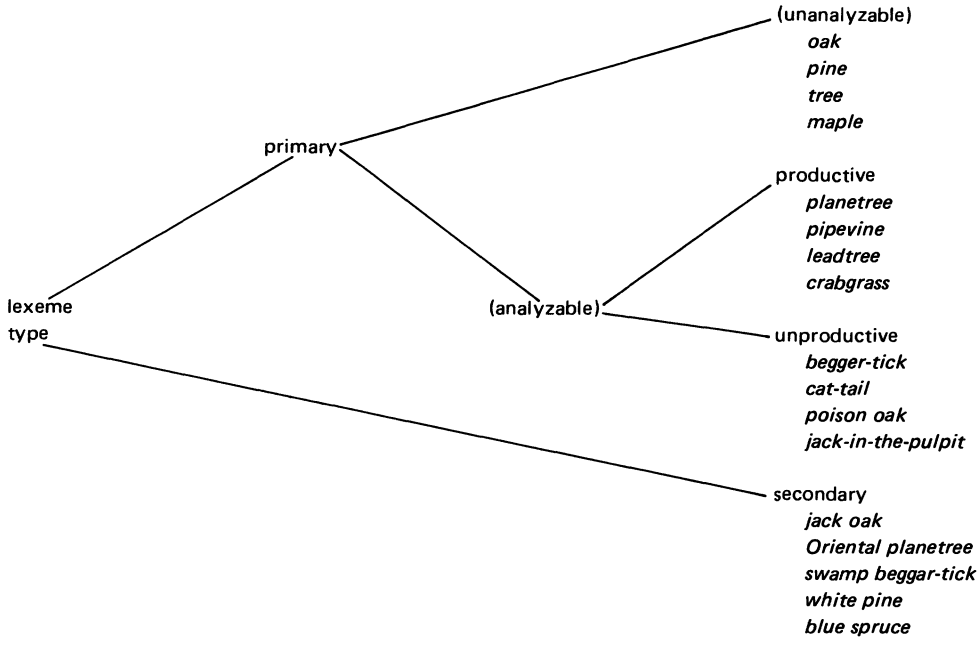


Figure 2. Analysis of lexemes by lexemic type.

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[5] or immediately include taxa designated by secondary lexemes. Taxa satisfying these conditions are generic; their labels are generic names.

(2) Some taxa[6] marked by primary lexemes 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, varietal names.

In the following sections we will show the applicability of these nomenclatural principles to the description of the plant names of the Tzeltal, a swidden agricultural Mayan people with whom we have been working intensively for several years, and for which a monographic treatment will appear shortly (Berlin, Breedlove, and Raven n.d.). Further on we will present analogous linguistic materials from other languages which lend support to the claim that these principles have widespread application.

TZELTAL PLANT TAXONOMY AND NOMENCLATURAL RULES

With the exception of all fungi, lichens, algae, and the like, the boundaries of the domain of plants as conceived by the Tzeltal corresponds almost perfectly with the standard plant division of Western systematic botany.

The domain as a conceptual class, however, is not marked by a habitual linguistic expression comparable to the English term *plant*. Nonetheless, there are numerous expressions which may be utilized to contrast any one member of the plant world with a member of some other domain, for example, animals. Characteristically, plants "don't move" *ma šnihik*, while animals do; plants "don't walk" *ma šbenik*, while animals do; plants are "planted in the earth" *ʔay c'unulik ta lum* or "possess roots" *ʔay yisimik*, clearly features not characteristic of animals.

On more formal linguistic grounds, plant names uniquely occur with the numeral classifier *tehk*. Numeral classifiers are obligatory expressions which must be used when counting certain objects in Tzeltal (see Berlin 1968). Thus, "three trees" would be stated as *ʔoš-tehk teʔ* 'three members of the plant class tree'. Animal names, on the other hand, occur with the numeral classifier *koht* (e.g., *ʔoš-koht c'iʔ* 'three members of the animal class dog'), and names for human beings occur with the classifier *tul* (e.g., *čan-tul winik* 'four members of the human class men').

On both botanical and linguistic grounds, then, the plant domain for the Tzeltal, though not named as such, is unambiguously bounded and distinctly defined.

Life Form Taxa and Life Form Names

In the Tzeltal conception of the plant world, four major life form categories are unique in that, between them, they include at least seventy-five percent of all other plant taxa. Each of these four categories is labelled by a simple primary lexeme. These major plant class names refer to the most obvious and widespread life forms that plants can assume, namely 'trees' *teʔ*, 'vines' *ʔak'*, 'grasses' *ʔak*, and 'broad-leafed herbaceous shrubs' *wamal*.

Generic Taxa and Generic Names

At this time, a total of 471 mutually exclusive generic taxa have been established as legitimate Tzeltal plant groupings. Of the total 471 generic classes, 356 are immediately included in one of the four life form categories, *teʔ*, *ʔak'*, *ʔak*, or *wamal*. Some ninety-seven generic forms, about twenty percent, are not included in any of the four life form taxa and are thought of by the Tzeltal as unaffiliated generics. Plants conceived as unaffiliated are almost without exception cultivated and/or morphologically peculiar in some fashion. Examples are *ʔišim* 'corn', *čenek'* 'bean', *halal* 'bamboo', and *či* 'agave'. Finally, a residue of some eighteen generic taxa, approximately five percent are ambiguous in that they exhibit characteristics of two (or, rarely, three) life form classes, i.e., they fall on the boundaries of the major classes.

The distribution of the inventory of 471 generic taxa over these six categories can be seen below.

Category	Number of Generic Taxa
te? 'trees'	178
wamal 'herbs'	119
?ak 'grasses'	35
?ak' 'vines'	24
unaffiliated taxa	97
ambiguous taxa	18
Total	471

Some ninety-one of the 471 generic taxa are labelled by expressions that can be shown to be of recent origin, i.e., are loan words or loan expressions primarily from Spanish. All of the remaining 380 taxa are labelled by native Tzeltal expressions which can be analyzed linguistically as primary lexemes. 101 taxa are labelled by simple primary lexemes, 125 by unproductive primary lexemes, and 154 by productive primary expressions. Examples of generic names exhibiting these various lexical types can be seen in Table I.

Most generic plant taxa in Tzeltal ethnosystematics are monotypic, i.e., are terminal taxa marked by primary lexemes which include no other named categories. Our data now indicate that of the total inventory of 471 named generic taxa (including those

TABLE I. EXAMPLES OF TZELTAL GENERIC NAMES ILLUSTRATING THE THREE LEXICAL TYPES OF PRIMARY LEXEMES

Simple Primary

?on, avocado (*Persea americana, P. donnell-smithii*)

?ič, chili pepper (*Capsicum pubescens, C. annuum*)

siban, dogwood (*Cornus excelsa*)

tok'oy, willow (*Salix bonplandiana*)

tah, pine (*Pinus* spp., *Abies* sp.)

Unproductive Primary

cis čauk, meadow rue (*Thalictrum guatemalense*) < *cis* 'fart', + *čauk*, thunder lit., "thunder fart"

c'inte?, manioc (*Manihot esculenta*) < *c'in* unanalyzable constituent + *te?*, tree, lit., "*c'in* tree" [but not a kind of tree].

balam k'in, wild sunflower (*Polymnia maculata*) < *balam*, jaguar; *k'in*, day, lit., "jaguar day"

cic ?ak [no common name] (*Tagetes* spp.) < *cic*, kind of avocado + *?ak*, grass, lit., avocado grass [but not a kind of grass].

yišim ?ahaw, wax calla (*Anthurium* spp.) < *y-?išim*, its corn + *?ahaw*, kind of snake, lit., "snake's corn"

Productive Primary

mes te?, coyote bush (*Baccharis vaccinioides*) < *mes*, broom + *te?*, tree, lit., "broom tree"

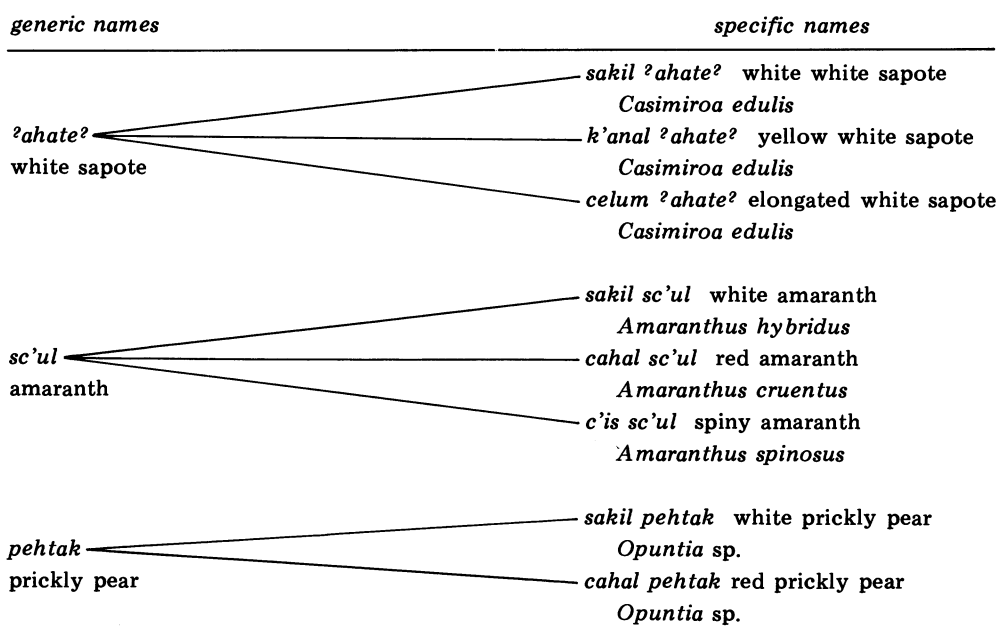
kul ?ak' greenbriar (*Smilax* spp.) < *kul* unanalyzable constituent + *?ak'*, vine, lit., "*kul* vine"

čitam ?ak, kind of grass (*Muhlenbergia macroura*) < *čitam*, pig + *?ak*, grass, lit., "pig grass"

k'an ču? wamal, spurge (*Euphorbia graminea*) < *k'an*, to want it, to resemble it + *ču?*, woman's breast + *wamal*, herb, lit., "resembles-woman's-breast herb" [due, perhaps, to white sappy milk exuded from broken stems of plant].

čihil te?, elderberry (*Sambucus mexicana*) < *čihil* unanalyzable constituent + *te?*, tree, lit., '*čihil*-tree'

TABLE II. EXAMPLES OF TZELTAL SPECIFIC NAMES ANALYZABLE AS SECONDARY LEXEMES



labelled by loan words), 398, or eighty-five percent are monotypic. The remaining seventy-three generic taxa, or fifteen percent, are polytypic including from two to seventeen named specific classes.

Furthermore, our research indicates that generic taxa form the basic core of Tzeltal plant taxonomy. The names for such fundamental categories are those most readily elicited from Tzeltal informants and most easily recalled by them, suggesting that they are highly salient psychologically. There is evidence from the investigations of Stross (1968 and n.d.) that generic names are learned quite early in the acquisition of botanical terminology by the Tzeltal child, a finding which can be taken as an independent measure of psychological importance.

Specific Taxa and Specific Names

As already noted, seventy-three Tzeltal generic classes are partitioned into two or more smaller taxa which we will refer to as specific taxa. There are 239 such taxa in our inventory at present.

With the exception of several rare instances, the names for such specific taxa are all linguistically analyzed as secondary lexemes. The general nomenclatural rule in Tzeltal specific name formation is to modify the generic name involved with a single attributivizing expression. The resulting form is logically comparable to the Linnaean binomial.

Examples of specific names exhibiting this binomial structure can be seen in Table II.

At the present time, we have found only four specific taxa which are further subdivided into varietals. Three classes refer to highly important cultigens. The first two are types of beans (*čenek'*); the third is a type of banana (*loʔbal*). A fourth is limited to one of the classes of tree legumes. As might be expected, varietal names are formed by the modification of the specific name through the addition of an attributive. An example

can be seen in the division of the generic *čenek'* 'bean'. Beans are divided into seventeen specific taxa, one of which is *šlumil čenek'* 'common bean' (*Phaseolus vulgaris*). This specific taxon is further partitioned into the two color variants *cahal šlumil čenek'* 'red common bean' and *ʔihk'al šlumil čenek'* 'black common bean'.

No plant names in Tzeltal ethnobotany have been elicited which refer to groupings of greater specificity than that of the varietal. However, if such names were found, we can be assured that they would be formed in an analogous fashion to that mentioned above and that they would always be labelled by secondary lexemes.

Varietal taxa are not usually referred to, in actual speech, by their full names. There is a tendency for such forms to be "abbreviated," to use Conklin's terminology (1962:122). In such instances, a portion of the name will be used to refer to the class as a whole. In general, abbreviation will lead to the deletion of the generic constituent of the name (i.e., the head of the expression) and the specific portion of the name will become the head. In English, the varietal forms *butter lima(s) bean* and *baby lima(s) beans* may be abbreviated to *butter lima(s)* and *baby lima(s)*. In Tzeltal, one can abbreviate the varietal expression *cahal šlumil čenek'* 'red ground bean' (*Phaseolus vulgaris*) to *cahal šlumil*, literally, 'red ground [ones]'.

NOMENCLATURE AND CLASSIFICATION: SOME POSSIBLE QUALIFICATIONS

We have shown that in Tzeltal ethnobotanical systematics, life form and generic names are labelled by primary lexemes and that specific and varietal names are labelled by secondary lexemes. As such, Tzeltal plant name terminology conforms to the nomenclatural principles outlined in the section on general principles. Our data reveal a small number of exceptions to these general rules, however, which merit discussion. There are at least three generic names in Tzeltal which appear to be labelled by secondary lexemes. Likewise, there may be some evidence that at least one specific taxon is labelled by a primary lexeme. We feel that the circumstances underlying these apparent exceptions are sufficient to indicate that they are, in fact, exceptions which prove the general rule.

Instances Where Generic Taxa Are Labelled by Secondary Lexemes

It will be recalled that a secondary lexeme is a complex expression which (a) comprises a constituent which labels a taxon immediately superordinate to the form in question and (b) occurs in a contrast set whose members also are labelled by secondary lexemes which share the same superordinate constituent. Three taxa which we would treat as generic classes appear to be labelled in Tzeltal by secondary lexemes. The taxa involved are all introduced to the highland Chiapas area and refer to *sorghum*, *wheat*, and *strawberry*. We will discuss them in turn.

Sorghum and *wheat* and *strawberry*: The native term for corn in Tzeltal is *ʔišim*. It is a polytypic generic taxon including at least five widely recognized specific taxa, namely, *sakil ʔišim* 'white corn', *cahal ʔišim* 'red corn', *k'anal ʔišim* 'yellow corn', *ʔihk'al ʔišim* 'black corn' and *píntu ʔišim* 'spotted corn'.[7]

At the time of the Hispanic Conquest, the highland Mayan groups were introduced to two similar and yet quite distinct edible grains, wheat and sorghum. These grain bearing field crops were considered to be similar by the Tzeltal population to their own polytypic class of corn. Logically enough, the two introduced classes were linguistically designated as *kašlan ʔišim*[8] 'Castilian corn', i.e., 'wheat' and *móro ʔišim* 'Moors corn', i.e., 'sorghum'. The conceptual affiliation of these two taxa with corn is verified in that both names occur as responses to the query *bitik sbil huhuten ʔišim*, "What are the names of each kind of corn?" Further questioning, however, clearly demonstrates that these two introduced plants are not kinds of genuine corn, i.e., *Zea mays*, a fact which is

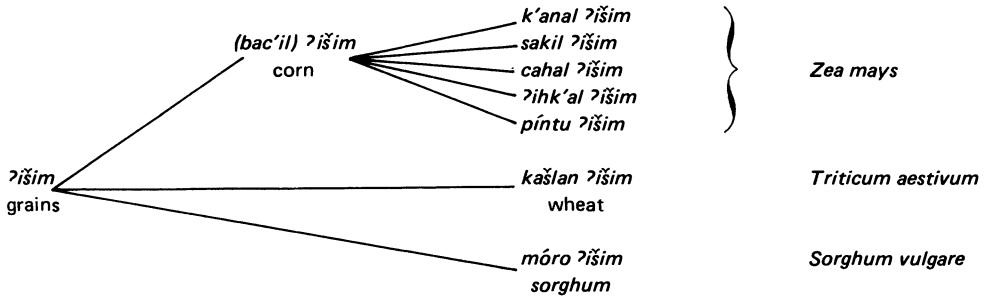


Figure 3. Inferred taxonomic structure showing relationship of corn, wheat and sorghum in Tzeltal folk botany.

linguistically noted by the expression *bac'il ?išim* 'true corn'. Taxonomically, the relationship among corn, sorghum, and wheat is seen in Figure 3.

A comparable situation to the classification of "grains" is seen in the treatment of the polytypic generic class *makum* 'blackberry' in Tzeltal. In this case, the Spanish introduced the European strawberry *Fragaria vesca*. The strawberry was obviously similar to the known specific varieties of blackberries but not similar enough to simply be included as a kind of *makum*. Thus, as with *?išim*, the class *makum* was elevated to become a higher order taxon including now the native blackberry *bac'il makum* and the introduced strawberry *kašlan makum*, lit. 'Castilian blackberry'. The taxonomic structure of this group of plants can be seen in Figure 4.

Each of the above examples describe special situations brought on by culture contact and indicate that under certain conditions a native polytypic generic name will be elevated to mark an intermediate superordinate category of a higher order than that of the folk genus. Taxa immediately included in this new category may include generic names which are linguistically analyzable as secondary lexemes. However, such a situation can develop only when (a) a labelled native polytypic generic already is present in the taxonomy and when (b) conceptually similar (at the generic level, not the specific) plants are introduced.

Finally, it should be reiterated that the native generic must be polytypic. If the native form is unsegmented and an introduced variety is seen to be similar enough to be a "kind of" the native plant, the generic taxon is simply segmented into two specific taxa. In almost all cases, the native specific takes the attributive *bac'il* 'genuine', the introduced variety *kašlan* 'foreign'.

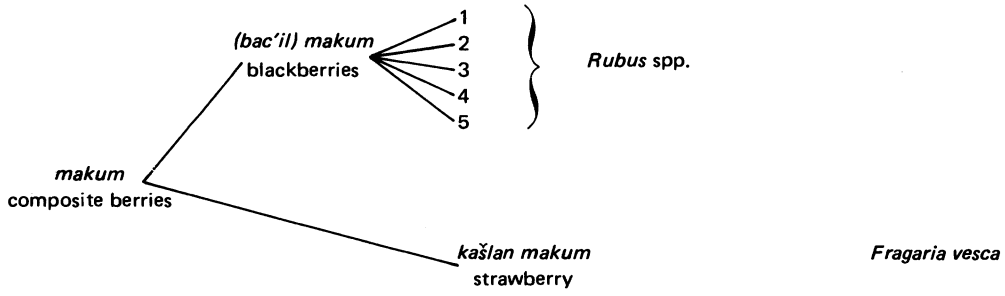


Figure 4. Inferred taxonomic structure indicating relationship of blackberry and strawberry in Tzeltal folk botany.

Instances Where Specific Taxa Are Labelled by Primary Lexemes

Just as there are some examples where a generic taxon may be labelled by a secondary lexeme, a situation contrary to our general principles of nomenclature, one also finds instances of specific taxa taking labels that must be analyzed as primary lexemes. As with generic taxa, we suggest that the atypicality of such examples can be explained and that they in fact provide confirmation of the general rule.

There appear to be two types of situations involved where specific taxa may be indicated by primary lexemes. The first, and most widespread, occurs when one of the specific classes included in a generic taxon is considered to be the type specific of the set. Often, the label of this type specific class will be polysemous with that of the superordinate generic name, or as Wyman and Harris have said in referring to this kind of nomenclature in Navaho, "The situation is as if in our binomial system the generic name were used alone for the best known species of a genus, while binomial terms were used for all other members of the genus" (Wyman and Harris 1941:120).

A second situation where specific taxa may be labelled by primary lexemes occurs when, for reasons not clearly understood, a specific taxon appears to be in the process of assuming a generic status. In so doing, it ceases to be marked by the standard binomial expression characteristic of specific taxa. Each of these various exceptions to the binomiality of folk specific nomenclature will now be discussed in detail.

Type specific nomenclature in Tzeltal: In most, if not all, Tzeltal specific contrast sets, one of the members of the set is considered as the focal or most dominant member. Generally, the type specific taxon refers to members of the generic class which have the widest geographical distribution, are larger in size, or are the best known.

In many natural contexts, it is often the case that one can refer to the type specific by the generic name alone (i.e., by the polysemous use of the generic name) with total confidence of being understood. An example can be seen in the classification of kinds of custard apple (*Anona* spp.). For the Tzeltal there are three specific taxa in this set as seen in Figure 5.

In many situations, *k'eweš* can be used alone to refer to the most prominent type specific class, *A. cherimola*. However, when greater precision of designation is desired, informants readily provide binomial designation by the addition of the attributive *bac'il* 'genuine', leading to the form *bac'il k'eweš* 'genuine custard apple'. In fact, the linguistic contrast required between type specific members and all other members of the specific contrast set is invariably indicated by the addition of the attributive *bac'il* in all other cases found in Tzeltal where the type specific is polysemous with the generic name. (For a detailed discussion of this process which can be understood as a type of linguistic marking, see Berlin 1972.)

Aberrant specific taxa marked by primary lexemes: Some specific taxa may be labelled by primary lexemes if the taxa in question appear to be achieving generic status. We have data for one case in Tzeltal, but as will

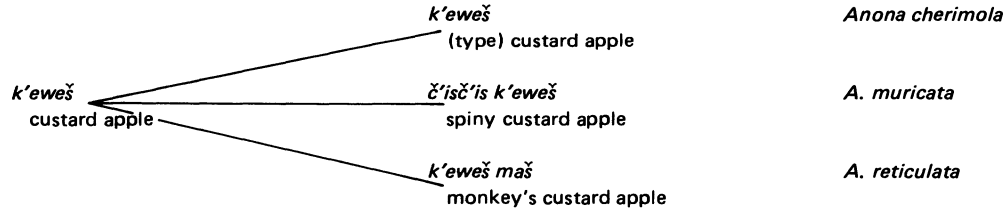


Figure 5. Type specific nomenclature as exemplified in names for custard apples in Tzeltal folk botany.

be pointed out, the process appears to be a general one.

For most Tzeltal informants, the generic *hih te?* 'oak' includes four specific taxa: *ca?pat hih te?* 'excrement barked oak', *sak yok hih te?* 'white footed oak', *k'eweš hih te?* 'custard apple oak' and *čikinib hih te?*, 'armadillo eared oak'. This latter form may, for most informants, be cited in abbreviated form, i.e., simply *čikinib*. For some informants, this is the preferred usage.

Some other Tzeltal speakers, however, recognize only the first three classes of oaks as "genuine oaks" and treat *čikinib* as being a closely related but distinct taxon coordinate with *hih te?* 'oak'. One Tzeltal Indian for whom the above classification of oaks holds, produced the taxonomic diagram indicated in Figure 6.

That such a situation could arise is partially explained in that *čikinib* is by far the most divergent class of oaks with many characters readily distinguishing it from the other three classes.

Concluding comments on Tzeltal nomenclature and category status: We have presented several examples from Tzeltal where the nomenclatural properties of a particular plant name were at variance with those expected given its ethnobiological category membership. On the one hand, we pointed out examples where generic taxa were labelled by secondary lexemes and, on the other, showed at least one example where a specific taxon was labelled by a primary lexeme. In the first case, it appears that all such names result from a change in the taxonomic structure due to the introduction of new organisms. In the latter case, taxonomic change appears to be taking place which suggests that a once specific taxon is achieving generic status due to its quite dissimilar characteristics when compared with contrasting specific forms.

While all of these cases are exceptions to the nomenclatural principles we outlined earlier, the processes which allow such deviations to arise appear to be describable. Considering that the Tzeltal have not been known to hold botanical nomenclatural congresses, it is of some interest that the number of exceptions are as few as those noted.

INTERMEDIATE TAXA

Thus far, our discussion of Tzeltal plant taxonomy and nomenclature has centered on an overview of the ethnobotanical categories whose members are life form, generic and specific taxa. We have mentioned the

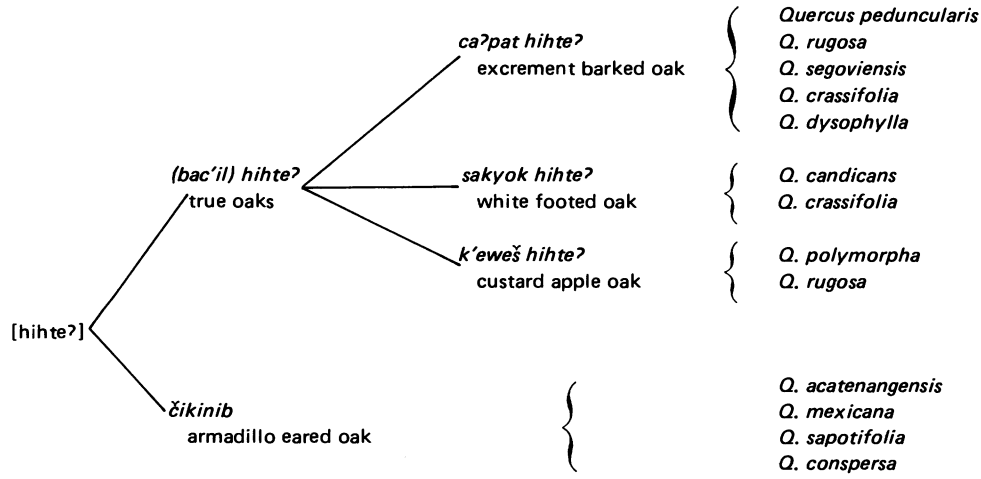


Figure 6. Inferred taxonomic structure indicating relationship of large leafed and small leafed oaks in Tzeltal folk botany.

occurrence of varietal taxa but their presence is of minor importance numerically (though, no doubt, of major importance culturally). One further comment on the taxonomic structure of the Tzeltal world of plants needs to be made at this point and this concerns the presence of categories of greater inclusiveness than that of the Tzeltal genus but of lesser inclusiveness than the Tzeltal life form taxa (cf. examples of "grains" and "berries" in Figures 2 and 3).

We have elsewhere (Berlin, Breedlove, and Raven 1968) suggested that one may recognize empirically, a number of so-called "covert categories" which for the most part represent groupings of generic names which are included in mid-level taxa that have not been labelled by Tzeltal plant lexemes. Thus, for Tzeltal informants, the generic names *kul ʔak'*, *č'iom hol*, *ʔihk'uye č'iš*, and *čohčoh č'is*, all vine names referring to members of the genus *Smilax*, compose a well defined taxonomic contrast set included in a superordinate taxon which is not marked by a simple linguistic expression. The same can be said of many conceptually similar groupings of generic taxa. To this point we have established approximately seventy-four covert taxa of greater inclusiveness than Tzeltal generics.

The recognition of unlabelled mid-level taxa can be of considerable importance in understanding fundamental principles of native classification and should not be ignored by placing too much stress solely on named categories. However, the fact that categories such as these *have not been labelled* suggests that the need to distinguish such classes is as yet relatively unimportant in most cultural contexts where the Tzeltal discuss the plant world.

SUMMARY OF TZELTAL PLANT TAXONOMY AND NOMENCLATURE

The Tzeltal world of plants as seen from this broad overview can now be summarized as follows. The domain as a whole corresponds very closely with the standard botanically defined plant division of Western science. It is not designated by a single habitual linguistic expression, although certain circumlocutions may be utilized to contrast the domain with other natural groupings of organisms such as animals. The occurrence of all plant names with the numeral classifer, *tehk*, permits the domain to be defined unambiguously on a strictly linguistic basis.

Linguistic and taxonomic considerations allow for the recognition of four conceptual classes of plant taxa which receive habitual names: life form taxa, generic taxa, specific taxa, and varietal taxa.

There are four life form names, *teʔ*, *wamal*, *ʔak* and *ʔak'* which correspond to the life forms "tree," "herbs," "grass," and "vines," respectively. There are 471 generic names. Generic names mark taxa which are the basic building blocks of the taxonomy and are of major importance psychologically. Most generic names, 398, are monotypic, while a minority, seventy-three, are polytypic. These latter polytypic generics include among them 239 specific names in contrast sets ranging from two to seventeen members. Intermediate mid-level taxa do exist, but the fact that they are unlabelled suggests that their cultural significance is as yet relatively small. In overview, the Tzeltal taxonomy of plants is seen as a simple taxonomy consisting essentially of two, and, less commonly, three named levels.

There appears to be a strong correlation between the linguistic form of a plant name and taxonomic category which it labels. With a few exceptions, most of which are explainable, primary lexemes are restricted to generic and life form taxa while secondary lexemes almost invariably label taxa of lesser inclusiveness than the folk genus, i.e., specific or varietal taxa. As such, Tzeltal ethnobotanical terminology is highly systematic and can be understood in terms of a small number of regular nomenclatural principles.

In the remainder of the article, we present data which suggest that these principles have applicability in a number of other ethnobiological systems of classification and,

by implication, may be thought to have widespread generality.

GENERALITY OF FOLK BIOLOGICAL PRINCIPLES OF CLASSIFICATION AND NOMENCLATURE

While data on some aspects of ethnobotany and ethnozoology, especially the uses of plants and animals, are available from a wide variety of sources, good materials on the classificatory principles underlying folk biological taxonomy and nomenclature in non-Western societies are sadly lacking. Much of the earlier work on ethnobiology focused on problems relevant to the time but made little attempt to discover the conceptual foundations of ethnoscience as practiced by preliterate peoples. Our supporting data are thus considerably less adequate than we would like. However, those systems which have been studied from an ethnoscientific point of view and are more or less complete in detailing the classificatory structure of a particular ethnobiological domain lend support to our hypotheses concerning the universal similarity of ethnobiological classification and nomenclature. We now sketch the major outlines of several systems which have been studied with a focus on the cognitive organization of the world of plants and animals.

Hanunóo Ethnobotany

One of the most complete and influential descriptions of the ethnobotany of a non-Western people is Harold C. Conklin's unpublished Ph.D. dissertation, "The Relation of the Hanunóo to the Plant World." This work, completed in 1954, lends considerable independent support to the generality of the propositions of universal ethnobiological categories as well as to the nomenclatural principles which appear to be operative in the labeling of taxa which occur as members of these categories.

In Hanunóo, almost all plants are included in one of three major groups distinguished by the criterion of habit of stem growth. They are *kāyu* 'tree', *ʔilamnun* 'herbs' and *wākat* 'vines'. These taxa are much like the major life form taxa of Tzeltal. There are, as well, several ambiguous taxa that cannot be so classified, some three percent of a total of 1625 terminal plant taxa. These ambiguous forms, such as bamboo, seem to be morphologically aberrant in some form or other and are logically comparable to the ambiguous taxa found in Tzeltal folk botany.

Immediately included in the three major life form taxa are some 822 plant taxa which are labelled by what Conklin refers to as "basic plant names." These forms are delimited by straight-forward linguistic criteria in that they are unique to ethnobotanical vocabulary, being full words which are "free morphemes or unanalyzable stems" (1954:114-115). Conklin's basic plant names appear to be "generic" in our sense.

Exactly 571 basic plant names are monotypic. The remainder, 251, are polytypic and include taxa of greater specificity than that of the basic plant name. Linguistically, these sub-generic taxa are labelled in the expected binomial fashion. "The most common form [of the sub-generic name] is a binomial combination" (*Ibid.*:17). Of the 1054 plant names labelled by secondary lexemes, 961 are of the binomial type, or about ninety-one percent of the total polynomial designations. Only for the cultivated plants *lada?* 'chili pepper' and *ma?is* 'corn' are expressions of three or four attributives utilized.

As in Tzeltal, named mid-level groupings between life form taxa and generic classes are conspicuously absent. In Conklin's words "mid groupings of plants are made, of course, but not according to a structured terminologically identifiable system" (1954:97).

Type specific-folk generic polyemy is also noted in Hanunóo folk botany. Thus, "a shared term [i.e., a polytypic generic plant name] when not followed by an attribute, may be read as that term plus *ʔurūŋan* 'real'." The resulting name is the preferred synonym required where the designated plant name is distinguished from others in

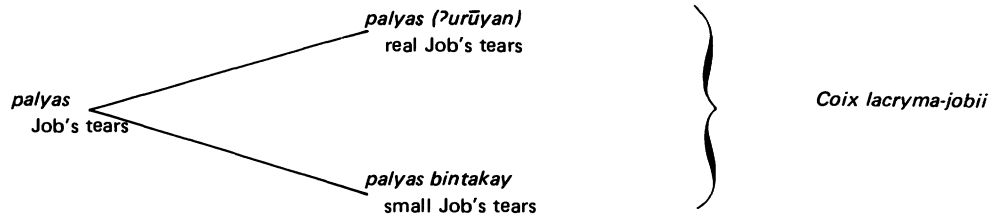


Figure 7. Hanunóo terms for kinds of Job's tears exhibiting optionally marked type-specific.

the same set (Conklin 1954:259). An example is seen in the labelling of the polytypic taxon Job's tears (in Figure 7).

There is little doubt, then, that the Hanunóo picture conforms well to the present exposition. Hanunóo major classes, inclusive of ninety-seven percent of all plant taxa, constitute a handful of life form taxa. Conklin's basic plant names are clearly generic forms marked by primary lexemes. Furthermore, most are monotypic (some 571 of the 822). The majority of all remaining terminal classes are specific taxa marked by secondary lexemes, the linguistic structure of which is predominantly binomial, i.e., a generic name modified by an attributive.

Karam Ethnozoology

Ralph Bulmer's work on Karam ethnozoology, a primitive people of New Guinea, is no doubt the most comprehensive modern ethnoscientific description of this biological domain yet available. While no monographic work has been published so far, several lengthy articles have appeared which allow for the major outlines of Karam animal classification to be known (Bulmer 1967, 1968, 1970; Bulmer and Tyler 1968).

The major thrust of Bulmer's research has been to show that primitive man's linguistic recognition of the naturally occurring groupings of related organisms found in nature are logically comparable to the species of Western biological science. (Bulmer is quick to point out, however, that no perfect mapping of folk and biological categories can be expected at all times.) He would refer to these natural units as "speciemes," a neologism based on the term "species" and the affix "-eme." Speciemes, as applied to animal taxa but with little modification applicable to plants as well, are defined as "groups of creatures marked off from all other animals known . . . by multiple distinctions of appearance, habitat and behavior and *not including recognized subgroupings marked off from each other in a similar way*" (my italics) (Bulmer and Tyler 1968:344). One is told that most speciemes are given names, and most are analyzable as linguistically simple. As such, speciemes are formally generic taxa in our current formulation.

On the other hand, Bulmer and Tyler are hesitant to depend too strongly on the linguistic form of the names of taxa as indicative of the taxonomic status of a particular class. Thus, the names applied to speciemes cannot be "given a fixed syntactic definition" (1968:350).

One of the difficulties in Bulmer's otherwise excellent treatment of Karam animal taxonomy is his assignment of the taxonomic rank of a taxon solely on the basis of its taxonomic level with little consideration of its cognitive status *vis-à-vis* other taxonomic categories. Bulmer recognizes four kinds of taxonomically defined groupings (see Bulmer 1970:1073-1074).

(1) primary taxa: "Those taxa not subsumable into any larger taxon other than *tap* 'thing' ";

(2) secondary taxa: "immediate subdivisions of primary taxa";

(3) tertiary taxa: "immediate subdivisions of secondary taxa";

(4) quaternary taxa: "subdivisions of tertiary taxa."

Karam taxa may also be classified as terminal "regardless of their hierarchical status, if they are units with no standardly named subdivisions" (*Idem*).

Bulmer reports that there are ninety-four primary taxa but that exactly sixty-six of these are monotypic, i.e., are also terminal (Bulmer 1968:7). Examples of such groups would be "*wowiy*, applied to a small gecko . . . ; *aypot*, applied to an agamid lizard . . . ; *ssk*, applied to certain black scarab beetles" (Bulmer 1970:1074).

The remaining twenty-eight primary taxa are polytypic and include additional taxa. Since Bulmer does not utilize the comparable concept of life form, it is difficult to determine from the published materials how many of these remaining classes are life form taxa and how many are generic. However, if the number of taxa included in each of these twenty-eight polytypic primary taxa is any clue, which we believe it is, we may surmise that the number of distinct major life form classes is relatively few.

Thus, twenty-three primary polytypic classes are said to include small numbers of taxa, from two to six members, all of which are themselves terminal. The remaining five primary taxa look suspiciously like life forms as may be seen by noting their semantic ranges and number of included categories.

yakt 'flying birds and bats'
181 terminal taxa
as 'frogs, small marsupials and rodents'
35 terminal taxa
kmn 'larger marsupials and rodents'
30 terminal taxa
joŋ 'grasshoppers and crickets'
20 terminal taxa
yn 'skinks'
11 terminal taxa

It is clear that the taxonomic level of a particular taxon in the Karam classification of animals is not necessarily crucial in determining its ethnobiological categorical status. Monotypic taxa such as *wowiy* 'small gecko' are logically comparable to such unaffiliated taxa as *bamboo* and *cactus* in Tzeltal. It is unlikely that the primary taxon *wowiy* has the same status in Karam thought as does the large polytypic primary taxon *yakt* 'bird', a class including 181 taxa. Bulmer recognizes this by analyzing *wowiy* as marking a class of specieme status while *yakt* is a taxon of a "higher order" (cf. Bulmer and Tyler 1968:350). The point is, of course, that the "higher order" referred to is one of *conceptual rank*. Thus, while *wowiy* and *yakt* may be "primary taxa" as taxonomically defined, they are members of different ethnobiological categories, generic and life form respectively.

It can be assumed, then, that the majority of Karam animal taxa are of generic status while a small number of names appear to designate life form categories. This conforms well with what one would expect in terms of the structures of other folk biological taxonomies.

An analysis of those Karam generic names which are polytypic provides some information on the applicability of our principles concerning folk specific nomenclature. Specific taxa, in our terms, are quite rare in Karam. One of the major polytypic life form taxa, *as*, frogs and small terrestrial mammals, includes twenty-five generic taxa. Only three are polytypic and are labelled by the names indicated in Figure 8.

The final polytypic generic *jejeg*, includes four specific taxa. Each is binomial in linguistic structure. One of the taxa, *(jejeg) pkay*, is of interest in that it may be abbreviated, the attributive constituent coming to stand for the class as a whole. This is quite common in much specific nomenclature and can be seen in English with the alternative forms *lima* and *lima bean*.

The taxa *lk* and *gwnm* are similar in that each includes a type specific taxon which is polysemously labelled with the generic name. The non-typical specific *(gynm) sbmganpygak* shows abbreviation as in the case of *(jejeg) pkay*. The only real exception to binomial nomenclature in these data is the apparently unanalyzable primary

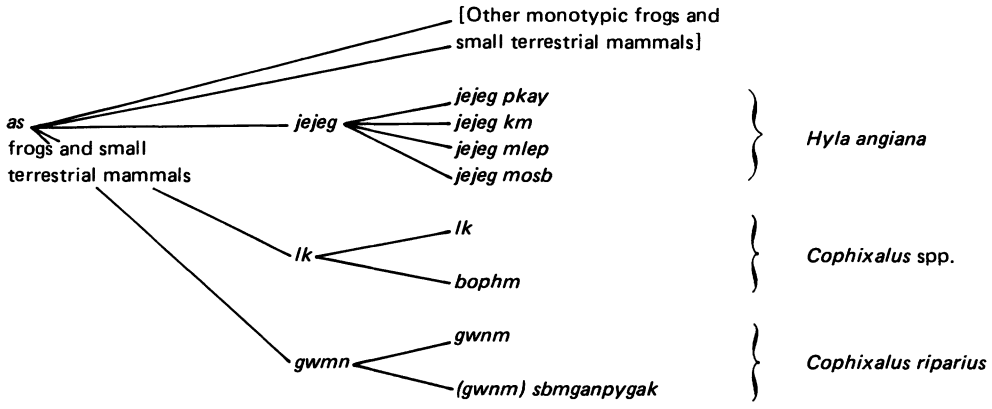


Figure 8. Taxonomic summary of Karam taxon *as*, frogs, indicating the only three polytypic generic taxa of this set.

lexeme *bopnm* which occurs as the name for one of the specific taxa of *lk*. Bulmer and Tyler's report lead one to believe that *bopnm* may be ambiguous as a specific taxon, comparable to the name *čikinib* in Tzeltal. If so, the fact that it is labelled by an apparent primary lexeme would indicate that it may be assuming generic status in Karam taxonomy.

Bulmer's frog data, as well as our own from Tzeltal, points up another difficult problem in interpreting folk biological materials. This concerns what might be referred to as the internal biological diversity of folk generics. Bulmer writes:

> the named subdivisions of *jejeg* can only be regarded in conceptual terms as variants or varietals, contrasting only in a single dimension, colour. *Lk* on the other hand includes two taxa of lower order which probably cannot be considered simply as variants, as they contrast both in size and ecology. *Gwnm* are more complicated still, the secondary taxon spanning at least five zoological genera and species. *Sbmganpygak* is normally applied to two subterranean dwelling 'zoological' genera, which Karam do not distinguish, and the unmarked terminal taxon *gwnm* spans the residue which includes at least two morphologically and ecologically highly distinctive forms which Karam recognise but do not have agreed names for.
>
> Thus if one regards *jejeg*, *lk* and *gwnm* as polytypic genera, one is faced with the awkward situation that the subdivisions of one are conceptually varietals, of another are conceptually specifics and of the third include one specific and one which is itself at least covertly generic [Bulmer, personal communication].

Comparable data from Tzeltal in the area of folk botany can be seen in comparing the two generics *nahk* 'alder' and *hih te?* 'oak'. *nahk*, for some speakers, is divided into two specific taxa, *cahal nahk* 'red beech' *(Alnus ferruginea)* and *sakil nahk* 'white beech' *(Alnus arguta)*, both of which refer to color variants of the genus *Alnus*.

The included specific taxa of *hih te?*, however, as seen in Figure 6, are distinguished by several criteria, namely, leaf characters (size, shape, color, texture, thickness, margin), bark characters (color, thickness, texture), acorn size, trunk strength, and trunk grain.

A possible interpretation of both the Karam and Tzeltal materials is that the greater the number of dimensions utilized to distinguish specifics, the greater the biological diversity of the folk generic. A more objective index, perhaps, might be the relative numbers of biological species referred to the respective folk generics. In the case of *nahk*, two biological species are involved. In

the case of *hih te?*, at least ten species of *Quercus* are represented in the folk genus. One could go further and suggest that a folk generic which referred to several species of distinct genera was more biologically diverse, objectively, than a folk generic which referred to several species of the same genus, e.g., *tah* in Tzeltal which refers to several species of *Pinus* and *Abies*.

On the other hand, demonstrating that two folk generics are different in terms of absolute biological diversity is not sufficient evidence to suggest that the two taxa are conceptually of differing ranks. Thus, both *hih te?* and *nahk* are taxonomically immediately included in the life form *te?* 'tree', both names are freely recalled in eliciting lists of tree names, neither appears, from tentative evidence, to be more difficult to learn than the other, and so on. While there is no doubt a continuum in the absolute biological diversity of folk generic taxa, some being relatively compact, others more wide ranging, we see no reason at this time to suggest that this continuum is conceptually relevant in prescientific biosystematics.

Cantonese Ethnoichthyology

A recent detailed analysis by Eugene Anderson indicates the generality of our findings for the domain of ethnoichthyology. In his recent study of the Cantonese speaking boat people of Castle Peak Bay, Hong Kong, Anderson describes a taxonomic system for sea-life which conforms closely to what we have suggested is typical for folk biological taxonomies generally. Firstly, the named taxonomy is quite shallow, consisting only of three levels. There is no "single term covering all the items discussed . . . except such descriptive labels as *hoi6 ie7* 'sea things' " (Anderson 1967:16).[9]

Of the three named levels one finds categories as follows: "very general (*u6* 'fish'; *hal* 'decapod crustacean'); fairly specific, corresponding roughly to Western species (*tshiing4 paan2* 'green grouper'; *hung5 paan2* 'red grouper')" (Anderson 1967:16). It would appear that the ethnobiological categories noted by these three successive levels can be easily understood as corresponding to life form, generic, and specific categories.

At level one of the taxonomy, Anderson describes six major classes which include the majority of all named organisms. These are *u6* 'fish', *hal* 'decapod crustaceans' (prawn, lobster), *hai7* 'crab', *lo6* 'snail', *hou5* 'oyster', *hin6* 'clam, bivalve' (*Idem*). These taxa are small in number and broad in scope and clearly mark life forms.

While the number of terms at level one are few, "The situation is quite different at the second level. Here one finds some 200 or more terms. Within the enormous set of *u6*, [fish], the number of terms is particularly high, and all of them contrast" (Anderson 1967:18). Thus, like other folk taxonomies, the number of generic terms appears to be relatively large. Some taxa, e.g., *u6* 'fish', are comparable to Tzeltal *te?* 'tree' in that they include large numbers of generic names. And, again, comparable to the Tzeltal materials, Anderson found intermediate categories to be lacking, or if present, not to be labelled by any name.

Anderson writes that certain of the generic taxa at level two are further partitioned and these would correspond to our notion of specific categories. This appears to be the full depth of the taxonomy for all "third level taxa are . . . terminal ones; no fourth level exists" (*Ibid.*:19).

Nomenclaturally, the system is highly regular and predictable. Terms at the second level, the generic terms, are linguistically analyzed as primary lexemes. Specific taxa are labelled by lexemes which are binomial and can be treated as secondary lexemes. They are formed, as expected, by the names for specific kinds of mackerel and sardines, as seen in Figure 9.

The polysemous labelling of the generic and the most common or type folk specific is also attested in the Cantonese materials. Dragon decapods (i.e., spiny lobsters) and

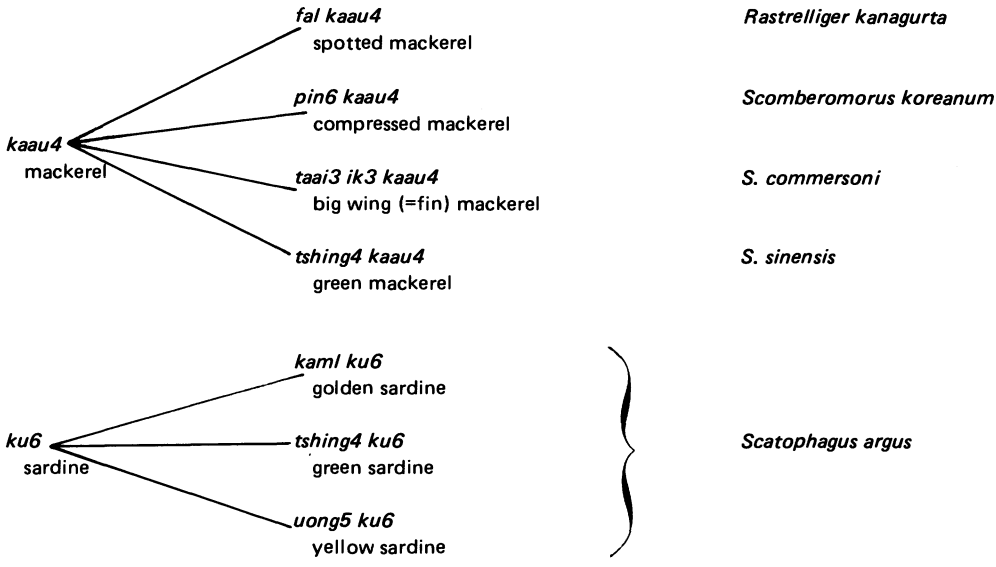


Figure 9. Chinese of Hong Cong Harbor mackerel and sardine terminology.

spring decapods (i.e., mantis shrimps) are labelled as seen in Figure 10. Anderson notes that "the common kind has no specific name (the same name contrasts at two levels)" or that "the ordinary name contrasts at both levels 2 and 3" (*Ibid.*:71).

Anderson's conclusions are of considerable interest for our typological argument and are given here in full:

> Some of the features of the Cantonese classification of marine life are interestingly similar to features of other systems. The author has experience with English and Tahitian fish taxonomies as well as with Cantonese. All of these folk taxonomies have three basic levels: very general ('fish', *'i'a'* 'fish' in Tahitian, and *'u6'*); more specific (*'ma'o'* 'shark' in Tahitian, *'sa4 u6'* in Cantonese); and very specific ('thrasher shark', 'hammerhead shark'... *'ma'o'a'ahi'* 'thrasher shark', *'ma'o afeta'* 'hammerhead shark' in Tahitian and *'nagau5 lim3 sa4'* 'thrasher shark' and the various words for hammerheads in Cantonese). The choice of examples points to another fact—that terms in these three totally unrelated languages are often nearly perfect transla-

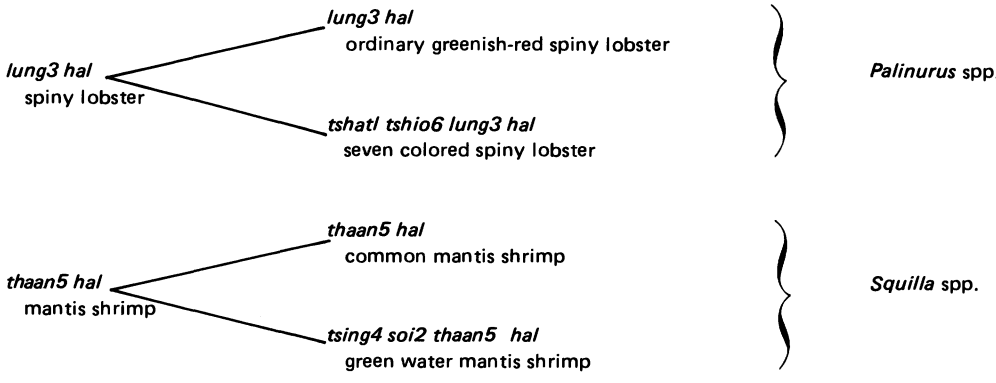


Figure 10. Chinese of Hong Cong Harbor lobster and mantis shrimp terminology.

tions of each other, at least in reference to fish" [Anderson 1967:35].

Finally the author notes that the structural characteristics of English, Cantonese, Tahitian, and Latin nomenclature "are more similar than coincidence alone [can] explain" (*Ibid.*:36). As our broader comparative evidence reveals, these similarities must certainly reflect identical ethnobiological nomenclatural principles employed by many prescientific peoples in their linguistic treatment of the biological universe.

Navajo Ethnobiology

Extensive studies have been carried out on Navajo ethnobiology by Leland C. Wyman and his collaborators. Two studies in particular (Wyman and Harris 1941; Wyman and Bailey 1964) are of particular interest in our comparative context in that both are fairly complete descriptions. In Wyman and Harris (1941), one is presented with a survey of Navajo ethnobotany. This is the first work, to our knowledge, where the logically comparable notions of scientific genera and folk genera are presented in a more or less explicit fashion. In this work, native groupings of plants which appear to represent the most significant discontinuities of the plant world are called Navajo genera. Such groupings are labelled by what Wyman and Harris call a "basic stem name." Classes smaller than the Navajo genus are called "varietals." Nomenclaturally, varietal names are comprised of a basic stem name plus some kind of attributive expression.

In this early publication, Wyman and Harris are hesitant to treat stem names as generics (though this position is to change in Wyman and Bailey 1964) as can be seen in this parenthetical footnote:

> It would be confusing to call the *stem* names *generic* names, since they do refer to definite botanical species. The situation is as if in our binomial system the generic name were used alone for the best known species of a genus, while the binomial terms were used for all other members of the genus [1941:12].

As we have seen, the situation described by Wyman and Harris can easily be understood as one where one of the specific taxa is seen to be a type specific and its label is polysemous with the superordinate generic name in common, every-day usage. That the authors should be confused here is due to an inordinate concern with the one-to-one mapping of scientific categories and native taxa.

In Wyman and Bailey's later treatment of Navajo classification on insects, one finds a ready acceptance of the notion of folk genera and folk species. Here we note that "It is more realistic . . . to employ the term *Navajo generic* for the native appellation of the basic group [of organisms] and *Navajo species* for the *generic* names qualified by adjectival terms" (1964:17).

Navajo ethnoentomology shows many characteristics in common with other systems of ethnobiological classification. Of the 102 Navajo genera discovered, forty-two were further partitioned into specific classes. Only nine of these polytypic forms included more than ten specifics. And, as we have seen, specific designation is as expected: linguistically it is binomial in all cases with the qualification noted above of type specific—generic polysemy.

Bulmer (1965), in a review of Wyman and Bailey's work, is correctly critical of certain aspects of it. He points out that no formal definition of *generic* category or *generic* name is offered, nor is an attempt made in their listing to indicate when a form is meant to designate generic or specific taxa. Likewise, Navajo generics are not distinguished in a convincing way from the few more inclusive Navajo class names (called *phyla*). It seems that Bulmer's major objection is that the authors utilize the scientific model of nomenclature too literally. He concludes: "The trouble with this procedure is that one simply cannot assume that nomenclature is an adequate guide to taxonomy" (1965:1565). On the other hand, this observation should not lead one to the opposite extreme which is to imply that the relationship between folk nomenclature and

folk taxonomy is spurious or fortuitous. As we have seen, a stronger hypothesis, and we think one supported by considerable data, is to assume that nomenclature *is* a reliable guide to taxonomy and to treat contrary evidence not as random exceptions but as explainable deviations from highly regular principles.

Fore Ethnozoology

A brief, but lucid, account of the general outlines of another preliterate people's classification of animals is seen in Diamond's discussion of the Fore of Highland New Guinea (Diamond 1966). While focusing primarily on a discussion of the folk classification of birds, Diamond provides some interesting information that corresponds, in most respects, to what we have said about other ethnobiological systems of classification.

In the first place, the Fore taxonomy of animals is relatively simple as far as the number of named taxonomic levels are concerned. Thus, "The Fore classificatory system was found to involve two levels ... There were no intermediate categories" (Diamond 1966:1102-1103). From the author's description, it does not appear that the domain of animals as a whole receives a linguistic designation and is unlabelled, another feature in common with many folk systems.

At level one of the taxonomy, one finds that "All animals are assigned to one of nine higher categories, designated by so-called *tábe aké* or "big names' " (*Idem*). The classes marked by these "big names" are *kábara* 'birds' (includes 110 taxa); *úmu* 'small flightless mammals' (includes 15 taxa); *íga* 'large flightless mammals' (20 taxa); *táro* 'frogs' (16 taxa); *kwiyágine* 'lizards and snakes' (17 taxa); and *kabágina* 'insects, spiders, worms' (number of included taxa not determined). There are two monotypic taxa which Diamond says occur as contrasting members with the above forms; *ámanani* 'cassowary' and *uba* 'fish'. Finally, there is one polytypic taxon that includes but two terminal taxa, *ísimi* 'bats'.

From the list of taxa found at level one it appears certain that the majority of them are large polytypic classes which we would analyze as members of the ethnobiological taxonomic category life form. The names for the taxa "cassowary" and "fish" we would want to treat as monotypic aberrant generics which are not conceptually included in any of the known major life forms, a typical feature of folk taxonomies. The analysis of the taxon for 'bat' *ísimi* must be ambiguous given the information available in Diamond's report. On structural grounds, one would want to treat this taxon as an aberrant generic name which includes two specific taxa. Whether or not the taxa included in *ísimi* are labelled by secondary lexemes, thus providing evidence that they are specific, is not known.

As concerns the linguistic structure of the perhaps more than 200 taxa at level two of the taxonomy, all appear to be labelled by primary lexemes and many of these may be simple primary lexemes. Diamond notes that some expressions were analyzable but that "the great majority of names had no obvious etymologies and were said by the Fore to be simply words without meaning [other than their zoological referents, of course]" (*Ibid.*:1103-1104).

Guaraní Ethnobiology

Guaraní provides additional evidence in support of many of the principles suggested here, though the data are, admittedly, incomplete. We have found information relating to the classification of some groups of animals and plants which is of relevance here.

Dennler (1939) presents a report on the classification of mammals in Guaraní. We are not told whether or not mammals, as a taxon, constitutes a native category in this language. Nonetheless, it appears that mammals are divided into twenty-nine groups, fourteen of which comprise single forms.

Arirai river wolf	*Pteronura brasiliensis*
Eirá huron	*Tayra barbara*
Wareruá squirrel	*Guerlinguetus ingrami*

Figure 11. Examples of monotypic mammal names in Guaraní.

"All the remaining groups contain two or more forms; the names of these forms are binomials" (Dennler 1939:233). From these data it would appear that Dennler has isolated twenty-nine generic taxa, fourteen of which are monotypic, the remaining fifteen taxa being polytypic.

Examples of unpartitioned folk generics are seen in Figure 11 (cf. Dennler 1939:225-233).

There are, as well, generics which include folk specific taxa and these may be illustrated by the following examples in Figure 12.

Some examples are suggestive of type specific-folk generic polysemy as seen in other systems, and are illustrated in Figure 13.

Dennler, a physician and natural scientist, was rightly impressed with the Guaraní system and closed his article as follows: Guaraní names "represent a well conceived system which bears a certain similarity to our Linnaean system of nomenclature. These Indians did not leave the selection of a name to chance but came together from time to time in order to decide which terms best corresponded to the characteristics of a species, and, in large part, classified them into groups and sub-groups in a logical and adequate fashion" (1939:244).

Leaving aside Dennler's questionable accuracy in reporting an ethno-zoological congress on native nomenclature (certainly the first of its kind, if true), it is clear that the Guaraní system corresponds closely to

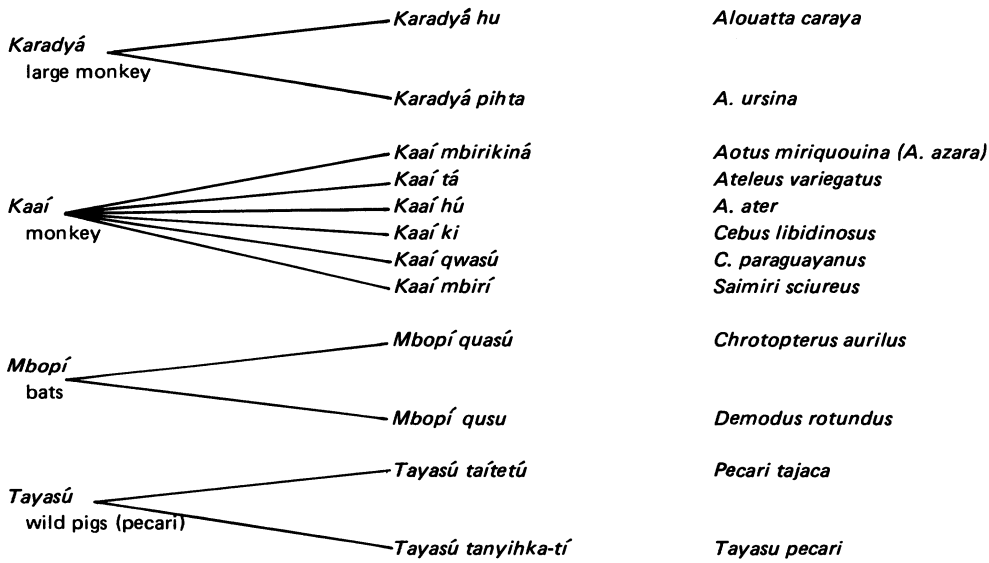


Figure 12. Examples of polytypic mammal names in Guaraní.

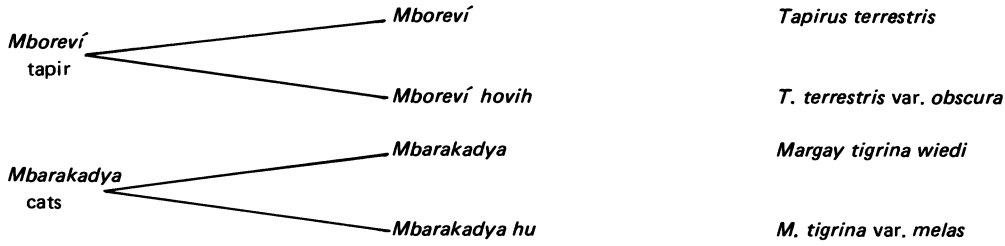


Figure 13. Guaraní mammal terms exhibiting polysemy of generic and type-specific.

the principles that we have suggested are generally operative in the linguistic designation of the biological world in folk biosystematics.

Our data on Guaraní plant classification is equally sketchy but suggestive. In a short paper on Guaraní agriculture, Martínez-Crovetto (1966:634-635) provides a list of cultivated plants found in common use among this people. All of the generic names which are divided into smaller classes are identical in that binomial nomenclature is applicable for all forms.

For corn, (*Zea mays*), one finds the following classes, all of which we would classify as specific taxa (Figure 14). Finally, binomial nomenclature is also found for the cultivated beans, manioc, potatoes, melons, peanuts, sugar cane, and cotton.

Classical Nahuatl Ethnobotany

The system of botanical and zoological nomenclature reported for classical Nahuatl as spoken by the Aztecs of the Central Mexican Plateau also corresponds closely to the general features of ethnobiological terminology seen in other languages. The basic structure of Nahuatl plant and animal names may be inferred from a cursory reading of *Book 11, Earthly Things*, Dibble and Anderson's important translation of Sahagun's Florentine Codex (Dibble and Anderson 1963).

The most explicit statement on nomenclatural principles, however, is found in Paso y Troncoso's early and sensitive treatment of Nahuatl ethnobotany (Paso y Troncoso 1886). This work, perhaps one of the most

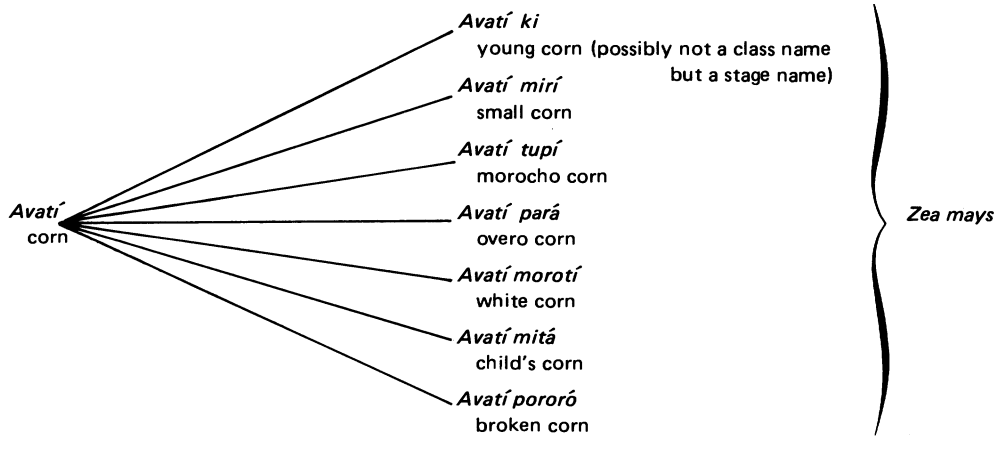


Figure 14. Guaraní corn names exhibiting regular binominal structure.

detailed and objective reports of its kind for the time of writing, indicates explicitly that the Nahuatl system had life form names, such as *tree*, *vine*, *grass*, in which the majority of plant taxa were included. Generic and specific taxa are the most numerous and specific names are primarily binomial expressions. The structure of Nahuatl specific names is shown to be logically identical to what we have seen for other languages, whereby the last term in a binomial expression

> represents the generic name, while the preceding term or terms can be considered as equivalent to the specific name . . . [Thus], the qualifiers, commonly, are attached before the substantive, as in English, with the difference that in this latter language each term of the binary nomenclature constitutes a separate word, while in the Mexican language, the terms remain joined, almost always, in a single word [1886:217].

Paso y Troncoso goes on to point out that most generic names are unanalyzable, many having no obvious etymology and as such are best treated in our terms as primary lexemes. On the other hand, the semantic features marked by the attributives used to form specific names are generally obvious, referring to such characters as "the place where the plant grows, at other times indicating some particular property of the plant, referring to its form, coloration, make-up, orientation, or any other characteristic vegetative properties that might apply . . ." (*Ibid.*:218).

Aztec botanical nomenclature is also comparable to Hanunóo, Navajo, Tzeltal, and the other languages we have observed in that the most common specific class of a particular generic taxon is labelled by a polysemous form of the generic name. Thus, one notes that the Nahuatl classification of sedges, *tollin*, included a "type-species that carried simply the name *Tollin* and that [also] referred to the sedge family: various other related species have been grouped together under the same name, each with a different determination" (*Idem*).

The author then proceeds to cite the following specific classes of *tollin*; as seen in Figure 15.

Clearly, *tollin* may be considered here as a generic name, its various included specific taxa being indicated according to the binomial principles we have outlined above.

THE PSYCHOLOGICAL SIGNIFICANCE OF TAXONOMIC ETHNOBIOLOGICAL CATEGORIES

Our description of the principles underlying taxonomy and nomenclature in folk biological science has placed considerable weight on the fundamental nature of taxonomic ethnobiological categories. This position is somewhat at variance with that taken by Kay (1971) in his important paper on the nature of taxonomy and semantic contrast. In Kay's view, the notion of absolute category membership is an irrelevant consideration in the description of taxonomic structure. A brief review of some of the major points of Kay's paper as related to the exposition here will be of value.

Kay defines five types of semantic contrast relations which are recognizable in any taxonomic structure. They are named and defined as follows:

> (1) inclusion contrast exists for any two taxa if one strictly includes the other (*tree* and *oak* are in inclusion contrast);
>
> (2) direct contrast exists between any two taxa which are immediately included in the same taxon (*oak* and *maple* are in direct contrast, in that they are immediately included in *tree*);
>
> (3) indirect contrast exists between any two taxa which are neither in direct contrast nor inclusion contrast via the two taxa which include them and which are themselves in direct contrast (*post oak* and *sugar maple* are in indirect contrast via *oak* and *maple*);
>
> (4) generic contrast occurs between any two generic taxa;

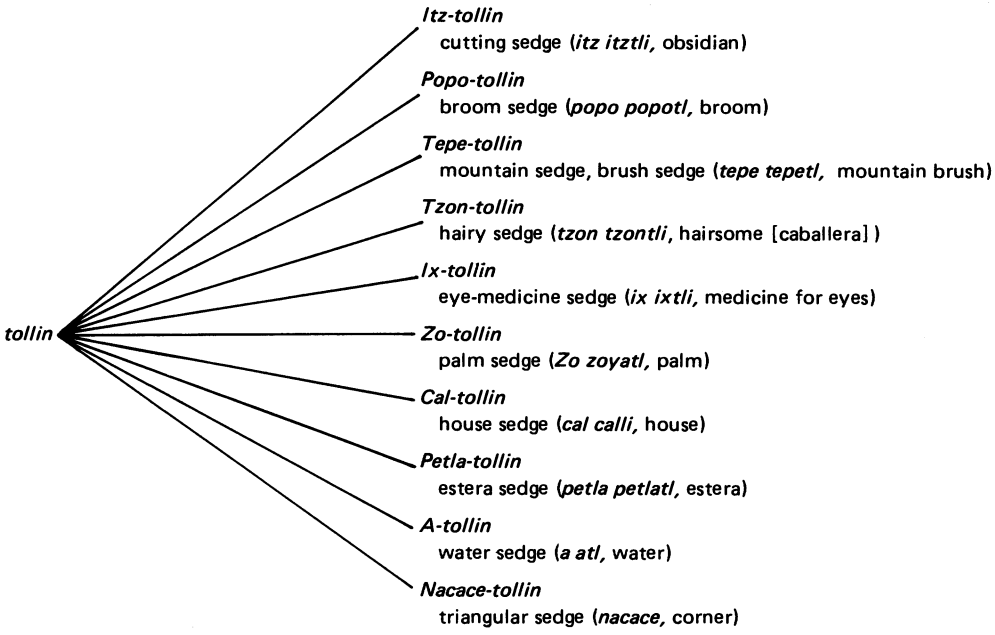


Figure 15. Classical Aztec terminology for sedges.

(5) terminal contrast occurs between any two taxa neither of which include additional taxa.

The first three types of semantic contrast are defined solely in terms of the kinds of formal taxonomic positions held by any two particular taxa as indicated by the logical relation of class inclusion. Terminal contrast may be said to be a special case in that the taxonomic relation of inclusion is *negatively* applied, i.e., taxa are said to be in terminal contrast if they *do not* include additional taxa. Only one of the five types of semantic contrast discussed by Kay is based on absolute category membership, namely, generic contrast, and this is defined as "that special relation of contrast which holds between any two generic taxa" (Kay 1971:878).

We are of the opinion that the varying types of contrast relations are not all of equal psychological significance. Furthermore, contrast defined by category membership may be as important, if not more so, than formal taxonomic contrast. Finally, there may be justification for positing additional types of semantic contrast based on absolute category membership.

Eugene Hunn (n.d.) in a study of the identification of gulls by American bird watchers, has recently shown that members of taxa in generic contrast are identified in a psychologically unique fashion, one that is essentially based on instantaneous recognition of the organisms in question. On the other hand, tokens of organisms which are conceptually classified as members of the ethnobiological category we have labelled "specific" are identified by a more formal processing routine that requires rather conscious psychological assessments of contrasting semantic features (cf. also Bulmer and Tyler 1968:353).

Hunn's research has provided evidence that the psychological processes used in making generic identifications differ from those used in making specific identifications. With further study it seems likely that one will be able to show psychological evidence for the significance of life form contrast as well. Terminal contrast, however, may have

little or no psychological significance in that the fact that two taxa are terminal is probably never a contrastive feature of relevance in any natural situation.

Empirically, it is most often the case in folk taxonomies that taxa of the same contrast set, i.e., taxa in direct contrast, are also members of the same ethnobiological category. There are several examples where this is not the case, however, and when this occurs, the mere fact of formal contrast set membership apparently becomes irrelevant.

The most common, and to our knowledge the only empirically documented examples of taxa of differing taxonomic categories occurring as members of the same contrast set is at level one in naturally occurring folk taxonomies. It will be recalled that level one comprises taxa which are immediately included in the unique beginner. Kay notes that "level one is unique in that all taxa at this level do constitute a single contrast set" (1971:877). Anderson's data on Cantonese ethnoichthyology provides an example of this psychologically aberrant situation. In Cantonese ethnoichthyology, there are six major classes of life form taxa which include the majority of all named marine organisms. However, there are a number of names for small groupings of marine animals which are *not* included in any of the life form taxa. These classes, of which horseshoe crab, starfish, jelly fish, and others are examples, "form independent, single member sets" (Anderson 1967:18). As such, they are comparable to the unaffiliated generic taxa such as bamboo, cactus, fern, etc., found at level one in Tzeltal botanical taxonomy.

Anderson says that formally such expressions "might be regarded as one the first level in regard to terminological distinctions" (*Idem*) contrasting with the life form terms for fish, decapod crustaceans, etc. However, he argues that the small, independent taxa are best treated as second-level taxa and are labelled, in our terminology, by generic terms. Not only is there nomenclatural evidence in Chinese to suggest that they are generic, but like most generic names, they "refer to small, compact groups of organisms" (*Ibid.*:18). Anderson's solution, while not formally correct, is of interest as concerns the psychological reality of ethnobiological categories:

> For these reasons they [i.e., the aberrant taxa] seem to contrast with second-level rather than first-level terms. In these cases it is possible that a series of first-level terms exists such that these items are included within them; but no such terms were elicited. These small, independent, named taxa form a tiny but interesting minority of those found . . . They may be roughly compared to the zoologist's taxa *incertae sedis*—fragmentary fossil species and genera of unknown allocation within higher-level taxa [*Ibid.*:18].

What Anderson has described is precisely the situation where one finds taxa of *different ethnobiological categories as members of the same contrast set*. When such is the case, it appears to Anderson (and presumably to his Hong Kong Boat People) that contrast set membership is overridden and the relevant psychological contrast becomes that which is found to hold between members of an identical ethnobiological category, in this case, the generic category.

Another ethnobiological description of a primitive New Guinea society provides evidence for the same kind of ambiguity that may arise when contrast set members are not all of equal conceptual (i.e., categorical) rank. Glick, in a short paper dealing with Gimi natural science, makes the following observations:

> There are more than twenty [taxonomically defined first level] botanical categories, ranging in size from *da* 'tree', with at least two hundred members, through *koi* 'ginger', with four, and on down to several problematical sets containing only two or three members apiece. At the lower end it becomes difficult to decide whether one is justified in calling a pair or trio of closely related plants a category: does this have the same taxonomic rank as say, *da* in Gimi thought? My answer is, probably not . . ." [Glick 1964:274].

While Glick makes no effort to describe "ethnobotanical taxonomic categories" it

appears clear that *da* 'tree' would be analyzed in our terms as a life form taxon and that *koi* 'ginger' and other few membered sets like it are best considered generic taxa. Some of these generic taxa clearly occur in the same contrast set with life form taxa, hence the dilemma suggested in Glick's question: do they "have the same taxonomic rank as, say, *da* in Gimi thought"?

Our conclusion is that formal, taxonomically defined semantic contrast—either inclusion, direct, or indirect—has no psychological significance *without knowledge as well of the ethnobiological category membership of the taxa involved.* Taxa of any category may be in taxonomic contrast—provided the formal conditions are met—but the psychological processes involved in distinguishing *oak* and *maple* or *catfish* and *perch* are quite distinct from those involved in distinguishing *red rose* and *white rose* or *large mouth bass* and *small mouth bass.* To reject "the notion of absolute category" (Kay 1971:885) in the analysis of taxonomic structures is logically convenient but should be re-evaluated if our descriptions are to have more than formal interest.

CONCLUSIONS

In this article, we have brought together certain data bearing on the nature of ethnobiological classification and nomenclature. Some of our more general findings may be stated as follows:

(1) 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. A category called "intermediate" is suggested but further data will be required to establish it firmly. Generally, the category exhibiting the largest number of taxa is the generic. Generic taxa mark the most salient conceptual groupings of organisms in any folk taxonomy and represent the fundamental units in ethnobiological classification.

(2) The five ethnobiological categories are arranged hierarchically and taxa assigned to each rank are mutually exclusive. Taxa of the same ethnobiological category characteristically, though not invariably, occur at the same level in any folk taxonomic structure.

(3) The naming of taxa which occur as members of the ethnobiological categories can be reduced to a small number of nomenclatural principles which are essentially identical in all languages. Life form and generic taxa tend to be labelled by primary lexemes; specific and varietal taxa tend to be labelled by secondary lexemes. The unique beginner is rarely named, but if so, its label will be a primary lexeme. While recognizing that nomenclature and category membership must be analyzed separately, there seems to be strong evidence that the linguistic structure of a plant or animal name is usually a good mirror of the taxonomic status of the category which it represents.[10]

NOTES

[1] For a discussion of the concepts "taxonomic structure," "taxonomic level," etc., the reader is referred to the definitive paper by Paul Kay (1971).

[2] A contrast set has been defined by Kay (1971) as any set of taxa all of whose members are immediately included in an identical superordinate taxon. Thus, *pinto bean, lima bean, string bean, kidney bean,* are members of a contrast set in that each member of the set is immediately included in the taxon *bean.*

[3] Kay's comments on an earlier draft of this paper relating to a concise definition of productive primary lexemes and secondary lexemes have been of major importance in the present formulation.

[4] The above classification of lexemic types found in ethnobiological nomenclature derives in large part from Harold Conklin's important paper on the nature of folk taxonomies (Conklin 1962). Conklin suggests the recognition of two basic lexemic types, unitary and composite. One of the defining features of composite lexemes is that they include constituents which designate "categories superordinate to those designated by the forms in question" (1962:122). As such,

both *tulip-tree* and *jack oak* are composite expressions in that both, as we have seen, satisfy this condition. We find it theoretically advantageous and empirically justified to recognize that *tulip-tree* and *jack oak* are only superficially similar linguistically and that they may be readily distinguished, as we have shown, as primary productive and secondary lexemes respectively.

[5] A terminal taxon is one which includes no other taxa.

[6] This condition excludes the taxon which occurs as the unique beginner, also marked by a primary lexeme (if labelled), and which includes all taxa in the set being classified.

[7] The attributive *pĭntu* < Spanish *pinto* 'spotted'. The specific class referred to, however, is an ancient variety of corn. *pĭntu* most likely replaced a Tzeltal attributive for this class.

[8] *kašlan* < sixteenth century Spanish */kaštilyáno/*. It is interesting to note that the Mayan Chuj name for rice is *kašlan ʔišim* (Breedlove and Hopkins 1970).

[9] Numerals refer to Cantonese Chinese tones.

[10] Some of the notions presented in the present paper were developed in an earlier draft titled "Evidence for the Concept of Genus in Folk Science" and a summary was presented orally in a paper titled "Universal Nomenclatural Principles of Folk Science" at the 68th Annual Meeting of the American Anthropological Association in New Orleans, 1970. The criticisms and suggestions of numerous colleagues have helped bring the paper to its present form. We wish to thank Paul Kay, Paul Friedrich, William Geoghegan, Harold C. Conklin, Brian Stross, and Oswald Werner for especially detailed comments on these early drafts. In addition, we have benefitted from the advice of Barry Alpher, Eugene Anderson, Robert Austerlitz, Donald Bahr, Keith Basso, Katherine Branstetter, Jan Brukman, Ralph H. Bulmer, Robbins Burling, Wallace Chafe, Lincoln Constance, Roy G. D'Andrade, Christopher Day, Robert M. W. Dixon, Catherine S. Fowler, Charles O. Frake, Terrence Hays, Richard Holm, Nicholas A. Hopkins, Eugene Hunn, Dell Hymes, Robert M. Laughlin, Yakov Malkiel, Robert McC. Adams, Duane Metzger, David Price, Robert Randall, David M. Schneider, and Michael Wilson. Financial support of the research on which the paper builds has been generously provided by the National Science Foundation through grants GS 383, 1183, 2280 and GB 7949X, the Center for Advanced Study in the Behavioral Sciences, and the Language-Behavior Research Laboratory, University of California, Berkeley. For a general statement concerning the possible implications of the findings presented here for modern western biosystematics, see Raven, Berlin, and Breedlove (1971).

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