Journal of Ethnobiology

VOLUME 8, NUMBER 1

SUMMER 1988

Journal and Society Organization

Journal of Ethnobiology is published semi-annually. Manuscripts for publication, information for the "News and Comments" and book review sections should be sent to the appropriate editor on the inside back cover of this issue.

ISSN 0278-0771

Journal of Ethnobiology

VOLUME 8, NUMBER 1

SUMMER 1988

In the opera "Turandot," with music composed by Puccini, the hero, a prince from a far off land, is presented with three riddles. If he failed to answer any of them correctly, he lost his life. Three correct answers won him the hand of Princess Turandot. Just for fun I present three riddles below. There's no risk and, alas, no reward.

What had two and a half days of serious, scholarly contributed oral and poster presentations in English and Spanish with simultaneous translations and seven days of friendly rapport, informal learning, and exchange of ideas?

What had two days of seemingly endless sitting and listening followed by a memorable day of browsing through informative poster sessions and an amazingly diverse book fair, of festive dining and spirited conversation in a garden setting, and of much appreciated entertainment provided by an exhilarating performance of the Ballet Folklorico?

What was capped with one to four days of fascinating field trips, much enjoyed by those lucky enough to participate, transforming what was already an unqualified success into a triumph?

Give up? Turn the book upside down to read the answer at the bottom of the page.

W.V.

The answer to all three riddles is the same: The 11th Annual Ethnobiology Conference which convened in Mexico City in early March, 1988. Congratulations to all those who worked so long and so diligently to make the conference a "smashing success." And thanks so much!

THE PRESIDENT'S PAGE

In July 1988 some of us in the Society of Ethnobiology were fortunate to attend the First International Congress of Ethnobiology. The tropical setting in the beautiful and modern city of Belém, Pará, near the mouth of the Amazon, was idyllic. (The Brazilian people must be among the most congenial in the world.) The local committee was utterly gracious. The social events they arranged night after night were stunning. Dr. Darrell A. Posey, organizer of the congress, seemed indefatigable. Approximately 400 attendees representing almost all continents participated. In addition to the New World countries, which were well represented, there were ethnobiologists from several European and African countries, New Zealand, and a delegation from mainland China. Some native peoples were represented by their own professionals. Scheduled participants from India were unable to attend, and various others who had hoped to attend were unable to make arrangements because of the rather short notice of the congress. There were concurrent sessions and as I look through the program, I'm disappointed that I had to miss some informative and provocative papers. The applications of ethnobiology were stressed throughout. One three-day workshop, for instance, focused on "Native Peoples and their Struggle to Preserve their Natural Resources." Indigenous people from Portuguese-, Spanish-, and English-speaking countries participated in this workshop, along with other scientists.

Congress participants automatically became founding members of a new international society, their dues being included in the registration fee. Our existing society was often referred to as the "North American Ethnobiology Society." One South American worker criticized our society as being myopic. There are, perhaps, some good reasons for this bias. Our membership and conference participation is drawn largely from Canada, Mexico, and the United States. We have not been very aggressive in our solicitation of members worldwide. (Many working ethnobiologists outside North America, I learned, had never even heard of our society or its journal!) The Brazilian congress demonstrated what a *truly* international meeting should be like. We are only slowly coming to a realization that we should consider languages in addition to English in our journal, at the very least for abstracts of papers dealing with Latin America. Our course thus far has been rather provincial.

But there is another side of the coin. Our by-laws of incorporation give no geographic limitations to the society. We have drawn membership, although not energetically, from various countries outside North America. The *Journal of Ethnobiology* has published authors from Australia, Germany, the Philippines, England, Brazil, Italy, and New Zealand, in addition to a significant number of papers by Mexican workers and North Americans working in other countries.

The Society of Ethnobiology evolved from a nucleus of researchers focused on southwestern North America but soon overcame this regional bias by scattering its conferences geographically, making it easier for people in other parts of the continent to attend. The 1988 Mexico City conference, with its simultaneous translations, proved a marvelous exchange of ideas. I want to thank the organizers and the local committee for a splendid production.

Although it is difficult to second-guess these things, I suspect that the newly founded society and the existing society will evolve somewhat differently. The Society of Ethnobiology has tended to be scholarly, with journal publication as major goal. And this is exactly what our by-laws state: "The objectives of this organization shall be to establish and maintain an organization of scientists of high standing with a common interest in ethnobiology, to promote the discussion and communication of knowledge devoted to the interdisciplinary study of anthropology and biology, and to stimulate and disseminate research advances concerning ethnobiology by sponsoring scientific and professional publications." The new society seems to be more political. One of the primary outcomes of the Brazilian congress was the hammering out of the "Declaration of Belém," a position statement calling world attention to, among other things, the drastic loss of native and peasant *knowledge* of the biota as well as the concomitant loss of critical habitats themselves. (This disastrous erosion of human knowledge is most evident among rain-forest people globally, but extends to those living in other fragile ecosystems as well.) Pivotal to this declaration is the premise "that there is an inextricable link between cultural and biological diversity." The congress was covered by newspaper and television people from several countries. The media had ample opportunity to digest and take home with them the messages in the Declaration.

Also, the new society will probably continue to draw on a broader constituency than does the existing society. It has no plans to initiate a journal but it planning to publish selected proceedings in some already existing journal, particularly one not timorous about multilingual contributions.

The new society originating from the Brazilian congress has called itself the International Society of Ethnobiology. I have formally suggested to Dr. Brent Berlin, interim president of the new group, that a different title would be less confusing since the existing Society of Ethnobiology is already international in both membership and scope of publication. Our society is already incorporated and its name copyrighted. Brent, who agrees, will convey this concern to the by-laws and nominating committee of the new society. Meanwhile, if you are interested in learning how to join this association, write the treasurer, Miguel Angel Martinez-Alfaro, Director, Jardín Botânico, UNAM, Apto. Post. 70-614, México 04510, México.

The next international congress, to be chaired by Dr. Pei Sheng-ji, will be held at the Institute of Botany, Kumning Botanical Garden, China. Professor Pei should have more details available by the time of our March ethnobiology conference in Riverside, California.

There will inevitably be overlap in societies concerned with ethnobiological research—it is such a rich field. Already there is the Grupo Etnobotanico Latinoamericano (GELO). It has just published the *Directorio Latinoamericano de Etnobotanicos* (1988). (For more information, contact Javier Caballero, Department of Anthropology, University of California, Berkeley, CA 94720). As president of the Society of Ethnobiology, I welcome GELA and the new association (whatever it may eventually be called) just organized in Brazil. They have much to teach us about our own provincialism. I would hope that these various ethnobiological groups might occasionally consider a joint meeting. And perhaps a special multilingual issue of the *Journal of Ethnobiology* might result from such a gathering.

Amadeo M. Rea
San Diego Natural History Museum

DECLARATION OF BELEM

Leading anthropologists, biologists, chemists, sociologists, and representatives of several indigenous populations met in Belem, Brazil to discuss common concerns at the First International Congress of Ethnobiology and to found the International Society of Ethnobiology. Major concerns outlined by conference contributors were the study of the ways that indigenous and peasant populations uniquely perceive, utilize, and manage their natural resources and the development of programs that will guarantee the preservation of vital biological and cultural diversity. This declaration was articulated.

As ethnobiologists, we are alarmed that:

SINCE

—tropical forests and other fragile ecosystems are disappearing,

—many species, both plant and animal, are threatened with extinction,

—indigenous cultures around the world are being disrupted and destroyed;

and GIVEN

—that economic, agricultural, and health conditions of people are dependent on these resources

—that native peoples have been stewards of 99% of the world's genetic resources, and,

—that there is an inextricable link between cultural and biological diversity;

We, members of the International Society of Ethnobiology, strongly urge action as follows:

1) henceforth, a substantial proportion of development aid be devoted to efforts aimed at ethnobiological inventory, conservation, and management programs;

2) mechanisms be established by which indigenous specialists are recognized as proper authorities and are consulted in all programs affecting them, their resources, and their environments;

3) all other inalienable human rights be recognized and guaranteed, including cultural and linguistic identity;

4) procedures be developed to compensate native peoples for the utilization of their knowledge and their biological resources;

5) educational programs be implemented to alert the global community to the value of ethnobiological knowledge for human well-being;

6) all medical programs include the recognition of and respect for traditional healers and the incorporation of traditional health practices that enhance the health status of these populations;

7) ethnobiologists make available the results of their research to the native peoples with whom they have worked, especially including dissemination in the native language;

8) exchange of information be promoted among indigenous and peasant peoples regarding conservation, management, and sustained utilization of resources.

Editor's Note—Please see The President's Page, this issue, for a brief discussion of the Declaration of Belem. Several of us from the Society of Ethnobiology were on the Committee which produced this document.

A CASE FOR TARO PRECEDING *KUMARA* AS THE DOMINANT DOMESTICATE IN ANCIENT NEW ZEALAND

EDWIN N. FERDON, JR.
Ethnologist Emeritus
Arizona State Museum
2141 E. Juanita St.
Tucson, Arizona 85719

ABSTRACT.—The assumed function of pre-Columbian earthen pits in New Zealand as over-wintering storage facilities for sweet potatoes concomitantly infers a pre-Columbian introduction of that American Indian crop. This, in turn, has led to the further assumption that *Ipomoea batatas* (L.) Lam., known locally as ***kumara,*** was the dominant prehistoric domesticate on North Island. In contradistinction to these concepts, a case is presented suggesting that the common Polynesian root crop, taro *(Colocasia esculenta* (L.) Schott.), may have been more adaptable to northern New Zealand climate than has been assumed, and was equally capable of having its seed corms over-wintered in storage pits. Thus, it may have been the dominant pre-Columbian domesticate of northern New Zealand, with the more productive sweet potato having arrived in post-Columbian times and been readily adapted to northern New Zealand environment by applying the field and storage techniques already developed by the Maori for taro.

Ever since Roland Dixon (1932) presented his historically based argument for the sweet potato having been introduced into Polynesia in pre-Columbian times, his view has been generally accepted by most Polynesianists. In fact, to such an extent has this occurred that it has led to the creation of several dubious cultural interpretations of Polynesians' prehistoric past. These have been based not only on Dixon's questionable assessment of the historic records, but upon assumptions which, perhaps because they fit his hypothesis, remain unchallenged. One of these is the archaeological interpretation of the presence of ancient Maori storage pits as being indicators of an early pre-Columbian presence of *Ipomoea batatas* (L.) Lam. in New Zealand. This, in turn, suggests a still earlier introduction of that tuber into central Polynesia, if one accepts Yen's assumption that there was a single, prehistoric transfer from South America which was first implanted in that area of Polynesia (Yen 1974:259-260).

The archaeological interpretation of the function of early Maori storage pits has been based upon a seemingly logical, but not necessarily correct, series of assumptions. The clearest of these has been best stated by Janet Davidson who wrote: "Of all the tropical crops available to migrating Polynesians, the ***kumara*** has adapted best in New Zealand conditions; it is reasonable to assume that the earliest settlers, like their descendants, concentrated their attention on the most successful of their cultigens (Davidson 1979:234)."

No one could argue with Davidson regarding the adaptive qualities of the sweet potato, nor her logical reasoning that the earliest settlers would probably have concentrated on their most successful cultigens. What is questionable, however, is the assumption that the sweet potato was one of the crops of the earliest settlers in New Zealand.

This idea seems to have been given its strongest support by yet another assumption based upon an attempt to interpret the function of a special type of prehistoric structure, thought to have been for storage, by applying historic ethnographic analogy. This was the rectangular, roofed, semi-pit structure whose function as a sweet potato storage facility was originally suggested by Jack Golson in 1959. These had been excavated by him at an Archaic site at Sarah's Gully. Since it was known that historic Maori had stored sweet potatoes in pits to serve as seed stock for the following spring planting, Golson applied ethnographic analogy to suggest a similar function for the Sarah's Gully structures. Since the radiocarbon dates for the site fell within the fourteenth century, by inference sweet potatoes had to have been in cultivation during that period of time (Golson 1959:45). This initial interpretation became sufficiently accepted that by 1970 R. G. Law found no reason to hesitate in stating in a footnote that "The vast majority of pits excavated in New Zealand can have served no other function but ***kumara*** storage (Law 1970:114, ft. nt. 2)." However, in his final remarks he confessed that while evidence pointed to agriculture being early in New Zealand, the presence of the sweet potato at that time could only be inferred (Law 1970:125).

Yet another argument for an early pre-Columbian introduction of the sweet potato has to do with what is seen as the need for an extended length of time for it to have adapted to New Zealand's cooler climates (O'Brian 1972:349; Yen 1974:307). While varieties of *I. batatas* must vary in their adaptive capabilities, the time factor need not have been overly excessive. At least we know that those that were introduced into the eastern seaboard of the United States, almost certainly from the Caribbean islands, appear not to have required a particularly long time to adapt to those cooler climates. Consider, for example, that the first English settlement in that region was Jamestown, Virginia, founded in 1607, and that by 1642 sweet potatoes were reported as one of the crops growing in Virginia. Thus, no more than 35 years was needed for the sweet potato to adapt to the climatic conditions of the seaboard between the latitudes of 37 and 38 degrees North. By 1764, 122 years later, the tuber was reported as being in general use in New England, which would place the sweet potato about 40°N. (Hedrick 1972:315). A time span of no more than 157 years, and probably less, was required for adaptation to those more extreme temperate environments.

While this is no attempt to equate precisely the environmental factors of the eastern seaboard with those of North Island, New Zealand, the historically recorded adaptive time element in the former region strongly suggests that no overly great amount of time need be envisaged for the adaptation of the sweet potato to at least the northern portion of the latter region. Therefore, the argument that its adaptation is an indication of its early pre-Columbian introduction into New Zealand would appear to be doubtful at best.

Since there is no solid evidence that the sweet potato was a pre-Columbian crop in New Zealand, there remains the possibility of its having been an early post-Columbian introduction. It would thus seem equally plausible to assume that the store of crops brought by the earliest agricultural settlers were only those of southeast Asian origin. Of these, historical records would seem to show that taro, *Colocasia esculenta* (L.) Schott, has proven to have adaptive qualities that have allowed it to grow in the warmer areas of the subtropics both to the north and south of the equator. For example, in Europe it was reported at an early date to be growing in Portugal and southern Italy, which would place it in the latitude of 40°N. (Candolle 1967:74). It was also noted as being cultivated in Japan (Hedrick 1972:186), where it was probably limited to that country's subtropical zone. This latter extends north on the east coast of Honshu to about 36°N. and on its west coast to only about 34°30'N. (Spencer 1954:403, Fig. 136).

South of the equator, in New Zealand, there appears to have been a belief that taro was limited to the more northern areas of North Island (Groube 1967:21-22). However, although Cook recorded sweet potatoes and yams *(Dioscorea* spp.) growing around Tolaga

Bay on the east coast of North Island at about 38°30'S. (Cook 1955, 1:186-87), his naturalist, Sydney Parkinson, identified the latter crop not as yams but as taro (Parkinson 1784:96-98). That this was correct is supported by both Parkinson and the other expedition naturalist, Joseph Banks, who reported no yams until the Bay of Islands was reached at about 34°30'S. In addition, the latter noted "cocos," the early vernacular name for taro, growing at Anauru Bay, just north of Tolaga Bay (Banks 1963, 1:417). That some unidentified varieties of taro have been known to grow somewhat farther south than 40°S. is indicated by R. Garry Law who cited E. Dieffenbach as referring to taro being grown in Queen Charlotte Sound (Law 1969:26). While this may have represented a historically introduced variety, at least it illustrated the adaptive capabilities of the plant. Regardless, on the basis of Parkinson and Banks, it would appear that taro was not always limited to the northernmost portion of North Island, and thus could have been a far more important prehistoric food crop than has been assumed. Accepting this as a possibility, it is worth returning to the subject of the pre-Columbian storage structures.

So well established has been the assumption of an early cultivation and storage of sweet potatoes that nobody in recent years seems to have seriously investigated the possibility that such facilities might have originally been used for taro. Yet, not only did Elsdon Best mention the use of storage pits for the taro cormlets used for seed stock (Best 1976:238, 243), but some of Douglas Yen's Maori informants on the east coast of North Island confirmed that such a practice had been common until quite recently. Furthermore, Yen noted that there were varieties of taro still being grown by the Maori in Northland and along the east coast that were capable of over-wintering in the ground in favorable locations (Yen 1961:345).

Though there was knowledge of the former storage of taro corms in pits, it appears not to have been applied as a plausible alternative to the presumed sweet potato storage function of at least the Archaic pits. Such an alternative would do away with the need to assume a warmer climate having had to exist in order for the sweet potato to have initially survived early introduction using only traditional tropical agricultural techniques which did not require storage, as envisaged by Yen (Yen 1974:29, 298-301). In other words, had the earliest agricultural settlers arrived on North Island *without* the sweet potato, but with an adaptive variety of taro, such as was still growing in Northland in 1961, climatic deterioration need not have had to be a consideration. The initial agricultural requirements of what surely was a small founding population could have been served by those initial corms and their offspring that had been planted in the more favorable locations, not to mention the gourd and the less adaptive yam that may have come with them. As the population increased, and the need to grow additional taro beyond the limited favorable locations became necessary, the time factor involved in such population growth would have been sufficient for the innovative experimentation in developing a technique of over-wintering the seed taro in prepared storage pits. Having once developed this technique, such knowledge, perhaps accompanied by minor variations, would have been available when the sweet potato finally did make its appearance in New Zealand at a later date.

That taro can be stored in subtropical regions has been proven in the United States in at least one area. Experiments by the U.S. Department of Agriculture in growing taro for commercial purposes in the humid subtropical southern states, found that extended storage for such a crop was quite feasible. It was determined that both the corms and cormlets, especially the latter, could be stored in ventilated, dry basements for a number of months, the cormlets up to six months, without sprouting. However, the temperature had to be maintained at around 50°F. (10°C.). Lower temperatures, especially those approaching freezing, killed the buds. The foremost requirement before undertaking such storage was the need to cure the corms and cormlets under conditions of free ventilation for several days at the time of harvest (Young 1924:17). That such open air curing before storage may have been practiced by the Maori was suggested by a statement by Best. He reported that in many cases harvested taro was not stored in food storage pits but stacked outdoors in conical heaps and covered with rushes or sedge grass (Best 1976:238). While this was interpreted by him as an optional storage technique, its real purpose may have been to cure the seed stock before final storage. Thus, considering the need for ventilation, dryness, and freedom from frost, the New Zealand rectangular, roofed, semi-pit structures, especially those with presumed drainage channels, may well have originally been made to accommodate the more limited storage time requirements for over-wintering taro, rather than sweet potato.

Adding to this scenario that taro may have been the important early crop is the matter of its soil requirements. While wetland taro is best served by alluvial soils in valley floors, dryland taro, although adaptable to a variety of soils, is reported to give best results when planted in well drained, friable soils (de la Pena 1983:167). This latter condition corresponds quite well with what has been assumed to represent prehistoric sweet potato soils in New Zealand, especially those in which sand or gravel has been added (Law 1970:117; Bellwood 1979:382). Indeed, Best (1976:236) referred to Colenso's observation of taro fields covered with white sand, as well as judge J. A. Nilson's account of sand or gravel being placed in a layer over the soil (Best 1976:241). He also referred to yet another source in which it was claimed that in planting taro in a hole, the cormlets were surrounded with gravel (Best 1976:236). In other words, the very soil additives that have been used as indicators of former plantings of sweet potatoes, apply equally well in assuming the former presence of taro. That both may be correct is a possibility in that, with the introduction of the more productive sweet potato, fields formerly used for planting taro were turned over to the production of sweet potatoes.

Based upon the above considerations, it would seem that Groube was indeed correct when, in 1967, he warned that the place of taro as a possible significant agricultural food had not been sufficiently considered in archaeological interpretation in New Zealand, and that the importance of the sweet potato was only based upon ethnographic analogy (Groube 1967:21-22). Nonetheless, there cannot be much doubt that when the more productive and adaptive sweet potato did arrive, it soon became the more significant of the two crops. Again, it is a question of when it arrived in New Zealand, and there are as yet no firm indications in the New Zealand archaeological record of when that might have taken place. It could have been a post-Columbian introduction from a source much closer to New Zealand than the often presumed Society Islands region. Gonzalez de Leza, chief pilot of Quiros' 1605-6 colonizing expedition from Peru, specifically stated that they had planted potatoes on Espiritu Santo in the New Hebrides (Markham 1967:387). Although Dixon (1932:43) chose to accept this as a reference to the common potato, *Solanum tuberosum* L., such seems highly unlikely since *S. tuberosum* is a temperate crop of which varieties have only recently been successfully introduced into some of the tropical islands of the Pacific (Barrau 1958:58, 87; 1961:61). It thus appears more probable, given Quiros' expedition having been victualled on the coast of Peru where *I. batatas* thrived, that de Leza's potatoes were sweet potatoes. Such could have diffused southward to New Caledonia and, as with Yen and Wheeler's 42-chromosone form of taro (1968:264), been transferred by an intentional or accidental human voyage southward to New Zealand. As previously noted, its adaptation to at least the northern portion of North Island need not have taken as long as has been conjectured, and with a pit storage technique for taro already in place, it would have been but a matter of applying this proven procedure to the more productive sweet potato to allow its further spread.

LITERATURE CITED

BANKS, JOSEPH. 1963. The Endeavour Journal of Joseph Banks. Angus and Robertson, Sydney. (J. C. Beaglehole, ed.), 2 vols.

BARRAU, JACQUES. 1958. Subsistence agriculture in Melanesia. B. P. Bishop Mus. Bull. 219:1-111.

__________. 1961. Subsistence agriculture in Polynesia and Micronesia. B. P. Bishop Mus. Bull. 223:1-94.

BELLWOOD, PETER. 1979. Man's conquest of the Pacific. Oxford University Press, New York.

BEST, ELSDON. 1976. Maori agriculture. Dominion Mus. Bull. 9:1-315. Reprint of 1925 edition with textual alterations.

CANDOLLE, ALPHONSE DE. 1967. Origin of cultivated plants. Hafner Publishing Co., New York. Third printing of reprint of 2nd edition of 1886.

COOK, JAMES. 1955-67. The Journals of Captain James Cook. Hakluyt Society, Extra Series, Nos. 34, 35, 36. (J. C. Beaglehole, ed.), 3 vols.

DAVIDSON, JANET M. 1979. New Zealand. Pp. 222-248 *in* Jesse D. Jennings (ed.). The prehistory of Polynesia. Harvard Univ. Press, Cambridge.

DE LA PENA, RAMON S. 1983. Agronomy. Pp. 167-179 *in* Jaw-Kai Wang (ed.). Taro: A review of *Colocasia esculenta* and its potential. Univ. Hawaii Press, Honolulu.

DIXON, ROLAND. 1932. The problem of the sweet potato in Polynesia. Am. Anthropol. 34:40-66.

GOLSON, JACK. 1959. Culture change in prehistoric New Zealand. Pp. 29-74 *in* J. D. Freeman and W. R. Geddes (eds.) Anthropology in the South Seas. Thomas Avery and Sons, New Plymouth.

GROUBE, L. M. 1967. Models in prehistory: A consideration of the New Zealand evidence. Arch. and Phys. Anthro. in Oceania 2:1-27.

HEDRICK, U. P. (ed.). 1972. Sturtevant's edible plants of the world. Dover Publications, New York.

LAW, R. GARRY. 1969. Pits and kumara agriculture in the South Island. Polynesian Soc. 78:223-251.

__________. 1970. The introduction of kumara into New Zealand. Arch. and Phys. Anthro. in Oceania 5:114-127.

MARKHAM, CLEMENTS (trans. & ed.). 1967. The voyages of Quiros, 1595 to 1606. The Hakluyt Society, 2nd Series, Vol. 14. Kraus reprint of 1904 edition.

O'BRIEN, PATRICIA J. 1972. The sweet potato: Its origin and dispersal. Am. Anthropol. 74:342-365.

PARKINSON, SYDNEY. 1784. A journal of a voyage to the South Seas, in His Majesty's Ship the Endeavour: Faithfully transcribed from the papers of the late Sydney Parkinson .... Dilly and Phillips, London.

SPENCER, JOSEPH E. 1954. Asia, east by south: A cultural geography. John Wiley and Sons, New York.

YEN, D. E. 1961. The adaptation of kumara by the New Zealand Maori. Polynesian Soc. 70:338-348.

__________. 1974. The sweet potato and Oceania: An essay in ethnobotany. B. P. Bishop Mus. Bull. 236:1-389.

__________ and JOCELYN M. WHEELER. 1968. Introduction of taro into the Pacific: The indications of chromosome numbers. Ethnology 7(3):259-267.

YOUNG, ROBERT. 1924. The dasheen: A southern root crop for home use and market. U.S. Department of Agriculture, Farmer's Bull. 1396. Washington, D.C.

Living Liqueurs. James A. Duke. Lincoln, MA: Quarterman Publications 1987. Pp. xvi, 110. $15.00.

Dr. James Duke's record of publications is full of surprises, but nothing more novel has appeared from his pen than this charming and really useful book. As the author points out in his introduction: "Hundreds of aromatic herbs have been used in liqueurs, and many of these can be grown as perennials in your kitchen window, or backyard . . ."

The book is a do-it-yourself manual on how to utilize many of our well-know and a good number of poorly-known herbs. A total of 50 species are discussed from the point of view of culture, uses, and folklore. Each plant is artistically depicted in line drawings by the author's wife, Peggy K. Duke. A list of 37 references is appended, as is an extensive index to folk medicinal uses, with asterisks indicating implications of scientific rationales for the uses. There are also three tables: 1) Liqueur ingredients generally regarded as safe; 2) Yields and drying temperatures; and 3) Ecosystematic data.

This little volume will have wide appeal because of its topic, thoroughness of coverage, and authoritative treatment.

Richard Evans Schultes
Professor Emeritus
Botanical Museum of Harvard University
Cambridge, Massachusetts 02138

L'ethnoscience: Autres regards, autres mots. Daniel Clément, ed. Recherches amérindiennes au québec (6200 de St-Vallier, Montréal H2S 2P5, Canada), Vol. XVII, No. 4, 1987-88. Pp. 100. Can. $7.50.

This journal usually has a regional focus, but this special collection of 6 papers goes farther afield to demonstrate that "ethnoscience" is alive and well. Three papers, by Cecil Brown, Gerry E. McNulty, and Mary Black-Rogers, address issues and present research results pertaining to ethnographic semantics; the other three deal specifically with ethnobiological topics.

"Taller de Tradicion Oral" and Pierre Beaucage argue that the cognitive processes involved in folk classification must be viewed in the context of praxis for a full understanding of Nahua (Mexico) ethnobotany. Daniel Clément advances our understanding of the place of the wolf ***(Canis lupus)*** in Montagnais (Eastern Canada) life and thought by comparing native and scientific perceptions. A critical overview of the work of Cecil Brown and his collaborators in ethnobiology is offered by Gilles Brunel, usefully relating this corpus to the paradigms established by Brent Berlin.

All of the papers (in French, with English abstracts) warrant close reading.

Terence E. Hays
Department of Anthropology and Geography
Rhode Island College
Providence, RI 02908

RICHARD SPRUCE: A MULTI-TALENTED BOTANIST

W. ARTHUR SLEDGE
Department of Plant Sciences
University of Leeds, Emeritus
Leeds, England,

and

RICHARD EVANS SCHULTES
Jeffrey Professor of Biology and Director
Botanical Museum of Harvard University, Emeritus
Cambridge, MA 02138

Richard Spruce, one of the greatest of the Victorian traveller-naturalists, was born at Ganthorpe in 1817 and died at Coneysthorpe in 1893. Both places are situated on the Castle Howard estate in Yorkshire.

Spruce sailed for South America in June 1849. His task was to investigate the flora of the Amazon valley and send back collections of herbarium specimens to Kew Gardens. His journey took him up many of the tributary rivers of the Amazon, and from 1855 until his return to England in May 1864 he worked the head waters of the Amazon in the northern Andes of Peru and Ecuador. In addition to the many thousands of specimens of Angiosperms which he sent back to England he also made copious collections of ferns, mosses, liverworts and lichens.

Although no economic strings were attached to his mission, Spruce's achievements had some consequences of far-reaching economic importance. He laid the botanical foundations for an understanding of the genus *Hevea*, source today of most of our natural rubber. After he had reached Peru he was commissioned by the India Office to locate and collect seeds and young plants of *Cinchona*, the so-called Peruvian or Jesuit's-bark and source of the anti-malarial medicine quinine, and send these back to Kew. He succeeded in the face of formidable difficulties in procuring on the western slopes of Mt. Chimborazo 100,000 seeds and 600 seedling plants which were successfully shipped to England. It was from these shipments that the *Cinchona* plantations and industry of south-eastern Asia were developed—an economic venture which contributed substantially to the wealth of the countries concerned but which yielded Spruce only a modest annual pension of £100 on his return home with his health seriously and permanently undermined.

The identifications of Spruce's huge collections of specimens were made by the leading experts of the day. The liverworts, his own favourite group, he worked out himself in the cottages at Welburn and Coneysthorpe where, as a chronic invalid, he spent the remainder of his life. His monumental *Hepaticae Amazonicae et Andinae*, published in 1885, still remains the greatest work in South American bryology. No botanist specializing in tropical American floristics and monographic research can afford not to consult Spruce's specimens and botanical writings. It is unlikely that his contributions to knowledge of tropical South American botany will ever be equalled by any other one man.

Spruce was never a robust man, but his physical limitations were outweighed by his great strength of character. Few travellers have shown greater fortitude, endurance and unflagging dedication to their mission in the face of prolonged privations and hardships. The breadth of his interests, the detail and accuracy of his observations and the meticulous recording of all that he saw were phenomenal. His collections ranged from the minutest liverworts to the lolftiest forest trees; he recorded the uses to which plants were put by the native tribes amongst whom he stayed, the customs and languages of the tribes (he brought back vocabularies of 21 Amazonian dialects) and sketched their villages and the country through which he travelled making maps of previously unexplored rivers. Nothing appears to have escaped his attention and capacity for orderly documentation.

After Spruce's death his friend Alfred Russell Wallace edited from his journal, memoranda and voluminous correspondence *Notes of a Botanist on the Amazon and Andes* (1908).[1] This two-volume summary of Spruce's travels and botanical investigations in South America is preceded by a lengthy biographical sketch. Those familiar with this work will know that Spruce was not only a distinguished botanist; he was also a notable anthropologist, linguist, geologist and geographer, as well as a perceptive sociological observer of the political systems and customs of the Amazonian and Andean tribes amongst whom he journeyed.

Our present communication is intended to illustrate another and less known facet of Spruce's versatile talents. In the biographical sketch referred to above Wallace refers to him as "a musician and chess-player" and it is with the former capability that we are concerned. We have found no other contemporary references to Spruce's competence as a musician or allusion to what instrument or instruments he played. But when one of us [R.E.S.] first visited Spruce's house in Coneysthorpe in 1950, it was occupied by an elderly lady, Mrs. R. A. Calvert, who entertained him to tea and with whom he had a long conversation. Wallace (loc. cit. *xlii*) has recounted how Spruce "was carefully looked after and nursed by a kind housekeeper and a little girl attendant, who were also his friends and companions." Mrs. Calvert was the "little girl attendant." She described how her mother had been "Mr. Spruce's" housekeeper when she was a young girl and told, amongst many interesting anecdotes, how he suffered from the cold and in the winter months would often ask her to tighten the woollen fabrics in the window joints to keep out the draughts, and how he would have her bring him his slippers and fetch him his "fiddle," which he would then play for a while.

The present tenants of Spruce's cottage, Mr. and Mrs. William Cross, have become deeply interested in Spruce's life and work and Mr. Cross wrote to us some time ago that "A few days ago our head forester Mr. Hardesty brought me a small hymnal which was found in the personal effects of Mr. Hardesty senior who passed away recently. I have had the relevant pages photostated. You will see that Richard Spruce contributed hymn no. 84 which he named 'Raywood' which is the wood adjacent to the Castle. Did you know that Spruce was a composer of hymns?"

The small hymnal (Plate 1) is entitled *The Welburn Appendix of Original Hymns and Tunes.* Its compiler was the Rev. James Gabb B.A., Rector of Bulmer and Chaplain to Lord Lanerton and the music was edited by S. S. Wesley, Mus. Doc. The place and date of composition are cited in the Preface as "Welburn, Castle Howard: Easter 1875," and the acknowledgements include thanks to, amongst others, "Dr. R. Spruce the distinguished naturalist and resident of this village for Tune No. 84 written before he entered on his travels in South America." This statement indicates that the tune (Plate 2) was composed in or before 1849.

The *Welburn Appendix* is now a scarce work but since Bulmer, like Ganthorpe, Welburn and Coneysthorpe, is another satellite village on the Castle Howard estate, it seemed certain that the Rector of Bulmer would have sent one or more copies of his work to the great house. On enquiry to Mr. Eeyan Hartley, archivist at Castle Howard, we were informed that the hymnal was indeed in their library and the Chapel Clerk stated that it was in use in the Private Chapel following its publication. We are grateful

THE

WELBURN APPENDIX

OF ORIGINAL

HYMNS AND TUNES.

BY THE

REV. JAMES GABB, B.A.,

RECTOR OF BULMER, AND CHAPLAIN TO LORD LANERTON.

THE MUSIC EDITED BY

S. S. WESLEY, ESQ., MUS. DOC.

"Speaking to yourselves in psalms, and hymns and spiritual songs, singing and making melody in your hearts to the Lord."

LONDON:
NOVELLO, EWER AND CO.,
1, BERNERS STREET (W.), AND 35, POULTRY (E.C.)

Plate 1.—Title page of *The Welburn Appendix.*

to Mr. Hartley and Mr. R. A. Robson for their helpful response to our enquiries and for sending us on loan the copy of the *Welburn Appendix* from which the accompanying illustrations were prepared.

Mr. John Montanus of Melrose, Massachusetts, a musicologist, has kindly submitted the following comments on Spruce's hymn.

> "Dr. Spruce's tune is interesting and certainly as worthy to be preserved and sung as many of the better known nineteenth-century hymns. The time would

Plate 2.—Tune composed by Spruce for his hymn "Raywood."

be listed in a metric index as 8-7-8-7-8-7, referring to the number of syllables in each line; line 5 in each stanza is to be repeated. The melody of this is identical with that of the first, the only repetition found in this pleasantly varied tune. The two lines differ, however, in their closing harmonies; it would be interesting to ascertain whether this was Spruce's doing or that of S.S. Wesley.

"Wesley, who died at age 66 in 1876, was one of the most distinguished church musicians of his day. He was the natural son of composer Samuel Wesley and grandson of Charles Wesley, co-founder of the Methodist movement.

"The metrical scheme of Spruce's tune, Raywood, is identical *inter alia* to that of Regent's Square, sung usually to the words *Angels from the Realms of Glory*. In other words either set of words may be sung to either tune."

We have no other references to Spruce's love of music or capabilities as a composer or instrumentalist save in a work by the American writer on natural history Wolfgang von Hagen. In his book entitled *South America Called Them* (1945), dealing with explorers of that Continent, the opening paragraphs of the first chapter on Richard Spruce give a colourful picture of him playing "the spirited air of a Yorkshire jig" on bagpipes as he sailed up-river to Santarem. We dismiss this as literary licence, perhaps suggested by the well known photograph of Spruce as a young man wearing a Scottish glengarry-type head dress. Having regard to the severe restrictions imposed on all baggage other than that required for his collecting work and essential personal requirements, it is unlikely that a musical instrument would have been included in his luggage and least of all so cumbrous a one as bagpipes.

In 1970, we appealed in the international botanical journal *Taxon* for contributions to a fund wherewith to place a memorial plaque over the door of the cottage in Coneysthorpe in which Spruce spent the last 17 years of his life. The late Mr. George Howard of Castle Howard, our acquaintance, later to become Lord Howard of Hinderskelf, was himself well aware of Spruce's history and achievements and kindly agreed to the project. The appeal was supported by donations from 12 countries and more than covered the cost of the grey-green Westmorland slate plaque with white lettering. The inscription reads:

Richard Spruce
1817-1893
of Ganthorpe, Welburn
and Coneysthorpe
Distinguished botanist, fearless
explorer, humble man, lived here
1876-1893

On September 3, 1971, a ceremony was held at Coneysthorpe presided over by Mr. Howard at which time Professor Schultes, who had come over from the United States primarily to attend this dedication, unveiled the plaque. Representatives of the Yorkshire Naturalists' Union, the Yorkshire Naturalists' Trust, the Yorkshire Philosophical Society and the British Bryological Society attended the ceremony.

We believe that this plaque, unveiled more than a century after Spruce's travels in South America, appropriately commemorates his memory and his love of the Yorkshire rural peace and tranquility to which, after years in the Amazonian wilderness, he returned to devote his remaining years working on his bryological collections.

We later secured the permission of the Reverend Canon W. Beswick of the parish of Terrington to employ the remainder of the fund in having Spruce's white marble scroll-tombstone cleaned and re-lettered. The renovated stone (Plate 3) with its simple inscription is an enduring memorial to an unassuming yet multi-talented man.

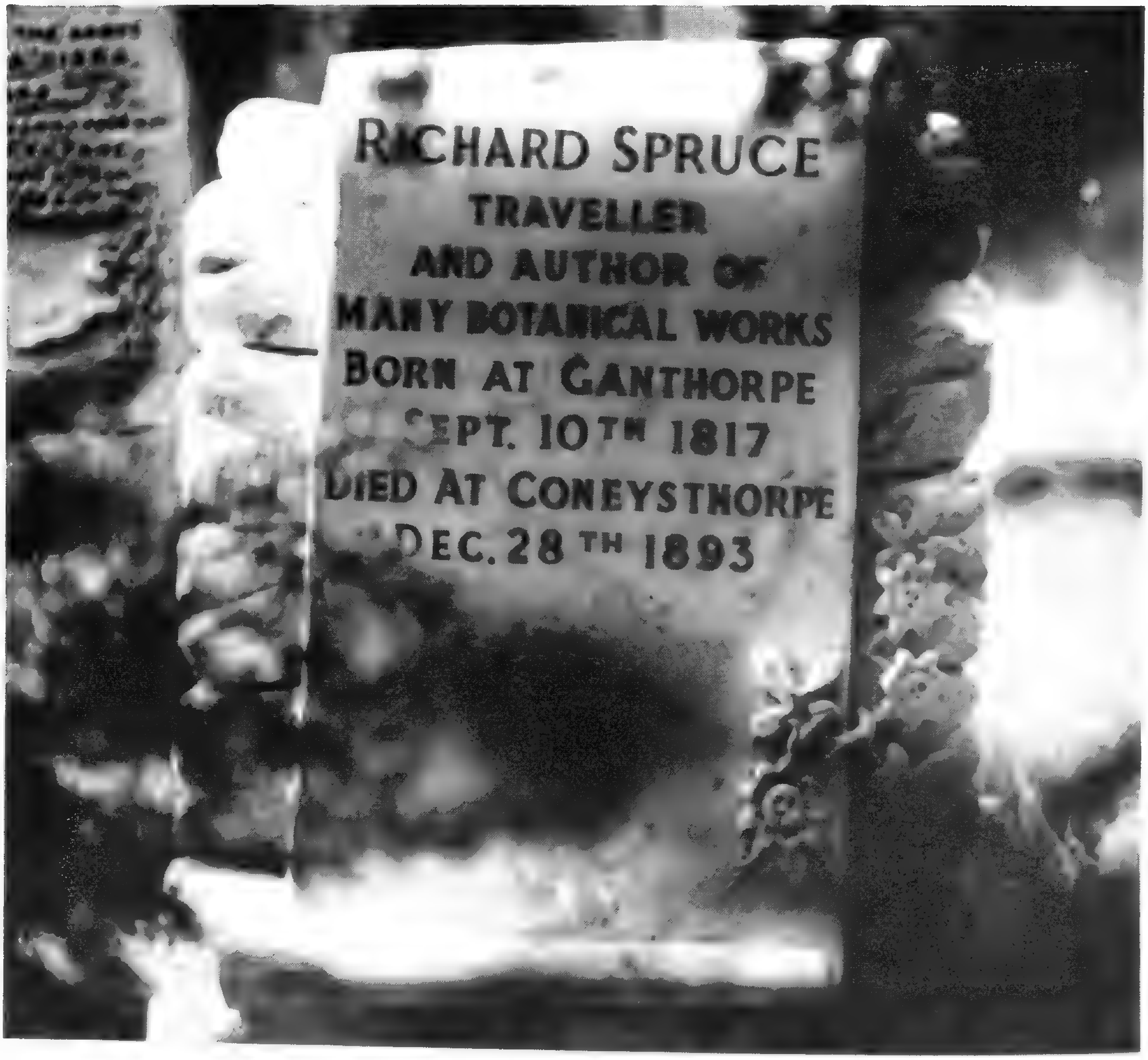


Plate 3.—Richard Spruce's gravestone in the churchyard of the parish church of Terrington, Yorkshire. Photograph by Dr. James Zarucchi.

Editor's Note: See J. Ethnobiol. 3(2):139-147, December 1983, for another paper on Richard Spruce, an early ethnobotanist of the Amazon and northern Andes. Also, "Richard Spruce still lives," Northern Gardener 7 (1953) 20-27; 55-61; 89-93; 121-125. Reprinted in *Hortulus Aliquando*, No. 3 (Autumn, 1978) 1-47.

NOTES

[1]Spruce, R. [Ed. A. R. Wallace] *Notes of a Botanist on the Amazon and Andes*, Macmillan and Co., Ltd., London. 2 vol. (1908). Reprinted edition with a new foreword by Richard Evans Schultes: Johnson Reprint Corporation, New York. 2 vol. (1970).

J. Ethnobiol. 8(1):13-33 Summer 1988

GITKSAN TRADITIONAL MEDICINE: HERBS AND HEALING

LESLIE M. JOHNSON GOTTESFELD
and
BEVERLEY ANDERSON
Gitksan-Wet'suwet'en Tribal Council
Box 229
Hazelton B.C. VOJ 1YO

ABSTRACT.—The Gitksan people live along the Skeena River in northwest British Columbia, Canada. Gitksan traditional medicine is still practiced as an adjunct to modern allopathic medicine. Medicinal plants are used as decoctions, infusions, poultices, and fumigants, or are chewed for a wide variety of medical conditions. Traditional Gitksan life involved seasonal movement to utilize a wide variety of plant and animal resources. The Gitksan people viewed their environment as a harmonious interacting whole which included people as one of its elements. Maintenance of this balance was crucial to the health of the environment and the survival and health of the people. Shamans, bone-setters, midwives and herbalists all contributed to maintenance of health and treatment of illness in the traditional system. Extensive use was made of plant products as medicines.

INTRODUCTION AND SETTING

The Gitksan people of northwestern British Columbia, Canada, live along the Skeena River and its tributaries (Fig. 1). The natural environment consists of densely forested wide glacial valleys separated by rugged mountain ranges with alpine meadows, glaciers and rocky cliffs at their summits. The region lies in the transition between the Pacific Coast Forest types which extend from Central California to Southeast Alaska and the Boreal Forest which extends across Canada and Central Alaska. The Gitksan culture, too, is transitional, combining coastal fishing strategies with interior hunting and trapping. It is part of the North Coast culture area (Drucker 1955; Woodcock 1977) and their language is closely related to Tsimshian (Drucker 1955; Garfield 1939; Duff 1959, 1964). The neighboring Wet'suwet'en are an Athabaskan speaking group allied to the Carriers of the interior of central British Columbia. The Wet'suwet'en have acquired many coastal cultural characteristics from prolonged contact and intermarriage with the Gitksan, and some diffusion of cultural adaptations and words with Wet'suwet'en roots has occurred in Gitksan. The eastward extent of Coastal cultural adaptations into the interior in the Nass and Skeena areas is made possible by the inland extension of western red-cedar (*Thuja plicata*[1]) and the presence of large navigable rivers with abundant salmon.

Traditionally subsistence involved seasonal movement to utilize different resources, notably four species of salmon (*Oncorhyncus* spp.), steelhead trout, oolachan (*Thalicthys pacificus*, an anadromous smelt), spring greens, berries, edible roots, and caribou, mountain goat and marmot. Periods of dispersal on the landscape were interspersed with winter residence in large centrally located villages. Before European contact, all activities of the Gitksan were conducted in the context of this annual cycle of movement (Fig. 2) and the people saw themselves as an integral part of the natural system.

Movement on the land to utilize the resources necessary for survival was shaped by the structure of the society which organized people into matrilineal clans and clan subdivisions called houses ***(wilp)*** (Cove 1982; Adams 1973; Neil Sterrit Jr., Don Ryan, personal communication) characterized by crests and governed by hereditary chiefs. These houses were the units which controlled access to the resources which were owned by the chief on behalf of his [her] people. The chiefs and their houses had specific territories which were hunting, gathering, and fishing grounds. The high chief controlled harvest of the resources and ensured, through sharing, that the needs of all were met. Some flexibility in where a family hunted or fished was afforded since either the husband's or wife's territory could be exploited, and the father's rights could be used until he died.

FIG. 1.—Gitksan Traditional Territories.

Resources in this landscape are extremely patchy (non-uniformly dispersed in space and in time)[2]. Gathering activities were intensive in season because of the marked seasonality of resource availability and the long winters. In past times not only fish and meat but also berries were dried and smoked for winter provision.

In the present time, most Gitksan live in the six large villages, which are Indian Reserves, or in the nearby towns. Subsistence activities are still very important in village economy. Fish and berries form a significant part of the local diet. Today canning and freezing largely replace smoking and drying food for winter storage. Purchased foods supplement wild foods especially in winter.

TIME	ACTIVITY	ANIMALS	PLANTS	MEDICINES	PLACE
DEC	Feasting	consume dried fish & meat, oolachan grease	consume dried & stored berries, fruits		winter villages
	Purification			purification before & during trapping	
JAN FEB	Winter Trapping	marten, mink, fox, wolverine, weasel, wolf, coyote, fisher			trapping territories
MAR	Spring Trapping & Fishing	beaver trapping over-wintering steelhead trout		gather devil's club bark, calla stems	
APR	Oolachan Grease Trade	oolachan & other marine resources			grease trail & coast
MAY	First Salmon Feast	chinook salmon		blessing to keep fish coming	
JUN	Spring Salmon Fishing	chinook salmon	cow parsnip, red cedar bark, pine cambium, soapberries, fireweed stalks	gather yellow pond lily root	fish camps
JUL	Summer Salmon Fishing/Smoking	sockeye salmon	saskatoon berries nettles for cordage	gather yellow pond lily root, soapberry leaves	fish camps
AUG	Berry Picking & Preserving	black bear	huckleberries, lowbush & highbush blueberries, highbush cranberries		berry patches
SEPT	Purification			purify self & gun with ***ʼmulgwasxw***	hunting territories
	Fall Hunting	moose, mountain goat, caribou, deer, marmot		gather ***ʼmulgwasxw***, valerian root, devil's club, yellow pond lily	
OCT	Fall Salmon Fishing/Smoking	coho salmon, steelhead			fish camps
NOV DEC	Preparation For Winter	moose hunting, smoke meat	collect firewood		winter villages

FIG. 2.—Generalized annual cycle of activities and resource gathering among the Gitksan in the late nineteenth and early twentieth centuries. Travel to the coast for commercial fishing and cannery work has been omitted from the present diagram.

Fishing sites remain valuable property of individual chiefs and river salmon fishing is conducted in accord with the traditional system. In contrast, berrying, gathering and hunting activities are much more opportunistic and reflect centralization of residence in villages and ease of access to sites by vehicle. The modern version of the hunting territory is the "trapline." The primary nature of a chief's "trapline" is not simply a trapping area, but rather a word for his traditional hunting territory.

Reflecting beliefs about the harmonious interaction of people and the land and the balance of natural forces, the fundamental Gitksan approach to health is holistic and preventative. When problems arose in pre-contact times, healing was handled by various specialists. ***Halayt*** (spiritual healers), herbal healers, bone setters, and midwives all participated in the maintenance of health and prevention and treatment of disease. Extensive use was made of plant products as medicines. In the past sixty years with the influence of the missionaries and modern Canadian life, the ***halayt***, bonesetters and midwives have largely disappeared. However, traditional herbal remedies have continued to be employed, and some people who were trained in herbal healing are still living.

The present study is part of a program to preserve and transmit traditional knowledge of plant uses and preparation of indigenous medicines among the Gitksan and Wet'suwet'en peoples. Until very recently, the low status of traditional lore and the cultural emphasis on ownership of knowledge made these practices very private, but the renewed interest and pride in culture in recent years has generated considerable interest in learning about and reviving this knowledge.

METHODS

We have conducted interviews with 23 Gitksan elders and other knowledgable Gitksan people about medicines and plant use[4]. Interviews were in Gitksan and English, and written notes and tape recordings made. Photographs were taken in the field of significant plants and herbarium specimens were collected. Identifications were verified by informants from growing or fresh material. Supplemental verification of plant identity was made from photographs or line drawings. Plant determinations were made by Gottesfeld and Gitksan language interviews were conducted by Anderson. Botanical specimens, photographs, and tape recordings are housed in the Gitksan-Wet'suwet'en Tribal Council Archives and Library in Hazelton British Columbia. A set of voucher specimens is housed in the British Columbia Provincial Museum Herbarium in Victoria.

MEDICINAL PLANTS

Use of medicinal plant preparations forms an important part of Gitksan traditional medicine. Medicinal plant preparations are used as tonics, purgatives and emetics, expectorants and demulcents, wound dressings and antiseptics, poultices, opthalmic and aural preparations, as skin washes, and as fumigants. Herbal preparations are used to prevent illness and promote health, to treat specific symptoms of disease, for purification, and for protection from witchcraft. In the Gitksan concept, illness results from an imbalance in the individual or the environment. Purification has as its aim the restoration of the disturbed balance, the cleansing of the affected individual. Likewise, there is a strong emphasis in treatment of disease by purgatives or emetics, which drive out the impurity or illness, leaving the body clean and ready for the return to normal body function.

A number of plants have been used by the Gitksan for medicinal purposes in the past and at present. Important and widely used plants include Devil's club *(Oplopanax horridum* (Smith) Miq.), yellow pond lily *(Nuphar polysepalum* Engelm.), soapberry *Shepherdia canadensis* (L.) Nutt.), lodgepole pine *(Pinus contorta* Dougl. *ex* Loud), subalpine fir *(Abies lasiocarpa* (Hook.) Nutt.) and spruce *(Picea engelmannii* Parry and *glauca* (Moench) Voss.), False or Indian hellebore *(Veratrum viride* Ait.) red elderberry *(Sambucus racemosa* L.), cow parsnip *(Heracleum lanatum* Michx.), common juniper *(Juniperus communis* L. subsp. *nana* (Willd.) Syme) and wild calla *(Calla palustris* L.). These plants are used alone or as mixtures for a wide variety of conditions. They are administered as poultices, decoctions, infusions, external washes, or as smudges.

Devil's Club.—***Wa'uumst, Hu'ums*** *[Oplopanax horridum* (Smith) Miq.] (Fig. 3). Devil's club is a sprawling deciduous shrub 1 to 5 m high which grows in moist coniferous and mixed forests, and in avalanche tracks. It is common in northwest British Columbia. The stems can be gathered after the leaves senesce or when the plant is dormant, but not in spring when it is just leafing out. It is not "ripe" or ready then. One elder stated it should be gathered after the first snowfall in October.

The leafless spiny stems are the part used by the Gitksan. For most uses the inner bark or cambium layer is scraped off of the stems. The prepared inner bark can be used fresh to prepare an infusion or decoction; it can be chewed, or applied as a poultice for dressing woulds (Wilson *et al.* 1984), or dried and stored as "chips" for later use. The pliable fresh bark strips are sometimes formed into "pills" for later chewing. Some recipes which involve boiling devil's club do not require scraping the inner bark from the stems. Some elders boil chunks of fresh, unpeeled devil's club stems to make decoctions of devil's club.

FIG. 3.—Elder Elsie Morrison gathering Devil's Club (***hu'ums***, *Oplopanax horridum*).

The inner bark of Devil's club is used fresh or dried for rheumatism, respiratory ailments, as a general tonic, for stomach ulcers and stomach pain, and for gynecologic cancers. The fresh inner bark is used as a dressing for open wounds (Wilson *et al.* 1984). Regular chewing of fresh devil's club inner bark is believed to maintain good health. Good health and vigor among older people has been attributed to regular use of devil's club. An infusion of fresh devil's club bark is a tonic and "energizer." An infusion of dried devil's club bark is used to treat stomach pain and ulcers. Devil's club tea was also drunk in conjunction with fasting in certain purification rituals. Devil's club is generally used by hunters and trappers to improve their luck and because bathing in a solution of devil's club is reputed to remove human scent (Wilson *et al.* 1984). Regular chewing of (preferably fresh) devil's club bark is reported to be helpful in treating rheumatism or stiffness of the joints. An elder from Kitwancool reported that he was able to cure arthritis in his right shoulder in one month by chewing devil's club every day. The chewed bark is swallowed by the user.

Devil's club is also an ingredient of a number of herbal mixtures (Wilson *et al.* 1984; H. Smith 1926). We have collected recipes for tonics which employ devil's club in combination with juniper boughs, alder bark (*Alnus incana*), wild calla stems (*Calla palustris*), subalpine fir bark (*Abies lasiocarpa*), mountain ash bark (*Sorbus sitchensis* or *scopulina*) and spruce bark (*Picea engelmannii* or *glauca*). These decoctions are used as tonics, to prevent or treat influenza, respiratory ailments or tuberculosis, and to achieve spiritual well-being.

The inner stem bark or the root bark of devil's club is widely used by all native groups throughout its range for a variety of medicinal purposes (Table 1) (see review by Turner 1982; and Gunther 1973; Turner *et al.* 1980, 1983; Justice 1966; Smith 1983; Smith 1928; MacGregor 1981). It is generally reputed to be helpful in arthritis and rheumatism, stomach ailments, wound treatment, childbirth or pregnancy, cancer, and respiratory ailments. In addition to the many uses listed in Table 1, it has been reported to control blood sugar levels (Justice 1966). Some modern Gitksan have employed it for control of diabetes after learning about it from Tsimshian relatives. Devil's club is burned as a fumigant to ward off sickness by the Wet'suwet'en or purify a dwelling of bad spirits by the Tsimshian. The Niska'a of the Nass Valley also place high value on it for medicine.

Devil's club was also widely used for its spiritual power in purification rituals and for "luck" (Turner 1982). The Wet'suwet'en, whose territory adjoins the Gitksan to the south and east, place high value on devil's club for purification and luck. Bathing with devil's club, and consumption of devil's club tea formed important parts of the ritual preparation for the winter hunting and trapping. The hunter who completed the extended preparation, it was believed, would be very lucky and successful in his endeavours.

It appears that no definitive investigation of the chemistry of devil's club stem bark has been made. Smith's (1983) review of the pharmacognosy of devil's club states that a 1927 study (Kariyone and Morotomi 1927, cited in Smith 1983) of an ether extract of devil's club roots and stems isolated two oils, a sesquiterpene named equinopanacene, and a sesquiterpene alcohol, equinopanacol. The general constituents of devil's club extracts include oleic and unsaturated fatty acids, glycerides, saponins and tannins (Stuhr and Henry 1944, cited in Smith 1983). Devil's club is in the Araliaceae, the same family as the widely used *Panax* spp. (ginseng). Like the ginsengs, a major use is as a tonic or to promote general health.

Table 1.—Uses of Devil's Club by different Indian groups.

Use	Group	Source[5]
emetic/cathartic/ purgative	Gitksan	Smith 1928
	Tlingit	Smith 1973
	Eyak	Smith 1973
	Bella Colla	Turner 1973; Smith 1928
	Southern Carrier	Smith 1928
	Wet'suwet'en	Smith 1928; Morice 1893
laxative	Haida	Turner 1973
	Tlingit; Kaigani Haida	Justice 1966
	Heiltsuq (Bella Bella)	B. Rigsby in Turner 1982
	Southern Kwakiutl	Turner & Bell 1973
	Tsimshian	MacGregor 1981
	Gitksan	Wilson *et al.* 1984
	Tanaina (Upper Inlet)	Kari 1977
	Tlingit; Kaigani Haida	Justice 1966

Table 1.—Uses of Devil's Club by different Indian groups. (continued)

Use	Group	Source[5]
	Bella Coola	Smith 1928
	Thompson	Turner *et al.* In Press
Arthritis/rheumatism	Gitksan	this study
	Tlingit; Kaigani Haida	Justice 1966; MacGregor 1981
	Haida	Turner 1970
	Bella Coola	Smith 1928
	Ohiat Nootka	Rollins 1972
	Nitinaht	Turner *et al.* 1983; Rollins 1972
	Sechelt	Bouchard 1977; Rollins 1972; Turner & Timmers 1972
	Squamish	Rollins 1979
	Upriver Halkomelem	Galloway 1979
	Lilloet	Turner 1972
	Tsimshian	MacGregor 1981
Tonic	Tlingit; Kaigani Haida	Justice 1966
	Haida	Turner 1970
	Bella Coola (with *Ribes*)	Bouchard 1975
	Sechelt	Bouchard 1977
	Cowichan/Halkomelem	Rollins 1972
	Thompson	Turner *et al.* In Press
	Gitksan	this study; Wilson *et al.* 1984
Childbirth	Carrier	Morice 1893
	Skagit (with *Chimaphila* and *Rhamnus*)	Gunther 1973
Fever	Tanaina (Kenai & Upper Inlet)	Kari 1977
Tuberculosis	Tanaina (Upper Inlet)	Kari 1977
	Tlingit; Kaigani Haida	Justice 1966
	Southern Kwakiutl	Turner & Bell 1973
	Nitinaht (with *Abies*)	Rollins 1972
	Skagit with *Chimaphila* and *Rhamnus*)	Gunther 1973
	Okanagan-Colville	Turner *et al.* 1980
	Sahaptin	D. French in Turner 1982
	Gitksan (alone and in mixture)	this study; Wilson *et al.* 1984

Table 1.—Uses of Devil's Club by different Indian groups. (continued)

Use	Group	Source[5]
Respiratory ailments/ coughs/colds	Gitksan	this study; Wilson *et al.* 1984
	Tanaina (Upper Inlet)	Kari 1977
	Tlingit; Kaigani Haida	Justice 1966; MacGregor 1981
	Haida	Turner 1970
	Squamish	Bouchard & Turner 1976
	Cowichan/Halkomelem	Rollins 1972
	Cowlitz	Gunther 1973
	Okanagan-Colville	Turner *et al.* 1980
	Tsimshian	MacGregor 1981
Poultice or wound dressing/disinfectant/ topical analgesic	Tlingit	Smith 1973
	Tlingit; Kaigani Haida	Justice 1966
	Central Carrier	Central Carrier Linguistic Comm 1973
	Gitksan	this study; Wilson *et al.* 1984
	Wet'suwet'en	unpublished study of authors
Cancer	Tlingit; Kaigani Haida	Justice 1966
	Gitksan	this study
	Tsimshian	MacGregor 1981
General sickness; flu	Haida	Turner 1970
	Carrier	Central Carrier Linguistic Comm 1973
	Bella Coola	Bouchard 1975-77 in Turner 1982
	Thompson	Annie York in Turner 1982
	Kootenay	Hart *et al.* 1981
Diabetes	Heiltsuq (Bella Bella)	MacDermott 1949
	Sechelt	Bouchard 1978
	Squamish (with *Abies*)	Bouchard & Turner 1976
	Tsimshian	Large & Brocklesby 1938; unpublished study of authors
Skin Wash	Mainland Comox	Bouchard 1973
	Sechelt	Rollins 1972; Turner and Timmers 1972
	Gitksan	Wilson *et al.* 1984

Table 1.—Uses of Devil's Club by different Indian groups. (continued)

Use	Group	Source[5]
Ashes or charcoal for sores burns or swelling	Tlingit	Krause 1956
	Southern Kwakiutl	Boas 1966
	Sechelt	Bouchard 1977
	Thompson	Steedman 1930
Purification	Haida	Newcombe unpub. notes ca 1901 (in Turner 1982)
	Gitksan	this study
	Wet'suwet'en	unpublished study of authors
	Tlingit	Krause 1956
Amulet (protection)	Haida	Turner 1970
	Bella Coola	Turner 1973
Luck (hunting or gambling)	Haida	Newcombe unpub. notes ca 1901 (in Turner 1982)
	Wet'suwet'en	unpublished study of authors
	Tsimshian	Boas 1916
	Gitksan	Wilson *et al.* 1984
Scent removal	Gitksan	Wilson *et al.* 1984, this study
	Tsimshian	M. Seguin in Turner 1982
Fumigant	Bella Coola	Bouchard 1975
	Wet'suwet'en	unpublished study of authors
	Tsimshian	unpublished study of authors

Yellow Pond Lily.—***Gahldaats*** *[Nuphar polysepalum* Engelm.]) (Fig. 4) Yellow pond lily is a rooted aquatic growing in small ponds and shallow lakes and marshes in 1 to 2 m of water. The leaves emerge in early May and senesce in the fall. The thick rootstock or rhizome, the portion used by the Gitksan overwinters, rooted in the muddy pond bottom. The rhizome is the portion of the plant used. It is laborious to dig. Because of this, floating rhizomes loosened by beavers are used if possible. According to one elder yellow pond lily should be harvested in May, or after flowering, in the fall. Other informants feel that the time of gathering during the growing season is not significant. The cortex and adhering leaf bases are peeled off of the fresh rhizome, it is sliced, and the slices strung on a stick to dry. They are stored in this manner until needed or powdered when dry and stored in sealed glass jars. It is necessary to rehydrate the root slices to use them; powdered root can be infused in boiling water for use. Powdered root can also be sprinkled on food and eaten.

Table 2.—Uses of *Veratrum Viride* by different Indian groups.

Use	Group	Source
internal use of infusions or decoctions of root or of fresh root juice	Haisla	Lloyd Starr pers. comm.
	Lillooet	Nancy Turner pers. comm.
	Tsimshian	MacGregor 1981
	Bella Coola	Edwards 1980
	Yakutat Tlingit	de Laguna 1972
external use of infusions or decoctions or of root piece	Gitksan	Wilson *et al.* 1984; this study
	Bella Coola	Edwards 1980
	Tsimshian	MacGregor 1981
	Yakutat Tlingit	de Laguna 1972
snuff	Tsimshian	MacGregor 1981
	Okanagan-Colville	Turner *et al.* 1980
poultice of the leaves for arthritis, sores or fractures	Tsimshian	MacGregor 1981
	Okanagan-Colville	Turner *et al.* 1980
	Bella Coola	Edwards 1980
purification with infusions or decoctions of the root	Gitksan	this study
fumigant for purification and spiritual purposes	Gitksan	this study
	Haisla	Lloyd Starr pers. comm.
	Bella Coola	Edwards 1980
amulet for luck and protection; protection from witchcraft	Lillooet	Nancy Turner pers. comm.
	Haisla	Lloyd Starr pers. comm.
	Gitksan	this study
	Bella Coola	Edwards 1980
magical uses	Okanagan-Colville	Turner *et al.* 1980

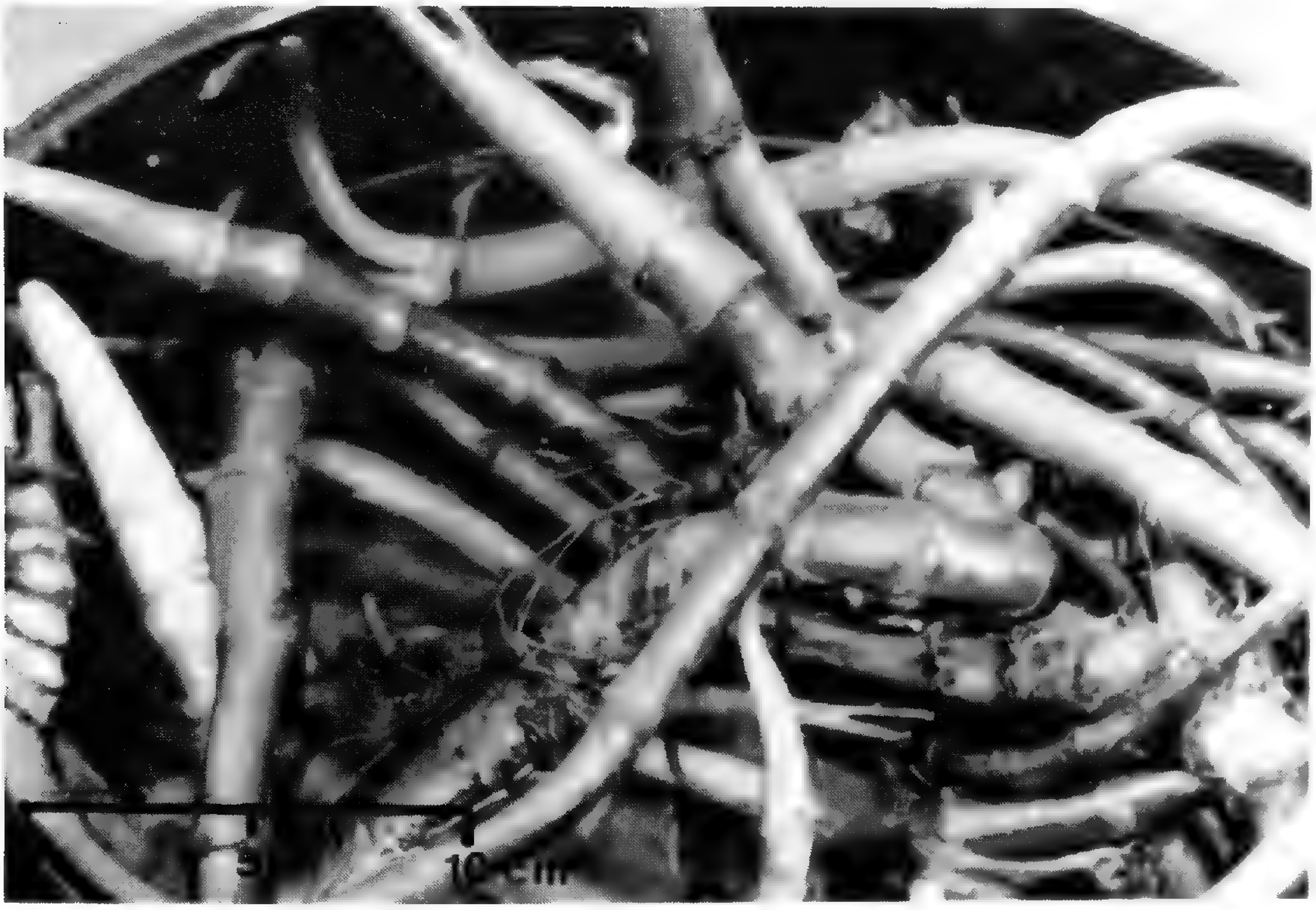


FIG. 4.—Dried **gahldaats** root slice *(Nuphar polysepalum)*.

The sliced rootstock of yellow pond lily is used as a poultice for arthritic joints, fractures, and skin ulcers, and the decoction of the fresh rootstock is drunk as an appetite stimulant for weak and sickly persons such as tuberculosis patients. Yellow pond lily has been used along with devil's club in the treatment of tuberculosis victims. Several people have reported they were cured of tuberculosis by using this medication. An infusion of the powdered dried rootstock is said to be useful for cancer and stomach complaints. It "cleans the lungs and the insides." It may also have been employed for birth control in the past (H. Smith 1926). One informant reported that too much will "make a man sterile." Powdered dried rootstock can also be added to warmed spruce pitch for application as a hot plaster.

The rhizome of the yellow pond lily is utilized by the neighboring Wet'suwet'en in combination with other ingredients for tuberculosis, and alone as a tonic. The Haida use a decoction of yellow pond lily rootstock and common juniper for tuberculosis treatment (Deagle, unpublished manuscript). An infusion of the rhizome of the yellow pond lily is used by the Nitinaht as a general tonic (Turner 1983).

Soapberry.—***Is*** *[Shepherdia canadensis* (L.) Nutt.] Soapberry is present over a wide elevation range from low elevations to montane sites except in the immediate coastal area. The berries contain saponins which causes their foaming properties and bitter taste. The constituents of leaves or branches are not known.

The berries are widely gathered in northwest British Columbia for food for home use and trade in June and early July. Some people gather green berries while others prefer the ripe ones. These are whipped with water (and sugar) to make "Indian ice-cream" ***yal is,*** a traditional dessert for feasts (People of Ksan 1980). Soapberries are an important item for trade with Coastal peoples as they are rare in the wet coastal forest.

An infusion of the dried leaves is used for a diuretic and to treat bladder and uterine infections. Dried leaves are steeped in about one gallon of water "to make a light tea" for these purposes. The berries are reported to speed childbirth and act as a uterine stimulant. The leaves are gathered for medicine after the berries dropped off. Smith (1926) reports use of a decoction of the whole plant, roots, branches and leaves, for treating chronic cough.

An infusion of soapberry twigs is drunk by the Central Carrier (Carrier Linguistic Committee 1973) for relief of constipation. Soapberry tea is also used by the Okanagan-Colville as a laxative, tonic or stomach medicine (Turner *et al.* 1980). The Lillooet use soapberry for heart attack and indigestion (Turner 1978). Common uses of soapberry decoctions among other native groups include use as a purgative, stomach tonic, skin wash or cough medicine (Turner 1981). It is used in a contraceptive mixture among the Okanagan-Colville, and as a treatment for amenorrhea by the Stoney (Turner 1981).

Conifer Pitch ***(Skyen)*** *and Conifer Bark.*—Lodgepole pine *[Pinus contorta* Dougl. *ex* Loud]; Subalpine Fir *[Abies lasiocarpa* (Hook.) Nutt.]; Spruce *[Picea engelmannii* Parry and *P. glauca.* (Moench) Voss and hybrid populations]

Pitch from lodgepole pine, subalpine fir and white or englemann spruce and their hybrids is called ***skyen.*** These kinds of pitch are all valued as wound dressings and antiseptics. Different qualities and grades of pitch are recognized. Pitch from the different tree species is used similarly, but informants will usually specify the kind of pitch in the recipe. Pine pitch is used as an antiseptic dressing for open wounds and boils. It is collected year round as needed and used fresh. Pitch is also an ingredient in medicinal mixtures. One such mixture includes spruce pitch, alder bark, or immature female catkins, and pine and spruce "tips" (newly expanded terminal buds). This forms a salve which is part of an arthritis treatment. Spruce pitch may also be mixed with powdered dried yellow pond lily rhizome and applied as a hot plaster.

The liquid pitch of subalpine fir bark blisters is particularly valued. Its Gitksan name, ***stu'uhl hoo'owxs,*** translates as 'the tears of the balsam [subalpine fir].' A term for the pitch blisters, ***motix hoo'owxs,*** means 'the teats of the balsam [subalpine fir].' The liquid pitch is used as a wound dressing and also in liquid medicines for respiratory problems. One recipe mixes subalpine fir pitch with rendered hoary marmot grease. This is taken internally "for cleaning the insides out."

Bark strips taken from young spruce and subalpine fir are also ingredients of various medicines. These bark strips contain tannins as well as a lot of pitch. Typically, a bark strip of a given dimension will be specified in a recipe. The fresh bark will then be chopped into pieces and boiled or steeped alone or as part of a mixture to release its medicinal principles. Subalpine fir bark forms an ingredient of a spring tonic mixture. Spruce bark is used in an anti-tubercular tonic. Another use for spruce bark is as a treatment for serious burns. The whole spruce bark ***('ootx)*** is roasted and pounded to a powder, then sprinkled over the burned area.

Conifer bark and pitch have non-medicinal uses as well. Spruce pitch was chewed like gum in the past. The modern word for chewing gum in Gitksan is ***skyen.***

Pine cambium and inner bark ***(gan hix,*** 'pine noodles') is gathered for food in June on a sunny day. It is very sweet but perishable, and is used fresh by the Gitksan. It is not commonly eaten now.

Pine, spruce and fir pitch are used by the Carrier Indians for sores or eye injuries. The barks of these trees are also used as medicine (Carrier Linguistic Committee 1973). The Wet'suwet'en use a decoction of spruce "tips" for cough. The Okanagan-Colville use fir *(Abies* spp.) pitch for ulcers. (Turner *et al.* 1980).

Red elderberry.—***Sk'an loots'*** *(Sambucus racemosa* L.) Red elderberry is an abundant shrub in moist bottomland forests from the Hazelton area to the coast. It is more common to the west. Red elderberries were important as a source of food for the Gitksan because of the abundance of their fruits. Although they are widely reported in the literature as poisonous *(e.g.* Hulton 1968), they are utilized mixed with other berries at traditional Northwest Feasts and we have never observed or heard of adverse reactions to ingestion of the fruits of the local populations of elderberries (see Turner 1975 for comments on edibility).

The bark of the red elderberry and its roots are used for medicine. The red elderberry root bark is used to prepare an emetic. The inner bark of the root is scraped off, as in the preparation of devil's club. A small quantity of the bark shavings are then added to boiling water and set to steep. The resulting milky fluid is drunk lukewarm, followed by lukewarm water. After the patient vomits, a cup of lukewarm water is given. This is repeated until vomiting ceases. Patients were treated with this medicine during the 1918 flu epidemic. Weakness, general illness and inability to eat were presenting symptoms for the use of the emetic preparation. Harlan Smith (1926) reports use of red elder roots as an emetic and purgative in the 1920's. Another reported use of elder bark is for tuberculosis. It can also be administered as a smudge as part of a medicine to cure a victim of evil witchcraft. For this purpose it is used with juniper *(Juniperus communis)* and cow parsnip *(Heracleum lanatum)* root. Red elder is used as purgative by the Nitinaht (Turner *et al.* 1983).

Chemical constituents of the root or bark have not been well characterized with modern techniques. Kingsbury (1964:390) states that the root is the most toxic part, containing purgative substances. A triterpene, ursolic acid, has been isolated from the roots and choline has been isolated from the bark (Borokov and Belova 1967; Yardin 1936).

Cow parsnip.—**Ha'mook, Huukx** *(Heracleum lanatum* Michx.) Cow parsnip is abundant in moist and open situations including river floodplains, meadows and avalanche tracks. In the Skeena area it grows from valley bottoms to moderate elevations.

Cow parsnip is locally called 'Indian rhubarb' or 'Indian celery.' These names point out the similarity of the portion eaten, the leaf stalk and flower bud stalk ***(huukx)***, to common introduced European vegetables. Cow parsnip stalks are suitable for food only for a short portion of the year in the spring. They are highly prized and still widely collected. After the flowering stalk exceeds about 40 centimeters in height, it is considered poisonous.

Mature cow parsnip contains abundant furanocoumarins which react with sunlight to cause blistering of the skin (Camm *et al.* 1976). Kuhnlein and Turner (1986) have found that peeled young cow parsnip stalks contain about half the concentrations of furanocoumarins of unpeeled young cow parsnip stalks, demonstrating that preparation techniques reduce potential toxicity.

The parsnip-like root can be gathered for medicine at any time. Medicinal uses include a poultice of the fresh root for rheumatism, and use with red elder bark and juniper boughs as part of a smudge treatment to counteract bewitchment. Cow parsnip root is also used as a poultice for rheumatism by the Central Carrier (Carrier Linguistic Committee 1973).

Common Juniper.—**Laxsa laxnok, T'seex** *[Juniperus communis* L. subsp. *nana* (Willd.) Syme] Juniper is fairly abundant in the central Skeena valley. It is restricted to drier more open plant communities of low to mid elevations. It can be gathered fresh when needed.

A number of studies have been made of the constituents of the foliage and stems of common juniper. Flavonoids, benzenoids, lignans, alkenes, diterpenes polyprenoids, malic acid, malonic acid, oxalic acid, phenyl pyruvic acid, aconitic acid, tartaric acid, vanillic acid, and ascorbic acid have been isolated by a number of different investigators, largely from European samples (for example see De Pascual *et al.* 1980; Lamar-Zarawaka

1977; Linder and Grill 1978). The fruits show embryotoxic effects *in vivo* in several studies performed on rats and antitumour and antiviral effects *in vivo* and *in vitro* (Agrawal *et al.* 1980; Belko *et al.* 1952; May and Willuhn 1978 and others).

The juniper has a long history of medicinal use in both Europe and North America. Its foliage is employed among the Gitksan. Fresh juniper boughs are chopped and boiled as part of mixtures of plants to obtain a decoction which is drunk for medicinal purposes. These mixtures include devil's club and other ingredients. Juniper boughs can also be burned as a fumigant to purify a dwelling. Its name, ***laxsa laxnok,*** translates as 'boughs of the supernatural' which indicates the power attributed to the plant. Some informants restrict this name to a specific ecotype of juniper growing in rocky places in the mountains, calling low elevation plants ***t'seex,*** while others call all common juniper ***laxsa laxnok.***

Harlan Smith (1926) reports use of a decoction of the whole plant of juniper for hemorrhage of the mouth and kidney trouble. It was reported to be a purgative and diuretic, and "to make one strong" (Luke Fowler, in Smith 1926). Fowler called the plant ***sk'an naxnok*** which means 'supernatural plant.'

Juniper is used by the Okanagan-Colville for respiratory illnesses and tuberculosis and as a tonic before a sweat (Turner *et al.* 1980). The Wet'suwet'en used juniper for a tonic to ward off flu or respiratory ailments. The Central Carrier use juniper for tuberculosis (Carrier Linguistic Committee 1973). The Haida also use juniper to treat tuberculosis and stomach ulcers (Deagle, unpublished manuscript).

Wild Calla.—***Hisgahldaatsxw*** [*Calla palustris* L.] *Calla palustris* grows in swampy areas and the shallow margins of ponds in wet mucky soil or up to 0.5 m of water. In the Skeena Valley it does not occur west of Seeley Lake, just west of Hazelton. The prostrate creeping stem and buds of wild calla are gathered in the early spring after the ice is gone but before leaf expansion. Our material was collected in mid April.

The entire plant contains irritating saponin-like substances and oxalic acid crystals which are rendered harmless by prolonged boiling (Hulten 1968; Kingsbury 1964). The preparation of the medicine involves boiling the fresh stems for six hours. Ingestion of medicine which has not been cooked long enough will cause throat irritation. Ingestion of raw calla will cause severe irritation of the oral cavity and throat, swelling and difficulty in swallowing.

Wild calla is reported as a medicinal plant used by the Gitksan by Harlan Smith (1926). He reports the name ***"shien"*** for this plant. Uses reported by his informant, Luke Fowler, included use of a decoction of calla for cleaning the eyes of the blind, for hemorrhage of lungs or mouth, for short breath and for treatment of influenza (Smith 1926). Our informant called the plant ***"hisgahldaatsxw,"*** which means resembles or similar to ***gahldaats,*** the yellow pond lily. Our informant uses this plant as a part of a mixture employed as a spiritual spring tonic. The use of *Calla palustris* for medicinal purposes is not reported for any other group in the herbal and ethnobotanical literature we have examined.

Indian Hellebore.—***'Mulgwasxw, Sk'an Ts'iks*** [*Veratrum viride* Ait.] (Fig. 6) Indian hellebore, *Veratrum viride,* grows in avalanche tracks, meadows and moist open montane plant communities. In Gitksan territory *V. viride* is found from about 450 m to timberline at around 1400 m. Near the coast *Veratrum viride* also grows in low elevation bottomland environments.

Veratrum viride roots ***('mulgwasxw)*** are gathered in the fall after the leaves senesce. This is frequently done by men in conjunction with hunting trips. The plants are located

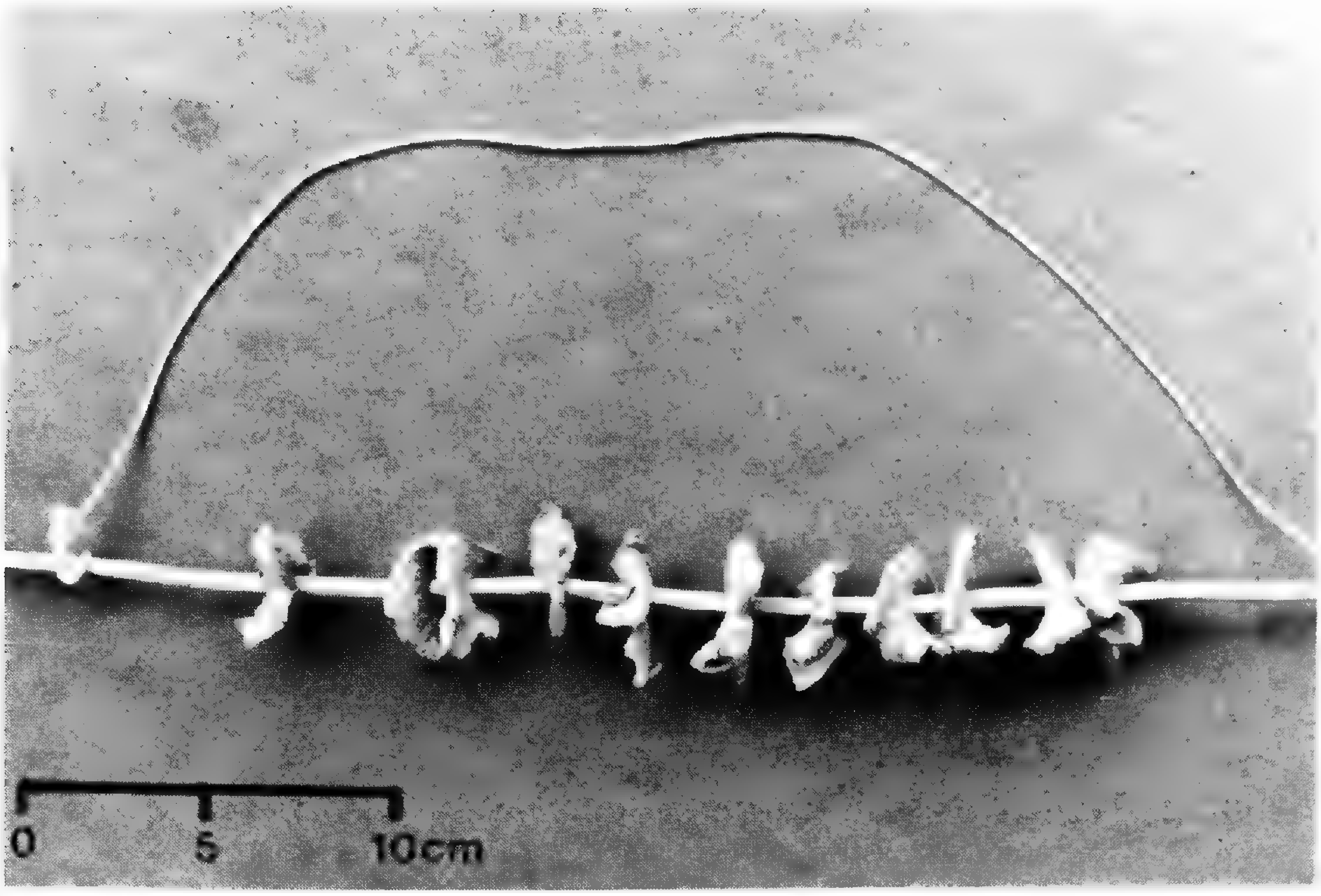


FIG. 5.—Freshly gathered wild calla ***hisgahldaatsxw*** *(Calla palustris).*

by the dead stalk and pieces of the rhizome dug up. The cleaned rootstock pieces are hung to dry and then stored.

'Mulgwasxw is the most important herb in use among modern Gitksan people. It is the rootstock of the Indian hellebore plant, *Veratrum viride.* The whole plant is called ***sk'an ts'iks. 'Mulgwasxw*** appears to differ from "ordinary" medicinal herbs in that it has high spiritual value. It is an herb of purification as well as healing. The proper state of mind is required to gather and use it. One should purify oneself before gathering ***'mulgwasxw*** by fasting and use of devil's club tea, and express proper thanks for the gift by saying a prayer and leaving a return gift.

The smoke of ***'mulgwasxw*** is used to assist the spirit of sleepwalkers in returning to the body properly. The grated dried root is used medicinally steeped in bath water for skin conditions (Wilson *et al.* 1984). The grated root can also be added to laundry water and used to purify or cleanse clothing. ***'Mulgwasxw*** is used to purify a house ("to kill the germs" or "to remove bad spiritual vibrations") by being burned as a smudge or fumigant on the (wood) stove top. It is believed to confer luck. Use of ***'mulgwasxw*** is intimately involved with purification rituals for hunting and trapping, and a piece may be carried as an amulet for luck in hunting and in gambling. ***'Mulgwasxw*** is highly valued, treated with respect and not left untended.

Turner (personal communication 1986) reports that the Lillooet use Indian hellebore root as a powerful medicine and that it is believed to confer luck. Infusions were used internally with great caution by these people. The Okanagan-Colville use it for rheumatism or arthritis and as a snuff. It is also reportedly used "to jinx people" (Turner *et al.* 1980). The Bella Coola use it for a skin wash, as a compress for sprains, bruises and fractures, and for luck. It is used internally with great care (Edwards 1980). The Haisla, a Northern Kwakiutl group, also use Indian hellebore root as an amulet for luck. Like the Gitksan the Haisla burn Indian hellebore root as a fumigant to drive away evil spirits. A dilute infusion of the grated rootstock, mixed with other herbs, is also taken internally by some Haisla. Victims of the 1918 influenza epidemic were treated with Indian

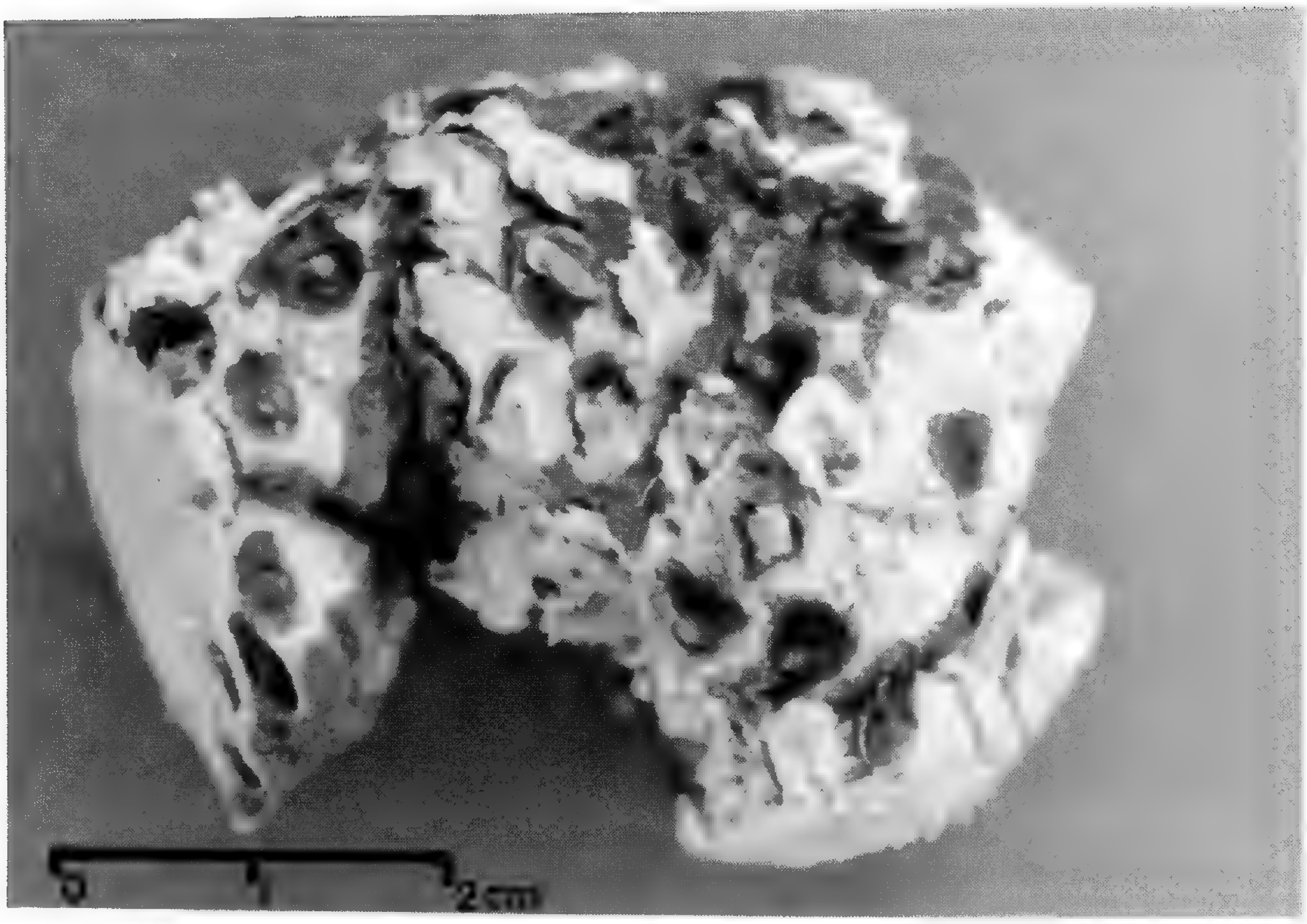


FIG. 6.—Dried **'mulgwasxw** *(Veratrum viride root).*

hellebore root infusions (personal communication, Lloyd Starr). The Tsimshian in Southeast Alaska (originally from Metlakatla, B.C.) use Indian hellebore ("skookum root") for scalp disease and as a snuff for sinus infections. The leaves were used to treat arthritis. The root was used in a treatment for insanity. A decoction of the whole root was evidently taken internally, but it is not clear for what purposes (MacGregor 1981). Haida of Southeast Alaska apparently use Indian hellebore for a tranquilizer and pain killer (MacGregor 1981). Decoctions of "skookum root" were used for treatment of diverse illnesses, including menstrual cramps and (with devil's club) pneumonia by the Yakutat Tlingit (de Laguna 1972). Like other groups they treated baldness and scalp conditions with "skookum root."

Veratrum viride contains a number of toxic alkaloids including veratrine, veratrasine, veratramine, veratrin (Edwards 1980; Jeger and Prelog 1960; Kingsbury 1964). These alkaloids act to depress blood pressure, and can cause "salivation, prostration, depressed heart action, and dyspnea . . . additional subjective symptoms include burning sensations of the mouth and throat, hallucinations and headache" (Kingsbury 1964:460). It is an extremely toxic plant, and only knowledgeable persons should use it. Overdoses can be fatal. It is not normally used internally by the Gitksan. Chemical components of the smoke of burning Indian hellebore root have not been investigated nor have the medical effects of smoke inhalation been described.

DISCUSSION

Opportunities to obtain medicinal plants depended in the past on the annual cycle of movement on the land. The location of seasonal subsistence activities determined which plant communities were available. This exerts some control on medicinal plant use in the present as well. For example, different plants are available in floodplain forests adjacent to fishing sites and subalpine meadows near berry picking areas. The phenology of desired plants must also be taken into account as the properties and chemical composition of plant parts changes with the stage of maturity. Some plants can be gathered when available at the right stage and dried for later use such as yellow pond lily root or Indian hellebore, while other plants must be gathered fresh for immediate preparation and use. The selection of which plants to utilize to treat a condition is, therefore, influenced by what plants are available for use at the time they are needed. Plants which have to be used when freshly gathered can only be used if available nearby at the right stage, whereas other products can be used from stored supplies at any time.

As in European and Asian folk medicine, Gitksan medicines are used as tonics or for the treatment of specific symptoms of disease. Purification differs from these approaches because its goal is the treatment of the whole individual to prevent or overcome a diseased state. The role of 'purification' in Gitksan medicine has parallels in the medical practices of other indigenous groups in northwestern North America (Vogel 1970; Kew & Kew 1981). As the person and the environment are seen as harmoniously interacting wholes, imbalance in the individual or environment is believed to have potentially far-reaching consequences for health. Therefore, purification, the removal of impurity and the restoration of the natural balance, is seen as an important aspect of maintenance of health.

Many Gitksan teaching stories warn of the consequences of disturbing the balance of nature such as the famous story of the One-Horned Goat of Temlaham (Harris 1974; Barbeau-Beynon notes). In this drama failure to respect the mountain goats results in overhunting, mistreatment of the animals and subsequent disaster for the village as the goats wreak their vengeance. A virtuous man who remembers the proper behavior and acknowledges the equality of living things is permitted to survive and teaches the remaining people how they must act to maintain the balance and bring prosperity for their people.

Purification in traditional Gitksan society was sought in each season for different functions. Men underwent purification before setting out for such important activities as trapping and hunting. Women underwent purification in connection with puberty, menstruation and childbirth. The springtime was the most important season for purification. This process was accomplished through various means such as fasting, bathing in cold water, sweat baths, solitary meditation or use of herbal preparations. Herbs such as Indian hellebore and devil's club were utilized for this purpose. Purification was an individual matter. Each person sought to resolve conflicts and achieve harmony through his or her own efforts.

Concepts of purification are finding a role in the present particularly in dealing with stress and emotional disorders. Purification can provide a means for the stressed individual to alleviate or remove the stress and thereby improve mental and physical health. The ***Wilp-si-Satxw*** (House of Purification) Society, a modern group sponsored by the Gitksan-Wet'suwet'en Tribal Council to deal with problems of mental health and substance abuse, is investigating ways to integrate traditional approaches to purification with a modern drug and alcohol abuse treatment program.

THE EFFECT OF EUROPEAN CONTACT ON GITKSAN TRADITIONAL MEDICINE

In the period of contact, a systematic disruption of aboriginal culture took place, particularly by the agency of Christian missionaries. The ***Wilp si Satxw*** (house of purification) and the ***Halayt*** were banned as pagan. Healing was taken out of the hands of the traditional practitioners. The holistic preventative approach of traditional healers was largely supplanted by Western allopathic medicine. New infectious diseases and alcohol had arrived with the Europeans, creating previously unknown health problems. The outlawing of the potlatch (literally, "the Gift") was a fundamental attack on the integrity of the aboriginal culture as the feasthall was the place where all important public business and much of the education took place, with the community participants as witnesses (Neil Sterrit Jr., personal communication). The so-called "Potlatch Law," which came into effect January of 1885, prohibited potlatches and winter ceremonies and provided six months imprisonment as the punishment for participation in such activities (Raunet 1984). These clauses were finally dropped from the Indian Act in 1951 (Duff 1964).

As in much of North America, the government and missionaries, from the turn of the century until the 1960s, deliberately supplanted the traditional culture by isolating the children in residential schools where they were forbidden to speak their language (Levine and Cooper 1976). Strong pressure was applied to children to reject their own cultures as primitive and backward. This disrupted both the extended family and the nuclear family and removed the children from the process of cultural transmission and traditional education at about six years of age. The pivotal role of elders in traditional education was particularly undermined, especially as the children lost fluency in their native tongue. Botanical and healing concepts and spiritual values were difficult for elders to express in an unfamiliar tongue. This knowledge has therefore been especially vulnerable.

Despite these policies Gitksan is still widely spoken in the Skeena Valley. The Gitksan Wet'suwet'en Tribal Council estimates the number of Gitksan speakers at about 800 people. However, children are rarely fluent speakers in spite of efforts to revive the language with the establishment of language programs in the local schools (Powell and Stevens 1977; Jensen and Powell 1979).

Although there have been far reaching changes to Gitksan society in the past one hundred years, traditional medicinal practices have survived and are being practiced today. A great deal more information on the aboriginal medical practices of the Gitksan remains in the minds of elders still living. The paucity of young Gitxsanimx speakers makes the interviewing of these elders and the translation of their knowledge of traditional culture into English an activity which should not be delayed. The resurgent interest in traditional culture has extended to Gitksan traditional medicine. This project is an outgrowth of the renewed interest in Gitksan traditional medicine by the Gitksan people, and their desire to preserve their knowledge of medicines and healing.

CONCLUSION

Gitksan use of plants for medicines must be seen within the cultural context of views of the nature of health and healing. Plant utilization will also reflect availability to potential users in the course of their annual activity patterns, changes in plant properties at different phenological stages, and the storage qualities of the herbal preparation produced.

The three most important medicinal plants used by the Gitksan today are Indian hellebore *(Veratrum viride)* root, devil's club *(Oplopanax horridum)* bark, and yellow pond lily *(Nuphar polysepalum)* rootstock. Gitksan plant uses are similar to uses reported for the plants by other British Columbia Indian groups, particularly those of similar geographic and cultural regions. However, some differences in emphasis are notable, and certain plants, such as wild calla *(Calla palustris)*, do not seem to be utilized by other groups reported in the literature.

ACKNOWLEDGEMENTS

We would like to acknowledge the staff of the Gitksan-Wet'suwet'en Tribal Council for assistance and support during this research effort and to acknowledge and thank all of the Gitksan people who have been generous with their time and knowledge making this project possible. We would also like to thank several Wetsuweten elders: Charles Austin, Andrew George and Alfred Joseph; and Lloyd Starr of Kitamaat Village for sharing their knowledge with us and assisting us with this project. We wish to thank Lee Oates for sharing his materials on Northwest plant uses, Nancy Turner, Allen Gottesfeld and Ian Anderson for helpful comments on the manuscript, and Phillip Howard Jr., Kathy Holland and Eric MacPherson for field assistance. Any errors of fact or interpretation are the sole responsibility of the authors.

LITERATURE CITED

ADAMS, J. W. 1973. The Gitksan Potlatch: Population Flux, Resource Ownership and Reciprocity. Holt, Rinehart & Winston of Canada, Ltd., Toronto and Montreal.

AGRAWAL, O. P., J. S. BHARADWAJ and R. MATHER. 1980. Antifertility effects of fruits of *Juniperus communis*. Planta Medica Suppl. 40:98-101.

BARBEAU, M. and W. BEYNON. Unpublished interview notes in Archives, National Museums of Canada.

BELKIN, M., D. B. FITZGERALD and M. D. FELIX. 1952. Plants Used as Diuretics. Nat. Cancer Instit. 13:741- .

BOROKOV, A. V. and N. V. BELOVA. 1967. Ursolic acid in certain plants. Khim. Prir Soedin 3:62A- .

CAMM, E. L., W. CHI-KIT and G. H. N. TOWERS. 1976. An Assessment of the roles of furanocoumarins in *Heracleum lanatum*. Canadian J. Botany 54:2562-2566.

CARRIER LINGUISTIC COMMITTEE. 1973. ***Hanuyeh Ghun 'Utni-i***, Carrier Linguistic Committee, Fort Saint James, British Columbia.

COVE, J. 1982. The Gitksan Traditional Concept of Land Ownership. Anthropologica. 24:3-17.

DEAGLE, G. Haida Medicine, unpublished manuscript.

DE LAGUNA, F. 1972. Under Mount Saint Elias: The History and Culture of the Yakutat Tlingit, Part Two. Smithsonian Institution Press, City of Washington.

DE PASCUAL, T. J., A. F. BARRERO, L. MURIEL, A. SAN FELICIANO and M. GRANDE. 1980. New Natural Diterpene acids from *Juniperus communis* Phytochemistry 19:1153-1156.

DRUCKER, P. 1955. Indians of the Northwest Coast. American Museum of Natural History, New York.

DUFF, W. 1959. Introduction. *In* Histories, Territories and Laws of the Kitwancool (W. Duff, ed.). Anthropology in B.C. Memoir No. 4. British Columbia Provincial Museum, Victoria.

DUFF, W. 1964. Indian History of British Columbia Vol. 1: Impact of the White Man. Anthropology in British Columbia Memoir 5. Provincial Museum of Anthropology and Natural History, Queen's Printer, Victoria, British Columbia.

EDWARDS, G. T. 1980. Bella Coola Indian and European Medicines. The Beaver Winter 4-11.

GARFIELD, V. 1939. Tsimshian Clan and Society. Univ. of Washington, Seattle.

GUNTHER, E. 1973. Ethnobotany of Western Washington, the Knowledge and Use of Indigenous Plants by Native Americans, Rev. Edit. Univ. Washington Press, Seattle and London.

HINDLE, L. and B. RIGSBY. 1973. A Short Practical Dictionary of the Gitksan Language. Northwest Anthropol. Res. Notes 7(1).

HULTEN, E. 1968. Flora of Alaska and Neighboring Territories, a Manual of the Vascular Plants. Stanford Univ. Press, Stanford, California.

JEGER, O. and V. PRELOG. 1960. Steroid Alkaloids, Veratrum Group. Pp. 363-417 *in* The Alkaloids, V. VII, (R. H. F. Manse, ed.). Academic Press, New York.

JENSEN, V. and J. V. POWELL. 1979. Learning Gitksan, Book 1, Western Dialect. Kitwancool, Kitsegukla and Kitwanga Indian Bands, Kitwanga, British Columbia.

LITERATURE CITED (continued)

JUSTICE, J. W. 1966. Use of Devil's Club in Southeast Alaska. Alaska Medicine 8:36-39.

KARIYONE, T. and S. J. MOROTOMI. 1927. The essential oil of *Echinopanax horridus*, Decne et Planch. J. Pharma. Soc. Japan 546:671-674.

KEW, M. and D. KEW. "People need friends, it makes their minds strong," a Coast Salish curing rite. *In* The World is as Sharp as a Knife, (D. Abott, ed.) 29-36. British Columbia Provincial Museum, Victoria.

KINGSBURY, J. M. 1964. Poisonous plants of the United States and Canada. Prentice-Hall, Englewood Cliffs, New Jersey.

KUHNLEIN, H. and N. J. TURNER. 1986. Cow Parsnip *(Heracleum lanatum* Michx.): an indigenous vegetable of Native People of Northwestern North America. J. Ethnobiol. 6(2):309-324.

LAMER-ZARAWAKA, E. 1977. Flavonoids of *Juniperus communis*. Rocz Chem 51:2131- .

LEVINE, R. and F. COOPER. 1976. The Suppression of B.C. Languages: Filling Gaps in the Documentary Record. Sound Heritage (3&4):43-75.

LINDER, W. and D. GRILL. 1978. Acids in conifer needles. Phyton (Horn, Austria) 18:137- .

MACARTHUR, R. H. and E. R. PIANKA. 1966. An optimal use of a patchy environment. Amer. Natur. 100:603-609.

MACGREGOR, M. 1981. Native Medicine in Southeast Alaska: Tsimshian, Tlingit, Haida. Alaska Medicine 23(6):65-69.

MAY, G. and G. WILLUHN. 1978. Antiviral activity of aqueous extracts from medicinal plants in tissue cultures. Drug Res. 28(1):1-7. (in German)

PEOPLE OF 'KSAN. 1980. Gathering What the Great Nature Provided. Douglas & McIntyre Ltd, Vancouver British Columbia and Univ. Washington Press, Seattle, Washington.

POWELL, J. V. and R. STEVENS. 1977. Gitsanimx. Gitksan Language Book 1. Kispiox Band, Hazelton, British Columbia.

RAUNET, D. 1984. Without Surrender, Without Consent. Douglas & McIntyre, Vancouver.

SIH, A. 1982. Optimal patch use: variation in selective pressure for efficient foraging. Amer. Natur. 120:666-685.

SMITH, G. W. 1983. Arctic Pharmacognosia II. Devil's Club, *Oplopanax horridus*. J. of Ethnopharma. 7:313-320.

SMITH, H. I. 1926. Gitksan Ethnobotany. Unpublished manuscript prepared for the National Museum of Canada, on file National Museums of Canada.

__________. 1928. Materia Medica of the Bella Coola and Neighbouring Tribes of British Columbia. Pp. 47-68 *in* 1927 Annual Report of the National Museum of Canada. Kings Printer, Ottawa.

STUHR, E. T. and E. B. HENRY. 1944. An investigation of the root bark of *Fatsia horrida*. Pharma. Archives 15:9-15.

TREASE, G. E. and W. C. EVANS. 1983. Pharmacognosy, 12th Edition. Bailliere Tindall, Eastbourne.

TURNER, N. 1975. Food Plants of British Columbia Coastal Indians, Part 1, Coastal Peoples. British Columbia Provincial Museum Handbook No. 34. British Columbia Provincial Museum, Victoria.

__________. 1978. Food Plants of British Columbia Indians, Part 2, Interior Peoples. British Columbia Provincial Museum Handbook No. 36. British Columbia Provincial Museum, Victoria.

__________. 1981. Indian Use of *Shepherdia canadensis*, Soapberry, in Western North America. Davidsonia 12(1):1-11.

__________. 1982. Traditional Use of Devil's-Club *(Oplopanax horridus*; Araliaceae) by Native Peoples in Western North America. J. Ethnobiol. 2(1):17-38.

TURNER, N., R. BOUCHARD and D. I. D. KENNEDY. 1980. Ethnobotany of the Okanagan-Colville Indians of British Columbia and Washington. British Columbia Provincial Museum No. 21, Occasional Papers Series. British Columbia Provincial Museum, Victoria.

TURNER, N., J. THOMAS, B. F. CARLSON and R. T. OGILVIE. 1983. Ethnobotany of the Nitinaht Indians of Vancouver Island. British Columbia Provincial Museum, Occasional Papers Series No. 24. British Columbia Provincial Museum, Victoria and Parks Canada, Western Region.

VOGEL, V. 1970. American Indian Medicine. Univ. Oklahoma Press, Norman.

WILSON, S. P. PIERRE, M. HOWARD and G. RUSSELL. 1984. Some Medicinal Remedies of the Gitksan People, unpub-

LITERATURE CITED (continued)

lished manuscript, Kitsegukla Band Council, Kitsegukla, B.C.

WINTERHALDER, B. 1981. Optimal Foraging Strategies and Hunter-Gatherer Research in Anthropology: Theory and Models. Pp. 13-35 *in* Hunter Gatherer Foraging Strategies, (B. Winterhalder and E. A. Smith, eds.). Univ. Chicago Press, Chicago and London.

YARDIN, H. 1936. Presence of alkaloids in *Sambucus* species. Compt. Rend. Soc. Biol. 122:155-156.

NOTES

[1]Botanical nomenclature follows Eric Hulten, Flora of Alaska and Neighboring Territories, Stanford University Press, Stanford, California 1968 except for *Oplopanax horridum* (Smith) Miq.

[2]Patchiness is an ecological concept relating to the distribution of resources in the environment. A patchy environment is an environment where the attribute or resource under consideration is not uniformly or evenly dispersed. Within a patch the resource may be abundant and efficient to utilize; between patches, the resource is absent or too dispersed for efficient use. See MacArthur & Pianka. 1966, Winterhalder 1981, and Sih 1982 for discussions of foraging efficiency in patchy environments.

[3]Gitksan names are transcribed following the orthography used in the Western Gitksan and Gitxsanimx language text series (Jensen and Powell 1979; Powell and Stevens 1977). Some spellings were also derived from Lonnie Hindle and Bruce Rigby's Practical Dictionary of the Gitksan Language (1973).

[4]A list of the Gitksan people who generously shared their knowledge and time to provide information for this study follows: Beverley Anderson, Abel Brown, Martha Brown, Godfrey Good, David Green, Phillip Howard, Sadie Howard, Ernest Hyzims, Fred Johnson, Joanne MacKay, Elsie Morrison, Gertie Morrison, Pete Muldoe, Olive Mulwain, Lilac Russell, Don Ryan, Bertha Starr, Neil Sterrit Jr., Neil Sterrit Sr., Percy Sterrit, Jeff Wilson, Marie Wilson, Walter Wilson.

[5]References not included in the citations for this article will be found in Nancy Turner's review article on Devil's Club (Turner 1982).

A Manual of Ethnobotany. S.K. Jain, ed. Jodhpur, India: Scientific Publishers, 1987. Pp. x, 228. Rs. 125.

During the past quarter-century, India has been in the forefront of ethnobotany. There is hardly another nation that has so many trained young ethnobotanists. One of the outstanding leaders in this upsurge of interest in ethnobotany is Dr. S.K. Jain. He has many achievements to his credit, principal amongst which is his major influence in founding the very active Indian Society of Ethnobotany. The editing of this significant *A Manual of Ethnobotany* is certainly not one of his least contributions to the high place that this inter-disciplinary discipline has attained in his country.

The book fully covers the concepts, scope, practical and academic value, and field methodology of ethnobotany and instruction in this aspect of science. Fifteen Indian specialists have contributed to the work, which is divided into 16 sections, all of which are based on lectures given at a meeting of the Indian Society of Ethnobotany held at Lucknow in 1986. The spectrum of topics considered is very wide-ranging, from the scope and subdisciplines of ethnobotany to plants in magico-religious beliefs in the Sanskrit literature and guidelines to the preparation of scientific and technical papers, reports, and popular articles.

India must be congratulated; Dr. Jain must be thanked; and the contributors must receive our gratitude for the effort involved in producing this worthwhile and useful manual.

Richard Evans Schultes
Professor Emeritus
Botanical Museum of Harvard University
Cambridge, Massachusetts 02138

J. Ethnobiol. 8(1):35-44 Summer 1988

NUMERICAL ANALYSIS OF ARCHAEOLOGICAL *CUCURBITA PEPO* SEEDS FROM HONTOON ISLAND, FLORIDA

DEENA S. DECKER
Department of Botany
University of Guelph
Guelph, Ontario
Canada N1G 2W1

and

LEE A. NEWSOM
University of Florida
Department of Anthropology
Gainesville, Florida 32611

ABSTRACT.— Numerous well-preserved cucurbit seeds were recovered from water-saturated deposits at Hontoon Island, Florida. These deposits indicate a continuous occupation at the site from approximately 500 B.C. through A.D. 1750. Visual examination as well as numerical analysis of the seeds suggest that while some seeds represent cultivated forms of *Cucurbita pepo*, others resemble wild members of the species (ssp. *ovifera* var. *texana*). Temporal changes in the seed remains suggest *in situ* developments in some cases and introductions in other cases.

INTRODUCTION

In 1980, excavations began at a shell midden site on Hontoon Island (8-VO-202) on the St. Johns River in northeastern Florida (Purdy and Newsom 1985; Newsom 1986). Ceramic chronology and radiocarbon dates indicate that the excavated deposits range from approximately 500 B.C. to A.D. 1750 (Newsom 1986). Plant remains, including over 1500 squash seeds, were recovered from water-saturated deposits over a five year period. The squash seeds, identified as *Cucurbita pepo* L., were uncharred though tannin-stained. Both the quantity and excellent preservation of these seeds provided the opportunity to examine temporal variation in *C. pepo* remains and make comparative analyses with modern material, both domesticated (*C. pepo* ssp. *pepo* and *C. pepo* ssp. *ovifera* (L.) Decker var. *ovifera* (L.) Alef.) and wild (*C. pepo* ssp. *ovifera* (L.) Decker var. *texana* (Scheele) Decker) (Decker 1986, 1988).

Of particular interest was the possible affinity of the Hontoon Island seeds with those of var. *texana*. Viewed alternately as a feral escape and as progenitor to domesticated forms, var. *texana* always has been considered wild or weedy, while the rest of the species consists wholly of cultivars and landraces. The variety *texana* traditionally has been considered endemic and restricted to Texas (Correll and Johnston 1979). Although spontaneous populations of *texana*-like plants occurring beyond Texas (e.g., Alabama, Arkansas, Illinois, and Missouri) are usually considered cultivar escapes, recent evidence suggests they may represent remnants of original wild populations in an area northeast of Texas (Decker 1986; Decker and Wilson 1986, 1987). The existence of archaeological remains that may represent var. *texana* could have great impact on this controversy.

A recent study of modern domesticated and wild *C. pepo* seeds (Decker and Wilson 1986) has provided a methodological framework for testing the affinities between the archaeological and modern material.

MATERIALS AND METHODS

Although various units, trenches, and columns have been excavated at Hontoon Island, this study focuses on the 1980 Unit and 1982 Column. These had fairly good stratigraphic control and together covered the earliest known cultural level at the site through the Spanish Period (Newsom 1986). The 1980 Unit was a 3 m square excavated stratigraphically to about 150 cm below the surface. The uppermost and lowermost zones, one and five respectively, were devoid of cultural artifacts. The Spanish Period is represented by Zone 2 and the top of Zone 3 (Newsom 1986). Two radiocarbon dates of A.D. 1190 and A.D. 1220 were associated with Zone 4 (Newsom, unpubl. data). The 1982 Column was excavated to a depth of 140 cm. Levels were arbitrarily defined at 10 cm intervals from the surface. Levels 1 through 4 lacked cultural artifacts even though some cucurbit remains were found in Level 4 (Newsom 1986). The earliest radiocarbon date associated with Level 14 was A.D. 800. Level 10 was dated to approximately A.D. 1470, while 17th century dates begin to appear in Level 8 (Newsom, unpubl. data).

Most of the complete or nearly complete squash seeds from these two excavations were examined. A total of 253 seeds were measured using the digitizing hardware and image analysis software previously employed to measure modern seeds (Decker and Wilson 1986). Information recorded from the face view of the seed included whole image measurements such as length and width, as well as measurements based on division of the seed from bottom (seed scar) to top by 10 equidistant diameters to produce partial areas and widths (Decker and Wilson 1986: Fig. 1).

Data from Decker (1986) and Decker and Wilson (1986) served as modern comparative material. *Cucurbita pepo* cultivars were chosen that represented the range of variation in the species, including members from both subspecies. *Cucurbita pepo* ssp. *pepo* was represented by pumpkins (PJO 71, PSU 72), zucchinis (MBZ 206, MGZ 46), 'Vegetable Spaghetti' (UVS 50), Mexican accessions (XCC 163, 172, XV? 225, X?I 124), and one ornamental gourd cultivar (OWO 56). Accession codes and corresponding cultivar names are listed in Decker (1986) and Decker and Wilson (1986). Infraspecific classification of cultivars follows Decker (1986, 1988). *Cucurbita pepo* ssp. *ovifera* var. *ovifera* was represented by various ornamental gourds (OBB 3, OEN 1, OEW 62, OFS 55, OPB 10, OPS 18, OPW 60, OSB 46), a crookneck (CYE 118), and a scallop squash (SWB 61). Populations of *C. pepo* ssp. *ovifera* var. *texana* were included in the analyses also (TEX 1, 2, 3, 4, 5, 6, 10, 17, 31, 36). Ten accessions (10 seeds per accession) from each of the three infraspecific taxa were used to establish two canonical discriminant functions. Each archaeological seed was subsequently classified to one of the three taxa on the basis of the discriminant functions.

Analyses focused on a small but important subset of the original characters. Temporal analysis of the archaeological seeds was based primarily on overall width and length measurements. For the discriminant procedure (subprogram DISCRIMINANT in SPSS (Klecka 1975)), a stepwise selection technique based on Wilks' lambda (procedure STEPDISC in SAS (Ray 1982)) was used to choose five characters that could best discriminate the three taxon classes: width (W), length (L), RCPWD, RCRWD, and REPAR. RCPWD and RCRWD are ratios of the widths CP and CR over the overall width (W), respectively. The width CP was measured at 1/9 the length of the seed from the seed scar, while CR was measured at 3/9 the length. REPAR is the ratio of the second partial area up from the seed scar (EP) over the entire face view area of the seed. Together, these three ratios characterize the size and shape of the small sinuses on either side of the seed near the seed scar.

The discriminating power of the five characters was tested by defining two discriminant functions on the basis of nine of ten seeds randomly chosen from each accession. The remaining seeds served as a test group. Observations were classified on the basis of posterior probabilities of group membership, or P(G|X). For classification of the archaeological seeds, the discriminant functions were redefined on the basis of all the modern seed material. Four of the original 253 seeds were not classified because of aberrations in these seeds near the seed scar.

RESULTS

Width and length statistics are presented in two plots (Fig. 1 and 2) and in Table 1. Among the seeds recovered from the 1980 unit, one seed from Zone 2 is much larger than the other seeds (Fig. 1). The remaining seeds show a decrease in size from older

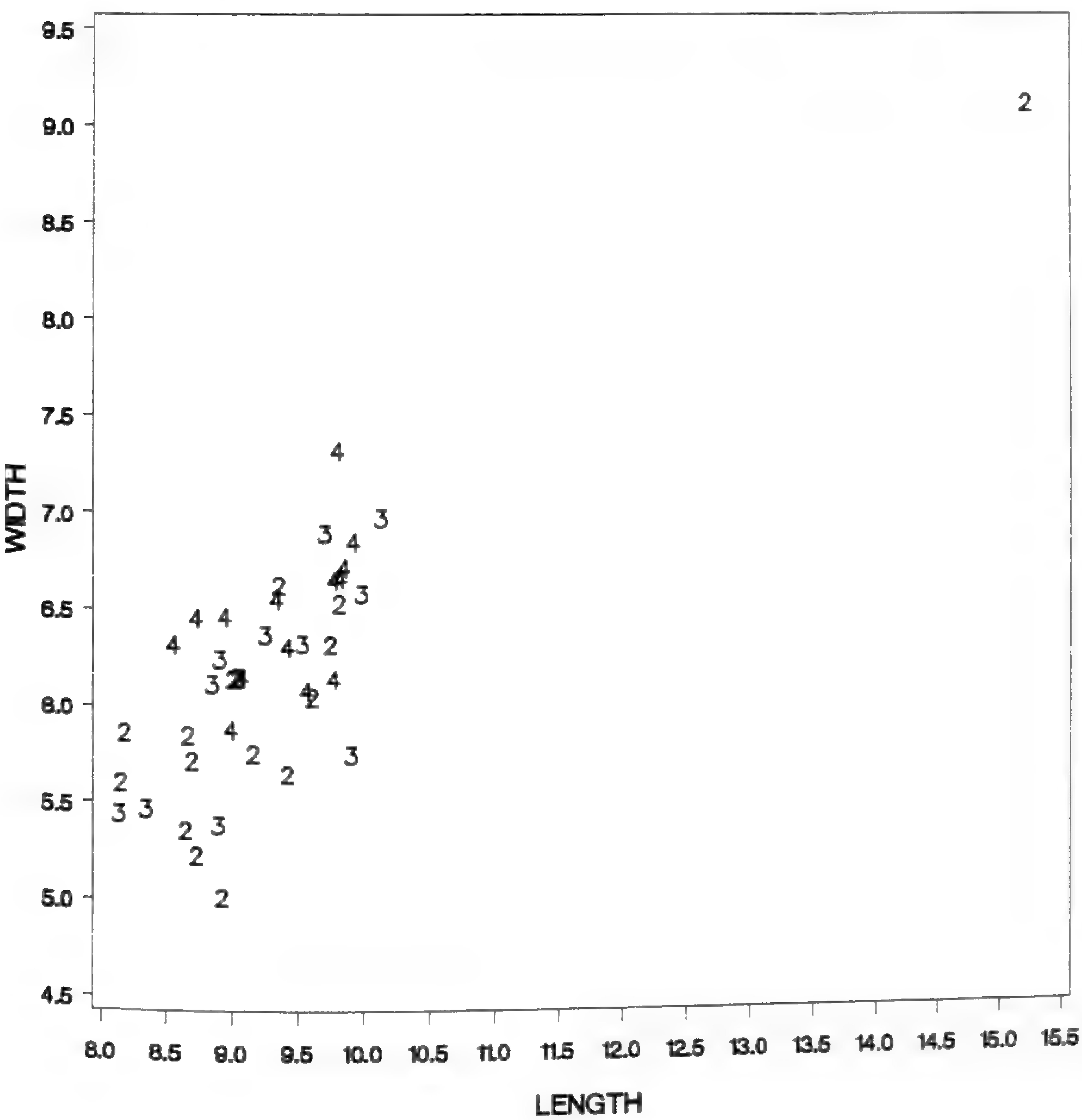


FIG. 1.—Width by length plot of the archaeological cucurbit seeds from the 1980 Unit at Hontoon Island. Numbers indicate the zone in which a seed was found. Units are mm.

TABLE 1.—*Width and length statistics for the archaeological seeds from Hontoon Island, var.* texana, *and 20 cultivars of* C. pepo. *Data on modern seeds are from Decker (1986) and Decker and Wilson (1986).*

Excavation/ Taxon	Level[1]/Zone/ Cultivar	N	WIDTH Mean[2]	WIDTH S.D.[3]	LENGTH Mean	LENGTH S.D.	W/L
80	2	16	6.05	0.93	9.39	1.63	0.64
80	2A	15	5.85	0.46	9.00	0.51	0.65
80	2B	1	9.10	.	15.22	.	0.60
80	3	12	6.13	0.54	9.22	0.64	0.66
80	4	14	6.46	0.37	9.39	0.46	0.69
82	4	1	5.90	.	8.93	.	0.66
82	5	25	6.11	0.45	9.07	0.67	0.67
82	6	50	7.10	0.79	10.35	1.18	0.69
82	6A	24	6.37	0.42	9.28	0.71	0.69
82	6B	26	7.76	0.33	11.33	0.41	0.68
82	7	40	6.38	0.44	9.43	0.53	0.68
82	8	24	6.47	0.50	9.63	0.85	0.67
82	8A	23	6.42	0.45	9.54	0.75	0.67
82	8B	1	7.64	.	11.68	.	0.65
82	9	13	6.10	0.52	9.55	0.75	0.64
82	10	21	6.14	0.55	9.36	0.51	0.66
82	11	16	6.18	0.44	9.14	0.53	0.68
82	12	16	6.30	0.50	9.07	0.34	0.69
82	13	3	6.10	0.36	9.01	0.86	0.68
82	14	2	6.62	0.18	9.94	0.04	0.67
var. *texana*	TEX	100	6.11	0.43	9.44	0.67	0.65
var. *ovifera*	CYE 118	10	7.05	0.53	11.66	0.74	0.60
var. *ovifera*	OBB 3	10	5.20	0.29	9.73	0.63	0.53
var. *ovifera*	OEN 1	10	6.63	0.55	10.80	0.74	0.61
var. *ovifera*	OEW 62	10	5.91	0.35	9.59	0.80	0.62
var. *ovifera*	OFS 55	10	5.84	0.56	9.83	0.69	0.59
var. *ovifera*	OPB 10	10	5.60	0.34	8.97	0.62	0.62
var. *ovifera*	OPS 18	10	5.53	0.42	8.94	0.74	0.62
var. *ovifera*	OPW 60	10	5.89	0.67	8.80	0.85	0.67
var. *ovifera*	OSB 46	10	5.16	0.44	8.13	0.63	0.63
var. *ovifera*	SWB 61	10	7.87	0.71	12.62	1.39	0.62
ssp. *pepo*	MBZ 206	10	8.03	0.39	12.16	0.48	0.66
ssp. *pepo*	MGZ 46	10	8.88	0.60	14.06	0.92	0.63
ssp. *pepo*	OWO 56	10	7.03	0.73	12.09	0.78	0.58
ssp. *pepo*	PJO 71	10	8.98	0.81	16.04	1.40	0.56
ssp. *pepo*	PSU 72	10	8.36	0.90	14.37	1.46	0.58
ssp. *pepo*	UVS 50	10	9.01	0.47	13.74	0.98	0.66
ssp. *pepo*	XCC 163	10	9.19	0.65	20.36	1.99	0.45
ssp. *pepo*	XCC 172	10	8.39	0.51	19.52	1.88	0.43
ssp. *pepo*	XV? 225	10	8.95	0.55	19.96	1.31	0.45
ssp. *pepo*	X?I 124	10	8.72	0.59	17.82	0.83	0.49

[1]Values were calculated for all seeds of a level or zone first. When width x length plots (Fig. 1 and 2) revealed the presence of outliers or more than one grouping, then values were recalculated for the new groups, designated A and B.

[2]Units are mm.

[3]Standard deviation.

to younger deposits (Fig. 1, Table 1). Additionally, the width to length ratios (W/L) indicate that at least some seeds near the top of the unit (Zone 2) are relatively thinner. The exceptionally large seed has a particularly low value for this ratio (Table 1).

The plot of the 1982 data (Fig. 2) reveals a small group of seeds somewhat removed from and larger than all other seeds. This group consists of about half the seeds from Level 6 and one seed from Level 8. A few seeds from Levels 6 through 9 occur in the transition zone between these larger seeds and the numerous smaller seeds. Interestingly, some of the smallest seeds from the column are also from the upper strata. Most of the seeds from the column are within the size range for the var. *texana* seeds used in this study (width = 5.07 to 7.52 mm; length = 7.86 to 10.91 mm). However, the seeds representing var. *ovifera* have similar ranges in width (4.60 to 8.77 mm) and length (7.16 to 14.30 mm). Only the largest seeds from the column fall within the size range of ssp. *pepo* seeds (width = 6.15 to 10.60 mm; length = 10.80 to 23.20 mm). Average W/L ratios among levels in the column are about the same except for the somewhat lower values in Levels 4 and 8 through 10 (Table 1). Among individual seeds, some from Level 12 have values as high as 0.80, while others from Level 10 have values as low as 0.57 (Fig. 2).

In both the 1980 Unit and 1982 Column, there appears to be more diversity in seed size in the younger deposits. This can be tested by calculating a unitless statistic of

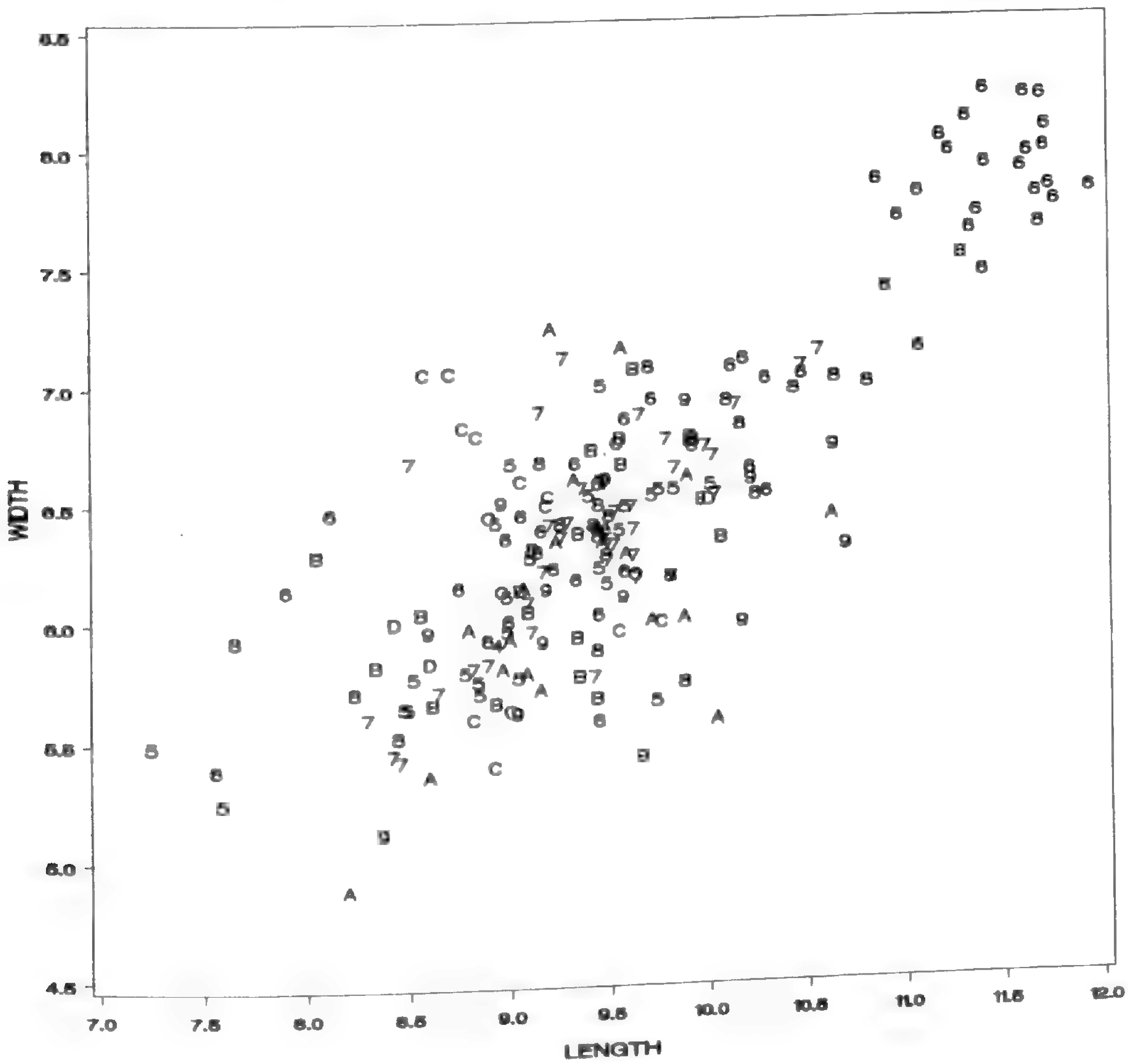


FIG. 2.—Width by length plot of the archaeological cucurbit seeds from the 1982 Column at Hontoon Island. Numbers and letters indicate the level in which a seed was found (letters A-E represent Levels 10-14, respectively). Units are mm.

variability, called the coefficient of variation (C.V. = 100 x S.D./mean), from values listed in Table 1. In the 1980 Unit, Zone 4 has the lowest coefficients of variation for width (C.V. = 5.72) and length (C.V. = 4.91), while Zone 2 has the highest values (width C.V. = 15.31; length C.V. = 17.36). The highest coefficients of variation in the 1982 Column are for Level 6 (width C.V. = 11.18; length C.V. = 11.39).

On the basis of width, length, and W/L, the majority of small seeds from Hontoon Island most resemble seeds of var. *texana*. Among the modern accessions reported here, pumpkins, especially those from Mexico, have the lowest values for W/L, while var. *texana*, 'White Pear' (OPW 60), 'Black Zucchini' (MBZ 206), and 'Vegetable Spaghetti' (UVS 50) have the highest values (Table 1). Values for most of the archaeological material are even higher. Relatively high values for W/L are not uncommon for *C. pepo* seeds from eastern U.S. sites (King 1985). Among the Hontoon Island seeds, the very large and relatively narrow seed in Zone 2 has a much lower value. Its measurements place it within ssp. *pepo*. In contrast, the large seeds of Levels 6 and 8 are most similar in their dimensions to the scallop, a member of var. *ovifera*. Thus, all three infraspecific taxa appear to be represented by the archaeological seeds. This was tested further via the discriminant analysis.

Classification of the test group was 89% accurate. After the discriminant functions were redefined using all of the modern seeds, both the modern and archaeological seeds were classified (Table 2). The percentage of correctly classified modern seeds was somewhat lower (86.3%) than predicted by the test group due to a few accessions that did not fit well into their respective taxa. Parallel evolution within the two domesticated lines is not surprising given that seed characters are influenced by human selection pressures.

Over half of the archaeological seeds were classified as var. *texana* (Table 2). In fact, the majority of seeds in all zones and levels, except Levels 4, 5, and 14 were placed into the var. *texana* group. Although the Level 14 seeds were classified as var. *ovifera*, both seeds had P(X|G) (probability that a seed that far from the centroid actually belongs to the group) values of less than 27% and actually fell closer to the var. *texana* centroid (Fig. 3). They were not identified as var. *texana* because their positions were slightly beyond the range for var. *texana* seeds. In Level 6, the majority of small seeds were categorized as var. *texana*, while most of the larger seeds fell into the var. *ovifera* group. The larger seeds also exhibited an affinity for ssp. *pepo*; the second highest P(G|X) was for this subspecies for about 40% of those seeds. One of the seeds was primarily classified as ssp. *pepo*, even though it had a P(G|X) of only 56% and a P(X|G) of 2%. Only one of the archaeological seeds (the large seed from Zone 2) was well-classified as ssp. *pepo*.

Placement of the Hontoon Island seeds in the space defined by canonical discriminant functions one and two is illustrated in Figure 3. Taxon centroids, as well as ranges for each taxon along the discriminant functions, are plotted also. Again, only the large seed from Zone 2 (1980 Unit) lies significantly close to the ssp. *pepo* centroid. Most of the other seeds lie well within the ranges of var. *ovifera* and/or var. *texana*. In fact, many of the seeds occupy the region between these taxon centroids. A few archaeological seeds occur beyond the ranges defined by the modern material. This suggests that they may belong to cultivars or wild populations not represented by the modern accessions chosen to define the discriminant functions.

DISCUSSION

Most of the archaeological cucurbit seeds from the 1980 Unit and 1982 Column at Hontoon Island resemble those of modern *C. pepo* ssp. *ovifera* var. *texana* (Fig. 4, top row). Others are small and narrow like ornamental gourd seeds, some resemble scallop seeds (Fig. 4, center row), and at least one seed approached the dimensions of a pumpkin

TABLE 2.—*Classification results for wild populations and cultivars of* C. pepo *and the archaeological seeds from Hontoon Island.*

Taxon/ Excavation	Accession[1]/ Level / Zone	Predicted Group Membership[2] T	O	P
var. *texana*	TEX 1	9	1	
	TEX 3	8	2	
	TEX 5	9	1	
	TEX 6	8	2	
	TEX 17	6	4	
	TEX 36	9	1	
var. *ovifera*	CYE 118		5	5
	OEN 1	1	8	1
	OFS 55	1	9	
	OPB 10	1	9	
	OPS 18	3	7	
	OPW 60	3	7	
	SWB 61		4	6
ssp. *pepo*	OWO 56		8	2
	PSU 72		1	9
80	2	10 (.63)	5 (.31)	1 (.06)
	3	7 (.58)	5 (.42)	
	4	10 (.71)	4 (.29)	
82	4		1 (1.0)	
	5	10 (.40)	15 (.60)	
	6[3]	28 (.58)	19 (.40)	1 (.02)
	7	31 (.77)	9 (.23)	
	8	15 (.63)	9 (.37)	
	9	9 (.69)	4 (.31)	
	10	13 (.62)	8 (.38)	
	11	13 (.81)	3 (.19)	
	12[3]	10 (.71)	4 (.29)	
	13	2 (.67)	1 (.33)	
	14		2 (1.0)	
Summary—				
var. *texana*		89	11	0
var. *ovifera*		9	79	12
ssp. *pepo*		0	9	91
Hontoon Island		159 (.64)	88 (.35)	2 (.01)

[1]Only accessions with misclassified seeds are listed.

[2]T = var. *texana*, O = var. *ovifera*, P = ssp. *pepo*. Percentages are in parentheses.

[3]Two seeds with broken margins were not analyzed.

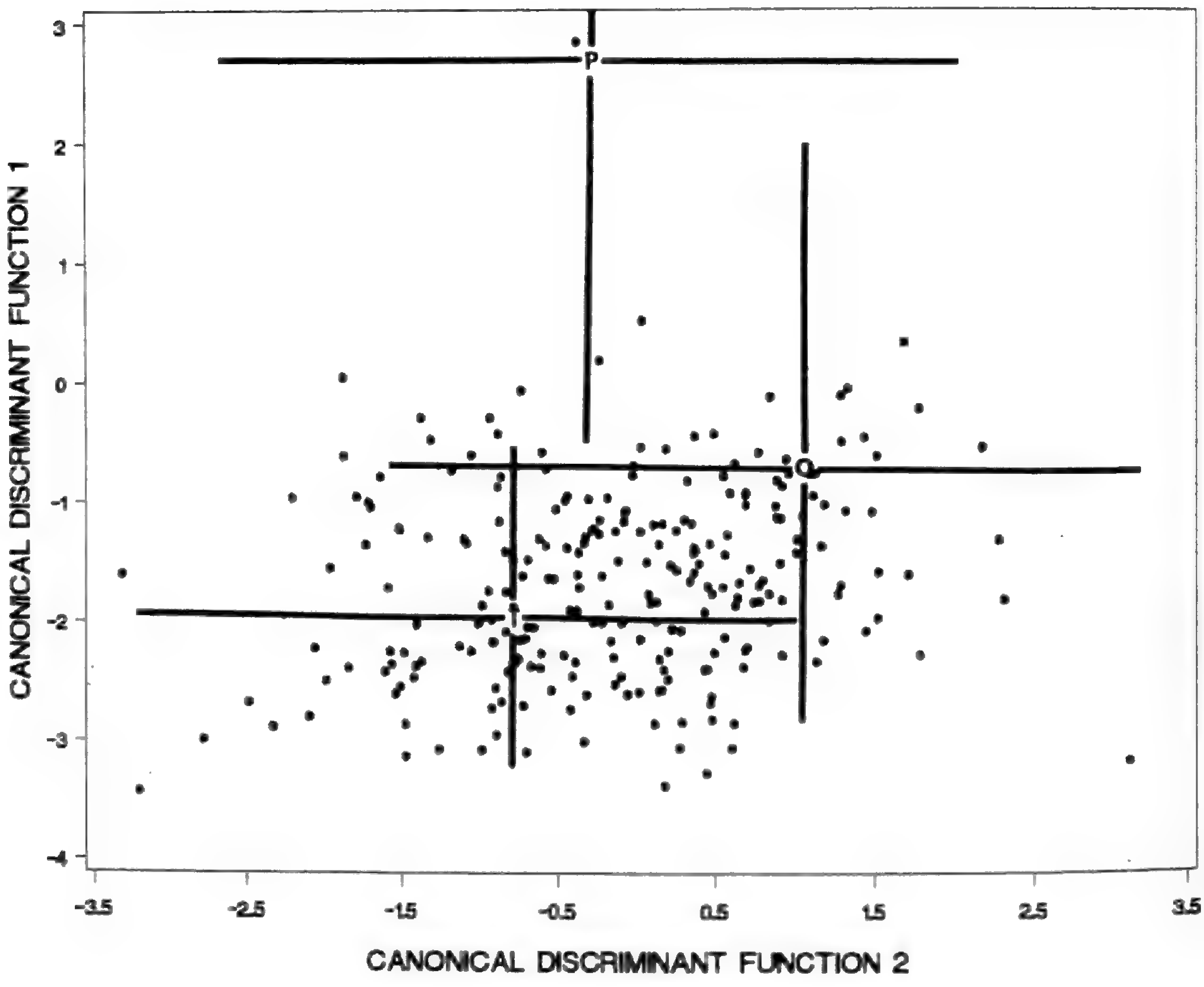


FIG. 3.—Plot of the archaeological seeds from Hontoon Island along canonical discriminant functions 1 and 2. Also shown are centroids and ranges for *C. pepo* ssp. *pepo* (P), var. *ovifera* (O), and var. *texana* (T). The upper range for ssp. *pepo* along the first discriminant function extends to 5.8.

seed. Not all of these seed types appear to be *in situ* developments. Continuity among the majority of the small seeds throughout the unit and column suggests that there was at least one local and persistant form. Particularly small and narrow seeds, resembling those of some ornamental gourds, do not appear until historic times (Zone 3 and Level 10). Seeds similar to those of the modern scallop squash are first detected in Level 8 and are relatively abundant in Level 6. A few seeds in Levels 6 through 9 that appear intermediate between the majority of small seeds and the scallop-like seeds indicate that the latter could have been an *in situ* development. Likewise, this type of squash may have been traded to Florida Indians from groups to the north. In either case, the historic use of scallop squashes by tribes of southeastern U.S. has been documented (Speck 1941). A more certain introduction to the Hontoon Site are pumpkin-like seeds. While only one such seed was found in the 1980 Unit (Zone 2) and none in the 1982 Column, 1985 excavations have uncovered many of these, ranging in size from approximately 7 to 10 mm wide and 12 to 18 mm long (Fig. 4; Newsom 1986). All were found in historic strata, usually associated with Spanish remains (gold coins, etc.). There is no evidence of any intermediate forms. Similar seeds have been found at archaeological sites in Mexico (Cutler and Whitaker 1967; Whitaker *et al.* 1957). Perhaps the Spanish brought pumpkins from Mexico to the Hontoon Island inhabitants.

FIG. 4.—Archaeological *Cucurbita pepo* seeds from Hontoon Island. Top row: 1980 Unit, Zone 4, small seeds, abundant type; center row: 1982 Column, Level 6, larger scallop-like seeds; bottom row: 1985 Square No. 59, pumpkin-like seeds. Units of scale are cm.

From the data presented here, it is difficult to ascertain whether two small-seeded varieties (var. *ovifera* and var. *texana)* coexisted at Hontoon Island, or if a single type existed which produced seeds whose varying dimensions covered parts of the ranges of variation we see in wild populations and some ornamental gourds today. In the latter case, the intermediate nature of the seeds might indicate that the Hontoon Island populations were less divergent from either var. *ovifera* or var. *texana* than these taxa currently are from each other. In either case, the affinity of the archaeological material to var. *texana* is evidence that wild, weedy, encouraged, or even cultivated populations of *texana*-like plants existed in northeastern Florida between approximately A.D. 800 and A.D. 1750. The riverine environment at Hontoon Island could have provided habitats suitable for wild populations similar to those in Texas (Correll and Johnston 1979). This supports a hypothesis based on isozyme data that var. *texana* once inhabited an area north and east of its currently recognized distribution in Texas (Decker 1986; Decker and Wilson 1987). This possibility necessitates consideration of var. *texana* when dealing with *Cucurbita* remains in eastern U.S. Whether or not these remains indicate domestication should be questioned also. These considerations are vital to hypotheses concerning the origin of horticulture in eastern U.S.

ACKNOWLEDGMENTS

This study is based on material provided by Lee Newsom and Barbara Purdy of the University of Florida, Gainesville. We would like to thank Vaughn Bryant, Jr. and Terrence Walters for their comments on an early draft of the manuscript.

LITERATURE CITED

CORRELL, D. S. and M. C. JOHNSTON. 1979. Manual of the Vascular Plants of Texas. Univ. Texas Press, Austin.

CUTLER, H. C. and T. W. WHITAKER. 1967. Cucurbits from the Tehuacan caves. Pp. 212-219 *in* Prehistory in the Tehuacan

LITERATURE CITED (continued)

Valley, vol. 1 (D. S. Byers, ed.), Univ. Texas Press, Austin.

DECKER, D. S. 1986. A Biosystematic Study of *Cucurbita pepo*. Ph.D. Dissert. (Biology) Texas A&M Univ., College Station.

__________. 1988. Origin(s), evolution, and systematics of *Cucurbita pepo* (Cucurbitaceae). Econ. Botany 42(1):4-15.

__________ and H. D. WILSON. 1986. Numerical analysis of seed morphology in *Cucurbita pepo*. Syst. Botany 11:595-607.

__________. 1987. Allozyme variation in the *Cucurbita pepo* complex: *C. pepo* var. *ovifera* vs. *C. texana*. Syst. Botany 12:263-273.

KING, F. B. 1985. Early cultivated cucurbits in eastern North America. Pp. 73-98 *in* Prehistoric Food Production in North America (R. I. Ford, ed.), Pap. Mus. Anthropol. 75, Univ. Michigan, Ann Arbor.

KLECKA, W. R. 1975. Discriminant analysis, Pp. 205-237 *in* SPSS: Statistical Package for the Social Sciences, 2nd Ed. (N. H. Nie, C. H. Hull, J. G. Jenkins, K. Steinbrenner, and D. H. Bent, eds.), McGraw-Hill, New York.

NEWSOM, L. A. 1986. Plants, Human Subsistence, and Environment: A Case Study from Hontoon Island (8-VO-202), Florida. Ms. Thesis. (Anthropology) Univ. Florida, Gainesville.

PURDY, B. A. and L. A. NEWSOM. 1985. Significance of archaeological wet sites: a Florida example. Natl. Geog. Res. 1:564-569.

RAY, A. A. 1982. SAS User's Guide: Statistics. 1982 Ed. SAS Institute, Cary, NC.

SPECK, F. G. 1941. Gourds of the Southeastern Indians. New England Gourd Society, Boston.

WHITAKER, T. W., H. C. CUTLER and R. S. MACNEISH. 1957. Cucurbit materials from three cave near Ocampo, Tamaulipas. Amer. Antiq. 22:352-358.

J. Ethnobiol. 8(1):45-79 Summer 1988

ETHNOBOTANY IN A TROPICAL-HUMID REGION: THE HOME GARDENS OF BALZAPOTE, VERACRUZ, MEXICO

ELENA LAZOS CHAVERO
and
MARIA ELENA ALVAREZ-BUYLLA ROCES
Laboratorio de Plantas Vasculares
Departamento de Biologia
Facultad de Ciencias, UNAM
Apdo. Post. 70-614, 04510 Mexico, D.F., Mexico

ABSTRACT.—In this work, we analyse the home garden's floristic composition and how the peasant families use the plant species in relation to their cultural origin and date of establishment at a rural community recently formed in Veracruz. The home garden is a production alternative that plays an important role in peasant economy and, at the same time, is the family's habitational unit. It has a high floristic richness providing the family with numerous products to satisfy various needs: of the 338 species reported, 37.6% were used for ornament, 25.4% for nourishment and 39.3% had secondary medicinal usages. However, the species with the highest densities and frequencies were the food plants. The interchange of plants and knowledge of plants by the families in the community has made the home garden more floristically homogeneous. The home garden is a place of agricultural experimentation in which all the family participates.

RESUMEN.—En este trabajo, analizamos las especies vegetales de los solares, sus usos y el conocimiento en relacion al origen cultural y a la fecha de establecimiento de las familias campesinas de una comunidad recientemente formada en Veracruz. El solar es una alternativa productiva importante en la economia campesina y es, ademas, la unidad habitacional de la familia. El solar se caracterize por una gran riqueza floristica lo que permite al campesino proveerse de diferentes productos para satisfacer varias necesidades. De las 338 especies reportadas, el 37.6% tienen un uso ornamental, el 25.4% son alimenticias y el 39.3% tienen como uso secundario el medicinal. Sin embargo, las especies mas frecuentes y abundantes son las alimenticias. El intercambio de plantas y de conocimiento ha ido homogeneizando floristicamente los solares. El solar se constituye como un lugar de experimentacion agricola donde toda la familia interviene.

INTRODUCTION

One of the earliest descriptions of home gardens was given by Willis in 1914 quoted in Etifier (1985): "I see the mixed gardens in Ceylon as a wild jungle-like mixture of fruit trees, creepers, bamboo and useful undergrowth surrounding every house." Thereafter, home gardens of traditional societies in tropical-humid regions have received the attention of researchers, e.g. for Africa (Diarra 1975); for Asia (Abdoellah and Henky 1979; Anderson 1979; Bompard *et al.* 1980; Friedberg 1971; Sastrapradja *et al.* 1985; Soemarwoto 1975); in the Pacific Islands (Barrau 1954), for the Antilles (Kimber 1973; Konpem 1978); for Mexico (Alvarez-Buylla *et al.* 1981; Gonzalez and Gutierrez 1983; Lazos and Alvarez-Buylla 1983; Vara 1980; Zizumbo and Colunga 1982).

In general, these studies define the home garden as an area around the peasants' house where they cultivate a complex vegetation to satisfy their needs. Many of these works describe only the floristic composition (Sastrapradja *et al.* 1985), others (Abdoellah and Henky 1979; Kimber 1973; Peeters 1976) point out the relation between the home garden and the cultural factors, while others (Anderson 1979; Brierly 1976; Diarra 1975; Konpem 1978) emphasize the floristic composition and the species use and management. There are few works that depict the home garden as an economic alternative playing an important role in peasant economy (Etifier 1985; Friedberg 1971; Vara 1980; Zizumbo and Colunga 1982). We propose that an understanding of the economic importance of the home garden in peasant's agricultural production can be a basis upon which one can relate with other aspects of the peasant family life.

The present work is part of a broader study in which we analyzed the relationship between socioeconomic and cultural factors and the home garden's spatial organization, composition, structure, plant usages and process of production (Lazos and Alvarez-Buylla 1983). In this article we discuss the analysis of the home garden's floristic composition and the familiarity and use of plant species by families coming from different cultural origins and with varying length of residence in the community of Balzapote. As new plant species are introduced from outside, residents of Balzpote gradually learn their growth requirements and possible uses. Such dynamics of trial, acceptance and rejectance and learning have led some authors to the hypothesis that home gardens were the ideal place for the origin of plant domestication and agriculture (Anderson 1979).

METHODS

At Balzapote, we collected 414 voucher specimens (deposited in the Herbarium of the Science Faculty, UNAM) from 64 home gardens, and reported their usages. We undertook an ecological census for eight home gardens recording for each sample species its taxonomic identity, structural and ethnobotanical data, and site of origin. We conducted socioeconomical and cultural interviews for each one of the 71 families in Balzapote during November 1980 to December 1982.

Description of the study site.—Balzapote is located in the southeastern tropical-humid region of Los Tuxtlas in the State of Veracruz in Mexico (Fig. 1). It is a recently established "ejido" due to the migration, mainly during the 1960s, of peasants from other regions and from other communities of the same Los Tuxtlas region (Table 1).

TABLE 1. *Date of settlement of the peasant families in Balzapote, Veracruz.*

Date of Settlement	Percentage of Families
1945-1949	2%
1950-1954	1%
1955-1959	23%
1960-1964	38%
1965-1969	20%
1970-1974	14%
1975-1982	2%

The main reasons for the migration since the 1940s were: (a) a regional livestock production "boom"; (b) a rapid population growth—in Veracruz—population increased from 17.6% to 33.7% between 1930 and 1960 (Secretaria de Programacion y Presupuesto 1964); and (c) the fragmentation of land and lack of resources in other regions. Thus, Balzapote is made up of families who entered the community at different dates (Table 1) coming from different regions but mainly (93%) from the same State of Veracruz (Fig. 1).

Economic History of Balzapote.—Production has changed during Balzapote's history. In the beginning, the tropical forest was transformed into corn and bean plots under a shifting cultivation system. This was replaced in importance by livestock raising during the 1970s. As hunting and plant collection decreased and since fishing represents a marginal production source for only some families, home gardens have always played an important role for rural families. Today, pasturelands and home gardens are the two most frequently managed production alternatives (Table 2).

TABLE 2. *Management of different production alternatives among the peasant families in Balzapote, Veracruz (1980-1982).*

Production Alternative	Percentage of Families who Manage the Production Alternatives
Home garden	97%
Cattle raising	70%
Crop fields	55%
"Acahual"*	39%
Fishing	7%
Hunting and Plant Collection	3%

*Portions of secondary vegetation from which plant products are obtained for selfconsumption.

RESULTS

Description of the home gardens.

The home garden is the only dual purpose alternative that peasant families manage. It offers a production option and therefore a means of work where animal and plant species are managed and, at the same time, it serves as the peasnat's habitational unit, giving it a peculiar vegetation structure and a physical arrangement in three components: the backyard, the garden, and the orchard, each one fulfilling different aspects of the dual purpose (Fig. 2). The home garden is basically composed of perennial self-generating (either vegetatively or by seed) species which allow a continuous extraction of products (for a fuller description see Lazos and Alvarez-Buylla 1983).

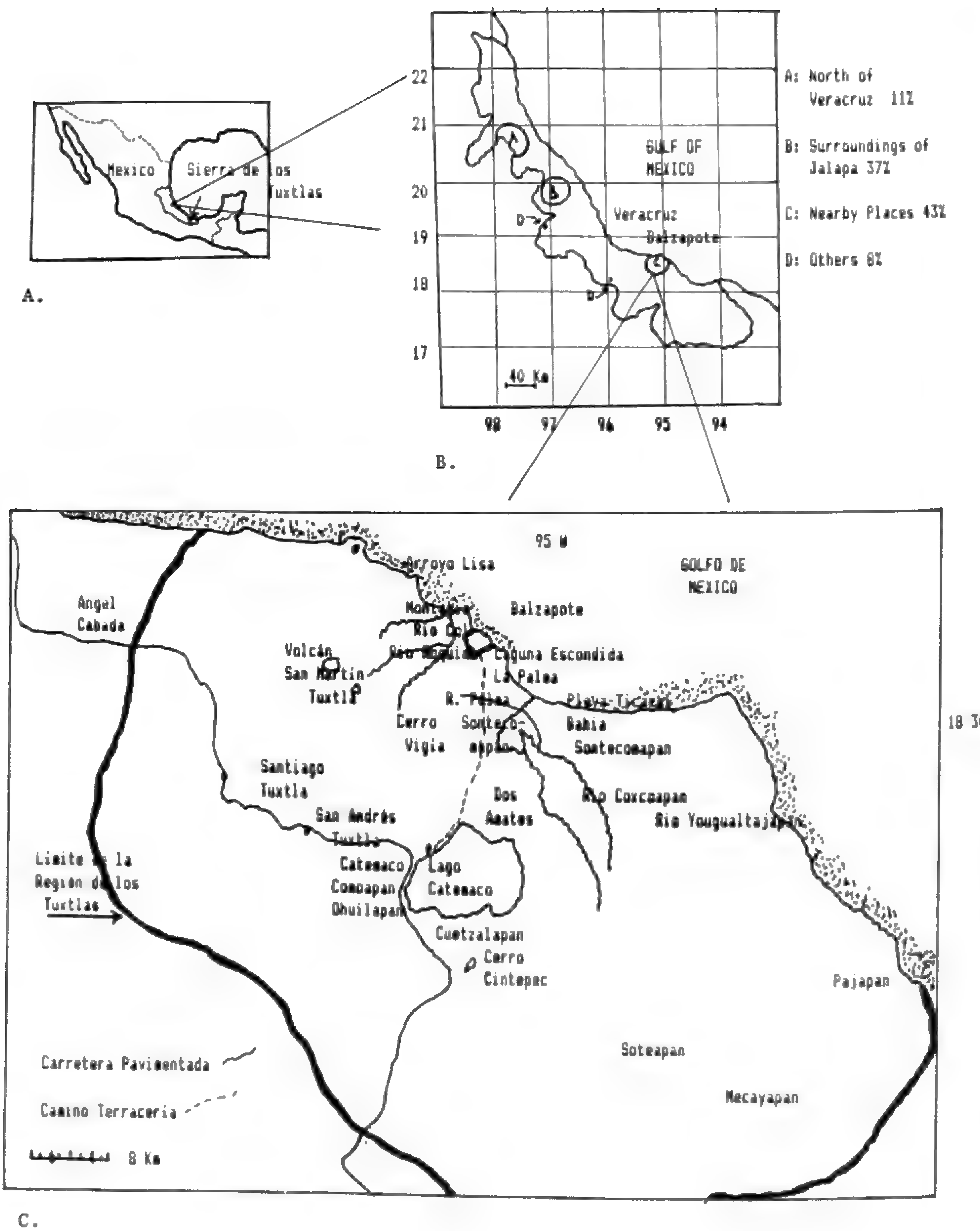


FIG. 1.—A. Geographical localization of Veracruz in Mexico. B. Geographical localization of the native regions of the peasant settlers of Balzapote and percentages of families coming from those regions. C. Geographical localization of Balzapote and nearby places in Los Tuxlas Region.

FIG. 2.—Home garden of Balzapote. At right, a typical peasant house and backyard, left foreground, garden with ornamental plants and, at left background, an orchard with fruit trees and trees for construction and various domestic uses.

Use and knowledge of home garden's plants.

In the home gardens of Balzapote a large number of plant species are grown and used for a number of different purposes. Furthermore, some species are multi-purpose plants; we distinguish a primary and a secondary use.

In Table 3, we analyse the uses of 338 species in 76 angiosperm families and 3 pterydophytes and report their primary and secondary uses in Appendix 1. We note that 127 species (37.6%) have an ornamental use and of the 25.4%8 (86 species) used for nourishment the majority are fruits. A large number of species (31) are used mainly for curative purposes and 27.8% of those remaining are irregularly distributed among other categories. However, food species are represented by the highest densities and the highest frequencies of appearance in the home gardens.

Of the 338 species, 35% have secondary uses, of which 39% are used for medicine and the rest to create shade (hereinafter, shadow plants), for construction, for firewood, to serve in rituals, as edible fruit, or as seasonings in food.

Some of the most broadly used species are very common plants. Such is the case of the "guayaba" *(Psidum guajava)*, naturalized in Balzapote, which is used in eight different ways, the: (a) fruit for human and animal food; (b) stem for construction and manufacturing of tools; (c) cortex and leaves for curative purposes: as antidiarrheic and antipiretic and for vaginal washes; (d) leaf as seasoning; (e) whole tree as a shading plant and for domestic uses (support for hammock, hen shelter, etc.).

TABLE 3. *The primary and secondary use of species in the home gardens of Balzapote.*
* Percentage (total number species = 338).
+ Percentage (total number species with secondary use = 117).
Coffee was included here (commonly considered as stimulant) because it is used as beverage or as complement with meals.

Category of Use	SPECIES				
	Primary Use		Secondary Use		
	Number	Percentage*	Number	Percent*	Percent +
Ornamental	127	37.6%	3	0.9%	2.6%
Nourishment	86	25.4%	12	3.5%	10.3%
Fruit	51	15.1%	5	1.5%	4.3%
Vegetable	17	5.0%	1	0.3%	0.8%
Spice	17	5.0%	5	1.5%	4.3%
Beverage	1	0.3%	1	0.3%	0.8%
Medicinal	31	9.2%	46	13.6%	39.3%
For Shadow	20	5.9%	11	3.2%	9.4%
Domestic Uses (dyes, glues)	17	5.0%	4	1.2%	3.4%
Construction	11	3.2%	7	2.1%	5.9%
Fences	10	3.0%	3	0.9%	2.6%
Animal Fodder	8	2.4%	3	0.9%	2.6%
Weeds	5	1.5%	16	4.7%	13.7%
Rituals	3	0.9%	6	1.8%	5.1%
Firewood	2	0.6%	6	1.8%	5.1%
Without use	18	5.3%			

Ornamental species.—Ornamental plants are kept in home gardens to decorate the house. Flowers are occasionally cut for funerals using any color for children and only white and/or pink for adults. Most ornamental plants are appreciated for their flowers ("tulipanes," *Hibiscus* spp.), for their scent ("huele de noche," *Cestrum racemosum),* or for both reasons ("rosasm" *Rosa* spp.), as well as for the shape and color of the leaves ("terciopelo," *Coleus* spp.), and the stem ("nopal," *Opuntia* sp.) or for the fruit ("manzanita," *Malpighia glabra).*

The most common ornamental plants are secondarily used in rituals. Those of red and white color are considered magical. For example the salmon lily ("lirio salmon," *Crinum* sp.) and the red rose ("rosa," *Rosa* spp.) are used by some families for "spiritual cleansing" or to protect the home garden against the influence of evil spirits."

Food plants.—In the case of food species [illegible] prepared as refreshments or sometimes as conserves ("guayaba [illegible] vegetables, peasants consume the fruit (tomato, "jitomate," *Lycopersicum esculentum*), flower (squash, "calabaza" *Cucurbita pepo),* bulbs, root stalk or corms (garlic, "ajo," *Allium cepa;* "malanga," *Colocassia esculenta;* cassava, "yuca," *Manihot esculenta*

Many fruit trees have a secondary curative use for which the leaves are generally prepared as infusions. Because they are also trees, they are used for construction, as shadow trees or for several domestic uses (such as drying places, hen shelters, support for hammocks).

Seasoning plants.—The most common seasoning species grown in the home gardens are "oregano" *(Lippia* sp.), "epazote" *(Chenopodium ambrosioides)* and "cilantro extranjero" *(Eryngium foetidum)* from which the stem and leaves are used.

Medicinal plants.—Medicinal species are used to cure mild diseases or to relieve the symptoms of serious ones. In this case, the infusion of leaves is the most common preparation. These species have no secondary uses because they are too specific. For example, a cultivated species "maravillosa," *Crassula* sp., is only used as an antiseptic and as analgesic. Also, a wild species like "hierba martina," *Hyptis mutabilis,* has only a medicinal use, the leaves are used as antispasmodic and the roots are taken to stop internal bleedings (for a fuller description see Alvarez-Buylla and Lazos 1983).

Plants with other ues.—Large trees with permanent foliage, *e.g.* "nopo," *Cordia stenododa,* are grown to give shadow for the house. Trees used for construction are strong and have erect, thick trunks, *e.g.* "chagane," *Dalbergia glomerata.* Most of them are canopy trees of the mature tropical forest. Some home gardens have living fences of native species chosen for their quick regeneration from stumps ("palo mulato," *Bursera simaruba).* Most trees grown in the home garden protect the house against northern and southern winds.

At Balzapote, there are few species which serve strictly for ritual purposes and are used generally for "spiritual cleansing." The most common ones are basil ("albaca" *Ocinum basilicum),* elderberry ("sauco" *Sambucus mexicana),* and marigold ("flor de muerto" *Tagetes erecta).*

Many of the weeds found have specific uses. Such is the case of the "escobilla," *Sida* spp. used in the manufacture of brooms and as forage for the animals raised in the home garden.

From the detailed analysis of the eight home gardens, 27 species are the most common and were found in four or more of the eight home gardens. Of these 27 species, 33% are food plants, 45% are ornamentals and the rest have other uses (construction, shadow trees or living fences). Curative species are common at the most to three home gardens. Of the 993 individuals distributed among these 27 species, 43% are used for food, 36% as ornamental plants and 21% for fences or as shadow trees. The frequency of ornamental plants varies greatly: from a species found in only one home garden (*e.g.* "cola de gato" *Lobelia fulgens)* to other broadly distributed among almost all of them *(Coleus* spp.).

Figure 3 shows the percentage of species, individuals and canopy areas assigned to different uses in the eight home gardens. It is clear that food and ornamental species are the most dominant plant uses. Although there are a greater number of ornamental species, individuals of the fewer food species occur in greater abundance and contribute a greater proportion of the total covering. Curative and shadow plants are represented by a lower percentage of species, individuals and canopy areas and the rest of the plant uses are represented in fewer home gardens and with still lesser percentages.

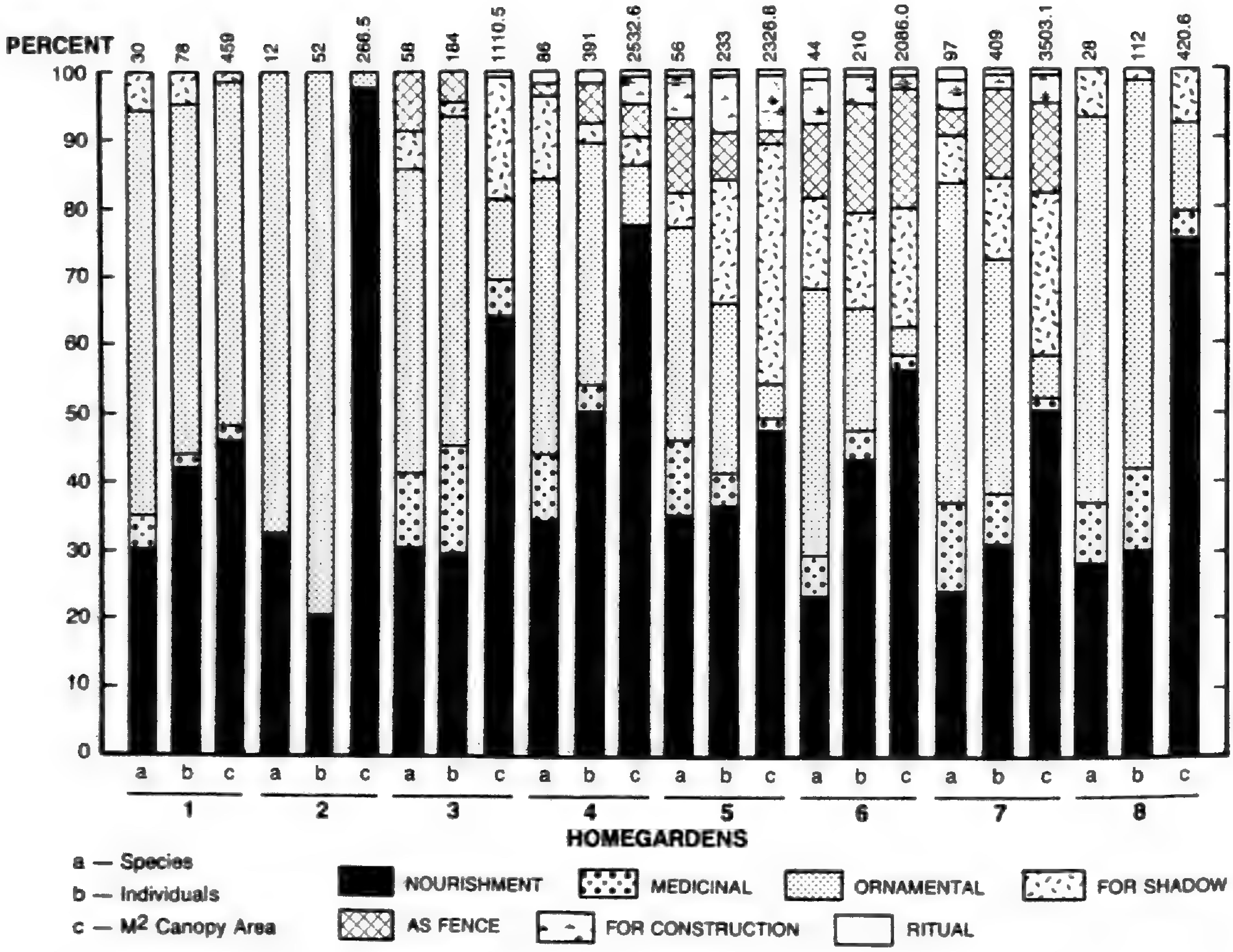


FIG. 3.—Percentages of species, of individuals, and of canopy areas in relation to their use in the 8 target home gardens. The numbers at the top of the graphic correspond to the total of species in column a, to the total of individuals in column b, and to the canopy area in column c.

Familiarity with and knowledge of plants.

The families of Balzapote are very heterogeneous in their geographical and cultural origin and date of establishment. This is the reason for the striking heterogenity of knowledge about plants and their uses among them, reflected, for example in the diversity of names given to the same species and the number of them without a name (Table 4).

Slightly over half (58.3%) of the species have a name composed of one term (the primary lexeme or monomial term). These may be species with a general use known to all of the inhabitants or are species at the generic level (Berlin *et al.* 1966; Friedberg 1986). Examples of well known species: "coco" *Cocos nucifera*, "jicama" *Pachyrrhizus erosus*; and of species at the generic level: "chocho" *Astrocaryum mexicanum*, "escobilla" *Sida* spp.

Species with more than one name (base term plus the determinants) may be a variety of a well known species or somewhat unfamiliar species that [illegible] a modifier for specification. Examples: Compound name for different [illegible] the same genus: "rosa blanca" *(Rosa moschata)*, "rosa carton" *(R.* [illegible] *R. chinensis)*, "rosa nina" *(R. multiflora)* and "rosa roja" *(R.* [illegible] that need a description: *Senecio* sp. named "vara amarilla," [illegible] shrub with yellow

TABLE 4. *Different names given to one and the same species according to the geographical origin of the peasant families.*

Scientific Name	Name from nearby		N. from Jalapa
	Ohuilapan	Catemaco	
Bryophyllum pinnatum	siempreviva	maravillosa	belladona
Delonix regia	arbol del fuego	cochimbo	framboyan
Erythrina spp.	gasparito or iquimite		cosquelite
Hampea eutricia	caimito or tapaculo		no name
Justicia sp.	no name		añil
Lippia alba	salvia		manrubio
Mimulus longiflorus	no name		no name
Psidum guajava	guayaba		guayaba
Philodendron hederaceum	mafafa		mafafa
Xanthosoma robustum	apichi		mafafa

flowers; *Thunbergia tragans,* "copa de oro," a yellow cup flower. Other wild species unknown to the inhabitants of Balzapote have neither name nor use.

Among the species managed in the home gardens some are known only by the families who introduced them, while others are generally used by most families. There are also species whose usages lie in between these extremes. We devised six artificial groups of plant species according to the extent of knowledge and management in Balzapote, and to their origin.

1. *Species domesticated long ago with common uses and names known by all families.* They represent 17% of the 338 species found in the home gardens. From these, 73% are food plants. Examples: "calabaza" *Cucurbita pepo,* "jitomate" *Lycopersicum esculentum,* "ajo" *Allium sativum,* "rosa" *Rosa* spp.

2. *Plants introduced to Balzapote by the first settling families.* Some of the plants are now broadly distributed or even naturalized in the area. Examples: "guayaba" *Psidum guajava,* "citricos" *Citrus* spp., "ninfa" *Vinca rosea.*

3. *Broadly distributed wild species from secondary plant communities.* Although they have several different uses and names, they are known by almost all the people at the village. Example: "malva de cochino" or "escobilla," *Sida* spp.

4. *Wild species from the tropical forest or from secondary vegetation.* These were familiar to most of the inhabitants coming from nearby places, and unknown to those coming from places with contrasting climatic conditions to those of Balzapote. Among these species, some are tolerated in the home gardens (*e.g.* "cascarillo" *Croton nitens* used for construction) and others are brought for curative or ornamental purposes (*e.g.* various species of orchids).

These three last groups (2, 3 and 4) constitute 42% of the 338 species. From these, 51% have construction and domestic uses, 25% medicinal, and 23% food and ornamental uses.

5. *Species introduced to Balzapote by peasants from neighboring villages.* These plants represent 45% of the 338 species. From these, 50% are for ornament, 33% for medicine and 22% for nourishment. Examples: "manguito" *Codiaeum vanegatum* var. *pictum*, "hoja morada" *Acalypha* sp., "florinfundio" *Datura suaveolens.* Peasants coming from other regions did not know their name or use or they gave them other uses and names.

6. *Species introduced to Balzapote by families from distant regions.* Most of these species can be found only in home gardens belonging to those families who brought them from their original villages. These species constitute only 9% of the total number (338) of species and from these, 52% are for medicine, 36% for ornament, and 23% for food. Examples: coffee, *Coffea arabica*, is grown by families from Jalapa and Chicontepec although its knowledge and cultivation have now diffused. The "acate chichi" *Calea zacatechichi*, brought from Jalapa, is used for medicine.

If we analyse the origin of the species in the eight target home gardens, we conclude that most species are cultivated in Balzapote (31% of 198 species and 50% of the 1,675 individuals), but also, there is a significant number of wild species (32% of species and 21% of individuals). The other plants are from nearby places (27% of species and 20% of individuals) and the rest from distant places.

On the other hand, taking into consideration this analysis, it is worthwhile making an attempt to explain the differences in the percentages of species of different origins grown in the eight home gardens. First, it is necessary to state two facts: 1) species considered as cultivated in Balzapote are those introduced by the first settlers of Balzapote (about 30 years ago). For these families they were considered as species introduced from their native villages, but for the subsequent inhabitants they were considered as cultivated species in Balzapote. 2) the species brought by families whose native villages were located nearby Balzapote were pooled with those of group 5.

From Table 5, we conclude that in home gardens 1 and 4, whose owners come from villages nearby Balzapote and who settled 20 to 25 years ago, there is a significant percentage of species brought from neighboring places, that as we stated above, can be mixed with those brought from their native villages. Furthermore, because they were born in nearby places, the peasants are familiar with the cultivated species there and have easy access to plants from their original villages where they always have relatives and/or friends. In home garden 4, the percentage of species brought from Catemaco (the native village of the family) is very high. Many of the species introduced by this family are now considered as currently grown in Balzapote.

Another interesting fact regarding these two home gardens is the percentage of wild plants, with number 1 having a low and home garden 4 a high percentage of wild species. This can be associated with the fact that the first one was established in a very disturbed site, without trees, and far away from any area with wild vegetation. On the contrary, the second was established in an 8-year-old secondary vegetation site. These same reasons explain the high percentages of wild plants present in home gardens 3, 5, 6, and 7 and the low values for home gardens 2 and 8.

The data shown for home gardens 3 and 8 indicate that in both cases the percentage of species brought from their original village (Ohuilapan) is also high (in comparison with the rest of the home gardens). This can be explained because Ohuilapan is relatively near Balzapote and has similar ecological conditions. Be[illegible] periodic visits by the families to their villages, there is a constant flow of spe[illegible] the two communities.

The families 5, 6, and 7 come from places [illegible] distant town and with different environmental conditions, which ex[illegible] [illegible]entage of species found

TABLE 5. *Different origins of the species found in the 8 home gardens, origin and date of settlement of the family, and prior vegetation to the establishment of the home garden.*

HN = Home garden number; GB = grown in Balzapote; GN = grown in nearby places; GO = grown in their original places; W = Wild; T = total.

HN	SPECIES					FAMILY		PRIOR
	GB	BN	GO	W	T	Origin	Date	Vegetation
1	13 43%	14 47%	1 3%	2 7%	30	Montepio	1962	Secondary (1 year)
2	11 92%	1 8%	0 0%	0 0%	12	Puebla	1966	Secondary (1 year)
3	31 53%	6 10%	9 16%	12 21%	58	Ohuilapan	1955	Secondary (10 years)
4	19 20%	44 46%	16 16%	17 18%	96	Catemaco	1954	Secondary (8 years)
5	37 65%	2 4%	2 4%	16 28%	57	Jalapa	1966	Secondary (7 years) Cropfield
6	22 52%	2 5%	5 12%	13 31%	42	Jalapa	1963	Primary Home garden
7	31 32%	31 32%	2 1%	34 35%	98	Jalapa	1958	Primary Home garden
8	13 45%	6 21%	8 27%	2 7%	29	Ohuilapan	1959	Secondary (1 year)

from their original place. Moreover, and in contrast to those coming from nearby places, it is more difficult for these families to travel frequently to their native places and the species grown in them can hardly be adapted to the conditions of Balzapote. In these home gardens the percentage of the so-called species currently grown at Balzapote is high, although it should be stressed that in home garden 7 it is lower, because many species have been introduced from neighboring places. This can be explained because this family is more prosperous than the average at Balzapote and thus has financial resources to purchase exotic ornamental plants from nearby villages.

Finally, in home garden 2 most of the species are those currently grown in Balzapote, probably because it belongs to a young family who has not yet completed the establishment of its home garden and thus have sown only the most common and fastest growing species of Balzapote. Also the family's original place (Puebla) is far away from Balzapote and has differing environmental conditions.

The role of the family members in the plant species knowledge and use.

In Balzapote, the family is the socioeconomic, productive, and consuming unit in charge of deciding the management of their different economic options. This management is based in a sexual and age work division where the role of each family member is stipulated (Alvarez-Buylla and Lazos 1988).

The family is also the cultural unit. This is reflected in the family's knowledge implied in the use and management of plants. This knowledge is not a steady phenomenon, instead it is a continuously changing and broadening process according to the family's needs. Different aspects of it are undertaken by different members of the family.

The father and the older sons are in charge of acquiring the knowledge involved in the handling and use of the cultivated trees. Mother and older children are in charge of obtaining the plants for the garden (mostly ornamental, medicinal and seasoning species), as well as investigating the way of growing and using them.

The role played by children is very important, since they introduce to the home garden new useful species, mainly fruits. For example, "zapotillo" *(Bunchosia lanceolata)* and "chagalapoli" *(Ardisia* aff. *belizensis)* are introduced consciously and unconsciously by the children when their seeds are sown or carelessly discarded in the garden.

In the home gardens, children are early initiated into different agricultural practices through the experimentation and the knowledge of their parents that is carefully passed on. So, the home garden is a place of agricultural experimentation where all the family takes part. The father tests new cultivars that are later introduced to crop fields and, the mother generally selects the best food and ornamental varieties.

DISCUSSION

Local people consider the house and the garden as a unit called the "solar." All the peasant families at Balzapote devote part of their work in the transformation of nature to result in a home garden fulfilling two functions: an habitational unit and an economic alternative. Other studies have also remarked upon this fundamental characteristic (Bompard *et al.* 1980; Etifier 1985; Vara 1980; Zizumbo and Colunga 1982).

This double purpose is reflected in the spatial organization and in the management of a high diversity of plant species with different uses. The home garden floristic richness or high diversity, more than 300 cultivated or wild species, perennials or annuals, represented by trees, shrubs and herbs, enables the family to satisfy various needs. This production ensures the acquisition of food (principally fruits), ornamental and medicinal plants, timber for construction, shadow and fence trees, animal fodder, firewood and other diverse products in small scale but all year around (for the production analysis, see Alvarez-Buylla *et al.* 1988). Moreover, most plants are cultivated for more than a single purpose, most of their parts being utilized for different means, and this diversity is increased by the intraspecific variation often found.

Ornamental species are represented by the highest number of species (38% of the 338 species), but the food species are the most common and abundant (Fig. 3). This has also been found in home gardens of Indonesia (Bompard *et al.* 1980), of Africa (Diarra 1975) and of Mexico (Gonzalez and Gutierrez 1983). On the other hand, the home gardens of Morne des Esses in Martinique have more medicinal (56%) and ritual species (Etifier 1976).

The low frequency of use of ritual plants among the families and the gradual disuse of medicinal plants is interesting. This may be explained, in part, because Balzapote is a mestizo population without a strong ethnical cultural background which has been greatly influenced and subordinated by the capitalist system not only from an economic point of view, but also from a cultural and ideolo[illegible] also due to the impact of migration of certain families that were culturally uprooted. Some could not bring them their plants or even if they could, the plants did not adapt to the climatic conditions of Balzapote. For example, "ruda" *(Ruta chalepensis)* has been introduced, without success, several times to Balzapote, but the conditions are not appropriate for it.

So we have to consider both the number of species and their relative abundances to conclude that home gardens are not only for ornament, but they are multifunctional according to the peasant's needs. The way in which different families organize their work in home gardens, and in general in the rest of the productive alternatives, varies. The role played by the home garden production in the household economy is therefore peculiar to each family (Lazos and Alvarez-Buylla 1983).

Such differences are associated with socioeconomical and cultural factors. In Balzapote, the socioeconomic and cultural differentiation originated with the establishment of the community. The families came from different regions and had different economic statuses. In Balzapote the most prosperous residents are those whose production is based on livestock raising; those of more modest means combine several productive alternatives (livestock raising, cornfields, "acahual," home garden), while the poorest residents have little land and must sell their human labor to earn their living (for a more detailed description, see Lazos and alvarez-Buylla 1983). These conditions are reflected in the floristic composition and plant ues (Lazos and Alvarez-Buylla 1983) and in the home garden management (Alvarez-Buylla *et al.* 1983). In general terms, the most prosperous families have home gardens with more exotic ornamental species which are bought in nearby villages, and food plant production is more as a complement to their diet; while the poorest families have more food plants (fruits, vegetables, tubers) as they are basic in their diet (for the variations and the intermediate cases, see Lazos and Alvarez-Buylla 1983). This is also studied in the "kampung" of Central Java. Bompard *et al.* (1980) state that for poor people, the home garden food production is a solution for the interval between rice harvests. In other research, Lizet (1979) considers ornamental species as an index of social progress.

Not all floristic differences among home gardens can be explained by socioeconomic conditions; some are related to the cultural origin and the date of settlement of the families. The species more related to certain cultural background of the families are those used for medicinal, food and ritual purposes. This shows that families have deep roots for some food customs and for certain curative and ritual practices. For example, we see the influence of cultural habits in the presence of coffee trees only in those home gardens belonging to families that come from places where coffee is usually grown and consumed. The cultural influence is also reflected in the existence of some medicinal species ("salvia" *Lippia graveolens;* "zacate chichi" *Calea zacatechnichi)* which are only grown in home gardens of families who used them in their native villages.

Also with respect to the cultural origin of the family, we can conclude that the families that come from places nearby Balzapote with similar environmental conditions, know most of the wild species grown in Balzapote and play an important active role in the introduction of cultivated species. In fact, these families have introduced the greatest number of species that are grown in the home gardens, and have also diffused the knowledge of some wild ones.

Meanwhile, families coming from villages located far away and with climatic conditions different from those of Balzapote, do not know most of the wild plants and introduce a small number of cultivated species from their native villages. These families therefore handle only some of the species at their arrival and as they become familiar with Balzapote's wild and cultivated flora start using a larger number of species.

If we relate the place from which plants are introduced and their use, we see that the plants brought from nearby places are mainly ornamental and those from far away villages are mainly medicinal. While the species domesticated long ago are primarily food plants and most of the species found in Balzapote are used for construction.

The exchange of plants and the knowledge inherent in their use and management among the families with different origins are bringing about a homogenization of the species compositon of home gardens. In this sense, we can state that a dynamic process of use and knowledge of plants grown in the home garden is taking place through an exchange of information among peasant families in Balzapote.

Although a tendency to homogenization exists, we find that the home garden is also the place where the family is a cultural unit expreses its peculiar customs and/or tastes. In the home garden, families experiment, introducing new wild species in a incipient form of domestication or management and in the selection of different varieties. The home garden constitutes a product of peasant's work, which becomes the family's habitational unit, one of its productive options important in their economy and a place with rich cultural meaning where their conception of life it reflected.

ACKNOWLEDGEMENTS

We wish to thank the members of the community of Balzapote for providing us with the information necessary to do this work. Specificially we are indebted to the families of Dn Santos Tepox, Dna Rosa Lara, Dn Jose Xolo, Dn Isidoro Trujillo, Dn Juan Sn Gabriel, Dna Basilia Mixtega, Dn Manuel Chang, Dna Pomposa, Dn Gregorio Dolores, Dn Luis Arguellos and all the children of Balzapote who helped us as we worked.

We thank M. en C. Nelly Diego for the direction of this work, M. en C. Montserrat Gispert for introducing us to the study site and Dra. Claude-Berthe Friedberg and Raul Garcia for giving us good ideas to continue this work. We thank the Laboratory of Vascular Plants and the Herbarium of the Science Faculty of the UNAM for their help.

LITERATURE CITED

ABDOELLAH, N. and H. HENKY. 1979. Effect of culture on homegarden structure. V. International Symposium of Tropical Ecology. Kuala Lumpur, Malaysia.

ALVAREZ-BUYLLA, E. and E. LAZOS CHAVERO. 1983. Un estudio etnobotanico en Balzapote, Veracruz: Los Solares y sus Plantas Medicinales. I Congreso Internal de Medicine Tradicional. Mor., Mexico.

ALVAREZ-BUYLLA, E., E. LAZOS CHAVERO and R. GARCIA BARRIOS. Homegardens of a Humid Tropical Region in Southeast Mexico: an Example of an Agroforestry Cropping System in a Recently Established Community. 1988 In preparation.

ALVAREZ-BUYLLA, E., C. BONFIL, G. COLINA, L. GODINEZ, F. JUAREZ, E. LAZOS, E. MEZA, G. MURGUIA, G. OCAMPO, S. TORRES, I. TREJO, G. ZAMUDIO, E. HERNANDEZ-XOLOCOTZI, F. INZUNZA, R. PARRA, y F. SOLANO. 1981. Estudio del proceso de produccion agricola en Coscatlán de los Reyes, Sierra de Zongolica, Veracruz. Biología de Campo, Depto de Biología, Facultad de Ciencias, UNAM, Mexico.

ANDERSON, J. 1979. Traditional homegardens in Southeast Asia. V International Symposium of Tropical Ecology. Malaysia.

BARRAU, J. 1954. Traditional economy and agricultural progress in Melanesia. SPC Quart. Bull., Noumea.

BERLIN, B., D. E. BREEDLOVE and P. H. RAVEN. 1966. Folk Taxonomies and Biological Classification. Science 154:

BOMPARD, J., C. DUCATILLON, P. HECKETSWEILER and G. MICHON. 1980. A Traditional Agricultural System: Village-Forest-Gardens in West Java. Academie of Montpellier. Memoire DEA.

LITERATURE CITED (continued)

BRIERLY, J. 1976. Kithen Gardens in the West Indias with contemporary study from Grenada. J. Trop. Geog. 43:30-40.

DIARRA, N. 1975. Le jardinage urbain et suburbain au Mali le cas de Bamako. JATBA XXII (10, 11, 12):359-364.

ETIFIER, M. E. 1985. Etude Descriptive des Jardins Traditionnels des Campagnes de Sainte-Marie, Martinique. These de Doctorate, Montpellier, Universite du Languedoc.

FRIEDBERG, C. 1971. L'Agriculture des Bunaq de Timor et les conditions d'un equilibre avec le milieu. JATBA XVIII (12):481-532.

__________. 1986. La classification des objets naturels. Cours dans le DEA d'Anthropologie, EHESS, Paris.

GISPERT, M. 1981. Les Jardins Familiaux au Mexique: leur etude dans une communaute rurale nouvelle située en région tropicale humide. JATBA XXVIII (2):159-182.

GONZÁLEZ, T. and C. GUTIERRÉZ. 1983. Descripcion del uso, manejo y algunos aspectos ecológicos de los Huertos Familiares de la Rancheria Fco Madero, Tabasco, Mexico. Tesis de Ing. Agrónomo Colegio Superior de Agricultura Tropical. Tabasco, Mexico.

KIMBER, C. 1973. Spatial patterning in the dooryard garden in Puerto Rico. Geog. Rev. 63:6-26.

KONPEM, J. 1978. L'Agriculture Traditionnelle en Haiti. Fonctionnement des systemes de culture et valorisation du milieu. Centre Madian Salagnac, Fac d'Agronomie et Service de Recherches.

LAZOS CHAVERO E. and E. ALVAREZ BUYLLA. 1983. Un estudio etnobotanico en Balzapote, Veracruz: Los Solares. Tesis para obtener el Titulo de Biologia. Facultad de Ciencias, UNAM, Mexico.

LEITH ROSS, S. 1939. African women. London Publish. (photocopy).

LIZET, B. 1979. Le jardin, lieu de confrontation culturelle? Etude du cas d'une vallée de la Haute Savoie. JATBA XXVI, 1:9-27.

PEETERS, A. 1976. Le petit paysannat martiniquais et son environnement végétal. JATBA (1, 2, 3):47-56.

SASTRAPRADJA, D. *et al.* 1985. Komponen Hayati Yang Sering Dijumpaidi Pekarangan Kasus Teluknaga, Citereup dan-Pacet. BERITA BIOLOGI 3(2):25-36.

SOEMARWOTO, O. 1975. The home garden system. Ecological consideration of an integrated approach for the prevention and rehabilitation of degraded soil. Universitas Padjadjora, Bundung.

SECRETARIA DE PROGRAMACIÓN Y PRESUPUESTO. 1964. VIII Censo General de Población 1960. Veracruz, Mexico.

VARA, A. 1980. La dinámica de la milpa en Yucatán: El Solar. En: Hernández-Xolocotzi, E. y R. Padilla y Ortega (ed.). Seminario sobre Producción Agrícuola en Yucatan. SPP, SARH, CP. Yuc, Mexico.

ZIZUMBO, D. and P. COLUNGA. 1982. Los Huaves, la apropiación de los recursos naturales. Dpto. Sociología Rural, Chapingo, Mexico.

NOTES

[1]Ejido is the land tenure given in usufruct by the Mexican State after the Revolution to the peasant communities. The ejidatario cannot rent, mortgage, sell or alienate this land.

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz.

USES:

A = ANIMAL FODDER Species.
C = Species used for CONSTRUCTION.
D = Species with a DOMESTIC use. a = to wrap food, b = to make brooms, ch = children's game, f = perfume, g = glue, h = henshelter, i = ink, p = poison, t = to make tools, wc = to wash clothes, wd = to wash dishes, wp = to bath.
E = Species used as a FENCE.
F = FOOD species. c = candy, f = fruit, g = beverage, s = spices, t = stimulant, v = vegetable.
I = Species used for FIREWOOD.
M = MEDICINAL Species. a = antiparasites and anthelmintic, b = anthemorrhagic, c = antiseptic, d = antidiarrhoea, db = antidiabetes, f = pharyngitis, g = for grains, h = to make the hair grow, i = to cure inflammations, it = testicular inflammation, iv = vaginal inflammation, k = to disappear spots on the skin, l = to sleep, meas = measles, mr = muscular relaxing, o = for cough, p = antipoison, ps = snake antipoison, pp = spider antipoison, r = antipyretic, s = antispasmodic, se = ear antispasmodic, ss = stomach antispasmodic, t = to calm, tet = antitetanic, th = to take out thorns, v = vitamins, ves = vesicular problems, y = eye problems.
O = ORNAMENTAL Species.
R = RITUAL Species, c = cleansing.
S = Species used for SHADOW.
W = WEEDS.

PART USED:

The symbols after the used part refers to the way of use. External: *As cataplasm (poultice). **Baths and washes. Internal: +As infusion. ++Taken directly.

Family and Scientific Name	Common Name	Use	Part Used
ACANTHACEAE			
Justicia sp.	Anil	M mr	Leaf**
Spathacanthus parviflorus Leon.	Campanita	O	Flower
Thunbergia fragans Roxb.	Copa de oro (cup of gold)	O	Flower
AGAVACEAE			
Polianthes tuberosa L.	Nardo (nard)	O	Flower
AMARANTHACEAE			
Cyathula achyranthoides (HBK)Moq	Cadillo	W	
Iresine celosia L.	Pata de paloma	W	
Amaranthus spinosus L.	Quelite de espinas, bisquelite rojo y blanco	W	
AMARYLLIDACEAE			
Hippeastrum equestre Herb.	Azucena	O	Flower
Crinum scabrum Herb.	Lirio blanco	O	Flower
Himenocallis americana Roem.	Lirio blanco	O M it	Flower Leaf*

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
C. amabile Donn.	Lirio rayado	M it	Leaf*
Sprekelia formossisima	Lirio rayado	M it	Leaf*
Crinum sp. (hybride)	Lirio salmon	M it	Leaf*
		R c	Leaf*
Agave sp.	Maguey	O	Plant
Narcissus poeticus L.	Narciso (narcissus)	O	Flower
ANACARDIACEAE			
Spondias purpurea L.	Ciruela	F f	Fruit
Spondias mombin L.	Jobo	A	Fruit
		S	Tree
		F f	Fruit
Mangifera indica L.	Mango (mango)	S	Tree
ANNONACEAE			
Annona cherimola Mill.	Anona, anonilla, chirimolla (anona)	F f	Fruit
		S	Tree
Annona muricata L.	Guanabana	F f	Fruit
APOCYNACEAE			
Nerium oleander L.	Habanera	O	Flower
Stemmadenia donnell-smithii (Rose)Woods	Huevo de mono	F f	Fruit
		M	Leaf
		E	Tree
		S	Tree
Thevetia plumeriaefolia Benth.	Huevo de mono	S	Tree
T. ahouai (L.) A.D.C.	Huevo de venado	S	Tree
		E	Tree
		F f	Fruit
Tabernaemontana citrifolia L.	Lecherillo, sangrillo	E	Stem
		S	Tree
T. alba Mill.	Lecherillo	S	Tree
Vinca rosea L.	Ninfa	O	Flower
Plumeria rubra L.	Totopolote	O	Flower

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
ARACEAE			
Xanthosoma robustum Schott	Apichi	O	Leaf
Diaffenbachia maculata N.A.H.B.	Bandera	O	Leaf
(non identified)	Capa de Rey	O	Leaf
Zantedeschia aethiopica (L)Spr.	Capote	O	Leaf
Caladium bicolor (Ait) Vent.	Hoja pinta, hoja de colores, bandera	O	Leaf
Philodendron hederaceum (Jq)Scht	Mafafa	O	Leaf
		D a	Leaf
Colocasia esculenta Schott.	Malanga	F v	Corm
(non identified)	Malanga china, malanguita	F v	Corm
ARALIACEAE			
Dendropanax arboreus (L)Dacna	Hogo	C	Stem
ASCLEPIADACEAE			
Asclepias curassavica L.	Yerba del sapo (milkweed)	M mr	Leaf**
		D ch	Flower
BALSAMINACEAE			
Impatiens balsamina L.	Gachupina	O	Flower
		M g	Flower*
I. sultanii Hook	Gachupina	M g	Flower*
I. holstii Engler & Warb.	Gachupina rellena	M g	Flower*
BEGONIACEAE			
Begonia corallina Carriere	Ala de Angel	O	Flower
B. nelumbifolia Schl & Cam	Begonia, Coralina	O	Flower, Leaf
B. maculata Ruddi	Begonia, Coralina (begonia)	O	Flower, Leaf
B. lobulata A.D.C.	Begonia, Coralina (begonia)	O	Flower, Leaf
B. patula Haw.	Begonia, Coralina (begonia)	O	Flower, Leaf
B. barkeri Knowl & Westc.	Begonia, Coralina (begonia)	O	Flower, Leaf
B. cucullata Willd	Begonia, Coralina (begonia)	O	Flower, Leaf
BIGNONIACEAE			
Tabebuia rosea (Bertol) D.C.	Roble	S	Tree
		O	Flower

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Crescentia cujete L.	Jicara	D t	Fruit
		M se	Flower*
BIXACEAE			
Bixa orellana L.	Axiote (achiote)	F s	Seed
BOMBACACEAE			
Ceiba pentandra (L.) Geertn.	Ceiba, pochote	C	Stem
	(kapoc)	S	Tree
Quararibea funebris (Llav) Vis.	Molinillo	C	Stem
BORAGINACEAE			
Cordia stenododa I.M. Johnston	Nopo	S	Tree
		D g	Fruit
		A	Fruit
		I	Branch
		D h	Tree
Tournefortia glabra L.	Palo de agua	E	Stem
Cordia alliadora L.	Suchil	C	Stem
Cordia spinescens L.	Vara prieta	D b	Branch
		M pp	Leaf*
		M tet	Leaf*
BROMELIACEAE			
Annanas comosus (L.) Merrill	Piña (pineapple)	F f	Fruit
BURSERACEAE			
Bursera simaruba (L.) Sarg.	Palo mulato, jiote	E	Stem, Tree
	chaca	M a, s	Stem +
		M meas	Leaf*
CACTACEAE			
(non-identified)	Cruceta	M g	Leaf*
		E	Plant
		F v	Stem, Fruit

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Opuntia lasiacantha	Nopal	O	Plant
CANNACEAE			
Canna indica L.	Chilalaga cimarronia	O	Flower
Canna sp.	Mariposa	O	Flower
C. indica L.	Papatla, chilalaga,	O	Flower
CAPPARIDACEAE			
Cleome serrata Jacq.	Charamusca	O	Flower
CAPRIFOLIACEAE			
Sambucus mexicana Presl.	Sauco, ramo de novia	O	Flower
	(elderberry)	R c	Flower
		M o, r	Leaf +
		M y	Leaf*
		M h	Leaf*
CARICACEAE			
Carica papaya L.	Papaya	F f	Fruit
	(papaya)	M a	Latex
CARYPHILLACEAE			
Dianthus cruentus Griseb.	Clavel	O	Flower
CASUARINACEAE			
Casuarina cunninghamiana Miq.	Casuarina	E	Tree
COMMELINACEAE			
Zebrina pendula Schinzl.	Matalin	O	Flower, Leaf
COMBRETACEAE			
Terminalia catappa L.	Almendro	S	Tree
		F f	Fruit

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
COMPOSITAE			
Simsia sp.	Bella Eusebia	O	Flower
(non identified)	Cardo	O	Flower
Dahlia coccinea Cav.	Dalia	O	Flower
Tagetes erecta L.	Flor de muerto	R	Flower
	(marigold)	M s	Leaf +
Zinnia elegans Jacq.	Girasol, mirasol	O	Flower
Artemisa ludoviciana Nutt.	Hierba maestra,	M s	Leaf +
ssp. *mexicana* (Willd) Kecq.	estafiate	M ves	Stem +
Panudelephantopus sp.	Lengua de perro	A	Leaf
		W	
Bidens pilosa L. var *pilosa*	Mozote	A	Plant
		M pp	Leaf +
Tagetes lucida Cav.	Pericon	M s	Branch
		F s	Leaf
Epaltes mexicana Less	Sabanon	D b	Branch
		M c	Leaf*
Monanoa sp.	Tatuana, tatuaca	O	Flower
		C	Stem
Montanoa grandiflora (DC) Sch. Bjr.	Teresita	O	Flower
Verbesina sp.	Tres lomos,	M ss	Flower
	manzanilla	M erysipela	Leaf*
Senecia sp.	Vara amarilla	O	Flower
Calea zacatechnchi Schl.	Zacate chichi	M ves	Branch +
		M k	Branch*
CONVOLCULACEAE			
Ipomoea batatas (L) Poir ex Lam.	Camote (sweet potato)	F v	Tubercule
Quamoclit lederifolia (L) Pom	Campanita	O	Flower
Ipomoea fistulosa Mar. ex Choisy	Cola de gato	O	Flower
CRASSULACEAE			
Kalancho sp.	Siempreviva	O	Plant
Crassula sp.	Maravillosa	M c, g	Leaf*
		M s	Leaf*

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Bryophyllum pinnatum (Kurz) Lam.	Belladona maravillosa, siempreviva	M g	Leaf*
CUCURBITACEAE			
Cucurbita pepo L.	Calabaza (squash)	F v	Flower, Fruit
C. pepo L. var. *melopepo* Alef	Calabaza pipiana	F s	Seed
Momordica balsamina L.	Cundeamor	D wc	Leaf
Sechium edule S.W.	Chayote	F v	Fruit
Cucumis melo L.	Melon (melon)	F v	Fruit
Cucumis sativus L.	Pepino (cucumber)	F v	Fruit
Citrullus vulgaris Schrad.	Sandia (watermelon)	F v	Fruit
CYPERACEAE			
Cyperus hermaphroditus (Jack.) Standl.	Zacate	A	Leaf
		W	
CHENOPODIACEAE			
Chenopodium ambrosioides L.	Epazote	F s	Leaf
		M a	Root +
Ch. botrys L.	Epazote extranjero	M a	Root +
Ch. amaranticolor Cost & Rey.	Epazote vermifugo,	M a	
	epazote zorrillo	M d	Leaf +
EUPHORBIACEAE			
Sapoim macrocarpum Muell. Arg.	Amate capulin, tomatillo	S	Tree
Acalypha wilkesiana Muell. Arg.	Arbol colorado	O	Leaf
Croton nitens S.W.	Cascarillo	C	Stem
		I	Branch
C. glabellus L.	Cascarillo	I	Branch
Codiaeum vanegatum var. *pictum* M.	Cola de gallo	O	Leaf
Acalypha hispida Burm.	Cola de gallo	O	Leaf, Flower
Euphobia splendens	Corona de Cristo	O	Plant
Breynia nivosa Small.	Hierba pinta, arbolito verde	O	Leaf

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Ricinus comunis L.	Higuerilla	M a	Latex
		M r	Leaf*
		M i	Leaf*
		M birds	Seed
Acalypha sp.	Hoja morada	O	Leaf
Codiaeum vanegatum var *pictum* Muell.	Manguito	O	Leaf
		R c	Branch
Euphorbia pulcherrima Willd.	Nochebuena (poinsettia)	O	Flower
Euphorbia sp.	Pinito	O	Plant
Jatropha crucas L.	Pinon	E	Stem
		M c	Latex
Manihot esculenta Crantz.	Yuca (cassava)	F v	
Pedilanthus tithymaloides L. Por.	Zapatito, mayorga	O	Flower
		M g	Leaf*
		M th	Latex*
		M mumps	Latex*
		M se	Leaf*
FLAVOURTIACEAE			
Zuelania guidonia (SW) Britt & Mill	Nopotapeste	S	Tree
GERANIACEAE			
Pelargonium zonale Ait.	Geranio, capote	O	Flower
P. radula L'Her	Geranio, capote (geranium)		Flowers
GESNERIACEAE			
Haberna rhodopensis Friv	Lazo, mono	O	Flower
GRAMINEAE			
Saccharum officinarum L.	Caha de Azucar (sugar cane)	F v	Stem
Guadua aculeata	Cana Otate	C	Stem
Cynodon plectostachyus (Schum) Pil	Estrella de Africa	A	Leaf
		W	
Zea mays L.	Maiz (maize, corn)	F v	Fruit
Arundo donax L.	Tarro, carrizo	C	Stem
		E	Stem

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Cymbapogon citratus Stepf.	Te limon	M s	Leaf +
	(lemon grass)	F g	Leaf +
Paspalum conjugatum Bergius	Zacate grama	A	Leaf
		W	
Axonopus compressus (Sw.) Beauv.	Zacae grama	W	Leaf
GUTTIFERAE			
Rheedia edulis Triana (Planch.	Limoncillo	F f	Fruit
		C	Stem
HIPPOCRATACEAE			
Salacia impressifolia (Miers) SM	Tengualala	F f	Fruit
IRIDACEAE			
Sisyrinchium johnstonni Standl.	Cebollin	F s	Bulb
LABIATAE			
Ocimum basilicum L.	Albaca	R c	Branch
	(basil)	M s uterus	Leaf +
		M t	Leaf +
Hyptis mutabilis (Rch.) Briq.	Hierba martina	M s	Leaf
		M b	Root*
		W	
H. verticillata Jacq.	Hierba martina	W	Root*
Coleus blumei Benth.	Hoja pinta	O	Leaf
Salvia coccinea Juss. ex Mutt.	Mirto	O	Flower
Melampodium divaricatum Rich ex D.D.	Mozote amarillo	O	Flower
Pogostemon heyneanus Benth.	Pechulin	D wc	Leaf
		D wp	Leaf
Coleus thyrsoideus Baker	Purpura	O	Leaf
LAURACEAE			
Persea americana Mill.	Aquacate morado	F f	Fruit
	(avocado)	M d	Leaf +
P. schiedeana Nees x americana	Aguacate negro	M d	Leaf +
Persea schiedeana Nees.	Chinine, pagua	F f	Leaf +

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Hectandra ambigens (Blak) CK. All	Laurel aguacatillo	C	Stem
H. loesenerii Mes	Laurel	C	Stem
		M ps	Leaf +
LEGUMINOSAE			
(non identified)	Arrocillo	E	Tree
Caesalpinia pulcherrima (L) Sw.	Caballera	O	Flower
Arachis hypogaea L.	Carahuate (peanut)	F	Seed
Delonix regia (Boj.) Raf.	Cochimbo, framboyan,	O	Flower
	arbol del fuego	R c	Flower
Gliricidia sepium (Jack) Sted.	Cocuite	C	Stem
		E	Stem
Acacia cornigera (L.) Willd.	Cornizuelo	M d	Leaf +
Dalbergia glomerata Hemsl.	Chagane	C	Stem
Inga punctata Willd.	Dhalahuite	F f	Seed
		S	Tree
Pisum sativum L.	Chicharo	F v	Seed
	(pea)		
Diphysa robinoides Benth.	Chipile	C	Stem
		M g	Leaf*
Pithecellobium sp.	Chiquipile	D t	Branch
Mimosa pudica L.	Dormilona	M l	Root
	tapavergenzas	W	
Acacia farnesiana (L.) Willd.	Flor de aroma	O	Flower
		D f	Flower
		M	
Phaseolus vulgaris L.	Frijol (bean)	F v	Seed
Clitoria ternata L.	Gallito	O	Flower
Erythrina sp.	Gasparito, iquimite,	E	Stem
	cosquelite	F v	Flower
		D p	Seed
E. caribeae Krukoff & Barn.	cosquelite	D p	Seed
Leucaena leucocephala (Lam) Wit.	Guajillo	F f	Seed
Pachyrrhizus erosus (L.) Urb.	Jicama	F v	Root
Lonchocarpus guatemalensis Benth	Palo gusano, gallito	I	Branch

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
L. santarosanus Dom.	Palo gusano, gallito	I	Branch
Dialium swartizia	Paqui	C	Stem
Tamarindus indica L.	Tamarindo	F f	Fruit
		S	Tree
		E	Tree
Inga sapindioides Willd.	Vaina chica	F f	Seed
		S	Tree
I. brevipedicellata Harms.	Vaina grande	S	Tree
I. jinicuil Schlecht.	Vaina grande	S	Tree
Inga sp.	Vaina mediana	S	Tree
LILIACEAE			
Allium sativum L.	Ajo	F s	Leaf
	(garlic)	M s	Leaf +
Allium cepa L.	Cebolla (onion)	F s	Bulb
Asparagus sefaceus (Kun) Jess.	Esparrago (asparagus)	F v	Stem
Hemerocallis dumortieri Mill.	Lirio amarillo	O	Flower
Aloe barbadensis Mill.	Sabila	M tumours	Leaf*
LOBELIACEAE			
Lobelia aff. *fulgens* Willd.	Cola de gato	O	Flower
LOGANACEAE			
Buddleja sp.	Tepozan	M g	Leaf*
LYTHRACEAE			
Lagerstroemia indica L.	Astronomica	O	Flower
MALPIGHIACEAE			
Bunchosia lanceolata Turcz.	Zapotillo, zapote domingo	F f	Fruit
Byrsonima crassifolia (L) HBK	Nanche (Nance)	F f	Fruit
		M r	Leaf**
		M d	Stem +
Malpighia glabra L.	Manzanita	O	Flower, Fruit
MALVACEAE			
Pavonia schiedeana Stendel	Cadillo	W	

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Cyathula sp.	Cadillo	W	
Hampea nutricia Fryxell	Caimito,	M b	Latex*
	tecolixtle, tapaculo	F f	Fruit
Sida rhombifolia L.	Escobilla, malva	D b	Branch
	de cochino	A	Leaf
		W	
S. acuta Burm		W	
		M iv	
Robinsonella Mirandae Gomez P.	Manzanillo	C	Stem
Hibiscus calcynus Willd.	Tulipan amarillo	O	Flower
	(hibiscus)	M r	Flower +
H. schizopetalus Hook.	Tulipan canastito	M r	Flower +
Hibiscus sp. (hybride)	Tulipan clavelito	M r	Flower +
H. rosa-sinensis L.	Tulipan rojo	M r	Flower +
		R c	Flower
H. syriacus L.	Tulipan rosa	O	Flower
MELIACEAE			
Cedrella odorata L.	Cedro	C	Stem
	(cedar)	M mr	Cortex*
Guarea glabra Vahl.	Gaga	C	Stem
Trichilia lavanensis Jacq.	Rama tinaja	M ves	Leaf +
MONIMIACEAE			
Siparuna andina (Tul.) A.D.C.	Limoncillo	S	Tree
MORACEAE			
Poulsenia armata (Mig) Standl.	Agabasgabi	F f	Fruit
Cecropia obtusifolia Bertol.	Chancarro	C	Stem
		I	
		M db	Leaf +
Brosimum alicastrum Sw.	Ojochi	D p	Fruit
Pseudolmedia oxyphyllaria Donn.	Tomatillo	C	Stem
MUSACEAE			
Heliconia collinsiana Gelggs.	Hoja de berijao	F s	Leaf

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Musa acuminata (Grupo AA)	Platano ciento en	F f	Fruit
	boca	F s	Leaf
	(banana)	F s	Fruit
		M r Fruit +	
M. acuminata x balbisiana (G. ABB)	Platano cuadrado	M r	Fruit +
M. acuminata (Grupo AA, Subgrupo Cavendish)	*Platano enano-gigante*	*M r*	*Fruit +*
M. acuminata x balbisiana (G. ABB)	Platano cuadrado	M r	Fruit +
M. acuminata (Grupo AA, Subgrupo Cavendish)	*Platano enano-gigante*	*M r*	*Fruit +*
M. acuminata x balbisiana (G. AAB, Subgrupo Plantain)	Platano hembra o dominico, Platano macho.	M r	Fruit +
M. acuminata x balbisiana (G. AAB)	Platano manzano	M r	Fruit +
M. acuminata Colla (G. AAA) Simmond	Platono morado, guineo, roatan, injerto, indio.	M r	Fruit +
Heliconia latispatha Benth.	Platanillo	O	Flower
		F s	Leaf
MYRTACEAE			
Sysygium jambos Alston.	Pomarrosa	F f	Fruit
Pimienta dioica (L.) Merrill	Pimienta	F s	Fruit
	(pepper)	M t	Leaf +
Psidum guajava L.	Guayaba	F f	Fruit
	(guava fruit)	M r, s	Stem*
		M d	Leaf +
		M g	Leaf*
		D t	Branch
		F s	Leaf
		S	Tree
Eugenia capuli Berg.	Escobilla	O	Flower
MYRSINACEAE			
Ardisia nigropunctata Oerst.	Capulin	F f	Fruit
Ardisia compressa H.B.K.	Capulin de Mayo	F f	Fruit
Ardisia aff. *belizensis* Lundell	Chagalapoli	F f	Fruit
Parathesis psychotrioides Lund.	Silling	F f	Fruit
		S	Tree

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
NYCTAGINACEAE			
Bougainvillea spectabilis Willd.	Bugamibilia (bougainvillea)	O	Flower
Mirabilis jalapa L.	Maravilla	O	Flower
		M g	Leaf*
OLEACEAE			
Jasminum sambac Ait.	Jazmin (jasmin)	O	Flower
ORCHIDACEAE			
Oncidium sphacelatum Lindl.	Parasita	O	Flower
Epidendrum paniculaum Ruiz & Pavon	Parasita	O	Flower
Oncidium ascendens Lindl.	Parasita	O	Flower
O. luridum Lindl.	Parasita	O	Flower
Encyclia cochleata (L) Lemee	Parasita	O	Flower
PALMAE			
Cocos nucifera L.	Coco	F f	Fruit
	(coconut)	S	Tree
Astrocaryum mexicanum Liebm.	Chocho	C	Stem
PEDIALIACEAE			
Sesamum indicum L.	Ajonjolí (sesame)	F s	Seed
PHYTOLACCACEAE			
Rivina humulis L.	Lluvia	O	Flower
		W	
PIPERACEAE			
Piper auritum H.B.K.	Acuyo	F s	Leaf
		M p	Leaf*
Piper amalago L.	Cordoncillo	M ps	Leaf*
PLUMBAGINACEAE			
Plumbago capensis Thumb.	Lluvita	O	Flower
POLYGONACEAE			
Coccoloba barbadensis Jack.	Uvero	S	Tree

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
		C	Stem
		F f	Fruit
		M d	Fruit +
POLYPODACEAE			
(non identified)	Palmitas	O	Leaf
PORTULACACEAE			
Portulaca oleracea L. var *sativa* D.C.	Mananita, verdolaga	O	Flower
		F v	Leaf
P. grandiflora Hook.	Mananita, amor de un rato	O	Flower
PUNICACEAE			
Punica granatum L.	Granada	F f	Fruit
		M d	Fruit +
ROSACEAE			
Eriobotrya japonica (Thumb) Lindl	Nispero	F f	Fruit
Rosa moschata Herm.	Rosa blanca chica	O	Flower
R. odorata Sucet.	Rosa carton, rosa blanca	O	Flower
R. chinensis Jacq.	Rosa concha, rosa roja y amarilla	O	Flower
R. multiflora Thumb.	Rosa nina, rosa carolina	O	Flower
R. damascena Mill.	Rosa roja (roses)	O	Flower
		R c	Flower
RUBIACEAE			
Coffea arabica L	Café	F t	Seed
	(coffee)	M t	Leaf
Hamelia patens Jacq.	Coyolillo	M ps	Leaf*
Calycophyllum candidissimum DC.	Dagame, agame, palo colorado	C	Stem
Ixora coccinea L.	Flor roja	O	Flower
Gardenia augusta L.	Gardenia	O	Flower
	(gardenia)	M o	Flower
Crusea hispida (Mill) Rob.	Nueva cimarrona	W	

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Dioidia brasiliensis var. *angulata* Benth Stand.	Romerillo	D b	Branch
		W	
Richardia scobra L.	Roseta	O	Flower
Rondeletia leucophylla HBK	Roseta	O	Flower
RUTACEAE			
Citrus aurantifolia (Christm) Sw.	Limon agrio chico,	F f	Fruit
	limon injerto	M o	Leaf +
	(lemon)		
C. limonia Osbeck	Limon agrio grande,	F f	Fruit
	limon real	F s	Leaf
Murraya paniculata (L.) Jack.	Limonaria	O	Flower
Citrus limon Burm.	Limon canario	F f	Fruit
	F s	Leaf	
C. limetta Risso	Limon dulce, lima	F f	Fruit
	limon, lima		
Citrus sinensis Osbeck	Naranja dulce	F f	Fruit
	(orange)	M s	Leaf +
C. aurantium L.	Naranja mateca,	F f	Fruit
	naranja agria	M l	Leaf +
		M o	Leaf +
		M o	Leaf +
		S	Tree
		A	Fruit
C. nobilis Lour	Naranja reina, mandarina	F f	Fruit
	china, tangerina	M a	Leaf +
Citrus paradisi Maaf.	Pomelo	F f	Fruit
		M mr	Leaf +
Ruta chalepensis L.	Ruda	R c	Branch
		M s	Leaf* +
Citrus maxima (Burm) Merrill	Toronja (grapefruit)	F f	Fruit
SAPINDACEAE			
Cupania glabra Swartz.	Guacamayo, tronador	S	Tree

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
C. macrophylla A. Rich	Guacamayo	S	Tree
		C	Stem
Cupania dentata D.C.	Tronador	I	Branch
SAPOTACEAE			
Pouteria mamosa Cronquist.	Mamey	F f	Fruit
		M f	Seed
		D f	Seed
Chrysophyllum mexicanun Brand & Standl.	Pistillo, pischahuite	F f	Fruit
Pouteria campechiana (HBK) Baeh.	Zapote agrio	F f	Fruit
SAXIFRAGACEAE			
Hydrangea macrophylla (Thumb) DC	Hortensia (hydrangea)	O	Flower
SCROPHULARIACEAE			
Russelia equisetiformis Schl (Chm.	Campanita de Oro	O	Flower
Bacopa procumbens (Mill) Greenm.	Chotete, hojita	M ar	Plant**
	de quebranto	M r, s	Leaf +
Angelonia ciliaris Rob.	Espuela	O	Flower
SOLANACEAE			
Solanum torvum Swarz.	Berenjena	D wd	Leaf
		M mr	Leaf*
S. chiapasense Roe	Berenjenilla	D wd	Leaf
		W	
S. umbellatum Mill	Berenjenilla	W	Leaf
Capsicum annuum var *aviculare*	Chile bolita (capsicum, chilli)	F s	Fruit
C. frutescens L.	Chile santanera, chile veneno	F s	Fruit
C. annuua L. var *minium* Mill.	Chilpaya, chiltepin	F s	Fruit
		M v	Leaf + +
Datura suaveolens Humb. & Bonpl.	Florinfundio	O	Flower
		M o	Leaf +
Cestrum racemósum R & P	Huele de Noche	O	Flower

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
		R c	Leaf
Datura stramonium L.	Toluache, hoja de	M	Leaf*
	tapa	M paralysis	Leaf
Lycopersicum esculentum (Doral) Gray & Syn	Tomate (tomato)	F v	Fruit
STERCULIACEAE			
Guazuma ulmifolia Lam.	Guasimo	F f	Fruit
		I	Branch
		D t	Branch
		M e	Stem
TILIACEAE			
Triumfetta semitriloba Jacq.	Cadillo	W	
Heliocarpus appendiculatus Turcz.	Jonote	C	Stem
ULMACEAE			
Trema micrantha (L) Blume	Togalapoli	F f	Fruit
		C	Stem
UMBELLIFERAE			
Pimpinella anisum L.	Anis	Fc	Leaf
	(anise)	M c	Leaf +
Coriandrum sativum L.	Cilantro (coriander)	F s	Leaf
Eryngium foetidum L.	Cilantro extranjero	F s	Leaf
Petroselinum crispum (Mill) Nym	Perejil (parsley)	F s	Leaf
URTICACEAE			
Myriocarpa longipes Liebm.	Palo de agua	E	Stem
VERBENACEAE			
Clerodendrum thomsoniae Balt.	Enredadera, clorodendo	O	Flower
C. aspeciasum D'Ombrain	Enredadera, clorodendo	O	Flower
Clerodendrum japonicum Sweet	Flor roja, copa de oro	O	Flower
Duranta repens L. var *alba* Bail.	Lluvia	O	Flower
Lippia sp.	Oregano (oregano)	F s	Leaf
		M se	Leaf*
		M p	Leaf + +

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
Lippia hypoleia Brig.	Palo gusano	S	Tree
		I	Branch
		D h	Tree
Verbena teucriifolia Mort & Gal.	Pizarrina	O	Flower
Lippia graveolens HBK	Salvia	M tet	Leaf*
Lippia alba (Mill) Brown ex Britt & Wilson.	Salvia, manrubio, hoja de salvia	M o	Leaf +
		M s	Branch +
		M erysipela	Leaf*
Holmskioldia sanguinea Retz.	Sombrerito chino	O	Flower
Petrea volubilis L.	Tachicon	O	Flower
Duranta repens L.	Tres lomos	S	Tree
		A	Fruit
		F f	Fruit
Stachytarpheta jamaicensis (L.) Vahl.	Verbena	M toothache	Leaf*
		O	Flower
VIOLACEAE			
Viola odorata L. Sweet	Violeta (violet)	O	Flower
ZYNGIBERACEAE			
Hedichium coronarium Koenig. Ret.	Chilalaga	O	Flower
Kaempferia rotunda L.	Huerfanita	O	Flower
NON IDENTIFIED			
	Cochinilla	D p	
	Chichin	D i	Flower
	Espino blanco	S	Tree
		M	Leaf
	Hoja cuchara	C	Stem
	Ilama	F f	Fruit
	Lagana	D ch	Leaf, Flower
	Matanche	M ves	Leaf +
		M r	Leaf +
	Olozapote	S	Tree
	Palo dulce	D t	Stem

APPENDIX 1. Uses and parts used of the plant species of the Home Gardens of Balzapote, Veracruz. (continued)

Family and Scientific Name	Common Name	Use	Part Used
	Primavera	C	Stem
	Romero	M s uterus	Leaf +
		M cold	Leaf**
	Rosablanca	C	Stem
	Sabina	C	Stem
	Taberna	O	Flower
	Veveta	O	Flower
	Viudita	O	Flower

Santa Ysabel Ethnobotany. Hedges, Ken and Christina Beresford. Illustr. by Rose Christensen. San Diego Museum of Man, Ethnic Technology Notes No. 20. 1986. Pp. 58. n.p. (paper).

Santa Ysabel Ethnobotany is based primarily on the testimony of Christina Beresford, one of the last Diegueño (Yuman) Indian basketmakers. The information was recorded by Ken Hedges as a student project in 1966 and has been circulated informally since then. This published version is well illustrated with Rose Christensen's line drawings.

A total of 77 botanical species, including 8 of Eurasian origin, are arranged alphabetically by Latin name and individually described; an additional 13 unidentified taxa are discussed in conclusion. Diegueño names (mostly supplied by Mrs. Beresford) are recorded for 33 taxa, incuding 5 named types of oaks ***(Quercus);*** these 5 oak taxa are not labeled binomially. (By contrast, several species of cacti are lumped under a single Diegueño term.) A special section on the key Diegueno staple—acorns—describes terminology, methods of preparation of acorn mush, and associated material culture current in 1966. Basketry plants are also detailed separately. A table comparing Diegueño plant uses with those reported in the literature for the neighboring Kumeyaay (Yuman: Hokan), Luiseño, Cupeño, and Mountain Cahuilla (all Takic: Yuto-Nahuan) is appended.

We may be grateful to the authors for their efforts in preserving this tantalizing remnant of Diegueño ethnobotanical ethnography.

Eugene S. Hunn
Department of Anthropology
University of Washington
Seattle, WA 98195

J. Ethnobiol. 8(1):81-129 Summer 1988

A SURVEY OF TRADITIONAL METHODS EMPLOYED FOR THE DETOXIFICATION OF PLANT FOODS

TIMOTHY JOHNS
School of Dietetics and Human Nutrition
Macdonald College of McGill University
Ste. Anne de Bellevue
Quebec H9X1C0, Canada

and

ISAO KUBO
Entomology and Parasitology
College of Natural Resources
University of California
Berkeley, CA 94720, USA

ABSTRACT.—From a survey of ethnobotanical reports a list of 216 species of lichens, fungi, algae and vascular food plants that are detoxified during processing was compiled. Major techniques of detoxification are categorized as heating, dissolution, fermentation, adsorption, drying, physical processing and pH change, and a classification scheme that contains details of the specific ways these techniques are employed is presented. An ancillary survey of chemical data indicates that detoxification is used to remove a range of potential toxins. The Cycadales, the families Araceae, Dioscoreaceae, and Fabaceae, plus *Quercus* spp. and *Manihot esculenta* stand out as taxa that are detoxified by people worldwide. Dense carbohydrates available in these plants may have motivated humans to develop detoxification techniques. Although their antiquity is unknown, these techniques may have played a role in the evolution of human dietary patterns.

INTRODUCTION

Although human food procurement is constrained by the same allelochemicals (secondary compounds) that make many plants unavailable as food for herbivorous animals, processing technology is one means employed by humans for making foods more palatable and less toxic. Selection for genetic changes during domestication risks exposing plants to attack by insects and plant diseases. By eliminating undesirable compounds subsequent to maturation of the plant we allow chemicals to play their natural role in defense during vegetative and developmental stages, thus ensuring a harvest for ourselves. Technological innovations, then, allow humans to circumvent the coevolutionary competition that characterizes plant-herbivore interactions (Harborne 1982).

The extent to which plant resources were eaten by early humans and our hominid predecessors is a concern that is relevant for understanding the evolution of the human dietary patterns (Milton 1987; Stahl 1984). Processing techniques for detoxifying wild and cultivated foods may have played an important role in early human food procurement by making plant foods more available. Cultural methods for dealing with toxins augmented the biological detoxication capabilities we share with other animals. Plants were probably always eaten by hominids but processing contributed to improving their dietary quality.

While the use of fire dates back to at least 500,000 years B.P. (Clark and Harris 1985; Isaac 1984), evidence from which to determine the antiquity of other traditional processing techniques is less available. The use of these techniques predates the origins of agriculture, indeed detoxification methods were probably important in allowing humans to interact with certain plant foods to the extent that they could begin a selection process leading to domestication. Study of processing techniques employed in historical times by agriculturalists and gather-hunter peoples, the mechanisms by which they function and their incidence patterns, may provide insights into the possible ways by which they developed. Modern industrial food processes have a partial function in detoxifying foods; these techniques have their roots in practices of the past.

Traditional detoxification techniques are essential to the subsistence of many people around the world, and their importance in specific instances both historically and in the present day has been noted repeatedly. The methods used globally to detoxify bitter cassava (*Manihot esculenta* Crantz.) have been the most extensively studied (Lancaster *et al.* 1982). Fewer authors have addressed detoxification as a general phenomenon (cf. Harris 1977; Hayden 1981). Through a compilation of individual cases, this study attempts to contribute to the understanding of the overall significance of this human activity.

While processing techniques have apparent value, little attention has been given to their efficacy (cf. Christiansen and Thompson 1977; Lancaster *et al.* 1982). Residual amounts of toxins may be present even when acute toxicity is eliminated, and their effectiveness may be relative. Cyanide poisoning, for example, continues to be a problem in many parts of the world in spite of cassava processing (Cock 1982).

Processing may eliminate nutrients along with toxins and requires greater evaluation from this perspective. In addition to cultural methods, humans have physiological ways for avoiding plant toxicity, but little is known about the relationship between the two. Microsomal enzyme activities may depend on nutritional status (Anderson *et al.* 1986). Where humans subsist on diets of limited diversity such as those dominated by cassava, greater evaluation of the risks and benefits of processed toxic foods are needed.

SURVEY OF TRADITIONAL PLANT DETOXIFICATION METHODS

Ethnobotanical reports from around the world were surveyed. One hundred and thirty-seven genera and 216 species from 65 families of lichens, fungi, algae and vascular plants that are used after some detoxification are listed in Table 1. While this survey is comprehensive it is not exhaustive. Although similar processing techniques are used in various other circumstances, this survey lists only those cases where it was explicitly stated that the plants were being detoxified or bitterness was being eliminated. Although the elimination of toxic and bitter constituents is the focus of this discussion, it must be recognized that processing techniques improve foods by making them more digestible or more palatable in several ways (Stahl 1988). For example cooking, soaking, grating and the addition of lye are used widely to soften foods. Increasing the digestibility of foods makes nutrients more available.

Table 1 includes known toxic chemicals reported from the plants of interest. It should be noted that any particular plant may contain a number of potentially toxic allelochemicals, and until more detailed chemical data are available the listed chemicals may only provide an approximation of what compounds are the subject of detoxification efforts.

Of the taxa in Table 1 certain ones are conspicuous. The Cycadales, the families Araceae, Dioscoreaceae, and Fabaceae, plus *Quercus* spp. (Fagaceae) and *Manihot esculenta* (Euphorbiaceae), are notable in their exploitation around the world and this because of the role detoxification has played.

Processing techniques eliminate a large range of allelochemicals representing a cross-section of the classes of chemicals found in plants. No pattern is apparent in these particular chemicals. Just the important taxa listed above include calcium oxalate, alkaloids, MAM (methylazoxymethanol) glycosides, cyanogenic glycosides, saponins, tannins, lectins and non-protein amino acids.

Why do humans bother to process certain plant foods and not others? People who utilize toxic plants exploit other plants which require little or no processing. Perhaps the answer lies in the fact that the major processed plants are all of widespread distribution and produce a reliable, recognizable and abundant food resource. The aroids, cycads, yams, acorns, and cassava are all important carbohydrate-supplying staples for various cultural groups. The legumes represent another source of abundant food. However, none of the major exploited legumes (e.g. beans, peas, and lentils), except edible lupines, require detoxification (other than cooking).

CLASSIFICATION OF TRADITIONAL PLANT DETOXIFICATION METHODS

Processing methods show marked similarities worldwide and are classifiable according to the way in which they function to eliminate toxins. Coursey's (1973) classification of cassava processing served as a basis for the more elaborate scheme presented in APPENDIX 1. Plants considered in Table 1 were classified according to this new scheme. The classification codes provide a convenient way to analyze individual cases of detoxification.

Heat, solution, fermentation, adsorption, drying, comminution, and chemical reaction due to pH change comprise the major means of detoxification. Many detoxification procedures involve more than one of these functions, and it is a matter of judgement as to the most important part of the process. The classification is hierarchical and designed so that the more important a part of the process is in the overall detoxification the higher is its decimal point. For example boiling of a food may involve both detoxification by heating and detoxification by solution. Either of the codes 1.12 or 2.27 is chosen over the other in specific cases where one function is considered the more crucial. The classification might be further complicated if, for example, the material is ground before it is boiled and/or if lye, acid, or clay is added to the water.

METHODS OF PLANT FOOD DETOXIFICATION

1. *Detoxification by heating.*—Heat provides energy to drive chemical reactions within foods and those between chemical constituents of a food and environmental chemicals such as oxygen. Toxins may be converted or degraded to less poisonous chemicals. Heat

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1.*

Plant Group Family Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Lichens												
Bryoria fremontii (Tuck.) Brodo & D. Hawksw.	(P)	British Columbia	vulpinic acid	X	X				X		2.1216	Turner 1977
Cetraria islandica (L.) Ach.	(P)	Japan; N. temperate		X	X						2.2812	Tanaka 1976
Fungi												
Gyromitra esculenta Pers. ex Fr.	(Fb)	Europe	gyromitrin	X							2.121	Garnier et al. 1978 Tanaka 1976
Morchella esculenta Pers. ex Fr.	(Fb)	Temperate region		X							2.121	Tanaka 1976
Algae												
Asparogopsis sanfordiana Harv.	(T)		halogenated hydrocarbons		X				X		2.212	Moore 1977 Tanaka 1976
VASCULAR PLANTS												
Aizoaceae												

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1.* (continued)

Plant Group Family Scientific Name Plant Part ( )	Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Glinus oppositifolius A.DC.		saponins								Hegnauer 1964
(P)	Philippines	X							2.11	Burkill 1985
Sesuvium portulacastrum L.		salt								Burkill 1985
(P)	W. Africa	X	X						2.2812	Burkill 1985
Tetragona tetragonioides	(Pallas) O.Ktze									
(P)	W. Africa	X							2.12	Burkill 1985
Alismaceae										
Alisma plantago L.		sesquiterpenoids, triterpenoids, choline								Oshima 1983
(R)	Eurasia					X			2.51	Hedrick 1919
Sagittaria cuneata Sheld.										
(T)	W. North America	X							2.12	Johnston 1970
Sagittaria latifolia Willd.										
(T)	E. North America	X							2.12	Hussey 1974
Amaranthaceae										
Achyranthes japonica Nakai										
(L)	Asia	X	X						2.2812	Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry / Processing Classification 1	2	3	4	5	6	7	Code	Reference
Amaryllidaceae											
Lycoris radiata Herb.			alkaloids								Wildman 1968
	(B)	Japan		X						2.221	Tanaka 1976
L. sanguinea Maxima.	(B)	Japan		X						2.221	Tanaka 1976
L. squamigera Maxima.			alkaloids								Wildman 1968
	(B)	Japan		X						2.221	Tanaka 1976
Anacardiaceae											
Corynocarpus laevigata Forst.	(SF)	New Zealand	nitropropanoyl glucopyranoses								Moyer 1979
			X	X						2.251, 2.214, 2.2111	Hedrick 1919; Wright-St. Clair 1972
Semecarpus anacardium L.			pentadecylcatechols								Hembree et al. 1978
	(F)	Asia, Australia	X				X			2.13, 2.51	Hedrick 1919
S. austaliensis Engl.	(F)	Australia	X							2.131	Cribb & Cribb 1975; Irvine 1957

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )	Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Annonaceae										
Mezzettia leptopoda (Hook. f. & Thoms.) King (T)	Malay Penninsula	X	X		X	X			2.31114	Skeat & Blagden 1906
Apiaceae										
Cymopterus fendleri A. Gray		furocoumarins								Yost et al. 1977; Hegnauer 1973
(L)	W. North America	X							2.131	Steggerda & Edkardt 1941
Lomatium orientale Coulter &Rose (R)	Arizona	X							2.131	Steggerda & Eckardt 1941
Cogswellia orientalis)										
Apocynaceae										
Apocynum spp.		cardiac glycosides								Hegnauer 1964
Apocynum angustifolium Wooton (La)	New Mexico			X					2.4115	Castetter 1935

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Araceae											
Alocasia macrorhiza Schott. *(Colocasia macrorhiza)*			cyanogenic glycosides proteinase inhibitors								Nahrstedt 1975 Sumathi & Pattabiraman 1977
	(St)	Australia	X	X				X		2.132, 2.212	Cribb & Cribb 1975; Irvine 1957
	(T)	Philippines	X							2.121, 2.131	Brown 1920
	(T)	New Caledonia	X							2.13	Tanaka 1976
Amorphophallus abyssinicus N.E.Br.	(T)	S. Africa	X	X						2.2711	Scudder 1971
A. aphyllus (Hook.) Hutch.	(T)	W. Africa	X	X			X		X	2.235, 2.1125, 2.235	Burkill 1985; Busson 1965
A. campanulatus (Roxb.) Blume.	(T)	India	X	X						2.2211	Singh & Arora 1965
	(T)	Asia, Philippines	X							2.121, 2.13	Hedrick 1919; Brown 1920
A. dracontioides N.E. Br.			saponins								Burkill 1985
	(T)	W. Africa	X	X				X		2.22222	Burkill 1985

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
A. glabra F.M. Bailey	(TFSt)	Australia	X							2.13	Cribb & Cribb 1975
A. lyratus Kunth	(T)	India	X							2.121	Tanaka 1976
Anchomanes difformis (Bl.) Engl.	(Rh)	W. Africa	X	X	X				X	2.31134	Burkill 1985
A. welwitschii Rendle	(T)	W. Africa	X	X						2.2211	Burkill 1985
Arisaema amurense Maxim	(R)	Asia	X	X				X		2.2111	Tanaka 1976
A. curvatum Kunth.	(T)	India	X	X	X					2.31112	Hedrick 1919
A. triphyllum (L.) Torr. *(Arum triphyllum)*	(T)	E.N. America	X				X	X		2.11, 2.5122, 2.132	Kuhm 1961; Harris 1890; Havard 1895
Arisarum vulgare Targ.	(R)	North Africa		X						2.22	Hedrick 1919
Arum maculatum L.			cyanogenic glycosides								Nahrstedt 1975
	(R)	Europe	X							2.11	Hedrick 1919
	(L)	Europe	X				X			2.28115	Hedrick 1919

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Calla palustris L.	(R)	Europe; N. Asia; North America	X				X	X		2.112	Hedrick 1919
Colocasia antiquorum Schott	(L)	Australia	X	X						2.2812	Irvine 1957
C. esculenta (L.) Schott	(T)	W. Africa	X	X						2.224	Burkill 1985
	(T,St)	Pacific						X		2.61	Bascom 1965
	(T)	Australia	X							2.12, 2.13	Cribb & Cribb 1975
C. indica Hassk.	(T)	S. Asia	X							2.11	Hedrick 1919
Lysichiton americanum Hulten & St. John	(R)	W.N. America	X							2.121	Gunther 1973
Peltandra virginica Rafin. *(Arum virginica)*	(T)	E.N. America	X				X	X		2.514, 2.131, 2.12	Harris 1890; Hedrick 1919
Plesmonium margaritiferum Schott	(T)	India	X	X					X	2.28114	Tanaka 1976
Stilochiton lancifolia Kotschy & Peyr.	(L)	W. Africa	X	X						2.28112	Burkill 1985
	(Rh)	W. Africa		X					X	2.2611	Burkill 1985

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Symplocarpus foetidus Nutt.	(R)	E.N. America					X	X		2.131	Harris 1890
Typhonium angustilobium F.V. Muell.	(T)	Australia	X					X		2.132	Cribb & Cribb 1975
T. brownii Schott.	(T)	Australia	X					X		2.132	Cribb & Cribb 1975; Irvine 1957
T. trilobatum (L.) Schott	(Rh)	West Africa	X				X			2.11, 2.5	Burkill 1985
Areacaceae											
Ancistrophyllum secundiflorum (G. Mann & H. Wendl.)	(St,L)	W. Africa	X							2.12	Irvine 1952
Asclepiaceae											
Ceropegia bulbosa Rosb.	(R)	West Indes	cardiac glycosides X							2.121	Hegnauer 1963 Tanaka 1976
Asteraceae											
Agoseris retrorsa Greene	(P)	W.N. Africa	X	X						2.2144	Zigmond 1981
Artemisia laciniata Willd.		Manchuria	terpenoids, polyacetylenes X							2.121	Greger 1977 Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Aster ageratoides Turcz.	(L)	Asia		X							2.12	Tanaka 1976
Balsamorrhiza spp.	(R)	W.N. America							X		2.61	Havard 1895
Hemizonia luzulaefolia DC	(S)	California		X							2.131	Tanaka 1976
Scorzonera hispanica L.	(R)	C. & S. Europe		X	X						2.2112	Hedrick 1919
Vernonia amygalina Del.	(L)	W. Africa	elemanolide lactones	X	X			X	X		2.2811, 2.222, 2.121	Ganjian et al. 1983 Burkill 1985; Keshinro & Ketiku 1979; Busson 1965
V. colorata (Willd.) Drake	(L)	W. Africa	elemanolide lactones	X	X						2.2811, 2.22	Gasquet et al. 1985 Burkill 1985
V. thomsoniana Oliv. & Hiern.	(L)	Gabon		X	X						2.2812	Burkill 1985
Brassicaceae												
Arabis glabra Bernh.	(L)	Asia	glucosinolates	X	X						2.2812	Hegnauer 1964 Tanaka 1976
Dentaria spp.		America	glucosinolates									Hegnauer 1964

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Dentaria maxima Nutt.	(R)	North America		X		X					2.31113	Tanaka, 1976
Isatis tinctoria L.	(L)	China			X						2.211	Tanaka 1976
Senebiera coronopus Poir.	(P)	cosmopolitan		X							2.121	Hedrick 1919
Stanleya pinnata (Pursh) Britton	(L,St)	California		X	X				X		2.2144	Zigmond 1981
Capparaceae												
Boscia senegalensis (Pers.) Lam.	(S)	W. Africa	glucosinolates, alkaloids		X						2.211	Ahmed et al. 1972 Delaveau et al. 1973; Burkill 1985
Capparis retusa Griesb.	(F)	Chaco, South America		X							2.2812	Mêtraux 1950
C. salicifolia Griesb.	(F)	Chaco, South America	glucosinolates	X							2.2812	Ahmed et al. 1972 Mêtraux 1950
C. speciosa Griseb.	(S)	Chaco, South America		X	X				X		2.221222	Mêtraux 1950

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name / Plant Part ( )		Location	Chemistry / Processing Classification 1	2	3	4	5	6	7	Code	Reference
Cleome gynandra L. *(Gynandropsis gynandra)*	(L)	Tanzania	glucosinolates X	X						2.22, 2.11	Hasapis et al. 1981; Ahmed et al. 1972 Burkill 1985
C. serrulata Pursh.	(L)	Arizona	X	X						2.2812	Steggerda & Eckardt 1941
Courbonia edulis Gilg. & Benedict	(F)	E. Africa	alkaloids X							2.2812	Delaveau et al. 1973; Watt & Breyer-Brandwijk 1962
Maerua glauca Chiov.		S. Africa	alkaloids X	X				X	X	2.28123	Taylor & Henry 1973; Scudder 1971
Thylachium africanum Lour.	(T)	E. Africa	glucosinolates, alkaloids X							2.12	Ahmed et al. 1972; Delaveau et al. 1973; Weiss 1979
Celastraceae											
Celastrus scandens L.	(B)	United States	X							2.121	Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Euonymus sieboldianus Blume	(L)	W. Asia	sesquiterpenester alkaloids X							2.121	Bruning & Wagner 1978; Tanaka 1976
Chenopodiaceae											
Chenopodium pallidicaule Aellen.	(S)	Peru		X						2.211	Gade 1970
C. quinoa Willd.	(S)	Andes, South America	saponins							2.221	Hegnauer 1964 Sauer 1950; Kroeber 1950
Cucurbitaceae											
Citrullus colocynthis (L.) Schrad			cucurbitacins								Hegnauer 1963
	(S)	W. Africa	X	X			X			2.212, 2.15	Burkill 1985
	(F)	S. Africa	X	X					X	2.2812	Hedrick 1919
Hodgsonia capniocarpa Ridl.	(S)	Malaysia	X							2.131	Tanaka 1976
Momordica balsamina L.	(S)	Australia	X	X						2.2511	Burkill 1985
	(F)	China		X				X		2.2111	Hedrick 1919
M. charantia L.	(F)	India, S.E. Asia		X			X			2.2111	Burkill 1985
	(F)	India		X						2.2511	Hedrick 1919

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Cupressaceae											
Thuja orientalis L.	(S)	W. Asia								2.	Tanaka 1976
Cycadaceae											
Cycas sp.			MAM(methylazoxymethanol) glycosides								de Luca et al. 1980;
	(S)	Australia	X	X				X		2.211, 2.214	Warner 1958
C. circinalis L.	(S)	Guam	X	X			X	X		2.2221	Brown 1920
C. media R. Br.	(S)	Australia	X	X	X		X	X		2.2127, 2.233, 2.132	Cribb & Cribb 1975; Tanaka 1976
	(F)	Australia	X	X	X		X	X		2.2127	Irvine 1957
C. revoluta Thunb.	(St)	Trop. Asia	X					X		2.132, 2.64	Tanaka 1976
C. rumphii Miq.	(S)	Bay of Bengal	X							2.121	Bhargava 1983
	(St,S)	Oceania	X	X				X		2.2112	Barrau & Peeters 1972
C. thuarsii Guad	(St)	E. Africa		X	X		X	X		2.31212	Weiss 1979

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry	1	2	3	4	5	6	7	Code	Reference
Dioscoreaceae												
Dioscorea spp.	(T)	E. Africa	saponins, alkaloids	X				X	X		2.28222, 2.31211	Takeda 1972; Karnick 1971; Weiss 1979
D. alata L.	(T)	Africa	saponins	X					X			Karnick 1971 Burkill 1985
D. bulbifera L.	(T)	Pacific	saponins, alkaloid: disocorine	X	X				X		2.2812, 2.231, 2.243	Takeda 1972; Willaman & Li 1970; Lessa 1977; Barrau & Peeters 1972; Bascom 1965
D. cochleari-apiculata De Wild	(T)	Africa			X						2.2	Burkill 1985
D. dumetorum Pax.	(T)	Africa	alkaloids, phenanthrenes		X		X		X	X	2.211, 2.213, 2.22, 2.43, 2.25	Willaman & Li 1970; El-Olemy & Reisch 1979 Coursey 1967

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry / Processing Classification 1	2	3	4	5	6	7	Code	Reference
	(T)	Africa	X	X		X		X	X	2.222, 2.231, 2.261, 2.63, 2.431, 2.432	Corkill 1948
	(T)	Africa		X					X	2.271	Watt & Breyer-Brandwijk 1962
D. glabra Roxb.			saponins, alkaloids								Karnick 1971
	(T)	Bay of Bengal	X							2.121	Bhargava 1983
D. hispida Dennst. *(D. daemona)*			saponins, alkaloids								Karnick 1971; Willaman & Li 1970
	(T)	Malay Penninsula	X					X	X	2.1323	Skeat & Blagden 1906
	(T)	Cambodia		X			X	X		2.2326	Martin 1971
	(T)	Philippines		X				X		2.232	Brown 1920
D. latifolia Benth.	(T)	West Africa	X	X						2.2211, 2.2112	Labouret 1937; Busson 1965
D. praehensilis Benth.	(T)	C. Africa	X	X						2.2812	Burkill 1939
D. prainiana R. Kunth	(T)	Malaysia	X							2.111	Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
D. preussii Pax.	(T)	W. Africa		X				X		2.232, 2.221	Busson 1965; Tanaka 1976
D. sansibarensis Pax.			alkaloids								Willaman & Li
	(T)	Africa	X	X				X		2.213 2.253, 2.233	1970; Burkill 1939
Tamus communis L.			saponins, phenanthrenes								Takeda 1972;
	(St)	Europe; Persia; N. Africa	X	X						2.2712	El-Olemy & Reisch 1979; Hedrick 1919
Ebenaceae											
Diospyros spp.			naphthaquinones								Hegnauer 1966
D. oleifera Cheng	(F)	China								2.	Tanaka 1976
Elaeocarpaceae											
Elaeocarpus sp.			indolizidine alkaloids								Johns & Lamberton 1973
E. dentatus Vahl.	(F)	New Zealand	X				X			2.5111	Wright-St. Clair 1972

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Euphorbiaceae											
Elateriospermum tapos Blume.											
	(S)	Malaysia, Indonesia	X							2.121, 2.131	Tanaka 1976
Euphorbia lathyrus L.			igenane-type diterpene esters								Hecker 1977
	(S)	S. Europe	X						X	2.251	Hedrick 1919
Hevea brasiliensis Muell.-Arg.			cyanogenic glycosides								Hegnauer 1966
	(S)	S.E. Asia			X					2.311	Tanaka 1976
Jatropha curcas L.	(S)	Mexico	X							2.131	Dressler 1953
	(S)	Trop. America, Asia						X		2.61	Tanaka 1976
J. multifida L.	(S)	Trop. America, Asia						X		2.61	Tanaka 1976
Manihot esculenta Crantz.			cyanogenic glycosides								Hegnauer 1966
many methods of detoxification practiced worldwide											Lancaster et al. 1982
	(T)	Malay Penninsula	X	X				X		2.233	Skeat & Blagden 1906
	(T)	Congo				X				2.43	Miracle 1967

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry / Processing Classification 1	2	3	4	5	6	7	Code	Reference
Mercurialis annua L.			cyanogenic glycosides								Hegnauer 1966
	(P)	Germany	X							2.121	Hendrick 1919
Fabaceae											
Abrus precatorius L.			lectins, alkaloids								Wei et al. 1974;
	(F,S)	Bay of Bengal	X							2.131	Mears & Mabry 1971; Bhargava 1983
Acacia albida Delile	(S)	S.Africa	X	X				X	X	2.28123	Scudder 1971
Canavalia obtusifolia DC	(S)	Australia	X	X				X		2.2113	Irvine 1957
Cassia occidentalis L.	(S)	W. Africa	X								Irvine 1952
Castanospermum australe A. Cunningh. & Fraser			octahydroindolizine alkaloid								Hohenschutz et al. 1981;
	(S)	Australia	X					X		2.131	Tanaka 1976
			X	X						2.234	Harris 1987
Crotalaria spp.			pyrrolizidine alkaloids								Mears & Mabry 1971
C. mucronata Desv.	(S)	E. Trop. Asia	X	X	X					2.2147	Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Entada phaseoloides Merr.	(S)	Australia	saponins, entegenic acid X	X				X		2.233	Yasuraoka et al. 1977; Cribb & Cribb 1975
Erythrina veriegata L.	(S)	Trop. Asia	erythrina alkaloids X							2.131, 2.111	De Silva & Snieckus 1978; Tanaka 1976
Intsia retusa Kurz.	(F)	E. Malaysia	X	X				X		2.214	Tanaka 1976
Lupinus albus L.	(S)	Italy	quinolizidine alkaloids, saponins X							2.121	Mears & Mabry 1971; Hudson & El-Difrawi 1979; Hendrick 1919
L. hirsutus L.	(S)	Europe	quinolizidine alkaloids X							2.121	Batra & Rajagopalan 1978 Tanaka 1976
L. littoralis Dougl.	(R)	British Columbia	X							2.121, 2.151	Turner & Bell 1973
L. luteus L.	(S)	Italy	quinolizidine alkaloid X							2.121	Murakoshi et al. 1979; Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )	Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
L. mutabilis Sweet		quinolizidine alkaloids, saponins								Hatzold et al. 1983; Hudson & El-Difrawl 1979; Gade 1969; Sauer 1950
(S)	Andes, South America	X	X						2.234, 2.211	
L. termis Forsk.		quinolizidine alkaloids								Gabrial & Morcos 1976; Tanaka 1976
(S)	Mediterranean		X						2.211	
Mucuna sp.		proteinase inhibitors, canavanine								Mears & Mabry 1971; Bell 1971
M. cochinchinensis A. Chev. (S)	Trop. Asia		X						2.211	Tanaka 1976
Neorautanenia spp.		rotenoids, pterocarpans								Brink et al. 1977
N. mitis (A. Rich.) Verd. (R)	S. Africa	X	X			X	X		2.2182	Scudder 1971
Olneya tesota A. Gray (S)	Mexico	X	X						2.2812	Felger & Moser 1976
Pachyrrhizus erosus Urb. (*P. angulatus* Rich.) (T)	China	X							2.11	Hedrick 1919
Prosopis spp.		non-protein amino acids								Krauss & Reinbothe 1973

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
P. pubescens Benth.	(S)	W. North America	X		X	X				2.13, 2.3, 2.41	Castetter & Bell 1942
P. juliflora DC	(S)	W. North America				X		X		2.41141	Hodge 1907; Castetter 1935
Tamarindus indica L.			haemagglutinins								Toms & Western 1971;
	(S)	S. Africa	X	X				X	X	2.28123	Scudder 1971
Fagaceae											
Quercus spp.			tannic acid								Hegnauer 1966
	(S)	E. North America		X					X	2.261	Gilmore 1932; Waugh 1916
	(S)	W. North America	X	X				X	X	2.28123; 2.242	Zigmond 1981; Barrett & Gifford 1933; Gifford 1936
	(S)	W. North America		X		X		X		2.4123	Barrett 1952; Chestnut 1902
	(S)	Persia		X				X		2.232	Gifford 1936
	(S)	Japan	X							2.281	Gifford 1936
	(S)	Sardinia	X			X				2.4123	Gifford 1936
Q. chrysolepis Liebm.	(S)	W. North America				X				2.431	Gifford 1936

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Q. garryana Dougl.	(S)	W. North America				X				2.431	Guther 1973
Flacourtiaceae											
Pangium edule Reinw.			cyanogenic glycosides								Hegnauer 1966
ex Blume	(F)	Malay Penninsula	X	X				X		2.233	Skeat & Blagden 1906
	(S)	Philippines		X						2.211	Brown 1920
	(S)	Trop. Asia, Micronesia			X					2.311	Tanaka 1976
Fumariaceae											
Corydalis ambigua Cham. &			protoberberine alkaloids								Hegnauer 1969
Schlecht.	(B)	Saghalin Is.		X		X				2.2712, 2.4112	Laufer 1930
Haemadoraceae											
Haemadorum coccineum			phenylenone								Hegnauer 1986
Hook. (*H. corybosum*)	(R)	Australia	X			X				2.41131, 2.41142	Grey 1841; Cribb & Cribb 1975; Laufer 1930

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Hippocastanaceae												
Aesculus spp.			saponins (escin)									Hegnauer 1966
A. californica (Spach) Nutt.	(S)	California		X	X				X		2.243, 2.333	Chestnut 1902; Zigmond 1981; Barrett & Gifford 1933; Barrett 1952
A. indica Colebr. ex Wall.	(S)	Himalayas			X						2.211	Hedrick 1919
A. turbinata Blume	(S)	Japan	saponins	X	X				X	X	2.262	Hegnauer 1966; Tanaka 1976
Icacinaceae												
Icacina spp.			diterpene alkaloids									On'okoko & Vanhaelen 1980
I. senegalensis A. Juss.	(T)	W. Africa			X	X			X		2.2326	Irvine 1952
Lamiaceae												
Ajuga nipponensis Makino	(L)	Japan	diterpene: ajugamarin		X						2.221	Shimomura et al 1981; Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Lauraceae											
Beilschmeidia bancroftii	(S)	Australia	X	X						2.233	Harris 1987
B. tarairi Kirk. (*Nesodaphne tarairi*)	(S)	New Zealand	X							2.121	Hedrick 1919
B. tawa Kirk. (*N. tawa*)	(F)	New Zealand	X				X			2.5111	Wright-St. Clair 1972
	(S)	New Zealand	X							2.121	Hedrick 1919
Endiandra pubens Meissn.	(S)	Australia	terpenoids X	X				X		2.233	Bandaranayake et al. 1981; Cribb & Cribb 1975; Harris 1987
E. palmerstonii C.T. White	(S)	Australia	X	X				X		2.233	Cribb & Cribb 1975; Harris 1987
E. tooram	(S)	Australia	X	X						2.233	Harris 1987
Nectandra spp.			benzylisoquinoline alkaloids								Dos Santos & Gilbert 1975
N. rodioei Hook.	(S)	Tropical South America		X				X		2.222	Lévi-Strauss 1950; Kirchoff 1950

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry / Processing Classification 1	2	3	4	5	6	7	Code	Reference
Umbellularia californica (Hook. & Arn.) Nutt.	(S)	W. North America	X					X		2.133	Chestnut 1902
Lecythidaceae											
Barringtonia asiatica (L.) Kurz.			saponins								Hegnauer 1966
(*B. racemosa*)	(S)	Bay of Bengal	X							2.131	Bhargava 1983
	(L)			X					X	2.261	Watt & Breyer-Brandwijk 1962
	(F)	Indochina	X							2.111	Tanaka 1976
Liliaceae											
Allium geyera S. Wats (*A. deserticola*)	(B)	Arizona	X							2.131	Steggerda & Eckardt 1941
Allium tricoccum Ait.			saponins								Hegnauer 1963
	(B)	E. North America	X				X			2.51, 2.52	Kuhm 1961
Asphodelus ramosus L.		Europe	X				X			2.12, 2.51	Tanaka 1976
Chlorogalum pomeridianum			saponins								Hegnauer 1963
Kunth.	(B)	W. North America	X							2.11	Harvard 1895

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Ophiopogon japonicus Ker-Gawl.	(R)	Japan	saponins							2.	Hegnauer 1986 Tanaka 1976
Polygonatum spp.			saponins								Hegnauer 1986
P. lasianthum Maxim	(Rh)	Japan	X	X				X		2.222	Tanaka 1976
Zigadenus venenosus Wats.	(B)	California	veratrum alkaloids: zygadenine	X						2.2376	Windholz 1976 Ray 1963
Malvaceae											
Abutilon theophrastri Medik.	(S)	Asia		X				X		2.2116	Tanaka 1976
Meliaceae											
Owenia cerasifera F. Muell.	(F)	Australia			X					2.3	Irvine 1957
Moraceae											
Artocarpus gomeziana Wall.	(F)	Malaysia	X							2.111	Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Myrtaceae												
Eucalyptus bicolor A. Cunn.	(S)	Australia	terpenoids		X						2.2216	Hegnauer 1969; Roth 1897; Cribb & Cribb 1975
E. largiflorens C.T. White	(S)	Queensland, Australia			X						2.22	Cribb & Cribb 1975
Olacaceae												
Ximenia americana L.	(L)	Australia		X							2.11	Cribb & Cribb 1975
	(S)	Indonesia		X							2.11	Brown 1920
Oleaceae												
Olea europaea L.	(F)	Mediterranean	oleunopein		X	X				X	2.3115, 2.2288, 2.2588, 2.71	Windholz 1976 Hartmann & Bougas 1970

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Orobanchaceae												
Orobanche cooperi (Gray) Heller	(St)	Mexico		X							2.13	Felger & Moser 1976
Oxalidaceae												
Oxalis tuberosa Molina	(T)	Andes, South America	oxalic acid		X				X		2.216	Sauer 1950
Pandanaceae												
Pandanus spp.	(F)	Australia	alkaloids, dimethyltryptamine	X							2.131	Hyndman 1984 Cribb & Cribb 1975
Pinaceae												
Pinus spp.	(S)	North America	terpenes	X							2.131	Havard 1895
P. ponderosa Dougl.	(S)	W. North America		X							2.131	Steedman 1930

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry / Processing Classification 1	2	3	4	5	6	7	Code	Reference
Poaceae											
Gigantochloa apus Kurz & Munro	(Sh)	Indonesia	hydrogen cyanide X							2.11	Hegnauer 1963 Tanaka 1976
Setaria sphacelata (Schum.) Stapf. & Hubbard	(S)	S. Africa	oxalic acid X							2.12	Roughan & Slack 1973; Watt & Breyer-Brandwijk 1962
Polygonaceae											
Polygonum bistorta L.	(R)	N. temperate	tannins X	X						2.2113	Hegnauer 1969 Hedrick 1919
Pontederiaceae											
Eichhornia crassipes Solms	(LF)	Asia	phenolic acids, flavonoids, tannins X							2.15, 2.11	Hegnauer 1986 Tanaka 1976
Portulacaceae											
Lewisia spp.			saponins								Hegnauer 1969
L. rediviva Pursh	(R)	British Columbia	X							2.111	Steedman 1930

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Proteaceae												
Hicksbeachia pinnatifolia	(S)	Australia		X	X						2.233	Harris 1987
Macadamia spp.			cyanogenic glycosides									Hamilton & Young 1966
M. whelanii F.M. Bailey	(S)	Australia		X	X						2.2113	Cribb & Cribb 1975; Harris 1987
Ranunculaceae												
Clematis spp.			ranunculin									Ruijgrok 1966
C. ianthina Koehne	(L)	Korea		X				X			2.12	Tanaka 1976
Ranunculus bulbosus L.	(R)	Europe	ranunculin	X							2.121	Ruijgrok 1966 Hedrick 1919
R. eisenii Kellog	(S)	W. North America		X							2.131	Tanaka 1976
R. sceleratus L.	(L)	Japan, Eurasia	ranunculin	X							2.111	Misra & Dixit 1980; Tanaka 1976

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group / Family / Scientific Name	Plant Part ( )	Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Rhizophoraceae												
Bruguiera sp.	(F)	Oceania	tannins, tropane alkaloids	X	X				X		2.2112	Barrau & Peeters 1972; Cribb & Cribb 1975; Saxton 1971; Barrau & Peeters 1972
B. conjugata Merr. (*B. gymnorhiza*)	(R)	Australia		X	X				X		2.223, 2.53	Cribb & Cribb 1975
Rosaceae												
Potentilla tormentilla Neck.	(R)	N. Asia, Europe	tannins	X							2.121	Hegnauer 1973 Hedrick 1919
Prunus campanulata Maxim.	(F)	W. Asia									2.	Tanaka 1976
Solanaceae												
Datura inoxia Mill. (*D. meteloides* DC)	(F)	W. North America	tropane alkaloids				X				2.41141, 2.41142	Hegnauer 1973 Castetter 1935

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Lycium pallidium Miers.	(F)	W. North America	X			X		X		2.41252, 2.41251, 2.41242	Whiting 1939; Steggerda & Eckardt 1941
Solanum spp.			glycoalkaloids								Hegnauer 1973
S. X *curtilobum* Juz. & Buk.	(T)	Peru, Bolivia		X		X		X		2.366, 2.41152	Johns 1986; Werge 1979
S. gilo Raddi	(L)	W. Africa	X	X				X		2.22122	Keshinro & Ketiku 1979
S. jamesii Torr.	(T)	W. North America				X				2.41152, 2.4125	Johns 1986
S. fendleri A. Gray	(T)	W. North America				X				2.41152, 2.4125	Johns 1986
S. X *juzepczukii* Juz. & Buk.	(T)	Peru, Bolivia		X		X		X		2.366, 2.41152	Johns 1986; Werge 1979
S. simile F. Muell. *(S. semele)*	(F)	Central Australia		X						2.311	Irvine 1957

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
Taccaceae											
Tacca leontonpetalodes (L.) Kuntze. *(T. involucrata)*	(T)	W. Africa	taccalin X	X				X		2.112, 2.222	Scheuer et al. 1963 Busson 1965; Irvine 1952
(T. pinnatifida)	(T)	Pacific	X	X				X		2.222, 2.2121, 2.2112	Lessa 1977; Barrau & Peeters 1972; Bascom 1965; Hedrick 1919; Brown 1920
	(T)	Australia	X	X				X		2.2123	Cribb & Cribb 1975
Tiliaceae											
Tilia japonica Simonk	(F)	Japan, China	X							2.121	Tanaka 1976
Tropaeolaceae											
Tropaeolum tuberosum Ruiz & Pav.	(T)	South America	glucosinolates X					X		2.11, 2.24	Johns & Towers 1981; Sauer 1950

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry	Processing Classification 1	2	3	4	5	6	7	Code	Reference
Urticaceae												
Urtica dioica L.	(L)	Europe	histamine, serotonin, acetylcholine	X							2.121	Hegnauer 1973; Hedrick 1919
Valerianaceae												
Valeriana edulis Nutt.	(R)	W. North America	alkaloids: valerianin	X							2.11, 2.13	Hegnauer 1973; Havard 1895; Hedrick 1919
Verbenaceae												
Avicennia marina Vierh.	(S)	Australia		X	X						2.214	Cribb & Cribb 1975
Zamiaceae												
Macrozamia spp.	(S)	Australia	MAM glycosides	X	X						2.213, 2.2116	de Lucca et al. 1980; Cribb & Cribb 1975
M. fraseri Miq. *(M. macdonnelli)*	(StS)	Australia		X							2.214	Irvine 1957

TABLE 1. *Survey of Traditional Methods of Plant Detoxification. Each report is categorized for the seven basic techniques outlined in the text and coded according to the schema in APPENDIX 1. (continued)*

Plant Group Family Scientific Name Plant Part ( )		Location	Chemistry Processing Classification 1	2	3	4	5	6	7	Code	Reference
M. miquelii A. Dc.	(S)	Australia	X	X				X		2.112, 2.212	Tanaka 1976; Irvine 1957
M. spiralis Miq.	(S)	E. Australia	X					X		2.112	Tanaka 1976
Zamia sp.			MAM glycosides								
	(S)	Australia		X			X			2.2116	de Lucca et al. 1980; Grey 1841
Zamia chigua Cuatr.	(S)	Panama	X	X						2.2112	Duke 1970
Z. furfuracea Ait.	(R)	Mexico, Central America								2.	Tanaka 1976
Zamia pumila L *(Z. integrifolia)*	(T)	Caribbean		X						2.2	Palmer 1878
Zygophyllaceae											
Balanites aegyptica Del.			saponins								Hegnauer 1973
	(L)	Africa	X							2.121	Burkill 1985
	(S)	W. Africa	X							2.272	Busson 1965

*Plant Part: B = bulb; F = fruit; Fb = fruiting body; L ^{5} leaf; La = latex; P = plant; R = root; Rh = rhizome; S = seed; Sh = shoot; St = stem; T = tuber.

may also denature plant enzymes that are necessary to liberate certain active principals from glycosides such as glucosinolates or cyanogenic glycosides. However, in these cases liberation of active isothiocyanates and hydrogen cyanide, respectively, may subsequently be carried out by bacterial or endogenous enzymes. Proteinaceous toxins such as lectins and proteinase inhibitors are usually effectively denatured by heat.

Boiling and some form of roasting or baking are the most common cooking techniques used worldwide. Although many plant foods are eaten raw, most are cooked in some way. However, more often than not detoxification is not the explicit function of the cooking process. Roasting was perhaps the only cooking method used during most of human history since boiling requires watertight and heat-resistant containers. Many peoples solved the problem of applying heat to water by placing heated rocks directly in the contents of watertight but not heat resistant containers. Clay pots can be used for boiling foods, but it was the introduction of metal pots that greatly increased the distribution of this technique.

2. *Detoxification by solution.*—The use of water to remove toxins basically involves the dissolving of compounds in the water and their leaching from the food. The process is enhanced in specific and often sophisticated ways and takes many forms as is apparent in level 2.2 of APPENDIX 1. Heat accelerates the leaching process. When the solubility of a toxin is low a turnover of water, either by repeated pouring off and replacing, by placing the object in running water, or by passing water through a food, will help. Salt increases the polarity of the aqueous environment and can help in making certain compounds more soluble. Any process which causes more tissue to be exposed to the water or which liberates plant constituents by destroying the integrity of the plant cells will speed up leaching.

3. *Detoxification by fermentation.*—Simple fermentation techniques are part of the repertoire of detoxification of human groups worldwide. Microorganisms are ubiquitous and fermentation proceeds spontaneously under appropriate conditions. The metabolism of microorganisms alters the chemical composition of food. Basic techniques involve burying a food plant in the ground or in swamps, or enclosing it in some kind of container so that conditions conducive to fermentation can be achieved.

4. *Detoxification by adsorption.*—Chemical constituents in plants may be bound by physical and chemical processes to other substances. Charcoal is the standard detoxification substance used in cases of acute toxicity in clinical settings in modern medicine (Gilman *et al.* 1985). Both charcoal and clay are made up of small particles and have large surface areas. They undergo weak interactions with organic compounds, primarily through van der Waals and electrostatic forces. Clay mineral lattices may be charged (usually negatively) and adsorption of chemicals may also be by ion-exchange (Johns 1986).

Humans deliberately use the adsorptive properties of clay to bind toxins in food in ways that appear to be elaborations of the geophagous behavior of animals (Johns 1986). Detoxification basically involves adding clay directly to food plants during processing or at the time of ingestion, or soaking the plant product in wet mud.

5. *Detoxification by drying.*—Drying is likely to be an effective technique for removing volatile toxins from food and is usually used in combination with one of the other methods of detoxification. More often than not material is simply dried by placing it in the sun, although ovens or kilns are used in some circumstances.

6. *Detoxification by physical processing.*—Techniques such as grating, grinding, pounding, freezing etc. which break down the tissues of plants are collectively termed

comminution (Coursey 1973). Comminution will greatly enhance fermentation, solubilization and other processes. In methods that utilize the metabolic machinery of the plant cell comminution is a primary means of detoxification. Enzymes contained in the same tissue breakdown certain more stable allelochemicals such as cyanogenic glucosides or glucosinolates to release compounds which are volatile, water-soluble or heat labile.

Grating of cassava *(Manihot esculenta)* is a widespread mechanism for detoxifying bitter varieties of this important staple. Hydrogen cyanide, enzymatically liberated from cyanogenic glycosides, is released into the atmosphere during processing rather than while the plant is being chewed or digested. Processes employed with cassava are diverse and many are elaborate seemingly beyond necessity since comminution followed by enough time for the enzymatic reaction to occur is sufficient (Seigler and Pereira, 1981).

7. *Detoxification by pH change.*—Change in pH can affect the solubility of many chemicals. In addition acidic and alkaline conditions can lead to the hydrolysis of compounds.

The additions of ashes and acids to foods play important roles in a number of chemical processes affected by pH change. Although acid hydrolysis will degrade many organic compounds including glycosides and amides, concentrated acidic substances are rarely directly employed in traditional food processing. Acids formed during fermentation may contribute to the breakdown and/or the solubilization of some toxins. Acidic fermented products such as vinegar, and organic acids from fruits such as tamarind, are occasionally added to foods and may serve some role in detoxification. Pickling is carried out in combination with other techniques and may play a role in producing a final nontoxic product. Tamarind pulp is widely used in tropical regions as a flavor additive to food, although because of its acidity it may play other roles in altering food quality. Tartaric acid which makes up 10% of the weight of tamarind pulp (Windholz 1976) is a good organic buffer. A concentrated solution of tamarind that we tested had a pH of 2.5 although its buffering capacity was not assayed. We are familiar with three cases where tamarind is used to detoxify food. Two of these cases involve plants in the Araceae which may have high levels of calcium oxalate. Significantly tartaric acid may be effective in increasing the solubility of the highly irritating crystals (raphides) of this compound (Oke 1969). The third case of tamarind use with toxic plants involves roots of the legume *Neorautanenia mitis*. The genus is characterized by rotenoids and other toxic flavonoid derivatives.

Alkali materials in the form of lye from plant ash and mineral lime are readily available and widely applied. They participate in hydrolysis reactions of common chemical linkages such as ester and acetals. Ashes are usually used in solution, often with heat which greatly enhances the hydrolysis process.

It is known that interactions occurring when different chemicals are ingested together by animals may reduce the toxicity of one or both of them. The documented cases involve interactions of tannins with cyanogenic glucosides (Goldstein and Spencer 1985) and saponins (Freeland *et al.* 1985). There is no indication from the present survey that chemical interactions such as these are exploited by humans to detoxify foods. Many processes are subtle, and even when effective would not necessarily be understood or articulated by people practicing them. Further research examining the effectiveness of traditional processing must recognize the complexity of chemical systems and should be observant for more subtle ways by which humans may have exploited poisonous plants to their advantage.

THE ORIGIN OF FOOD PROCESSING TECHNIQUES

The question of how humans learned to detoxify plants in particular ways is difficult to answer. The ubiquity of the various techniques and their sophistication supports their antiquity. The use of clays for their adsorption properties has antecedents in animal behavior (Johns 1986). Heating, leaching, fermentation, and drying of foods all have simple cause and effect relationships with change in food palatability that could be observed in common events. Harris (1977) suggested that plants that are detoxified by leaching were originally used for fish poisons. Plants that had been left in streams could be subsequently discovered to be acceptable foods. Comminution of plants and the use of lye and salt to facilitate detoxification require greater sophistication. However, the use of tools is a longstanding human trait that would have been involved in detoxification since early in human history. Once tools were used to open nuts or other foods, refining the techniques to diminish the foods further is not a great leap for human beings. The use of salt in boiling would take place once boiling itself was established. Salt water could have been used initially in coastal areas simply because of its availability. The use of lye also would follow cooking, and ashes would be readily available from cooking sites. Perhaps hot coals or ash covered rocks were initially added only to heat water, but consequently were discovered to improve the food. The use of alkali and acidic substances in processing appears to represent the most sophisticated of the basic techniques.

A preference for nutrient dense foods such as animal protein and fats and concentrated carbohydrates in fruits, tubers and seeds has characterized the genus *Homo* (Milton 1987) and directed our technological achievements over the past 2 million years for scavenging, hunting and processing plant products. The energetic reward offered by dense carbohydrate sources would have provided a strong motivation for the development of detoxification processes and once a technology for detoxifying plant foods was established it is not surprising that deliberate elaboration using available resources would occur. Once the basic mechanisms of detoxification were widespread, their refinement to deal in sophisticated ways with particular plants was a function of human adaptability and intelligence. The adaptation of humans to exploit the resources of a new environment involves the application of detoxification techniques to utilize the available plant resources. Where human groups were in intimate association with a food resource over many generations it is not surprising that considerable refinements took place.

ACKNOWLEDGEMENTS

We wish to acknowledge financial support from the Natural Sciences and Engineering Research Council of Canada (Postdoctoral Fellowship and University Research Fellowship to TJ). F. J. Hanke made many helpful suggestions during the course of this project and K. V. Milton and D. B. McKey made useful comments on an earlier draft.

LITERATURE CITED

AHMED, Z. H., A. M. RIZK, F. M. HAMMOUDA and M. M. SEIF EL-NASR. 1972. Naturally occurring glucosinolates with special reference to those of family Capparidaceae. Planta Med. 21:35-60.

ANDERSON, K. E., A. H. CONNEY and A. KAPPAS. 1986. Nutrition as an environmental influence on chemical metabolism in man. Pp. 39-54. *in* Ethnic differences in reactions to drugs and

LITERATURE CITED (continued)

xenobiotics, (W. Kalow, H. W. Goedde, and D. P. Agarwal, eds.). Alan R. Liss, New York.

BANDARANAYAKE, W., J. E. BANFIELD, D. ST. C. BLACK, G. D. FALLON and B. M. GATEHOUSE. 1981. Constituents of *Endiandra* species. I. Endiandric acid, a novel carboxylic acid from *Endiandra introrsa* (Lauraceae), and a derived lactone. Aust. J. Chem. 34:1655-1677.

BARRAU, J. and A. PEETERS. 1972. Histoire et préhistoire de la préparation des aliments d'origine végétale. J. Sociéte des Océanistes. 35:141-152.

BARRETT, S. A. 1952. Material aspects of Pomo culture. Part One. Bulletin Public Museum City Milwaukee 20:1-260.

__________ and E. W. GIFFORD. 1933. Miwok material culture. Bulletin Public Museum City Milwaukee 2:117-376.

BASCOM, W. R. 1965. Ponape: a Pacific economy in transition. Anthropol. Records, Univ. California Press, Berkeley 22:1-156.

BATRA, V. and T. R. RAJAGOPALAN. 1976. Alkaloids of *Lupinus hirsutus* (Leguminosae). Indian J. Chem. Sect. B. 14B:636-637.

BELL, E. A. 1971. Comparative biochemistry of non-protein amino acids. Pp. 179-206 *in* Chemotaxonomy of the Leguminosae, (J. B. Harborne, D. Boulter and B. L. Turner, eds.). Academic Press, London.

BHARGAVA, N. 1983. Ethnobotanical studies of the tribes of Andaman and Nicobar Islands, India. I. Onge. Econ. Botany 37: 110-119.

BRINK, A. J., G. H. J. RALL and J. C. BREYENBACH. 1977. Pterocarpans of *Neorautanenia edulis* and *N. amboensis*. Phytochem. 16:273-276.

BROWN, W. H. 1920. Wild food plants of the Philippines. Bull. No. 21. Department of Agriculture and Natural Resources Bureau of Forestry, Manila.

BRUNING, R. and H. WAGNER. 1978. Ubersicht über die Celastraceen-Inhaltsstoffe: Chemie, Chemotaxonomie, Biosynthese, Pharmakologie. Phytochem. 17:1821-1858.

BURKILL, H. M. 1985. The useful plants of West Tropical Africa. Vol. 1 Royal Botanic Gardens, Kew.

BURKILL, I. H. 1939. Notes on the genus *Dioscorea* in the Belgian Congo. Bulletin du Jardin Botanique de L'État, Bruxelles. 15:345-428.

BUSSON, F. 1965. Plantes Alimentaires de l'Ouest Africain. Leconte, Marseilles.

CASTETTER, E. F. and W. H. BELL. 1942. Pima and Papago Indian agriculture. Univ. New Mexico Press, Albuquerque.

CASTETTER, E. F. 1935. Uncultivated native plants used as sources of food, ethnobiological studies in the American Southwest I, Univ. New Mexico Bull. No. 266, Biological Series. Vol. 4, No. 1, 1-62.

CHESTNUT, V. K. 1902. Plants used by the Indians of Mendocino County, California. Contrib. United States National Herbarium 7:295-422.

CHRISTIANSEN, J. A. and N. R. THOMPSON. 1977. The utilization of "bitter" potatoes in the cold tropics of Latin America. Pp. 212-215 *in* Proceedings of the Fourth Symposium of the International Society for Tropical Root Crops. (J. Cock, R. MacIntyre and M. Graham, eds.). International Development Research Centre, IDRC-080e, Ottawa.

CLARK, J. D. and J. W. K. HARRIS. 1985. Fire and its roles in early hominid lifeways. Afr. Archaeol. Rev. 3:3-27.

COCK, J. H. 1982. Cassava: a basic energy source in the tropics. Science 218:755-762.

CORKILL, N. L. 1948. The poisonous wild cluster yam, *Dioscorea dumetorum* Pax, as famine food in the Anglo-Egyptian Sudan. Ann. Trop. Med. Parasit. 42:278-287.

COURSEY, D. G. 1967. Yams: an account of the nature, origins, cultivation and utilization of the useful members of the Dioscoreaceae. Longmans, London.

__________. 1973. Cassava as food: toxicity and technology. Pp. 27-36 *in* Chronic Cassava Toxicity, (B. Nestel and R. MacIntyre, eds.). International Development Research Centre, Ottawa.

CRIBB, A. B. and J. W. CRIBB. 1975. *Wild Food in Australia.* William Collins Pty Ltd, Sidney.

DELAVEAU, P., B. KOUDOGIBO and J.-L. POUSSET. 1973. Alcaloïdes chez les Capparidaceae. Phytochem. 12:2983-2895.

DE LUCCA, P., A. MORETTI, S. SABATO, G.

LITERATURE CITED (continued)

SINISCALCO GIGLIANO. 1980. The ubiquity of cycasin in cycads. Phytochem. 19:2230-2231.

DE SILVA, S. O., and V. A. SNIECKUS. 1978. *Erythrina* and related alkaloids. Alkaloids (London). 8:137-143.

DOS SANTOS FILHO, D., and B. GILBERT. 1975. The alkaloids of *Nectandra megapotomica*. Phytochem. 14:821-822.

DRESSLER, R. L. 1953. The pre-columbian cultivated plants of Mexico. Bot. Mus. Leaflets, Harvard Univ. 16:115-172.

DUKE, J. E. 1970. Ethnobotanical observations on the Chocõ Indians. Econ. Botany 24:344-355.

EL-OLEMY, M. M., and J. REISCH. 1979. Isolation of batatsin I from *Dioscorea dumetorum* rhizomes. Z. Naturforsch. 34:288-289.

FELGER, R. S., and M. B. MOSER. 1976. Seri Indian food plants: Desert subsistence without agriculture. Ecol. Food Nutr. 5: 13-27.

FREELAND, W. J., P. H. CALCOTT and L. R. ANDERSON. 1981. Tannins and saponin: interaction in herbivore diets. Biochem. Syst. Ecol. 13:189-193.

GABRIAL, G. N., and MORCOS, S. R. 1976. The use of *Lupinus termis* L. cultivated in Egypt as a food protein supplement. Z. Ernaehrungswiss. 15:333-339.

GADE, D. W. 1969. Vanishing crops of traditional agriculture: the case of tarwi *(Lupinus mutabilis)* in the Andes. Proceedings Assoc. Amer. Geographers. 1:47-51.

GADE, D. W. 1970. Ethnobotany of Cañihua *(Chenopodium pallidicaule)*, rustic seed crop of the Altiplano. Econ. Botany 24: 55-61.

GANJIAN, I., I. KUBO, and P. FLUDZINSKI. 1983. Insect antifeedant elemanolide lactones from *Vernonia amygdalina*. Phytochem. 22:2525-2526.

GARNIER, R., F. CONSO, M. L. EFTHYMIOU, G. RIBOULET and M. GAUTHIER. 1978. Acute poisoning by *Gyromita esculenta*. Toxicol. Eur. Res. 1:359-364.

GASQUET, M., D. BAMBA, A. BARDJAMIAN, G. BALANSARD, P. TIMON-DAVID, and J. METZGER. 1985. Action amoebicide et anthelminthique du vernolide et de l'hydroxyvernoilide isoles des feuilles de *Vernonia colorata* (Willd.) Drake. Eur. J. Med. Chem. Chim. Ther. 20:111-115.

GIFFORD, E. W. 1936. California balanophagy. Pp. 87-98 *in* Essays in Anthropology. Univ. California Press, Berkeley.

GILMAN, A. G., L. S. GOODMAN, T. W. RALL, and F. MURAD, (eds.). 1985. Goodman and Gilman's the pharmacological basis of therapeutics. 7th Ed. Macmillan Publishing Co., Inc., New York.

GILMORE, M. R. 1932. Some Chippewa uses of plants. Papers Mich. Acad. Sci. Arts Letters. 17:119-143.

GOLDSTEIN, W. S., and K. C. SPENCER. 1985. Inhibition of cyanogenesis by tannins. J. Chem. Ecology. 11:847-858.

GREGER, H. 1977. Anthemidae—chemical review. Pp. 499- *in* The Biology and Chemistry of the Compositae, Vol. II, (V. H. Heywood, J. B. Harborne, B. L. Turner, eds.). Academic Press, London.

GREY, G. 1841. Journals of two expeditions of discovery in northwest and western Australia during the years 1837, 38 and 39. Vol. 2. T. and W. Boone, London.

GUNTHER, E. 1973. Ethnobotany of Western Washington. Univ. Washington Press, Seattle.

HAMILTON, R. A., and R. L. YOUNG. 1966. Transfer of bitterness in *Macadamia integrifolia* by grafting. California Macadamia Society Yearbook.

HARBORNE, J. B. 1982. Introduction to ecological biochemistry. 2nd Edition, Academic Press, London.

HARRIS, D. R. 1977. Alternative pathways toward agriculture. Pp. 179-243 *in* Origins of Agriculture, (C.A. Reed, ed.). Mouton Publishers, The Hague.

__________ 1987. Aboriginal subsistance in a tropical rain forest environment: food procurement, cannibalism, and population regulation in northeastern Australia. Pp. 357-385 *in* Food and evolution: Toward a theory of human food habits, (M. Harris and E. B. Ross, eds.). Temple Univ. Press, Philadelphia.

HARRIS, G. H. 1890. Root foods of the Seneca Indians. Rochester Acad. Sci. 1:106-114.

HARTMANN, H. T., and P. G. BOUGAS. 1970. Olive production in Greece. Econ. Botany. 24:443-459.

HASAPIS, X., A. J. MACLEOD, and M. MOR-

LITERATURE CITED (continued)

EAU. 1981. Glucosinolates of nine Cruciferae and two Capparaceae species. Phytochem. 20:2355-2358.

HATZOLD, T., I. ELMADFA, R. GROSS, M. WINK, T. HARTMANN and L. WITTE. 1983. Quinolizidine alkaloids in seeds of *Lupinus mutabilis*. J. Agric. Food Chem. 31:934-938.

HAVARD, V. 1895. Food plants of the North American Indians. B. Torrey Bot. Club. 22:98-123.

HAYDEN, B. 1981. Subsistence and ecological adaptations of modern hunter/gatherers. Pp. 344-421 *in* Omnivorous primates. (R.S.O. Harding and G. Teleki, eds.). Columbia Univ. Press, New York.

HECKER, E. 1977. New toxic, irritant and cocarcinogenic diterpene esters from Euphorbiaceae and Thymelaeaceae. Pure Appl. Chem. 49:1423-1431.

HEGNAUER, R. 1962-1986. Chemotaxonomie der Pflanzen. Vol. I-VII. Birkhauser Verlag, Basel.

HEMBREE, J. A., C.-J. CHANGE, J. L. MCLAUGHLIN, G. PECK, and J. M. CASSADY. 1978. The anticancer activity of *Semecarpus anacardium*. I. 9KB active pentadecylcatechols. Lloydia 41:491-493.

HEDRICK, U. P. (ed.) 1919. Sturtevant's Notes on Edible Plants, New York Agricultural Experimental Station, Albany.

HODGE, F. W. 1907. The Narrative of Alvar Nunez Cabeza de Vaca. Pp. 12-126 *in* Spanish Explorers in the Southern United States 1528-1543. New York.

HOHENSCHUTZ, L. D., E. A. BELL, P. J. JEWESS, D. P. LEWORTHY, R. J. PRYCE, E. ARNOLD and J. CLARDY. 1981. Castanospermine, a 1,6,7,8-tetrahydroxyoctahydroindolizine alkaloid, from seeds of *Castanospermum australe*. Phytochem. 20:811-814.

HUDSON, B. J. F., and E. A. EL-DIFRAWI. 1979. The sapogenins of the seeds of four lupin species. J. Plant Foods. 3:181-186.

HUSSEY, J. S. 1974. Some useful plants of early New England. Econ. Botany. 24:311-337.

HYNDMAN, D. C. 1984. Ethnobotany of Wopkaimin *Pandanus:* significant Papua New Guinea plant resource. Econ. Botany. 38:287-303.

IRVINE, F. R. 1952. Supplementary and emergency food plants of West Africa. Econ. Botany. 36:84-99.

__________. 1957. Wild and emergency foods of Australian and Tasmanian Aborigines. Oceania. 28:113-142.

ISACC, G. L. 1984. The archaeology of human origins: studies of the Lower Pleistocene in East Africa 1971-1981 *in* Advances in world archaeology, Vol. 3, (F. Wemdorf and A. E. Close, eds.). Academic Press, Orlando.

JOHNS, S. R., and J. A. LAMBERTON. 1973. *Elaeocarpus* alkaloids. Alkaloids 14:325-346.

JOHNS, T. 1986. Detoxification function of geophagy and domestication of the potato. J. Chem. Ecol. 12:635-646.

__________ and G. H. N. TOWERS. 1981. Isothiocyanates and thioureas in enzyme hydrolysates of *Tropaeolum tuberosum*. Phytochem. 20:2687-2689.

JOHNSTON, A. 1970. Blackfoot Indian utilization of the flora of the northwestern Great Plain. Econ. Botany. 24:301-324.

KARNICK, C. R. 1971. Phytochemical investigation of some *Dioscorea* species and varieties found in India. Quat. J. Crude Drug Res. 11:1761-1773.

KESHINRO, O. O., and A. O. KETIKU. 1979. Effect of traditional cooking methods on the ascorbic acid content of some Nigerian leafy and fruit vegetables. Food Chem. 4:303-310.

KIRCHOFF, P. 1950. The Warrau. Pp. 869-881 *in* Handbook of South American Indians, Vol. 3, (J. H. Steward, ed.). Bureau American Ethnology 143, Washington.

KRAUSS, G.-J., and H. REINBOTHE. 1973. Die freien Aminosauren in Samen von Minosaceae. Phytochem. 12:125-142.

KROEBER, A. L. 1950. The Chibcha. Pp. 887-909 *in* Handbook of South American Indians, Vol. 2, (J. H. Steward, ed.). Bureau American Ethnology 143, Washington.

KUHM, H. W. 1961. Uses of native herbs by Wisconsin Indians. Wisconsin Archeol. 42:97-132.

KUHNLEIN, H. V., and N. J. TURNER. 1986. Cow-parsnip *(Heracleum lanatum* Michx.) an indigenous vegetable of native people of northwestern North America. J. Ethnobiol. 6:309-324.

LABOURET, H. 1937. La geographie alimentaire en Afrique Occidentale. Annales de

LITERATURE CITED (continued)

Geographie. 46:591-610.

LANCASTER, P. A., J. S. INGRAM, M. Y. LIM, D. G. COURSEY. 1982. Traditional cassava-based foods: survey of processing techniques. Econ. Botany. 36:12-45.

LAUFER, B. 1930. Geophagy. Field Mus. Nat. Hist. Anthropol. Ser. 18:99-198.

LESSA, W. A. 1977. Traditional uses of the vascular plants of Ulithi Atoll, with comparative notes. Micronesia 13:129-190.

LEVI-STRAUSS, C. 1950. The use of wild plants in tropical South America. Pp. 465-486 *in* Handbook of South American Indians, Vol. 6, (J. H. Steward, ed.). Bureau American Ethnology 143, Washington.

MARTIN, M. A. 1971. Introduction a l'Ethnobotanique du Cambodge. Editions du Centre National de la Recherche Scientifique, Paris.

MEARS, J. A., and T. J. MABRY. 1971. Alkaloids in the Leguminosae. Pp. 73-178 *in* Chemotaxonomy of the Leguminosae, (J. B. Harborne, D. Boulter and B. L. Turner, eds.). Academic Press, London.

METRAUX, A. 1950. Ethnography of the Chaco. Pp. 197-370 *in* Handbook of South American Indians, Vol. 1., (J. H. Steward, ed.). Bureau American Ethnology 143, Washington.

MILTON, K. 1987. Primate diets and gut morphology: implications for hominid evolution. Pp. 93-115 *in* Foods and Evolution, (M. Harris and E. B. Ross, eds.). Temple Univ. Press, Philadelphia.

MIRACLE, M. P. 1967. Agriculture in the Congo Basin. Univ. Wisconsin Press, Madison.

MISRA, S. B., and S. N. DIXIT. 1980. Antifungal principle of *Ranunculus sceleratus*. Econ. Botany. 34:362-367.

MOORE, R. E. 1977. Volatile compounds from marine algae. Accounts Chem. Res. 10:40-47.

MOYER, B. G. 1979. 3-Nitropropanoyl-D-glycopyranoses of *Corynocarpus laevigatus*. Phytochem. 18:111-113.

MURAKOWSHI, I., K. TORIIZUKA, J. HAGINIWA, S. OHMIYA, H. OTOMASU. 1979. (-)-(trans-4'- -D-Glucopyranosyloxycinnamoyl) lupinine, - a new lupin alkaloid in *Lupinus* seedlings. Chem. Pharm. Bull. 27:144-146.

NAHRSTEDT, A. 1975. Triglochinin in Araceen. Phytochem. 14:2627-2628.

OKE, O. L. 1969. Oxalic acid in plants and nutrition. World Rev. Nutr. Dietetics. 10:262-303.

ON'OKOKO, P., and M. VANHAELEN. 1980. Two new diterpene-based alkaloids from *Icacina guesfeldtii*. Phytochem. 19:303-305.

OSHIMA, Y., T. IWAKAWA, and H. HIKINO. 1983. Alismol and alismoxide, sesquiterpenoids of *Alisma* rhizomes. Phytochem. 22:183-185.

PALMER, E. 1878. Plants used by the Indians of the United States. Am. Nat. 12:593-606, 646-655.

RAY, V. F. 1963. Primitive Pragmatists: The Modoc Indians of Northern California. Univ. Washington Press, Seattle.

ROTH, W. E. 1897. Ethnological Studies Among the North-west-central Queensland Aborigines. Edmund Gregor, Government Printer, Brisbane.

ROUGHAN, P. G., and C. R. SLACK. 1973. Simple methods for routine screening and quantitative estimation of oxalate content of tropical grasses. J. Sci. Food Agr. 24: 803-811.

RUIJGROK, H. W. L. 1966. Distribution of ranunculin and cyanogenetic compounds in the Ranunculaceae. Pp. 175-186 *in* Comparative Phytochemistry, (T. Swain, ed.). Academic Press, London.

SAUER, C. O. 1950. Cultivated plants of South and Central America. Pp. 487-543 *in* Handbook of South American Indians, Vol. 6, (J. H. Steward, ed.). Bureau American Ethnology 143, Washington.

SAXTON, J. E. 1971. Tropane alkaloids. Alkaloids 1:55-58.

SCHEUER, P. J., C. E. SWANHOLM, L. A. MADAMBA and W. R. HUDGINS. 1963. The constituents of *Tacca leontopetaloides*. Lloydia 26:133-140.

SCUDDER, T. 1971. Gathering among African woodland savannah cultivators A case study: The Gwembe Tonga. Zambian Papers. 5:1-150.

SEIGLER, D. S., and J. F. PEREIRA. 1981. Modernized preparation of casave in the Llanos Orientales of Venezuela. Econ. Botany. 35:356-362.

LITERATURE CITED (continued)

SHIMOMURA, H., Y. SAHIDA, K. OGAWA and Y. IITAKA. 1981. Ajugamarin, a new bitter diterpene from *Ajuga nipponensis* Makino. Tet. Let. 22:1367-1368.

SINGH, H. B., and R. K. ARORA. 1978. Wild Edible Plants of India Indian Council of Agricultural Research, New Delhi.

SKEAT, W. W., and C. O. BLAGDEN. 1906. Pagan Races of the Malay Penninsula. Vol. 1. Macmillan and Co., Limited, London.

STAHL, A. B. 1984. Hominid dietary selection before fire. Curr. Anthropol. 25:151-168.

STAHL, A. B. 1987. Plant food processing: implications for dietary quality *in* Foraging and Farming: the Evolution of Plant Domestication, (D. R. Harris and G. C. Hillman, eds.). Allen and Unwin, London. In press.

STEEDMAN, E. V. 1929. Ethnobotany of the Thompson Indians of British Columbia. Bureau of American Ethnology, 45th Annual Report. Smithsonian Institution, Washington, D.C.

STEGGERDA, M., and R. B. EDKARDT. 1941. Navajo foods and their preparation. J. Am. Diet. Assoc. 17:217-225.

SUMATHI, S., T.N. PATTABIRAMAN. 1977. Natural plant enzymes inhibitors. V. A trypsin/chymotrypsin inhibitor from *Alocasia macrorhiza* tubers. Biochim. Biophys. Acta 485:167-178.

TAKEDA, K. 1972. The steroidal sapogenins of the Dioscoreaceae. Prog. Phytochem. 3:287-333.

TANAKA, T. 1976. Tanaka's Cyclopedia of Edible Plants of the World. Keigaku Publishing Co., Tokyo.

TAYLOR, D. A., and A. J. HENRY. 1973. Alkaloids from *Courbonia glauca* rhizomr. Phytochem. 12:1178-1180.

TOMS, G. C., and A. WESTERN. 1971. Phytohaemagglutinins. Pp. 367-462 *in* Chemotaxonomyu of the Leguminosae, (J. B. Harborne, D. Boulter and B. L. Turner, eds.). Academic Press, London.

TURNER, N. J. 1977. Economic importance of black tree lichen *(Bryoria fremontii)* to the Indians of Western North America. Econ. Botany. 31:461-470.

TURNER, N. J. 1984. Counter-irritant and other medicinal uses of plants in Ranunculaceae by native peoples in British Columbia and neighbouring area. J. Ethnopharmacol. 11:181-201.

TURNER, N. C., and M. A. M. BELL. 1973. The ethnobotany of the Southern Kwakiutl Indians of British Columbia. Econ. Bot. 27:257-310.

WARNER, W. L. 1958. A black civilization: a social study of an Australian tribe. Harper and Brothers Publishers.

WATT, J. M., and M. G. BREYER-BRANDWIJK. 1962. The medicinal and poisonous plants of Southern and Eastern Africa. 2nd ed. E. & S. Livingstone Ltd., Edinburgh.

WAUGH, F. W. 1916. Iroquois foods and food preparation. Geol. Sur. Can. Mem. 86 (Facsimile edition 1973).

WEI, C. H., F. C. HARTMAN, P. PFUDERER, W.-K. YANG. 1974. Purification and characterization of two major toxic proteins from seeds of *Abrus precatorius*. J. Biol. Chem. 249:3061-3067.

WEISS, E. A. 1979. Some indigenous plants used domestically by east African coastal fisherman. Econ. Botany. 33:35-51.

WERGE, R. W. 1979. Potato processing in the Central Highlands of Peru. Ecol. Food Nutr. 7:229-234.

WHITING, A. F. 1939. Ethnobotany of the Hopi. Museum Northern Arizona, Bull. 15:1-120.

WILDMAN, W. C. 1968. The Amaryllidaceae alkaloids. The Alkaloids 11:307-405.

WILLAMAN, J. J., and H.-L. LI. 1970. Alkaloid-bearing plants and their contained alkaloids. Lloydia. 33, Supplement No. 3A.

WINDHOLZ, M. (ed.) 1976. The Merck Index. Merck and Co., Inc. Rahway, N.J.

WRIGHT-ST. CLAIR, R. E. 1972. Diet of the Maoris of New Zealand. Ecol. Food Nutr. 1:213-223.

YASURAOKA, K., Y. INE, K. TAKAMURA, H. SHIMOMURA, J. HASHIGUCHI, M. J. SANTOS, and A. T. SANTOS. 1977. Laboratory and field assessment of the molluscicidal activity of gogo *(Entada phaseoloides)* against the amphibious snail intermediate host of *Schistosoma japonicum*. Jpn. J. Exp. Med. 47:483-487.

YOST, G. S., F. R. STERMITZ, and M. C. WILLIAMS. 1977. Toxic furocoumarins of

LITERATURE CITED (continued)

Cympopterus longipes. Phytochem. 16: 1097-1098.

ZIGMOND, M. L. 1981. Kawaiisu Ethnobotany. Univ. Utah Press, Salt Lake City.

APPENDIX 1
Classification of Traditional Plant Processing Techniques

2. No special detoxification techniques applied (subdivide as in Coursey, 1973)
2. Special detoxification techniques applied
    - 2.1 Detoxification by heat
        - 2.11 Unspecified cooking
            - 2.111 Cooking of whole pieces
                - 2.1111 Cooking without the addition of salt, lye, or acid
                - 2.1112 Cooking with the addition of salt
                - 2.1113 Cooking with the addition of lye
                - 2.1114 Cooking with the addition of acid
                - 2.1115 Cooking after drying
                - 2.1116 Cooking after soaking
            - 2.112 Cooking after comminution (Subdivide as for 2.111)
            - 2.113 Cooking after peeling (Subdivide as for 2.111)
        - 2.12 Boiling, stewing, etc. (Subdivide as for 2.11)
        - 2.13 Roasting, baking (Subdivide as for 2.11)
        - 2.14 Frying (Subdivide as for 2.11)
        - 2.15 Steaming (Subdivide as for 2.11)
    - 2.2 Detoxification by solution
        - 2.21 Soaking in static water
            - 2.211 Soaking or leaching of whole pieces
                - 2.2111 Followed by unspecified cooking
                - 2.2112 Followed by boiling
                    - 2.21121 Simple boiling (Subdivide as in 2.111)
                    - 2.21122 Repeated boiling in changes of water (Subdivide as for 2.21121)
                - 2.2113 Followed by roasting or baking
                - 2.2114 Followed by frying
                - 2.2115 Followed by steaming
                - 2.2116 Followed by drying
                - 2.2117 Followed by fermentation
                - 2.2118 Followed by pickling
            - 2.212 Soaking or leaching after comminution (Subdivide as for 2.211)
            - 2.213 Soaking or leaching after cooking and comminution (Subdivide as for 2.211)
            - 2.214 Soaking or leaching after cooking (Subdivide as for 2.211)
            - 2.215 Soaking or leaching after boiling with lye (Subdivide as for 2.211)
            - 2.216 Soaking or leaching after freezing (Subdivide as for 2.211)
            - 2.217 Soaking or leaching after drying (Subdivide as for 2.211)

- 2.218 Soaking or leaching after peeling or cutting (Subdivide as for 2.211)
- 2.22 Soaking with change(s) in water (Subdivide as for 2.21)
- 2.23 Soaking in running water (Subdivide as for 2.21)
- 2.24 Leaching (Subdivide as for 2.21)
- 2.25 Soaking in salt water (Subdivide as for 2.21)
- 2.26 Soaking with the addition of ashes or lye (Subdivide as for 2.21)
- 2.27 Soaking with the addition of acidic substances (Subdivide as for 2.21)
- 2.28 Boiling
    - 2.281 Boiling of whole pieces
        - 2.2811 Simple boiling
            - 2.28111 Without salt, lye, or acid
            - 2.28112 With salt
            - 2.28113 With lye
            - 2.28114 With acid
            - 2.28115 After drying
        - 2.2812 Repeated boiling in changes of water (Subdivide as for 2.2811)
    - 2.282 Boiling after comminution (Subdivide as for 2.281)
    - 2.283 Boiling after peeling (Subdivide as for 2.281)

2.3 Detoxification by fermentation

- 2.31 Spontaneous fermentation
    - 2.311 Fermentation of whole pieces
        - 2.3111 Without previous treatment
            - 2.31111 Followed only by washing
            - 2.31112 Followed by washing and heat treatment
            - 2.31113 Followed by heat treatment
            - 2.31114 Followed by comminution
            - 2.31115 Followed by drying
        - 2.3112 After cooking (Subdivide as for 2.3111)
        - 2.3113 After boiling with lye (Subdivide as for 2.3111)
        - 2.3114 After soaking (Subdivide as for 2.3111)
        - 2.3115 With addition of salt (Subdivide as for 2.3111)
    - 2.312 Fermentation after communition (Subdivide as for 2.311)
- 2.32 Fermentation with use of inoculum from earlier preparations (Subdivide as 2.31)

2.4 Detoxification by adsorption

- 2.41 Addition of clay
    - 2.411 Addition to whole pieces
        - 2.4111 Addition during soaking
            - 2.41111 Addition without previous treatment
            - 2.41112 Addition after cooking
        - 2.4112 Addition during boiling (Subdivide as for 2.4111)
        - 2.4113 Addition during cooking (Subdivide as for 2.4111)
        - 2.4114 Addition during comminution (Subdivide as for 2.4111)
        - 2.4115 Addition to consumed product (Subdivide as for 2.4111)
    - 2.412 Addition after comminution (Subdivide as for 2.411)
- 2.42 Addition of charcoal (Subdivide as for 2.41)
- 2.43 Soaking in wet mud
    - 2.431 Soaking of whole pieces

- 2.432 Soaking after comminution
- 2.5 Detoxification by drying
  - 2.51 Sundrying
    - 2.511 Drying of whole pieces
      - 2.5111 Sundrying followed by cooking
      - 2.5112 Sundrying followed by soaking
      - 2.5113 Sundrying followed by fermentation
      - 2.5114 Sundrying followed by comminution
    - 2.512 Drying after comminution (Subdivide as for 2.511)
  - 2.52 Kiln or hot-air drying (Subdivide as for 2.51)
- 2.6 Detoxification by physical processing
  - 2.61 Peeling
  - 2.62 Grating or rasping
  - 2.63 Squeezing
  - 2.64 Pounding
  - 2.65 Grinding
  - 2.66 Cutting
- 2.7 Detoxification by pH change
  - 2.71 Lye or lime added
  - 2.72 Acidic substance added

Social Adaptation to Food Stress: A Prehistoric Southwestern Example. Minnis, Paul E. Chicago: University of Chicago Press. 1985. $8.50 (paper).

The usefulness of ecological models in archaeology is amply demonstrated in Minnis's disquisition on the response of social groups of food stress. Minnis's model, outlined in Chapter Two, states that more or less sedentary social groups will resort to increasingly drastic and more inclusive social and economic responses when faced with progressively severe problems of food provisioning. Three ethnographic examples (two from Southeast Asia and one from Africa) indicate the general utility of the model.

The study is carried out using a 1150-year prehistoric sequence (outlined in Chapter Three) of the Rio Mimbres region of southwestern New Mexico. Population estimates based upon room area indicate a fairly uniform rate of population increase during the Early Pithouse and Late Pithouse Periods (the first 800 years), a high rate of increase during the succeeding Classic Mimbres Period (150 years), and an abrupt decline in the subsequent Animas and Salado Periods (200 years).

Examination of biotic and abiotic environs of the Rio Mimbres region in Chapter Four provides a feeling for the agricultural marginality of the study area. The basis for reconstructing the environmental stress experienced by the prehistoric human population is a tree ring-dated precipitation history, which indicates periodic drought conditions, based upon indices derived from a region 100 km to the north. Archaeological evidence, in the form of wood charcoal, documents anthropogenic environmental degradation prior to and during the Classic Mimbres Period, when increasingly intense use of the floodplain for agriculture largely denuded the local gallery forests.

Having documented change in population and agricultural intensification in the more productive floodplain, attention is directed at estimating the degree and periodiciy of food stress in the study area (Chapter Five). As a first step toward estimating the stress experienced by the prehistoric Mimbres population, Minnis provides a useful though limited discussion of the problems inherent in estimating subsistence economy from "raw" archaeological data. Using the generally preferred ubiquity method (percent of total samples containing a particular specimen type) for estimating the importance of archaeobotanical materials, maize, not surprisingly, is argued to be the most important dietary resource during the Late Pithouse and Classic Mimbres Periods. The relative contributions of other potential plant resources to prehistoric diet between these two time periods is believed to have remained more or less the same throughout the sequence. Arguing by analogy to ethnographic and archaeologic examples, the dietary contribution of maize to the prehistoric occupants is estimated at 35% for the Early Pithouse Period and 50% for the later Periods.

The contribution of agricultural endeavors to subsistence for each period is then estimated. Using as analog the Eastern Pueblos, where the per capita amount of agricultural land has already been calculated, Minnis estimates that 0.4 hectares/person was necessary during the Early Pithouse Period, and 0.6 hectares/person for the later Period populations. Projecting these estimates into the past indicated that floodplain agriculture would have been insufficient to support the Classic and, perhaps, the Animas Period populations. These projections are refined further by assessing from the precipitation record whether certain periods had reliable or extremely variable moisture availability. The insights from these estimates are useful: the early portion of the Classic Mimbres Period had a very favorable agricultural climate, but the later (1090-1149 A.D.) portion experienced much less favorable conditions, hence greater stress.

Estimation of subsistence is completed by calculating net exploitable productivity of the entire study area. The relevance of these estimates is that if productivity of the prehistoric agricultural system was at any time insufficient to support the population, wild food use would be expected to make up the deficit. In estimating exploitable productivity, Minnis combines a variety of productivity estimates that include contributions for all trophic levels with reasonable assumptions concerning the useable fractions of total ecosystem productivity. Here, as with the calculation of agricultural needs, the model would have benefitted from inclusion of variance estimates for each parameter. Though it would have resulted in an increase in model complexity, the gain in resolution would seem worth the investment. After considering all inputs, it seems clear that during the Late Pithouse and Classic Mimbres Periods, population increase outstripped adequate available agricultural lands during a period when insufficient moisture would have made it difficult to supplement dietary needs by harvesting wild plants and animals.

Having documented stress, Minnis proceeds to assess the social and economic changes his model proposes (Chapter Six). Architectural changes only suggest there might have been social system change with increased stress. Economic change is examined by assessing the relative difference in intra- and extra-regional exchange that took place from Early Pithouse to Classic Mimbres Periods. Though evidence is only suggestive, trends in the relative quantities of exotic vs. local products indicate that during the period of greatest stress intra-regional exchange increased while extra-regional interchange decreased. Hence the model in its original formulation seems more or less correct: with increasing subsistence stress, the population's response is to intensify agricultural production, and when this fails the social groups undergo requisite changes in sociopolitical organization, and possibly also experience increased intra-regional economic interaction.

The use of analogy to infer various aspects of prehistoric subsistence is a common approach in archaeology. The more attributes shared between analog and subject society in, for example, level of sociopolitical integration, subsistence regime and environmental context, the more direct and appropriate the inference. Minnis relies heavily upon analogy to estimate many parameters of agricultural subsistence (percent of cultigens [maize only] in diet, necessary per capita agricultural land, maize yield per hectare), but in most situations he selects one from a number of quite disparate estimates. One can perhaps see the need to focus upon a single estimate, but inclusion of minima and maxima, or some other measure of variation for each estimate from the numerous potentially useful analogs, would have greatly increased the model's resolution.

The study as a whole is beautifully conceived and executed. No stone is left unturned in searching for data useful in describing system variables. Methods of estimating system attributes are well reasoned, though each estimate should have included some measure of variation to obtain a more robust approximation of systemic variation. In *Social Adaptation to Food Stress*, Minnis gives us an excellent approach to problem-oriented archaeological research that will serve as a baseline from which future studies in the Southwest and elsewhere can be formulated.

Bruce F. Benz
Laboratorio natural Las Joyas de la sierra De Manantlan
Universidad de Guadalajara
Apdo. Postal 1-3933
Guadalajara, Jal. CP 44100
Mexico

Nutzpflanzen in Deutschland: Biologie und Kulturgeschichte. Korber-Grohne, Udelgard. Stuttgart: Theiss. 1987. Pp. 490. 29.50 in Great Britain.

The principal aim of this book is to chart the history of field crops in Germany, excluding fruits but including vegetables, dyeplants, and oilseeds. This aim is achieved by a thorough survey of all available archaeological evidence (the author is a distinguished archaeobotanist) and of literary sources such as herbals and agricultural histories. The rise and (in many cases) fall in popularity of crops right up to the twentieth century are covered with the aid of numerous distribution maps, which often extend to include Europe as a whole. Comparatively recent introductions, such as maize, potatoes, and tomatoes, are included, as are even minor ancient domesticates of Europe and the Near East. These parts of the book will be of great value in their own right to those interested in the prehistory and history of farming in Europe.

What makes this book really special, however, is the copious ancillary information provided for each of the 60-plus species covered. The section for each species begins with a useful description of the appearance of the plant, supported by one of the chief glories of the book: its illustrations. These include many clear line drawings of whole plants and 132 well-reproduced photographs (many in color) of the ancestral wild plants in their original habitats, of the crops in cultivation, and of illustrations in medieval herbals. Seeds are also depicted in many photographs and drawings that will be of use to the practicing archaeobotanist. In addition, the domestication and spread of each species is described, often at length, and again often supplemented by distribution maps. Although these sections sometimes lack the most recent literature references, they are very useful syntheses. The author concludes with a short period-by-period summary of changes in crop use in Germany's past, and a bibliography of some 300 references.

This book is a remarkable and thorough *tour-de-force* and it is reasonably priced given its size and handsome standard of production. It is botanically accurate, clearly written, and comprehensible even to those with only a fair reading knowledge of German. In any event, the plates alone are enough to make the book a pleasure to handle. Korber-Grohne's work will clearly be a standard source for many years to come and should be owned by all ethnobotanists interested in Old World cultivated plants.

Mark Nesbitt
British Institute of Archaeology
Tahran Caddesi 24
Kavaklidere
Ankara, Turkey

ADDENDUM TO "NEWS AND COMMENTS", JOURNAL OF ETHNOBIOLOGY, VOLUME 8, NUMBER 1

Readers of this journal are familiar with Darrell A. Posey because of his publications on the ethnobiology of the Kayapo Indians and his service as an editorial board member. Some of you may not know that Darrell and two Kayapo Indians (Paulinho Paiakan and Kube-i Kaiapo) have been accused of violating the Brazilian Foreign Sedition Act which forbids foreigners from interfering with the internal affairs of the Brazilian republic (Articles 107 and 105, XI of Law No. 6.815/80). Conviction of these charges may carry a penalty of expulsion and/or one to three years in prison. Since complete information on the Posey case was received too late to include in Vol 8, No. 1, this insert will provide the basics in a case which promises to have many ramifications for scientific and scholarly research in Brazilian Amazonia and for the well being of Brazilian Indians and their environment.

The following is modified from a fact sheet prepared by the Washington office of the National Wildlife Federation (contact Sheila Crum at 202-797-6604 or 797-6646 for additional or the most recent information). Posey and the two Kayapo Indians were invited to participate in a conference on the tropical rainforest in early 1988 in Miami. Posey gave a scholarly paper and translated the presentations of the two Kayapo, which focused on deforestation and forest destruction from Brazilian public works projects, especially a large hydroelectric dam project. Representatives of the National Wildlife Federation and Environmental Defense Fund attended this conference and, impressed by the testimony, invited Posey and the Kayapo to Washington where they spoke to the Treasury and State Departments, several committees of Congress and officials of the World Bank.

The World Bank has delayed a loan of $500 million to Brazil's national power company as a result of Brazil's failure to meet the conditions of earlier loans. Although the Bank officially states that the presentations in Washington by the two Kayapo Indians had no effect in these delays, it would appear that officials of the Brazilian government perceive the situation otherwise. It appears that the prosecution of Posey and the two Kayapo Indians is motivated by a broadening policy to deny scientists, Brazilian as well as foreigners, research among indigenous populations in the Amazon and to discourage Indian leaders from attempts to defend their lands and traditonal cultural rights.

A prelimiary hearing was held on August 26, with a second, final hearing scheduled for November 1, 1988. Since the final outcome of this hearing will significantly affect the future of ethnobiological studies in Brazil and the welfare of Brazilian Indians, we encourage you to lend support in two ways--Voice your concern and support by writing directly to the President of Brazil, as follows: EXMO. Sr. Jose Sarney, Presidente da Republica, Palacio do Planalto, Brasilia, DF., Brasil and contribute to a defense fund in behalf of Posey and the two Kayapo. Make checks payable to "Darrell Posey-Kayapo Defense Fund" and mail them to Darrell's father, Henry Addison Posey, Rt. 2, Box 186, Henderson, Kentucky, USA or to Dr. Brent Berlin, Department of Anthropology, University of California, Berkeley, California 94720, USA. --Brent Berlin, Amadeo M. Rea, Willard Van Asdall

NEWS AND COMMENTS

NEWS ITEMS:

Free trade and protectionism have been a key issue in this year's presidential debate. Ethnobiology is embroiled in the issue, as these news items indicate:

From the *Seattle Post-Intelligencer* of September 30, 1987 we learn of a pitched battle between the American Soybean Association and the Malayasian government. The Soybean Association is "playing hardball," labeling palm oil—one of Malaysia's primary sources of foreign exchange income, earning that nation $1.3 billion in 1986—a "tropical fat." One Soybean Association ad shows a coconut bomb with its fuse burning with the warning: "What you don't know about 'tropical fats' can kill you." Soybean lobbyists want Congress to enact a labeling law requiring users of palm oils to inform consumers of the health risks associated with saturated fats. Malaysia's minister of primary industries, Lim Keng Yaik, complains that the Soybean Association's lobbying campaign is "highly" discriminatory . . . selective protectionism in disguise . . ." It is generally conceded that saturated fats raise blood cholesterol levels and that palm oils —at 51% saturated fat—are high in such fats compared to most vegetable oils. (By contrast, soybean oil contains just 15% saturated fats.) However, some recent research suggests that "despite its high saturated fatty acid content, palm oil 'does not behave as a saturated oil,' " and may even counteract thrombosis, the blood clotting implicated in most heart attacks *(Nutrition Reviews*, July 1987).

The Washington Post of December 18, 1987 reports on a dispute between the Congressional Beef Caucus—spearheaded by Sen. Phil Gramm (R-Texas)—and the Japanese government over Japan's slack purchases of American beef. Tsutomo Hata, chairman of Japan's Liberal Democratic Party's Agricultural Committee cited Buddhist restrictions on eating meat and explained that the Japanese have a "much, much larger" digestive system than Americans, making it harder for them to eat beef. Gramm replied: "Open your markets and let people see if your intestines are too long, let them see if the teachings of Buddha" will keep the Japanese from eating beef! Despite the Buddha and the Japanese intestine Japan still imported nearly $500 million worth of U.S. beef last year, making Japan our largest overseas market for that commodity. (Thanks to Bill Sturtevant for this item.)

The UPI reports from Moscow on the arrest of an amateur botanist for "flower-napping" in the theft of "Cosmonaut," the only orchid ever grown in outer space. Police followed a trail of illegal rare flower sales for eight days before arresting Vladimir Tyurin, 36, for the crime. "Cosmonaut" was grown aboard the Salyut 6 space station and was considered priceless due to its value in biological and genetic experiments. The flower died during the escapade. *(Seattle Post-Intelligencer*, 3 April 1988).

CONFERENCES:

Past:

Janis Alcorn and Margery Oldfield organized a symposium on "Traditional Cultures and Conservation of Their Biological Resources" at the Southwest and Rocky Mountain (SWARM) regional meetings of the American Association for the Advancement of Science held 29 March to 2 April, 1988 in Wichita, Kansas. The symposium featured 14 speakers representing the UNESCO-MAB Biosphere Reserve program, USAID, Cultural Survival, and the World Wildlife Fund. For further information contact Dr. Alcorn at

Department of Biology, 2000 Percival Stern Hall, Tulane University, New Orleans, LA 70118.

Graham Baines and Nancy Williams of the Centre for Resource and Environmental Studies. The Australian National University, Canberra organized a workshop on TEK, viz., *Traditional Ecological Knowledge,* designed to "prepare guidelines for the investigation, documentation and interpretation of traditional ecological knowledge, and to promote that interaction between anthropologists and ecologists which will facilitate the study of traditional ecological knowledge." Dr. Baines is editor of *Tradition, Conservation & Development* an occasional newsletter of the International Union for Conservation of Nature and Natural Resources (IUCN) Commission on Ecology's Working Group on Traditional Ecological Knowledge. For more information contact Dr. Nancy Williams at GPO Box 4, Canberra, ACT 2601, Australia or Dr. Eugene Hunn, Department of Anthropology, University of Washington, Seattle, WA 98195.

Future:

The Commission on Ethnobotany of the International Union of Anthropological and Ethnological Sciences (IUAES) will meet 21-22 July 1988 just before the IUAES biennial Congress at Zagreb, Yugoslavia scheduled for 25-30 July.

The First International Congress of Ethnobiology is scheduled 19-24 July 1988 in Belém, Pará, Brazil. The Congress is being organized by Dr. Darrell Posey (a *Journal of Ethnobiology* editorial board member), Head, Núcleo de Etnobiologia (NEB), Museu Paraense Emílio Goeldi. A recent addition to the program is a session on ethnoornithology being organized by Dr. David Oren of that Museum. For more information write Dr. Posey at 66.040 Belém-Pará-Brazil Caixa Postal 399.

An International Symposium on Plant Resources is being organized 4-7 October 1988 in Kunming, Yunnan Province, People's Republic of China. Sponsors include the Kunming Institute of Botany, the Academy of Sciences of China, and the Yunnan Association for Science and Technology. Topics to be highlighted include: 1) taxonomic and floristic basis of plant resources, 2) phytochemistry, 3) plant biotechnology in plant resources utilization, 4) ethnobotany, and 5) conservation of plant gene pools and cultivation of economic plants. The working language of the symposium will be English. For more information contact Mr. Guan Kalyun, Secretariat, International Symposium on Plant Resources, Kunming Institute of Botany, The Academy of Sciences of China, Heilongtan, Kunming, Yunnan Province, The People's Republic of China.

The First National Symposium on "New Crops: Research, Development, Economics" is scheduled for 23-26 October 1988 at Indianapolis, Indiana. It is sponsored by The Society for Economic Botany, the American Society for Horticultural Science, and the U.S. Department of Agriculture, among others. Sessions will be devoted to: 1) economics and research, 2) technology and development, 3) biotechnology and new crops, 4) status of new crops research, 5) unexploited new crops, and 6) germplasm and new crops. For more information contact Jules Janick, Department of Horticulture, Purdue University, West Lafayette, IN 47907.

ANNOUNCEMENT

The Florutil Conservation Project is a joint effort of the Desert Botanical Garden (Phoenix, Arizona), the Asociación Ecológica Tamaulipeca (Ciudad Victoria, Tamaulipas, México), and the Native American Botanical Research and Survey (Santa Fe, New Mexico). Project goals include developing a data base for rare and endangered useful plants of the U.S./Mexico borderlands, promoting the conservation of these resources, and promoting the preservation of traditional knowledge about these plants.

Eugene Hunn
Department of Anthropology
University of Washington
Seattle, WA 98195

BARBARA LAWRENCE PRIZE ANNOUNCED

The Society will award a prize in honor of Barbara Lawrence for the best paper submitted by a student for presentation at the 12th Annual Meeting. The competition is open to any member who considers themself a student and has not held the PhD degree at the end of the preceding summer session. The paper can be presented in an oral or a poster session and will be considered for publication in the *Journal of Ethnobiology.*

Manuscripts submitted for this competition should be single authored only; joint efforts will not be considered. Manuscripts are judged solely on quality, originality, and presentation of research. They should follow the *Journal of Ethnobiology* format and should be sufficiently precise and documented to enable the reviewing committee to judge their merits. Manuscripts are limited to eight double-spaced, typed pages, including a required abstract but excluding copies of figures, tables, and references.

Please include a cover letter indicating that you are a Society member and meet the criteria listed above and send it and your paper early enough that they will arrive at their destination on or before December 15, 1988. Send all material to the 12th Annual Ethnobiology Conference Committee, c/o Elizabeth J. Lawlor or Sharon J. Rachele, Department of Anthropology, University of California, Riverside, CA 92521, USA.

SOCIETY NEWS

12th Annual Ethnobiology Conference

The Society of Ethnobiology 12th Annual Conference will be held March 30 to April 2, 1989, at the University of California, Riverside. The conference will be sponsored by the Department of Anthropology and the Department of Botany and Plant Sciences.

Registration and a reception will be on Thursday evening, March 30. Two full days of presentations are scheduled for Friday, March 31 and Saturday, April 1. Field trips and a possible film festival are being planned for Sunday. A more detailed agenda will be mailed in October.

Riverside is in Southern California, one to two hours from Los Angeles, San Diego, the Sonoran Desert, and the Mojave Desert. We are served by Ontario International Airport, which is thirty minutes away, and by airports in Los Angeles, Burbank, and San Diego, each about ninety minutes away.

We welcome any papers (or poster abstracts) submitted for consideration; the deadline for abstracts will be December 15, 1988. For more information, or to get on our mailing list, please contact Elizabeth Lawlor or Sharon Rachele, Department of Anthropology, University of California, Riverside, CA 92521 / (714) 787-5524.

12th ANNUAL
ETHNOBIOLOGY CONFERENCE

Riverside, California

March 30 — April 2, 1989

Please see page 135
for additional details.

COMMENT ON LYMAN'S "ZOOARCHAEOLOGY AND TAPHONOMY: A GENERAL CONSIDERATION"

Kelly R. McGuire
Far Western Anthropological Research Group, Inc.
P.O. Box 413, Davis, California 95617

R.L. Lyman (1987:93-117) presents a review of previously published statements regarding taphonomic methods, principles, and terminology with the stated goal of facilitating construction of a "universally applicable" theory of taphonomy. The results of this effort are then used to evaluate two case studies which Lyman judges to be "good" (Barnosky 1985) and "not so good" (McGuire 1980, 1982) applications of his emerging general model. As the author of the "not so good" example—a study of natural bone assemblages and depositional structure at Mineral Hill Cave—I am compelled to respond to its use as the "straw man" in Lyman's search for general theory. While a number of issues deserve clarification, my comments are directed primarily at what I consider to be Lyman's most egregious error, namely, his near dismissal of archaeological context.

The Mineral Hill Cave program was largely a contextual and comparative study where results were evaluated vis-a-vis several reported associations of artifacts and extinct animals within the Great Basin. Taphonomic information (charcoal, burnt bone, spiral fractured long bone, etc.) was therefore evaluated primarily on the basis of its historic use in Great Basin Early Man cave studies (e.g., Orr 1956, Harrington 1934, Cressman 1946, 1966, Gruhn 1961), and only incidentally with an eye toward recent trends in bone fracture studies and other ancillary taphonomic issues. Lyman and other faunal particularists may object to this focus but it is the evidentiary milieu from which much of the case for Great Basin Pleistocene hunters has developed.

This indifference to context is also apparent in several strained assertions regarding Great Basin prehistoric tool-kits and their manifestation at cave sites. As I have previously stated, the residues of fully developed flaked stone industries have been identified in virtually all Great Basin cave cultural deposits dated from the Pleistocene-Holocene contact to the protohistoric period. Lyman ignores this comparative evidence raising instead the specter of bone expediency tools in the Mineral Hill assemblage even though no such assemblage has ever been documented from the Great Basin. Further, he has no clear notion on how to operationalize this identification and paradoxically cites himself (p. 104) in acknowledging that no reliable criteria has yet been developed to identify such bone tools. Apparently, Lyman feels his point is made by simply citing examples from the Great Plains (Johnson 1982, 1985) where presumably bone expediency tools were recovered from several Paleoindian butchering localities. Here, again, Lyman ignores context, failing to reconcile the fact that most well-documented Great Basin archaeological cave sites were habitation or caching loci, and not butchering localities.

The issue of Early Man aside, one wonders what Lyman's explanation is for the lack of any cultural signatures from more recent prehistoric occupations of Mineral Hill Cave when population densities were presumably higher and there is even more overwhelming evidence for the use of cave and shelter locations within the Great Basin. The answer (which satisfies Lyman's preoccupation with positive evidence but is left unmentioned in his critique) probably resides in habitation limitations wrought by a combination of extreme humidity and low ambient air temperature within the interior of this active limestone solution cave (McGuire 1980:264). While no comparative data were brought to bear on this potentially productive research issue, suffice it to say that it provides a parsimonious explanation for the lack of both early and late prehistoric occupation at Mineral Hill Cave.

On more procedural matters, Lyman offers his impression that the Mineral Hill Cave excavation sample was small and leaves it at that. He provides no insight into the admittedly troublesome question of what constitutes a representative sample for the purpose of demonstrating human groups *did not* utilize a given space. While most archaeologists, including myself, are willing to concede that large excavation samples are better than small ones, the estimated 2.3% sample from Mineral Hill resulted in the recovery of several thousand large and small faunal elements with no attendant evidence of Man, artifactual or otherwise. From a comparative standpoint, this is at extreme variance with other reported archaeological cave/occupation sites in the Great Basin.

The Mineral Hill study was conducted over a decade ago and, notwithstanding Lyman's notion that it should be held accountable for more recent approaches to taphonomic analysis, still provides a cogent contextual backdrop from which to assess published claims of Pleistocene hunters at Great Basin cave sites. Lyman's goal of an "holistic theory" of taphonomy is laudable, and his summary of general taphonomic principles and effects contained elsewhere in his report are thorough. When at such a time his program is used in conjunction with a regional contextual approach—and not as a substitute—Early Man studies in the Great Basin may benefit.

LITERATURE CITED

BARNOSKY, A.D. 1985. Taphonomy and herd structure of the extinct Irish elk (Megaloceros giganteus). Science 228:340-344.

CRESSMAN, L.S. 1946. Studies of early man in south-central Oregon. Carnegie Institute of Washington Yearbook 39:300-306.

__________. 1966. Man in association with extinct fauna in the Great Basin. American Antiquity 31:866-867.

GRUHN, R. 1961. The archaeology of Wilson Butte Cave, south-central Idaho. Occasional Papers of Idaho State Museum 6.

HARRINGTON, M.R. 1934. American horses and ancient men in Nevada. Southwest Museum Masterkey 8:165-169.

JOHNSON, E. 1982. Paleoindian bone expediency tools: Lubbock Lake and Bonefire Shelter. Canadian Journal of Anthropology 2:145-157.

__________. 1985. Current developments in bone technology. Pp. 157-235. In advances in archaeological method and theory, vol. 8. (M.B. Schiffer, ed.) Academic Press, Orlando, Florida.

LYMAN, R.L. 1987. Zooarchaeology and taphonomy: A general consideration. Journal of Ethnobiology 7(1):93-117.

MCGUIRE, K.R. 1980. Cave sites, faunal analysis, and big-game hunters of the Great Basin: a caution. Quaternary Research 14:263-268.

__________. 1982. Reply to Gruhn and Bryan's comments on "Cave sites, faunal analysis, and big-game hunters of the Great Basin." Quaternary Research 18: 240-242.

ORR, P.C. 1956. Pleistocene Man in Fishbone Cave, Pershing County, Nevada. Nevada State Museum, Bulletin 2.

Reply to K.R. McGuire

R. Lee Lyman

McGuire's comment grants me the forum to clarify several points raised in my paper. My intent was not to construe the Mineral Hill Cave (MHC) analysis as a "straw man." I cited two other studies with identical problems. I chose to focus on MHC because it was published in an international journal; the other two studies remain unpublished. My intent was to point out where the MHC analysis (and by implication the other two studies) might be improved. In his comment McGuire indicates one way to improve that analysis: comparative study of the humidity and ambient air temperature in caves. For that I applaud; it is clearly good.

The thrust of McGuire's comment lies in his concern for "archaeological context." He uses that term two rather different ways. His second paragraph indicates he studied the MHC materials for purposes of elucidating how taphonomic data had been (or might be) used within the context of the debate over whether or not people were present in the Great Basin during the Late Pleistocene. I did not "dismiss" that context but rather enlarged it to encompass the search for evidence of Late Pleistocene people in the Americas. My intent in doing so was to show that the problem was not restricted to the Great Basin.

McGuire accuses me of a "preoccupation with positive evidence." Careful reading of what I wrote will reveal I *never denied* the existence of a Pleistocene-Holocene aged flaked stone industry in the Great Basin. When McGuire suggests expedient bone tools are undocumented in the Great Basin he effectively exposes his own preoccupation with positive evidence. Were he to admit that preoccupation, his criticism of my "raising the specter" of such tools would lose its force. That I think we lack robust methods for identifying such tools is beside the point; that expedient bone tools *may have existed* is enough (Grayson 1986).

This brings us to the second apparent meaning of "context": the type or function of the site which might produce expedient bone tools. McGuire correctly notes those Great Plains sites which have produced such tools are functionally distinct from Great Basin cave sites. But the former were more than simply "butchering localities," they very often were kill loci as well. Most importantly, he uses the Great Plains sites to imply Great Basin cave sites are *not* "butchering localities." That, I think, will surprise many archaeologists working in the Great Basin (e.g., Grayson 1988, Miller 1979, Thomas and Mayer 1983). Caves served as kill-butchery loci as well as habitation loci in the Great Plains (e.g., Dibble and Lorrain 1968), and have produced bone specimens identified as expedient tools (Johnson 1982). Not surprisingly, both open sites (Schmitt 1986) and cave sites (Miller 1982, Schmitt 1989, Thomas 1983) in the Great Basin have also produced such tools, although to my knowledge no cave site in the Great Basin has been labeled a "kill site."

My explanation for the absence of evidence of human ocupation of MHC did *not*, as McGuire alleges, consider only the fact that the sample consisted of 2.3% of the horizontal space. I noted the sample volume was unknown. I also pointed out that if I or many other Great Basin archaeologists were to search for evidence of people in MHC, we would dig in more than one area of the cave interior, and at least one pit would be on or very near the drip line where artifacts tend to be most dense in Great Basin caves. As I noted, "archaeologists sample space [but] no reasons are given for the sampling design used" at MHC. To paraphrase him, McGuire's sampling design seems to "be at extreme variance with other reported [samplings of] archaeological cave/occupation sites in the Great Basin" and other reported taphonomic studies.

Clearly studies such s that of MHC are important. By using it as an example, I sought to indicate what I perceive as ways to derive the maximum amount of taphonomically useful (and requisite) information from such studies. I stand by my conclusion that the data available do not clearly indicate whether or not MHC was ever utilized by people, and hope to have shown now such an indication might best be obtained. It is indicative of the work we must now do that my statement regarding the key problem here still exists 10 years after McGuire's work: "we simply do not know what a fossil assemblage deposited by people but without associated tools should look like" (Lyman 1987:104).

LITERATURE CITED

DIBBLE, D.S. and D. LORRAIN. 1968. Bonfire Shelter: a stratified bison kill site, Val Verde County, Texas. Texas Memorial Mus. Misc. Paps. No. 1.

GRAYSON, D.K. 1986. Eoliths, archaeological ambiguity, and the generation of "middle-range" research. Pp. 77-133. *In* American archaeology past and future. (D.J. Meltzer, D.D. Fowler and J.A. Sabloff, eds.) Smithsonian Institution Press, Washington, D.C.

__________. 1988. Danger Cave, Last Supper Cave, and Hanging Rock Shelter: the faunas. Amer. Mus. Nat. Hist. Anthropol. Paps. 66(1).

JOHNSON, E. 1982. Paleoindian bone expediency tools: Lubbock Lake and Bonfire Shelter. Canadian J. Anthropol. 2:145-157.

LYMAN, R.L. 1987. Zooarchaeology and taphonomy: a general consideration. J. Ethnobiol. 7:93-117.

MILLER, S.J. 1979. The archaeological fauna of four sites in Smith Creek Canyon. Pp. 272-329. *In* the archaeology of Smith Creek Canyon, eastern Nevada. (E.R. Tuohy and D.L. Rendall, eds.) Nevada State Mus. Anthropol. Paps. No. 17.

__________. 1982. The archaeology and geology of an extinct megafauna/fluted-point association at Owl Cave, the Wasden Site, Idaho: a preliminary report. Pp. 81-95. *In* Peopling of the New World. (J.E. Ericson, R.E. Taylor and R. Berger, eds.) Ballena Press Anthropol. Paps. No. 23.

SCHMITT, D.N. 1986. Faunal analysis. Pp. 209-239. *In* The archaeology of the Vista Site 26WA3017. (C.D. Zeier and R.G. Elston, eds.) Intermountain Research Report to Nevada Department of Transportation, Carson City.

__________. 1989. Bone artifacts and human remains. *In* The archaeology of James Creek Shelter. (R.G. Elston and E.E. Budy, eds.) Univ. Utah Anthropol. Paps. In press.

THOMAS, D.H. 1983. The archaeology of Monitor Valley 2: Gatecliff Shelter. Amer. Mus. Nat. Hist. Anthropol. Paps. 59(1).

__________ and D. MAYER. 1983. Behavioral analysis of selected horizons. Pp. 353-391. *In* The archaeology of Monitor Valley 2: Gatecliff Shelter. (by D.H. Thomas.) Amer. Mus. Nat. Hist. Anthropol. Paps. 59(1).

NOTICE TO AUTHORS

The *Journal of Ethnobiology* accepts papers on original research in ethnotaxonomy and folk classification, ethnobotany, ethnozoology, cultural ecology, plant domestication, zooarchaeology, archaeobotany, palynology, dendrochronology and ethnomedicine. Authors should follow the format for article organization and bibliographies from articles in this issue. All papers should be typed double-spaced with pica or elite type on 8½ x 11 inch paper with at least one inch margins on all sides. The ratio of tables and figures to text pages should not exceed 1:2-3. Tables should not duplicate material in either the text or graphs. All illustrations are considered figures and should be submitted reduced to a size which can be published within a journal page without further reduction. Photographs should be glossy prints of good contrast and sharpness with metric scales included when appropriate. All illustrations should have the author(s) name(s) written on the back with the figure number and a designation for the top of the figure. Legends for figures should be typed on a separate page at the end of the manuscript. Do not place footnotes at the bottom of the text pages; list these in order on a separate sheet at the end of the manuscript. Metric units should be used in all measurements. Type author(s) name(s) at the top left corner of each manuscript page; designate by handwritten notes in the left margin of manuscript pages where tables and graphs should appear.

If native language terminology is used as data, a consistent phonemic orthography should be employed, unless a practical alphabet or a more narrow phonetic transcription is justified. A brief characterization of this orthography and of the phonemix inventory of the language(s) described should be given in an initial note. To increase readability native terms should be indicated as ***bold-face italics*** to contrast with the normal use of *italic* type for foreign terms, such as latin binomials. If necessary, the distinction between lexical *glosses*, i.e., English language approximations of a term's referential meaning, and precise English equivalents or definitions should be indicated by enclosing the gloss in single quotation marks.

Authors must submit two copies of their manuscript plus the original copy and original figures. Papers not submitted in the correct format will be returned to the author. Submit your manuscripts to:

DR. WILLARD VAN ASDALL, Editor
Journal of Ethnobiology
Arizona State Museum, Building 26
University of Arizona
Tucson, Arizona 85721

NEWS AND COMMENTS

Individuals with information for the "News and Comments" section of the *Journal* should submit all appropriate material to Eugene Hunn, Department of Anthropology, DH-05, University of Washington, Seattle, Washington 98195.

BOOK REVIEWS

We welcome suggestions on books to review or actual reviews from the readership of the *Journal*. Please send suggestions, comments, or reviews to Terence E. Hays, Department of Anthropology and Geography, Rhode Island College, Providence, Rhode Island 02908.

SUBSCRIPTIONS

Subscriptions to the *Journal of Ethnobiology* should be addressed to Cecil H. Brown, Department of Anthropology, Northern Illinois University, Dekalb, Illinois 60115-2854. Subscription rates are $40.00, institutional; $20.00 regular members, for U.S., Canada, and Mexico; foreign subscribers add $8.00. Write checks payable to *Journal of Ethnobiology*. Defective copies or copies lost in shipment will be replaced if written request is received within one year of issue.

CONTENTS

Journal of Ethnobiology

VOLUME 8, NUMBER 2 WINTER 1988

Journal and Society Organization

EDITOR: Willard Van Asdall, Arizona State Museum, Building 26, University of Arizona, Tucson, Arizona 85721.

ASSOCIATE EDITOR: Karen R. Adams, Department of Ecology & Evolutionary Biology, University of Arizona, Tucson, Arizona 85721.

ASSOCIATE EDITOR: Alejandro de Avila B., Centro de Graduados e Investigacion, Instituto Tecnologico de Oaxaca, A.P. 1378, Oaxaca, Oaxaca 68000, Mexico.

NEWS AND COMMENTS EDITOR: Eugene Hunn, Department of Anthropology, DH-05, University of Washington, Seattle, Washington 98195.

BOOK REVIEW EDITOR: Terence E. Hays, Department of Anthropology and Geography, Rhode Island College, Providence, Rhode Island 02908.

PRESIDENT: Amadeo M. Rea, Curator of Birds and Mammals, San Diego Museum of Natural History, P.O. Box 1390, San Diego, California 92112.

PRESIDENT-ELECT: Elizabeth S. Wing, Department of Natural Science, Florida State Museum, University of Florida, Gainesville, Florida 32611.

SECRETARY/TREASURER: Cecil H. Brown, Department of Anthropology, Northern Illinois University, Dekalb, Illinois 60115-2854.

CONFERENCE COORDINATOR: Jan Timbrook, Department of Anthropology, Santa Barbara Museum of Natural History, 2559 Puesta Del Sol Road, Santa Barbara, California 93105.

Journal of Ethnobiology is published semi-annually. Manuscripts for publication, information for the "News and Comments" and book review sections should be sent to the appropriate editor on the inside back cover of this issue.

ISSN 0278-0771

Journal of Ethnobiology

VOLUME 8, NUMBER 2

WINTER 1988

MUSEU PARAENSE EMILIO GOELDI
NUCLEO DE ETNOBIOLOGIA - NEB
66.040 Belem-Para-Brasil Caixa Postal 399

20.10.1988

Dr. Will Van Asdall
University of Arizona
Arizona State Museum
Tucson, AZ 85721
EUA

Dear Will,

Thanks so much for your kind letter of solidarity and comments about the Congress. I think the Congress was a magical experience. Ironically the "gala" nature of the event combined with the criminal prosecution against me and the two indian leaders to prove that ethnobiology can provoke science into taking a significant social stand on critical world issues.

Looking at the positive side of the criminal prosecution, I am pleased that representing indigenous peoples and their knowledge as important human resources has been interpreted as "subversive" to the Brazilian government. This means that the language of ethnobiology is managing to hit close to the points of power and decision-making. Furthermore, the press coverage (both national and international) that has been generated by this case has given us an enormous opportunity to reach many people with this new, integrative language of humanistic (and "activistic") science. Ethnobiology has become an almost household word here.

Finally, I think is very significant that the FIRST INTERNATIONAL CONGRESS OF ETHNOBIOLOGY gave birth to the International Society for Ethnobiology during these turbulent events. The Society was christened with a social and humanistic responsibility that provides a charter for ethnobiology to be more than "just another branch of science." The challenge, of course, is to produce an activist-humanistic science without jeopardizing the quality of scientific data—that is, afterall, our only weapon.

Sincerely,

Dr. Darrell A. Posey

This letter from Darrell A. Posey seems tailor-made for *Sketches in the Sand* for this issue. I am pleased to share it with you.

—W.V.

President's Page . . .

From opening remarks, 11th Annual Ethnobiology Conference, Mexico City.

The first president of the Society of Ethnobiology, Steve Weber, has described our science as "work that draws on both biology and anthropology to make statements about the interrelationship between living organisms and human culture, whether prehistoric, historic, or contemporary."

He goes on to note that ethnobiology, this hybrid field, has no unifying theory of its own, but this may be a characteristic of many disciplines. I think, for instance, of my own field, ornithology, with all of its diverse aspects.

Perhaps, though, there is some underlying characteristic that pervades much, though not all, of what we call ethnobiological research. And this has to do with perception. I'll return to this in a moment.

I think I probably hardly need to point out that the world in our era has been undergoing a period of *pervasive homogenization.* With the explorations and colonizations by Western European powers during the past four or five centuries and with the Industrial Revolution, we have seen an unprecedented simplification in the world's biota; a loss of languages, particularly in the New World; and a deterioration and loss of the cultures speaking those languages.

The homogenization of the biota is truly astounding. According to the fossil record, one species of plant or animal became extinct every thousand years. Now biologists estimate that we lose one thousand unique members of the earth's living organisms each year. Since A.D. 1600 only 1% of the extinctions are attributable to natural extinction. We have increased the extinction rate a million times.

In a recent analysis of biotic diversity (*Science* 1988, 241:1441-1449), Robert M. May summarized the situation this way:

"If we assume that something like half the extant species evolved in the last 50 million to 100 million years and that maybe half of all extant species will become extinct in the next 50 to 100 years if current rates of tropical deforestation continue, then contemporary rates of speciation are of order 1 million times slower than rates of extinction. Were speciation rates plotted as the y-axis on a graph 10 cm high, then on the same scale extinction rates would require an x-axis extending 100 km [62 miles]."

But not only biological diversity is being simplified. The homogenization is extending to languages and cultures as well. Recently I discussed language loss with Dr. Brent Berlin. At the time of conquest, he said, an estimated 1200 different languages were being spoken in the New World. Of the 800 from Central and South America, only 400 remain today—an extinction rate of 50%. Of the surviving 400 languages, 80% are spoken by less than a thousand people. The situation is even worse in Mexico and the remainder of North America. Here some of us work with communities of one to a dozen native speakers.

And with languages go cultures. This loss is something environmentalists have been slow to discover because of our traditional dichotomy between the "natural" and the human sciences. With the loss of each language is the loss of a unique ethnotaxonomic system and a unique value system, and all the folk science that depends on these. Stop for a minute to think of how many groups have had just their ethnotaxonomies recorded in a comprehensive fashion. Check your bookshelves. For the most part you will find a fragment of this and a fragment of that. Our ignorance of emic knowledge that has developed over millenia is bewildering.

The Declaration of Belem (see page v of previous issue) recognized that "there is an inextricable link between cultural and biological diversity." Because of this link there is an urgent need to preserve both.

Of course, this homogenization process includes the loss of ancient genetic strains of crops, locally modified land races, among native agricultural peoples. Take for instance the Pimans of southern Arizona where I work. Dr. Gary Nabhan tells me that seven prehistoric crop *species* have been lost from the River Pima. That's a loss of 50%. Elderly Gila Pima have given me the names and characteristics of seven native varieties of maize—all 60-day desert-adapted races. Of these, only one survives today. That's a loss of 86% from a major crop. Generic erosion is a frightening simplication of another aspect of world diversity. Today on a worldwide scale we are growing more and more of less and less.

What is being lost, in addition to biotic diversity and language diversity and cultural diversity and crop diversity, is the different ways humans have of looking at the biological world around them, a world that we all depend on. Being lost in this ongoing process are the different ways of classifying the flora and fauna and of communicating about it—ways of relating to and using the biotic world. Colonization by a few major powers has spread a technology that is pervasive and aggressive. It has also resulted in a few major languages becoming dominant. I suppose today if you spoke English and Spanish, and spoke as well as wrote Chinese, you could go almost anywhere in the world and communicate. The world views of Charles Darwin, Adam Smith, Karl Marx, and John Locke continue to be evangelized as the one and only true "progress."

Quite often, I think what we as ethnobiologists are attempting to do is to characterize and record alternate perceptions of the biotic (and indeed the whole external) world. These different perceptions encode different relationships of use or abuse of the flora and fauna. Some of these views might produce cultures far more sustainable in the long run than those currently touted by either capitalistic or communistic world views based on consumerism.

As I flew over the Pyramid of the Sun and the Moon on one of Mexico City's few clear days, I thought: If Cortez had arrived in this great Valley of Mexico to collect knowledge rather than gold, today's world might be more enriched. But still, in the 1980s our job is to collect the parts and pieces left of native knowledge about the biological world. They are precious parts and pieces.

—Amadeo M. Rea

ESPIRITUS INCORPORADOS: THE ROLES OF PLANTS AND ANIMALS IN THE AMAZONIAN MESTIZO FOLKLORE

MATTI KAMPPINEN
Institute of Folklore and Comparative Religion
University of Turku
SF-20500 Turku
Finland

ABSTRACT.—The Mestizo ethnomedicine of the Peruvian Amazon [consists of] a group of models which identify the symptoms of illnesses, provide the options of therapy and recategorize the natural environment. Models of witchcraft endow animals and plants with different roles from [those] they have in everyday life: plants and animals "are" embodied spirits controlled by means of power songs *(ikaros).* Spirited animals can function either as illness projectiles or even as their senders, whereas the mother spirits of the *ayahuasca* vine and other plants are the source of all medicinal knowledge.

INTRODUCTION

The client's perspective of the Mestizo health behaviour system in two Amazonian villages (San Rafael and Nuevo Progreso) recognizes various types of evil that can cause illness. Intentionally inflicted evil or witchcraft is the most variable of all illnesses. Witchcraft *(hechiceria, brujeria)* may be caused either by evil spirits *(mal de aire),* by animals and their spirits *(mal de agua, mal de monte)* or by men *(mal de gente),* the latter being the most dangerous of all illnesses, the [meanest] variety of witchcraft. Evil animals and evil spirits are subordinated to evil persons who may use them as weapons. Thus the dangerous cases of *mal de monte* and *mal de agua* are cases of *mal de gente.*

The roles of plants and animals from the viewpoint of the cognitive systems utilizing them have been studied only recently (Chiappe *et al.* 1985, Luna 1986), whereas the corresponding information from coastal and highland Peru has been available for a relatively long time (Valdizan & Maldonado 1922). In what follows I shall supply material for reconstructing the Amazonian client's perspective.

MAL DE AGUA

The evil inflicted by the animals and spirits of rivers and lakes and by the water itself is called *mal de agua.* The most common symptom is unbearable pain in the lower abdomen. *Mal de agua* affects mainly women who bathe during menstruation, but it may affect any person who happens to be close to water. There are no other symptoms: headache, fever, diarrhea and vomiting are absent. The responsible animals are the pink river dolphin *(bujeo colorado)* and the boa snake. They can smell when a menstruating woman is bathing and follow the smell tracks. They are very powerful animals: dolphins carry projectiles with them whereas boa snakes radiate heat which makes people sick. *Mal de agua* is treated by healers who use tobacco, power songs and suction to extract the evil. Here Juan Silbano relates a personal account, which suggests that the blood from a woman had activated the pink river dolphin:

> I have suffered *mal de agua.* Afterwards I have never canoed alone, since the river dolphin chases me. When I went to a healer for the first time, he said that there had been a woman bathing in the river and therefore the water had harmed me. I had terrible pains, I was about to go crazy. I went to a healer in Iquitos and he sang me a power song *(me ha cantado).* Still I feel pain now and then, when I'm near to water. It's right here in my stomach, not in another place. It sticks like a spine. The river dolphin has bewitched me. The healer blew tobacco smoke to cure me and he sucked my stomach. He searched and found where the pain was and he extracted the spines. When you are thus bewitched, you cannot eat fish which contains either bones or phlegm. *Boquichico* is the only fish without phlegm. (TKU 87/212)

The pink river dolphin is not utilized for alimentation since it is considered very powerful. The guardian spirit of aquatic animals is the *Yacumama,* or the mother of the river. It ''is'' (from the perspective of folklore) a large boa snake whose primary task is to punish excessive fishing (Regan 1983:89).

MAL DE MONTE

The evil may stem from the jungle *(monte)* instead of the river. *Mal de monte* is usually distinguished from *mal de agua. Mal de monte* includes snake bites, insect bites, skin infections, etc. These are cured by homemade plant remedies or by pills and injections. But there are more serious varieties of *mal de monte.* There are spirits in the jungle who can do serious harm. One is *shapshico,* or *chullachaqui,* which owns a garden in the jungle, and is very jealous about it. It is the guardian of plants and animals. The following account by Jose Huaniri suggests that *shapshico* is a spirit embodied in an animal. The apparent contradiction between being an animal and being invisible is solved since it is a case of *espiritu incorporado* which can have both these properties simultaneously:

> This *shapshico* has his garden in jungle. If you cut a tree in his garden, he hurts you. He is a little man living there, an animal, a little demon. *Shapshico* uses projectiles. Healer will extract the projectile *(virote)* and you calm down. You cannot see a *shapshico* or speak with it. (TKU 87/194)

However it is in *mal de gente* [that] plants and animals enact their most complicated roles.

MAL DE GENTE

Mal de agua and *mal de monte* are considered as witchcraft, but the most dangerous (and sometimes the only) variety of witchcraft is *mal de gente* (evil of people). Other evils are lesser ones and turn really serious only when evil persons are involved. Evil people may inflict harm by means of evil spirits embodied in plants and animals, and thus the other varieties of witchcraft are subordinated to them. *Mal de gente* has several names: *mala gente, brujeria, hechiceria* and *embrujamiento.* In the following, the term witchcraft will be used.

The main symptom is sudden, unbearable pain, but any illness may be due to witchcraft. The pain may be located in the stomach, lungs, chest, head, foot, throat or back. Persistent fever, infected wound, skin irritation, or any illness whatever that is difficult to cure may be due to witchcraft. Also accidents, family or neighbour problems and economic setbacks are sometimes seen as signs of witchcraft, especially when they co-occur with some persistent illness. The origin of witchcraft is interpersonal envy. The mechanism of witchcraft was explained to me by Hipolyto Lachuma as follows:

> For example, *gringo*, we are here, and you have some good like plantain, manioc, meat or fish. Then comes a man, a witch, who asked you to sell or donate a kilo of fish, but you don't sell because you need it yourself. The man gets furious and returns to his place to make witchcraft. He may harm you by snake bite, or by animals that fly. When you go to your garden you may encounter a snake and you are frightened, you get fever and you have been done harm, this is witchcraft. The snake bite leaves a little wound, and you may think that it will heal easily. But no, it will enlarge, and you feel like the wound is eating you little by little. You can't sleep, you are not tranquil since you feel like you are being eaten. Then you go to healer who knows more. He takes your pulse and says that you have been harmed, since you didn't want to donate fish and because of this vengeance you have been harmed. It affects very quickly. Within two days you may be dead, since the pain gets more intense and fever gets higher. The symptom is pain, in any part of your body, pain you cannot resist. It hurts a lot, as if a hot iron was stuck into you. And you have to look for a healer. If he knows he will cure you. He extracts the evil, for example the evil of *chullachaqui*. (TKU 87/202)

Hipolyto's account suggests that a "normal" harm caused by an animal (e.g., a snake bite) is recategorized as a "serious" case of witchcraft when the pain turns out to be persistent.

WORMS, BEETLES AND OTHER *MICROBIOS*

The cause of persistent pain is a *projectile* shot by someone. The theme of an arrow-like shot (e.g., fairy shot) has been rather prevalent in various world traditions (cf. Honko 1967). Small animals like beetles and worms have functioned in causes of illness. The Mestizo model of witchcraft attributes illnesses to spirits and projectiles, and ascribes various versatile properties to them, which allows them to fulfil multiple causal roles: they are able to enter human bodies and intervene with normal bodily functions, yet they are invisible to an untrained eye and are seen only by specialists who control them by power songs *(ikaros)*. A number of things can function as projectiles: fish bones, wooden sticks, animal and plant spines, insects (especially worms and beetles), very [small] animals *(microbios)*, and various kinds of phlegm (from trees, human innards or from water). *Microbio* seems to be a collective terms for [small] animals, ranging from visible beetles and worms to invisible "microbes." They eat the victim and if they are not extracted, the victim is bound to die. Different *microbios* have different effects. A beetle that is shot into the victim's head causes madness. Here's Juan Silbano's story:

> I was once bewitched because of one girl I was in love with when I was 18 years old. I was like crazy. I was in pain, I didn't recognize my mother or

> anyone. I went round and round like a madman. My father said to me that let's go, since he didn't know what it was. We went to Iquitos. I don't remember since I was so desperate *(estaba en desperacion)* but my father told me later. Anyway, the healer came to see me. He said that I had been bewitched because the girl I was in love with had a husband and there was vengeance. It took six or seven days to cure me, that I could stand up again. The cost was 250 *intis*. He extracted spines from my mind *(sentido)*. He sucked my head with force and I felt as if he ate me. He extracted beetles *(papasitos, papasos)* from my head. With them the husband had wanted to kill me. If I had died, the girl would have returned to her husband without further ado. Witchcraft hurts, hurts, hurts, hurts. I was like a madman, ran through the jungle and didn't know where to go. The little animals in my mind ate me, they itched. The healer extracted beetles from here [forehead], here [sides of head] and here [back of the head]. (TKU 87/212)

A worm or any other *microbio* that is shot into the victim's muscle eats the victim alive. I witnessed the treatment of such a case. Before the treatment it was described by Don Pablo as follows:

> All animals can be used to do harm; insects, *microbios*. The witch studies all of them, for example various worms in order to kill us. I have cured many cases and I know all the animals. Especially they use *microbios*. If we didn't study these, we would die. Witches use, assisted by demons, also other things like trees or spines of different animals. And also the vomit of dogs. Dogs, you know, eat grass because it's a *purga* and then vomit it. Witches study this vomited grass in order to kill with it. They put it in our throats so we cannot eat. I once extracted grass from a person's throat. [...] I have one patient whose leg is about to rot. He was in hospital for two months but it just got worse. There are worms *(gusanos)* in his leg which eat him. It's witchcraft, done by means of worms which were placed there to eat the person until he dies. The witches bewitch us by means of worms. I will cure this patient when I go to Iquitos. I'll extract the worm by sucking. Worm has its power song, and if you don't know it, it may kill you. All the witchcraft has its power song. The witches utilize all kinds of *microbios* to harm us. They study all the *microbios* to kill us. (TKU 87/215)
>
> I found out that it was witchcraft. In fact, there were four *microbios* there. I have extracted already one, and tonight I will extract the rest three. Then I can prescribe some plant remedies for the wound, since only after the evil has been extracted, it makes sense to treat the wound, for then the *microbios* aren't there anymore eating the flesh. Then I will find out what plant remedy to use, how to prepare it and so on. The *microbios* have to be extracted by night, for the tobacco *(mapachu)* will be the strongest then. (TKU 87/218)

Recently the *microbios* have become more prevalent, I was told. Earlier the main cause of witchcraft was a kind of head-on collision with a powerful witch, whereas nowadays the main cause is either a demon or a *microbio*. According to Don Pablo, their presence/absence is relative to the amount of rainfall:

> The soil contains lots of *microbios* during the wintertime. They enter us and cause ulcers and cancers and all that. They come from the soil. Now it's summer and there are hardly any *microbios,* for the soil is dry. (TKU 87/215)

In order to do harm by means of an animal, the witch has to know the power song *(ikaro)* of the animal in question, and the power song is also needed in extracting the projectile. Curing power songs are received from plants, evil songs are from demons.

SECOND-LEVEL ETHNOBIOLOGY: *CIENCIAS VEGETALES*

The metaphor of *ikaro* ascribes a power song to each causally interactive entity, especially to humans, their illnesses, spirits, projectiles, trees, animals and plant remedies. Also houses and paths can be protected from evil by power songs. Power songs form the basis for causing and treating illnesses. By learning these songs the healer *(curandero* or *medico)* learns to cure illnesses, and the witch *(brujo)* learns to do harm. The knowledge obtained by the healer is more powerful than the knowledge of the witch, since it takes more time to learn the art of healing. Power songs are described by Julio Siri, a young healer, as follows:

> All power songs are dialects. They are songs, but in different ways. There are many different power songs. [How do they work?] The *medico* sings the power song of the evil which he tries to cure. He takes his *purga* and begins to sing. The *medico* has power songs for different evils. Every illness has its power song. If it's an illness of witchcraft, the power songs change totally: our knowledge of them is on the spiritual level of plant sciences *(ciencias vegetales).* There are lots of power songs and the type of power song you use depends on the illness you are going to treat. [When the plants are used in curing, do they also have their power songs?] Yes, all plants and trees have their spirits. When you treat with a plant, you concentrate and call its power song. With the authorization you have, you treat the patient. In order to cure with plants, you have to know their power songs. You can cure without knowing the power songs, but then you are not a *medico.* You have to talk with the plant, since the plant is a living thing, it has a spirit. The plant dies when it's chopped down. You have to talk to it. You ask: "Listen, grandfather *(abuelito),* I have this illness and want you to cure me." There are strong illnesses which you don't resist and which require that you know the science of trees *(ciencia de los palos).* You don't treat illnesses alone. If you have an illness which you cannot cure, you have to take a diet and cure it together with the plant. When you prepare a cure for the first time, you have to ask all plants for help, but if you know the plants very well, you can just talk to them. (TKU 87/208)

The knowledge encapsulated in power songs is available to humans through healers and witches. Healers and witches tap the same sources of information, but with different goals, as explained by Don Pablo. The purga used by him was the *ayahuasca* vine *(Banisteriopsis caapi),* by far the most widely used hallucinogenic plant in Amazonian shamanism:

> The *brujos* study power songs in order to do harm. The *medicos* learn different power songs than the *brujos*. But the *medico* has to know the power song of the evil done, otherwise he cannot extract it or cure. In order to learn these power songs of evil, you take the *purga;* the mother spirit *(madre)* of *ayahuasca* appears and says, "Listen, this is the power song of the evil which is done." The *brujos* have to know the power song of the worm in order to do harm with it and the *medico* has to know the power song of the worm in order to cure the illness caused by the worm. [Are the power songs of *brujos* and *medicos* equal?] Well, the *medico's* power songs are for medicine, and the *brujo's* power songs are for demons. The *brujos* have power songs of the demons, which means that they study the demons, they don't study God. *Medico vegetalisto* studies for God. Thus in order to be a good *medico,* you have to study well, all the *brujos* of jungle, of people, of animals, and of water. Thus you can cure. If you don't study all this, you won't cure. The *medico* has to know the power songs of *brujos* which are quite similar except that they are from demons. Witchcraft is a plant demon *(demonio vegetal);* the demon tells the *brujo* to take this-and-this to kill somebody. And the demon teaches the *brujo* the power song needed. (TKU 87/215)

Here Don Pablo characterizes witchcraft as a plant demon, which suggests that the ultimate source of knowledge (for both curing and inflicting illnesses) is in the "realm of plants." Indeed, Julio Siri had a special word to pick out this slice of realty, *espacio vegetal,* or plant space. In general the spirits of nature are neither good nor evil per se, but may be used for both purposes by humans. Here Julio Siri sketches the plant space:

> There are white and black spirits. The white one is good. I don't know it very well, since I am an apprentice, I am learning more all the time. This white spirit speaks spiritually with you, saying for example that this patient has this-and-this and should be treated with such-and-such power song, and with such-and-such plants. It's not a spirit of the dead, but of the plant space *(espacio vegetal).* It's the spirit of the plants, of the medicinal trees. Here in the jungle, there are trees which are *curanderos,* and trees which are *brujos,* which kill us. Speaking on the level of science *(hablamos en el nivel de la ciencia),* all trees are full of spirits, and you cannot take whatever *purga* you like, since there are too many spirits. A *maestro curandero* knows how to protect himself from evil spirits and how to let the good spirits teach him. [...] All spirits are good, if you know how to treat them, how to work with them. If you don't know, they are all evil to you. Just as there are good people and evil people, so you can treat evil spirits. (TKU 97/208)

What we have here is a reflective second-level model concerning the first-level model of herbal medication and illness extraction. The model of spirits and power songs gives an epistemic ground or justification for particular treatments just as the model of projectiles justifies the use of suction in extracting the illnesses.

THE MULTIPLE USES OF *ERYTHROXYLUM CATUABA*

The use of the bark of the tree *Erythroxylum catuaba,* known in Amazon as *chuchuhuasi,* is another clear example of the plant transformation induced by an *espiritu* *incorporado.* Almost every house in San Rafael and Nuevo Progreso has a bottle hanging on the wall which contains bark of *chuchuhuasi* "marinated" in *aguardiente,* strong alcohol distilled from sugar cane. I inquired about its use and I was told that it is good for rheumatism and pain (cf. also *Manual).* Later on, I found out that it would be extremely unwise to drink cold drinks when suffering from rheumatism, since rheumatism results from the overheating of blood which, in turn, results from an excessive exposure to cold. *Chuchuhuasi* is also used in the prevention of bleeding after child-birth: it is mixed either with boiled water or *aguardiente.*

In addition to its "common sense use," it was tapped as the source of spiritual knowledge. In the village of Indiana I spent some time with a healer named Brahulio Tuanama who used *chuchuhuasi* with *aguardiente* to treat all sorts of illnesses. He called the drink *chullachaqui*. The word stems from Quechua and it means "unequal feet." The guardian spirits of the jungle are thought to have unequal feet when embodied in human form (Huaman 1985:345 ff.) Brahulio told me that he "consulted" *chullachaqui* by means of taking little sips of his drink regularly.

> *Chullachaqui* is drunk in order to learn to cure, to be a *medico.* You [addresses me] can learn to cure. You take this to your country and you cure little children. [...] Evil animals are *brujo's* spines. You drink this and they disappear. (TKU 87/140)

Brahulio could have provided an explanation of why *chuchuhuasi* is effective for rheumatic pain, for the model of spirits embodied in the drink would presumably give a fine-grained account of the mechanisms of pain. But he had consulted his alcohol-based source of knowledge quite frequently, lately.

CONCLUSION

The plants and animals interacting with the Amazonian Mestizos seem to have both "down-to-earth" and "theoretical" aspects. The former are utilized when witchcraft is not suspected, whereas the latter aspects, i.e. spirited animals and plants, are referred to when an illness is diagnosed as a case of witchcraft. The aspect actualized depends on the level of model used in the interaction. The boundaries amid adjacent models are not so sharp and a switch from one model to another can take place in the course of one consultation.

ACKNOWLEDGEMENTS

This study has been supported by the Academy of Finland and the Finish Cultural Foundation. I wish to thank Billie Jean Isbell (Cornell University) for her comments.

LITERATURE CITED

CHIAPPE, M., M. LEMLIJ and L. MILLONES. 1985. Alucinogenos y Shamanismo en el Peru Contemporaneo. El Virrey, Lima.

HONKO, L. 1967. Krankheitsprojektile: Untersuchung uber eine Urtumliche Krankheitserklarung. Folklore Fellows Communications No. 178. Helsinki.

HUAMAN, C. 1985. Los Misterios de la Selva: Mitos, Cuentos, Leyendas y Narraciones folkloricas de la Amazonia. Tipo-Offset, Lima.

LUNA, L. 1986. Vegetalismo: Shamanism among the Mestizo Population of the Peruvian Amazon. Almqvist & Wicksell, Stockholm.

LITERATURE CITED (continued)

Manual para Promotores en Salud. 5th edition. 1986. CETA, Iquitos.

REGAN, J. 1983. Hacia la Tierra sin Mal: Estudio de la Religion del Pueblo en la Amazonia I-II. CETA, Iquitos.

TKU 87/XXX. Tradition Archives at the Institute of Folklore and Comparative Religion, University of Turku, Finland.

VALDIZAN, H. and A. MALDONADO. 1922. La Medicina Popular Peruana: Contribucion al Folklore Medico el Peru I-III. Imprenta Torres Aguirre, Lima.

BOOK REVIEW

The Fascinating World of the Nightshades. Charles B. Heiser, Jr. New York: Dover, 1987. Pp. ix, 200. $5.95 (paper).

The "nightshade family" (Solanaceae) has few rivals in the plant kingdom for sheer number and diversity of genera and species used by human beings—as foods, medicines, poisons, drugs, and ornamentals. One could not hope to survey the family systematically in a slim volume, nor is that Heiser's intention. Rather, the book is a selective celebration of the "nightshades," an unabridged and corrected republication of his earlier popular work, *Nightshades: The Paradoxical Plants* (San Francisco: W.H. Freeman, 1969). In a new preface, Heiser notes changes in scientific names of the plants discussed and refers to the published proceedings of two major Solanaceae conferences held since his book was originally published. Otherwise, however, there has been no attempt to expand or update the earlier text. For his purposes, this seems unproblematic.

Following a brief prologue that sketches the principal characteristics of the family, nine chapters focus on New World "peppers" ***(Capsicum*** spp.); the potato; eggplant; tomato; black nightshade or "wonderberry" ***(Solanum nigrum)***; a variety of lesser food plants; several containing powerful alkaloids, such as mandrake, jimson weed, henbane, and deadly nightshade; tobacco; and flower garden ornamentals. In each case, superb line drawings by Marilyn Miller (and sometimes photographs as well) complement the text. While treatment of the botany of the plants varies in detail from chapter to chapter, each is accompanied by selected references to refer the reader to the more technical literature.

For each plant discussed, we are given information on its homeland and traditional uses; the plant's "discovery" by Westerners; economic and other factors involved in its adoption and diffusion; folk beliefs, especially in Western communities; cultivation techniques; and general botanical description. Throughout, the emphasis is on the "story" of the plant, and the stories told are, indeed, fascinating. The general reader is well-served by this accurate compendium and the professional will find much of interest, too. The very attractive price should make it a potentially useful supplementary text in undergraduate courses on Economic Botany.

Terence E. Hays
Department of Anthropology and Geography
Rhode Island College
Providence, RI 02908

J. Ethnobiol. 8(2):149-169 Winter 1988

THE ROLE OF MEDICAL ETHNOBOTANY IN ETHNOMEDICINE: A NEW GUINEA EXAMPLE

BORUT TELBAN[1]
Department of Anthropology
Research School of Pacific Studies
Australian National University

ABSTRACT.—Medicinal plants are known all over the world. They are indispensable as ingredients of many important modern drugs and are sources for the imitation of natural molecular structures by synthesizing even more powerful analogues in laboratories. Of the 300 million prescriptions written during 1963 in the United States, 47% contained a drug of natural origin and the yearly world market for medicinal plants has been established at $300,000,000 (Logan 1978:181). Some people maintain that medicinal plants are efficacious; others are skeptical of the plants' curative powers. Despite this it has been estimated that from 25 to 50 percent of the non-Western pharmacopoeia are empirically effective (Hughes 1978:154).

In the present paper I am mostly concerned with the Meiwa tribe of the Northern Melpa people, and Sau Enga, Kombolo, and some Hagahai groups (Pinai, Mamusi and Luyaluya).[2] The area where these people live lies at the border of three provinces: Western Highlands, Madang, and Enga in the Highlands of Papua New Guinea. During my field research I was able to observe different healing practices in this remote area. Extensive bibliographies on traditional healing in Papua New Guinea not discussed in my paper are those by Hill (1985) on medicinal plants and Jilek (1985) on ethnomedicine.

THE HISTORY OF MEDICAL ETHNOBOTANY IN THE SOUTH PACIFIC

Some say that pre-literate tribal societies would hardly have continued to use drugs for centuries if they possessed no curative properties, a faith, as Evans-Pritchard says, which is unhappily contradicted by the history of European medicine and by the history of magic everywhere (1972:494). On the basis of my experience in the upper Yuat area of Papua New Guinea, I question whether these traditional tribal people have used medicinal plants through the centuries. If we compare three neighboring groups of people: the Northern Melpa, who have extensive contacts with other groups and the outside world, the Pinai with fewer such contacts, and the Kombolo and those Hagahai groups who are virtually without them, knowledge about medicinal plants is found to decrease in the same order.

People tend to be curious about any kind of knowledge if it is closely connected with their own way of life, and if they discover an interesting plant that does not grow in their home area, they will take it home. We often carried seeds, or even whole plants attached to my backpack, from one hamlet to another and from one group to another, and transplanted them. This applied equally to plants of decorative, food, and medical value. It is obvious that people with more contacts with other groups and the outside world will have developed a richer repertoire of herbal medicine and related knowledge through their wider experiences. According to Romanucci-Ross:

> Folk culture is . . . a more open system of beliefs and behaviors than societies we call primitive, which are characterized by transmission of beliefs and behaviors in a closed system lacking the opportunities found in a situation of culture contact (1982:5).

For the Melpa living in Hagahai (Pinai) territory, the leap from primitive to folk medicine, which occured after contact with other groups (especially Enga), resulted in an extension of medical beliefs and practices, and also had a significant outcome for their knowledge of medicinal plants.

If one asks people about the history of their medicinal plants they will say that they inherited their knowledge from their ancestors and that they have used plants as medicine for centuries. How is it then, that the majority of the Hagahai and Kombolo people, who were considered 'lost tribes' until 1983, know so little about ***marasin bilong bus*** (Pidgin term for bush medicine) (see also the scanty reports on medicinal plants by Miklouho-Maclay 1886). If we survey healing practices in other parts of the South Pacific, we find parallels in the history of the development of use of medicinal plants. Rivers (1927:65) wrote that the medical art of Indonesia presents more variety than that of Melanesia or Polynesia. He attributed this to the influences to which Indonesia has been historically exposed (Hindu and Chinese in particular). Rivers argued that Polynesian medicine (in the sense of plants) could hardly be said to exist, and that little use was made of herbs or other internal remedies. Even where definite therapeutic remedies were employed in Polynesia, including New Zealand, these were of recent introduction (Rivers 1927:63,64). He stressed that herbal medicine was much more elaborate in Melanesia than in Polynesia (Rivers 1927:93). When Rivers wrote his book nothing was known about the New Guinea Highlands. The area was thought to be uninhabited. In Samoa, for example, where medicinal knowledge had evolved to a state where an expanded range of causal agencies was acknowledged, Macpherson found:

> . . . [a] greatly increased range of plants and plant compounds used in the management of illness. Contemporary Samoan medical practice depends heavily on a wide range of indigenous and exotic plant species. This appears to be a post contact development, a conclusion supported by examination of the record of Samoan plant usages over time. An analysis of early editions of Pratt's much-praised dictionary yields very few plant usages connected with medicine despite a large number of non-medicinal plant usages (1985:14).

If we look at what Stair noted in 1897, we can see that there were few Samoan remedies, and these did not include many medicinal plants or herbs of much value (MacPherson 1985:8). Early missionary accounts make little mention of the use of plant medicines in Futuna, while today they play an important role in traditional healing (Biggs 1985:121). In Nanumea, Tuvalu, herbal medicines are a recent introduction and Kennedy reported during his research in the mid 1920s (Chambers 1985:34) that traditional therapies using plants were not known before import from Fiji (for Fijian medicinal plants see Cambie 1986). After quoting Martin (1817) who reported that in Tonga few medicinal plants were used around 1800, and that the first plant infusions were taken from the people of Fiji, Weiner (1971:424) asks himself:

> Why is there no record present or past of the employment of hallucinogenic or narcotic plants by the Tongan in his medical or religious rites? Has there been less need for these agents than in many areas of South America and Asia? Have these Pacific islanders been less inquisitive about their flora?

We can ask these very same questions of the medical knowledge of the New Guinea Highlands. While among the Northern Melpa, herbal medicine has reached that stage where plants play a role in everyday treatment (but not much more), medical ethnobotany among the Hagahai and Kombolo is still in an initial process of development, and shows no historical presence. In the upper Yuat area of the Hagahai and Kombolo, we witness the phenomenon of a dual system: knowledge about medical ethnobotany is appearing and disappearing at the same time. But when considering the value of plant collection I agree with Parsons (1985:213):

> . . . whatever the truth about the history and the extent of herbal remedies being used they do exist today. Indeed, the interest in locating and documenting such plants is increasing.

RESEARCHERS AND MEDICINAL PLANTS IN THE NEW GUINEA HIGHLANDS

It is interesting that medical anthropologists such as Glick (1963, 1967) and Lewis (1975, 1979, 1986), who have worked for long periods in Papua New Guinea, became very skeptical about the extent of use and efficaciousness of medicinal plants. Johannes (1976) says that very few medicinal plants are known to Nekematigi non-curers in the Eastern Highlands Province, though curers know a great variety of them. Johannes (1975, 1976) is one of the few anthropologists who insists: 'that the clinical attributes of specific plants are important factors in the healing equation in New Guinea and presumably elsewhere' (Brown 1987:6). Welsch (1982a:76, 94) tells us that only nettles and a few other substances in the traditional Ningerum repertoire are likely to have specifically positive effects. Short-term researchers (ethnobotanists usually) without knowledge of local people's medical beliefs and magico-religious worldview, came back full of enthusiasm, with collections of plants that people had told them about. On the basis of such reports, an untrained observer can easily be mislead concerning the number of effective drugs in use in the Papua New Guinea Highlands. Our duty is to place medicinal plants in the context of people's cultural (medical) worldview, to examine their professional and non-professional use, and to recognize any other medical practices which occur. The medical plants I have documented (Table 1) must be considered as part of the whole body of beliefs and practices. Once we understand that most serious illnesses are attributed to spirits, sorcery, or the breaking of taboos, and are thus principally socio-psychological in nature, then we also understand why divination and counter-magic are considered as appropriate treatments. The Northern Melpa, Sau Enga, Hagahai, and Kombolo do not have a social category for herbalists, witch-doctors, or shamans. Their traditional healers are ritual specialists who know spells for exorcizing malevolent forces. Plants used in such performances have no direct pharmacological effect (but are part of psychosomatically effective ritual); and even if they did have some active compounds, these would hardly be absorbed through the skin into the body when used externally. I call them healing plants in contrast to plants that cure.[3] A professionalized, indigenous medical system, using medicinal (curing) plants, simply does not exist. That is why it is comparatively easy to collect basic data about plants that cure, but more difficult to record plants used in counter-magic. Curing plants could be classed in the 'Popular sector of Health Care' as defined by Kleinman:

> It can be thought of as a matrix containing several levels: individuals, family, social network, and community beliefs and activities. It is the lay, non-professional, non-specialist, popular culture arena (1980:50).

Evans-Pritchard (1972:482) says that an individual Zande will not know more than three hundred plants used for medical purposes. Frake (1961:131) tells us that among the Subanum of Mindanao, responses to illness depend on the selection of botanically-derived remedies from 724 recorded plants. From a close review of the medical, anthropological, and botanical literature, and judging by my own experience, it appears that Highlanders in general are poor herbalists. The small number of plants employed medicinally could be explained partly by their perception of the cosmos, including medical beliefs, and their lack of anatomical and physiological knowledge.

One could say that quality is much more important than quantity and that it is better to have a small number of highly effective drugs than a large number of ineffective ones. Let us note first how Evans-Pritchard doubts the effectiveness of plants used by the Azande:

> The enormous number of drugs which Azande employ and the variety of herbal products they bring to bear on a single disease at once demonstrate their lack of therapeutic value when we reflect what scientific pharmacology really implies (1972:494).

I found, however, that medicinal plants among the Northern Melpa at least deserve the term, and serve people in everyday life, particularly in the event of external injury. These medicines cannot compete with Western medicines and usually do not show any potency in the modern pharmaceutical sense. In cases of serious illness, a person usually receives no relief (if he does not employ a ritual specialist, or does not go to an aid post or hospital) and waits for the self-limiting system of the organism to win or lose. But with the combination of traditional and Western knowledge individuals can enjoy a reasonably good state of health.

Readers of reports often complain about poorly recorded information on the preparation and dosage of medicines (Croom 1983:15, 21); but for the whole area around the Yuat and Lai rivers, there are no real recipes or prescriptions for self-treatment by individuals. They never prepare complicated mixtures or extractions; nor do they make tinctures, solutions, suspensions or emulsions; they do not prepare teas or infusions either (Panoff 1970:76 for Maenge). They never cook mixed herbs to prepare a special medicine. They merely chew leaves and spit them (or heat and squeeze them) on the injured area, or they simply eat them. Knowledge about medicinal plants is poor and no individual could really be called a specialist. Everyone knows how to use stinging nettles and ginger and perhaps a further five to ten more useful medicinal plants. In his discussion of Gimi plant use in the Eastern Highlands Glick (1963:153; 1967:44-5) states that 'most plants are used simply because they are there, and we will not go far trying to explain their use by noting their qualities or peculiarities.' Furthermore, I sometimes heard the same name given for different species and I had to ask several people before I could collect the correct one (Weiner 1971:426 for Tonga). It was often the case that those who went collecting with me in the bush knew the particular plant only from descriptions given to them the previous day by somebody else. An informant, in a single sentence, will state how and why a plant is used. A curious observer will ask to be shown the whole process, and during his stay with the people he will often attend curing sessions. But throughout these performances he will learn little more. It is unusual for the size of the dose to be mentioned, but doses do vary from time to time, according to the age of the patient, the stages of illness, as a result of individual differences between practitioners, and because today is different from yesterday.

People will often tell a researcher about plants used for treatments which, in reality, they do not use. In fact, he will be surprised to find that people do not use plants once they are injured, however enthusiastic they might have seemed about the power of plants just a couple of days before. When I arrived in the field and asked people if they used plants as medicine, the answer was: 'A lot, even more than a lot.' The picture changed towards the end of my fieldwork and I came to agree with Lewis, who said that among the Gnau only nettle leaves are commonly used in serious illness, and that they use no specific herbs in the sense of plants whose medicinal use depends on the clinical signs observed (Lewis 1975:144). Murdock (1980:6-7) argued that infectious diseases in isolated small-scale societies could spread only with difficulty and tended therefore to be localized in particular areas. He went on to say that human beings develop a relative immunity through a process of natural selection, while the disease micro-organisms undergo an opposite evolutionary development; the more lethal strains kill their carriers and thus tend to be eliminated. This dual process would help to explain why medicine men in pre-literate societies have more often been specialists in magical therapy than herbalists or bone setters. On the other hand, once we accept that curing plants are part of lay treatment, we can see that people use them as medicine from time to time, after the physical aspects of illness are recognized. Unfortunately for ethnopharmacologists searching for new powerful drugs, however, in the majority of cases these are lesser maladies. From my own observation, and my own use, I can say that these medicinal plants are not very effective, or are not even consistently used by people. Such is the case, for example, with ***Kui bono*** (Melpa) *(Buchnera tomentosa)* which was claimed to be used as a contraceptive; but when at the end of my stay I repeatedly asked about it, people (especially women) admitted that it does not really work.[4] Likewise, external injuries, if they do not fester (and many times even if they do), will usually remain untreated. The only powerful plant is stinging nettle which is somewhat surprising for a region with a rich flora. I must agree once again with Lewis, when he states:

> If we look at treatment in tribal societies, hoping to learn from it, it is in their skill at meeting expectations and at providing social and psychological support and care during illness that the primary interest lies, I think, rather than in the possibility that we may find useful healing plants or drugs that we do not know (1979:237).

PLANTS THAT CURE

Among the most popular curing plants are those which are used in everyday life (these are not mentioned in Table 1). Sore and cuts are covered with the oily juice of *Pandanus,* smeared with latex of breadfruit. People moisten tobacco leaves with saliva, or heat them over the fire and press them on lesions. Quite often, after chewing *Areca* nut, they spit the red juice over the sores. People give little attention to this treatment, it does not require continuity of practice, and it is simply part of everyday life. Sores and cuts usually fester, before or after the treatment. Leaves of ***tanget*** (Pidgin) *(Cordyline* sp.) or banana are stuck into the lower part of bark belts to reduce the pain caused by scabies. When abscesses are in the ripening stage and at their most painful, people use fresh leaves of tobacco *(Nicotiana tabacum),* leaves of ***daka*** (Pidgin) *(Piper betle)* and sweet potato *(Ipomoea batatas),* and leaves for rolling up cigarettes *(Acalypha insulana).* These leaves are heated over the fire, moistened with saliva and stuck over the abscess. The reason for this is to accelerate ripening. The common green vegetable ***aibika*** (Pidgin) *(Hibiscus manihot)* is eaten for general

TABLE 1.—Plants Used in the Treatment of Illness Collected between August 1986 and March 1987 in the Territory of Lai and Yaut Rivers, Papua New Guinea.

Ser. No.	Coll. No.	Plant name	Family	Native name	Part used	Application
1	65	*Acalypha insulana* Muell. & Arg.	Euphorbiaceae	*tsedeway* (*tecuwa*) P	leaves	sores, wounds
2	33	*Acorus calamus* L.	Araceae	*manana* or *kopan* P	leaves	serious illness
3	53	*Alphitonia ferruginea* Merr. & Perry	Rhamnaceae	*pokta M poger* E	bark, leaves	counter magic, toothache
4	85	*Alsomitra macrocarpa* (Bl.) M. Roem.	Cucurbitaceae	*damdam* M	fruit	poison
5	42	*Alstonia scholaris* (L.) R.Br.	Apocynaceae	*(k)oguli* P	sap	sores, wounds
6	74	*Amomum aculeatum* Roxb.	Zingiberaceae	*pu* P	pith	in mixture for hair oil
7	76	*Amorphophallus campanulatus* (Roxb.) Bl. ex Decne	Araceae	*gongon* M	whole plant	poison
8	47	*Angiopteris* sp.	Angiopteridaceae	*pombukma* M	leaves	counter magic
9	28	*Anisomeles malabarica* (L.) R.Br.	Labiateae	*kond* M	leaves, whole plant	earache
10	2	*Ardisia* cf. *subanceps* Laut. & K. Schum.	Myrsinaceae	*kupang* M	whole plant	hunting (protective) magic
11	81	*Arenga microcarpa* Becc.	Palmae	*tim* M	pith	cough
12	88	*Asplenium nidus* L.	Aspleniaceae	*l'gou* M	leaves	contraceptive (pigs)
13	69	*Baccaurea papuana* F.M. Bail.	Euphorbiaceae	*aka* P	fruits	stomachache
14	60	*Bambusa macrolemma* Holttum	Gramineae	*hotu* P	leaves, pith	diarrhoea
15	78	*Begonia serratipetala* Irmscher	Begoniaceae	*kurtnuninga* M	leaves	for pigs to get pregnant
16	12	*Bixa orellana* L.	Bixaceae	*kelye* M	fruits	docoration
17	106	*Blumea riparia* (Bl.) DC.	Compositae	*mungulya* M	leaves, stem	toothache
18	97	*Breynia cernua* M.A.	Euphorbiaceae	*poimbek* M	leaves	counter magic
19	95	*Buchnera tomentosa* Bl.	Scrophulariaceae	*kui bono* M	whole plant	contraceptive

TABLE 1.—Plants Used in the Treatment of Illness Collected between August 1986 and March 1987 in the Territory of Lai and Yuat Rivers, Papua New Guinea. (continued)

Ser. No.	Coll. No.	Plant name	Family	Native name	Part used	Application
20	39	*Calamus vestitus* Becc.	Palmae	*balsa* P *p(u)ruk* M	liquid	eye inflammation
21	57	*Calanthe arfakana* J.J. Sm.	Orchidaceae	*gambelkamp* M	leaves, fruits	hair growing (dogs), scabies, sores
22	8	*Caryota rumphiana* Mart.	Palmae	*kupanga* M *kauriya* E	pith	cough
23	103	*Castanopsis acuminatissima* (Bl.) A.DC.	Fagaceae	*kuan* M	rotten trunk	burns
24	80	*Chloranthus officinalis* Bl. Syn. *Chloranthus erectus* (Buch-Ham.) Verdc.	Chloranthaceae	*arapandana* M	whole plant	eye inflammation
25	9	*Cinnamomum frodinii* Kosterm.	Lauraceae	*kunyakunya* M *sini* P	bark	boils, head pain, mosquitos
26	30	*Cissus aristata* Bl.	Vitaceae	*yara* E	liquid from the stem	eye inflammation
27	25	*Clematis clemensiae* Hj. Eichler	Ranunculaceae	*alga* M *maruka* E *nadat* P	stem	cough, head pain
28	62	*Colocasia esculenta* (L.) Schott	Araceae	*barka* P *me* M taro *nabu* P	leaves	wounds
29	54	*Cordyline terminalis* (L.) Kunth	Liliaceae	*kumin* M *usa* P *tanget* (Pidgin)	leaves	hair growing & bilas (decoration)
30	34	*Cryptocarya idenburgensis* C.K. Allen	Lauraceae	*kaima* P	fruits	wounds, sores
31	3	*Cryptocarya weinlandii* K. Schum.	Lauraceae	*palima* M	bark	head pain, mosquitos, boils
32	75	*Cyathea* sp.	Cyatheaceae	*lokokos* P	leaves	cough
33	82	*Datura arborea* (L.) Steud.	Solanaceae	*spak* (Pidgin)	leaves, flowers	mosquitos
34	24	*Dawsonia gigantea* C. Muell. ex Schl.	Musci	*ue* E	called in spell	contraceptive magic
35	31	*Decussocarpus wallichianus* (Presl.) De Laub.	Podocarpaceae	*butuk* P	sap	wounds, sores, bilas
36	58	*Derris koolgibberah* Bailey	Leguminosae	*omakan* M *akra* P	root	fish poison

TABLE 1.—Plants Used in the Treatment of Illness Collected between August 1986 and March 1987 in the Territory of Lai and Yuat Rivers, Papua New Guinea. (continued)

Ser. No.	Coll. No.	Plant name	Family	Native name	Part used	Application
37	27	*Digitaria bicornis* (Lamk.) R.&S.	Gramineae	*dondanbil* M	called in spell	asking ghosts who brought illness
38	68	*Elaeocarpus sphaericus* (Gartn.) K. Schum.	Elaeocarpaceae	*silaga* P	leaves	wounds, sores
39	83	*Elatostema beccarii* Schroter	Urticaceae	*kengana* M	leaves	counter magic
40	23	*Emilia prenanthoidea* DC.	Compositae	*naka* E	leaves	wounds, sores
41	104	*Emilia sonchifolia* (L.) DC.	Compositae	*kint koyma* M	leaves	leprosy
42	10	*Euodia hortensis* J.R. & G. Forster	Rutaceae	*lingit* M *timbili* E	leaves	worms, stomachaches
43	49	*Euodia latifolia* Bl.	Rutaceae	*kilt* M *alink* E	leaves	eye inflammation, to stop menstruation
44	51	*Euphorbia plumerioides* Teysm.	Euphorbiaceae	*temp* M	sap, latex	toothache, sores, boils
45	13	*Eurya tigang* Laut. & K. Schum.	Theaceae	*kelyua* M	leaves	leprosy
46	59	*Ficus adenosperma* Miq.	Moraceae	*bandji* M	leaves	counter magic
47	5	*Ficus botryocarpa* Miq. var. *subalbidoramea* (Elm.) Corner	Moraceae	*kindap* M	sap, latex	wounds, sores
48	55	*Ficus crassiramea* Miq. var. *patelifera* (Warb.) Corner	Moraceae	*kele* M	sap, latex	toothache
49	84	*Ficus dammaropsis* Diels.	Moraceae	*menimba* M	latex, sap, pith	cough
50	35	*Ficus pungens* Reinw. ex Bl.	Moraceae	*wakai* P *wataly* M	leaves	sores, wounds
51	37	*Ficus wassa* Rosb.	Moraceae	*makus* P *sebana* P	sap, leaves	sores, wounds
52	22	*Geniostoma rupestre* J.R. & G. Forster	Loganiaceae	*kengaba* M *kengap* E	leaves	sores, wounds
53	101	*Geunsia farinosa* Bl.	Verbenaceae	*muripamp* M	leaves	counter magic
54	41	*Gigasiphon schlechteri* (Harms) De Wit	Leguminosae	*sakai* P *baya* M	seeds	hair growing and decoration

TABLE 1.—Plants Used in the Treatment of Illness Collected between August 1986 and March 1987 in the Territory of Lai and Yuat Rivers, Papua New Guinea. (continued)

Ser. No.	Coll. No.	Plant name	Family	Native name	Part used	Application
55	4	*Glochiadion novoguineensis* K. Schum.	Euphorbiaceae	*eym* M	bark	toothache
56	32	*Grevillea papuana* Diels.	Proteaceae	*aulu* P	leaves	sores, wounds
57	32	*Hemigraphis* sp.	Acanthaceae	*sudime* P	leaves	hair growing
58	96	*Holochlamys guineensis* Engl. & Krause	Araceae	*kuoypaga* M	leaves	burns
59	98	*Homalanthus novoguineensis* (Warb.) Laut. & K. Schum.	Euphorbiaceae	*kurup* M	sap, pith	boils, abscesses
60	20	*Homalomena cordata* Schott.	Araceae	*kuaipnalimamp* M *yadik* P	leaves	sores, rain magic
61	73	*Homalomena versteegii* Engler	Araceae	*kurimp medana* M *kogolo* P	leaves	sores, love magic
62	93	*Hornstedtia lycostoma* K. Schum.	Zingiberaceae	*d(u)imba* M *tumbi* E *gorgor* (Pidgin)	seeds, mucus from flowers	diarrhoea, eye inflammation
63	99	*Impatiens hawkeri* Bull	Balsaminaceae	*kundip krapa* M	leaves	scabies
64	14	*Ischaemum polystachyum* Presl.	Gramineae	*pogel pora* M	mucus	eye inflammation
65	1	*Laportea decumana* (Roxb.) Wedd.	Urticaceae	*nunt* M *nagau* E *jabu* P	leaves	universal
66	7	*Lycopodium serratum* Thumb.	Lycopodiaceae	*mayrepa* M	whole plant	antidote for poisons
67	94	*Macrothelypteris torresiana* (Gaud.) Ching	Thelypteridaceae	*kota* M	leaves	boils, abscesses
68	18	*Maesa haplobotrys* F.V. Muell.	Myrsinaceae	*gap* M	leaves	sores, wounds
69	102	*Maoutia* sp.	Urticaceae	*namp* M	leaves, called in spell	fish poison, burns, cuts, sores
70	29	*Morinda umbellata* L.	Rubiaceae	*tipopamp* (*tipokoypamp*) M	leaves	sores, wounds
71	26	*Mucuna cyanosperma* K. Schum.	Leguminosae	*kuguba* M	whole plant	hair growing

TABLE 1.—Plants Used in the Treatment of Illness Collected between August 1986 and March 1987 in the Territory of Lai and Yuat Rivers, Papua New Guinea. (continued)

Ser. No.	Coll. No.	Plant name	Family	Native name	Part used	Application
72	105	*Nothofagus starkenborghi* van Steenis	Fagaceae	*kraip* M	rotten trunk	burns
73	43	*Oenanthe javanica* DC.	Apiaceae	*kun* M *chakam* P *tasida* P	leaves	earache, inflammation
74	77	*Ophiuros tongcalingii* (Elmer) Heurad	Gramineae	*por* or *qui por* M	leaves	contraceptive for pigs
75	16	*Pangium edule* Reinw.	Flacourtiaceae	*mut* E *uya* M *sis* (Pidgin) *musa* P	bark, leaves	sores, lice, food, pig's wounds
76	61	*Paspalum conjugatum* Berg.	Gramineae	*chebela* P	leaves	sores, wounds
77	21	*Pentaphalangium pachycarpa* A.C. Smith	Guttiferae	*noga* E	sap, latex	scabies
78	64	*Piper betle* L.	Piperaceae	*mada* P *daka* (Pidgin)	leaves	boils, abscesses
79	45	*Piper wichmannii* C. DC.	Piperaceae	*koke* M *kyengaly* E	leaves	counter magic
80	78	*Pipturus argenteus* (Forst.f.) Wedd.	Urticaceae	*kilip* M	bark, leaves	plaster, counter magic
81	15	*Platea excelsa* Bl. var. *borneensis* (Heine) Slum.	Icacinaceae	*ipik* M *tindokop* E	fruits	sores, wounds, leprosy
82	100	*Polyscias ledermannii* Harms.	Araliaceae	*puli* E *pembla* M	called in spell	contraceptive magic
83	40	*Pometia pinnata* J.R. & G. Forster	Sapindaceae	*kobia (kobyama)* P *ton* (Pidgin)	leaves, fruits	sores, wounds, food
84	87	*Premna obtusifolia* R. Br.	Verbenaceae	*bapa* M	leaves	counter magic, vegetable
85	6	*Rhododendron* sp.	Ericaceae	*pil* M	leaves	antidote for poisons
86	50	*Sacciolepis indica* Chase	Gramineae	*gangalye* M	whole plant	in magic against menstruation
87	46	*Setaria palmifolia* (Koenig) Stapf.	Gramineae	*kura* M *vandama* P	leaves	counter magic
88	91	*Solanum lasiocarpum* Dun.	Solanaceae	*rik* M	leaves	boils, abscesses

TABLE 1.—Plants Used in the Treatment of Illness Collected between August 1986 and March 1987 in the Territory of Lai and Yaut Rivers, Papua New Guinea. (continued)

Ser. No.	Coll. No.	Plant name	Family	Native name	Part used	Application
89	86	*Sphaerostephanos unitus* (L.) Holltum	Thelypteridaceae	*pulpint* M	leaves	protective magic
90	56	*Syzygium pteropodum* (Laut. & K. Schum.) Merr. & Perry	Myrtaceae	*qui* M	leaves	counter magic
91	17	*Ternstroemia cherryi* (F.M. Bailey) Merr.	Theaceae	*por* M	leaves	back pain (pigs)
92	19	*Uvaria rosenbergiana* Scheff.	Annonaceae	*kendelh* M	leaves	eye inflammation
93	11	*Zingiber officinale* Rosc.	Zingiberaceae	*konga* M *itamaiya* E *hamu (omu)* P *kawawar* (Pidgin)	root	universal

M = Melpa E = Enga P = Pinai a is pronounced as a in 'along' ch is pronounced as ch in 'church' body pains and pains in the joints, legs and arms. The leaves and young shoots are cooked in an earth oven, boiled or steamed in pots and eaten by the sick person. The main nutritive value of ***aibika*** lies in its high protein-to-calorie ratio and high mineral and vitamin content (Powell 1976:124). Pain in the mouth including the tongue, palate, gums and teeth, can be alleviated by chewing wild or cultivated *Areca* nut with leaves, fruits or bark of ***daka*** *(Piper betle)* and lime. Although the practice of chewing betel nut turns the teeth black (mouth cancer is not yet known in this area), it also has the useful effect of cleaning them after meals.

Leaves of *Laportea decumana* have a miraculous role in people's lives all over the New Guinea Highlands. What aspirin and antibiotics are to Western scientific medicine, stinging nettles are to New Guineans in the bush. Nettles are used in cases of major illness and minor ailments, but mostly as an analgesic and antirheumatic. They are used in headache, backache, stomach complaints, diarrhoea, fever and general weakness. In such treatments innumerable small lumps appear after the rubbing, but they disappear within half an hour. Nettles work as a rubefacient and stimulate the circulation of the blood in that part of the body. Injected histamine leads to hyperemia in the treated area and gives relief to pain resulting from ishemic conditions, while the acute pain it causes is superimposed so that the deep and heavy pain the patient was complaining about is not felt to the same degree as before (Schiefenhoevel 1971:143). If the skin is itchy because of fleas, for instance, nettle leaves are rubbed over the body in the evenings before going to bed. In serious illness *L. decumana* is used together with spells against sorcery or malevolent spirits. The plant is common on trail sides and it is planted around houses. Leaves are kept in bundles in people's homes and are carried around in their ***bilums*** (string bags in Pidgin).

Another universal plant is ginger *(Zingiber officinale)*. Although rarely used among the Meiwa, the last Northern Melpa group, it is very well-known and used among the Hagahai, Kombolo, and Sau Enga. When a man is wounded in a fight, and the head of an arrow remains in the body, leaves and rhizomes of ginger are chewed and spat over the wound, while the leaves are used as a dressing, and bandaged with a creeper. People use chewed ginger when they cut their hands or legs with knives and axes. When somebody has an eye inflammation, a bit of ginger is masticated, spat onto the leaf, and the eyes are then washed with the saliva. In the case of a cough, people eat and inhale rhizome of ginger. Since ancient times this species, cultivated in the tropics, has had varied therapeutic uses, and it is widespread (Perry 1980:443; Ayensu 1981). The effects of gingers have been tested for a number of different pharmacological activities, and *Zingiber* specimens have been chemically analysed (Perry 1980:443; Reutrakul *et al.* 1986:197).

As the whole collection is given in Table 1 and the uses of individual plants are described in my thesis (Telban 1988), I do not intend to discuss the particular use of each plant here. I also omit in this paper all those plants that are used as poisons, whether fishing or for homicide. Melpa people are not experienced sorcerers (Strathern 1979b:80), but fear of poisoning is present all the time. In a discussion that follows I exclude nettle and ginger, because of their wide use, and those plants which are used for decoration and poison. The Northern Melpa use 36% of medicinal plants for external lesions (Pinai and Mamusi 48%) and 15% together with spells (i.e. healing plants) for exorcizing malevolent powers, sorcery or spirits, out of the body (Pinai and Mamusi 17%). Between 7 and 8 percent are used as pain relievers (earache, toothache), for cough (7-8%), for eye inflammation (7-8%), and 9% for animal treatment. The rest are single plants used as contraceptives or emetics (poison antidotes), for leprosy and scabies, and for repelling mosquitos.[5] Twenty percent of medicinal plants shown in Table 1 were known to only one or two people, and were not used at all in practice.

PLANTS THAT HEAL

Healing plants are used only by ritual specialists in cases where sorcery or spirits are suspected as the main cause of illness. As there is insufficient space here to discuss how and why spirits or sorcerers bring illness to the patient, how people perform divination, sorcery, and how they sacrifice (A. Strathern 1968, 1969, 1979b; Strathern A. and M. 1968; M. Strathern 1968; Bulmer R. and S. 1962; Telban 1988), I will just mention some cases of treatment known and performed by Meiwa, the last Northern Melpa tribe, to show how healing plants are used.

When Reka, an honest, influential, old big-man from Kokowa was struck by 'eye' sorcery on his return from Enga territory, his skin was burning, he felt tired and weak, with pain all over the body. He groaned, cried and screamed. He immediately sent for a man whose name was always mentioned with respect and fear, as people knew about his command of magical practices. But only a minority of them knew that in the past he had helped many people from the Ukini tribe around Baiyer River. When the ritual specialist arrived at Reka's hamlet he ordered Reka's relatives to prepare food for a ***mumu*** (earth oven). He went into the bush and collected branches with leaves of (all terms in Melpa) ***bapa*** *(Premna obtusifolia),* which is often used as the green component in earth ovens, ***kengana*** *(Elatostema beccarii),* and ***muripamp*** *(Geunsia farinosa),* and one big leaf of banana, ***be***.[6] A pig was killed with a blow to its head and its blood was collected in the banana leaf. Reka and the ritual specialist went to the nearest stream with a small pool, while all the relatives stayed waiting in the house. The blood was mixed with a little water. A bunch of leaves ***(bapa, kengana, muripamp)*** was first dipped into the stream and then the specialist gently struck Reka's shoulders, back, stomach, arms and legs. After a while, he started whispering an incantation to expel the sorcery. He moistened the leaves with the pig's blood and beat the patient's skin, smearing the blood all over his body, still uttering the spell. In the spell he called the names of two Pinale sorcerers (one of the Hagahai groups), some trees (which burn well), and added the standard phrase: 'Cook in the fire.' He used the same spell when we went to a foreign area as a preventive measure against 'eye' sorcery (Telban 1988). The specialist beat the water and the patient's skin alternately, washing away all of the pig's blood from his body, and thus washing away all the illness. All the leaves were then thrown away into the stream, including the banana leaf with the rest of the pig's blood. Then the two men returned to the house. Meanwhile Reka's family cooked a pig in an earth oven, shouting loudly, pretending that they did not have any interest in what was going on near the stream. They distributed the best pork to the specialist and to Reka, who quickly got better, and after a couple of days had totally recovered. The only sign that he had been attacked by 'eye' sorcery were the scars (which looked like dead flesh excrescences) on his back.

Another woman explained to me that when she was sorcerized, she and the ritual specialist went to the stream and made an artificial pool.[7] During the ritual she sat in the middle of the pool, which was broken up when the ritual ended. For a week she was not allowed to come close to water, and the place of ritual was also taboo for others from the village. If the other people were present during the ritual, or if they visited the place later, they could get sick and die. Some months later I was told of this same practice by an old woman in Rapgam (Ukini tribe, Melpa); the only difference was that she did not mention ***bapa*** leaves.

Some older people still remember how to expel ***kum,*** the kind of sorcery in which a sorcerer who has changed into an animal, insect or stone, has entered the victim's body through his or her buttocks, and is eating him or her inside. The ritual specialist takes ***kilip*** (Melpa) leaves *(Pipturus argenteus)* and utters a long spell, blowing between each few words, calling the places of ***kum,*** prohibiting ***kum*** from coming close and telling ***kum*** to stay in its own place. In the spell a specialist shoots into the armpit of a cassowary and throws the ***kum*** towards the junction of the Jimi and Lai rivers. With the leaves he rubs the patient's skin, eyes, head, neck, and testicles, and throws the leaves into the stream in the forest. This practice is not performed anymore as people do not go to the place of ***kum,*** and because they now follow the church.

If a person is possessed by a bush spirit demon, or by a ghost, a ritual specialist collects four different types of leaves (all names in Melpa): ***qui*** *(Syzigium pteropodum),* ***bandji*** *(Ficus adenosperma),* and the indispensable ***kura*** *(Setaria palmifolia)* and ***koke*** *(Piper wichmannii).*[8] He binds them together at the stem with some bush rope or a vine and cooks them over glowing embers. He rubs the skin of the sick person with these hot leaves using an incanatation at the same time. Many specialists use only leaves of the last two species, or ***koke*** together with ***pombukma*** leaves *(Angiopteris* sp.) or with ***kengana*** *(Elatostema beccarii).* Pig's blood is often smeared over the patient's skin, and then washed with water and leaves (just as described in the first case for 'eye' sorcery).

Almost all of the practices are accompanied by pig sacrifice to please spirits, and the stick which is used to kill the pig is taken far away into the bush and thrown into the river Lai or buried. I describe all the plants used in these practices as 'plants that heal' (as they are not supposed to have any pharmacological or chemical activity on the patient's body) as distinct from 'plants that cure'. 'Plants that heal' are said 'to be the forest abode of the spirit so that it will be attracted out of the man and back to its proper home' (Strathern, A.J. and M. 1968:183). After use, the leaves are thrown into the stream which will take them to the Jimi and Lai rivers' junction where spirits belong.

PLANTS USED FOR ANIMAL TREATMENT

References concerning animal treatment are very rare in the literature. This is surprising as we know how important pigs, dogs, cassowaries and even chickens are to the people of Papua New Guinea. Counter magic is not performed for animal treatment. People use magical incantations for piglets' birth and growth, but I have never heard of sorcery against pigs, or that they were spiritually possessed. When a pig disappears in the bush, people will say: 'Maybe a rotten tree killed it, or it fell into a hole or cave; maybe somebody stole it; but the most likely event is that bush spirits—demons—killed and ate it.' Pigs fight among themselves and with dogs. Wild pigs attack dogs during hunting, and so wounds occur quite often. When a pig suddenly dies, people examine its liver and usually eat it. But when it is sick or wounded, they will feel sorry for it and will try to relieve its discomfort. When a poisonous snake bites a pig or a dog, people will usually cut the animal's ear and let the blood run. They say that all the bad blood will pour out.

The red oil liquid of *Pandanus* fruit, known as ***marita*** in Melanesian Pidgin, pig's fat, ashes and clay are often applied to animal wounds and sores. Some Northern Melpa prepare a fish poison with the ***omakan*** root *(Derris koolgibberah)*, the stem of ***alga*** *(Clematis clemensiae)* and ***temp*** *(Euphorbia plumerioides)* and apply the boiled and mashed mixture onto purulent sores and wounds of their pets (all names in Melpa).

When Parka's (a boy around 16 years of age) dog was wounded fighting with a wild pig, and its wounds subsequently festered, he heated some leaves of ***wataly*** (Melpa), *(Ficus pungens)* over the fire, and when they were soft and hot he crushed them with his hands and rubbed them into the dog's wounds. He repeated this for a couple of days and the dog recovered almost completely. *Ficus pungens* was reported for different purposes also in other parts of Papua New Guinea (e.g. Clark 1971: Appendix; Holdsworth 1977:31) and Indonesia (Perry 1980:274).

For animal wounds and sores Parka used some other leaves mashed with a bush knife and a stone, bound in a banana leaf and cooked in the ashes for an hour. Leaves of ***gambelkamp*** (Melpa), *(Calanthe arfakana)* release a juice which is rubbed together with the leaves over sores on a dog's skin. When I watched this, a boy, Gris, who was approximately 10 years old, told me that he had done the same thing when his father's dog lost almost all its hair. He did not cook the leaves, but simply hung a bundle high over the fire during the night. In the morning he rubbed juice and leaves over the dog's naked skin. Both dogs yelped, because the leaves and the juice were hot (both in temperature and symbolically 'hot') when applied. People avoid getting this juice in their eyes. Gris told me that the dog's hair grew again with the same speed as his hair after his mother shaved his head. I saw two men during my fieldwork who applied this juice to infected sores which developed from scabies under the bark belts. The treatment was unsuccessful.

When a pig's legs bend and shake, or it falls to the ground, people rub leaves of ***por*** (Melpa) *(Ternstroemia cherryi)* over its back and make its bed in the sty with these leaves. That helps it to recover. On Manus island the fruit is scraped and placed onto a cut or sore (Holdsworth 1977:62). When domestic pigs fight and their wounds fester, people scrape the inner part of the bark of ***uya*** (Melpa) *(Pangium edule)* and apply the scrapings to sores and wounds where pus occurs. This bark is not used for fresh wounds, but as they say: 'When "animals" (maggots) are in the injured parts.' The bark of this tall tree, known as ***mus*** in Pinai vernacular (whose fruits are prized locally as the most delicious food after *Pandanus* [Miklouho-Maclay 1886:349]), is smashed and applied to sores among all Hagahai groups. The sliced fruit is used for sores and cuts in Northern Province (Holdsworth 1977:46). *Pangium edule* is found all over South East Asia and has an exceptionally large quantity of hydrocyanic acid, with the seed rich in oil (Perry 1980:156). A greatly thinned prussic acid solution, such as a cold water infusion of the fresh leaves or seeds, makes an excellent external antiseptic, disinfectant and antiparasitic (Perry 1980:156).

When people are preparing for feasts and do not want their pigs to carry piglets in the meantime, they give them big leaves of ***l'gou*** (Melpa) *(Asplenium nidus)* to eat, and they say that these protect pigs from pregnancy. The same is said of leaves of ***por*** *(Ophiuros tongealingii)*. *Asplenium nidus* (syn. *Neottopteris nidus* J.Sm.) is considered to be depurative. In the Malay Peninsula, one tribe is reported to give an infusion to ease labor pains; a lotion obtained by pounding the leaves in water is applied to cool the feverish head (Perry 1980:323).

Leaves of a shrub with violet flowers, which is planted around the houses as decoration, are used for the opposite purpose. When pigs do not bear piglets, people will give them the leaves of ***kurtnuninga*** (Melpa) *(Begonia serratipetala)* to eat, which should help them to carry. Stopp reported that the juice from the leaves of *Begonia augustae* Irmsch., known as ***nuninga*** among Mount Hagen people, is applied locally for itching conditions. The whole plant is mixed with hog feed in order to cure skin eruptions on these animals (Stopp 1963:18). Among the Kukukuku, leaves of *Begonia* sp. are heated and rubbed on the skin for abdominal pains (Blackwood 1940:123); and in the Eastern Highlands, crushed leaves and scraped stems are heated in a hollow bamboo and eaten with other food to give relief to stomach aches (Holdsworth and Giheno 1975:191). The Pinai use leaves of ***manana*** *(Acorus calamus)* to rub on the bellies of sows that have already carried piglets and have difficulty in breathing. They then cook withered leaves together with sweet potato and cassava, and give the food to the pigs. I have never witnessed these practices for contraception and fertility.

A SHORT REVIEW OF OTHER TREATMENTS

What do people do then, if they do not use medicinal plants? Besides healing practices known to specialists where healing plants are used, experts also perform rituals where the emphasis is on spells and the extraction of objects from the patient's body; plants are not used at all in these cases. In societies such as the Meiwa (Northern Melpa), social conceptions of illness play an important role. Wrongdoings and 'wrongtalkings', breaches of taboos, and moral or social transgressions are considered important causes of illness. People and ghosts can both experience anger and frustration. Because of people's wrongdoings ghosts can send illness either as punishment or because they feel sorry for a sufferer (A. Strathern 1968, 1977; M. Strathern 1968; Telban 1988). In such psychosocial illness only special treatments like sacrifice, compensation, and confession (to 'speak out') will remove the source, allowing the patient to recover.

Good food, especially pork, fresh greens or the oily juice of *Pandanus* fruit, is almost always included in treatment. A very sick patient usually refuses all food and just sits or lies quietly, with grief on his face. There are also a number of common 'lay' treatments that require no plants. Everyday practice is to bathe in the stream, to wash away illness. Drinking cold water is also considered a useful treatment. Pinai people, when covered with festering sores and skin ulcers, would often go to the Mina river. Its water is considered curative and people would stay and sleep there for two or three days, washing everyday in the river, until all the skin lesions dried. Water from pig wallows is recognized as health-giving and is recommended quite often as an externally applied treatment (sometimes together with soil from the wallow) for *otitis media* in children and for boils and abscesses. Among the Kombolo this soil is rubbed above the navel in the case of diarrhoea. Northern Melpa, but Hagahai and Kombolo even more so, recognize the importance of soot, ashes, earth, soil, and clay in the treatment of illness to much the same extent that they recognize medicinal curing plants. Small cuts and sores are sometimes covered with pig's or cow's fat (they obtain the latter from the Ruti Cattle Station in the Jimi valley). In the case of *cystitis/nephritis* a patient will cook a stone in the fire, take it into the bush and urinate on it.

As there is no space in this paper to discuss all the practices, why these treatments are performed, and how people explain them, I would just like to mention a treatment which was recommended after I suffered recurrent abscesses. I was told to take a hard piece of wood and make a digging stick approximately one meter long. Then I was to press the pus out of the abscess onto a leaf and smear it over that part of the stick which I had previously sharpened. I should thrust this stick into the ground beside the path, or even on the path, so that the sharpened end was pointing up. Somebody, whether man, woman, or child, would then pass by and see this nice digging stick. He or she would fancy using it for digging sweet potato, sowing corn or peanuts, and would take it away, together with the pus. All the boils and abscesses would thus go away and never return to me again.

CONCLUSION

What I have suggested in this paper is that indigenous medical ethnobotany in the New Guinea Highlands cannot be shown to have great antiquity of practice, anymore than elsewhere in the South Pacific. As I stayed with isolated populations in the bush, I was able to observe the dual process of adoption and loss of different portions of this knowledge. I agree neither with the majority of medical anthropologists who neglect the existence of medical ethnobotany, nor with those who sing its praises. I distinguish plants that heal from plants that cure, arguing that the latter constitute the corpus of lay, non-professional medical knowledge. People living in remote areas use these practices, but their medical beliefs are more oriented towards moral, social, magical, and spiritual causes of illness (which are natural for them, but not so for us), for which treatment is offered in kind, rather than with the aid of detailed medical ethnobotanical knowledge.

ACKNOWLEDGEMENTS

During 18 months of ethnomedical research in Papua New Guinea, between June 1986 and December 1987, I carried out 7 months field work in a remote area at the border of Western Highlands, Enga, and Madang Provinces, among Northern Melpa, Sau Enga, and some Hagahai and Kombolo groups of people. I am most grateful to many individuals, but most of all to Kela, Krai, Olyua (Melpa), Iwat (Pinai), Bidali (Mamusi), and Mokome (Luyaluya). This work could not have been undertaken without the generous support of my parents and the Slovenian-Australian Association from Canberra, especially two of its members: Roman Bizjak and Erik Fras. A grant from the World Wide Fund For Nature and the financial support of the Research School of Pacific Studies at the Australian National University enabled me to write up my results. Both the Biology Department at University of Papua New Guinea and Department of Anthropology in the Research School of Pacific Studies at Australian National University provided me with excellent working conditions. I am most grateful to all of them.

My voucher specimens are stored in two places: one collection in the National Herbarium in Lae (Department of Forests, Division of Botany), and an identical one in the Herbarium of the University of Papua New Guinea. I am grateful to Paul Katik and Jim Croft of the Herbarium in Lae for their identification of my specimens, to Dr. Helen Hopkins for 'supervising' my botanical collection, and to Dr. Topul Rali for friendship and consultations.

Many thanks to Drs. Lance Hill, Helen Hopkins, and Diane Turner who patiently read Chapter 5 of my thesis which constitutes the largest part of this paper, to Dr. Paul Gorecki for consultation and access to manuscripts before I left Papua New Guinea, and to Professors Ole Hamann and Richard Evans Schultes for their constant moral support before, during, and after my fieldwork. I cannot sufficiently express my gratitude to Chris Ballard, Dr. Gerald Haberkorn, Professor Roger Keesing, and Dr. Michael Young for all their help, for guiding me throughout my writing, and for their comments on previous drafts.

This paper was presented as a Departmental Seminar at the Research School of Pacific Studies, the Australian National University, in April 1988.

NOTES

[1]Present address: Periceva 7, 61ooo Ljubljana, YUGOSLAVIA.

[2]I have adopted from Dr. Carol Jenkins (1987, pers. comm.) the term Hagahai when referring to the people who comprise the following parishes: the Aramo, the Miamia, the Luyaluya, the Mamusi, the Pinale and the Pinai. 'Hagahai' is their own word for 'people' although the Pinai, the Mamusi and the Luyaluya have, to my knowledge, never grouped themselves under this name. As significant differences exist among the languages within the same sub-family, I must point out that the local Hagahai names used in the text and Table 1 are in the Pinai language, which is understood by the other groups. A short note on orthography is included at the end of Table 1.

[3]When referring to medicinal plants, I distinguish between 'plants that cure' and 'plants that heal' in the same way that researchers have accepted the distinction between 'disease' and 'illness' drawn by Fabrega (1972:213; 1974). This distinction has been followed by a majority of workers (Colson and Selby 1974:246; Kleinman 1980:72; Young 1982:270), and, in Papua New Guinea for instance, by Lewis (1975:149) and Frankel (1986:2-3). The distinction is also valid for the terms 'curing' and 'healing.'

[4]*Buchnera tomentosa* Bl., Scrophulariaceae is the only plant known as a contraceptive to the population around the Lai and Yuat rivers. Family limitation is controlled by socially determined norms (abstinence) or, in individual cases by magical contraceptive practices (Telban 1988). In addition we may observe that prolonged breast-feeding of infants is known to retard the return of ovulation (Schaefer 1985:318; Wirsing 1985:308-9). Postpartum amenorrhoea can prevent conception in excess of 18-24 months in breast feeding women in traditional societies, regardless of any cultural taboos on sexual intercourse (Schaefer 1985:318).

[5]Among the Maenge, according to Panoff (1970:81), half are employed for wounds, sores, and the like, about a quarter for pains, and another quarter for digestive disorders. Stopp (1963:21) noted for the Central Melpa people that about 60% of medicinal plants are used externally, but if we include so-called 'magic' (healing) plants, the figure rises to 80%.

[6]Strathern (1970:581), in describing performances associated with the female and male spirit cults, says that earth ovens are covered at the bottom with ***kengana*** *(Elatostema beccarii)* leaves. An expert explained to him that ***kengana*** is a cool thing, which grows in watery forest places and stays fresh after it is picked. To put it together with pork in an earth oven, means that their crops will grow well and the men will be healthy and live long.

[7]'The dead aspect of still lake, however, is contrasted with the life of running water, which has primarily beneficial attributes' (Strathern, A.J. and M. 1968:195).

[8]Strathern (1979a:63) noted that Ongka had explained to him that very young children, whose skin was soft and tender, were put in net bags where their bed was prepared with the soft round leaves of, as he called it, the ***koki***. I think that this was done to protect a child from the spirits. Stratern states that nowadays, leaves of ***koki*** are also used for chewing together with *Areca* nut.

LITERATURE CITED

AYENSU, E.S. 1981. Medicinal Plants of West Indies. U.S.A. Reference Publication.

BIGGS, B. 1985. Contemporary healing practices in East Futuna. Pp. 108-128 *in* Parsons, C.D.F. (ed.): Healing Practices in the South Pacific. The Institute for Polynesian Studies, Univ. Hawaii Press.

BLACKWOOD, B. 1940. Use of plants among the Kukukuku of Southeast central New Guinea. Proceedings of the 6th Pacific Science Congress of the Pacific Science Association, 1939, Vol. 4, VCP:111-126.

BROWN, M. F. 1987. Toward a human ecology: Medical ethnobotany and the search for dynamic models of plant use. Rev. in Anthrop. 14(1):5-11.

BULMER, R.N.H. and S. 1962. Figurines and other stones of power among the Kyaka of Central New Guinea. J. Polyn. Soc. 71(2):192-208.

CAMBIE, R. C. 1986. Fijian medicinal plants. *In* Steiner, R.P. (ed.): Folk Medicine, the Art and the Science. Washington, D.C., American Chemical Society.

CHAMBERS, A. and K.S. 1985. Illness and healing in Nanumea, Tuvalu. Pp. 16-50 *in* Parsons, C.D.F. (ed.): Healing Practices in the South Pacific. The Institute for Polynesian Studies, Univ. Hawaii Press.

CLARKE, W. C. 1971. Place and People: An Ecology of a New Guinean Community. ANU Press, Canberra.

COLSON, A. C. and K.E. SELBY. 1974. Medical anthropology. Pp. 245-262 *in* Siegel, B., Beals, A.R. and Tyler, S.A. (eds.): Ann. Rev. Anthrop. 3.

CROOM, E. M. 1983. Documenting and evaluating herbal remedies. Econ. Botanty 37:13-27.

EVANS-PRITCHARD, E. E. 1972. Witchcraft, Oracles and Magic among the Azande. Oxford Univ. Press.

FABREGA, H. 1972. Medical anthropology. Pp. 167-229 *in* Siegel, B.J. (ed.): Biennial Rev. of Anthrop. 1971.

__________. 1974. Disease and Social Behavior: An Interdisciplinary Perspective. MIT Press, Cambridge, Massachusetts.

FRAKE, C. O. 1961. The diagnosis of disease among the Subanum of Mindanao. Amer. Anthropol. 63:113-132.

FRANKEL, S. 1986. The Huli Response to Illness. Cambridge Univ. Press.

GLICK, L. B. 1963. Foundation of a Primitive Medical System: The Gimi of the New Guinea Highlands. Ph.D. Dissert., Univ. Pennsylvania.

__________. 1967. Medicine as an ethnographic category: the Gimi of the New Guinea Highlands. Ethnology 6(1): 31-56.

HILL, L. 1985. Preliminary bibliography on the traditional medicine plants of Papua New Guinea. Pp. 135-144 *in* Jilek, W.G. (ed.): Traditional Medicine and Primary Health Care in Papua New Guinea. WHO and University of Papua New Guinea Press.

HOLDSWORTH, D. K. 1977. Medicinal Plants of Papua New Guinea. South Commision Noumea, New Caledonia. Tech. Pap. No. 175.

__________ and J. GIHENO. 1975. A preliminary survey of Highlands medicinal plants. Sci. in New Guinea 3(3):191-198.

HUGHES, C. C. 1978. Medical care: ethnomedicine. Pp. 50-158 *in* Logan, M.H. and Hunt, EE. (eds.): Health and the Human Condition: Perspectives on Medical Anthropology. Belmont, CA, Wadsworth.

JENKINS, L. C. 1987. Medical anthropology in the western Schrader range, Papua New Guinea. National Geogr. Res. 3:412-430.

JILĖK, W. G. 1985. Bibliography of ethnomedicine, ethnopsychiatry and traditional healing in Papua New Guinea. Pp. 145-161 *in* Jilek, W.G. (ed.): Traditional Medicine and Primary Health Care in Papua New Guina. WHO and University of Papua New Guinea Press.

JOHANNES, A. 1975. Medicinal plants of the Nekematigi of the Eastern Highlands of New Guinea. Economic Botany 29:268-277.

__________. 1976. Illness and Medical Care in a New Guinea Highlands Society. Ph.D. Dissertation. Chicago, Northwestern University.

LITERATURE CITED (continued)

KLEINMAN, A. 1980. Patients and Healers in the Context of Culture: An Exploration of the Borderland between Anthropology, Medicine, and Psychiatry. Univ. California Press.

LEWIS, G. 1975. Knowledge of Illness in a Sepik Society. A Study of the Gnau, New Guinea. London. The Athlone Press.

__________. 1979. Beliefs and behavior in disease. *In* CIBA Foundation Symposium 49 (new series): Health and Disease in Tribal Societies. Excerpta Medica, Amsterdam.

__________. 1986. Concepts of health and illness in a Sepik Society. Pp. 117-135 *in* Currer, C. and Stacey, M. (eds.): Concepts of Health, Illness and Disease: A Comparative Perspective. Leamington, Berg Publishers Ltd.

LOGAN, M. H. 1978. Digestive disorders and plant medicinals in highland Guatemala. Pp. 80-188 *in* Logan, M.H. and Hunt, E.E. (eds): Health and the Human Condition: Perspectives on Medical Anthropology. Belmont, CA, Wadsworth.

MACPHERSON, C. 1985. Samoan medicine. Pp. 1-15 *in* Parsons, C.D.F. (ed.): Healing Practices in the South Pacific. The Institute for Polynesian Studies, University of Hawaii Press.

MARTIN, J. 1817. William Mariner's Account of the Natives of the Tonga Island. J. Murray, London, Vol. 2.

MIKLOUHO-MACLAY, N. N. VON. 1886. List of plants used by the natives of the Maclay coast, New Guinea. Proceedings of the Linnean Society of New South Wales 10:346-354.

MURDOCK, G. P. 1980. Theories of Illness: A World Survey. Univ. of Pittsburgh Press.

PANOFF, F. 1970. Maenge remedies and conception of disease. Ethnology 9(1): 68-84.

PARSONS, C.D.F. 1985. Tongan healing practices. Pp. 87-108 *in* Parsons, C.D.F. (ed.): Healing Practices in the South Pacific. The Institute for Polynesian Studies, Univ. Hawaii Press.

PERRY, L. M. and J. METZGER. 1980. Medicinal Plants of East and Southeast Asia: Atributed Properties and Uses. The MIT Press, Cambridge, Massachusetts.

POWELL, J. M. 1976. Ethnobotany. Pp. 106-183 *in* Paijmans, K. (ed.): New Guinea Vegetation. Canberra, ANU Press.

REUTRAKUL, V. *et al.* 1986. Zingiberaceus Plants. Pp. 191-204 *in* Steiner, R.P. (ed.): Folk Medicine: The Art and the Science. Washington, D.C., American Chemical Society.

RIVERS, W.H.R. 1927. Medicine Magic and Religion. Kegan Paul, New York (2nd ed.).

ROMANUCCI-ROSS, L. 1982. Folk Medicine and metaphor in the context of medicalization: syncretics in curing practices. Pp. 5-19 *in* Romanucci-Ross, L. *et al.* (eds.): The Anthropology of Medicine: From Culture to Method. Mass., Bergin and Garvey Publishers, Inc.

SCHAEFER, O. 1985. Comments on Wirsing. Current Anthropology 26(3):318.

SCHIEFENHOEVEL, W. 1971. Aspects of the medical system of the Kaluli and Waragu language-group, Southern Highlands District. Mankind 8:141-145.

STOPP, K. 1963. Medicinal plants of the Mt. Hagen people (Mbowamb) in New Guinea. Econ. botany 17:16-22.

STRATHERN, A. J. 1968. Sickness and frustration: variations in two New Guinea Highlands societies. Mankind 6(2):545-551.

__________. 1969. Kor-Nga Poklambo or Ui Mbo? Hagen magic stones. Archaeology and Physical Anthropology in Oceania 2:91-96.

__________. 1970. The female and male spirit cults in Mount Hagen. Man 5(4): 571-585.

__________. 1977. 'Why is the shame on the skin?' Pp. 99-110 *in* Blacking, J. (ed.). The Anthropology of the Body. Academic Press, London.

__________. 1979a. Ongka: A Self-Account by a New Guinea Big-Man. Duckworth, London.

__________. 1979b. The Rope of Moka: Big-Man and Ceremonial Exchange in Mount Hagen, New Guinea. Cambridge Univ. Press.

LITERATURE CITED (continued)

STRATHERN, A. J. and M. 1968. Marsupials and magic: a study of spell symbolism among the Mbowamb. Pp. 179-207 *in* Leach, E.R. (ed.): Dialectic in Practical Religion. Cambridge Univ. Press.

STRATHERN, M. 1968. Popokl: the question of morality. Mankind 6(2):553-562.

TELBAN, B. 1988. People, Illness and Plants: Ethnomedicine in the Highlands fringe of New Guinea. M.Sc. Thesis, Univ. of Zagreb.

WEINER, M. A. 1971. Ethnomedicine in Tonga. Econ. Botany 25(4):423-450.

WELSCH, R. L. 1982. The Experience of Illness among the Ningerum of Papua New Guinea. Ph.D. Thesis, Univ. of Washington.

WIRSING, R. L. 1985. The health of traditional societies and the effects of acculturation. Current Anthrop. 26(3):303-315, 319-322.

YOUNG, A. 1982. The anthropologies of illness and sickness. Pp. 257-286 *in* Siegel, B.J. (ed.): Annual rev. Anthrop. California.

BOOK REVIEW

Pharmacopées traditionnelles en Guyane: Créoles, Palikur, Wayãpi. Pierre Grenand, Christinan Moretti, and Henri Jacquemin. Collection mémoires No. 108. Paris: Institut Francais de recherche scientifique por le Devéloppment. 1987. Pp. 569 + 76 colored plates. n.p.

The meticulous work of Drs. Grenand, Moretti, and Jacquemin is immortalized in one of the most complete and beautiful works in ethnobotany and ethnomedicine/ ethnopharmacology that has ever appeared in any language. *Pharmacopées traditionelles en Guyane* is an ethnobiological achievement as well as a superb scientific contribution to our understanding of native and creole knowledge and use of medicinal plants.

This volume not only discusses the medical concepts of the three groups studied (the indigenous Palikur and Wayãpi, and the Créoles of Cayenne), but it also offers linguistic details of plant names and variations in names between groups. In addition, ethnographic detail is provided for each entry in the pharmacopoeia, including data on plant selection and medicinal preparations. To make this work even more distinct, pharmacological data are also provided for many of the major species. Complementary bibliographic data on the plants and pharmacological sources also contribute to the scientific quality and value of the volume. Numerous magnificently-done colored plates not only enhance the utility of the work by providing visual guides to many of the plants discussed, but they also mark the exceptional quality of production of the book.

Botanists, ecologists, anthropologists, physicians, and pharmacologists interested in traditional medical and pharmacological knowledge *must* have this book, which will undoubtedly serve as a standard for ethnoscientific research for many decades to come.

Darrell Addison Posey
Nucleo de Etnobiologia
Museu Paraense Emilio Goeldi and
Pesquisador Titular, CNPq
Brasilia, Brazil

BOOK REVIEW

Amazon Frontier. John Hemming. Cambridge, MA: Harvard University Press, 1987. Pp. 647. $29.95 (cloth).

If tropical rainforest ecosystems are to be preserved for future generations and managed to provide a sustained economic return, then more emphasis must be placed on the utilization of non-timber products. Almost every important tropical food, medicine, oil, fiber, etc., was first learned of from local aboriginal peoples. Consequently, in the search for new and useful forest products, we must continue to expand ethnobotanical research efforts.

The absence of a thorough overview of the history of Amazonian Indians has been a stumbling block for ethnobotanists for many years. In 1978, John Hemming published his classic, *Red Gold: The Conquest of the Brazilian Indian,* which covered the years 1500-1850 in a scholarly, yet accessible, format. *Amazon Frontier* is essentially a companion volume which picks up where *Red Gold* left off. Hemming has once again done an extraordinary job of pulling together a wide variety of information to tell a difficult story. This history of the Indians of the Amazon Basin is not confined to Brazil, but also involves Portuguese royalty, German clergymen, French diplomats, Peruvian rubber barons, Dutch traders, and British botanists, and it is, for the most part, an extremely depressing tale.

I do have a few minor criticisms. The book is entitled *Amazon Frontier,* yet many of the events described take place outside the Amazon. For example, the book's attractive cover is adorned with the famous Richter painting of Prince Maximilian zu Wied-Neuwied, best known as an explorer of eastern Brazil, and the Indian guide at Maximilian's side is generally believed to be from the Botocudo tribe of Brazil's Atlantic forest region; as far as I know, neither Prince Maximilian nor his guide ever set foot in the Amazon.

My other concern has to do with the use of Latin names for plants mentioned in the text. Though it may be somewhat unfair to expect an anthropologist to use Latin names, consistent inclusion of this terminology would have made the book a more useful scientific tool. The author uses scientific names in some instances but not in others (e.g., on p. 44 the scientific name is included for "cravo" but not for Brazil nuts or ipecac).

There are two sections of the book which will be of special interest to the economic botanist. The first is an intriguing section on the rubber boom, and the second an Appendix which gives excellent capsule biographies and itineraries of over sixty travellers, scientists, and artists who visited Brazilian Indians. This latter is particularly useful for those of us who know these people only as authors, and lack the biographical data to understand them in a historical context.

I consider this to be an excellent book which will serve as an indispensable reference for the ethnobotanist or anyone who is interested in conservation, Indians, and the Amazon. One can only hope that Hemming will write the next chapter at a time when there will be happier tales to tell.

M.J. Plotkin
World Wildlife Fund
1250 Twenty-Fourth St., NW
Washington, DC 20037

J. Ethnobiol. 8(2):171-184 Winter 1988

BOTANICAL LIFE-FORMS IN EUROPEAN ROMANY

F. DAVID MULCAHY
Department of Social Sciences
Polytechnic University
Brooklyn, New York 11201

ABSTRACT.—Fifty European Romany (Gypsy) lexicons are examined. The typical botanical life-form inventory in E.R. is "tree" + "grass-grerb" + "bush." The data suggest two alternative reconstructions of the Romany life-form lexicon at ca. 1000 A.D. when the Gypsies left India. The first reconstruction contains only a "tree" term and a partially consolidated "grass" term. The second contains fully consolidated "tree," "grass" and "bush" terms. The effects of subsequent language contact and bilingualism on plant life-form lexicons are discussed. Finally data from two closely related varieties of Romany are evaluated regarding the effect of urbanization on wood/tree polysemy.

INTRODUCTION

In this paper[1] I will examine the botanical life-form lexicons of the varieties of Romany spoken by European Gypsies. The botanical life-form lexicons of two closely related varieties of ***Kalderasitska,*** the Romany spoken by the ***Kalderasa*** or "Coppersmith" Gypsies will serve as primary data which will be evaluated in the context of comparative data from other varieties of European Romany (hereinafter: E.R.). Finally a general statement concerning the development of European Gypsy botanical life-form lexicons will be proposed.

During recent years linguistic anthropologists have dedicated considerable effort to the construction of theoretical models which clarify the ways in which certain nomenclatural domains show pan-cultural regularities in their development. Some of the most interesting and productive work in this area has been done by Cecil Brown with regard to the ways in which human languages add plant life-form labels to their lexicons. Life-form labels are those taxa which are immediately superordinate to generic labels in folk taxonomies. In North American English, for example, beech, oak and maple are all genera classified under the English botanical life-form label "tree."

Brown (1984) has demonstrated that for plants:

1. The occurrence of life-form labels in languages is implicational: certain life-form labels are regularly encoded in languages before others. Thus, plant life-form labels are added to languages in a relatively fixed sequence.
2. This sequence is strongly associated with societal complexity. Languages spoken in large-scale, state-level societies commonly have many life-form labels, while languages spoken in small-scale societies have relatively few such labels. As technology and urban life increasingly distance humans from their natural environments, the numerous generic and specific labels which small-scale societies have for plants decrease. This decrease favors a concomitant increase in number

of life-form labels. Thus, the numerous life-form labels of languages spoken in large-scale societies, act as a sort of nomenclatural "shorthand" for what was lost.

3. The sequence apparent in the growth of life-form labels can be understood by the application of pan-human principles of naming behavior and marking.

THE STUDY OF GYPSY NOMENCLATURAL SYSTEMS

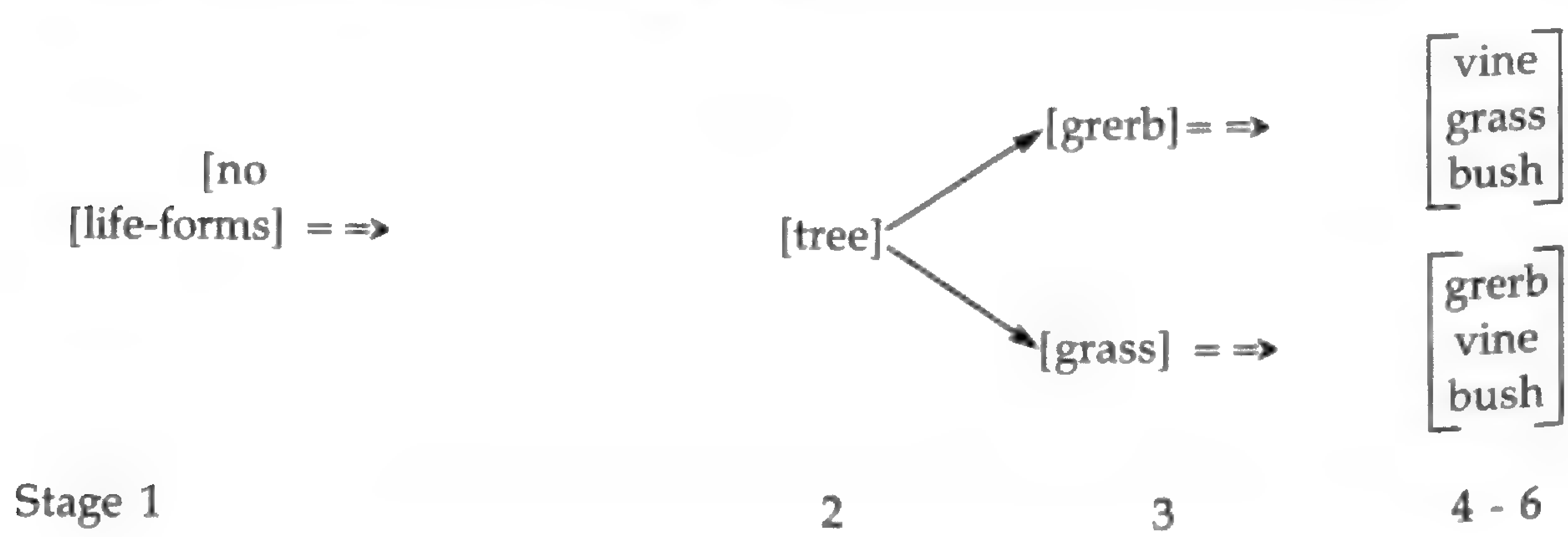
The linguistic behavior of Gypsies presents us with data relevant to the study of how developmentally constrained nomenclatural systems such as life-form inventories behave. Around 1000 A.D., the Gypsies left India and during much of the ensuing millennium, lived in and traveled through numerous European countries. The vast majority of Gypsies are at least bilingual. They speak the language of the country in which they have settled, or the languages of the countries through which they travel most heavily. They also usually speak a variety of Romany, which is classified as an Indic language belonging to the Indo-Iranian branch of Indo-European. By definition, Gypsies are always in symbiosis with the culture and language of the host states in which they live and/or through which they travel. The collective term with which Gypsies label the non-Gypsy citizens of these states, is ***gaze*** or *outsiders.*

During the ten centuries of Gypsy-Gaze symbiosis, there has been ample opportunity for items of linguistic and non-linguistic culture to be transferred from one group to the other. Even with regard to extremely conservative Gypsy communities, one should not underestimate the degree of Gaze cultural influence. Likewise, several regions and subcultures of modern state societies, such as Spain, have been rather profoundly affected by Gypsy language and culture (see Claveria 1951: chapt. 1).

In view of the foregoing, the status of life-form nomenclatures in Gypsy communities poses itself as a theoretically interesting question. Have Gypsy communities, because of their symbiosis with European state societies, adopted the life-form nomenclatures of their Gaze neighbors? Put another way, are the structure and content of Gypsy botanical life-form lexicons best explained by processes of language contact and bilingualism, or has an indigenous nomenclature been retained?

THE DEVELOPMENT OF BOTANICAL LIFE-FORM TERMS

Brown (1984:24) found the following sequence for the development of botanical life-forms in a sample of 188 languages:



That is, some languages have no life-form terms and thus form Stage 1. Others have only one life-form term (always "tree") and thus occupy Stage 2. Two term systems (either "tree" and "grerb" or "tree" and "grass") comprise Stage 3. If the Stage 3 term is "grerb," then Stages 4, 5, and 6 involve the addition of "vine," "grass" and "bush" in no particular order. If the Stage 3 term is "grass," Stages 4, 5, and 6 involve the additon of "grerb," "vine," and "bush," again, in no particular order (Brown 1984:23-24).

The five life-form terms are defined as follows:

— "tree," Large plant (relative to the plant inventory of a particular environment) whose parts are chiefly ligneous (woody).

— "grerb," Small plant (relative to the plant inventory of a particular environment) whose parts are chiefly herbaceous (green, leafy, nonwoody).

— "bush," Plant of intermediate size (relative to the plant inventory of a particular environment) which is characteristically bushy (shows much branching and lacks a single, main support).

— "vine," Elongated plant exhibiting a creeping or twining or climbing stem habit.

— "grass," A flowerless, herbaceous plant with narrow, often bladelike or spear-shaped leaves (Brown 1984:13-14).

KALDERASITSKA

The European Kalderasa see themselves as one of the three great tribes of the ***R̰om***, a category of Gypsies which also includes the ***Lowára*** and the ***Tšurára***. They speak a form of Romany which, in terms of basic vocabulary and grammatical features, is strongly Indic, but which at the same time has adopted as many as 1,500 Rumanian loan-words (Gjerdman and Ljungberg, 1963:xix-xx). The Rom had, prior to the 1850s, spent at least a century in Rumania where they found an economic niche. In the 1850s there was a massive diaspora of Rom out of Rumania. They now live in, or travel through North, Central and South America, Europe, and Australia.

Gjerdman and Ljungberg (1963, hereinafter G&L) have published an excellent descriptive grammar and 3,600 item vocabulary of "Swedish" Kalderasitska based on the language of Mr. Johan Dimitri Taikon, or ***Miloš*** (ca. 1879-1950). The book has become a classic in the area of Gypsy linguistics and is the definitive work on Kalderasitska. Beginning in 1972, in the course of various field trips to Spain, I have been able to spend approximately a year and a half living and working in a community of Kalderasa in a large Spanish urban center. Data concerning Kalderasa botanical life-form categories will be drawn from both the Taikon vocabulary and from my own field observations among the "Spanish" Kalderasa.

Swedish and Spanish Kalderasitska are closely related varieties of the same language, and, as such, are instructive regarding botanical life-form development. To the Kalderasitska cases I add the botanical life-form lexicon of the Welch Gypsies as recorded by Sampson (1968). For data on the life-form lexicons of other European Gypsy communities I have relied upon Wolf[2] (1960) who provides data concerning the distribution of 3,862 words in 47 Romany lexicons with the following geographical distribution: 17 (36%) from Germany, 13 (28%) from Western and Northern Europe and 17 (36%) from Eastern and Southern Europe (Wolf 1960:34). The total number of lexicons in our sample, then, comes to 50.

BOTANICAL LIFE-FORM TERMS OF THE SWEDISH KALDERASA

Botanical life-form categories cited in G&L are:

1. "tree," G&L (256a) claim an Indic etymology for the "tree" term ***kaš***, referring the reader to Sampson (1968:pt. iv:138-139) who cites the Sanskrit *kaṣṭha* "piece of wood, log" as an etymon. In addition, G&L (256a) note that in Taikon's speech ***kaš*** also means "wood."

2. "grass," G&L (368b) gloss ***tšar*** as "grass." They give an Indic derivation for the word citing Sampson (1968:pt. iv:56) who cites the Sanskrit radical *car I carati* meaning "to roam, graze" as its etymon. G&L (281a-b) also list ***luludží*** "flower" <Modern Greek *lulúdi* "flower," a secondary meaning of which is "herb," or perhaps "flower-plant." Cognates of ***luludží*** occur in three of the Romany lexicons listed by Wolf (entry 1815), where they mean only "flower."

3. "bush," ***túfa***, according to G&L (374a) means, in the variety of Kalderasitska spoken by Taikon, "bush" or "shrub." They cite the Rumanian *túfe̥* "bush, shrub" as its etymon.

BOTANICAL LIFE-FORMS OF THE SPANISH KALDERASA

Spanish Kalderasa plant life-forms are:

1. "tree," in the Spanish variety of Kalderasitska, ***kaš*** is restricted to meaning "wood." The Spanish Kalderasa "tree" term ***sálka*** is defined by informants as being big and having woody parts as opposed to the "grerb" term ***tšar*** (see below) which is small and has no woody parts. G&L (337a) list the same form ***(sálka)*** in the Swedish Kalderasitska vocabulary where it means "sallow, willow" or "osier" and relate it to the Rumanian and Transylvanian *sálke̥*. Although ***sálka*** came into Kalderasitska as a Rumanian-Transylvanian loan word, it has a wide distribution and a long history in South Central and Western Europe. The Castilian *sarga* "a kind of osier or willow" (Velázquez de la Cadena, 1970:576) is also a cognate. Corominas and Pascual (1983:v:176) relate that, in Spain, *sarga* signifies several species of the genus *Salix,* and also suggest that the Castilian form, as well as its Catalan cognate, came into Romance from the Celtic *SALICA (which corresponds to an attested form SALICO-) by way of the Proto-Basque *SARICA.

2. "grerb," Spanish Kalderasa informants equate their "grerb" term ***tsar*** with the Castilian "grerb" term *hierba* which means "any small plant without rigid, woody parts, that generally germinates and dies during the same year" (Moliner 1984:ii:41). Castilian does not distinguish between "grass" and "grerb." Moliner (1984:i:590), for instance, defines *césped* "lawn" in terms of *hierba:* "a short and dense 'herb' *(hierba)* which covers the ground . . ."

3. "bush," The Spanish Kalderasitska "bush" term is ***bózi.*** G&L (216b) list the Swedish Kalderasitska cognate ***bózo*** "elder-shrub," (genus *Sambucus,)* which is derived, they note, from the Rumanian *boz* "elder bush." Again the word has a wide distribution and considerable history in South Central and Western Europe. The Castilian *sauco* "elder" is a cognate, derived according to Corominas and Pascual (1983:v:176-177), from the classical Latin SAMBUCUS, via an intermediate form SABUCUS. Corominas and Pascual also note that the clasical form survives in "Italian, and in various Sardinian, Rhaeto-Romanic and Occitanian dialects."

DISCUSSION

Both Swedish and Spanish Kalderasitska have three botanical life-form terms. Both languages have "tree" and "bush," but have taken somewhat different developmental routes, in that the Swedish Gypsies encoded "grass," while the Spanish Gypsies encoded "grerb" at Stage 3. According to Brown (1984:13-14 and above) "grass" is distinguished from "grerb" in that its leaves are bladelike, and it bears no flowers. "Grerbs" then, have broader leaves and can have flowers. In his book, Brown (1984:14) employs the English "herb" to mean "grerb." We have seen that the Spanish Kalderasa ***tšar*** incudes both grasses and herbs. The Swedish Kalderasa perhaps distinguished between these two concepts by the use of *flower* to label herb, hence, this use of flower might be an incipient "grerb" label.

The data presented by Wolf do not provide a *label for label* translation for each Romany life-form term. Hence, in entry 3438, Wolf *collectively* glosses the many forms of ***tšar*** which he compiled as "grass, lawn, pasture-land" and "herb *(Kraut).*" In the development of life-form lexicons, however, "grass" and "grerb" are not totally exclusive categories. Brown (1984:14) maintains: "Grerb, when encoded, always includes nongrass herbaceous plants (denoted by *herb* in this work). However, it is frequently extended to grasses . . . " This broader Stage 3 category includes both herbs and grasses. This being the case, Stage 3 in E.R. seems to be a "grass-grerb" stage in its most inclusive sense, i.e., as including herbaceous *and* sometimes grass-like small plants—but also at times representing purely grass-like small plants, and only such plants.

ADDITIONAL BOTANICAL LIFE-FORMS IN EUROPAN ROMANY

The botanical life-form lexicons for 47 varieties of E.R. (compiled from Wolf, 1960) are listed in Table 1. The first column of this table contains Wolf's code letter or number for each of the 47 varieties he investigated. The third column lists the author of each vocabulary or lexicon, while the life-form labels in each Gypsy lexicon follow each author's name. The last column gives the stage of life-form development of each lexicon. Since the vocabularies represented in the table vary greatly in length, sampling error must affect the completeness of the shorter and intermediate length lexicons. To assess this effect, a sample of 1,110 lexical items from Wolf was randomly selected, and then sorted by vocabulary of origin. The fraction represented by the number of items selected from each lexicon, divided by the total number of items (1,110), and expressed as a percent, indicates the completeness of each vocabulary, and is listed in column two. Since the life-form lexicons are listed by order of completeness (least to most), the lexicons listed toward the end of the table should be considered as most representative of E.R. The initial 19 lexicons, which individually represent $<$ 1% of the total sample of words in Wolf's compendium, have their life-form stage score followed with a question mark to indicate their probable incompleteness.

Inspection of the Table indicates the following:

1. *The Typical Life-form Lexicon in Romany.* Of the last 16 and most complete lexicons in Table 1 (3 through 0), 12 encode for "tree" + "grass-grerb" + "bush." These referents are represented in the table by the numbers 2, 3, and 4 respec-

tively. The unnumbered terms, usually the first listed, designate "wood." It will be recalled that the two Kalderasitska lexicons also encoded for "tree" + "grass-grerb" + "bush." Welch Romany (see below) also encodes for this sequence. Thus 15 of the 19 Romany varieties discussed (79%) encode for "tree" + "grass-grerb" + "bush."

2. *Implicational Relationships.* The encoding sequence for Romany botanical life-form lexicons viz. "tree" + "grass-grerb" + "bush" is rare but not unique—Brown (1984:25) found this sequence in 4% of the world-wide sample of 188 languages which he investigated. This encoding sequence is violated (signified by * in the table), only three times in the E.R. data.

STAGE 2 AND 3 IN EUROPEAN ROMANY

Both varieties of Kalderasitska share the Indic term ***tšar*** at Stage 3. Wolf (3438) glosses ***tšar*** as "grass, lawn, pasture-land," and "herb" and records variants of the term in 24 European Gypsy languages. Sampson (1968:pt. iv:55-56) also notes a form of ***tsar*** meaning "grass" in Welch Romany. Other possible labels for the "grass-grerb" category are contained in the following entries given by Wolf.

— (3181) ***štoro*** (and variants) "herb" in one lexicon (2, after Uhlik) ‹ Unclear.

— (935) ***gråsa(n)*** "grass" in one lexicon (d, after Etzler) ‹ Swedish *grås.*

WOOD/TREE POLYSEMY

Witkowski, Brown and Chase (1981) have shown that approximately two thirds of the world's languages have a common term for wood and "tree," while Brown (1984:60-62) has found that of a world-wide sample of 188 languages, 93 languages (49%) exhibit wood/tree polysemy. He presents a strong argument "that tree usually develops through referential expansion from 'wood' " as a response to increase in societal scale. Such growth in scale would involve a speech community's distancing itself from the natural environment to the point where a "tree" label would be a convenient device to refer to a class of objects, the individual members of which have lost a degree of adaptive importance and therefore salience.

The Kalderasitska case is instructive concerning changes in societal scale and wood/tree polysemy. According to Gjerdman (G&L, 1963:v-xi), their informant, Mr. Taikon traveled through Sweden, Norway, Finland, Russia, the Baltic States, Poland, Germany and France. At least some of his travels took place during horse and wagon days, as is indicated by the considerable emphasis in his lexicon on items having to do with horses and their care. It is certain that these journeys took him and his people to many rural campsites, where they came in contact with a great variety of plant life. G&L (1963) list the following "tree" names (with probable etymologies) in Taikon's vocabulary: ***aníno*** "alder(-tree)" ‹Rumanian *anín* (197b); ***pendexín*** "hazel bush/tree" ‹Persian, Kurdish *penaxå* (309b); ***dudulín*** "mulberry tree" ‹Rumanian *dud* (230a); ***pálmo*** "palm tree" ‹"European" (304a); ***mestetiín*** "birch tree" ‹Rumanian *mesteåkẹn* (290a); ***o kaš le kritšunósko*** "Christmas-tree" (256a); ***brádo*** "fir, spruce" ‹Rumanian *brad* (216b); ***sálka*** "sallow, willow, osier"‹Rumanian *sálkẹ* (337a); ***pẹdureátsa*** "crab(-tree)" *[sic]* ‹ Rumanian *pẹduréts* (310b); ***líka*** "linden tree" ‹ Russian *liko* (278b); ***phabelín*** "apple tree" ‹ Šanskrit *pʿabai* (311b); ***plópo*** "popular, aspen" ‹ Rumanian *plop* (319a); ***pruiín*** "plum tree" ‹Rumanian *prúnẹ* (327a);

strežári "oak" ◄ Rumanian ***stežár*** (346b); ***akhorín*** "walnut tree" an Indic form (194a); ***rekíta*** "sallow, osier, willow" ◄ Rumanian *rekiite* (333a). G&L (1963:46) note that the suffix ***-ín*** is placed on names of fruits to form the name of the tree upon which a particular fruit grows.

The Spanish Kalderasa present a rather different case in their relationship to the natural environment. By their own admission they are "city Gypsies" rather than "country Gypsies." Even the best informants know little of the horse and wagon days, and of the vocabulary related to horses. They are sedentary and their domestic and work environment is urban and has been urban for fifty years. They have little interest in plant life. When I went over the above list of "tree" names with knowledgeable informants they recognized very few of the non-fruit "tree" labels and they knew nothing of the ***-ín*** suffix used by Taikon. They did recognize ***pálmo,*** "palm tree" for which they use the Castilian label *palma.* ***Sálka*** was, of course, recognized, but only as the life-form label "tree." They knew "pine tree," but only as "Christmas tree," ***sálka kretšunóski.*** "Apple tree" was glossed as ***sálka phabaiéngi.*** "Fruit trees" could, in general, be glossed by combining ***sálka*** with a genitive form of the fruit which they bear (as in the last example).

Taikon's people made their living by doing metalwork on a contractual basis for the Gaze, as do the Spanish Kalderasa. Hence, the appellation "Coppersmith." The technological vocabularies of the Swedish Kalderasa and the Spanish Kalderasa are very similar. It is highly probable that there is little technological difference between the two groups in the area of metalworking process. The difference between the two groups lies in their typical lifeways. First, the Spanish Coppersmiths adopted the automobile. Second, they opted, years ago, to use the urban center in which they live as a permanent base of operations for their business. The Spanish Coppersmiths have become urban businessmen, who have only sporadic contact with a rural environment—hence, they have been distanced enough from the world of natural things to have lost many individual "tree" names, and, as part of the same process, to have expanded a particular "tree" name into a "tree" life-form, eschewing the wood/tree polysemy of their Swedish predecessors who had a more rural lifestyle.[3]

In Swedish Kalderasitska ***sálka*** is restricted in meaning to "sallow, willow" or "osier." Languages often innovate life-form labels by expanding the reference of folk generic labels (Brown 1984:71 *et seq.)* and frequently "tree" terms develop from extension of the referential range of the label for a tree which is particularly important in a local environment (Brown 1984:60). Sallow, willow and osier trees belong to the genus *Salix* of the cosmopolitan family *Salicacae.* The genus *Salix* contains about 300 species and is of economic importance for materials used in tanning, the manufacture of charcoal, small wooden implements and baskets (cf. Lawrence 1951:447-448). Such activities would certainly have been important with regard to the estate economies in Rumania prior to the 1850s, which is the approximate date of large-scale Rom out-migration from that country.

WOOD AND TREE LABELS IN EUROPEAN ROMANY

In Table 1, forms of ***kaš*** (entry 1334) meaning "wood, tree, stick" and "staff" appear in all but eight of the 47 lexicons searched. These lexicons represent the smaller and therefore least complete vocabularies. Another lexicon (d, after Etzler) lists ***hultrum*** "wood," a German loanword. We have seen that ***kaš*** has its etymon in the Sanskrit *kāṣṭha* which means "piece of wood" or "log." It is unlikely that

Romany developed directly from Sanskrit but it is interesting and significant that in Sanskrit wood/tree polysemy had dissolved into separate terms for "wood" = *kāṣṭha* and "tree" = *vṛksa* (Burrow 1959:161; Sampson 1968 pt. iv:321).

The foregoing is important because it compels one to entertain the hypothesis that all, or some of the ancestors of the Gypsies came out of India, a millennium or so ago, speaking a variety of Romany with separate wood and "tree" terms, the wood term being ancestral to the modern ***kaš*** and the "tree" term consisting of some other Indic word or words. An excellent candidate would be the form ancestral to ***ruk*** and its variants which denote "tree" in 24 of the Gypsy lexicons summarized by Wolf (2801). Of the 16 most complete lexicons searched by Wolf, 12 had ***ruk*** terms for "tree" (see Table). ***Ruk*** also glosses "tree" in the Welch variety of Romany studied by Sampson (1968: pt. iv:321). Sampson (1968) traces ***ruk*** to the Sanskrit *vṛkṣá* or *rukṣa*, both denoting "tree" and gives the Prakrit *rukkha* and the Hindi *rūkh* as cognates. Wolf (444) gives only one other Romany "tree" label of Indic origin: ***daro, daru*** ‹ Hindi *taru;* ‹ Persian *daraxt,* which appears in just one lexicon (5, after Serboianu, in the Table). Two additional "tree" labels are given by Wolf: ***chopácho*** (1493) ‹ Rumanian *copac* "tree," from one Romany lexicon (5, after Serboianu) and ***lithi*** (1784). The first term: ***chopácho,*** involved the direct borrowing of a European "tree" label. For the second label, ***lithi,*** Wolf gives a tentative Eastern and Southeastern European etymology, citing the Albanian *lis,* and its cognates in Serbo-Croatian, Slovak, Czechoslovak, and Polish—all meaning "leaf." Wolf seems overcautious in this case. We are dealing with a wide-spread European word, which is represented in three varieties of Romany (13, after Puchmayer; 10, after Wratislaw; and 8, after Jesina). As noted by Brown (1984:67), plant parts sometimes expand lexically to designate life-forms.

EUROPEAN ROMANY STAGE 4 AND THE INNOVATION OF BUSH

Bor at its cognates represent a frequent label for the life-form "bush" in E.R. Wolf (328) records variants of the label meaning "hedge, bush, grove, wood, forest" and "undergrowth" from 13 varieties of E.R. (11 of which appear in the 16 most representative lexicons), and cites Hindi *būṭā* "bush, shrub;" Persian *bote* "bush, shrub" and Polish *bór* "forest" as cognates. The primary meaning of the label is "hedge" which signifies a "fence or boundary formed by a row of shrubs or small trees planted close together . . ." (WTNID 1976:1048). The secondary meaning "bush" is clear. The tertiary denotation, the (Ger.) *Hain* means "grove" but also a "sylvan glade" as well as a "bosket" = "thicket" and "boscage" = "a growth of trees or shrubs" (NCGD 1958:213; WTNID 1976:257). Clearly, the term signifies referents along two continua, viz., size: (small to large plant) and density: (single plant to assemblage of plants). It would not be imprudent to approach the primary and secondary meanings (which largely coincide with those of the word's Oriental cognates) as being the usual meanings of ***bor*** in E.R.

Wolf (2801) also gives the diminutive of ***ruk*** "tree," ***rukoro*** "little tree," hence "shrub," which appears in one variety of Romany (6, after Colocci (Balk.)), while Sampson records a similar "bush" label for Welch Romany—***bita*** or ***xuredō ruk*** "little tree," beside ***buros.***[4] Two additional "bush" terms of low representation are cited by Wolf:

— (3555) ***túfa*** "bush, shrub, green oak branch" from one lexicon (5, after Serboianu) ‹ Rumanian *tufe* "bush, heath, briar patch" ◂ Latin *tufa* (Cioranescu

1960:863, and identical to the "bush" term in Swedish Kalderasitska, qv., above).

— (2799) ***rugo,*** from two lexicons. In one it means "blackberry, bramble, raspberry and wild rosebush," while in the other "bush," (lexicon 2, beside ***hrgo,*** after Uhlik) ◄Rumanian *rug* "bramble" *(Rubus caesius)* "any thorny bush or shrub" ‹ Latin *rubus* "bramble or blackberry bush" (Cioranescu 1960:708; Leverett 1895:783).

Thus, three European loanwords for "bush" found their way into E.R.; one of which (***tufa,*** above) involved direct borrowing, while two involved lexical expansion of a European generic term (***rugo,*** above and ***bozi*** in Spanish Kalderasitska). But let us return to the etymological status of ***bor.*** Could it have a European origin? Proponents of this point of view might stress the Polish *bór,* "forest" as a form phonetically close to the modern Romany ***bor*** and would suggest a Slavic origin for the term. Sampson (1968:pt. iv:48-49) gives the origin of the Welch Romany ***buros,*** "bush," as "somewhat obscure," but finally doubts a Slavic origin in favor of its being a cognate of the Hindi *būṭā,* "bush," as does Pott and Miklosich (Sampson 1968:pt. iv:49). This is also the view of Wolf (see above). The Hindi cognate is certainly close to ***bura*** (a variant of ***bor,*** which occurs in five of the lexicons in the table).

THE SPANISH KALDERASITSKA BUSH TERM

It will be recalled that the Swedish Kalderasitska cognate for the Spanish Kalderasitska "bush" label ***bózi,*** is ***bózo*** meaning "elder bush." According to G&L (63; 216b) ***bózo*** forms its nominative plural in Romany through the addition of the (Rumanian) ending ***-urea,*** hence ***bózurea*** "elder bushes." Spanish Kalderasa informants, however, state that ***bózi*** is the same in both singular and plural and equate it with the Romany ***sulumá*** "straw(s)," the plural of ***sulúm*** "straw."

Brown (1984:62), in discussing the innovation of "grerb" terms, remarks that in both genetically and geographically separate Mayan and Polynesian language groups, "grerb" terms have evolved from the referential expansion of words denoting "rubbish, garbage, trash, litter, rotten stuff, and the like." A common colloquial meaning of Castilian *paja* "straw" is "a thing of little importance or interest" or "the useless part of something . . . that which remains when what is of value has been selected" (Moliner 1984:ii:604). The climate of the city in which the Spanish Kalderasa live is dry and the vacant lots in its working-class—residential and industrial districts are densely covered with low, dry, straw-colored bushes for a good part of the year. The ground cover of this "worthless" vegetation provides the Gypsies with their primary and enduring notion of "bush". Two processes seem to be going on here. First we see an example of life-form/plant assemblage polysemy and second, we note a reversal of the process of expansion noted by Brown. Instead of a useless and "bothersome" entity expanding to include neutral and even useful plant material, neutral or even useful entities have begun to take on negative meanings due to the special social and ecological environment in which the Spanish Kalderasa speech community finds itself.

MARKING AND THE DEVELOPMENT OF BUSH

The straighforward lexical process which seems to have governed the development of "bush" for European Gypsies entails *marking* in terms of binary opposition according to the dimension of *size*. According to Brown (1984:83 et seq.) unmarked items in a language are shorter, used more frequently, and are *implied* in implicational relationships rather than being the *impliers* in said relationships. Regarding the growth of "bush" terms when "tree" and "grerb" labels are already present in a language Brown (1984:107) contends:

> Usually only after the tree/grerb distinction is made and biggest plans are distinguished from smallest ones, will a bush class be recognized which consists of those botanical organisms that are smaller than the largest plants and larger than the smallest plants in any given environment. Thus tree, grerb, and bush form a marking sequence based on size in which tree is least marked, bush is most marked, and grerb is in between in marking value.

SUMMARY AND CONCLUSIONS

Earlier in this paper I posed the question: Have Gypsy communities, because of their symbiosis with European state societies, adopted the life-form nomenclatures of their Gaze neighbors? Put another way, are the structure and content of Gypsy botanical life-form lexicons best explained by processes of language contact and bilingualism or has an indigenous nomenclature been retained? The answer to this question has several parts:

(1) Regarding the botanical life-form development of E.R., we found that the typical lexicon has three terms viz. "tree," "grass-grerb," and "bush." While there was a "vine" term in Sanskrit (Sampson 1968:pt. iv:88), it appears not to have survived as such in any of the Romany varieties examined. The Stage 4 status of E.R. would seem to be more in accord with the relatively small-scale orientation of Gypsy society than with the Stage 5 or 6 status that tends to occur in large-scale urban societies.

(2) The data presented might support the hypothesis that the ancestors of the European Gypsies left India with native terms for wood and "tree" and less surely for "grass" and "bush." The fact that the Sanskrit etymon for ***tsar*** signified "to roam, graze," might be interpreted as evidence that 1,000 years ago, the Gypsy equivalent of this radical had not consolidated into a nominal label for "grass." Proponents of this point of view might stress the Polish *bor,* "forest" as a form phonetically close to the modern Romany ***bor*** and would suggest a Slavic origin for the term. However, one could also follow Sampson and doubt a Slavic origin for ***bór*** and stress the view that it is a cognate of the Hindi *būṭā,* "bush." Another interpretation, then, would favor the position that a millennium ago the Gypsies left India with fully consolidated terms for "tree," "grass," and "bush."

(3) The most stable life-form related term has been the wood term or ***kas***. Only one European loanword for "wood" found its way into only one Romany lexicon (***hultrum*** in lexicon d, after Etzler). The rest of the terms have been somewhat less stable in that European synonyms, on occasion, have passed into Romany lexicons. Such was the case with the Swedish *gräs* "grass" (d, after Etzler); the Rumanian *túfę* "bush (Swedish Kalderasitska; 5, after Serboianu); and the Rumanian *copac* "tree" (5, after Serboianu).

However, if one considers the percentage of Indic terms (including the terms for wood) which survive in E.R. life-form lexicons, the effect of European contact on E.R. is less important than is the persistence of an indigenous Gypsy life-form nomenclature. If we consider the most complete population of lexicons, i.e., the last 16 cases in the Table, as well as the Kalderasitska and Welch cases, and if we count ***bor*** items as being European loanwords, then 68% of the terms in this population are of Indic origin. If we count the ***bor*** terms as being Indic, then the percentage increases to 84%.[5] If we do not count wood terms in our calculations, the figures are 61% and 81%, respectively. Moreover, although European synonyms were incorporated into the E.R. life-form lexicon, other loanwords were not, but rather represented lexical expansions of European terms. Thus, in Spanish Kalderasitska, the term ***sálka*** was not borrowed with its European meaning "willow, osier, etc." intact, rather, the European term was expanded to signify "tree in general." Likewise the Spanish Kalderasitska "bush" term ***bozi,*** resulted from an expansion of a Rumanian loanword meaning "elder bush." Other examples of European terms which underwent lexical expansion when they were borrowed by Romany were ***lithi*** "leaf," which expanded to "tree" in three lexicons described by Wolf (8, after Jesina; 10, after Wratislaw; and 13, after Puchmayer); as well as ***ṟugo*** "bramble," which expanded into "bush" (2, after Uhlik). Here, the effects of language contact were indirect.

(4) Two closely related varieties of Romany were found to differ in that one, Swedish Kalderasitska possessed wood/tree polysemy while the other, Spanish Kalderasitska, had separate terms for wood and "tree." These two Gypsy societies differ in that the Swedish community led a primarily rural life-style, while the Spanish group are urban Gypsies. This finding from Kalderasitska is in agreement with Witkowski, Brown and Chase (1981) who maintain that presence of wood/tree polysemy correlates with societal scale.

LITERATURE CITED

BROWN, C.H. 1984. Language and Living Things: Uniformities in Folk Classification and Naming. New Brunswick: Rutgers Univ. Press.

BURROW, T. 1959. The Sanskrit Language. Faber and Faber, London.

CIORANESCU, A. 1958-1960. Diccionario Etimologico Rumano. Fascículos 1-5. (Biblioteca Filólogica: Universidad de la Laguna). Gredos, Madrid.

CLAVERIA, C. 1951. Estudios sobre los Gitanismos del Espanol. Revista de Filología Espanola 53. Madrid.

COROMINAS, J. and PASCUAL, J.A. 1983. Diccionario Crítico Etimológico Castellano e Hispánico. 5 vols. Gredos, Madrid.

GJERDMAN, O. and LJUNGBERG, E. 1963. The Language of the Swedish Coppersmith Gypsy Johan Dimitri Taikon. A.-B. Lundequistska Bokhandeln, Uppsala.

LAWRENCE, G.H.M. 1951. Taxonomy of Vascular Plants. The Macmillan Company, New York.

LEVERETT, F. (ed.) 1895. A New and Copious Lexicon of the Latin Language. J.B. Lippincott Company, Philadelphia.

MOLINER, M. 1984. Diccionario del Uso del Español. 2 vols. Gredos, Madrid.

NCGD, 1958. The New Cassell's German Dictionary. Funk and Wagnalls Company, New York. (Karl Bruel and Harold Betteridge, eds.).

SAMPSON, J. 1968. The Dialect of the Gypsies of Wales. Oxford Univ. Press, Oxford. (Originally published in 1924).

VELAZQUEZ de la CADENA, M. 1970. Dictionary of the Spanish and English Languages. Appleton/Century/Crofts, New York.

WITKOWSKI, S.R., C.H. BROWN and P.K. CHASE. 1981. Where Do Trees Come From? Man (N.S.) 16:1-14.

WOLF, S.A. 1960. Grosses Wörterbuch der

"tree:" ***ruk*** (Sampson 1968:pt. iv:321). "grass:" ***čār̊*** (Sampson 1968:pt. iv:56-57). "bush:" ***buros*** (Sampson 1968:pt. iv:48), beside ***bita*** or ***xuredō ruk*** lit. "little tree" (Sampson 1968:pt. iv:321).

[5]In the calculation of these figures, multiple variants of a term (*e.g.* ***r̲ugo, hrgo***) were counted as only one term.

TABLE 1.--*Botanical life-forms in 47 varieties of European Romany (after Wolf, 1960).*

15	*[0.00]*	*Ludolfus:----*	1?
17	*[0.09]*	*Van Ewsum: 2.* ***raeck***	2?
16	[0.09]	Vulcanius: ***kascht***	1?
e	[0.18]	Miskow: ***khas***	1?
i	[0.18]	Barrere-Leland:----	1?
n	[0.18]	Ganander:----	1?
G	[0.27]	Pischel: ***gast***	1?
g	[0.36]	Winstedt:----	1?
R	[0.36]	Beschreibung: ***gascht***	1?
l	[0.36]	Febvre (Romanes): 3. ***tchar, cear***	*?
b	[0.45]	Febvre (Calo): 2. ***carchta*** 3. ***cha***	3?
12	[0.45]	Kruse: ***kascht***	1?
14	[0.45]	Grellmann: ***karscht, kazht*** 2. ***ruk***	2?
f	[0.54]	Palm: ***kast***	1?
L	[0.72]	Tielich:----	1?
a	[0.81]	Calvet: ***kaš***	1?
k	[0.81]	Francis: 2. ***kosh*** 3. ***chaw***	3?
M	[0.09]	Blankenburg: ***gasch*** 2. ***ruck***	2?
P	[0.90]	Rudiger: ***gascht, karscht*** 2. ***rukkes***	2?
11	[0.99]	Borrow (Hung. & Trans.): ***karscht*** 2. ***rook*** 3. ***char***	3?
1	[1.17]	Colocci (Ital.): ***khast(e), kuast*** 2. ***ruc***	2
m	[1.26]	Smart: 2. ***rook*** 3. ***chor***	3
4	[1.35]	Kopernicki: 2. ***kašt*** 3. ***čiar*** 4 ***bur***	4
h	[1.53]	Thesleff: 2. ***kašt, kacht*** 3. ***čar***	3
J	[1.53]	Graffunder: ***gascht*** 2. ***ruk***	2
K	[1.62]	Frenckel: ***kascht*** 2. ***ruk***	2
C	[1.89]	Juhling: ***gast*** 2. ***ruk*** 4. ***bur***	*
7	[2.16]	v. Sowa (Slovak.): ***kašt***	1
c	[2.16]	Iversen: 2. ***kasjt, kasj*** 3. ***kjar***	3
Q	[2.16]	Beytrag: ***kasht, kaahsd*** 2. ***ruck*** 3. ***tschaar***	3
A	[2.16]	Wolf: ***gascht*** 2. ***ruck***	2
3	[2.34]	Rozwadowski: 2. ***kašt*** 3. ***ćār*** 4. ***bur***	4
d	[2.79]	Etzler: ***kasjt, hultrum*** 2. ***ruckan, rubban*** 3. ***tjar, grašå(n)***	3
13	[2.79]	Puchmayer: ***kaszt*** 2. ***lithi*** 3. ***czár*** 4. ***bura***	4
F	[2.97]	v. Sowa (E): ***kašt*** 2. ***ruk*** 3. ***čar***	3
9	[3.33]	v. Wlislocki: ***kast*** 2. ***ruk*** 3. ***cár*** 4. ***bura***	4
H	[4.14]	Liebich: ***gascht*** 2. ***rukk*** 3. ***tschar*** 4. ***porr***	4
N	[4.50]	Bischoff: ***gascht*** 2. ***ruk*** 4. ***porr***	*
E	[4.50]	v. Sowa (W): ***kašt*** 2. ***ruk*** 3. ***čar*** 4. ***bor***	4

LITERATURE CITED (continued)

Zigeunersprache (romani tšiw). Bibliographisches Institut, Manheim.
WTNID. 1976. Webster's Third New International Dictionary of the English Language (Unabridged). G.&C. Merrian Company. Springfield, Massachusetts.

NOTES

[1]I would like to thank the National Endowment for the Humanities for a Summer Stipend which funded some of the fieldwork upon which this paper is based. A grant from the Mellon Foundation, which was administered by Polytechnic University, also aided my fieldwork. I would also express my gratitude to the anonymous reviewers for their careful critique of an earlier draft of this paper. Finally, I thank Chuli.

[2]The data from Wolf must be used with care. The data collected from the Spanish and Swedish Kalderasa as well as from the Welch Gypsies should be considered as representing the "best" data for our purposes, since they were collected under rigorous field conditions from Gypsy informants in three separate communities. Hence, the probability of cross-contamination of these sources is near zero. According to Wolf (p. 36-43), some of the authors of the 47 lexicons, to a greater or lesser degree, copied from each other. This possibility must then be kept in mind when interpreting these data. One way of *minimizing* the probable effects of copying is to use lexicons from geographically distinct areas. The most important data from Wolf are the last 16 (entries 3 through 0 in the Table) and most complete lexicons. These lexicons represent, according to their titles and Wolf's commentary (1960), the speech of Gypsies in: East Germany (F), West Germany (E), Germany (H, N, D, O), Germany and Eastern Europe (B), Rumania (5), Sweden (d), Poland (3), Czechoslovakia (8, 13), Transylvania (9), Austria (10), the Balkans (6), and Serbia and Croatia (2). Except for the German cases, a reasonably wide geographic spread is evident. Further, the probability of copying can be *assessed* by the similarity of each lexicon to the other lexicons in terms of the life-form labels themselves, their orthography, and the diacritical marks they carry. In general, copying should engender great similarity among lexicons. I have not found any two lexicons which are alike in all of these three features. In fact, with a few exceptions, the lexicons are rather dissimilar. Combined with the Kalderasitska and Welch cases the data from Wolf seem sufficient to get a good idea of a typical life-form lexicon in E.R. and a rough idea of the relative contributions of Indic vs. European labels to that lexicon.

[3]A claim could be made that wood/tree polysemy and its lack could be shaped in Gypsy langauges by its presence or lack in the languages of host-states in which Gypsies live. According to Witkowski, Brown and Chase (1981:4) both Swedish and Spanish lack polysemy. However Polish and Russian have it, and Mr. Taikon spent time in both countries, and he is said to have spoken fluent Russian, and imperfect Swedish (G&L 1963:V-VI). A claim has been made by one scholar (Tillhagen, cited in G&L 1963:XX) "that the Gipsy *[sic]* language of Taikon and his tribesmen 'was mixed with Russian words and constructions.' " G&L doubt this, because Slavic words constituted less than 2% of the 3,600 word vocabulary collected from Mr. Taikon. Many Kalderasa communities have Russian backgrounds; they like Russian music and dancing, and keep and use samovars. This is markedly true of the Spanish Kalderasa. Quite a few of their now deceased forebearers, the contemporaries of Taikon, spent time in Russia and spoke Russian. Yet the Spanish Kalderasa thought it very strange to refer to both wood and "tree" by the same word.

[4]Welch Romany plant life-form labels are as follows: wood: ***kåšt, kåš*** (Sampson 1968:pt. iv:138).

TABLE 1.—*Botanical life-forms in 47 varieties of European Romany (after Wolf, 1960).* (continued)

5	[5.14]	Serboianu: ***chásh*** 2. ***daro, daru, chopácho*** 3. ***cear*** 4. ***túfa***	4
D	[5.14]	Finck: ***kašt*** 2. ***ruk*** 3. ***tšār*** 4. ***bor***	4
10	[5.23]	Wratislaw: ***kašt*** 2. ***ruk, lithi*** 3. ***čar*** 4. ***porr, pore, bura***	4
6	[5.23]	Colocci (Balk.): ***kasht, kash*** 2. ***ruk*** 3. ***tchar*** 4. ***rukoro***	4
8	[5.59]	Jesina: ***kašt*** 2. ***ruk, lithi*** 3. ***čar*** 4. ***bura***	4
B	[5.68]	Hrkal: ***kašt*** 2. ***ruk*** 3. ***čar*** 4. ***bor, bur, bura***	4
2	[5.86]	Uhlik: 2. ***kaš*** 3. ***čar, štoro, štaro, šturo*** 4. ***bur, rugo, hrgo***	4
o	[5.95]	Kraus: ***kascht*** 2. ***ruk*** 3. ***tschar, tscharr***	3
	[99.98% total]		

BOOK REVIEW

The Peyote Book: A Study of Native Medicine. G. Mount. Arcata, CA: Sweetlight Books, 1987. Pp. 80, $7.50.

The American Indian has consistently had to fight for his religious right to use the peyote cactus, a completely unaddictive psychoactive drug basic to a cult that has done wonders against alcoholism and other problems and for native respect among American Indians through the Native American Church. Some of our western and southwestern states have enacted oppressive laws against the native religious use of peyote, quite against Federal laws that permit its ceremonial use.

This little book should be had by anyone interested in the ethnobotany of peyote and in the rights of a true minority to practice its own inoffensive religious practices based on an inoffensive plant.

Richard Evans Schultes
Professor Emeritus
Botanical Museum of Harvard University
Cambridge, Massachusetts 02138

J. Ethnobiol. 8(2):185-194 Winter 1988

ETHNOBOTANY OF LADAKH (INDIA) PLANTS USED IN HEALTH CARE

G. M. BUTH and IRSHAD A. NAVCHOO
Department of Botany
University of Kashmir
Srinagar 190006 India

ABSTRACT.—This paper puts on record the ethnobotanical information of some plants used by inhabitants of Ladakh (India) for medicine. A comparison of the uses of these plants in Ladakh and other parts of India reveal that 21 species have varied uses while 19 species are not reported used.

INTRODUCTION

Ladakh (elev. 3000-5900m), the northernmost part of India is one of the most elevated regions of the world with habitation up to 5500m. The general aspect is of barren topography. The climate is extremely dry with scanty rainfall and very little snowfall (Kachroo *et al.* 1976). The region is traditionally rich in ethnic folklore and has a distinct culture as yet undisturbed by external influences. The majority of the population is Buddhist and follow their own system of medicine, which has been in vogue for centuries and is extensively practiced. It offers interesting insight into an ancient medical profession.

The system of medicine is the "Amchi system" (Tibetan system) and the practitioner, an "Amchi." The system has something in common with the "Unani" (Greek) and "Ayurvedic" (Indian) system of medicine. Unani is the traditional system which originated in the middle east and was followed and developed in the Muslim world; whereas the Ayurvedic system is that followed by Hindus since Rig vedic times. Both are still practiced in India. Though all the three systems make use of herbs (fresh and dry), minerals, animal products, etc., the Amchi system, having evolved in its special environment, has its own characteristics. A prescription in the system usually consists of 2 to 5 herbs combined in various ways, supplemented by certain unique rituals. The individual expertise (or whim) of the Amchi is often the deciding factor for the dose and supplementary advice. In actual practice, the system is complicated and has to be learned after long years of study and training under experienced Amchis. The profession of an Amchi is a family affair and the knowledge passes from father to son. There are no institutions and no formal Amchi education. When an apprentice wants to be declared a full-fledged Amchi and practice independently, his guide, who is often his own father, calls a few experienced Amchis who conduct a sort of *viva-voce* examination. If the performance is satisfactory the apprentice is declared fit for practicing as an Amchi.

In view of the importance of the Amchi system over a vast tract of J&K state (India), efforts were made to collect and collate all available information on it to assess its relevance to the changing socio-cultural scenario in these highlands. This paper records medicinal uses of 40 plant species growing in the region.

METHODS

Periodic surveys of ethnic groups in remote areas of Ladakh have been conducted during a two and a half year period ending in October, 1986. The areas surveyed include:

1. Leh and adjoining villages .... 1-15th Aug. 1985
2. Diskit (Nubra valley) .... 16th-30th Aug. 1985
3. Lungna .... 15th-30th Sept. 1985
4. Panamik (Nubra valley) .... 15th May-2nd June 1986
5. Numa (Changthang) .... 5th-15th June 1986
6. Chumathang .... 1st-14th July 1986
7. Khalsi .... 16th-31st July 1986
8. Likir and Tamisgam .... 1st-10th Aug. 1986
9. Himis .... 12th-30th Aug. 1986
10. Himia .... 21st-30th Sept. 1986
11. Dumkhar .... 1st-7th Oct. 1986
12. Khardungla and Khardung .... 8th, 9th, 10th Oct. 1986
13. Pullu .... 12th, 13th Oct. 1986
14. Saspul and Nimu .... 14th, 15th, 16th Oct. 1986
15. Durbung .... 18th-25th Oct. 1986

The ethnobotanic information was gathered on fresh as well as dried plant specimens in the field through field interviews, conducted daily. On the final day of a survey, group discussions with knowledgeable old people, local priests (Lamas) and village heads were conducted to check uniformity of opinion regarding various uses of plants. Final confirmation was made by discussions with Amchis (local medicine men) and also through visits to the Amchi Research Center Leh (Ladakh).

After completion of field data, the dried specimens were identified in KASH (Kashmir University herbarium) using Hooker (1872-97), Kachroo *et al.* (1976), and Stewart (1917 and 1972). Voucher specimens are deposited in KASH.

ETHNOBOTANY

The species used medicinally in Ladakh (India) are arranged alphabetically. For each species the botanical name, family, voucher number, localname (in quotation marks) and curative use(s) are given.

Allium stoliczkai Regel — Alliaceae (IN 21)

"Skotse." The decoction of the dried bulb is given to women after delivery for energy. A decoction of the leaves is considered a remedy for constipation.

Anthriscus nemerosa Spreng. — Apiaceae (IN 1130)

"Sunak." The sun-dried plants are powdered. It is claimed that the smoke of the powder, when inhaled, cures rheumatism and inflation.

Aster diplostephoides Benth. — Asteraceae (IN 168)

"Utpal Vanpo." Dry or fresh flower heads are boiled in milk with a little sugar. The decoction is administered to patients suffering from cough and a low rate of respiration.

Astragalus zanaskariensis Benth. Papilionaceae (IN 39)

"Chisigma." The sun-dried roots are powdered. The powder is dissolved in luke warm milk and given to expel intestinal worms. The extract of fresh roots is claimed to be effective against ring worm.

Berberis ulicina HK.f.&T Berberidaceae (IN 146)

"Sinskingnama." The dried fruits are administered orally against ring worm.

Capparis spinosa Lamk. Capparidaceae (IN 77)

"Kabra." The leaves are placed in water for 2-3 days with continuous changing of water. Then leaves are boiled in fresh water with a little salt and given against hyperacidity and other stomach troubles.

Caragana moorcroftiana Benth. Papilionaceae (IN 55)

"Takay vonpo." Fresh leaves are boiled in milk and cooled. Taken in the morning for a week, it is claimed to act as a blood purifier. The dry leaves are used as an antiseptic in powdered form.

Carduus nutans Linn. Asteraceae (IN 51)

"Jangchar." Fresh leaves and roots are chewed to initiate vomiting in cases of indigestion.

Carum carvi Linn. Apiaceae (IN 34)

"Kajnut." Leaves and fruits are boiled in water and cooled. The extract is taken as an antiacid and against digestive ailments. Bath in extract is claimed to cure rheumatism.

Centauria depressa M.Bieb. Asteraceae (IN 12)

"Vasaka." Luke warm extract of fresh leaves and seeds is used against cough, chest pains and fever.

Chenopodium album Linn. Chenopodiaceae (IN 14)

"Janchikarpo." Leaves are boiled in water and cooled overnight. It is given against gastric troubles. An extract from seeds is used as a diuretic.

Delphinium brunonianum Royle Ranunculaceae (IN 62)

"Chargosposz." Fresh leaves are crushed in a little water and made into a paste. the paste is given with bread against malaria.

D. viscosum Hk.f.&T. Ranunculaceae (IN 1261)

"Bilamonokh." The fresh shoots and leaves are made into a paste. The paste is applied as a poultice on inflamed joints to relieve pain and edema.

Ephedra gerardiana Wall. Ephedraceae (IN 5)

"Sephat." The decoction of aerial parts is used against bronchial troubles and liver diseases. It is also claimed to cure irregularities of menustration.

Hippophae rhamnoides Linn. Elaegnaceae (IN 2)

"Shraman." Regular consumption of fresh fruits is claimed to be effective against asthma.

Jaeskea oligosperma (Grisb.) Knobl. Gentianaceae (IN 1189)

"Tikta." The plants are consumed raw or sometimes prepared in milk and it is claimed to act as a blood purifier.

Juglans regia Linn. Juglandaceae (IN 69)

"Starga." The dry kernal is roasted directly on fire and used for treatment of constipation. Bark in powder form is used as tooth powder.

Juniperus macropoda Boiss. Cupressaceae (IN 1168)

"Shukpa." The extract of fresh seeds along with seed extract of *Polygonum hydropiper* is used as diuretic.

Lactuca sativa Linn. Asteraceae (IN 41)

"Dums." Leaves are boiled in water with salt and allowed to cool. They are crushed and used against fever. Sometimes used against lack of appetite.

Lepidium latifolium Linn. Brassicaceae (IN 1261)

"Seoji." The plants are crushed and made into a paste and applied as a poultice to cure rheumatism.

Morina longifolia Wall. Morinaceae (IN 801)

"Agzaima." Seeds are crushed to obtain oil which is claimed to be a nutritive for children of 3-6 years of age.

Myricaria germanica (Linn.) Desr. Tamaricaceae (IN 166)

"Umboo." A decoction of leaves is taken as a blood purifier.

Nepeta brachypetala Benth. Lamiaceae (IN 71)

"Tiyanko." Seeds are dried, powdered and boiled in water. On cooling, the extract is used against hyperacidity.

Onosma hispidum Wall. Boraginaceae (IN 61)

"Deemok." Fresh roots and leaves are boiled in milk and stored overnight. The decoction, if taken before breakfast, is claimed to stop blood vomiting and act as a blood purifier.

Oxyria digyna (Linn.) Hill. Polygonaceae (IN 1199)

"Chumcha." The shoots are kept in lukewarm water and taken in the morning as an appetizer.

Pedicularis oederi Vahl. Scrophulariaceae (IN 108)

"Lugrusserpo." The fresh seedlings are consumed raw in case of food poisoning.

Plantago asiatica Linn. Plantaginaceae (IN 1197)

"Karache." The cooked or boiled leaves are used as a blood purifier.

P. Himaliaca Linn. Plantaginaceae (IN 106)

"Tharum." Dried seeds in powdered form is dissolved in curds and used to cure diarrhoea.

Polygonum Hydropiper Linn. Polygonaceae (IN 301)

"Chumerche." The seeds are placed in water and boiled for 2-3 days. On cooling, the extract is used as a diuretic and to decrease obesity.

Prunus aremeniaca Linn. Rosaceae (IN 431)

"Phating." Oil extracted from the seeds (kernals) is given to women after delivery for energy. It is also used to stimulate growth of long, healthy hair.

Saussurea taraxicifolia Wall. Asteraceae (IN 171)

"Psangijarpachan." The sundried rhizomes are powdered and added to preboiled milk. It is kept as such for 1-3 days and then used against fever.

Saxifraga flagellaris Willd. Saxifragaceae (IN 166)

"Teetasarzing." Fresh aerial parts are crushed on a stone, a little water is added so that a paste is formed. It is applied on cuts and wounds as an antiseptic.

Scutellaria heydei Hk.f Lamiaceae (IN 113)

"Jimthiglae." Aerial parts are dried near fire and then powdered. An extract of the powder in water is used against eye trouble. The powder with curds is used as a diuretic.

Sedum tibeticum Hk. f. & T. Crassulariaceae (IN 435)

"Sholo." Dry leaves in semicrushed form are used with curds as diuretic. It is also used to decrease obesity.

Senecio kraschenninkovii Schich. Asteraceae (IN 1193)

"Unarswah." Fresh leaves are crushed and made into a paste. The paste is applied on the forehead to relieve headache and is sometimes used as a poultice on inflamed parts to relieve pain.

Sisymbrium orientale Linn. Brassicaceae (IN 1150)

"Staga." The powdered seeds are rolled into small tablets with butter or milk and used as an appetizer and carminative.

Swertia petiolata Royal ex. D. Don Gentianaceae (IN 1139)

"Zantik." The decoction of whole plant in milk is used against headache and bodyache.

Thalictrum minus Linn. Ranunculaceae (IN 42)

"Chak-achoo." The aerial parts are kept in water for several days and boiled. The cooled extract is used as an eye sterilizer, also to cure gout and rheumatism.

Waldhemia stoliczkai (Cl.) Ostenf. Asteraceae (IN 1175)

"Solo-marpo." The decoction of shoots and leaves is used in headache, fever and bronchial troubles. The extract is claimed to act as a blood purifier.

W. tomentosa (Dcne.) Regd. Asteraceae (IN 160)

"Solo-kerpo." Achenes are consumed raw in acidity. The crushed, fresh leaves are applied as a poultice in arthritis.

DISCUSSION

Amchi System.—The region is rich in ethnic folklore and has its own deep rooted traditions which have been protected through centuries and are still practiced. The Amchi system is one of these traditions. It has been derived from the original

Tibetan system of medicine and whatever has been noted centuries ago is practiced even now, with some modifications here and there. The literature is in the Tibetan language and is not printed.

The people of Ladakh have lived in isolation for centuries though some eminent travelers like Fa-Hien (400 A.D.), Hyder Duglat (1534), Moorcraft (1819-1825), Cunningham (1864) have visited the region occasionally (Kachroo 1980). Howeve, in 1974 Ladakh was formally opened to tourists. Modern amenities and facilities were introduced in the region which gradually initiated a change in the way of the life of Ladakhis. Medical facilities have also been provided but these are too few to meet the demands of the people scattered over such a vast track of land. The people are therefore largely dependent on Amchis, who are usually found in almost every village, even in places like Taksha, Tsaga, Tsemtsen, etc., which are more than 250 kms away from the headquarters of the region.

The Amchis enjoy more confidence than modern allopathic doctors, who are usually non-residents and cannot speak the Ladakhi language. Even though all the amchis are Buddhists, Muslims have equal faith in them. People who have personal experience with the system as patients, testify to certain miraculous cures where the modern allopathic system has failed to do them any good. There is no doubt that these experiences are authentic (Kachroo 1980), which probably accounts for the Ladakhi people not having fully accepted the allopathic system as an alternative to the Amchi system.

On professional visits, the Amchis carry a long, rectangular leather box around the middle of which is fixed a broad strip of leopard skin. It is believed that this strengthens the potency and efficacy of the drugs inside. The case usually contains different drug preparations in small leather bags which are provided to patients free, thus the treatment becomes cheaper and drugs easily available.

HERBAL MEDICINE

A large number of herbs, usually in combinations of 2-5, are used in the Amchi system of medicine. Often minerals, mineral water, treatment with water from hot water springs, brandings with red hot metals or burning vegetable matter (cauterization or moxibustion), puncturing of veins and mysticism (prayers) are recommended along with these herbs either to supplement their effect or to correct the undesirable effect. It, therefore, becomes difficult to distinguish physical effects of plant medicine from the psychological effects of accompanying rituals. The prescription for the treatment of a particular ailment is known as "yoga."

Some of the herbs have become popular with the Ladakhi's. The people are so familiar with these herbs that it becomes easy for them to collect and prepare desired combinations of these herbs on Amchi's advice. These are often seen preserved in every household to be prescribed or used for ailments like bronchial trouble, digestive and stomach ailments and eye trouble which are common in the region. Sometimes preparations from these plants are administered to patients without consulting the Amchi. These herbs include: *Astragalus zanaskariensis, Capparis spinosa, Carduus nutans, Carum carvi, Chenopodium album, Lactuca sativa, Nepeta brachypetala,* and *Plantago himaliaca.*

Comparison of plant use in Ladakh with other parts of the country are given in Table 1. The study revealed that only 6 species are used for the same or similar ailments in other parts of the country. These are *Carum Carvi, Ephedra gerardiana, Juglans regia, Nepeta brachypetala, Polygonum hydropiper* and *Thalictrum minus.* Some herbs used medicinally in Ladakh are used for other than medicinal purposes elsewhere in the country. These are *Chenopodium album, Juniperus macropoda, Lactuca sativa, Lepidium latifolium, Morina longifolia, Myricaria germanica, Oxyria digyna, Prunus armeniaca,* and *Sedum tibeticum.*

These studies also reveal that 10 species, although found in neighboring countries (e.g., Pakistan, China (Tibet) and Soviet Central Asia), are restricted to Ladakh only. Of course, four species are specifically used for diseases like ringworm, constipation, food poisoning and arthritis. These include *Berberis ulicina, Allium stoliczkai, Pedicularis oederi* and *Waldhemia tomentosa.* The remaining six species have varied medicinal use.

A perusal of the literature also revealed that nine species are exclusively used in Ladakh as herbal medicine. These are: *Aster diplostephoides, Anthriscus nemerosa, Delphinium viscosum, Jaesckea olgosperma, Plantago himaliaca, Saxifraga flagellaris, Scutellaria heydei, Senecio kraschennikovii, Sisymbrium orientale, Swertia petiolate* and *Waldhemia nivea.*

Table 1. *Comparison of uses of plants in Ladakh and other parts of India.*

(1) Plant Species	(2) Use in Ladakh (Present study)	(3) Use in other parts of India	(4) Reference
Allium stoliczkai	For energy and as a remedy for constipation	Not reported	—
Anthriscus nemerosa	Against rheumatism and inflation	Not reported	—
Aster diplostephoides	Against cough and low rate of respiration	Not reported	—
Astragalus zanaskariensis	Against worms	Not reported	—
Berberis ulicina	Against ringworm	Not reported	—
Capparis spinosa	Against hyperacidity	As a vegetable in western India diuretic & expectorant	Vertak, 1980 Ann. Vol. II, 1950
Caragana moorcraftiana	As a blood purifier and antiseptic	Not reported	—
Carduus nutans	To initiate vomiting	Flowers as a blood purifier	Ann. Vol. II, 1950
Carum carvi	Against digestive ailments & rheumatism	Against rheumatism As a spice	Vishnu-Mittre 1980 Ann. Vol. II, 1950
Centauria depressa	Against cough and chest pains	Not reported	—
Chenopodium album	Against gastric trouble	Seed as substitute for rice. Leaves as a vegetable	Dam & Hajra, 1980 Ann. Vol. II, 1950

Table 1. *Comparison of uses of plants in Ladakh and other parts of India.* (continued)

(1) Plant Species	(2) Use in Ladakh (Present study)	(3) Use in other parts of India	(4) Reference
Delphinium brunonianum	Against malaria	As a cardiac and respiratory depressant	Ann. Vol. III, 1952
D. viscosum	To relieve pain and oedema	Not reported	—
Ephedra gerardiana	Against bronchial and liver diseases	Against bronchial trouble in Northern India	Jain, 1980 Ann. Vol. III, 1952
Hippophae rhamnoides	Against Asthma	Against lung complaints. Against cutaneous eruptions	Gupta, 1980 Ann. Vol. V, 1959
Jaesckea oligosperma	As a blood purifier	Not reported	—
Juglans regia	As tooth powder and treatment of constipation	Leaves for cleaning teeth, wood for furniture	Ann. Vol. V, 1959
Juniperus macropoda	As a diuretic	Wood for building construction works	Ann. Vol. V, 1959
Lactuca sativa	As a appetizer and against fever	As a salad plant	Ann. Vol. VI, 1962
Lepidium latifolium	Against rheumatism	As a fodder in Kashmir	Ann. Vol. VI, 1962
Morina longifolia	As a tonic	As an incense	Ann. Vol. VI, 1962
Myricaria germanica	As a blood purifier	As fuel/fodder in Northern India	Jain, 1980
Nepeta brachypetala	Against hyperacidity	Against hyperacidity in Eastern India	Vishnu-Mittre 1980 Gupta, 1980
Onosma hispidum	As a blood purifier	Cardiac stimulant For coloring food stuffs	Ann. Vol. VIII, 1969
Oxyria digyna	As an appetizer	As a salad plant	Ann. Vol. VII 1966
Pedicularis oederi	Against food poisoning	Not reported	—
Plantago asiatica	As a blood purifier	Against inflamatory conditions of urine/ genital tract	Ann. Vol. VIII, 1969
P. himaliaca	Against diarrhoea	Not reported	—

Table 1. *Comparison of uses of plants in Ladakh and other parts of India.* (continued)

(1) Plant Species	(2) Use in Ladakh (Present study)	(3) Use in other parts of India	(4) Reference
Polygonum hydropiper	As a diuretic and to decrease obesity	For fishing in Eastern India As a diuretic	Joseph & Kharkongor, 1980 Ann. Vol. VIII, 1969
Prunus armeniaca	For energy and to stimulate growth of long hair	As a fruit and for extraction of oil	Ann. Vol. VIII, 1969
Saussuria taraxicifolia	As a remedy for fever	Not reported	—
Saxifraga flagellaris	As an antiseptic	Not reported	—
Scutellaria heydei	Against eye trouble and as a diuretic	Not reported	—
Sedum tibeticum	As a diuretic	As a pot herb	Ann. Vol. IX, 1972
Senecio kraschennikovii	To relieve pain and headache	Not reported	—
Sisymbrium orientale	As a carminative and appetizer	Not reported	—
Swertia petiolata	Against headache and bodyache	Not reported	—
Thalictrum minus	As an eye sterilizer and against gout and rheumatism	As a source of dye As a conjuctivitis in several parts	Vishnu-Mittre 1980
Waldhemia stoliczkai	Against headache, vomiting, fever, cold, cough and a blood purifier	Not reported	—
W. tomentosa	Against acidity and in arthritis	Not reported	—

CONCLUSION

The Amchi system is an age-old medicinal system developed in Tibet. The literature is in Tibetan language and is not printed. The people have more faith in this system than the allopathic system of medicine. Large numbers of herbs are used for the purpose and are often accompanied by certain specific rituals. The herbs listed in this paper give a mere indication of the association of a particular herb with a particular ailment. Like other systems, the Amchi system of medicine may have its merits and demerits, but it is very rich and offers an interesting study. Some of its more important aspects may be tested in the light of modern scientific knowledge. Botanists can play an important role in establishing the correct identity of drugs. This may bring to light some very rare and unknown medicinal plants which grow wild here. The development, conservation and utilization on a scientific basis can help in socio-economic development of the region.

LITERATURE CITED

ABROL, B.L. and CHOPRA, I.C. 1962. Some vegetable drug resources of Ladakh (Little Tibet). I. Curr. Sci. 31. 324.

ANONYMOUS. 1950-1972. Wealth of India Vol. I-XII, CSIR, New Delhi.

DAM, D.P. and HAJRA, P.K. 1980. Observation on ethnobotany of Monpas of Kameng, Pp. 107-114. *In* Glimpses of Indian Ethobotany. (S.K. Jain, ed.). IBH New Delhi.

GUPTA, S.P. 1980. Folklore about medicine with reference to Munda. Culture, Pp. 199-207. *In* Glimpses of Indian Ethnotany. (S.K. Jain, ed.). IBH New Delhi.

HOOKER, J.D. 1872-1897. Flora of British India, Vol. 1-7. L. Reeve & Co., London.

JAIN, S.K., ed. 1980. Glimpses of Indian Ethnobotany, IBH New Delhi.

JOSEPH, J. and KHARKONGOR, P. 1980. A preliminary ethnobotanical survey in the K. Khasi and Jaintia Hills, Pp. 115-123. *In* Glimpses of Indian Ethnobotany. (S.K. Jain, ed.). IBH New Delhi.

KACHROO, P., SAPRU, B.L. and DHAR, U. 1976. Flora of Ladakh, BSMS Dehradun.

KACHROO, P., ed. 1980. Ladakh—an integrated survey, University of Kashmir, Sringagar (INDIA).

STEWARD, R.R. 1917. Flora of Ladakh and Western Tibet, Bull. Tor. Bot. Club. 43:571-590.

__________. 1972. Flora of West Pakistan and Kashmir. An Annonated Catalogue of Vascular Plants of West Pakistan and Kashmir. Fakhri Press, Karachi.

VARTAK, V.D. 1980. Observation on wild edible plants from hilly regions of Maharashtra and Goa, Pp. 261-271. *In* Glimpses of Indian Ethnobotany. (S.K. Jain, ed.). IBH New Delhi.

VISHNU MITTRE. 1980. Wild plants in Indian folk-life a historical perspective, Pp. 37-58. *In* Glimpses of Indian Ethnobotany. (S.K. Jain, ed.). IBH New Delhi.

__________. 1983. The uses of wild plants and the process of domestication in Indian subcontinent, Pp. 281-291. Proc. Intt. Symp., IBH New Delhi.

THE UTILIZATION OF INSECTS IN THE EMPIRICAL MEDICINE OF ANCIENT MEXICANS

DRA. JULIETA RAMOS-ELORDUY DE CONCONI
M. EN C. JOSE MANUEL PINO MORENO
Instituto de Biologia
Universidad Nacional Autoñoma de México
Apartado Postal 70-153
04510 México 20, D.F. CP. México

ABSTRACT.—Since early times humanity has been concerned with the medicinal properties of animals in its surroundings. With the passage of time, many animals along with their presumed medicinal attributes have been registered in various post-conquest historical writings, e.g., codices. Many species of insects form part of the materia medica of some Mexican cultures, in some cases have mystical and magical properties. To date we have noted 43 species of insects employed in traditional medicine as ointments, pomades, or infusions. They have also been prepared and applied, in various ways in order to alleviate such ailments as stomach distress, kidney and liver disorders, nervous breakdowns, and urogenital, inmunological, and glandular diseases.

INTRODUCTION

Since early times in Mexico, many species of insects, along with a large number of species of plants, have been recognized as possessing curative properties. The Aztecs and several other indigenous groups had knowledge of what might be termed ''medicinal insects'' (De Asis 1982; Meza 1979; Sahagun 1980). Many species of insects have played important roles in the mysticism and magic inherent in many Mexican cultures as well as in the treatment of a variety of illnesses. (Aguirre 1947; Clavijero 1980).

Knowledge of medicinal insects and their uses has persisted in many rural areas today, having been passed down from earlier practitioners of this healing art. Insects are sold in the markets of some towns and various insects parts are said to be useful as diuretics, analgesics, anaesthetics, aphrodisiacs, etc. Considering that the number of rural areas where this knowledge survives is reduced each year and that in some regions the diversity of insects is available only during certain seasons of the year, it is important to study the insects associated with the empirical medicine of past and contemporary Mexican cultures. We feel it is imperative to learn about and develop indigenous medicine since it utilizes almost exclusively natural products with minimal side effects.

MATERIALS AND METHODS

The majority of the insects mentioned in the present work are reported in the Florentine Codex (Sahagun 1980). Others are found in Hernandez (1959) and De Asis (1982). The insects in these historical sources were indentified by comparing their descriptions with the specimens deposited in the Scientific Collection of the Biology

Institute of the Universidad Nacional Autónoma de México (UNAM). Behavioral characteristics, nest type, location, and other details described in the codices are also considered. Since many of the descriptions in the codices were incomplete, we encountered some difficulty with this means of identification.

We solicited supplemental information and made collections of insects in the field among different cultures as Nahoas, Otomies, Mixtecos, Zapotecos, Mayas, Lacandones, Tarascos, Purepechas, Mazahuas, etc. in several states of Mexico. A number of people living in different rural communities were interviewed about the types of insects they used for medicinal purposes and how, when, for what illnesses or conditions preparations of these insects could aid in treatment. All specimens of insects collected were identified at the Laboratory of Entomology, Institute of Biology, UNAM. They were deposited in the Scientific Collection of the Institute of Biology, along with the collections of edible insects of Mexico.

RESULTS AND DISCUSSION

The 43 species of medicinal insects were identified, based upon the studies of the codices and field work. They belonged in 16 families in six orders and include grasshoppers, locusts, crickets, bugs, mealybugs, beetles, butterflies, ants, and bees. The number of insects per order varies from nine in the Hymenoptera (bees, wasps, and ants) to only three in the Lepidoptera (butterflies). Although, for the most part, insects were used in the adult stage, it must be mentioned that usually only certain parts of any given species of insect were considered efficacious and were employed in the medicinal preparation. In the case of bees, honey, the propolis, and royal jelly were all used.

In the following section, various insects will be discussed regarding parts used, preparation, administration, and illnesses treated. In many cases information recorded by other authors was verified by us in the field.

Grasshoppers, Sphenarium spp., Taenipoda sp. Melanoplus sp. (Orthoptera, Acrididae) ***(Chapolin** in Nahuatl).* The hind legs of grasshoppers were crushed and mixed with water, then drunk as a powerful diuretic to treat kidney diseases. The infusion, which is said to have refreshing properties, reduces swelling (De Asis 1982). Rural people in the State of Oaxaca today use grasshoppers to treat certain intestinal disorders.

Locusts, Schistocerca spp. These insects were pulverized and eaten as a dietary supplement to alleviate nutritional deficiencies (FAO 1973) and to fortify the blood. It was also reported to be helpful in cases of postchildbirth anemia and in lung diseases, e.g., asthma and chronic cough.

Crickets, Acheta domestica. (Orhoptera, Gryllidae). Crickets legs were prepared like those of grasshoppers and were employed as a diuretic for dropsy (edema) (Barajas 1952; Conconi 1982; De Asis 1982).

Bugs., (Hemiptera Pentatomidae) Euchistus spp., Edessa spp., Atizies sp. and (Stink bugs), (Hemiptera, Coreidae), Acanthocephala spp., (Leaf-footed bugs) ***(Xomitl-Jumiles** in Nahuatl).* The oil of the bugs obtained in these four taxa was applied externally in treating Scrofula and other tubercular diseases and was also used for kidney, liver, and stomach ailments. When alive, these bugs are a powerful analgesic and anaesthetic against toothache and rheumatic and arthritic pain or to alleviate gastrointestinal diseases.

It was also used to treat goiter and was recommended for those with a weak constitution and as an aphrodisiac (Ancona 1933; De Asis 1982; Taylor 1975). Contemporary people of rural areas in the State of Guerrero use them against Bocio disease, perhaps because of the large amount of iodine they contain.

Xamues, Pachilis gigas. (Leaf-footed bugs). These insects were roasted and powdered and utilized in whooping cough cases (Meza 1979), eating the entire body. This could be because of their nutritional value and the quantity of vitamins they contain.

Mealybugs, Coccus axin. (Homoptera coccidae). Known as "Aje," mealybugs can be considered a multi-purpose medicinal and useful insect. In addition to their use as an ointment (Jenkins 1964), varnish, or perfume, whole insect bodies were boiled to produce a sticky mass which was placed over lesions of leprosy and other skin conditions and to treat muscular pain, chronic itching, mange burn, or scars. It aids in the healing of burns through reducing excessive swelling and inflammation and thus is said to be helpful in heat strokes and diseases of fluid imbalance such as dropsy. The mass of boiled mealybugs was sometimes ingested to alleviate the affects of poisonous mushrooms and other fungi, or diarrhea and to clean the teeth (Herrera 1871). *Dactylopius coccus,* known as "grana" mealybug, is mostly used as an agent to color or redden tissue or foods. It, too, can be boiled to produce a sticky mass and used, as discussed above, as a skin treatment, a tooth powder to clean teeth and in the treatment of caries (Lopez 1971; Mexa 1979).

Beetles, Coleoptera, Meloidea, Buprestidae. Derived from the Nahuatl ***Tetl*** (fire) and ***Ocuillin*** (worm), several species have been used in Mexico as an aphrodisiac in a manner similar to that of the well-known Spanish fly *(Lytta vesicatoria).* Larvae of these beetles are roasted or crushed, mixed with water then drunk to treat urogenital disorders. It is equally well-known as a stimulant (love potion) for lovers (Asis 1982; Meza 1979; Robelo 1904).

Tlalomitl, a corruption of the Nahuatl ***Tlalli*** (bone) and ***Omitl*** (worm), are actually larvae of several species in the Elateridae. Before being eaten alive or roasted (Lopez 1972), they are hard, rigid and worm-like in appearance. They never bend and are used to alleviate impotence in men and are said to strengthen a faint penis. One species, *Strategus julianus, (Scarabeidae, Dynastinae)* known as a little bullfight because the male has three horns on its head, is prepared as a drink to increase sexual performance (Hernandez 1959).

Butterflies, Lepidoptera. "Meocuilin" is the common name for *Aegiale (Acentrocneme) hesperiaris, (Megathymidae),* the white agave worm. It comes from the Nahuatl terms ***Metl*** (Agave) and ***Ocuilin*** (worm). Having an appearance of white worms, they are eaten alive for their reputed aphrodisiac properties as well as for stomach disorders and rheumatic diseases.

Phasus spp. (Hepialidae), known as "gusanillo" (little worm), are said to have aphrodisiac properties. In Oaxaca, Veracruz and Chiapas states where it is eaten alive or roasted, it is used against gastrointestinal diseases such as dysentery, especially in children (Conconi 1982). Also, in rural areas it is used as an ointment for cracked lips or for dry skin.

Bombyx mori (Bombycidae). The boiled larvae were used in a variety of ailments, e.g., apoplexy, aphasy, bronchitis or pneumonia, and convulsions. The boiled pupae were used to treat hemorrhages and to alleviate polyuria or frequent urination. Excrements of the pupae are eaten to alleviate vomiting and diarrhea brought on by cholera, and to improve circulation.

Hymenoptera, several species of ants (Formicidae). Honey ants, *Myrmecosistus* spp. or ***necauzcatl,*** derived from the Nahuatl terms for ***Necu*** (honey) and ***azcatl*** (ants), are important because of the healing qualities of its honey. Produced and stored in the bodies of certain classes of the worker caste of these ants, the honey was fermented and drunk for its anti-inflammatory and anti-fever properties. The honey was also applied directly as a pomade for eye diseases, cataracts or growths over the iris called pterigions. The fermented drink was considered a sacred drink in religious ceremonies among many cultures, e.g., the Aztecs and Toltecs (Brygoo 1946; Kunckell de Herculais 1885-1886).

The mandibles of worker caste adults *Atta* spp. were used after surgery to close wounds. Several ants were positioned so their bites would pierce the skin on either side of the wound. The heads were then separated with the mandibles acting as sutures. Secretions from the salivary glands were reputed to have antibiotic properties, preventing infections.

Pogonomymex sp. The venom of these ants was used to cure rheumatic diseases. Ants were positioned on the afflicted part of the body, and allowed to sting. The venom penetrated directly into the bloodstream and in this respect resembled an intramuscular injection. Its efficacy in treating rheumatism, arthritis, and poliomyelitis is related to its immunological reaction. Even today in rural areas of Mexico with arid zones, this ant is used with the same purpose.

Bees, (Apidae) several species in three genera of Apidae. Melipona spp. The bees in this genus were so important to the Maya that they created a god, named A Much Keba, for them. The Maya prepared a sacred drink (''Balche'') from the honey. It was also known as ''Water of Youth.'' After fermentation, the honey was drunk and used against internal parasites such as intestinal worms (Favre 1968).

Trigona sp. The honey produced by this species was known as ''virgin honey.'' It was used (and still is in Huejutla, Hidalgo) for regulating menstruation, decreasing post-childbirth aches, and as a health restorative in the elderly.

Apis mellifera, the well-known honey bee, produces abundant honey which was and is applied to the skin for such conditions as excessive scar tissue, rash, and burns. In addition, it was prepared as a plaster or poultice for eye infections. It was consumed as a food supplement, for digestive problems, and as a general health restorative. When heated, it was taken for head colds, catarrh, cough, throat infections, laryngitis, tuberculosis, and lung diseases.

The venom of honey bees has, for more than a century, been utilized intramuscularly through direct stings of live bees to the part of the body afflicted by arthritis, rheumatism, and polineuritis. The frequency, dosage and duration of the treatment varies according to the disease and degree of development, for example, arthritic pain requires large dosages while asthma needs only a small one. Venom is gathered from both snakes and bees in much the same way; it is prepared in different concentrations and applied by injection. However it is necessary to know before-hand if the patient is allergic because this preparation is a powerful medicine (Partheniu 1981).

Propolis is a resinous, adhesive substance elaborated by bees to serve as a cementing material. It is often deposited on the buds of trees and other plant surfaces. The substance is now known to contain many hormones and, together with enzymes from bee saliva is thought to have antibiotic, bactericidal, and bacteriostatic properties. It can be employed as an anaesthetic and for all kinds of inflammations, even those resulting from tumors (Donadieu 1980).

Royal jelly is a white gelatinous product derived from pharingeal glands of worker bees of 5 to 14 days of age. The ancient Mexicans used it to re-establish healthy conditions in cases of anaemia. Today it is ingested in very small quantities when it is pure or in capsules or spoon if diluted, and is used for the following diseases: asthenia, anorexia, gastrointestinal ulcers, arteriosclerosis, anaemia, hypo- or hypertension, neurasthenia or inhibition of sexual libido (Donadieu 1979).

Pollen is the male gametophyte of flowers of plants. The pollen of many species is collected by bees and is referred to as "bee pollen." It is reputed to be a general health restorative and to be useful in treating internal and external infections by ingesting it.

Today these products are available in tablet or capsule form through the health food and wholistic health industries. Certain clinics and hospitals which have "Apitherapy" programs use these products by physiotherapy, ionizations, inhalations, electrophoresis and other treatments (Pochinkova 1981).

Wasps, Vespidae. Three species in three genera were studied. *Polistes instabilis,* known as "guitarre wasps," roasted or boiled or eaten alive are used to cure nervous breakdowns (Conconi 1982). Although this wasp has a powerful venom, people, usually women of menopause age, ate their brood. It could be the quantity of hormones immature stages of insects contain, steroid type compounds and/or by their high nutritive value, or the quantity and quality of their proteins that help in this physiological change of woman. Today in all Pacific coast areas of Mexico, especially in Oaxaca State, rural folks use them for the same purpose.

Polybia occidentalis nigratella. The little black wasp are used in the case of urinary diseases (Conconi 1982). The people of Tlaxiaco, Oaxaca eat the brood alive directly from the hive.

Brachygastra mellifica, known as "Castilla hive" in the state of Oaxaca or "Panal de Olla" in Hidalgo, is used for such eye diseases as cataracts or cloud formation. Two or three drops of this honey is applied to the eye daily and then the eye is to remain closed for a half an hour.

DISCUSSION

As is often the case with other forms—either plant or animal—which have been used in empirical medicine, the use of insects seems to be allied with the Doctrine of Signatures, which is based upon a complete or partial resemblance between the plant or animal and the specific organ or part of the human body or bodily function which it is capable of healing, e.g., the femur of the last leg of grasshoppers, that are similar in shape to the bladder and is used for urinary diseases, or the resemblance of the penis of the certain insect larvae and their use to alleviate impotence in men.

Some species of insects had, and still have, demonstrated medicinal value. These species undoubtedly contain biodynamic compounds or principles which are capable of effecting physiological or other changes in the human body, eg., the iodine content of jumiles bugs used against bocio; the effect of the bee venom over the inflammation of articulations; of honey bee in the treatment of respiratory diseases; the effect of antibiotic substances in the salivary glands of *Atta,* ants that promote healing of wounds; or the re-establishment a healthy condition in women of menopause age because of the hormone content of immature stages of insects. Side effects are thought to be minimal if medicinal plants or animals are properly prepared and administered, but this has received little attention. If the true role of medicinal insects is known in the traditional medicine of an indigenous group—knowledge based upon observation and experiences of medicine men—these organisms, and the active principles within them, can more effectively be evaluated as prototype drugs.

Bees were emphasized not only because venom may be effective for treating certain conditions (although this seems more directly associated with wasps), but also because of the several medicinal products from them. These are now available in pharmacies, health food stores, and wholistic health outlets under commercial names such as Melitin, Oftalmosept, Apinen, Apicosan, Apiuroset, etc.

Finally, it is well to mention again that insects have played an important role in the traditional medicine of a number of indigenous groups in Mexico, eg., the Nahuas, Mazahuas, Mixtecas, Zapotecos, Mayas, Otomies, Olmecas, etc. and may prove a valuable source of prototype drugs.

CONCLUSIONS

For the first time, a group of insects with a medical use was taxonomically classified and scientific names were provided. The review included former classifications dated before and after the Conquest. This field of investigation provides a promising research topic due to the importance to man in various fields (eg., ethnobiology, medicine, pharmaceutical, etc.) and because of its historical significance.

ACKNOWLEDGEMENTS

We want to express our gratitude to Drs. W. Van Asdall and Margarita Kay of the University of Arizona, Tucson and to Dr. R. Bye of Botanical Gardens (UNAM MEXICO) for their help in the translation and suggestions to this manuscript.

APPENDIX 1

TAXONOMIC RELATION OF THE INSECTS UTILIZED IN THE EMPIRICAL MEDICINE BY THE ANCIENT MEXICANS.

Order	Family		Species	Common Name
Orthoptera	Acrididae	*Sphenarium*	*purpurascens* Ch.	[Grasshoppers]
		Sphenarium	*histrio* G.	(Chapulines)
		Sphenarium	*magnum* M.	(Chapulines)
		Melanoplus	*mexicanus*	(Chapulines)
		Taeniopoda	*sp.*	(Chapulines)
		Schistocerca	*sp.*	[Locusts]
		Schistocerca	*paranensis* B.	(Langostas)

TAXONOMIC RELATION OF THE INSECTS UTILIZED IN THE EMPIRICAL MEDICINE BY THE ANCIENT MEXICANS.

Order	Family		Species	Common Name
	Gryllidae	*Gryllus (Acheta)*	*domesticus* L.	[Crickets] (Grillos)
Hemiptera	Pentatomidae	*Euchistus*	*strennus* D.	[Stink bugs] (Jumiles)
		Euchistus	*egglestoni* R.	[Stink bugs] (Jumiles)
		Euchistus	*crenator* S.	[Stink bugs] (Jumiles)
		Euchistus	*lineatus* W.	[Stink bugs] (Jumiles)
		Atizies	*taxcoensis* A.	[Stink bugs] (Jumiles)
		Edessa	*petersii* D.	[Stink bugs] (Jumiles)
	Coreidae	*Acantocephala*	*declivis* S.	[Leaf-footed] bugs
		Acantocephala	sp.	[Leaf-footed] bugs
		Pachilis	*gigas* B.	Xamoes [Mealybugs]
	Margarodidae	*Coccus (Llavea)*	*axin* de la LL.	Axim, Axe, Aje, Aji, Age
	Dactylopidae	*Dactylopius*	*coccus* C.	"Cochinilla de la grana"
		Datylopius	*indicus* Gr.	"Cochinilla de la grana"
		Datylopius	*confusus* Cock.	"Cochinilla de la grana"
		Dactylopius	*tomentosus* L.	"Cochinilla de la grana"
Coleoptera	Buprestidae	*Thrincopyge*	*alacris* Le Conte	[Worms] Teocuilin
		Chrysobothris	*basalis*	[Worms] Teocuilin
	Meloidae	*Meloe*	sp.	Tlaxiquipillin
	Scarabaeidae	*Strategus*	*julianus* B.	Temoli
		Canthon	*sp.*	Escárabajos estiercoleros
		Copris sp.	*sp.*	Escarabajos estiercoleros
	Elateridae			Tlalomitl
Lepidoptera	Megathymidae	*Aegiale (Acentrocneme)*	*hesperiaris* K.	Gusano blanco de maguey
	Hepialidae	*Phasus*	sp.	"Gusanillo"
	Bombycidae	*Bombyx*	*mori* L.	Gusano de seda [Ants]
Hymenoptera	Formicidae	*Myrmecosistus*	*melliger* W.	Honey ants
		Mymecosistus	*mexicanus* W.	Honey ants
		Atta	*cephalotes* L.	Gardening ants
		Atta	*mexicana* S.	Gardening ants
		Pogonomyrmex	*barbatus*	Harvesting ants
	Apidae	*Apis*	*mellifera* L.	[Bees]
		Trigona	sp.	Stingless bees

TAXONOMIC RELATION OF THE INSECTS UTILIZED IN THE EMPIRICAL MEDICINE BY THE ANCIENT MEXICANS.

Order	Family		Species	Common Name
		Melipona	*beeckei* B.	Stingless bees
	Vespidae	*Polybia*	*occidentalis*	[Wasps]
			nigratella B.	Black Wasp
		Polistes	*instabilis* S.	Yellow jacket
		Brachygastra	*mellifica* S.	Castilla Hive

LITERATURE CITED

AGUIRRE, B.G. 1947. La medicina indígena, América Indígena, VII N°2 107-127.

ANCONA, L. 1933. Los jumiles de Cuautla, An. Inst. de Biol. UNAM, 4:103-108.

BARAJAS, C.L.E. 1951. Los Animales usados en la medicina popular mexicana. Tésis Prof. Fac. de Ciencias, UNAM.

BRYGOO, E. 1946. Essai de Bromatologie Entomologique. Les Insectes Comestibles These Doctorat, Bergerac. 233 p.

CLAVIJERO, F.J. 1880. General History of Things of New Spain, Paris, 320 p.

CONCONI, J.R.E. de 1982. Los insectos como una fuente de proteinas en el futuro. Ed. Limusa México, 142 p.

DE ASIS, F. y T. 1982. Historia de la Medicina en México. Ed. Fascimilar, IMSS IV Vols. 2819 p.

DONADIEU. 1979. La jalea real terapeútica natural, 3a. Ed. Paris, 32 p.

__________. 1980. La propolis terapeútica natural. Ed. Malonine, S.A. Paris, 47 p.

F.A.O. 1973. Energy and Protein requirements, FAO Nutrition meetings, Report Series N°52 Food and Agriculture Organization, Rome, 12 p.

FAVRE, H. 1968. Historie, Ethnographie et folklore, Traité de Biologie de L'Abeille. Mason Ed. Paris, 978 p.

HERNANDEZ, F. 1959. Obras Completas Historia Natural de la Nueva Espana, Vol. II. Tratado Cuarto, p. 384-395.

HERRERA, A. 1871. "Aje." Gaceta Medica:6 N°23:283-284.

JENKINS, J.K. 1964. Aje or ni-in (The fat of a scale insect), painting medium and unguent. XXXV. Congreso Internacional de Americanistas (1962). Mexico, p. 625-636.

KUNCKELL DE HERCULAIS. 1885-1886. Observaciones de la Hormiga de miel *(Myrmecosisus melliger)*. La Naturaleza, VII:1-10. Trad. de A. Herrera.

LOPEZ, A.A. 1971. De las plantas medicinales y de otras cosas medicinales. Est. de Cultura nahuatl IX:125-230.

LOPEZ, A. 1972. Textos acerca de las partes del cuerpo humano y de las enfermedades y medicinas de las primeras memorias de Sahagun. Est. de Cultura Nahuatl IX:135-230.

MEZA, C. 1979. La utilización de los insectos en la farmacopea mexicana. Tésis Prof. Fac. de Ciencias, UNAM, 67 p.

PARTHENIU, A. 1981. El veneno de abejas y la dinámica informacional normal y patológica del organismo humano. XXVIII Congreso Internal. Apicultura 105-106 p.

POCHINKOVA, A. 1981. Métodos Fisioterapeúticos en la Apiterapia. XXVIII Congreso Internal. Apicultura p. 108.

ROBELO, C.A. 1904. Diccionario de Aztequismos, Mexico. 708 p.

SAHAGUN, F.B. de 1980. Códice Florentino Ed. Fascimilar Ed. Archivo General de la Nacion, Libro XI. p. 221-261.

TAYLOR, R. 1975. Butterflies in my stomach or insects in human nutrition. Woodbridge Press Publishing Co., California, p. 135.

SHORT COMMUNICATIONS

YUCATECAN MAYAS KNOWLEDGE OF POLLINATION AND BREEDING SYSTEMS

In a study of the composition and structure of Mayan homegardens in Tixcacaltuyub and Tixpeual, Yucatan, Mexico (March-April and July, 1988) special effort was made to determine the amount of knowledge possessed by the gardeners in regard to pollination and breeding systems of the garden's common trees and shrubs. In interviews with the homegarden owners, questions were designed to test their knowledge of plants regarding names and functions of flower parts, pollination, breeding systems in general, etc. The questions seemed pertinent as many of the homegarden trees and shrubs are planted for fruit production involving native and introduced plant species. Information of this type is lacking in ethnoecological or ethnobotanical studies of native cultures (Bawa, *per. comm.).* Do contemporary Mayans utilize knowledge of plant reproductive systems in managing their gardens?

The homegarden owners interviewed recognized flower parts, nectar production as "honey," and pollen. There was a clear recogntion of stamens as masculine and the ovary as feminine, and that the fruit was the result of ovary transformation. Homegarden owners recognized hermaphrodite and dioecious plants but did not recognize flowers with different sexes in one plant. The most surprising finding was lack of knowledge of the pollination process. Although many homegarden owners keep honeybee hives, the connection between bee foraging visits (whether for pollen or nectar) and pollination resulting in fruit set is totally lacking.

The information was obtained by utilizing dioecious species as examples of the pollination process. Several homegarden plants are dioecious, i.e., ***papaya*** *(Carica papaya:* Caricaceae), ***kumché*** *(Jacaratia mexicana:* Caricaceae), ***chaká*** *(Bursera simaruba:* Burseraceae), ***abal*** *(Spondias* sp.:Anacardiaceae), ***uaya*** *(Melicoccus bijugatus:* Sapindaceae); all are highly esteemed fruit trees (except ***chaká***) requiring pollination for fruit set. Since these plants are grown for their fruit production, only females are important; male plants are considered worthless and usually eliminated from the garden unless they possess alternative values, as shade *(M. bijugatus)* or nectar for honeybees *(Spondias* sp.). Male individuals are considered to be the result of "bad seed" or having experienced some problem during development; many are eliminated when space is needed for other plants or other homegarden structures.

Important questions arise as a result of these observations: How is fruit production maintained with a seemingly low male to female plant ratio? Does the reduction of male individuals affect the genetic composition of the dioecious species homegarden populations? Several possibilities should be considered in the future: (1) the present male to female plant ratio is sufficient to insure proper pollination; (2) the bees could obtain pollen in the surrounding forest patches (but we have seen only ***abal*** and ***chaká*** in the wild); (3) the Maya may have selected for parthenocarpic races of dioecious trees, but we have no evidence for or against this process; and (4) as a result of management pressure (cutting out male trees), some plants may undergo sex reversal. All possibilities should be explored, but we think that emphasis should be placed on number four, because of the relative ease whereby breeding systems can change

(Richards 1986). ***Papaya*** is a good example of these changes, plants of this species may undergo sex reversal (Crane & Walker 1984; McGregor 1976). Is it possible that the long history of manipulation has produced changes in the homegarden plants breeding systems?

Presumably the ancient Maya carefully manipulated plants in the forest (i.e., ***pet kot,*** succession) and in homegardens. Is it possible that the knowledge of the relationship between insect vectors and fruit production has been lost because the gardeners no longer need to worry about breeding systems or pollination? At present, most of the fruit producing species are hermaphroditic and were introduced after the spanish conquest (i.e., ***citrus, tamarindo, mango),*** and now the Italian honey bee is the main pollinator.

ACKNOWLEDGEMENTS

We wish to thank L.B. Thien and S.P. McLaughlin for their comments and suggestions to this manuscript. Field work was supported by a grant from the World Wildlife Fund-U.S. to VRG. The paper was written while the senior author was a visiting research scientist at the Missouri Botanical Garden supported by a fellowship from the Tinker Foundation.

REFERENCES

CRANE, E. & P. WALKER. 1984. Pollination Directory for World Crops. International Bee Research Association, London.

MCGREGOR, S.E. 1976. Insect Pollination of Cultivated Crop Plants. Agricultural Handbook No. 496. U.S. Department of Agriculture, Washington.

RICHARDS, A.J. 1986. Plant Breeding Systems. George Allen & Unwin, London.

V. Rico-Gray, J.G. Garcia-Franco, and A. Chemas
Moreles 3-1
Xalapa, Veracruz 91000 Mexico

J. Ethnobiol. 8(2):205-211 Winter 1988

RECENT DOCTORAL DISSERTATIONS OF INTEREST TO ETHNOBIOLOGISTS: FALL 1987 - FALL 1988

TERENCE E. HAYS
Department of Anthropology and Geography
Rhode Island College
Providence, RI 02908

and

JOSEPH E. LAFERRIÈRE
Department of Ecology and Evolutionary Biology
University of Arizona
Tucson, AZ 85721

RESUMEN.—En este bibliografía se incluyen disertaciones recientes de interés a los etnobiologos. Por cada uno se da el número de la página donde se halla el resumen en Dissertation Abstracts (D.A.), y el número de encargar un ejemplero de la disertación de University Microfilm International, 300 North Zeeb Road, Ann Arbor, MI 48106 USA (teléphono: 800-521-3042; desde Alaska, Hawaii y Michigan, 313-761-4700; desde Canadá 800-343-5299).

This is the sixth in an annual series, begun in 1983, of bibliographies listing selected doctoral dissertations drawn from the pages of Dissertation Abstracts (D.A.). All listings were constructed by scanning the titles and abstracts published in D.A. and making subjective decisions as to which ones might be relevant to work in ethnobiology or related disciplines such as ecological anthropology.

Dates covered in this edition include: Volume A (Humanities and Social Sciences): September 1987-August 1988; Volume B (Sciences and Engineering): September 1987-August 1988; Volume C (European Dissertations): Fall 1987-Summer 1988. It should be noted that these are the dates for the issues of D.A. in which the abstracts appear, rather than the dates of acceptance of the dissertations themselves. A few older dissertations only recently abstracted in D.A. have also been incorporated.

Included in the current list are dissertations categorized in D.A. under Agricultural Chemistry, Agricultural Economics, Agriculture, Agronomy, American Studies, Analytical Chemistry, Animal Culture & Nutrition, Anthropology, Biology, Botany, Ecology, Entomology, Environmental Science, Folklore, Food Science & Technology, Forestry & Wildlife, General Chemistry, Genetics, Geography, Language, Linguistics, Nursing, Nutrition, Organic Chemistry, Palaeoecology, Paleontology, Palynology, Pharmacology, Pharmacy, Public Health, Range Management, Sociology, and Zoology. The compilers attempted to be as inclusive as possible, but some appropriate dissertations may have been overlooked. Comments and suggestions would be welcome for items to include in next year's edition.

The dissertations are listed alphabetically by author, along with the year of acceptance, title, institution, length, advisor or major professor, number(s) of page(s) in D.A. where the abstract may be found, University Microfilms order number, and the ISBN number, as this information is given.

Most dissertations accepted at institutions in the United States, and some of those from Australia, Canada, South Africa, and the United Kingdom are available through University Microfilms International. Those listed here with UMI order numbers may be ordered by calling 800-521-3042; (collect) 313-761-4700 from Alaska, Hawaii, and Michigan; or 800-343-5299 from Canada. Further information and current prices may be obtained by writing to UMI Dissertations Information Service, 300 North Zeeb Road, Ann Arbor, MI 48106.

ACAMOVIC, THOMAS. 1987. Analysis, and nutritional evaluation for young chicks, of some toxic factors in three novel legumes *[Leucaena leucocephala, Canavalia ensiformis,* and *Lupinus albus].* University of Edinburgh, U.K., 308 pp. D.A. 49(2):266-B. Order no. BRD-80440.

ADELSKI, ELIZABETH. 1987. Ejidal agriculture in northern Sinaloa, Mexico; agricultural resources, production and household well-being. University of Kentucky, 325 pp. Director: Billie R. DeWalt. D.A. 48(4):967-968-A. Order no. DA8715911.

ADEOLA, MOSES OLANREWAJU. 1987. Utilization of wildlife resources in Nigeria. Colorado State University, 327 pp. D.A. 48(8):2162-B. Order no. DA8725614.

AL-DARAZI, FARIBA ABDULLWAHAB. 1987. Assessment of Bahraini women's health and illness cognitions and practices. University of Illinois at Chicago, Health Sciences Center, 241 pp. Adviser: Beverly McElmurry. D.A. 48(3):701-B. Order no. DA8712355.

AL-WOHAIBI, FAHED ABDULLRAHMAN. 1987. Survey of Umm an-Namel Island, State of Kuwait. Indiana University, 378 pp. Chairman: Wolf W. Rudolph. D.A. 48(5):1241-1242-A. Order no. DA8717781.

ALI, ABU MUHAMMAD SHAJAAT. 1987. Changes in near-saturated agro-ecosystems: a comparison of paddy agriculture in six villages in Bangladesh. Clark University, 673 pp. Chief Instructor: B.L. Turner, II. D.A. 48(11):2952-A. Order no. DA8722513.

ANFINSON, SCOTT FLEMING. 1987. The prehistory of the Prairie Lake region in the Northeastern Plains. University of Minnesota, 371 pp. D.A. 48(3):681-A. Order no. DA8713066.

BADEN, WILLIAM WALTER. 1987. A dynamic model of stability and change in Mississippian agricultural systems. University of Tennessee, 188 pp. Major Professor: Gerald F. Schroedl. D.A. 48(11):2914-A. Order no. DA8802649.

BAIZERMAN, SUZANNE. 1987. Textiles, traditions, and tourist art: Hispanic weaving in northern New Mexico. University of Minnesota, 341 pp. Adviser: Joanne B. Weicher. D.A. 48(9):2621-B. Order no. DA8726028.

BARTON, DAVID. 1987. Draught animal power in Bangladesh. University of East Anglia, U.K., 350 pp. D.A. 49(1):3-B. Order no. BRD-80393.

BELLANTONI, NICHOLAS FRANK. 1987. Faunal resource availability and prehistoric cultural selection on Block Island, Rhode Island. University of Connecticut, 273 pp. Major Adviser: Robert E. DeWar. D.A. 48(11):2914-2915-A. Order no. DA8800206.

BOLIN, INGE. 1987. The organization of irrigation in the Vilcanota Valley of Peru: local autonomy, development and corporate group dynamics. University of Alberta (Canada). D.A. 48(5):1243-A.

BOWEN, WALTER TRUMAN. 1987. Estimating the nitrogen contribution of legumes

to succeeding maize on an oxisol in Brazil. Cornell University, 194 pp. D.A. 48(4):922-B. Order no. DA8708990.

BOURFIA, MOHAMED. 1987. Evaluation of three Moroccan breeds of sheep. University of Minnesota, 182 pp. Adviser: R.W. Touchberry. D.A. 48(8):2153-B. Order no. DA8723810.

BROOKS, ROBERT LEE. 1986. Catchment analysis revisited: a critique and application of a test case. University of Kentucky, 296 pp. Director: Thomas Dillehay. D.A. 48(7):1812-A. Order no. DA8718396.

BROWER, BARBARA ANNE. 1987. Livestock and landscape: the Sherpa pastoral system in Sagarmatha (Mt. Everest) National Park, Nepal. University of California, Berkeley, 354 pp. D.A. 48(9):2420-2421-A. Order no. DA8726151.

BROWN, THEODORE MAX. 1987. The cultural ecology of agriculture in Caldwell County, Texas. University of Texas at Austin, 523 pp. Supervisor: Richard P. Schoedel. D.A. 48(5):1243-1244-A. Order no. DA8717375.

BRUSETH, JAMES EDWARD. 1987. Late Holocene environmental change and human adaptive strategies in Northeast Texas. Southern Methodist University, 332 pp. Adviser: Anthony Marks. D.A. 48(7):1812-A. Order no. DA8721365.

BYRD, BRIAN FRANKLIN. 1987. Beidha and the Natufian: variability in Levantine settlement and subsistence. University of Arizona, 408 pp. Director: Arthur J. Jelinek. D.A. 48(4):966-A. Order no. DA8715711.

CARNEY, JUDITH ANN. 1986. The social history of Gambian rice production: an analysis of food security strategies. University of California, Berkeley, 366 pp. D.A. 48(5):1284-A. Order no. DA8717920.

CASTILLO-GONZALEZ, FERNANDO. 1987. Agronomic evaluation of Latin American maize populations. North Carolina State University, 157 pp. Director: Major N. Goodman. D.A. 48(5):1190-B. Order no. DA8717283.

CATLIN, MARK ALAN. 1986. Regional research designs in the study of prehistoric culture change: an analysis of Late Archaic adaptations in the Middle Atlantic Piedmont. University of Virginia, 362 pp. D.A. 48(5):1242-A. Order no. DA8715118.

CHAN, KYUNG JUNG. 1987. Characterization of the arabinogalactan from tepary bean *(Phaseolus acutifolius* var. *latifolius).* University of Arizona, 113 pp. Director: James W. Berry. D.A. 48(3):608-B. Order no. DA8712866.

COGIL, BRUCE. 1987. The effects on income, health, and nutritional status of increasing agricultural commercialization in south-west Kenya. Cornell University, 561 pp. D.A. 48(7):1942-B. Order no. DA8724192.

CONKLIN, NANCY-LOU. 1987. The potential nutritional value to cattle of some tropical browse species from Guanacaste, Costa Rica. Cornell University, 348 pp. D.A. 48(6):1558-B. Order no. DA8715626.

CUEVAS-SUAREZ, SUSANA. 1987. The Amuzgos' zoological world: an ethnoscientific approach. State University of New York at Albany, 262 pp. D.A. 48(4):968-A. Order no. DA8715349.

DALOZ, CHARLES ROLAND. 1987. Productivity of vegetable legumes in the Special Territory of Aceh, Indonesia. Cornell University, 317 pp. D.A. 48(7):1862-B. Order no. DA8724128.

DA MOTA, CLARICE NOVAES. 1987. As Jurema told us: Kariri-Shoko and Shoko mode of utilization of medicinal plants in the context of modern Northeastern Brazil. University of Texas at Austin, 403 pp. Supervisor: James B. Brow. D.A. 48(5):1244-A. Order no. DA8717395.

DENNIS, JOHN VALUE, JR. 1987. Farmer management of rice variety diversity in

northern Thailand. Cornell University, 386 pp. D.A. 48(10):2826-B. Order no. 8725764.

DOWNIE, STEPHEN ROY. 1987. A biosystematic study of *Arnica* subgenus *Arctica*. University of Alberta (Canada). D.A. 48(5):1225-B.

DWYER, PHILIP MATTHEW. 1987. Herbalism and ritual: folk medical practices among Asian immigrants in Southern California. University of California, Los Angeles, 228 pp. Chair: Donald Ward. D.A. 48(6):1518-A. Order no. DA8719926.

GOODWIN, CONRAD MC CALL. 1987. Sugar, time, and Englishmen: a study of management strategies on Caribbean plantations. Boston University, 213 pp. Major Professor: Mary C. Beaudry. D.A. 48(7):1812-1813-A. Order no. DA8721317.

GREEN, WILLIAM. 1987. Between Hopewell and Mississippian: Late Woodland in the Prairie Peninsula as viewed from the western Illinois uplands. University of Wisconsin-Madison, 478 pp. Supervisor: James B. Stoltman. D.A. 48(9):2368-2369-A. Order no. DA8720800.

HALLSDOTTIR, MARGRET. 1987. Pollen analytical studies of human influence on vegetation in relation to the Landnám tephra layer in southwest Iceland. Lunds Unversitet, Sweden, 45 pp. D.A. 49(1):71-C.

HANSON, DOUGLAS BURKE. 1988. Subsistence change and biological adaptation: a microradiographic analysis of cortical bone remodeling in three prehistoric populations from the Lower Illinois Valley. Cornell University, 287 pp. D.A. 48(12):3146-A. Order no. DA8804636.

HIGUCHI, NIRO. 1987. Short-term growth of an undisturbed tropical moist forest in the Brazilian Amazon. Michigan State University, 142 pp. D.A. 48(3):612-B. Order no. DA8714334.

HOFFMAN, CAROL ANN. 1987. Comparative responses to physical and biological stresses: ecological relationships in the genus *Cucurbita*. University of Texas at Austin, 203 pp. Supervisor: Beryl B. Simpson. D.A. 48(10):2860-B. Order no. DA8728571.

HOFFMAN, ROBERT W. 1987. Taphonomy and zooarcheology of rockshelters of the Big South Fork area of the Cumberland Plateau, Tennessee and Kentucky. University of Tennessee, 220 pp. Major Professor: Walter Klippel. D.A. 48(7):1813-A. Order no. DA8721276.

HOGAN, PATRICK FRANCIS. 1987. Prehistoric agricultural strategies in west-central New Mexico. Washington State University, 279 pp. Chair: William D. Lipe. D.A. 48(8):2091-A. Order no. DA8724296.

HORNBERGER, KATHLEEN LEE. 1987. Systematics of the genus *Sisyrinchium* (Iridaceae) in the southeastern United States. University of Arkansas, 346 pp. Adviser: E.B. Smith. D.A. 48(5):1226-B. Order no. DA8718820.

HUCHON, BRIGETTE. 1987. *Vinca minor* L.: usage ancestral et source de vincamine. [*Vinca minor:* ancient use and vincamin source.] Université de Dijon, France, 98 pp. D.A. 49(10):109-C. [Dissertation and abstract in French.]

IRVINE, DOMINIQUE. 1987. Resource management by the Runa Indians of the Ecuadorian Amazon. Stanford University, 326 pp. Adviser: William H. Durham. D.A. 48(7):1816-A. Order no. DA8720400.

JESUE SIMONENA, CARMEN. 1987. Poblamiento rural de Navarra en la Edad Media. Bases arqueologicas. Valle de Urraul Bajo. [Rural settlements of Navarre in the Middle Ages: Archaeólogical Bases: The Lower Urraul Valley.] Universidad de Navarra, Spain, 838 pp. D.A. 49(2):190-C. [Dissertation in Spanish.]

JOHNSON, DAVID JOHN. 1987. Nabataean trade: intensificatin and culture change.

University of Utah, 168 pp. D.A. 48(9):2369-A. Order no. DA8726539.

JOSEPH, REBECCA M. 1987. Diffused batik production in Central Java. University of California, San Diego, 283 pp. Chairperson: David K. Jordan. D.A. 49(2):286-A. Order no. DA8804771.

KING, FRANCES B. 1987. Prehistoric maize in eastern North America: an evolutionary evaluation. University of Illinois at Urbana-Champaign, 189 pp. D.A. 49(1):107-108-A. Order no. DA8803089.

KIRKMAN, WILLIAM BENSON. 1987. The taxonomy, ecology, and horticulture of *Vaccinium* section *Herpothamnus* (Ericaceae). North Carolina State University, 205 pp. Directors: James R. Ballington & Arthur W. Cooper. D.A. 48(3):632-B. Order no. DA8712540.

KOONS, ADAM SURLA. 1987. Communication in the agricultural development process: a Cameroonian example. The American University, 387 pp. D.A. 49(2): 286-287-A. Order no. DA8805459.

KRUGER, HESTER. 1987. A study of the floral ontogeny, androgeny, and gynology of *Securidaca longepedunculata* Fresen (Polygalaceae). University of Pretoria, South Africa. Promoter: P.J. Robbertse. D.A. 48(3):632-B. [Dissertation in Afrikaans.]

LA BIANCA, OYSTEIN SAKALA. 1987. Sedentarization and nomadization: food system cycles at Hesban and vicinity in Transjordan. Brandeis University, 411 pp. Chairperson: Judith Zeitlin. D.A. 48(4):969-A. Order no. DA8715746.

LEONARD, WILLIAM ROWE. 1987. Nutritional adaptation and dietary change in the southern Peruvian Andes. University of Michigan, 299 pp. Chair: A. Roberto Frisancho. D.A. 48(12):3146-A. Order no. DA8801361.

LUDEKE, AARON KIM. 1987. Natural and cultural physical determinants of anthropogenic deforestation in the Cordillera Nombre de Dios, Honduras. Texas A & M University, 316 pp. Chair: Leslie M. Reid. D.A. 48(12):3467-B. Order no. DA8802109.

MANOLESCU, KATHLEEN MARIE. 1987. An approach to the ethnography of farming as a culturally structured technological system. University of Pennsylvania, 528 pp. Supervisor: Ward H. Goodenough. D.A. 48(4):969-970-A. Order no. DA8714086.

MATHEWSON, KENT. 1987. Landscape change and cultural persistence in the Guayas wetlands, Ecuador. University of Wisconsin-Madison, 544 pp. Directors: William Maxfield Denevan & Carl O. Sauer. D.A. 48(9):2422-A. Order no. DA8720818.

MC ANANY, PATRICIA ANN. 1986. Lithic technology and exchange among wetland farmers of the eastern Maya lowlands. University of New Mexico, 321 pp. Chairperson: Jeremy A. Sabloff. D.A. 48(4):966-967-A. Order no. DA8713297.

MEARNS, LINDA OPAL. 1988. Technological change, climatic variability, and winter wheat yields in the Great Plains of the United States. University of California, Los Angeles, 223 pp. Chair: Werner H. Terjung. D.A. 49(2):319-320-A. Order no. DA8805341.

MITCHELL, LOIS PATRICIA. 1987. "Making it pay": a study of the organization and operation of the Deer Island weir fishery. The University of New Brunswick (Canada). D.A. 49(2):355-356-A.

MOCHTAR, MOHAMMAD. 1987. Drying and storage of paddy rice in Indonesia. University of New South Wales, Australia. D.A. 48(11):3171-B.

MOODY, JENNIFER ALICE. 1987. The environmental and cultural prehistory of the Khania region of West Crete: Neolithic through Late Minoan III. University of Minnesota, 773 pp. Adviser: Fred E. Lukermann. D.A. 48(8):2091-A. Order no. DA8723836.

MORDI, RICHARD. 1987. Public attitudes toward wildlife in Botswana. Yale University, 248 pp. D.A. 48(10):2836-B. Order no. DA8729122.

MOST, RACHEL. 1987. Reconstructing prehistoric subsistence strategies: an example from east-central Arizona. Arizona State University, 343 pp. Chairperson: Sylvia Gaines. D.A. 48(4):967-A. Order no. DA8713671.

MROZOWSKI, STEPHEN ALBERT. 1987. The ethnoarchaeology of urban gardening. Brown University, 282 pp. Chair: Richard Gould. D.A. 48(4):967-A. Order no. DA8715538.

MULHOLLAND, SUSAN COLLINS. 1987. Phytolith studies at Big Hidatsa, North Dakota. University of Minnesota, 415 pp. Adviser: George Rapp, Jr. D.A. 48(9):2369-2370-A. Order no. DA8727427.

MUTORO, HENRY WANGUTUSI. 1987. An archaeological study of the Mijikenda *Kaya* settlements on hinterland Kenya Coast. University of California, Los Angeles, 320 pp. Chair: Merrick Posnansky. D.A. 48(6):1484-A. Order no. DA8721047.

NEWSTROM, LINDA EILEEN. 1986. Studies in the origin and evolution of chayote, *Sechium edule* (Jacq.) Sw. (Cucurbitaceae). University of California, Berkeley, 159 pp. Chair: Herbert Baker. D.A. 48(5):1226-B. Order no. DA8718102.

OGUNBIYI, ADETOKUNBO OLAMALE. 1987. Aspects of the toxicology of the bracken fern *(Pteridium aquilinum)*. University of Surrey, U.K., 230 pp. D.A. 49(1):82-B. Order no. BRD-80047.

PERLOV, DIANE CATHERINE. 1987. Trading for influence: the social and cultural economics of livestock marketing among the highland Samburu of northern Kenya. University of California, Los Angeles, 313 pp. Chair: Walter Goldschmidt. D.A. 48(6):1488-A. Order no. DA8721050.

RAMIREZ, JUAN FERNANDO. 1987. Biochemical studies on a Mexican fermented corn food—pozol. Cornell University, 193 pp. D.A. 48(9):2511-B. Order no. DA8715597.

SALAZAR, ROBERT CRISOL. 1987. The implementation of an agroforestry project in a Philippine village: a study in directed change. Ohio State University, 244 pp. Adviser: Chung-Min Chen. D.A. 48(5):1249-A. Order no. DA8717715.

SCHEPARTZ, LYNNE ALISON. 1987. From hunters to herders: subsistence pattern and morphological change in eastern Africa. University of Michigan, 155 pp. Chair: Milford H. Wolpoff. D.A. 48(11):2919-A. Order no. DA8801413.

SOWERS, FREDERICK WALTER. 1986. Moving on: migration and agropastoral production among the Fulbe in southern Burkina Faso. University of California, Berkeley, 368 pp. Chairman: Michael Watts. D.A. 48(5):1285-A. Order no. DA8718167.

SPERLING, CALVIN ROSS. 1987. Systematics of the Basellaceae. Harvard University, 291 pp. D.A. 48(11):3186-B. Order no. DA8800889.

SPRIGGS, MATTHEW JAMES THOMAS. 1981. Vegetable kingdoms: taro irrigation and Pacific prehistory. Australian National University, 516 pp. D.A. 48(3):683-A. Order no. DA8710524.

STOCKTON, JAMES HAROLD. 1984. The prehistoric geography of northwest Tasmania. Australian National University, 544 pp. D.A. 48(3):683-A. Order no. DA8710525.

SUELO, LUCITA G. 1987. Utilisation of the Australian jellyfish *Calostylus* sp. as a food product. University of New South Wales, Australia. D.A. 48(11):3167-B.

SVENSON, G. 1987. Studies on fossil plant communities, stratigraphy and development of peatlands in South Sweden. Lunds Universitet, Sweden, 5 pp. D.A. 48(3):520-C.

SWANSON, MARILYN ANN. 1987. Nutrtional significance and acceptance of solar dried foods of rural Leyte, Philippines. Washington State University, 200 pp. Chair: Madeleine E. Mitchell. D.A. 48(8):2271-B. Order no. DA8724327.

SWETNAM, THOMAS WILLIAM. 1987. A dendrochronological assessment of Western spruce budworm, *Choristonerua occidentalis* Freeman, in the southern Rocky Mountains. University of Arizona, 226 pp. Director: Malcolm J. Zwolinski. D.A. 48(3):637-B. Order no. DA8712915.

SWISHER, MICHAEL JAMES. 1987. Wood and water terminology in Old High German literature: a contribution to the study of Old High German nature vocabulary. Ohio State University, 457 pp. Adviser: Johanna Belin. D.A. 48(5): 1195-A. Order no. DA8717735.

THOMASSON, GORDON CONRAD. 1987. Indigenous knowledge systems, sciences, and technologies: ethnographic and ethnohistorical perspectives on the educational foundations for development in Kpelle culture. Cornell University, 399 pp. D.A. 48(7):1818-A. Order no. DA8724146.

TJITRADJAJA, IWAN. 1987. Drawdown farming at Jatiluhur Dam, West Java: a case study of local responses to new conditions. Rutgers The State University of New Jersey-New Brunswick, 204 pp. Director: Andrew P. Vayda. D.A. 49(2):289-A. Order no. DA8803522.

TRIERWEILER, WILLIAM NICHOLAS. 1987. The marginal cost of production in subsistence economies: an archaeological test. University of California, Los Angeles, 416 pp. Chair: James N. Hill. D.A. 48(7):1814-1815-A. Order no. DA8723211.

WANNAN, BRUCE STEWART. 1987. Systematics of the Anacardiaceae and its allies. University of New South Wales, Australia. D.A. 48(11):3186-B.

WATSON, GRETA A. 1987. The human ecology of rice farming in an Indonesian coastal wetland. Rutgers The State University of New Jersey-New Brunswick, 453 pp. Director: George E.B. Morren, Jr. D.A. 49(1):109-A. Order no. DA8803526.

WHELAN, MARY KATHRYN. 1987. The archaeological analysis of a 19th century Dakota economy. University of Minnesota, 285 pp. D.A. 48(8):2092-2093-A. Order no. DA8723859.

WHITE, JOHN PETER. 1968. Taim bilong bipo: investigations towards a prehistory of the Papua-New Guinea Highlands. Australian National University, 872 pp. D.A. 48(3):683-A. Order no. DA8710527.

WILEN, RICHARD NEAL. 1987. The context of prehistoric food production in the Khorat Plateau piedmont, N.E. Thailand. University of Hawaii. Chairman: Wilhelm G. Solheim, II. D.A. 48(7):1815-A.

WINDER, N. 1986. Faunal analysis: studies in the analysis and interpretation of animal bones from large, multiphase archaeological excavation. University of Southampton, U.K. D.A. 48(4):650-C.

WYMER, DEE ANNE. 1987. The paleoethnobotanical record of central Ohio—100 B.C. to A.D. 800: subsistence continuity amid cultural change. Ohio State University, 364 pp. Adviser: William S. Dancey. D.A. 48(5):1243-A. Order no. DA8717753.

BOOK REVIEW

Late quaternary Mammalian Biogeography and Environments of the Great Plains and Prairies. Russell W. Graham, Holmes A. Semken, Jr., and Mary Ann Graham (eds.). Springfield, IL: Illinois State Museum Society. 1987. Pp. xiv, 491. $20.00. (paper).

This volume, dedicated to Ernest L. Lundelius, Jr., is an anthology of 12 papers by 15 authors focusing primarily on the Northern Plains and Midwestern prairies. It contains general (3), regional (4), and local (5) discussions on late Pleistocene and Holocene mammalian records (primarily for micromammals), an appendix on scientific and common names of the animals discussed, and an index to the localities discussed.

The initial paper, by Graham and Semken, is on philosophy and procedures in paleoenvironmental studies, and it acts as an introduction and guide for the volume. It also is the most important contribution in its attempt to solidify methodological underpinnings for paleoenvironmental studies. An array of concepts are brought together in a well-stated synthesis. The major topics are problems in interpretation and methods of analysis. A number of important points are made that frequently have been overlooked or not considered, e.g., that interpretation is based on the identification of the skeletal remains and is only as good as the quality of the identification work. In most cases, identifications need to be on the specific level to be useful. This can be difficult at times given the material recovered and the identification of some modern species on non-osteological traits. Their point is the need to document and thereby establish osteological criteria which everyone can agree to use. A point not made but equally important concerns the training and competence of the identifier. Far too many remains from far too many sites have been identified from books or inadequate comparative collections by people not equipped to conduct the analysis.

Another problem area in interpretation is that of chronology. A rigorous chronological framework is mandatory for interpreting temporal changes in faunas and reconstructing paleoenvironments. A point well made is the time-transgressive nature of cultural stages coupled with relative or imprecise dating. This same problem is prevalent in paleontological faunas where biostratigraphic age is used. Taphonomic problems are of major importance to paleoecologic interpretation. The reader is cautioned to compare only local faunas that have undergone similar taphonomic pathways. Concomitant with that cautionary note is the plea to collect faunal samples by comparable methodologies. Furthermore, while the need for analogs is clear, modern analogs may not be the most appropriate to use. Faunal community members react independently to climatic and environmental changes and not as a whole community. This independent reaction is part of the basis for the concept of disharmonious faunas. This concept, pioneered by Semken, concerns ecologically incompatible species found as community members in fossil assemblages. The point is that no one area today duplicates the conditions of the late Pleistocene or for some time into the Holocene.

The section on methods of analysis focuses primarily on determining the area of sympatry and species composition. The area of sympatry is that geographic region where the modern ranges of all or most of the taxa overlap. The method provides evidence of environmental change when an area does not include the fossil location.

The more distant the sympatry from the fossil location, the greater the degree of change. If the fossil fauna contains allopatric species (i.e., they have exclusive ranges), then the fossil fauna is a disharmonious one. Frequently, the late Pleistocene and early Holocene faunas, because they are disharmonious, have at least two areas of sympatry. Once again, the point is that no modern analog exists: no one place or location duplicates or comes close to the conditions during those times.

Species composition is a complementary concept and analytical tool that relies primarily on environmental parameters that control the modern distribution of a species. Primary differences between area of sympatry and species composition include the importance of limiting factors and disjunct distributions to species composition. Microenvironmental data are particularly valuable in the analysis of species tolerances as limiting factors, while these aspects are not useful in determining area of sympatry. Species composition analysis leads to the creation of environmental mosaics and the concept of patchy vegetation.

Wendland, Benn, and Semken attempt to evaluate climatic changes based on faunal evidence. They focus on Holocene climates based on the data presented in the volume and infer paleoclimates from changes in faunal distribution. The premise is that the record of plains biotic history is a direct expression of climatic results and that mammals provide good insight into the nature of the grasslands. The temporal fluctuations are based on Wendland's major climatic episodes. The post-Atlantic periods are lumped together because of insufficient faunal data, with the focus primarily on the Atlantic period (8,500-5,000 BP) on the Northern Plains and Midwestern prairies. An important point made is that while climatic changes may be abrupt, environmental changes lag and may be both time and spatially transgressive.

The last paper, by Semken and Graham, is presented as a summary but it is more a summary of their previous statements than of the volume. Five major points are discussed in relationship to the philosophy and methodology presented in the introductory paper. In determining the nature of the climatic signal provided by the faunal data, both the overall composition and the number of allopatric species are important. Reliability is based on accurate identification, documentation, and systematic guidelines. Given the bandwagon effect in zooarchaeology over the past decade or so, this point cannot be stressed too often. Finally, collecting methodologies which greatly influence the usefulness and comparability of the faunal data must become standardized. Their plea is to go beyond the "one-liter sample syndrome" to employ well-controlled collecting on a bulk or spatial basis. "Bulk" is interpreted as stratigraphic column sampling adjacent to excavation areas, whereas "spatial" apparently means collecting within the excavation areas.

This volume makes two major contributions. First, it is a solid presentation of paleoenvironmental methodology as applied to the Quaternary record and suggestions for the further development of that interdisciplinary study. Second, as a synthesis of a large body of faunal data, it is a source book for the Northern Plains and Midwestern prairies to complement earlier (1983) syntheses by Lundelius and Semken in the 2-vol. *Late Quaternary Environments of the United States*.

The volume is not without problems. The "Plains" are divided up unusually, with northeastern Colorado considered with the "Southwestern Plains" while Oklahoma is considered to be Central Plains. The "Southwestern Plains" appears primarily to focus on Central Texas and the Val Verde area (Texas) where Lundelius has done most of his North American research.

In general the Southern Plains receives limited treatment, with some out-of-date or not pertinent references being used. For example, in the general paper on evaluating climatic changes based on faunal evidence, the Southern Plains data are not considered. Central Texas data are summarized for the Late Glacial period, but the Atlantic and post-Atlantic discussions focus on the Northern Plains and Midwestern prairies. The Val Verde and Trans Pecos (Texas) data for the post-Atlantic period are summarized and then generally extended to cover the ''Southwestern Plains.'' Wendland *et al.* (p. 469) make the statement that after 5,000 BP ''more moist conditions returned to the northern plains while in the southern plains the climate apparently continued to become more xeric, perhaps occasionally punctuated by short intervals of moisture.'' Data from the Southern Plains demonstrate that this extension is not valid. The Southern Plains experienced a two-drought altithermal between 6,400-4,500 BP with a return to moisture and an ameliorated climate by 4,500 BP. That situation began to change towards more xeric conditions after 700 BP (Holliday 1985; Hall 1988). Furthermore, Dillehay's model of the presence/absence of bison was used despite demonstrations that the model is not valid for the Southern Plains and Northcentral Texas.

A great deal of ''finger-wagging'' occurs aimed at archaeologists and their field methods and collecting techniques. While the admonishments are well deserved and heartily endorsed by this reviewer, paleontologists deserve the same treatment. Far too many cave localities have been quarried-out with litle regard for associational and taphonomic relationships or, at times, even stratigraphy. A more constructive, even-handed review of collecting problems and solutions would be beneficial. Both archaeological and paleontological localities should be collected in a very tightly controlled manner in well-dated context related to natural stratigraphy. At archaeological sites, those units must be related back to both the natural and cultural stratigraphies without crosscutting boundaries and mixing samples.

All in all, this volume is a thought-provoking and solid contribution to Quaternary studies. It is a fitting tribute to Ernest Lundelius, his unquestionable influence on the development and direction of Pleistocene and Holocene vertebrate paleontology and paleoenvironmental studies on the Plains and Midwestern prairies, and his place alongside other ''greats'' such as Claude Hibbard and John E. Guilday.

References Cited:

Hall, Stephen A. 1988. Environment and archaeology of the Central Osage Plains. Plains Anthrop. 33(120):203-218.

Holliday, Vance T. 1985. Archaeological geology of the Lubbock Lake Site, Southern High Plains of Texas. Bull. Geol. Soc. Am. 96:1483-1492.

Eileen Johnson
The Museum of Texas Tech University
Lubbock, Texas 79409

J. Ethnobiol. 8(2):215-218 Winter 1988

RALPH N.H. BULMER (1928-1988)

TERENCE E. HAYS
Department of Anthropology/Geography
Rhode Island College
Providence, RI 02908

Ethnobiology has lost one of its most valued practitioners and advocates with the death of Ralph N.H. Bulmer in Auckland (New Zealand) on July 18, 1988.

As a schoolboy in England, Ralph once told me, he detested cricket, so he would escape the playing fields by wandering off into surounding woods and fields, where a lifelong love of natural history was formed. Much of his life would be spent in the field, observing, collecting, and conducting ethnographic research. His anthropological fieldwork began while he was still an undergraduate at Cambridge University, when he spent six months in 1950-51 as part of a research team among the Reindeer Same (Lapps) of Northern Sweden and Norway. He will be remembered best, however, for his work in Papua New Guinea.

Following his undergraduate degree in 1953, Ralph was trained in Social Anthropolo y at the Australian National University; his thesis, based on 17 months' fieldwork with the Kyaka Enga of the Baiyer Valley of the Western Higlands, was completed in 1960 and his Ph.D. conferred in 1962. His work with the Kyaka focused on political and social organization, in conformity with his supervisors' preferences, but early publications dealt with Kyaka bird knowledge, lore, and utilization (Bulmer 1957) and involvement in the regional bird of paradise plume trade (1962). Later papers would incorporate Kyaka folk biology data, but Bulmer's true flowering as an ethnobiologist came with his fieldwork with the Kalam (formerly, Karam) of the northern Highlands fringe.

While Lecturer and then Senior Lecturer in Social Anthropology at the University of Auckland, Ralph initiated what would be a life-long enterprise, the Kalam Project. Between 1960 and 1985, he spent 28 months in the Kaironk Valley in 14 field trips, long and short, until he had become a regular part of the human and natural environment of the Kalam. Appreciating the importance of team research since his early experiences with the Same, Ralph always stressed collaboration in his work, and the Kalam Project would eventually include two anthropologists, two linguists, and more than 20 zoologists, botanists, and other scientific colleagues. While himself a gifted amateur naturalist, Bulmer always deferred to his professional colleagues, who co-authored with him numerous papers on the fauna and flora of the Kaironk Valley, from both scientific and Kalam perspectives (see Bibliography).

Ralph's most notable collaborator was Ian Saem Majnep, a Kalam who began as a teenaged field assistant and developed over the years into a knowledgeable and articulate full participant in Bulmer's work. Still unparalleled in ethnobiology, the collaboration resulted, in 1977, in the remarkable book, *Birds of My Kalam Country*, with Majnep as senior author. There, Majnep recounts in detail the traits, habits, and Kalam lore concerning 180 bird species, with Bulmer providing commentary from the Western scientific point of view. Including drawings by Chris Healey (one of

Bulmer's first students), the book is a *tour de force* in ethnobiology. (See accompanying book review for a more detailed consideration.) A second collaborative effort, *Animals the Ancestors Hunted,* dealing with Kalam knowledge of animals and hunting techniques, was seen through final revisions just before Bulmer's death, and on his final visit to Auckland to work with Ralph, Majnep brought along a draft of a third book, on Kalam ethnobotany, which will now be completed with the assistance of Andrew Pawley, long-time linguist on the Kalam Project.

Bulmer's gifts as a naturalist and his intimate knowledge of the Kalam gained through fieldwork that has been both intensive and extensive were combined with his collaborators' specialist contributions to result in a series of meticulously-crafted papers that have been enormously influential in ethnobiology. As a careful and thoughtful ethnographer, Ralph was always wary of the "general principles" and "universals" proposed by others. Moreover, he was always concerned with the cosmological dimensions of folk biology, demonstrating again and again that, for the Kalam, the salience of animals and plants derives not only from their economic importance or the compelling perceptual features they might possess, but also from their symbolic significance. These same concerns appeared again in his most recent work, as in his last years he began to publish his long-term investigations into the birds of the Bible—a new direction, with regard to the data examined, but a continuation of his determination to understand folk biological classification systems in their fullest context.

In addition to the intellectual problems related to folk biology, human problems and concerns were always important to Ralph. As Foundation Professor of Social Anthropology at the new University of Papua New Guinea, Bulmer served there from 1968-73, during which time he tried to apply the findings and perspective of "ethnoscience" to science teaching in schools (Bulmer 1971), just as he would later (1982a) argue for the importance of incorporating local knowledge of plants and animals in conservation efforts. Always generous with his time and talents, he worked hard to establish institutional supports for research and teaching, gave unsparingly of his energy to the training of students, and, whether in Papua New Guinea or New Zealand, welcomed visitors and itinerant fieldworkers to his homes with warm hospitality, stimulating talk, and chances to observe his pets of the moment, from birds to sugar gliders.

Ralph Bulmer was a gifted, erudite, versatile, amiable, gentle, generous, yet modest man whose passing represents a great loss, not only to ethnobiology but to all who knew him. Just before his death, in the middle of North American summer holidays, an urgent summons from Andrew Pawley elicited over 100 papers for a volume in Ralph's honor. Once gone, Ralph was taken to the Maori meetinghouse at the University of Auckland, where family, friends, and colleagues spent the day and night amidst speeches of reminiscence. As he had requested, he was buried near Manukau Harbour, near the beach where he had often wated the shorebirds.

ETHNOBIOLOGICAL BIBLIOGRAPHY OF RALPH N.H. BULMER

Bulmer, Ralph N.H.

1957 A primitive ornithology. Australian Museum Magazine 12:224-229.
1962 Chimbu plume traders. Australian Natural History 14:15-19.

1964 Edible seeds and prehistoric stone mortars in the Highlands of East New Guinea. Man 64:147-150.

1965a Beliefs concerning the propagation of new varieties of sweet potato in two New Guinea Highlands societies. Journal of the Polynesian Society 74: 237-239.

1965b Review of Leland C. Wyman & Flora L. Bailey, Navaho Indian Ethnoentomology. American Anthropologist 67:1564-1566.

1966 Birds as possible agents in the propagation of the sweet-potato. The Emu 65:165-182.

1967 Why is the cassowary not a bird? A problem of zoological taxonomy among the Karam of the New Guinea Highlands. Man, N.S., 2:5-25.

1968a Karam colour categories. Kivung 1:120-133.

1968b The strategies of hunting in New Guinea. Oceania 38:302-318.

1968c Worms that croak and other mysteries of Karam natural history. Mankind 6:621-639.

1970 Which came first, the chicken or the egg-head? *In* Échanges at communications: melanges offerts à Claude Lévi-Strauss. Jean Pouillon & Pierre Maranda, eds. The Hague: Mouton. pp. 1069-1091.

1971 Science, ethnoscience and education. Papua New Guinea Journal of Education 7:22-33.

1974a Folk biology in the New Guinea Highlands. Social Science Information 13:9-28.

1974b Memoirs of a small game hunter: on the track of unknown animal categories in New Guinea. Journal d'Agriculture Tropicale et de Botanique Appliquée 21: :(4-4):79-99.

1976 Selectivity in hunting and in disposal of animal bone by the Kalam of the New Guinea Highlands. *In* Problems in economic and social archaeology. G. de G. Sieveking et al., eds. London:Ducksworth. pp. 169-186.

1978 Totems and taxonomy. *In* Australian aboriginal concepts. L.R. Hiatt, ed. Conberra: Australian Institute of Aboriginal Studies. pp. 1-19.

1979a Mystical and mundane in Kalam classification of birds. *In* Classifications in their social context. R.F. Ellen & D. Reason, eds. London: Academic Press. pp. 57-79.

1979b Tameness and mystical associations of wild birds. *In* Birds of a feather: osteological and archaeological papers from the South Pacific in honor of R.J. Scarlett. Atholl Anderson, ed. Oxford: British Archaeological Reports. pp. 67-73.

1982a Traditional conservation practices in Papua New Guinea. *In* Traditional conservation in Papua New Guinea. Louise Morauta et al., eds. Boroko: Institute for Applied Social and Economic Research. pp. 59-77.

1982b Crop introductions and their consequences in the Upper Kaironk Valley, Simbai area, Madang Province. *In* Proceedings of the Second Papua New Guinea Food Crops Conference. R.M. Bourke & V. Kesavan, eds. Port Moresby: Department of Primary Industry. pp. 282-288.

1985a Comment on Cecil H. Brown, Mode of subsistence and folk biological taxonomy. Current Anthroplogy 26:54-55.

1985b Review Article: Trees, grerbs, wugs, snurms and quammals: The new universal natural history of Cecil H. Brown. Journal of the Polynesian Society 94:431-437.

n.d.a The uncleanness of the birds of Leviticus and Deuteronomy. (In press, Man).

n.d.b The unsolved problems of the birds of Leviticus. (Under review).

Bulmer, Ralph N.H. & Bryant Allen

1987 Pigs and pitpit. Science in New Guinea 13:97-99.

Bulmer, Ralph N.H. & J.I. Menzies

1972-73 Karam classification of marsupials and rodents. Journal of the Polynesian Society 81:472-499; 82:86-107.

Bulmer, Ralph N.H., J.I. Menzies & F. Parker

1975 Kalam classification of reptiles and fishes. Journal of the Polynesian Society 84:267-308.

Bulmer, Ralph N.H. & Michael J. Tyler

1968 Karam classification of frogs. Journal of the Polynesian Society 77:333-385.

Bulmer, Susan & Ralph N.H. Bulmer

1964 The prehistory of the Australian New Guinea Highlands. *In* New Guinea: The Central Highlands. James B. Watson, ed. American Anthropologist 66(4,2):39-76.

Majnep, Ian Saem (Ralph Bulmer, Transl.)

1982 On the importance of conserving traditional knowledge of wildlife and hunting. *In*, Traditional conservation in Papua New Guinea. Louise Morauta et al., eds. Boroko: Institute of Applied Social and Economic Research, pp. 79-82.

Majnep, Ian Saem & Ralph N.H. Bulmer

1977 Birds of my Kalam country (Mnmon yad Kalam yakt). Auckland: Auckland University Press and Oxford University Press.

Tyler, M.J., F. Parker & R.N.H. Bulmer

1966 Observations on endoparasitic leeches infesting frogs in New Guinea. Records of the South Australian Museum 15:356-359.

[Ed. note: The following book review originally appeared in the *Folk Classification Bulletin*, precursor of the *Journal of Ethnobiology*, in 1978, Vol. 1, No. 2, pp. 7-8. It is reprinted here, with minor corrections, to bring the attention of a wider readership to a remarkable work in ethnobiology. TEH.]

BOOK REVIEW

Birds of my Kalam country / Mnmon yad Kalam yakt. Ian Saem Majnep and Ralph Bulmer. Illustrations by Christopher Healey. Auckland: Auckland University Press and Oxford University Press, 1977. Pp. 219.

Ian Saem Majnep is Professor Bulmer's informant, native consultant, and colleague. This work is truly collaborative both in its organization and in its text. It is a winning combination: Bulmer has had over twenty years field experience in the East New Guinea Highland region: Majnep's experience is life-long, raised on the forest edge in the Schrader Range above the Kaironk Valley, home of the Kalam language group, and learning the forest fauna as a child in the company of his widowed mother.

The book's most outstanding quality follows from its authorship; it is not only an account *of* the native viewpoint but also *by* a sophisticated native participant (Majnep's contributions are pinted in Bodoni type), though by virtue of Bulmer's commentary and clarification (printed in Univers type) and Healey's fine drawings, *for* a broad audience of English-speaking cultural anthropologists and natural historians. Majnep is truly a folk scientist, comparable as an observer of pattern in nature to a Darwin or a Wallace, if not destined to design a revolutionary theoretical perspective. Consider the following account (p. 60):

"Although we call *ksks* and *bdon* [(adult male and unmarked, respectively) Princess Stephanie's Bird of Paradise] by different names you can say that *ksks* are a kind of *bdon*, because some *bdon* grow into *ksks*, and these are the males. We know that this is so, for we see birds with their plumage changing. First the head changes; then the striped brown breast of the *bdon* is replaced by the dark green and blue breast of the *ksks*; and lastly the long black tail grows. In the first year that it changes it does not grow a full tail—only *slp* ['shoots']: In the second year its tail is complete.

" . . . *ksks* stay hidden in the mountain forest, but *bdon* quite often come into old gardens at the forest edge. They eat many kinds of fruit in trees and shrubs and vines and in low vegetation, and we believe that they propagate *klmn* ***[Trema orientalis]***, *slwal* [a tree rather similar to ***Trema]***, and *sanep* ***[Alocasia***, the wild taro] . . . They choose different sorts of display trees from those of the Sicklebills, ones with a long straight bare branch with no foliage or epiphytes on it for a considerable distance, and coming out at an angle, not horizontal, from the trunk. First the *bdon* come, and call out, then the *ksks*. If five or six *ksks* come, then two or three station themselves at each end of the display-branch and dance there, then they change places, those from one end going to the other, and so on."

This account might have been quoted from Bent's *Life Histories of North American Birds* or any comparable treatise of avian natural history. Note the care in establishing the basis of the knowledge reported: "We know that this is so, for we see . . ." and "we believe that they propagate . . ." As Majnep notes by way of introduction: "To tell you what you yourself have seen and know to be true is easy; to fit together all the things that other men tell you, and decide which of the things they say are true, is much more difficult" (44). A New Guinea native cut from the "cake of custom" speaking! In addition these quotes neatly clarify the relationship of nomenclature to classification (in an instance of overdifferentiation) and of the native view of intracultural variation.

Yet Majnep continues his earlier account noting that, "Before men try to shoot *ksks* at a dance-tree they perform rituals to drive away the goblins—one of them involves shooting a stem of *kapyeed* ***[Phragmites karka]*** over the top of the display tree—and there are spells recited at the base of the tree, so that the ghosts both get rid of the goblins and prevent the thoughts of members of the hunters' families, if they know where they have gone, from following them and disturbing them so that they don't shoot straight'' (60). And he provides this testimonial (40): ''Although I am now a Christian, I believe in this ritual, for I have seen it work. I have seen a man, one of my mother's brothers from Simbai, perform this ritual, and strike the ground with his heel, and make a sorcery stick . . . jump right up out of the ground, where it had been concealed.''

At this point the ''natural historians'' among us scratch their heads while the ''cultural anthropologists'' among us perk up their ears. Majnep is a scientist operating without an axiom of strict mechanical causation, but a scientist nonetheless.

Bulmer's contribution is low key, just enough to clarify what Majnep takes for granted yet no more than is necessary to highlight the accuracy of Kalam observation. The value of an ethnographer who is also an accomplished amateur natural historian is suggested by Majnep in this back-handed aside (122): ''Archaeologists are funny people, they just call these things (flying-fox wing bones used by Kalam today as head-scratchers) 'bone-points' and some of them never get the message about what animal they come from or what they are used for.'' It is just such essential detail carefully informed by a keen interest in all aspects of natural history that illuminates Bulmer's commentary.

The book is in three parts, an ethnographic-ecological introduction, then 18 short chapters on each major ''covert category'' of birds recognized by Majnep (including bats and the cassowary for completeness), followed by 6 Kalam stories about birds. Appendices list all recorded bird species with their Kalam designations in scientific and Kalam alphabetic order as well as all plants mentioned in the text. Bulmer here has allowed the Native to speak for himself, and he has spoken clearly and eloquently of his partnership with nature.

Eugene S. Hunn
Department of Anthropology
University of Washington
Seattle, WA 98195

BOOK REVIEW

Persephone's Quest: Entheogens and the Origins of Religion. R. Gordon Wasson, Stella Kramrisch, Jonathan Ott, and Carl A.P. Ruck. New Haven: Yale University Press, 1988. Pp. 257, illustr. $30.00 (cloth).

This book is a group of essays, several by Wasson and others by three of his collaborators. The first is a charming summary of Wasson's discoveries with his wife, Valentina Pavlovna, regarding Vedic *Soma*, Aztec *teonanacatl*, a shamanic *velada*, the "one-legged man" of Herodotus, the LSD-like smut of barley in the Greek Mysteries. The identification of the fly-agaric ***Amanita muscaria*** with the lost psychotropic *Soma* of the Rig-Veda is a well-founded triumph of modern humanistic scholarship. Wasson produced a seemingly endless series of fascinating insights into the ethnological significance of various mushrooms and other mycological phenomena. Another valuable insight is Wasson's use of the flower-covered statue of Xochipilli as a Rosetta Stone for identifying Aztec hallucinogens.

The second essay by Wasson, identifying the thunder-lightning engenderment of mushrooms (a folk belief found in both the Old and New Worlds) is in the reviewer's opinion another sound demonstration of relationship, accompanied as it is in each case by the same mushroom species, the connection with the same high good Thunderbird-Eagle in both hemispheres, etc. Other conjectures, often framed as tentative queries, are not so impressive. For example, the first part of "Mycenae" as the mu-upsilon-kappa root for "mushroom" is provocative, but not proven. The burial in earth of the seed of Ceres, goddess of grain, imprisonment by the god of the underworld, the wailing of winter winds, and the resurrection of Persephone ("against death") in the Spring—all this sounds like a transparent parable of the planting and growth of winter wheat (or an alternate explanation, the Greek custom of underground winter storage of baskets of seed grain). That the Greek Mysteries included the eating of the ergot of grain (probably barley) has convincing support in classifical references.

But mycological enthusiasm perhaps leads sometimes into the quite unlikely. The Biblical "Tree of Knowledge" is probably *not* related to *Soma* or ***A. muscaria.*** I am not convinced that the swastika and other *grecas* (Greek frets seen in visions) are a plausible source of the Platonic "Ideas." *Soma* is surely not the sole or even principal source of historic religions, for all the important part it had in a forerunner of Christianity. The use of red ochre in prehistoric graves more likely symbolized blood-fire-life than the red color of the fly agaric. The "one-sided man" of folklore, like the one-footed humans of Herodotus, may imply the one-footed mushroom or *Soma*, but Satan is not so much "one-legged" as he is provided with a goat's hoof on one of his two feet. That the Hindu cow is sacred because ***Stropharia cubensis*** sometimes grows in its dung is a very tenuous thesis also, in view of the many alternative Indic symbolisms from Mohenjo-dara onward.

Kramrisch's essay on *putika* as a surrogate for *Soma* in the Santal Parganas, in connection with the Mahavira Vessel (head of Indra, or the Sun), is the redaction of a justly celebrated study in the *Journal of the American Oriental Society*. Her thesis, in this reviewer's opinion, is thoroughly established. Wasson's third essay, on the last meal of the Buddha as a pyschotropic mushroom, is carefully argued, but the final judgment must be left to experts. Jonathan Ott has a brief essay on the disembodied eyes at Teotihuaca in Mexico.

The second half of the book consists of three learned essays by the classicist Carl A.P. Ruck. The first is a captivating explanation of the "shade-foot men" of Herodotus and others as the one-legged mushroom "parasol" of *Soma;* Socrates as the profaner of the Mysteries (convincing); and Prometheus as Shade-Foot and thief of fire. The second essay is on the discovery of wine, and the third on offerings from the Hyperboreans, a most enlightening study. Ruck's essays are arguably the most revealing in the book.

Strong objections, however, must be launched against the proposed neologism "entheogen." First of all, a term should not embody a controversial theoretical assumption (e.g., "psychedelic"). Second, the "power" American Indians find in hallucinogens is not sufficiently personalized or individuated to be dubbed "god," nor do classic peoples conceptualize hallucinogens in this way. And third, the term is etymologically awkward. If a *hallucinogen* engenders hallucinations, and *hydrogen* engenders water when oxidized, then *entheogen* must engender gods within: itself? the user? Wasson's violent objection to "hallucinogen" is captious—"a lie is the essence of 'hallucinogen' " (p. 30)—or a term contaminated since also used of hippie "entheogens." Nor can *Cannabis indica,* favorite of the god Shiva, be flatly pronounced non-entheogenic because also used by the non-genteel. The United Nations officially uses the impersonal term "psychotropic," as indeed does Kramrisch in her study. "Psychotropic" is to be recommended for all properly objective usage.

The essays must, therefore, be regarded as quite uneven in their quality. It is saddening to realize that these will be the last in Wasson's brilliant series.

Weston LaBarre
James B. Duke, Professor of Anthropology Emeritus
Duke University
Durham, NC 27706

NEWS AND COMMENTS

NEW BULLETIN — GARDENS FOR DEVELOPMENT

Volume 2, Issue 1 of *Gardens for Development* is now available. *Gardens for Development* is a bulletin for professionals concerned with the improvement of household-level food production worldwide. It presents articles, discussions, and news on all aspects of small-scale food production in distinct socio-economic settings for improved health, nutrition, and income.

Subscription rates in US Dollars are: $20 for libraries and other institutions; $10 for professionals and students from developed countries; and $5 for students from less developed countries.

Current subscriptions entitle individuals for membership in the *Gardens for Development* network with the right to actively participate in information exchange through the GfD Bulletin (printed articles, news items, printed discussions, information requests, etc.).

Send all correspondence to: The Editor, *Gardens for Development*, Sun Station Box 41243, Tucson, AZ 85717 USA.

MEETING ANNOUNCEMENT

The Midwest Archaeological Conference is set for October 13-15, 1989 in Iowa City, Iowa. This event will be hosted by the Office of the State Archaeologist (OSA), The University of Iowa. Abstracts for symposia (and all symposium paper abstracts) are due by August 4, 1989. Abstracts for contributed papers are due by the 8th of September 1989. For further information, please contact William Green or Stephen Lensink, OSA, Eastlawn, University of Iowa, Iowa City, IA 52242 — Telephone: (319) 335-2389.

SOCIETY NEWS

The Twelfth Annual Conference of the Society of Ethnobiology will be held March 30-April 2, 1989, at the University of California at Riverside. For additional information please refer to page 135 of the previous issue of the *Journal of Ethnobiology* or contact Sharon J. Rachele or Elizabeth J. Lawlor, Department of Anthropology, University of California, Riverside, California 92521; (714) 787-5524.

DARRELL POSEY ON TRIAL

As reported in an addendum to this column inserted in Volume 8, No. 1 of the *Journal of Ethnobiology*, anthropologist/ethnobiologist and *JEB* editorial board member and contributor, Dr. Darrell Posey, has been accused of violating the Brazilian Foreign Sedition Act by "interfering with the internal affairs of the Brazilian republic." Dr. Posey and two Kayapo Indian colleagues, Paulinho Paiakan and Kube-i Kaiapo, were charged after returning from the United States where the Indians had testified as to the destructive potential of current and proposed hydropower developments on the Xingu River near their homeland. They spoke at a meeting of the World Wildlife Fund and to representatives of the United States congress and executive branch and the World Bank (which has bankrolled many of the projects in question).

Brent Berlin reports the following developments through November, 1988: Kube-i Kaiapo, a codefendant and Kayapo chief, refused to appear at the preliminary hearing August 26, 1988 but responded to an order to appear at the court in Belem on October 14 supported by a contingent of 400 Kayapo dressed in traditional attire. The judge refused to hear Kube-i, declaring his traditional clothing "an insult" to the Ministry of Justice. The defense petitioned to have the judge removed for prejudice.

The case has attracted international attention. Paulinho Paiakan completed a tour of Europe, Canada, and Washington, D.C., sponsored by Friends of the Earth. A substantial sum has been raised by benefit concerts in support of their Native Peoples Conference, planned for January, 1989 near Altamira, and the site of the proposed Xingu dam. The congress is a grassroots effort designed to organize strategies for protesting Brazilian Amazonian development policies. The participants hope to build a protest village just above the site of the proposed dam.

Contributions to the Darrell Posey-Kayapo Defense Fund may be sent to Brent Berlin, the fund coordinator, at the Department of Anthropology, University of California, Berkeley, CA 94720, U.S.A. Additional and current information is available from the National Wildlife Federation (contact Sheila Crum at 202-797-6604/6646).

CONFERENCES

Past: *Plants and Man in Polynesia*

Brigham Young University, Hawaii Campus / December 1-3, 1988

Co-organizers: Paul Allen Cox, Department of Botany, Brigham Young University, Provo, UT 84602, and

Jerry Loveland, Institute of Polynesian Studies, Brigham Young University, Hawaii, Laie, Hawaii 96762

Future: *Twelfth Annual Ethnobiology Conference*

University of California, Riverside / March 30-April 2, 1989

Note: The deadline for submission of abstracts has been extended to the 15th of January, 1989. This is also the new deadline for submitting papers in the Barbara Lawrence Award competition.

Contact: Sharon J. Rachele, Ethnobiology Conference Committee, Department of Anthropology, University of California, Riverside, CA 92521-0418.

Sixth International Conference of the ICAZ (International Council for Archaeozoology)

The Smithsonian Institution, Washington, D.C. / May 21-25, 1990

Contact: Melinda Zeder, Chair, ICAZ Planning Committee, Department of Anthropology, NMNH, Smithsonian Institution, Washington, D.C. 20560.

Theme: The nature and implications of human/animal interactions on the distribution, behavior, morphology, and survival of animal species. Contributions are also sought which examine the role of animals in human subsistence economies, in ritual and religion.

GRANTS OFFERED

DESERT BOTANICAL GARDEN RECEIVES CONSERVATION GRANTS

The Desert Botanical Garden has received funding support for FLORUTIL, a project to conserve rare useful plants of the U.S./Mexico borderlands, from the World Wildlife Fund and the U.S. National Park Service . . . The Garden envisioned a cross-cultural, binational research team that would develop and promote plant conservation alternatives among the 75 ethnic groups and tribes living in states on both sides of the U.S./Mexico boundary. . . The FLORUTIL project will . . . include native people's insights in the conservation and management planning for a plant . . . By comparing the impact of traditional and commercial harvesting on the status of protected, unmanaged populations of the same rare species, the group can offer guidelines to harvesters and park rangers that will help with the management of these plant resources for the future. The studies will be in Organ Pipe Cactus and Big Bend Parks, USA, and in Rancho El Cielo, the Pinacate, and the Bolson de Mapimi reserves, Mexico . . . "A significant benefit of our research design is the collaboration between Indian, Mexican and Anglo-American scientists," according to Gary Nabhan, Desert Botanical Garden researcher. "We have a lot to learn from one another."

For information, write: Desert Botanical Garden, 1201 N. Galvin Parkway, Phoenix, AZ 85008. Phone: (602) 941-1225.

THE JACOBS RESEARCH FUNDS
Small Grants Program

The Jacobs Research Funds invite applications for small grants (maximum $1200) for research in the field of social and cultural anthropology among living American native peoples. Preference will be given to the Pacific Northwest as an area of study, but other regions of North America will be considered. Field studies which address cultural expressive systems, such as music, language, dance, mythology, world view, plastic and graphic arts, intellectual life, and religion, including ones which propose comparative psychological analysis, are appropriate.

Funds will not be supplied for salaries, for ordinary living expenses, or for major items of equipment. Projects in archaeology, physical anthropology, applied anthropology, and applied linguistics are not eligible, nor is archival research supported.

For information and application forms, contact the Jacobs Research Funds (formerly the Melville and Elizabeth Jacobs Research Fund), Whatcom Museum of History and Art, 121 Prospect St., Bellingham, WA 98225 / Phone: (206) 676-6981. Applications must be postmarked on or before February 15, 1989.

ITEMS IN THE NEWS

From the *Wall Street Journal*, August 16, 1988:

Global warming and threat of repeats of this past summer's drought has added impetus to a growing market for information on water conserving landscaping, for which the term "Xeriscape" has been invented (and copyrighted as a trademark by the Denver Water Department). The interested public now can turn to the NXCI (National Xeriscape Council, Inc., 940 E. 51st St., Austin, TX 78751-2241) for enlightenment. As Patti Hagen notes in her *Journal* article, the movement has spawned a new vocabulary of "x-rated" terms: for example, "xerigation" is water efficient irrigation; "xeric" (from the Greek for dry, *xeros*) is familiar to botanists, but "xericity," "xerophily," and "xerophilous" may require some practice before they can be slipped unobtrusively into normal conversation. "Xeriscapists" decry water-guzzling lawns in favor of such ground covers as *Yucca baccata, Lantana horrida,* and *Chrysothamnus nauseosus*. (Thanks to Will Van Asdall.)

PLANTS IN SPACE:

From the *Seattle Post-Intelligencer*

NASA scientists have discovered that a number of common household ornamental plants are highly effective in cleaning the air of toxic chemicals. Future astronauts may carry these plants along on extended space flights in order to reduce their exposure to carcinogens and other health risks associated with living in a tightly sealed environment (such as that found in many modern, energy-efficient buildings). The NASA researchers determined that chrysanthemums were superior in the capacity of filter benzene, a known carcinogen from the air. Two varieties of philodendron *(P. domesticum* and *P. oxycardium)* and aloe vera were found to remove large quantities of formaldehyde while the green spider plant *(Chlorophytum elatum)* removed carbon monoxide. The value of toxic-swallowing plants as air cleansers in the normal home environment, however, is questionable as the rates of absorption are but a fraction of the normal atmospheric turnover due to ventilation. (August 2, 1988: byline: John Noble Wilford, *The New York Times).*

POLITICIANS SLUG IT OUT

SACRAMENTO—With a swift stroke of his veto pen, Gov. George Deukmejian squashed a much-ballyhooed bill that would have declared the lowly banana slug the official state mollusk of California.

"I think the governor has thoughtlessly missed the point on this one," said crestfallen Assemblyman Byron Sher, D-Palo Alto.

Sher quoted the veto message as saying banana slugs are not indigenous to California and not "representative of the international reputation that California enjoys."

Sher was quick to dispute the governor's statements.

"Four of the five banana slug species are found only in California. As for banana slugs' representative qualities, we have repeatedly shown that these animals are an excellent example of the unique diversity of California's wildlife." (August 31, 1988: UPI)

ANDEAN NATIVE GRAIN FEATURED

The latest Yuppie dietary discovery is quinoa (pronounced "keen-wa"), aka *la chisya mama* 'the mother grain,' or *Chenopodium quinoa.* This fine grain can now be purchased at many health food outlets in the Seattle area (and undoubtedly elsewhere around the USA). The force behind the quinoa marketing push is Steve Gorad, president of the Quinoa Corporation, Boulder, Colorado, founded in 1982. By 1984, the Quinoa Corporation sold 11,500 pounds of quinoa grain; as it is still shipped in from South America it is pricey in Seattle; it now sells for $3.19 a pound in bulk. Aficionados are fascinated by the unique sensations quonoa provides, both visual and gustatorial. "Tawny, round and seedlike when raw, quinoa undergoes a surprising transformation when cooked. The protein-rich germ (rated at 16.2% protein)—unusual in being on the outside of the grain—turns white and forms a thin ring around the starchy, translucent center. The effect is of a tiny Saturn." The taste is described as "slightly nutty, . . . reminiscent of bulgar wheat, . . . " It is "among the most versatile of foods . . . steamed or boiled . . . served as breakfast cereal, made into pilaf . . . paella and jambalaya, used as stuffing, paired with fruits or vegetables to make a salad, soup or stew, formed into croquettes . . . " Quinoa also provides edible greens, a source of fuel, and for soap which Andean peoples extract from the saponin-rich seedcoats (which require careful rinsing to remove this bitter substance). The author of the P.I. article, Wanda A. Adams suggests several recipes; here's one you might try:

CRUNCHY QUINOA SALAD

1 cup quinoa
1 cup water
1/4 cup finely chopped sweet red or green onion
1/2 cup red pepper and 1/2 cup green pepper
3/4 cup celery
1/2 cup water chestnuts
1/2 cup slivered almonds
1/8 cup lemon juice
1/8 cup soy sauce
1/2 cup brown rice vinegar (plain or seasoned)
1/4 cup water
2 cloves garlic, pressed
1 tablespoon olive oil, fresh-ground pepper to taste

Bring 1 cup water to a boil, add quinoa, quickly stir. Cover and turn off heat. Allow to steam for 10 minutes without lifting cover. Finely chop onion, peppers, celery, water chestnuts. Combine lemon juice, soy sauce, vinegar, water, garlic, olive oil and pepper for salad dressing. Toss with salad. Chill or serve at room temperature. Serves 6.

READERS WRITE

David E. Williams, graduate fellow at the Institute of Economic Botany at the New York Botanical Garden wrote president Rea to compliment the Society on its 11th Annual Meeting in Mexico City last March: " . . . Those were the best meetings that I have ever attended. Having the meetings in Mexico was a real coup for the Society, establishing direct contact with what we have seen to be a very large and active community of Mexican ethnobiologists. The participation of the Mexicans in our Society is an asset, and should be encouraged . . . I think that both the Mexican and North American participants came away from the meetings with good impressions of each other, and in this an important step for international scientific cooperation was achieved . . ."

Beatrice M. Beck, librarian of the Rancho Santa Ana Botanical Garden, Claremont, California, USA, takes us to task for misspelling Victor K. Chesnut's name as "Chestnut." (*JEB* 8(1):122). We regret the oversight.

ELEVENTH ANNUAL MEETING
SOCIETY OF ETHNOBIOLOGY

9-12 March 1988
Mexico City, Mexico

ROBERT A. BYE, JR.
Conference Chairperson

ABRIDGED MINUTES OF BUSINESS MEETING

The business meeting took place on March 12 between 1300 and 1400 h., with Amadeo M. Rea presiding. The meeting was open to all registrants at the conference. Reports were offered by President-elect Elizabeth S. Wing; Willard Van Asdall, Editor, *Journal of Ethnobiology;* Secretay/Treasurer Cecil H. Brown; Conference Coordinator Jan Timbrook; and President Amadeo M. Rea.

Elizabeth S. Wing announced this year's winner of the Barbara Lawrence Prize for best paper submitted by a student for presentation at the 11th Annual Meeting. Darrel L. McDonald won the award. Dina Sandberg came in second.

Willard Van Asdall extended an invitation to those who presented papers and posters to submit related papers for consideration for publication in the *Journal of Ethnobiology.* He also discussed the possibility of publishing papers in Spanish in upcoming issues.

Jan Timbrook announced that next year's conference (Twelfth Annual Meeting) will be held in Riverside, California from March 30 to April 2, 1989.

The assembled members voted to change the bylaws of the Society so that the Secretary/Treasurer's term is extended from two years to three years. The measure passed.

President Rea noted that a questionnaire will be sent to members in the near future to assess their opinions on a number of questions that have been discussed by the Board of Trustees.

SOCIETY OF ETHNOBIOLOGY SECRETARY/TREASURER'S REPORT

March 7, 1988

Date of Last Report: March 7, 1987

Funds in Account at Last Report	$ 7,587.36
Funds Received by new Secretary/Treasurer after Last Report	10,814.13

INCOME SINCE FUNDS RECEIVED:

Sale of Back Issues	$ 1,090.00
Dues:	
Volume 6	224.50
Volume 7	4,268.00
Volume 8	6,711.00
Volume 9	20.00
Author's Reprints	690.00
1988 Conference Income (so far)	7,874.10

Donations to Lawrence Fund	400.00
Interest	370.08
Miscellaneous Income	31.30
Total Income Since Funds Received	$21,678.98
Total Income Since Funds Received plus Funds Received	$32,493.08

EXPENSES SINCE FUNDS RECEIVED:

	Volume 6:2	Volume 7:1	Volume 7:2
Typesetting	—	$1,740.00	$1,579.50
Printing	$3,274.00	$3,650.00	—
Postage	*	*	*
Totals	$3,274.00	$5,390.00	$1,579.50

*Paid for by the Department of Anthropology, Northern Illinois University.

OTHER EXPENSES:

1988 Conference (so far)	$8,148.14
Reimbursements	78.75
Postage for sending back issues to new secretary/treasurer	125.56
Total	$8,352.45
Total Expenses Since Funds Received	$18,595.95
Total Income in Account	32,493.08
Total Expenses ($18,595.95):	$13,897.13
Total Funds in Account as of March 7, 1988	$13,897.13

Circulation History To Date Since Volume 3:

Volume 4	257
Volume 5	335
Volume 6	413
Volume 7	**401
Volume 8	**246
Volume 9	**1

**Not yet closed out.

NOTICE TO AUTHORS

The *Journal of Ethnobiology* accepts papers on original research in ethnotaxonomy and folk classification, ethnobotany, ethnozoology, cultural ecology, plant domestication, zooarchaeology, archaeobotany, palynology, dendrochronology and ethnomedicine. Authors should follow the format for article organization and bibliographies from articles in this issue. All papers should be typed double-spaced with pica or elite type on 8½ x 11 inch paper with at least one inch margins on all sides. The ratio of tables and figures to text pages should not exceed 1:2-3. Tables should not duplicate material in either the text or graphs. All illustrations are considered figures and should be submitted reduced to a size which can be published within a journal page without further reduction. Photographs should be glossy prints of good contrast and sharpness with metric scales included when appropriate. All illustrations should have the author(s) name(s) written on the back with the figure number and a designation for the top of the figure. Legends for figures should be typed on a separate page at the end of the manuscript. Do not place footnotes at the bottom of the text pages; list these in order on a separate sheet at the end of the manuscript. Metric units should be used in all measurements. Type author(s) name(s) at the top left corner of each manuscript page; designate by handwritten notes in the left margin of manuscript pages where tables and graphs should appear.

If native language terminology is used as data, a consistent phonemic orthography should be employed, unless a practical alphabet or a more narrow phonetic transcription is justified. A brief characterization of this orthography and of the phonemix inventory of the language(s) described should be given in an initial note. To increase readability native terms should be indicated as ***bold-face italics*** to contrast with the normal use of *italic* type for foreign terms, such as latin binomials. If necessary, the distinction between lexical *glosses*, i.e., English language approximations of a term's referential meaning, and precise English equivalents or definitions should be indicated by enclosing the gloss in single quotation marks.

Authors must submit two copies of their manuscript plus the original copy and original figures. Papers not submitted in the correct format will be returned to the author. Submit your manuscripts to:

DR. WILLARD VAN ASDALL, Editor
Journal of Ethnobiology
Arizona State Museum, Building 26
University of Arizona
Tucson, Arizona 85721

NEWS AND COMMENTS

Individuals with information for the "News and Comments" section of the *Journal* should submit all appropriate material to Eugene Hunn, Department of Anthropology, DH-05, University of Washington, Seattle, Washington 98195.

BOOK REVIEWS

We welcome suggestions on books to review or actual reviews from the readership of the *Journal*. Please send suggestions, comments, or reviews to Terence E. Hays, Department of Anthropology and Geography, Rhode Island College, Providence, Rhode Island 02908.

SUBSCRIPTIONS

Subscriptions to the *Journal of Ethnobiology* should be addressed to Cecil H. Brown, Department of Anthropology, Northern Illinois University, Dekalb, Illinois 60115-2854. Subscription rates are $40.00, institutional; $20.00 regular members, for U.S., Canada, and Mexico; foreign subscribers add $8.00. Write checks payable to *Journal of Ethnobiology*. Defective copies or copies lost in shipment will be replaced if written request is received within one year of issue.

CONTENTS

Journal of Ethnobiology

VOLUME 9, NUMBER 1

SUMMER 1989

Journal and Society Organization

Journal of Ethnobiology is published semi-annually. Manuscripts for publication, information for the "News and Comments" and book review sections should be sent to the appropriate editor on the inside back cover of this issue.

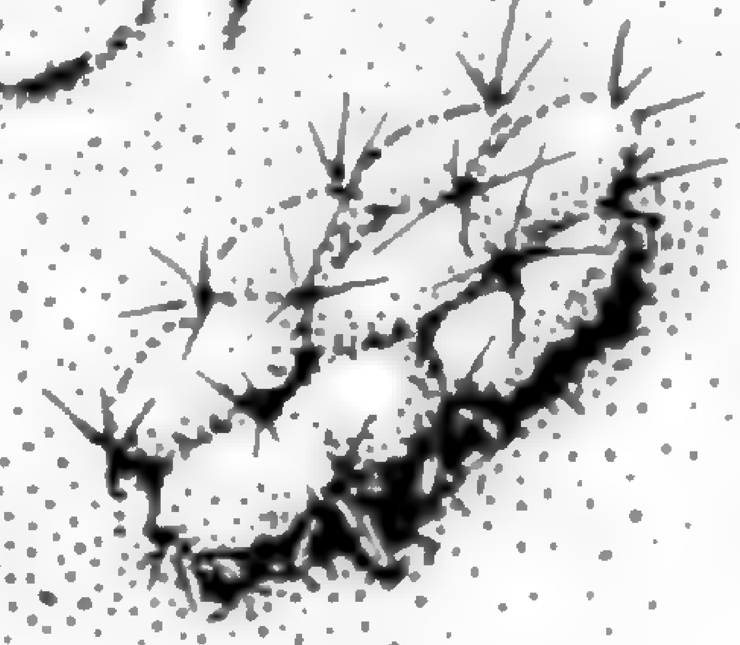
ISSN 0278-0771

Journal of Ethnobiology

VOLUME 9, NUMBER 1

SUMMER 1989

SKETCHES IN THE SAND



"Sketches in the Sand" for this issue is devoted, in one way or another, directly or indirectly to strawberries. Botanically speaking, strawberries are aggregrate fruits and not berries at all. With that technical detail disposed of, let us now turn to appreciation of that gastronomic delight, the straw-aggregate fruit. Having mentioned appreciation, I must commend the local committee of the 12th Annual Ethnobiology Conference in Riverside especially for the seemingly unending supply of enormous and incredibly delicious strawberries at the Poster Session on Friday evening and at the break on Saturday morning. Now on to other vignettes (an interesting word which you might wish to investigate).

On April 29th, my 39th (don't I wish) birthday, I was in Bisbee, Arizona, and my friends, in commenting that I seeemed a somewhat atypical Taurian, asked about my rising this and descending that, all of which is dependent upon the time and place of birth. Well, I know exactly where I was born (plus or minus a square foot or two) but I don't know with any precision the time of my birth. Some twenty years ago, when another set of friends were having their astrological charts prepared, I asked my mother about the time of birth and after thinking about it for several minutes (I was the eighth of twelve children) here's what she told me.

It must have been in the late afternoon. Yes, it had to be. You had to be the one who was born on the day the strawberries were in full flower. I remember we had had some nice warm days and this caused the strawberries to bloom. You see, the house was then on the north side of the maple trees, much closer to the road, and we had a strawberry patch for early berries on that southwest facing slope. After moving the house back from the road[1] we've always had that whole area in flowers. If you'll remember, we planted glads[2] there on the day your youngest sister was born. Anyhow, I remember sitting at the window admiring the strawberry patch and thinking they should ripen early this year when the weather suddenly began to turn cold. There I was, about to give birth, but I wasn't about to lose those early berries.

School had been out for about a week (in those days rural elementary schools closed their doors for the summer around April 20) so I showed two kids how to cover the strawberries plants with newspaper, then straw then more newspaper and to weigh it down with boards, and told another one to find your Dad and tell him it was time to get Doc Bell and your Aunt Eva—no, it was your Aunt Maud because Eva, who usually helped was living in West Virginia because John had finally gotten a job with that railroad bridge over the Ohio River. Anyhow, the strawberry plants got covered and after Doc Bell and Maud arrived, you were born lickity split. So it had to be late afternoon that you were born.

Yes, it had to be your Aunt Maud who helped bring you into the world because that's why you don't have a middle name. We decided that your first name should be your Dad's middle name and we couldn't decide upon a middle name for you. Finally your Aunt Maud (who was an immensely practical woman—herself a mother of many children and a widow) announced that Willard Van Asdall is a long enough name for anyone. (You know, she was correct.)

So you can see there is a connection, however tenuous, between strawberries and my birthday other than I often enjoy strawberry shortcake or pie on this occasion.

Although I have several other vignettes about strawberries I shall allow these tales to illustrate several points that we ethnobiologists can bear in mind. Many of the rural areas where ethnobiologists work are in about the same level of development as was much of rural America before World War II and I and prior to the virtual take over by agribusiness. People who are close to Nature often associate unusual events that occur in nature with events in their families—births, deaths, illnesses, etc. If we can develop a genuine interest in the families of the communities in which we work, then make interested, unobtrusive inquiries about family events, this may trigger all sorts of information about past climatic or other events. An ethnobotanist may have no inkling about a flood of 50 years ago, but it may be mentioned in connection with some event in the family, if we ask in a loving, gentle, genuinely interested way.

Thus, in asking about the time of my birth I not only found out about a late frost that year, I also was given information allowing me to hypothesize that everbearing strawberry varieties were not common then and was told about a change in land use as well. Clues of this type can be of great help in making sense out of puzzlingly contemporary situations in our field studies. Undreamed of connections can be revealed when we learn to better relate with those with whom we work.

—W.V.

[1]The original house was small and without a basement. A basement was dug large enough to accomodate both the old house and a large, entirely new section of house. Both the interiors and exteriors were coordinated giving the appearance that the entire structure was new. See "Sketches," Volume 3, Number 2.

[2]Gladiolus

NOTE: For an interesting, easily understood account of the strawberry, please see: Wilhelm, Stephen. 1974. The garden strawberry: A study of its origin. American Scientist 62(3):264-271.

Past President's Page . . .

from remarks opening the 12 annual conference, Riverside

At the International Congress of Ethnobiology in Brazil last summer, a committee prepared a formal statement now known as the *Declaration of Belem.* This was published in the *Journal of Ethnobiology* two issues back (see 8(1):v). One of the resolutions made was this recommendation: "The Declaration of Belem strongly urges that ethnobiologists make available the results of their research of the native peoples with whom they have worked, especially including dissemination in the native language." In other words, the people among whom we work are entitled to share the results. Of the many ways this can be done, I will highlight just a few.

For one. In this issue of the *Journal* you will notice the inclusion of abstracts in languages other than English. We hope this may be of some help to non-English speaking researchers. I feel another major goal of this policy is that some published information may come back to native peoples who may speak as their second language other colonial languages such as Spanish, French, or even Portuguese. It is our individual obligation to get these publications back to the appropriate peoples. They often feel great pride when they discover their information, their classification system, their folk knowledge is considered valuable.

There are other examples. In the latest seed catalog of the non-profit organization, Native Seeds/SEARCH, I found a conspicuous box saying. "[We are] grateful to the Native Americans of the Greater Southwest who developed most of the crop seeds offered in this listing and to their descendants who shared them with us. In appreciation for this heritage, we offer seeds free to all Native Americans on an as-available basis. We will also send our newsletter to any interested persons of Native American descent."

In British Columbia, ethnonutritionist Dr. Harriet Kuhnlein developed the Nuxalk Food and Nutrition Program with a staff of native people. In conjunction with ethnobotanist Dr. Nancy Turner, Kuhnlein and the group prepared the *Nuxalk Food and Nutrition Handbook* (1984), a work covering the identification and harvest of traditional foods, general health and physical fitness as well as the basics of nutrition. In 1985 the team produced the *Nuxalk Recipe Book* telling how traditional and marketed foods have been prepared by this group. Both of these books are written in non-technical language and are intended for use by the people themselves.

Elois Ann Berlin, Brent Berlin, and associates have launched an intensive ethnomedical program among 15 highland Mayan *municipios* in Chiapas, Mexico. This is truly a community project. Plant collections and individual medical histories are being made by native Tzeltal and Tzotzil. The Berlins are the coordinators and technical advisors. Interviews are in Mayan, as will be the publication of final results. A Highland Mayan Medicinal Plants Herbarium with representatives of all collections will be a permanent research and teaching center in Mayan country.

During the course of their studies of the great Mexican markets, Edelmira Linares and Dr. Robert Bye have produced a number of inexpensive and simply illustrated booklets on traditional teas, medicines, and foods. While employed by Meals for Millions Foundation in Tucson, Dr. Gary Nabhan wrote and illustrated booklets on native agriculture for the Tohono O'odham (Papago).

Although in each of these examples the researchers are working with current ethnographic problems, there are ways that archaeobotanists and archaeozoologists can bring their findings back to the people. Here are three. Helping with curriculum development at schools with enrollments of native peoples is most important at the elementary and secondary levels. Giving workshops and programs for adults can be mutually rewarding. The staffs of tribal museums often lack the expertise to develop the technical aspects of exhibits, expertise that ethnobiologists might readily supply.

Although the colonial mentality dies a slow death, scientists are beginning to recognize that there is often considerable wisdom in folk knowledge and practice. And it is most valuable when preserved *in situ*. Ethnobiologists can play an important role in the transmission of information between generations.

Returning the results of our ethnobiological research to the people is a challenge to all of us working in this field. Sometimes it requires imagination. Our efforts must not end with just the production of technical papers, even though this is generally what aids our professional advancement. We must also make the results of our research available in forms that are accessible to the people among whom we work, the people who are so generous with their own fund of knowledge.

Amadeo M. Rea, Past President
Natural History Museum
San Diego, California, USA

NOMENCLATURAL PATTERNS IN KA'APOR ETHNOBOTANY

WILLIAM BALÉE
Departamento de Programas e Projetos
Museu Paraense Emilio Goeldi
66040 Belém - Pará
Brazil

ABSTRACT.—A long history of horticulture appears to have affected plant nomenclature in Ka'apor and other Tupi-Guarani languages of lowland South America. The Ka'apor language displays patterns of and for the construction of primary productive and unproductive lexemes denoting plants. Such lexemes account for about one-third of all known folk generic plant names in Ka'apor. Five nomenclatural patterns relating to these lexemes distinguish names for traditionally cultivated plants from names for traditionally non-cultivated plants. These patterns conform to an underlying principle: productive and unproductive primary lexemes in Ka'apor ethnobotany refer to traditionally non-cultivated plants.

RESUMEN.—Una larga historia en horticultura parece haber afectado la nomenclatura de las plantas en lenguas de la familia Tupí-Guaraní, habladas en las tierras bajas de Sudamérica; una de ellas, la lengua Ka'apor. La lengua Ka'apor muestra patrones productivos e improductivos que son utilizados en la formación de lexemas que se refieren a plantas. Dichos lexemas aparecen en cerca de un tercio de todos los nombres genéricos folklóricos de plantas. Cinco de los patrones en los que participan estos lexemas, sirven para distinguir entre nombres de plantas tradicionalmente cultivadas, de aquellos nombres que se remiten a plantas no cultivadas. Estos patrones obedecen a un principio: los lexemas productivos o improductivos en la etnobotánica de Ka'apor hacen referencia a plantas tradicionalmente no cultivadas.

RESUME.—Il semble que l'histoire longue de l'horticulteur ait affecté le nomenclateur des plantes chez les Ka'apor et chez autres langues Tupi-Gurani des basses terres de l'Amérique du Sud. La langue des Ka'apor montre des modèles dès mots primaires productifs et non-productifs qui dénotent des plantes, et la construction de ceux-ci. Ces mots expliquent à peu près un troisième des noms génériques populaires connus des Ka'apor. Cinq modèles nomenclaturels qui se rapportent à ces mots se distinguent les noms des plantes traditionellement cultivées des plantes traditionellement non-cultivées. Ces modèles se conforment avec un principe fondamental: les mots productifs et non-productifs chez l'ethnobotanique des Ka'apor s'adressent aux plantes traditionellement non-cultivées.

INTRODUCTION

A long history of plant cultivation appears to have influenced ethnobotanical nomenclature itself in Ka'apor and other Tupi-Guarani languages of the tropical lowlands of South America. The Ka'apor language displays patterns of and for the construction of primary analyzable lexemes denoting plants. These nomenclatural patterns ultimately distinguish names for traditionally cultivated plants from names for traditionally non-cultivated plants. This finding should be of considerable interest to ethnobiologists, for in Ka'apor, not only do cultivated plants tend to be "unaffiliated" with major life forms (Berlin *et al.* 1973, 1974), principles for naming them are fundamentally different from those for naming non-cultivated plants.

Primary analyzable lexemes account for about one-third of all known folk generic plant terms in Ka'apor. Although some primary analyzable lexemes denote plants that the Ka'apor are now cultivating, none refers to a species *traditionally* cultivated by the Ka'apor. In the Ka'apor botanical lexicon, productive primary lexemes denote only non-cultivated plants. Unproductive primary lexemes may designate either non-cultivated plants or introduced cultivated plants, but not plants that have been traditionally cultivated by the Ka'apor. Unproductive primary lexemes in Ka'apor ethnobotany include names modeled by analogy on names for other plants, names incorporating misleading life-form labels, semantically obscure names (by which exclusively non-botanical phenomena are designated as well as plants), and names incorporating attributives meaning 'false' and 'divinity.' Although the compound (analyzable) nature of virtually all these unproductive lexemes is also a feature of secondary lexemes (cf. Berlin *et al.* 1974:28-29), nomenclatural patterns and Ka'apor criteria of plant classification readily permit one to differentiate the two types of lexemes. In other words, compound names for traditionally cultivated plants are basically distinct in structure from compound names for other plants.

Patterns of and for the construction of primary productive and unproductive lexemes denoting plants seem to be sufficiently stable as to argue for the antiquity of horticulture and lexical oppositions between names for traditionally cultivated and non-cultivated plants in Ka'apor ethnobotany. Similar patterns evidently also exist in the ethnobotanical systems of languages closely related to Ka'apor.

TUPI-GUARANI SOCIETIES AND HORTICULTURE

The Ka'apor Indians of extreme eastern Amazonian Brazil (Fig. 1) speak a language of the Tupi-Guarani family. They have also been referred to as the Urubus (Huxley 1957, Ribeiro 1955) and Urubu-Kaapor (Ribeiro 1970). I employ here their self-designation, Ka'apor, which may be glossed as 'footprints of the forest.' The Ka'apor population is now approximately 500, dispersed in 14 settlements over a forested reserve of 530,524 hectares in the basins of the Gurupi and Turiaçu Rivers. Like many other Tupi-Guarani speaking peoples (see Grenand and Haxaire 1977), the Ka'apor are not exclusively a "forest" people. Although they depend on game, fish, and fruits from unmanaged forests, swamps, and streams, they have also, since remote times, intensively managed plants and swidden fields (Balée and Gély 1989, Ribeiro 1955).

Intensive plant management is a key cultural factor shared by diverse societies affiliated with the Tupi-Guarani family. None of the Tupi-Guarani societies of the Atlantic Coast of South America in the 16th century was reported to have been without horticulture, even though some non-Tupian speakers of the coast evidently were hunter-gatherers (Balée 1984:249, Cardim 1939:174). The coastal Tupinambá cultivated numerous species, including 28 named varieties of manioc

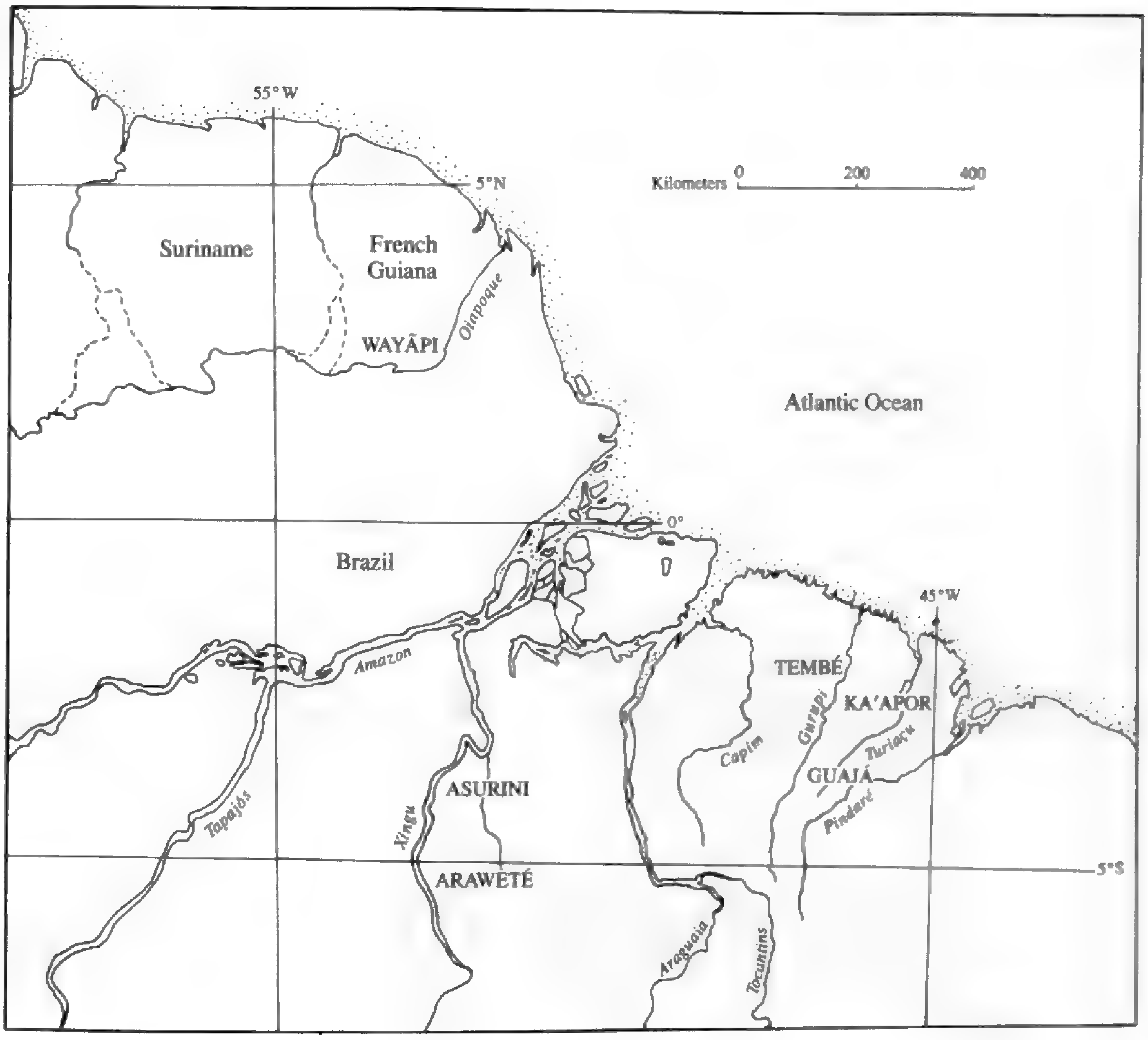


FIG. 1.—Situation Map of several Tupi-Guarani peoples of Eastern Amazonia.

(Métraux 1928:65-67). The Tupinambá of Bahia even practiced agricultural pest control. For example, they subtly detoured leaf-cutter ants away from manioc swiddens by scattering useless leaves along blind trails (Sousa 1974:89).

Given the importance of horticulture in all of the ethnohistorically known Tupi-Guarani societies, it may seem curious that four of the twenty-one living languages of Tupi-Guarani are associated with exclusively foraging societies (Rodrigues 1986:33). These are the Héta of extreme southern Brazil, the Aché of Paraguay, the Guajá of extreme eastern Amazonia, and the Avá-Canoeiro of central Brazil. Yet ethnohistorical and "inferential" linguistic evidence (Sapir 1949) indicates that a lifestyle of foraging for the Héta, Aché, Guajá, and Avá-Canoeiro is a regression from previously horticultural society. The Héta in the past evidently "practiced some plant cultivation" (Kozak *et al.* 1979:366). The Aché probably cultivated plants prior to the Spanish conquest, since their word for maize ***(wate)*** is cognate with words for maize in other Tupi-Guarani languages (Clastres 1968:51-52). The Guajá lived in settled villages in the 1760s rather than camps (Noronha 1856:8-9), which nearly always implies intensive plant management, at least in lowland South America. The Guaja word for maize is *wači* (3526)[1] which is also cognate with words for maize in other Tupi-Guarani languages. At an earlier time, the now foraging Avá-Canoeiro cultivated at least maize (Toral 1986), their term for which is ***avaši*** (Rivet 1924:177), also a Tupi-Guarani cognate. These maize words in modern Tupi-Guarani languages reconstruct in PTG (Proto-Tupi-Guarani) as ****abati*** (Lemle 1971:121). Such linguistic and ethnohistorical data suggest that the modern foraging Héta, Aché, Guajá, and Avá-Canoeiro were once cultivators of plants. They regressed to foraging apparently because of sociopolitical pressures from more powerful groups, both indigenous and not (Balée 1988:158).

PTG terms for several cultivated plants of Neotropical origin (see Lemle 1971) imply that horticulture was associated with PTG society of pre-Columbian times. The age of PTG has been estimated at 2000 BP (Migliazza 1982:502). Indeed, words for cultivated plants, swidden fields, and agricultural tools reconstruct in Proto-Tupi, the mother language of Tupi stock, of which Tupi-Guarani is one language family (Rodrigues 1988). The age of Proto-Tupi has been estimated at 4000 BP (Migliazza 1982:502). My purpose is to show that this archaic practice, horticulture, has affected the naming systems for plants in Ka'apor and evidently other Tupi-Guarani languages in highly regular, patterned ways.

METHODS

During 1984-87, I made extensive plant collections in the habitat of the Ka'apor. I carried out inventories of all plants greater than or equal to 10 cm dbh (centimeters in diameter at breast height) on two one-hectare plots of high forest (cf. Balée 1986, Prance *et al.* 1987). On one of these plots, I surveyed all vegetation in five sub-plots of 5 square meters each, collecting all species therein. I also conducted a one-hectare inventory of old fallow near a Ka'apor village, collecting all plants greater than or equal to 10 cm dbh. I made general collections in swiddens of various ages, high forest, fallow, swamp forest, and riverine forest in the region. The total number of individual plants I collected in the immediate vicinity of the Ka'apor was 1704, represented by voucher specimens and duplicates numbering more than 5000. These plant collections were made in and near four widely scattered Ka'apor villages: Urutawɨ-rena (1231 voucher specimens), Gurupiuna (415 voucher specimens), Šoanĩ (42 voucher specimens), and Šimo-rena (16 voucher specimens). I am confident that the vast majority of tree, palm, and liana species greater than 10cm dbh of the Ka'apor habitat is represented in these collections. All cultivated species of the Ka'apor have been identified and nearly all have been actually collected. Many non-cultivated grasses and herbs were also collected. The number of species accounted for by these collections is approximately 800.

Ka'apor informants were initially selected for their reputed knowledge of plants. In fact, all adults are ideally ethnobotanists. Ka'apor society is egalitarian, with distinctions of status adhering mainly to age/sex criteria, not to ranks. Adults are believed to possess the most knowledge about plants. For example, when a teenager is asked, 'Who knows about trees here?' ***(Awa mɨra-ta pe ukwa ko?)***[2], he/she invariably responds with something like 'The elders do' ***(Tamũĩ-ta ukwa)*** rather than with the name of someone, such as a headman or shaman, in particular.

Names, uses, and habitat data for all collected plants were elicited from 23 adult Ka'apor informants (17 men and 6 women). The responses to ten of these informants, divided among the four villages where collections were processed, tended very much toward agreement. These were the principal informants for Ka'apor plant nomenclature and classification. In the event of discrepancies between principal informants concerning a plant's name, I recorded the most cited name as the plant's valid name. If the main informants and/or most other informants insisted that two different names were valid responses for an individual plant (usually by saying 'It has two names'—***Makõĩ herr***), then both names, considered as synonyms, were recorded. There were no cases in which three or more plant names were synonymous.

Almost all interviewing was conducted in the Ka'apor language itself, in which I am reasonably fluent. With the exceptional bilingual informant, whose Portuguese (in which I am fluent) was superior to my Ka'apor, interviews were in Portuguese, but Ka'apor words for plants and uses were always obtained and recorded. With regard to each collected plant, informants were first asked, 'What is its name?' ***(Ma'e herr?)***, the specimen always being present before them. I also asked them several questions concerning the plant's uses, such as 'Is it edible?' ***(U'u awa?)***, 'Is it a remedy?' ***(Awa-puhan?)***, and 'Is it good for firewood?' ***(Yape'a-katu?)*** [cf. Balée 1986].

Establishing the folk categories of Ka'apor botanical classification was based on techniques described in Berlin *et al.* (1974:51-54). Once life-form terms were discovered from discussions about the plant domain in general, the generic members of each of these categories were elicited. In order to elicit all folk generic tree names, for example, I requested informants to 'Tell me all tree names' ***(Eme'u upa mɨra herr-ta).*** These data were obtained basically from four of the principal informants, including three men and one woman. Folk specific terms (secondary lexemes) were determined by eliciting the members of each folk generic taxon in like manner. In calculating the number of folk generics in Ka'apor (see below), synonyms were included.

In addition to research with the Ka'apor, I collected a total of 1804 voucher specimens with the Tupi-Guarani speaking Araweté (October-November 1985 and March-April 1986), Asurini of the Xingu (June 1986), Guajá (May-July 1987), and Tembé (July-August 1985). Names and uses for the plants collected among each of these groups were also elicited from several informants. Ethnobotanical classification was not thoroughly investigated among these other groups, as it was with the Ka'apor, but certain patterns of plant nomenclature in their languages appear to correspond closely with those of Ka'apor, as I describe below. The orthography of plant names given in these other languages follows suggestions by Aryon D. Rodrigues (pers. comm., 1988).

KA'APOR BOTANICAL LIFE-FORM LABELS

The class 'plant' is unnamed in the Ka'apor language. In the useful terminology of Brent Berlin and his colleagues (Berlin *et al.* 1973, 1974), which I adopt in part here, the botanical "unique beginner" is "covert." Numerous words that pertain exclusively to plants and plant products in Ka'apor and other Tupi-Guarani languages suggest that this covert category is real (cf. Berlin 1976:383-384, Berlin *et al.* 1973:214, 1974:30). Table 1 shows some of these terms in Ka'apor and four other Tupi-Guarani languages of eastern Amazonia, with the reconstructed forms in PTG.

In the Ka'apor language, the plant domain is subdivided into life-form classes (see Table 2). The semantic ranges of the labels for these classes correspond roughly to those of folk English 'tree,' 'herb,' and 'vine.' They do not correspond *precisely* with these partly because of polysemy. ***Mɨra*** ('tree') is polysemous with 'wood' and numerous finished wood products. The noun[3] ***ka'a*** ('herb') is polysemous with 'forest.' And ***sɨpo*** ('vine') covers both herbaceous vines and

TABLE 1.—Terms associated with the plant domain in several Tupi-Guarani languages with reconstructed forms in Proto-Tupi-Guarani (PTG).

Gloss	Ka'apor	Araweté	Asurini	Guajá	Tembé	*PTG
stem	*'ɨ*	*'i*	*'ɨwa*	*'ɨ*	*'ɨw*	**'iβa*
resin	*hɨk*	*hi*	*hɨk*	*hɨk*	*hɨk*	**hɨk*
leaf	*ho*	*hawe*	*haba*	*hawe*	*g̃wer*	**oβ*
root	*hapo*	*apo*	*iapu*	*hapo*	*həpə*	**hapo*
spine	*yu*	*yu*	*yu*	*yu*	*zu*	**yu*

a. See Lemle (1971).

TABLE 2.—Botanical life-form labels in several Tupi-Guarani languages with reconstructed forms in Proto-Tupi-Guarani (PTG).

Language	Gloss 'Tree'	 'Herb'	 'Vine'
Ka'apor	*mɨra*	*ka'a*	*sɨpo*
Araweté	*iwirã*	*ka'ã*	*ihipa*
Asurini	*ɨwɨra*	*ka'a*	*iipa*
Guajá	*wɨra*	*ka'a*	*wɨpo*
Tembé	*wɨra*	*ka'a*	*wɨpo*
Wayãpi*	*wɨla*	*ka'a*	*ipo*
PTG	**iβɨra*[b]	**ka'a*[b]	**ɨwɨpo*[c]

a. Wayãpi botanical life-form labels are from Grenand (1980).
b. See Lemle (1971).
c. Aryon Rodrigues (pers. comm., 1988).

TABLE 3.—Productive primary lexemes denoting plants in Ka'apor.

Ka'apor	Coll. No. (a)	Gloss	Botanical Referent
'Trees' ***mɨra***			
ag̃wa-yar-mɨra	1017	drum-owner-tree	*Pseudima frutescens* (Sapindac.)
ainumɨr-mɨra	3044	hummingbird-tree	*Bauhinia viridiflorens* (Caesalpiniac.)
akuši-mɨra	3031	agouti-tree	*Hirtella racemosa* (Chrysobalanac.)
arãkwã-mɨra	2208	Little chachalacha-tree	*Eugenia* sp. (Myrtac.)
arapasu-mɨra	92	woodpecker-tree	*Pithecellobium pedicellare* (Mimosac.)
arapuha-mɨra	280	brocket deer-tree	*Conceveiba guianensis* (Euphorbiac.)
ãyag̃-ara-mɨra	(b) 2259	divinity-hair-tree	*Solanum surinamensis* (Solanac.)
inamu-mɨra	326	tinamou-tree	*Exellodendron barbatum* (Chrysobalanac.)
kag̃waruhu-mɨra	2159	paca-tree	*Agonandra brasiliensis* (Opiliac.)
maha-mɨra	3539	white deer-tree	*Ocotea opifera* (Laurac.)
makahɨ-mɨra	2665	collared peccary-tree	*Duguetia yeshidah* (Annonac.)
mɨra-howɨ	693	tree-blue	Sapotac. indt. gen.
mɨra-pirer-hẽ'ẽ	956	tree-bark-sweet	*Glycoxylon* sp. (Sapotac.)
mɨra-pitag̃	957	tree-red	*Brosimum rubescens* (Morac.)
mɨra-tawa	2775	tree-yellow	*Casearia* sp. 1 (Flacourtiac.)
mɨra-wawak	1279	tree-spin	*Sagotia racemosa* (Euphorbiac.)
mɨra-wewi	613	tree-light	*Parkia* sp. 1 (Mimosac.)
mitũ-mɨra	2878	curassow-tree	*Erisma uncinatum* (Vochysiac.)
moi-mɨra	2795	snake-tree	*Poecilanthe effusa* (Fabac.)
pa'i-mɨra	5	priest-tree	*Dodecastigma integrifolium* (Euphorbiac.)
sawɨya-mɨra	2708	rat-tree	*Paypayrola grandiflora* (Violac.)
takwã-mɨra	2922	toucan-tree	*Virola carinata* (Myristicac.)
takwari-mɨra	2206	arrow-tree	*Coccoloba* sp. 1 (Polygonac.)
tamarĩ-mɨra	2302	saki-tree	*Diospyros* sp. 1 (Ebenac.)
tarara-mɨra	593	shred-tree	*Matayba spruceana* (Sapindac.)
teremu-mɨra	937	masc. personal name-tree	*Anaxagorea dolichocarpa* (Annonac.)

TABLE 3.—Productive primary lexemes denoting plants in Ka'apor. (continued)

Ka'apor	Coll. No. (a)	Gloss	Botanical Referent
tatu-mɨra	437	armadillo-tree	*Thyrsodium spruceanum* (Anacardiac.)
tayahu-mɨra	363	white lipped peccary-tree	*Tapirira pekoltiana* (Anacardiac.)
tupiyarɨma-mɨra	101	Long tailed tyrant-tree	*Talisia cf. micrantha* (Sapindac.)
wakura-mɨra	2227	nighthawk-tree	*Sapium* sp. 1 (Euphorbiac.)
wari-mɨra	2305	howler monkey-tree	*Clarisia racemosa* (Morac.)
yakamĩ-mɨra	3034	trumpeter-tree	*Coussarea paniculata* (Rubiac.)
yanu-mɨra	3542	spider-tree	*Myciaria* cf. *pyriifolia* (Myrtac.)
yapu-mɨra	938	oropendola-tree	*Tovomita brasiliensis* (Clusiac.)
yawa-mɨra	1002	jaguar-tree	*Protium aracouchini* (Burserac.)
yupara-mɨra	2961	kinkajou-tree	*Coumarouna micrantha* (Fabac.)
'Vines' ***(sɨpo)***			
akuši-sipo	2873	agouti-vine	*Alloplectus coccineus* (Gesneriac.)
arapuha-sɨpo	943	brocket deer-vine	*Coccoloba* sp. 2 (Polygonac.)
iraí-sɨpo	1024	masc. personal name-vine	*Schubertia grandiflora* (Asclepiadac.)
kurupi-'i-sipo	3048	divinity-little-vine	*Cordia multispicata* (Boraginac.)
maha-sɨpo	612	white deer-vine	Connarac. indt. gen.
mišik-sɨpo	432	roast-vine	*Moutabea guianensis* (Polygonac.)
musu-sɨpo	886	eel-vine	*Styzophyllum riparium* (Bignoniac.)
parawa-sɨpo	3423	Mealy parrot-vine	*Uncaria guianensis* (Rubiac.)
sɨpo-ãtã	2717	vine-hard	*Combretum* sp. (Combretac.)
sɨpo-hu	960	vine-big	*Cyclanthus funifer* (Cyclanthac.)
sɨpo-memek	618	vine-weak	Bignoniaceae indt. gen.
sɨpo-nem	3037	vine-fetid	*Cydista aequinoctialis* (Bignoniac.)
sɨpo-pihun	685	vine-black	*Forsteronia* sp. 1 (Apocynac.)
sɨpo-pɨrag̃	30	vine-red	*Hippocratea volubilis* (Hippocrateac.)

TABLE 3.—Productive primary lexemes denoting plants in Ka'apor. (continued)

Ka'apor	Coll. No. (a)	Gloss	Botanical Referent
sɨpo-šišik (b)	859	vine-smooth	*Heteropsis longispatacea* (Arac.)
sɨpo-tawa	2970	vine-yellow	*Humirianthera* sp. 1 (Icacinac.)
sɨpo-te (b)	859	vine-true	*Heteropsis longispatacea* (Arac.)
sɨpo-tuwɨr	1013	vine-white	*Amphilophium paniculatum* (Bignoniac.)
so'oran-sɨpo	885	rabbit-vine	*Stigmaphyllon hypoleucum* (Malpighiac.)
tayahu-sɨpo	3540	white lipped peccary-vine	*Ipomoea* sp. 1 (Convolvulac.)
tirɨrɨ-sɨpo	2785	crawl-vine	*Davilla nitida* (Dilleniac.)
yahɨ-sɨpo	987	moon-vine	*Dioclea reflexa* (Fabac.)
yaši-sɨpo-pe	2750	tortoise-vine-flat	*Bauhinia rubiginosa* (Caesalpiniac.)
yawapɨtağ-sɨpo	632	puma-vine	*Coccoloba* sp. 3 (Polygonac.)
yɨkɨrɨ-sɨpo	2738	sensitive-vine	*Acacia multipinnata* (Mimosac.)
wa-me-sɨpo	2299	fruit-inside-vine	*Monstera* cf. *pertusa* (Arac.)
'Herbs' ***(ka'a)***			
akuši-ka'a	996	agouti-herb	*Celtis iquanea* (Ulmac.)
ãyağ-ara-ka'a (b)	2666	divinity-hair-herb	*Solanum surinamensis* (Solanac.)
ipe-ka'a	3058	flat-herb	*Psychotria ulviformis* (Rubiac.)
ɨra-hu-ka'a	940	bird-big-herb	*Lomariopsis japurensis* (Lomariopsidac.)
irakahu-ka'a	2967	weasel-herb	*Schiekia orinocensis* (Haemodorac.)
ka'a-pɨši'u	2667	herb-fishy (in smell)	*Siparuna guianensis* (Monimiac.)
ka'a-riru	896	herb-container	*Phytolacca rivinoides* (Phytolaccac.)
ka'a-ro	2668	herb-leaf	*Ischnosiphon* (Marantac.)
ka'a-yu	1039	herb-yellow	*Eupatorium macrophyllum* (Asterac.)
ka'a-yuwar	923	herb-itch	*Solanum rugosum* (Solanac.)
kururu-ka'a	3088	toad-herb	*Amaranthus spinosus* (Amaranthac.)
kuyuɨ-ka'a	2235	Blue throated piping guan-herb	*Bertiera guianensis* (Rubiac.)

TABLE 3.—Productive primary lexemes denoting plants in Ka'apor. (continued)

Ka'apor		Coll. No. (a)	Gloss	Botanical Referent
parawa-ka'a		888	Mealy parrot-herb	*Ficus* sp. (Morac.)
pirapiši-ka'a		976	Characin fish-herb	*Justicia pectoralis* (Acanthac.)
purake-ka'a		815	electric eel-herb	*Laportea aestuans* (Urticac.)
suruwi-ka'a		2297	catfish-herb	*Calathea fragilis* (Marantac.)
tapi'i-ka'a		2222	tapir-herb	*Psychotria racemosa* (Rubiac.)
teyu-ka'a		3066	skink-herb	*Rania* sp. (Rutac.)
wari-ruwai-ka'a	(b)	761	howler monkey-tail-herb	*Lomariopsis japurensis* (Lomariopsidac.)
yag̃wate-ka'a		858	jaguar-herb	*Selaginella* sp. (Selaginellac.)
yakamĩ-ka'a		3069	trumpeter-herb	*Psychotria racemosa* (Rubiac.)
yakare-ka'a		3070	caiman-herb	*Pteridium aguilinium* (Dennstaedtiac.)
yawarũ-ka'a		973	black jaguar-herb	*Psychotria poeppigiana* (Rubiac.)
yu'i-ka'a		1033	frog-herb	Melastomatac. indt. gen.

a. Collection numbers refer to voucher specimens on the series Balée, deposited at the New York Botanical Garden with duplicates at the Museu Paraense Emilio Goeldi.
b. Synonym.

'lianas' (i.e., woody vines) as well as lashing material used by the Ka'apor in post-and-beam construction. Similar polysemous life-form labels have been noted in many other languages (Alcorn 1984:265, Hunn 1982:837-839). Ka'apor life-form labels are further not easily glossed in English, for they cover basically only non-cultivated plants, as shown below. The English glosses 'tree,' 'herb,' and 'vine' apply to Ka'apor botanical life-form labels, nevertheless, with these qualifications in mind.

Another Ka'apor word, ***kapi*** (PTG ****kapi'i,*** Lemle 1971:118), which covers numerous grasses, sedges, and other small succulent plants, seems, on initial inspection, to be a life-form label also. This is because ***kapi*** encompasses a large range of botanical species and Ka'apor informants consider ***kapi*** not to be a constituent of the other three life-form classes. The taxon ***kapi,*** however, is monotypic in Ka'apor, evidently containing no contrast sets (Kay 1971). In other words, ***kapi*** is an "empty taxon" (Hunn 1982:834, Turner 1974:34-35, 40). Folk botanical life-form labels, on the other hand, are polytypic, harboring a plurality of folk generic names, by definition (Atran 1985:307, Berlin *et al.* 1973:215, Randall and Hunn 198:330, cf. Brown 1977:319-320). The term ***kapi,*** therefore, may be understood either as a folk generic name which is unaffiliated with any of the life-form classes or as an aberrant life-form label.

KA'APOR BOTANICAL GENERICS

I take as an hypothesis that "nomenclature is often a near perfect guide to folk taxonomic structure" (Berlin *et al.* 1973:216, 1974:27, cf. Bulmer 1974, Hays 1983). I have thus far collected 404 Ka'apor generic plant names[4], of which 330 (82%) are classified by informants as being members of one of the three life-form classes labeled by ***mira*** ('tree'), ***ka'a*** ('herb'), and ***sipo*** ('vine'). These names are distributed in the following ways: 221 (67%) as 'trees', 47 (14%) as 'vines,' and 62 (19%) as 'herbs.' Of the 74 known folk generic names not so classified, 48 (65%) denote intensively managed plants and 26 (35%) refer to certain uncultivated grasses and/or morphologically unusual plants, such as bamboos and palms (for which no separate life-form label exists, in contrast to the Aguaruna of Peruvian Amazonia—Berlin 1976:385).

Berlin *et al.* (1974:28) define a productive primary lexeme as an expression in which one of the constituents (usually the head) refers to a taxon superordinate to the lexeme in question. Hence, in folk English, a 'pine tree' is a kind of 'tree.' An unproductive primary lexeme, although also compound, contains no constituents that label a superordinate taxon. For example, a 'hog plum,' in folk English, is not a kind of 'plum' (cf. Berlin *et al.* 1974:28). Of the 404 folk generic plant names in Ka'apor, 86 are productive primary lexemes and 45 are unproductive primary lexemes. In other words, these 131 productive and unproductive primary lexemes account for 32% of the 404 botanical folk generics thus far determined in Ka'apor. The other 273 (68%) Ka'apor generic plant names are simple primary lexemes, i.e., composed of single, linguistically unanalyzable stems and/or are superficially binomial (see Hunn and French 1984:77).

Many superficially binomial generics in Ka'apor incorporate the bound suffix ***'ɨ*** as the head term (e.g., ***kanei-'ɨ,*** a folk generic referring to many but not all *Protium* spp. in the Burseraceae). The term ***'ɨ*** is perhaps most accurately glossed as 'erect stem.' It should not be conflated with ***mɨra*** ('tree'), even though many organisms classified as 'trees' by Ka'apor informants incorporate this suffix. This is because in addition to constituting the head term in many 'tree' names, ***'ɨ*** is also the head term in many palm names. The stemwood of palms, when present as such, usually differs from that of most dicotyledonous trees since it does not serve as lumber or fuel, for the Ka'apor. Also, palms are not classified under the life-form term ***mɨra*** by Ka'apor informants. Insofar as ***'ɨ*** is a bound suffix, whereas ***mɨra*** is a free morpheme (occurring usually, although not always, as a head term in folk generic names), ***mɨra*** more closely approximates the status of life-form label than does ***'ɨ.*** One does not ask in Ka'apor, "What are the kinds of ***'ɨ***?". Another bound morpheme is ***rɨmo,*** which is incorporated as the head term in several 'vine' names. For essentially the same reasons that ***'ɨ*** does not replace ***mɨra*** as the label for 'tree,' ***rɨmo*** does not substitute for ***sɨpo*** as the label for 'vine.' All folk generic names incorporating either ***'ɨ*** or ***rɨmo*** as the head term, therefore, are here considered to be superficially binomial, i.e., the same as simple primary lexemes for the purposes of analysis. In the Ka'apor botanical lexicon, these simple primary lexemes may designate both cultivated plants (such as ***kara,*** which covers yams) and non-cultivated plants (such as ***kanei'ɨ,*** which denotes many but not all *Protium* spp.).

Patterns of nomenclature that dichotomize traditionally cultivated plants and traditionally non-cultivated plants are perceptible in the corpus of productive and unproductive primary lexemes in the Ka'apor botanical lexicon. All 87 known Ka'apor productive primary lexemes referring to plants are given in Table 3. These denote folk taxa that the Ka'apor classify as 'trees,' 'vines,' and 'herbs.' Three pairs of synonyms (denoting a total of three botanical species) are included and counted as six different productive primary lexemes. One of these pairs ***(ãyag̃-ara-mɨra*** and ***ãyag̃-ara-ka'a),*** which refers to *Solanum surinamensis,* exhibits disjunct life-form heads, which is an artifact of the morphological ambiguity of the plant itself (see below).

All productive primary lexemes (Table 3) immediately designate non-cultivated plants of the Ka'apor. Further, names for traditionally cultivated plants do not incorporate life-form heads. I qualify this with the phrase *traditionally cultivated,* because five names for cultivated plants do incorporate them. These are 1) ornamental hibiscus *(Hibiscus rosa-sinensis,* no coll. no.), called ***tupã-ka'a*** ('thunder-herb'); 2) a medicinal, *Petiveria alliacea,* 842, called ***mɨkur-ka'a*** ('opossum-herb'); 3) a spice for fish dishes, *Eryngium foetidum,* 941, called ***ka'a-piher*** ('herb-aromatic'); 4) forage for mules and donkeys, *Desmodium adecendens,* 3080, called ***ka'a-pe*** ('herb-flat'); and 5) lemon grass *(Cymbopogon citratus,* 955), called ***kãpĩ-piher*** ('grass-aromatic'). Although this last term incorporates the head ***kãpĩ,*** whose status as a life-form is dubious (see above), it is here included precisely because of this uncertainty and to ensure full presentation of the data.

It is noteworthy that all these plants have been recently introduced to the Ka'apor. In the late 1970s and early 1980s, the government Indian agent introduced *Eryngium,* lemon grass, and hibiscus. The Ka'apor acquired *Petiveria alliacea* from the neighboring Tembé in the 1970s. The Summer Institute of Linguistics missionary introduced *Desmodium* in 1986. None of these species, moreover, seems to have been a traditional Tupi-Guarani cultigen. For example, *Petiveria* was also introduced to the Tupi-Guarani speaking Wayãpi of the Oiapoque River region in 1979 (P. Grenand, pers. comm., 1988). Lemon grass is from South India and Sri Lanka (Bailey *et al.* 1976:354, Willis 1985:328). Ornamental hibiscus is probably native to tropical Asia (Bailey *et al.* 1976:562).

One can reason that the Ka'apor named these plants with words incorporating either life-form heads or attributives because, at the moment of introduction, these plants were obviously not managed, as far as the Ka'apor were concerned. Should these plants remain under cultivation for a long time, perhaps the Ka'apor would exchange the life-form constituents of these names for terms more appropriate to the domain of cultivated plants. In any case, all these names are unproductive primary lexemes, since they were not mentioned under any of the major life-forms by principal Ka'apor informants during general elicitation. In addition to names for recently introduced cultivated plants that incorporate life-form terms, there are several other kinds of unproductive primary lexemes in Ka'apor ethnobotany.

PLANT NAMES FORMED BY ANALOGY

Pierre Grenand (1980:43) described a cognitive barrier between cultivated and non-cultivated plants in Wayãpi ethnobotany as an "uncrossable frontier." The

Wayapi, he pointed out, distinguish no genealogical relationship between cultivated manioc and non-cultivated manioc, which are in the genus *Manihot*, occupy the same habitat, and outwardly appear similar (a chief difference being that the non-cultivated species are dispersed by non-human agents). Likewise, the Ka'apor distinguish cultivated manioc *(Manihot esculenta)*, the "bitter" forms of which usually incorporate the generic head ***Mani'ɨ***, from non-cultivated manioc *(M. quinquepartita)*, which they call ***arapuha-mani'ɨ*** ('brocket deer-manioc') [see Table 4].

Brocket deer are, in fact, ecologically associated with non-cultivated manioc. According to informants, brocket deer disperse the seeds of 'brocket deer-manioc' on the edges of swiddens (Balée and Gély 1989). When I asked an informant whether cultivated manioc was an 'herb' ***(ka'a)***, he emphatically stated "No, manioc is not an herb; manioc is manioc." This is a typical reply to similar queries about other traditionally cultivated plants. Yet 'brocket deer-manioc' is considered to be an 'herb' by the same informant, as with other informants. ***Arapuha-mani'ɨ*** is an unproductive primary lexeme, because it is not a member of the folk genus ***mani'ɨ*** (see Hunn and French 1984 for parallels). The name of non-cultivated manioc is modeled by analogy on a name for a cultivated plant to which an animal attributive is preposed (also see Berlin *et al.* 1974:38). Six other names of precisely the same structure occur in the Ka'apor botanical lexicon. These are shown

TABLE 4.—Plants names modeled by analogy on cultivated plants exhibiting animal attributives in Ka'apor.

Ka'apor	Coll No. (a)	Gloss	Botanical Referent	Botanical Model
a'ɨhu-pako	882	sloth-banana	Orchidac. (indt. gen.)	*Musa paradisiaca* (Musac.)
ara-kɨ̃'ɨ̃	2822	macaw-chili pepper	*Aparisthmium cordatum* (Euphorbiac.)	*Capsicum* spp. (Solanac.)
arapuha-mani'ɨ	2221	brocket deer-manioc	*Manihot quinquepartita* (Euphorbiac.)	*Manihot esculenta* (Euphorbiac.)
tapi'i-kanamɨ	973	tapir-cunami	*Psychotria poeppigiana* (Rubiac.)	*Clibadium sylvestre* (Asterac.)
tayahu-manuwi	1045	white lipped peccary-peanut	Marantac. (indt. gen.)	*Arachis hypogaea* (Fabac.)
teyu-pitɨm	952	skink-tobacco	*Conyza banariensis* (Asterac.)	*Nicotiana tabacum* (Solanac.)
yuruši-kɨ̃'ɨ̃	990	Ruddy quail dove-chili pepper	*Geophila repens* (Rubiac.)	*Capsicum* spp. (Solanac.)

a. See note a, Table 3.

in Table 4, together with their glosses, referents, and models. In all except one case ***(teyu-pitɨm,*** which refers to *Conyza banariensis),* the animal denoted by the preposed attributive is ecologically associated with the referent, according to informants. Although ***ara-kĩ'ĩ*** ('macaw-chili pepper') is not a kind of 'chili pepper,' macaws eat its fruits. ***Tayahu-manuwi*** ('white lipped peccary-peanut') is not a peanut, but white lipped peccaries eat its rhizomes in the high forest. The arboreal orchid ***a'ɨhu-pako*** ('sloth-banana') is not a banana, but sloths eat its leaves and flowers. ***Yuruši-kĩ'ĩ*** ('Ruddy quail dove-chili pepper') is not a chili pepper, but Ruddy quail doves eat its small red fruits on the forest floor. ***Tapi'i-kanamɨ*** ('tapir-cunami') is not the cultivated fish poison known as ***kanamɨ*** (nor is it any other kind of fish poison), but tapirs are said to eat its leaves. Regarding the one apparent exception to this pattern, although 'skinks' ***(teyu)*** are not ecologically associated with ***teyu-pitɨm*** ('skink-tobacco'), the two organisms do occur frequently together in the same habitat, namely, young swiddens. Other than ***arapuha-mani'ɨ,*** which, like its model ***mani'ɨ,*** is in the family Euphorbiaceae, these analogous names refer to plants that are in different botanical families than their models. In one case, a plant analogously named and its model are of fundamentally different stem habits ***(ara-kĩ'ĩ*** denotes the tree *Aparisthmium cordatum,* whereas its model, ***kĩ'ĩ,*** refers to shrubby chili pepper plants). With the exception of ***teyu-pitɨm,*** these names connote ecological relationships as well.

These analogous names are unproductive primary lexemes, not secondary lexemes. In terms of Ka'apor botanical classification, they are folk generics, not folk specifics. Two of these generics actually contain subordinate taxa. For example, ***tayahu-manuwi-ran*** ('white lipped peccary-peanut-false'), which refers to an indeterminate species of Marantaceae (665), is classified as a kind of ***tayahu-manuwi*** and ***teyu-pitɨm-ran*** ('skink-tobacco-false'), which denotes *Phyllanthus miruri* (3085), is considered to be a kind of ***teyu-pitɨm.*** Both species are non-cultivated. The models forming the head terms in the analogous generic names that incorporate animal attributives all refer to traditionally cultivated plants of the Ka'apor. These analogous names, therefore, evince a lexical opposition between cultivated and non-cultivated plants. A similar opposition is seen in the botanical lexicon of the Tupi-Guarani speaking Araweté. The Araweté cultivate seven named folk species of yam *(Dioscorea trifida,* 2086). All these names incorporate the folk generic head ***kara.*** These are classificatorily distinguished from an uncultivated species of *Dioscorea* (2081) called ***tatêtu-karã*** ('collared peccary-yam'). Both species commingle in swidden fallows, but Araweté informants do not consider 'collared peccary-yam' to be a 'yam' ***(karã)*** and it is not elicited as such. Collared peccaries consume and disperse this species, however, according to Araweté informants.

Although a name modeled by analogy on another plant name to which an animal attributive is preposed tends to refer to a plant that is ecologically associated with the animal, this is not so with names for cultivated plants. Names for cultivated plant varieties may incorporate preposed animal attributives, but the animals are not ecologically associated with the plants themselves. Such names for cultivated varieties are, incidentally, secondary lexemes, in contrast to the analogous names, which are unproductive primary lexemes. For example, five of the 16 varieties of bitter manioc named by the Ka'apor (Balée and Gély 1989) incorporate preposed animal attributives, while the other 11 are modified by color and/or shape terms. The names for bitter varieties incorporating animal attributives are ***yararak-mani'ɨ*** ('fer de lance-manioc'), ***yaši-mani'ɨ*** ('tortoise-manioc'), ***sarakur-mani'ɨ*** ('Wood rail-manioc'), ***ararũ-mani'ɨ*** ('Hyacinthine macaw-manioc'), and ***šimokape-mani'ɨ*** ('Black vulture-manioc'). Fer de lances, rails, tortoises, macaws, and vultures do not feed on manioc in swiddens (cf. Balée 1985:496-501) and, excluding fer de lances, are rarely encountered there. Hence, folk specifics for cultivated plants do not evoke ecological relationships as do most generics based on analogy that incorporate animal attributives. In other words, unproductive lexemes incorporate animal attributies in semantically different ways than do secondary lexemes referring to cultivated varieties. This is evidently not only so in Ka'apor, but in other Tupi-Guarani languages. For example, the only name for a cultivated yam modified by an animal attributive among the Tupi-Guarani speaking Tembé is ***yowoi-kara*** ('boa constrictor-yam') [1552]. The carnivorous boa constrictor, ostensibly, does not consume yams and no other ecological relationships between these two organisms exist.

MISLEADING LIFE-FORM CONSTITUENTS OF FOLK GENERIC NAMES

In Ka'apor, a few plant names incorporate life-form constituents that do not well describe the stem habit of the organisms denoted (some of these names correspond with Type 3 unproductive lexemes in Berlin *et al.* 1974:39). These names invariably denote non-cultivated plants. For example, ***tapuru-ka'a*** ('grub-herb') is classified by the Ka'apor as a 'vine,' not an 'herb,' as the head term ***ka'a*** misleadingly indicates. For this reason, ***tapuru-ka'a*** is an unproductive lexeme. Morphologically ambiguous plants may be named by synonyms displaying different head terms. For example, ***ãyağ-ara-mɨra*** ('divinity-hair-herb'), which denotes *Solanum surinamensis,* is synonymous with ***ãyağ-ara-ka'a*** ('divinity-hair-herb') [see Table 3]. This shrub is tall, reaching more than two meters, but not woody.

Two names incorporate the life-form label ***mɨra*** as an attributive to head terms designating traditionally cultivated plants. The shrubby *Myrciaria tenella* (947) of the high forest is called ***mɨra-kĩ'ɨ*** ('tree-chili pepper'). An unproductive lexeme, its status as a kind of 'tree' or any other life-form is uncertain among informants. Although mallow *(Urena lobata,* 947) was introduced to the Ka'apor as a commercial crop in the 1930s, it now grows spontaneously in clearings and is no longer cultivated by them. The Ka'apor name for mallow is ***mɨra-kɨrawa*** ('tree-*Neoglaziovia variegata*'). The head constituent, ***kɨrawa,*** denotes a traditionally cultivated bromeliad that the Ka'apor use for making bowstrings and rope. Mallow also possesses excellent fiber from which the Ka'apor fashion bowstrings and rope in the shortage of ***kɨrawa.*** The name ***mɨra-kɨrawa*** is modeled by analogy on the name of a cultivated plant that incorporates a preposed life-form attributive (see Berlin *et al.* 1974:38). It is interesting that mallow is not woody and in the habitat of the Ka'apor it attains only infrequently two meters (cf. Atran 1985:305). It was not elicited as a member of any of the three life-forms. Regardless whether the attributive ***mɨra*** ('tree') would be more aptly substituted by ***ka'a*** ('herb') in the construction of the word for mallow, the incorporation of ***mɨra*** may connote the traditionally non-cultivated status of mallow in Ka'apor culture.[5]

The use of a 'tree' word to label uncultivated herbs appears to be fairly common in other Tupi-Guarani languages. The Tupi-Guarani speaking Guajá, for example, refer to at least three species of non-cultivated, succulent herbs (*Dulacia* sp. [3421], *Ludwigia* sp. [3368], and *Conyza* sp. [3374]) by the life-form label for 'tree' ***(wɨra)***, even though the Guajá language has a word for 'herb' ***(ka'a)***. There appear to be no folk generic names in Guajá for these species. The Araweté also name several small, succulent herbs, including *Scoparia negleta* (2048), with the life-form label 'tree' ***(iwirã)***.

Words for 'tree' may hold the most psychological salience of all botanical life-form labels, among the world's languages (Brown 1977, Witkowski *et al.* 1981). Trees are "semantic primitives" (Friedrich 1970:8). With these Tupi-Guarani languages, tree words also extend to non-cultivated herbs and even to some vines. The Araweté, for example, call the rubiaceous *Uncaria guianensis* (2097), which is clearly a vine (and is so lexically encoded by the Ka'apor—see Table 3) by the term ***iwirã-'atĩ*** ('tree-unanalyzable constituent'). This is so despite a term for 'vine' ***(ihipa)*** in the Araweté language. The Araweté, moreover, referred to my daily collections of forest plants in their habitat, even when these included 'herbs' and 'vines,' as ***iwirã-nawe*** ('tree-foliage'). The Guajá described similar collections as being ***wɨra-riwe*** ('tree-foliage') [cf. Berlin 1976:383][6]. Tupi-Guarani life-form labels for 'tree,' hence, seem not to be merely polysemous with 'wood' and its products, but also with 'traditionally non-cultivated plant' (cf. Witkowski *et al.* 1981). The label for 'tree' in these languages, moreover, appears to be polysemously an incipient kingdom label, under which traditionally cultivated plants are conspicuously absent in folk classification.

OBSCURE PLANT NAMES

Some unproductive primary lexemes referring to plants at once denote, in their entirety, non-botanical phenomena as well. Although these (usually) compound expressions are single lexemes (see Hunn and French 1984:76), I call them "obscure" plant names because of their potential semantic ambiguity (these correspond with Type 4 unproductive primary lexemes in Berlin *et al.* [1974:39]). In Ka'apor, there are 15 such names (Table 5). Four of these names denote a cultivated plant. These are 1) ***awa-i*** ('person-little') for *Canna indica;* 2) ***pu'i-risa*** ('bead-cold') for Job's tears *(Coix lachryma);* 3) ***tawa*** ('yellow'), referring to turmeric (*Curcuma* sp.); and 4) ***u'ɨ-hu-ruwɨ*** ('arrow-big-blood'), denoting bath sponge *(Luffa cylindrica)*. A compound structure is noted in all these names except one, ***tawa***. Although the monomial ***tawa*** is therefore not technically analyzable, as are all other unproductive primary lexemes in the Ka'apor botanical lexicon, it is included here because of its semantic similarity to the other terms, that is, because of polysemy. The same word for turmeric occurs also in the Wayãpi language (P. Grenand, pers. comm., 1988). As with names for cultivated plants incorporating life-form constituents, these names refer to plants that have been apparently introduced to the Ka'apor. The center of dispersion of *Canna indica* appears to be southern Brazil (T. Koyama, pers. comm., 1987). Job's tears came

TABLE 5.—Obscure plant names in Ka'apor.

Ka'apor	Coll. No. (a)	Gloss	Botanical Referent
akuši-nami	3024	agouti-ear	*Psychotria* sp. (Rubiac.)
awa-i (b)	799	person-little	*Canna indica* (Cannac.)
ãyağ-nami	3065	divinity-ear	*Ipomoea setiflora* (Convolvulac.)
ɨra-hu-ra-wi	3097	bird-big-down-light	Bromeliac. indt. gen.
ɨra-kɨwa	987	bird-comb	*Asclepias curassovica* (Asclepiadac.)
ɨrapar-pukwa-ha	2301	bow-grip-generator	*Desmoncus polyacanthos* (Arecac.)
ka'uwa-pusan	945	insanity-remedy	*Siparuna amazonica* (Monimiac.)
kure-nami	3072	pig-ear	*Kalanchoë* sp. (Crassulac.)
ma'e-wɨra-puši	2794	some-bird-feces	*Struthanthus marginatus* (Loranthac.)
pu'i-risa (b)	928	bead-cold	*Coix lachryma* (Poac.)
suruku-yu-rašĩ	3073	bushmaster-yellow-spine	*Pithecellobium foliolosum* (Mimosac.)
tatu-ruwai	806	armadillo-tail	Polygonac. indt. gen.
tawa (b)	823	yellow	*Curcuma* sp. (Zingiberac.)
u'ɨ-hu-ruwɨ (b)	965	arrow-big-blood	*Luffa cylindrica* (Cucurbitac.)
u'ɨ-tɨma	847	arrow-leg	*Myrcia* sp. (Myrtac.)

a. See note a, Table 3.
b. Name refers to a cultivated species.

from tropical Asia (Willis 1985:271), as did turmeric (Bailey *et al.* 1976:346-347). Bath sponge also originated in Asia, probably in India (Heiser 1979:50). Obscure names in Ka'apor ethnobotany, then, encompass traditionally non-cultivated plants and evidently do not constitute a deviation from the proposed dichotomy between naming patterns for traditionally cultivated and non-cultivated plants.

FALSE PLANTS, DIVINE PLANTS

In Ka'apor, the postposed attributive ***ran*** ('false') tends to be incorporated only in generic names for traditionally non-cultivated plants. Preposed attributives that denote any deity, spirit, or soul, which are all best glossed as 'divinity' (Viveiros de Castro 1986:209-215), are not incorporated into generic names for traditionally cultivated plants. The models for all these names are cultivated species, only two of which, coffee and sugarcane, are not traditionally cultivated species of the Ka'apor. All 13 folk generic names based on analogy in these ways are presented in Table 6. In contrast to the analogous names in Table 4, whose

TABLE 6.—Generic plant names incorporating attributes for 'False' and 'Divinity' in Ka'apor.

Ka'apor	Coll No. (a)	Gloss	Botanical Referent	Botanical Model
'False' Plant Names:				
kase-ran	3059	coffee-false	*Casearia javitensis* (Flacourtiac.)	*Coffea arabica* (Rubiac.)
kawasu-ran	830	gourd-false	*Gurania eriantha* (Cucurbitac.)	*Lagenaria siceraria* (Cucurbitac.)
mãmã-ran	2158	papaya-false	*Jacaratia spinosa* (Caricac.)	*Carica papaya* (Caricac.)
mani'ɨ-ran	2691	manioc-false	*Stryphnodendron polystachyum* (Mimosac.)	*Manihot esculenta* (Euphorbiac.)
murukuya-ran	2657	passion fruit-false	*Passiflora aranjoi* (Passiflorac.)	*Passiflora edulis* (Passiflorac.)
nana-ran	2680	pineapple-false	*Ananas nanas* (Bromeliac.)	*Ananas comosus* (Bromeliac.)
u'ɨwa-ran	784	arrow cane-false	*Imperata brasiliensis* (Poac.)	*Gynerium sagittatum* (Poac.)
uruku-ran	3101	annatto-false	*Bixa orellana* (Bixac.)	*Bixa orellana* (Bixac.)
yɨtɨk-ran	879	sweet potato-false	*Ipomoea phyllomega* (Convolvulac.)	*Ipomoea batatas* (Convolvulac.)
'Divine' Plant Names:				
ãyaĝ-ruku	807	divinity-annatto	*Vismia* sp. 1 (Clusiac.)	*Bixa orellana* (Bixac.)
kurupir-nana	2680	divinity-pineapple	*Ananas nanas* (Bromeliac.)	*Ananas comosus* (Bromeliac.)
kurupir-pɨtɨm	537	divinity-tobacco	*Renealmia floribunda* (Zingiberac.)	*Nicotiana tabacum* (Solanac.)
kurupir-kã	1011	divinity-sugarcane	*Renealmia alpinia* (Zingiberac.)	*Saccharum officinarum* (Poac.)

a. See note a, Table 3.

referents and models tend to be in different botanical families, the majority of the names in Table 6 refer to plants in the same families as their models. Nevertheless, these names are unproductive primary lexemes, not secondary lexemes or folk specifics for cultivated plants. In listing folk specifics of bottle gourd ***(kawasu),*** for example, principal informants cited ***kawasu-ra'i*** ('bottle gourd-little'), ***kawasu-puku*** ('bottle gourd-long'), and ***kawasu-te*** ('bottle gourd-true'), which are all phenotypically distinct varieties (in terms of fruit size and shape) of the cultivated *Lagenaria siceraria* (906). They did not include ***kawasu-ran*** *(Gurania eriantha),* a non-cultivated cucurbit of secondary forest. Likewise, when queried about the folk specifics of ***nana*** ('pineapple'), informants cited ***nana-te*** ('pineapple-true') and ***nana-tikir*** ('pineapple-unanalyzable constituent'), both of which are phenotypic varieties (in terms of the leaves) of *Ananas comosus* (1019), but not the non-cultivated ***nana-ran*** *(Ananas nanas).* This pattern holds true also for generic names of the other non-cultivated plants based on analogy with names for cultivated plants that incorporate constituents meaning 'false' and 'divinity.'

Three seeming exceptions are not listed in Table 6 because they concern secondary lexemes, not unproductive primary lexemes. These secondary lexemes denote, nonetheless, cultivated plants and incorporate the postposed attributive ***ran*** ('false'). These are 1) ***taya-ran*** ('cocoyam-false') *[Xanthosoma* sp. 2, 3083]; 2) ***waraši-ran*** ('watermelon-false') *[Cucumis anguria,* 895]; and 3) ***kaka-ran*** ('cacao-false') *[Theobroma speciosum,* 2261]. The first two names refer to introduced cultivated plants. ***Taya-ran,*** whose botanical model is a traditionally cultivated species of cocoyam *(Xanthosoma* sp. 1, 3554), was introduced by the Summer Institute of Linguistics missionary in 1985. Although the Ka'apor have cultivated West Indian gherkin *(Cucumis anguria)* since the 1950s (Ribeiro 1955:15), this species was introduced to South America in post-colonial times (Bailey *et al.* 1978:342; Willis 1985:314). The third seeming exception concerns *Theobroma speciosum,* an occasionally cultivated tree (which is classified as 'tree' by informants). This is, however, a facultative species that occurs in primary forest as well as in dooryard gardens and fallows (Balée and Gély 1989) in the region. The term which denotes this species, ***kaka-ran,*** is a folk specific of ***kaka*** *(Theobroma cacao,* no coll. no.), the cacao of world commerce. It is noteworthy that cacao was at one time exported from lower Amazonia based on debt-peonage labor of Indians, a relationship probably known to the Ka'apor prior to about 1825 (Balée 1988:156). The term ***kaka,*** moreover, appears to be a direct borrowing from Portuguese *cacao,* which is in turn ultimately a borrowing from Nahuatl ***cacahuatl*** (Berlin *et al.* 1974:279-280). Given the facultative nature of *Theobroma speciosum,* and that cacao may once have superseded it as a cultivated tree crop of the Ka'apor, one may better comprehend the apparent anomaly of its name, which incorporates the postposed attributive meaning 'false.' No other secondary lexemes referring to traditionally cultivated plants do so.

Grenand (1980:38) indicated that the cognate Wayãpi ***lã*** ('false') is employed, as a rule, only in names referring to useless plants instead of their presumably 'true' models, that the Wayãpi utilize. Berlin *et al.* (1974:38) made a similar observation about Tzeltal Mayan plant names formed by analogy with cultivated models. The issue of the utility of plants whose names incorporate ***ran*** in Ka'apor, however, is best treated as a matter of degree. Useful 'false' plants abound in

Ka'apor ethnobotany (cf. Balée 1986), even with regard to those denoted by unproductive primary lexemes (Table 6). For example, although the Ka'apor do not use the fruits of ***kawasu-ran*** ('bottle gourd-false') for gourd bottles, as with its cultivated model ***kawasu,*** they apply white sap from the stem of ***kawasu-ran*** to remedy lacerations of the eye. The ***nana-ran*** ('pineapple-false') is considerably smaller than its cultivated congener, ***nana*** ('pineapple'), but the Ka'apor eat the succulent fruits of both species. Many Ka'apor also eat the fruits of ***mãmã-ran*** ('papaya-false') [Table 6], although these are somewhat bitter in taste compared to the 'real' papaya ***(mãmã,*** 918). 'False' is not incorporated as an attributive in names for useless plants *per se,* but far more systematically in names denoting traditionally non-cultivated plants. Further evidence is seen in the variable treatment of a single species, the annatto dye tree *(Bixa orellana).* The Ka'apor name for individuals of this species that they cultivate in dooryard gardens is ***uruku*** (801). Non-cultivated individuals of the same species, however, encountered in swamp forest, are called ***uruku-ran*** ('annatto-false') [see Table 6].

A semantic (but not structural) equivalence is evinced in the preposed attributives ***kurupir*** and ***ãyag̃*** (which both may be glossed as 'divinity') and the postposed attributive ***ran*** in unproductive primary lexemes.[7] For example, ***kurupir-nana*** and ***nana-ran*** are synonymous for the non-cultivated pineapple, *Ananas nanas* (Table 6). The Araweté language shows a similar pattern. In Araweté, the name for the cultivated bromeliaceous fiber plant, *Neoglaziovia variegata* (2406), is ***kirawã.*** This is distinguished from an uncultivated bromeliad of rock outcroppings *(Vriesia* sp., 2037), which is called ***anĩ-kirawã.*** Both exhibit the same potential uses, according to Araweté informants, the chief non-morphological differences between them being their habitat and state of cultivation. ***Anĩ-kirawã*** can be glossed as 'divinity-*Neoglaziovia variegata*' (cf. Viveiros de Castro 1986:209-215). In addition, the Araweté language also lexically differentiates between cultivated and non-cultivated annatto *(Bixa orellana),* as with Ka'apor. In Araweté, cultivated annatto is called ***irikə*** (2054), whereas non-cultivated annatto, of swamp forests, is named ***karuwa-nata'i*** ('divinity-unanalyzable constituent') [2096]. This lexical distinction is not *a priori* related to a difference in potential utility between cultivated and non-cultivated individuals of this single botanical species. Both Araweté and Ka'apor informants recognize that cultivated and non-cultivated varieties of annatto proffer dye from the pod for both clothing and the body in addition to combustible lignin used for making fire drills. In other words, constituents of unproductive primary lexemes meaning 'false' and 'divinity' do not connote an absolute measure of utility or lack thereof concerning plants, but rather the state of being traditionally non-cultivated.

The semantic equivalence of the attributives for 'false' and 'divinity' can be extended to life-form heads as well as to animal attributives referring to animals that are ecological associates of the plants thus named. All these constituents of unproductive primary lexemes are incorporated into names for plants that the Ka'apor did not traditionally cultivate.

SUMMARY AND CONCLUSIONS

Linguistic evidence for horticulture in Proto-Tupi-Guarani, which dates from about 2000 BP, indicates that all modern Tupi-Guarani languages are descended from a language spoken by a horticultural people. Even contemporary hunting-and-gathering societies affiliated with the Tupi-Guarani family display linguistic and other relics of a horticultural past. Plant nomenclature in Ka'apor and other modern Tupi-Guarani languages has been apparently affected in patterned ways by this ancient cultural heritage.

In Ka'apor ethnobotany, five specific and complementary patterns of nomenclature suggest a lexical dichotomy between traditionally cultivated and non-cultivated plants. This dichotomy is affirmed by Ka'apor folk classification. These patterns are: 1) Primary productive lexemes refer only to traditionally non-cultivated plants. These lexemes are of the type 'hummingbird-tree' wherein the head constituent ('tree' in this case) labels a superordinate taxon, viz., a botanical life-form. Some names for cultivated plants incorporate life-form heads seemingly appropriately, but the plants denoted are introduced, not traditional cultigens. These names are unproductive primary lexemes. 2) Unproductive primary lexemes incorporating a folk generic head for a cultivated plant with an animal attributive refer to traditionally non-cultivated plants. Six of the seven such names refer to plants that are ecologically associated with the animals denoted in the attributives. For example, sloths eat the leaves of ***a'ɨhu-pako*** ('sloth-banana'), but the plant is not classified as a 'banana' ***(pako)*** and is even in a different botanical family than are bananas. These are compound folk generic names, not folk specifics. In contrast, folk specific names (secondary lexemes) for cultivated plants that incorporate animal attributives do so in a semantically different way. The animals referred to by these attributives are not ecological associates of the cultivated varieties whose names incorporate them. 3) Misleading life-form constituents (heads and attributives that do not designate superordinate taxa or the superordinate taxon to which the plant belongs) are incorporated into some unproductive primary lexemes. These lexemes refer to traditionally non-cultivated plants. 4) Obscure plant names are unproductive primary lexemes that denote botanical as well as non-botanical phenomena. The 15 such names in the Ka'apor botanical lexicon refer to traditionally uncultivated plants of the Ka'apor (which include four introduced species). 5) Folk generic names that are based on analogy with names for cultivated plants and that incorporate attributives meaning 'false' and 'divinity' refer to traditionally non-cultivated plants.

These complementary patterns of nomenclature in Ka'apor ethnobotany may be subsumed under one principle: Productive and unproductive primary lexemes in Ka'apor ethnobotany refer to traditionally non-cultivated plants of the Ka'apor. This principle applies, *mutatis mutandis,* to the ethnobotanical systems of several other Tupi-Guarani speaking peoples. It evidently derives from a long history of horticulture (and its concomitant effects on the lexicon) associated with the Tupi-Guarani language family. Many plant names in Ka'apor do not merely indicate stem habit or even cultural utility, but rather imply the state of cultivation of these plants. 'Tree' words in Tupi-Guarani languages are not exhaustively glossed as 'woody plants,' 'plants of tall stem habit,' and 'woody commodities.' Trees seem to be 'traditionally non-cultivated plants' before anything else in Ka'apor ethnobotany and evidently in that of other Tupi-Guarani peoples.

ACKNOWLEDGEMENTS

I am grateful to the Edward John Noble Foundation for financial support of my fieldwork during 1984-87. Research in Brazil was facilitated by the collaboration of the National Indian Foundation (FUNAI), National Council on Science and Technological Development (CNPq), and the Goeldi Museum. I am indebted to the botanists who made determinations of many of the plants cited herein: P. Acevedo Rodriguez, W. Anderson, R. Barneby, C.C. Berg, B. Boom, R. Callejas, L. Constance, D. Daly, A. Gentry, C. Jeffrey, J. Kallunki, R.J.M. Maas, A. Mennega, J. Mickel, J. Mitchell, M. Nee, G.T. Prance, J. Pruski, and C. Sastre. I gratefully acknowledge helpful comments on an earlier version of this article offered by W. Van Asdall, B. Berlin, P. and F. Grenand, E. Hunn, D. Moore, A.D. Rodrigues and one anonymous reviewer. I am alone responsible for any possible errors of fact or interpretation.

NOTES

[1]All plant collection numbers cited herein are on the voucher series Balée. Voucher specimens are deposited at the New York Botanical Garden with duplicates at the Goeldi Museum. Collection numbers cited in Tables 3-6 are not reproduced in the text.

[2]A phonemicized orthography, adapted with minor modifications from Kakumasu (1986:399-401), is used here to represent Ka'apor speech sounds. Plain stops and affricates are ***p,t,k,kw,m,n,g̃,g̃w, s,š,h,r[ř]***. The glottalized stop is '. Semi-vowels are ***w*** and ***y***. Oral vowels are ***i, ɨ, u, e, a,*** and o, all of which have nasalized and phonemically distinct counterparts ***(ĩ, ɨ̃, ũ, ẽ, ã,*** and ***õ)***. Primary stress tends to fall on the final syllable and is indicated here only in an exception.

[3]As a verb, ***ka'a*** means 'defecate.' English 'bush,' which covers both 'shrub' and 'forest' (Sykes 1983:104), may seem to be a more appropriate gloss for ***ka'a*** than 'herb'; on the other hand, 'bush' may be considered to be even more polysemous than 'herb' and ***ka'a,*** since the semantic range of 'bush' includes non-botanical phenomena as well, such as 'luxuriant growth of hair' (Sykes 1983:104). 'Herb' refers only to botanical phenomena (Sykes 1983:104).

[4]About 5% of these names are synonymous with other folk generic names. I include all such synonyms in arriving at the sum total of 404 known folk generic names.

[5]The Tupi-Guarani speaking Tembé make semantically the same distinction: ***kurawa*** *(Neoglaziovia variegata,* no coll. no.) vs. ***wira-kurawa*** ('tree-*Neoglaziovia variegata*') [*Urena lobata,* 1628].

[6]Although the Ka'apor referred to my collections of trees, vines, and herbs as ***ka'a-ro*** (which, on one level of analysis, means 'herb-leaves'), ***ka'a-ro*** is also a word for leaves in general, regardless of provenience or stem-habit of the organisms in question.

[7]It is significant that the particular divinity denoted by the word ***kurupir*** is a dwarf who putatively controls game supplies and whose home range is exclusively in high forest. The decidedly evil divinity ***ãyag̃*** is also not associated with areas under cultivation.

LITERATURE CITED

ALCORN, J.B. 1984. Huastec Mayan ethnobotany. Univ. Texas Press, Austin.

ATRAN, S. 1985. The nature of folk botanical life-forms. Amer. Anthropol. 87(2):298-315.

BAILEY, L.H., E.Z. BAILEY, and STAFF of the Liberty Hyde Bailey Hortorium. 1976. Hortus Third: A concise dictionary of plants cultivated in the United States and Canada. MacMillan, New York.

BALÉE, W. 1984. The ecology of ancient Tupi warfare. Pp. 241-265 *in* Warfare, culture, and environment (R.B. Ferguson, ed.). Academic Press, Orlando.

____________. 1985. Ka'apor ritual hunting. Human Ecol. 13(4):485-510.

____________. 1986. Análise preliminar de inventário florestal e a etnobotânica Ka'apor (Maranhão). Bol. Mus. Paraense Emilio Goeldi, Ser. Bot. 2(2):141-167.

____________. 1988. The Ka'apor Indian wars of

LITERATURE CITED (continued)

lower Amazonia, ca. 1825-1928. Pp. 155-169 *in* Dialectics and Gender (R.R. Randolph, D. Schneider, and M.N. Diaz, eds.). Westview Press, Boulder.

__________, and A. GÉLY. 1989. Managed forest succession in Amazonia: The Ka'apor case. Adv. Econ. Bot., Vol. 7 (in press).

BERLIN, B. 1976. The concept of rank in ethnobiological classification: Some evidence from Aguaruna folk botany. Amer. Ethnol. 3:381-399.

__________, D.E. BREEDLOVE, and P.H. RAVEN. 1973. General principles of classification and nomenclature in folk biology. Amer. Anthropol. 75(1):214-242.

__________. 1974. Principles of Tzeltal Plant Classification. Academic press, New York.

BROWN, C.H. 1977. Folk botanical life-forms: Their universality and growth. Amer. Anthropol. 79:317-342.

BULMER, R. 1974. Folk biology in the New Guinea highlands. Soc. Sci. Inform. 13:9-28.

CARDIM, F. 1939. Tratados de Terra e Gente do Brasil. (Brasiliana, Vol. 168, ser. 5). Companhia Editora Nacional, São Paulo).

CLASTRES, P. 1968. Ethnographie des Indiens Guayaki (Paraguay-Brésil). J. Soc. Americanistes 57:9-61.

FRIEDRICH, P. 1970. Proto-Indo-European Trees: The Arboreal System of a Prehistoric People. Univ. Chicago Press, Chicago.

GRENAND, P. 1980. Introduction a l'Étude de l'Univers Wayâpi. SELAF, Paris.

GRENAND, F. and C. HAXAIRE. 1977. Monographie d'un abattis Wayâpi. J. Agric. Traditionelle Bot. Apl. 24:285-310.

HAYS, T.E. 1983. Ndumba folk biology and general principles of ethnobotanical classification and nomenclature. Amer. Anthropol. 85:592-611.

HEISER, C.B. 1979. The Gourd Book. Oklahoma Press, Norman.

HUNN, E. 1982. The utilitarian factor in folk biological classification. Amer. Anthropol. 84(4):830-847.

__________, and D.H. FRENCH. 1984. Alternatives to taxonomic hierarchy: The Sahaptin case. J. Ethnobiol. 4(1):73-92.

HUXLEY, F. 1957. Affable Savages. Viking Press, New York.

KAKUMASU, J. 1986. Urubu-Kaapor. Pp. 326-403 *in* Handbook of Amazonian Languages (D.C. Derbyshire and G.K. Pullum, eds.). Mouton de Gruyter, Amsterdam.

KAY, P. 1971. Taxonomy and semantic contrast. Language 47:866-887.

KOZÁK, V., D. BAXTER, L. WILLIAMSON, and R.L. CARNEIRO. 1979. The Héta Indians: Fish in a Dry Pond. Anthropological papers of the American Museum of Natural History, Vol. 55, Part 6. American Museum of Natural History, New York.

LEMLE, M. 1971. Internal classification of the Tupi-Guarani linguistic family. Pp. 107-129 *in* Tupi Studies I (D. Bendor-Samuel, ed.). Summer Institute of Linguistics Publications in Linguistics and Related Fields, Publication No. 29. Summer Institute of Linguistics, Norman, Oklahoma.

MÉTRAUX, A. 1928. La Civilisation Matérielle des Tribus Tupi-Guarani. Librairie Orientaliste Paul Geuthner, Paris.

MIGLIAZZA, E.C. 1982. Linguistic prehistory and the refuge model in Amazonia. Pp. 497-519 *in* G.T. Prance (ed.), Biological Diversification in the Tropics. Columbia Univ. Press, New York.

NORONHA, J.M. de. 1856. Roteiro da Viagem da Cidade do Pará ate as Ultimas Colonias dos Portuguezes em os Rios Amazonas e Negro. Noticias para a Historia e Geographia das Nacões Ultramarinas, Vol. 6. Lisbon.

PRANCE, G.T., W. BALÉE, B.M. BOOM and R.L. CARNEIRO. 1987. Quantitative ethnobotany and the case for conservation in Amazonia. Conservation Biol. 1(4):296-310.

RANDALL, R.A. and E.S. HUNN. 1984. Do life-forms evolve or do uses for life? Some doubts about Brown's universals hypotheses. Amer. Ethnol. 11:329-349.

RIBEIRO, D. 1955. Os índios Urubus: Ciclo anual das atividades de subsistencia de uma tribo da floresta tropical. Anais do XXXI Congresso Internacional de Americanistas, Vol. 1:125-157.

__________. 1970. Os Indios e a Civilização. Editora Civilização Brasileira, Rio de Janeiro.

RIVET, P. 1924. Les indiens Canoeiros. J. Soc. Americanistes de Paris, n.s., 16:169-181.

RODRIGUES, A.D. 1985. Relações internas na família lingüística Tupi-Guarani. Rev. Antropol. 27/28:33-53.

LITERATURE CITED (continued)

__________. 1986. Línguas Brasileiras. Edições Loyola, São Paulo.

__________. 1988. Proto-Tupi evidence for agriculture. Paper read at First International Congress of Ethnobiology, Belém.

SAPIR, E. 1949. Time perspective in aboriginal American culture: A study in method. Pp. 389-462 *in* Selected Writings of Edward Sapir (D. Mandelbaum, ed.). Univ. California Press, Berkeley.

SOUSA, G.S. de. 1974. Notícia do Brasil. Departamento de Assuntos Culturais do M.E.C., São Paulo.

SYKES, J.B. (ed.) 1983. The Pocket Oxford Dictionary of Current English, 6th ed. Clarendon Press, Oxford.

TORAL, A. 1986. Situação e perspectivas de sobrevivência dos Avá-Canoeiro. Xerox. Centro Ecumênico de Documentação e Informação, São Paulo.

TURNER, N.J. 1974. Plant taxonomic systems and ethnobotany of three contemporary Indian groups of the Pacific Northwest (Haida, Bella Coola, and Lilloet). Syesis 7 (Suppl. 1):1-104.

VIVEIROS DE CASTRO, E. 1986. Araweté: Os Deuses Canibais. Jorge Zahar, Rio de Janeiro.

WILLIS, J.C. 1985. A Dictionary of the Flowering Plants and Ferns, 8th ed. Revised by H.K. Airy Shaw. Cambridge Univ. Press, Cambridge.

WITKOWSKI, S.R., C.H. BROWN, and P.K. CHASE. 1981. Where do tree terms come from? Man (N.S.) 16:1-14.

BOOK REVIEW

Traditional Herbal Medicine in Northern Thailand. Viggo Brun & Trond Schumacher. Berkeley: University of California Press. 1987. Pp. xx, 349. $48.00.

The medical ethnobotanist's task in interpreting traditional herbal practices is complex and challenging. First, the herbalist's diseases may or may not have Western counterparts. Second, the success of a treatment is often a matter of subjective evaluation, influenced largely by the cultural context. Third, just as there are many species of organisms in a biota, there also is diversity in potential preparations and applications: prescriptions are often a composite of many different plant species, and individual plants may be part of several prescriptions against different indications. Putative properties of combinations of ingredients in a prescription may not be a simple linear sum of the ingredients. They may instead be due to the interactionof chemicals from several different ingredients, prepared in a prescribed way, even perhaps administered in a particular ceremony, to which the effects can be attributed. Thus, to efficiently obtain leads on pharmacologically active botanicals—at a time when both herbal traditions and their pharmacopoeias are endangered—requires an interdisciplinary team effort. Skills needed are those of a linguist, anthropologist, botanist, and physician or other specialist who can observe, describe, and verify the interpretation of herbalists' diagnoses.

Traditional Herbal Medicine in Northern Thailand represents such an interdisciplinary approach to the translation of one very different culture into terms understandable by ours. The authors and contributors include a lecturer in Thai (Brun), a medical doctor and botanist (Schumacher), and a chemist and botanist (Terje Bjornland). Three herbalists were interviewed intensively and five (others?)

donated written manuscripts of prescriptions for analysis. The authors supplemented their data collection with clinical observations—a time-consuming endeavor, but the only way to document the relationship between stated and actual practice. This first publication of their work is devoted to the ethnomedical results, with future volumes planned for botanical and chemical results. Here they explicate the local disease classification system, draw analogies between local and cosmopolitan disease concepts, compile information on the ethnomedical uses of over 300 individual plant species, and suggest remedies most promising for pharmacologic research.

One chapter is devoted to examination of the urban variant of Thai traditional medicine, the Royal Tradition of Wat Pho, whose texts were written about 1900. The authors extract "basic theories" (the four elements, the tridosa, and the taste theory) and "connective statements" in order to deduce the theoretical framework of this tradition, but conclude (p. 32) that "the theory of the royal medical school . . . is not integrated with practice, and functions only as a frame of reference or an explanatory model." General characteristics of rural Thai herbalism in practice, its position in relationship to other traditional methods, and personal histories of the main informants are then presented. A "cognitive map" of disease concepts is built by grouping diseases with common characteristics, *viz.*, location on the body or involvement of wind and blood, concepts central to the tradition. While other traditional concepts were not used as criteria in forming the disease map, they are discussed, and it is claimed that they generally reinforce the final map.

The creation of the map from interview data is admittedly subjective to a degree, but it is a creditable attempt to systematically organize the folk medical concepts. In addition, the authors attempt to validate it against an organization of disease concepts that can be extracted from written manuscrips of herbal prescriptions. In doing so, they assume that diseases treated by the same prescription have basic characteristics in common. This is a questionable assumption since, as with cosmopolitan medicine, one cannot rule out the possibility that a particular prescription has more than one effect and therefore acts on unrelated diseases. In any event, based on this assumption that the prescriptions yield valid classificatory criteria, they suggest a statistical approach to correlating diseases that occur together in the prescription headings. A correlation matrix of diseases thus formed would logically lead to cluster analysis, grouping the variables (diseases) according to the relationships of their correlation coefficients.

While thousands of prescriptions can be obtained quickly and they are written in a consistent format, a superior data set would be, of course, definitions of disease concepts from many different informants. The outcome of analysis would then be another "cognitive map" based not on whether diseases share prescriptions but on which characteristics are shared among all the descriptions of a given disease. Nonetheless, the use of prescriptions as a data base to organize disease concepts may be most practicable, and I agree with the authors that looking to statistical analysis is the next logical step in sorting the confusion, be it due to inadequate data or the non-cohesiveness of the tradition itself.

One chapter describes specific Northern Thai disease concepts in depth—concepts which turn out, for the most part, to be "collective diseases" or syndromes. The data for this section are apparently based on interviews, supplemented at times with clinical observations. The authors have made an attempt to match traditional disease concepts to cosmopolitan concepts, cautiously pointing out the incongruities of the two systems and the lack of precise translations. Despite this absence of isomorphism, the information provided, e.g., in a table of Northern Thai concepts for sexually transmitted diseases and their probable Western counterparts, would be of great value to Western health care providers in a clinical setting.

Under the title "Drugs and Diseases," the authors explore some logical ways to make sense out of their 1500 prescriptions and 500 medico-botanical single plant specimens (of which, one assumes, proper voucher specimens will be deposited in an herbarium in the future). In their attempt to present groups of the plants most promising for future investigation, the task proves to be formidable. For instance, they found that the rate of recurrence of a single ingredient in multiple prescriptions against the same disease was extremely low. Moreover, of the plants which in isolation were said to cure a specific disease, only a few were actually recorded in independently obtained prescriptions for the disease! They conclude (p. 214) that "information about medical properties of plants in isolation should be regarded with utmost skepticism"—that "prescriptions . . . reflect the complex reality of praxis"—and elsewhere (p. 225) point to the problems of homonymy and synonymy as adding to the confusion.

Since more than one answer may frequently be found to the same question, they conclude that the herbal tradition has "reduced chaos" but maintains only a loose theoretical framework. They recommend that herbalists dispense with secrecy and organize to make their theoretical framework more explicit. They conclude that on a national level the tradition is dying, but that sufficient numbers of students are being trained to keep it alive in the North. While the World Health Organization and others favor some integration of traditional and modern medicine, the authors claim that development agencies, in espousing support for traditional methods, may paradoxically be contributing to its decline. As an example they point to the education of Traditional Birth Attendants as a way to spread Western ideas rather than as a program where traditional and modern partners learn from each other. They also chastise those whose actions would take anthropological findings out of context and offend the sensibilities of those who value cultural understanding as an end in itself: "Traditional medicine is not just an overripe orange to be sucked for valuable pharmaceutical components for the immediate benefit of the Western pharmaceutical industry. It is a system belonging to a cultural tradition, and should be studied, appreciated, and used as such" (p. 239).

Particular strengths of the book include the authors' use of Thai words for medical concepts in their table of herbal medicines and throughout the book, rather than settling for an inadequate English translation. For readers who are unfamiliar with Thai, this slows comprehension, but by using one of several extensive indexes the reader can easily look to the section of the book that describes the disease concept in context. This work is an uncommon contribution because of its interdisciplinary nature, in-depth coverage of historical/cultural context, use of intensive interviews followed up with clinical observations, and attempts to employ a statistical approach to finding patterns in the data. Problems include the need to clarify who provided what data for which analysis, i.e., how much overlap was there among the three herbalists interviewed, those who donated manuscripts of prescriptions, and those who assisted with collecting plant specimens?

Catherine Pake
Department of Ecology & Evolutionary Biology
University of Arizona
Tucson, AZ 85721

Nutricomp (software). Joseph E. Laferriere. Nutricomp Program, $35.00; Database CULTIV, $25.00; Database SW, $60.00. (Order from the author at the Department of Ecology and Evolutionary Biology, University of Arizona, Tucson, AZ 85721.)

This is new for both of us: writing a software review for publication. Pooling Duke's experience with nutritional data and Perry's experience with computers, we offer our first software review.

The *Nutricomp* software is a series of ten programs and seven databases allowing storage, retrieval, and analysis of nutritional information on plants, animals, and fungi. Our software came with a database that contained a wide array of references, nutrients, and taxa, including more analytical data than Duke and Atchey's *CRC Handbook of Proximate Analyses Tables of Higher Plants* (Boca Raton, FL: CRC Press, 1986). *Nutricomp* can accommodate proximate analyses (including ethanol), 13 vitamins, 17 minerals, 28 lipids, 18 carbohydrates, and 22 amino acids for over 1,000 species (though none of the samples we printed had *all* this analytical material).

Written in interpreted BASIC, the software runs on a computer with an MS-DOS operating system and BASICA or GW-BASIC. Just as each program performs a specific task (such as indexing, deleting, menu operations, reporting, etc.), each database stores certain information, e.g., nutrient compositions, standard nutrient values, names of added nutrients, references, and taxa. We tested the software on a Compaq 386/20 microcomputer, three megabytes (MB) of memory, a 130 MB harddisk, GW-BASIC, and the DOS 3.32 operating system.

General operation of the software was fine. After initial orientation, menus and prompts were easy to follow. Although the 15-page NC.DOC file containing documentation did not easily orient the non-nutritionally-focussed user to the overall arrangement of software operation, it did provide most of the information that was needed for software operation.

After entering the program by using a batch file which loads BASIC and the programs and then runs the initial menu program, the user can add, change, view, delete, report, calculate meal composition, alphabetize (sort the taxa and/or references), link or change databases, and index common names. After either selecting an existing database or creating a new one, information can be added.

Function keys can be used throughout the software to type in the key words—list, any, or add—each of which will display the information under investigation. All functions work well with the appropriate means of stopping when listing. References, taxa, sample preparation techniques, organism part, reporting basis, nutrients, and kilocalories and protein score can be added/modified. When adding new records for each type of information, the reference and taxon information is protected against a code value meaning two different things, but this protection is not present for the nutrients. We added several different nutrients with the same name and were unable to differentiate among them in the list. A very nice feature of the software concerns the units for the nutrients. The software will automatically check the units for certain nutrients and prompt the user for additional information for specific ones, such as vitamins A, D, and E. Older units can be used and will be converted by the program. Similar actions occur with proteins, lipids, and carbohydrates.

Reasonably nice editing is possible before newly entered information is actually written to the disk, but editing of previously entered information by the program is not quite as neat as data entry. If something is wrong with part of the taxon or reference entry, that part must be retyped; however, these two files can be modified with ASCII text editing software outside of *Nutricomp.* Various modifications of numerical data will naturally change other data that were calculated by the program. The author clearly states the results of these changes in the documentation.

Information on the screen is examined by answering various questions that help narrow down the information selected. Prompts are provided for taxa, parts, preparation techniques, and nutrients. Selection of these is easy with the use of code numbers and the ability to list the values of the codes.

Printing appropriate information was most difficult. The program provides options for listing all information in the databases by taxon or reference, or allows selection of information on the disk by selecting nutrient or numerical data. The reference and taxon options print all this information with no provision for stopping the listing. We were unable to get the program to eject a page correctly; it always printed ten lines on the next sheet of paper and then ejected, but only when printing reference lists. We also tried to select only the data in the database by nutrients. The documentation indicated that only those records that have information for the nutrients selected will be printed. We found several species listed that did not have data for our selected nutrients, and not all of the taxa for which we knew data were available were listed. When printing, we encountered a blank screen, and did not realize what was happening. A message indicating that printing is underway would be informative.

Laferriere warns us to take his numbers with a grain of salt. Checking his data against Agriculture Handbook Number 8 (AH-8), we found his transcription of AH-8 data to be more accurate than our own. Laferriere converted AH-8 data to dry matter basis. For *Brassica oleracea* var. *acephala,* we find only one erroneous transcription (leucine) out of 42, whereas we had made two errors in our own transcription.

In general, other activities worked as indicated in the documentation, with some general deficiencies. There are no help screens to assist if the user gets stuck and does not know what to do. Also, the software is slow, even on the exceptionally fast machine on which it was tested. Still, this is a better buy for the money than Duke and Atchley's book.

James A. Duke
U.S.D.A.
Building 001, Room 133
BARC-West
Beltsville, MD 20705

Mark C. Perry
U.S.D.A.
Building 001, Room 139
BARC-West
Beltsville, MD 20705

A SURVEY OF PUBLIC PLANTINGS IN THE FRONT YARDS OF RESIDENCES IN GALVESTON, TEXAS, U.S.A.

DARREL L. McDONALD
Social Sciences
University of Texas at Tyler
3900 University Boulevard
Tyler, Texas 77501

ABSTRACT.—The cultural plantscapes (planted landscapes) of urbanized Galveston are the result of historical events, plant introductions, and habitat modifications. Since Galveston was chartered in 1837, residents have been continually altering and sculpturing private and public property. This study identifies significant native species and plant introductions which have resulted in tropical and European garden patterns. Several 19th century introduced exotics such as oleanders *(Nerium oleander* L.), palms *(Washingtonia* spp. and *Phoenix* spp.), and Chinese tallow *(Sapium sebriferum* (L.) Roxb.) still are plantings of choice, although plant introductions have continued. Because of human intervention, more colorful cultivated landscapes have replaced native Gulf coastal plant communities reflecting individual, community and institutional preferences. The survey also suggests lifestyle changes among residents have influenced planting designs in residential gardens.

RESUMEN.—Los sembrados tradicionales del Galveston urbano son la consequencia de eventos históricos, de introducciones de plantas, y de modificaciones del medio ambiente. Desde que Galveston se constituyó oficialmente, los residentes han estado alterando y esculpiendo continuamente la propiedad pública y privada. Este estudio identifica importantes introducciones de plantas nativas de Norteamérica y extranjeras, lo que ha resultado en patrones tropicales y Europeos en los jardines. Algunas plantas exôticas introducidas en el siglo XIX como adelfas *(Nerium* sp.), palmas, y arboles de sebo de China *(Sapium sebriferum* (L.) Roxb.) siguen siendo siembras escogidas, aunque las introducciones de plantas han continuado. A causa de la intervención humana, los sembrados pintorescos han reemplazado las comunidades de plantas indíginas de la costa del Golfo, reflejando preferencias individuales, comunales e institucionales. Esta perspectiva también sugiere que cambios en el estilo de vida entre los residentes han influido sobre los designios de sembrados en jardines residenciales.

RESUME.—Les jardins d'agrément (platnations paysagistes) du perimetre urbanisé de Galveston sont le résultat d'événements historiques, de l'acclimation de plantes nouvelles et de modifications de l'habitat. Depuis que Galveston fut elevée au rang de cité en 1837, ses habitants n'ont cessé de modifier et de remodeler les propriétés privées et la domaine public. La présente étude inventorie les principales especès locales et 'etrangères que ont servi a dessiner des jardins de type tropical et Européen. Quelques plantes exotiques introduites au XVIII ème siècle, telles que la *Nerium,* le palmier, le sapium, sont encore recherchées, bien que l'on continue a' importer de nouvelles espèces. Grâce a l'intervention humaine, des paysages cultivés richement colorés ont remplacé les ensembles végétaux typiques de la côte du Golfe du Mexique: ils reflètent le goût de particuliers, et les choix des communautés et institutions. Le présent inventaire fait allusion anx changements dans les modes de vie qui ont influencé la conception des plantations dans les jardins privés.

INTRODUCTION

The documentation of landscape change and transformation is an exciting area for cultural plant geography research. Schmid (1975:1), in his treatment of the urban vegetation of Chicago, states that city planting preferences in North America have largely been ignored in the literature because of the cross discipline approach that is necessary to address these problems. Schmid (1975:218) goes on to suggest planting preferences are used by residents to accentuate built structures and produce planted landscape themes. Hugill (1986:423) adds that these designed themes develop from the frequency and intensity of social contact between newly settled areas and established cultures. Thus, cultural plantscapes (planted landscapes) can be seen as a separate but important aspect of the total landscape. These plant associations have economic functions as well as express conscious garden designs of citizens (Jellicoe and Jellicoe 1987:7).

In *The Landscape of Man* (1987) the Jellicoes suggest the most complete expression of cultural preferences for plants and built structures is contained within the cultural landscape. Indeed, since earliest explorers and traders began moving plants, resources, and ideas about the earth, the selection process for cultural favorites has continued as a dynamic process resulting in landscape transformation. Crosby's (1986) discourse on the impact of European expansion on world cultures supports this assertion. Although landscape tastes in North America have been strongly influenced by European contact, over the centuries an American landscape tradition has emerged (Czeslochowski 1982; Leighton 1986:162).

Public plantings, those situated where people can readily observe them, represent an individual's effort to fit into the local cultural community (Schmid 1975:219). And yet, the individual's garden, the private planting space, may remain aloof from cultural pressures simply because it represents a personal, not collective expression of design preference (Jellicoe 1987:7).

The purpose of this study is to investigate changing planting preferences in front yards of Galveston residences in areas of the city that developed at different times. A further object is to determine the affect of location (habitat zone) on plantings in Galveston front yards.

Galveston Island has long been an important contact point for diverse cultural traditions. Since the 1830s immigrants, visitors and artisans have frequently passed through the port; during the late 1890s Galveston was recognized as one of the most prosperous coastal cities in the New World (Dexter 1900; Marinbach 1983). This flow continues today. Most people continued onward to settle inland or return to their homes, but many have taken up residence, endured and enriched the cultural diversity of this barrier island. Along with these people have come gardening traditions and plants.

HISTORICAL BACKGROUND

Physical environment.—Galveston is a low-lying subtropical barrier island located near the upper Texas Gulf Coast (Fig. 1). It is composed of water deposited sands overlying coastal sedimentary rocks. The island extends some 50 km (32 miles)

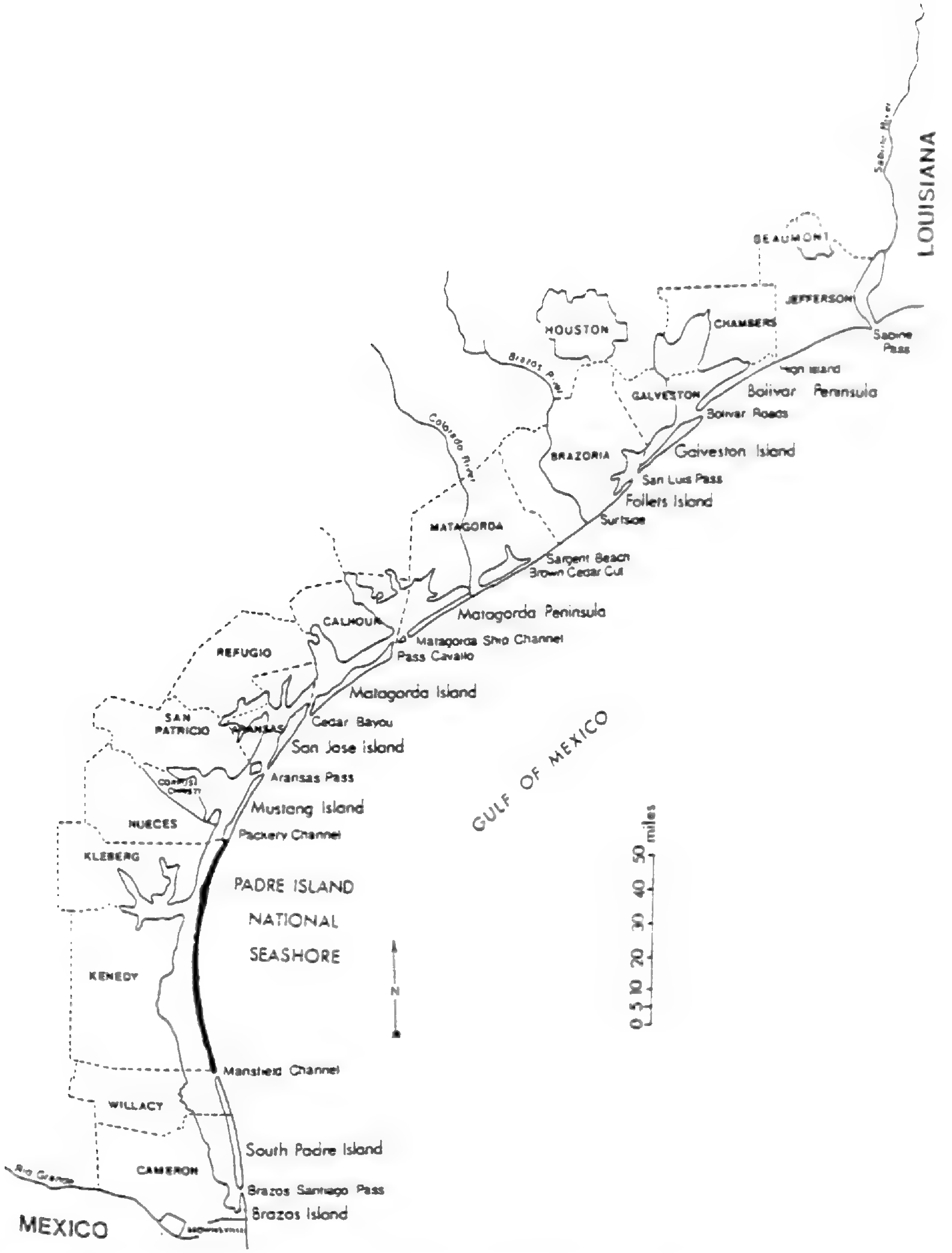


FIG. 1.—Texas Gulf Coast (From: Morton, R. *et al.*, 1983).

in length with the width varying from .8 km to more than 3 km (.5 to 2 miles). Galveston Island is a dynamic physical environment; wave action and storm surges regularly and significantly change its configuration (Davis 1981:2).

The island is geographically exposed to many environmental extremes. Summers are long and hot, many of which are accompanied by prolonged dry spells. Additionally, continental cold air masses, fondly referred to as "northers" by residents, occasionally descend upon the island reducing temperatures well below freezing (Bomar 1983:74). Historical records indicate infrequent 19th century cold spells were intense enough to freeze over Galveston Bay (Carson 1952). Snow accumulations have been recorded (*Galveston Daily News* 1886). Salt-laden sea breezes regularly add to the physical stresses plants must endure to survive. In addition, tree trimming to protect power lines appears to weaken some woody plants.

Natural vegetation.—In near shore or low inundated areas native salt marsh communities are dominated by *Spartina patens* (Ait.) Muhl. and *Distichlis spicata* (L.) Greene. Coastal prairie associations including *Andropogon gerardi* Vitm., *Muhlenbergia capillaris* (Lam.) Trin. and *Uniola paniculata* L. occupied higher beach ridges (Correll and Johnston 1979:3). Scattered shrubs, particularly *Prosopis glandulosa torreyana* (L. Benson) M.C. Johnst., the mesquite, provided the principal woody component. Trees were rare. Early 19th century historians and travellers to the island reported only one small motte of *Quercus virginiana* Mill. (live oak) located mid-island in an area now referred to as Lafitte's Grove (Mueller 1935:41; Hayes 1879:242). It has been estimated that Galveston Island's native plant communities included about 100 species. Although the area covered by these communities has decreased, there have been no reports of any species having been completely eliminated from the island (Steenberghen 1988:51).

Cultural component.—The island's resource base attracted early Amerindian groups. In particular, the Karankawa Indians seasonally exploited the island for tubers, berries and animals, but made few permanent alterations to the vegetation because of the harsh environment and mosquito population (Gatschet 1891:11; Bandlier 1964:68).

Early settlement and population growth.—In the early 1800s, privateer Jean Lafitte made Galveston his home base, erecting structures on the east end of the island. His cohorts practiced gardening in between forays in the Gulf of Mexico (Baker 1935:357). It was not until 1837 that permanent settlement was established on the island. In that year the Texas Legislature charted a tract of land to Col. Michael Menard as a site for the city. The city was platted on the east end near deep water anchorage and the mouth of Galveston Bay (Nesbitt 1976:79; Sandusky Map 1845 Rosenberg Library: Galveston Texas History Center [RL,GTHC]).

Population growth was sporadic in the early years but by 1843 nearly 600 homes had been built (McComb 1986:68). Population increases continued into the 20th century with several major fluctuations resulting from natural calamities such as yellow fever and hurricanes (Nesbitt 1985:53). Today Galveston's ethnic population is more diverse than in the early decades of growth in the 19th century. In 1985 the population was estimatd at 63,000; composed of approximately 70% white with 17% black and 12% hispanic (U.S. Department of the Navy 1986:2-99).

Early horticultural landscapes.—Galveston residents have persistently expanded planted landscapes since initial settlement. Residents have altered sizeable portions of the original vegetation by enriching planted areas with imported topsoil and diversifying the flora by introducing exotics from Mediterranean and tropical regions.

By the end of the 19th century Galveston had grown to be one of the richest cities in the United States and was a garden spot along the Texas Gulf Coast. Stately homes lined the streets adorned with palms, oleanders and oaks. These plantings gave a tropical look to the landscape (*Galveston Daily News* 1907).

Sources of plants.—Earliest plant introductions to Galveston included shade trees *Sapium sebiferum* (L.) Roxb., flowering shrubs, most notably *Nerium oleander* L. and tropical trees including *Phoenix* spp., *Washingtonia* spp. and *Musa* sp. (Mueller 1935:43; Fornell 1961:96). Flower and vegetable seeds were obtained from a variety of sources, such as New England Shaker communities, retail catalogs from the south of France, and from eastern U.S. seed suppliers (*The Civilian and Galveston Gazette* 1842; Samuel May Williams Papers 23-0867 RL,GTHC). The vast majority of introduced plant materials arrived on sailing vessels calling upon the most important port along the Texas Gulf Coast. Plants were viewed as a "filler" item by barque captains. They were more concerned about the lumber and food staples cargos which commanded high prices in Galveston (*Flakes Bulletin* 1868). Later, nurseries developed on the mainland nearby as people settled the hinterlands of Galveston.

Galveston's rapid climb to prosperity was brought to an abrupt halt by the 1900 hurricane (Weems 1957:114). In the period of a few hours all of the built and planted landscapes were laid to waste. Following one of the worst catastrophes in United States history, the island level was raised behind a concrete barrier constructed to prevent any such future devastation (Davis 1981). Although the majority of the fill was dredged and pumped from surrounding waters, substantial topsoil was brought from the mainland (McComb 1986:142).

The planted landscape of urbanized Galveston had to be totally replanted, with the exception of Borden's oak, which was the only culitivated plant known to survive the storm's devastation. Residents rallied through civic organizations, such as the Women's Health Protection Association (WHPA), to return urbanized Galveston to its pre-storm beauty. Initially, the WHPA focused their tireless efforts on storm victims. After helping many citizens recover from storm related injuries and calamities, the women turned their attention to the scarred island itself. The WHPA provided free plantings to Galveston residents, especially oleanders, to help return the planted landscape of Galveston to its pre-storm floral diversity (Kenamore 1987). Community and individual efforts to further enhance the beauty of the island continue today.

METHODS

The study area sampled for this survey included the original platted city (Sandusky Map 1945). It is essentially a grid pattern. Generally, city development has progressed east to west, with housing development replacing dairy and gardening landscapes surrounding the previous city "edge." Occasional outliers such as the exclusive 1930s Cedar Lawn subdivision were exceptions.

Within this pattern of development, sampling sectors were established (Fig. 2). The east end (Sector 1) was the earliest to develop. This area includes the now designated East End and Silk Stocking Historical districts. West of 25th Street, which bounded the early business district, is the middle sector (Sector 2). Most houses date from the 1930s to 1960s in this sector, with major exceptions being the Samuel May Williams (1839) and Michael Menard (1838) homes. The west end sector (Sector 3) represents more recent developments, most houses dating from the 1950s to 1970s.

Sampling Procedures.—Two streets randomly selected extending from the bay to the gulf side of the island were surveyed for woody plants within each sector. In addition, three streets were surveyed along avenues from 6th Street to 57th Street. In all, the front yard woody plantings of 1,088 residences were recorded From the population examined a random subset of 270 yards was selected; thirty (30) sampling sites from each of the nine (9) street transects. A total of 97 woody species representing 45 families were observed in the survey. Species are listed in Appendix A.

For the purposes of this survey, front yards were defined as the side of a residence facing the street or avenue. The boundary of the front yard contained the area from fence lines or a plane extending from the street side of the house to the street. Individual woody plant species were recorded from this area for

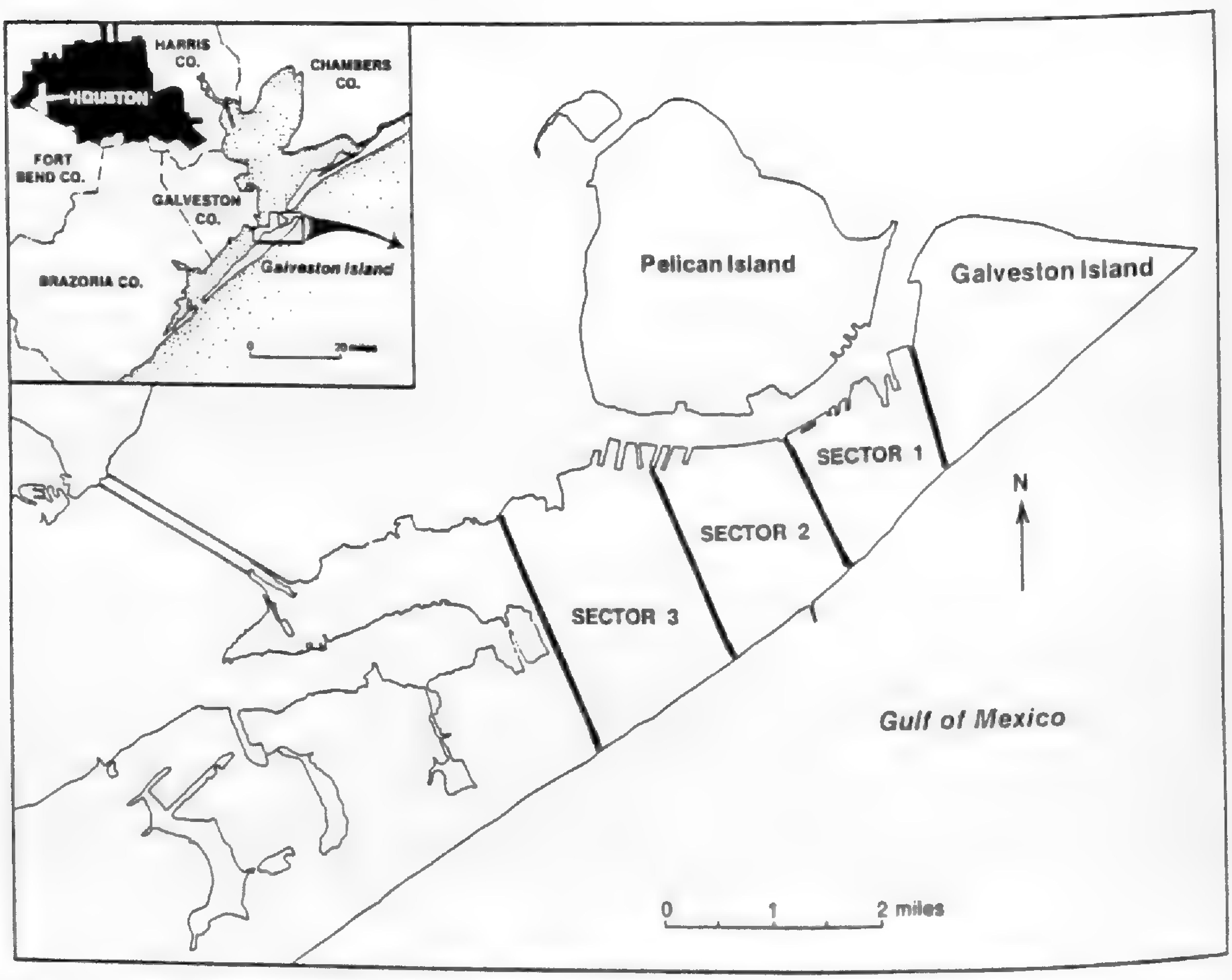


FIG. 2.—City sectors based on time of development.

each house sampled. Hedges were recorded as a single planting but were given a frequency value of ten. A hedge was defined as a continuous planting of a single species extending more than six feet. Means and standard deviations were calculated from the data for each sector to establish planting patterns in different areas of urbanized Galveston. This made possible the separation of different planting preferences. Differences in means between areas were interpreted as illustrating changing patterns and preferences in residential plantings.

RESULTS AND DISCUSSION

The west end sector had the highest total plantings per yard. Plantings were nearly balanced between trees and shrubs. Hedges were frequently found in yards. Hedges were recorded as a single planting. Thus, the weighted shrub plantings total exceeds the total planting number. The east end sector had the highest number of trees per yard. Hedges were occasionally recorded in this sector. The middle sector had the fewest average plantings per yard (Fig. 3).

Next, the most common shrubs were compared. *Nerium oleander* L., *Lingustrum quihoui* Carriere, and *Ilex vomitoria* Ait. (a native) were known from the 19th century as favored plantings. *Pittosporum tobira* (Thunb.) Ait. is a more recent introduction (Fig. 4). *Ligustrum* is hardy and most commonly used as a hedge plant. *Pittosporum* is an accent plant in yards and performs well as single plants or hedges. *Ilex vomitoria,* more common in the 19th century as a hedge, has recently been hybridized to become a more decorative single-bush planting.

Oleanders have been a perennial favorite of Galveston residents. Galveston is often referred to as the oleander city (Pleasants 1966:1). Oleander shows a frequency increase in newer areas, often because gardeners prefer its long lasting blossoms and hardy nature. While oleanders are quite visible in the east end, the greater plant diversity in the older section reduces oleander's rank. The

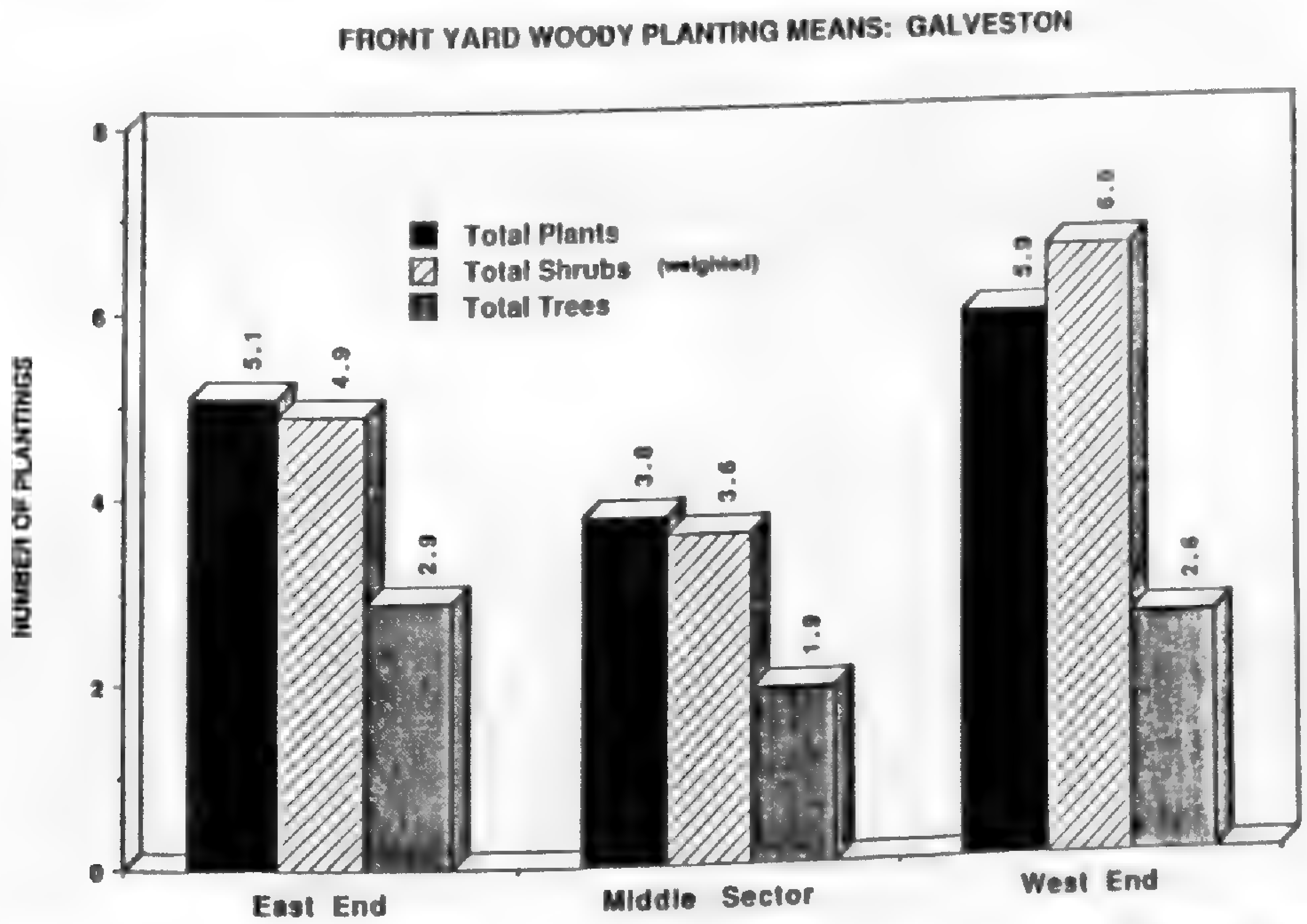


FIG. 3.—Front City sectors based on time of development. Front yard woody planting means: Galveston.

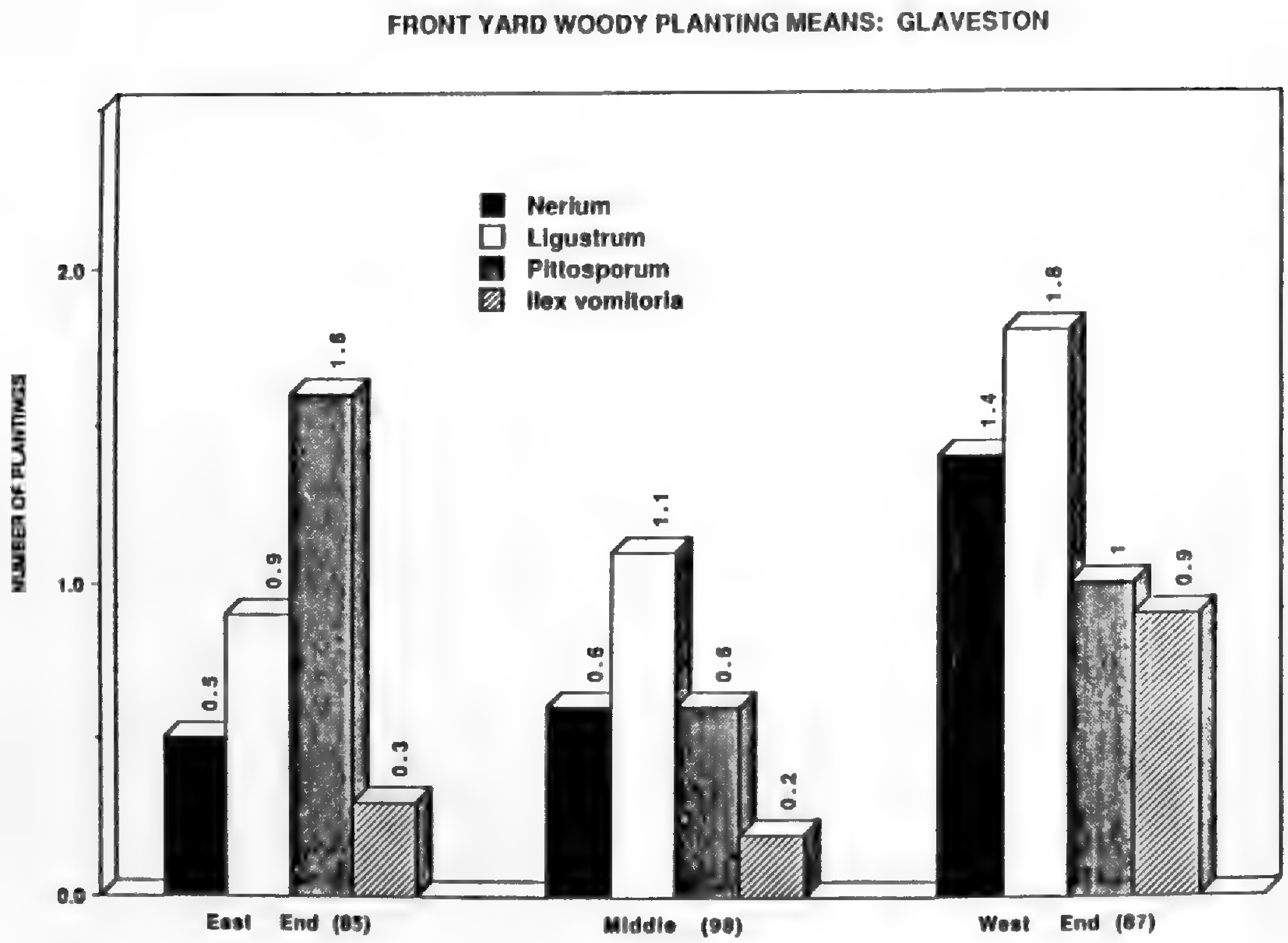


FIG. 4.—City sectors based on time of development. Front yard shrub planting means: Galveston.

oleander has been the plant most manipulated by residents. The oleander was introduced to the island in 1841 by Joseph Osterman (National Oleander Society brochure). By the early 1920s some 65 horticultural variants or cultivars were believed to have flourished on the island. Presently over 40 named cultivars are known, among which several are rare or endangered (Head pers. comm. 1987). Almost all of these are indigenous Galveston cultivars.

When comparing the most common trees, *Quercus* sp. has become less common, being replaced by *Sapium* sp. and *Fraxinus* sp. (Fig. 5). Preferences have shifted from slower growing oaks to faster growing softer wood trees. *Washingtonia* and *Phoenix* palms have remained favorite plantings because of the preference for a tropical plantscape theme.

As suggested earlier, the physical environment influences plant growth. In an attempt to better understand its effect on plantings, habitat zones were established in the originally sampled sectors based on exposure to the Gulf of Mexico (Fig. 6.). Results from this comparison are shown in Fig. 7. In general means for total plantings, shrubs and trees corresponded with sector means. But there are notable deviations. In particular, Sector 3 abuts the warehouse and railroad yard in a lower socio-economic neighborhood (McComb 1986:153). In addition, saline bay waters inundated this area during hurricane Carla in 1961, reducing the soil texture and fertility, thereby affecting plant growth.

Furthermore, the low value for trees in Sector 5 is related to increased exposure. There is less structural protection in this sector than the more established Sector 2 and the more affluent Sector 8.

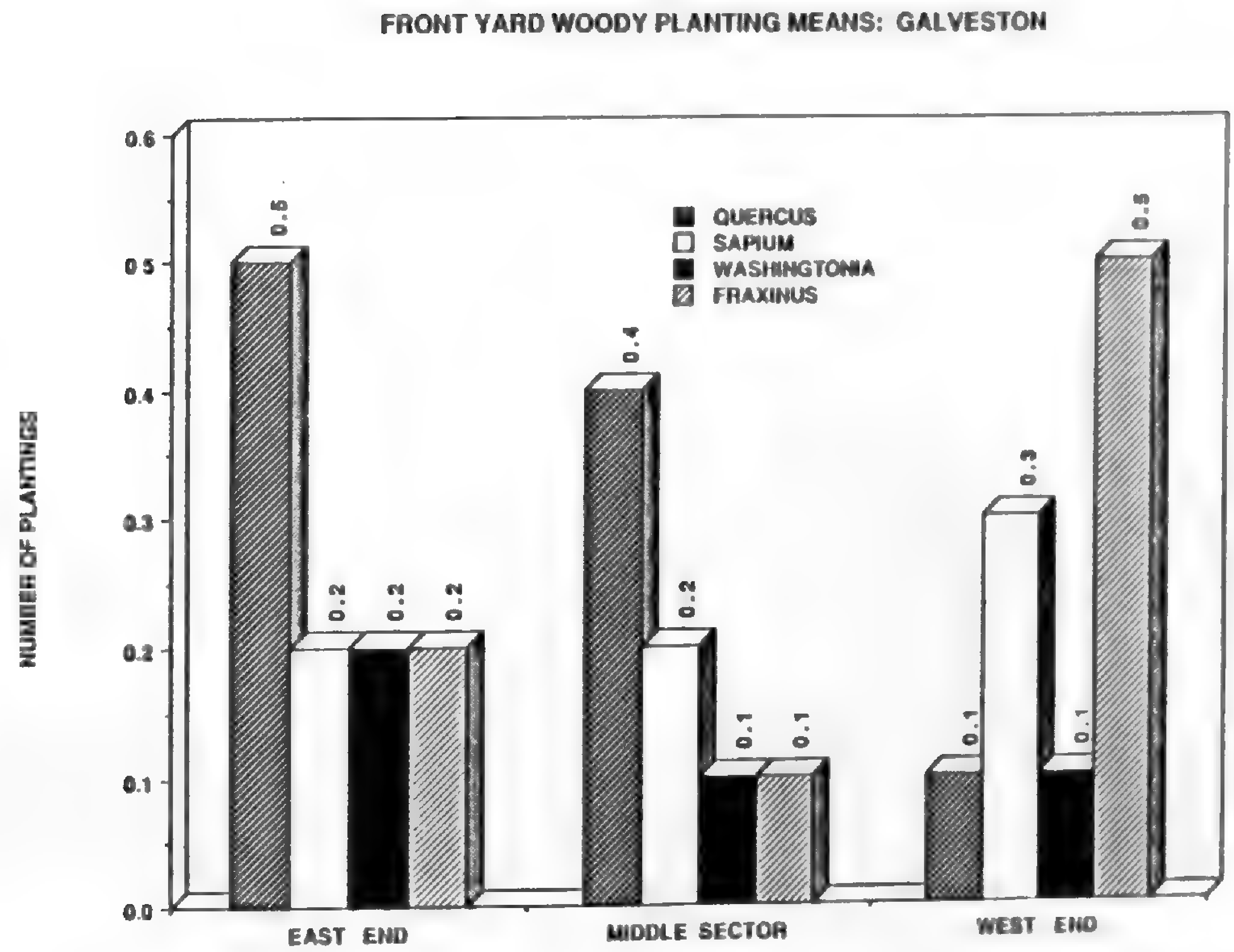


FIG. 5.—City sectors based on time of development. Front yard tree planting means: Galveston.

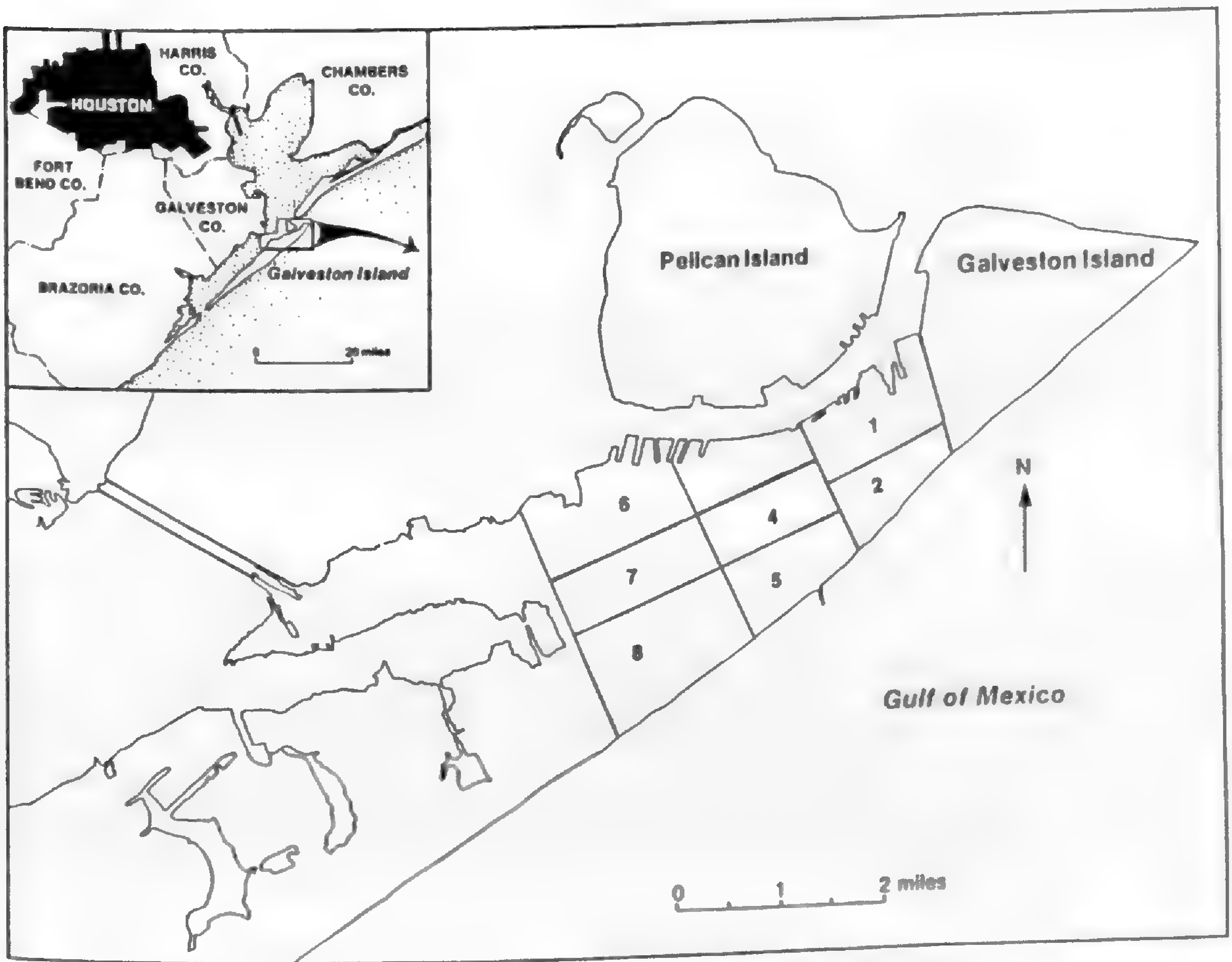


FIG. 6.—Habitat zones based on exposure to Gulf of Mexico.

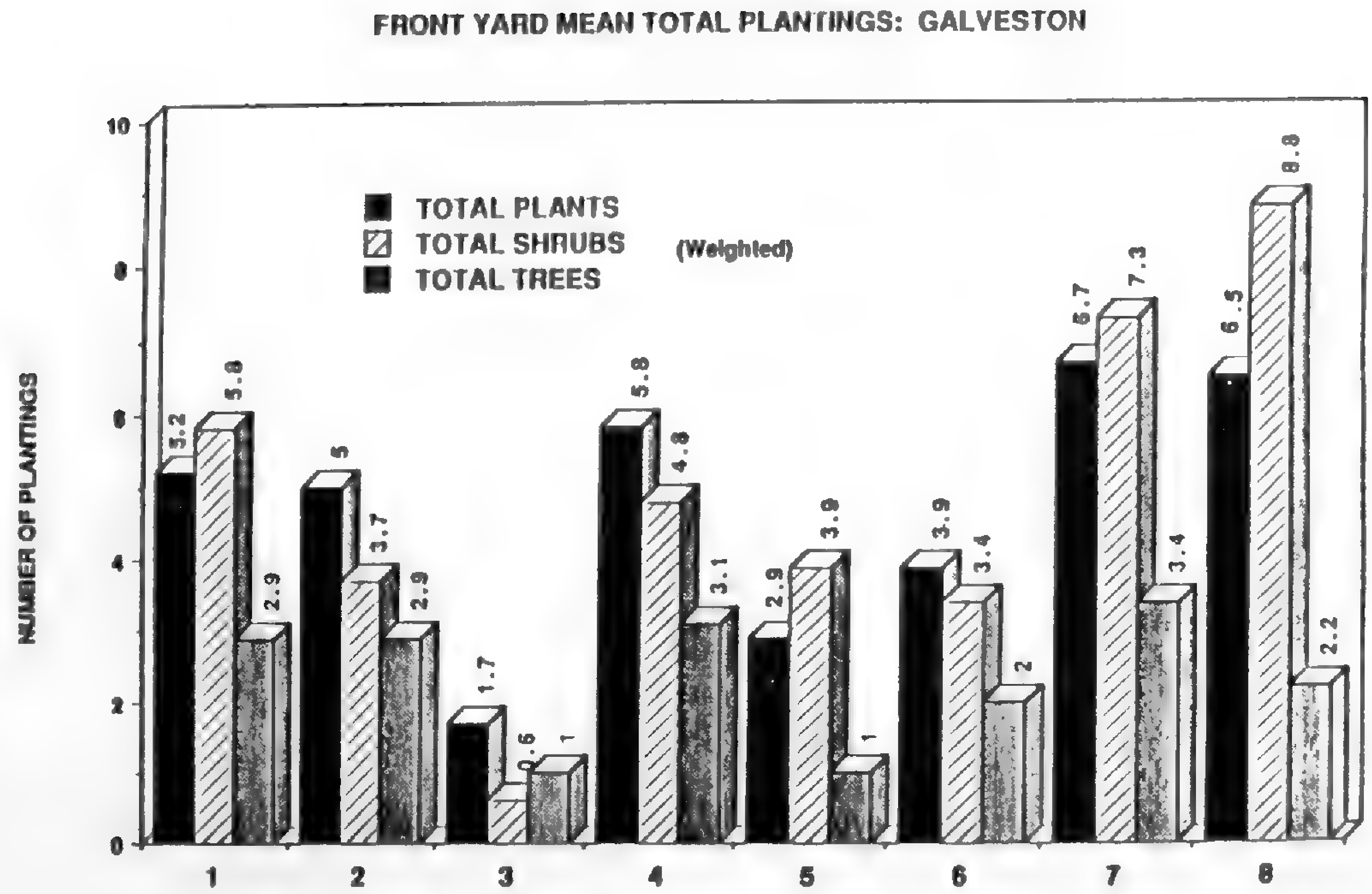


FIG. 7.—Habitat zones based on exposure to Gulf of Mexico. Front yard mean total plantings: Galveston.

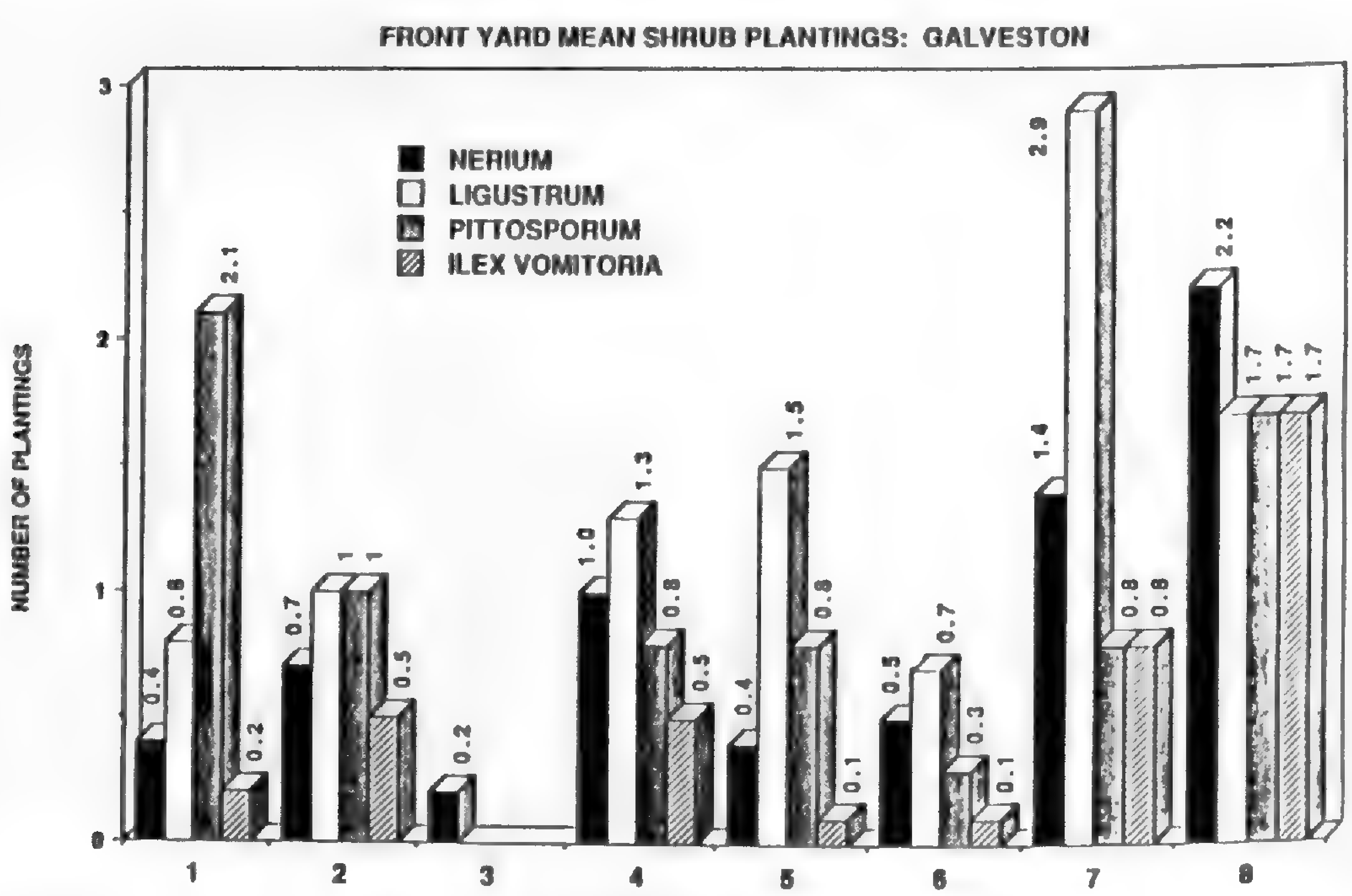


FIG. 8.—Habitat zones based on exposure to Gulf of Mexico. Front yard mean shrub plantings: Galveston.

Comparisons of the most common shrubs and trees supported earlier reports (Fig. 8). The survival of oleander in Sector 3 indicates that it is more hardy than other plants that have been tried there. Although a more recent introduction, the frequency of *Pittosporum* indicates residents especially appreciate the shrub as part of their gardens. In particular, the variegated *Pittosporum* adds variety to yards not readily found in the more established *Ligustrum* plantings.

Fig. 9 indicates changes in planting preference by island residents, from oaks to tallow and ash (almost exclusively *Fraxinus velutina glabra* Rehd.). However,

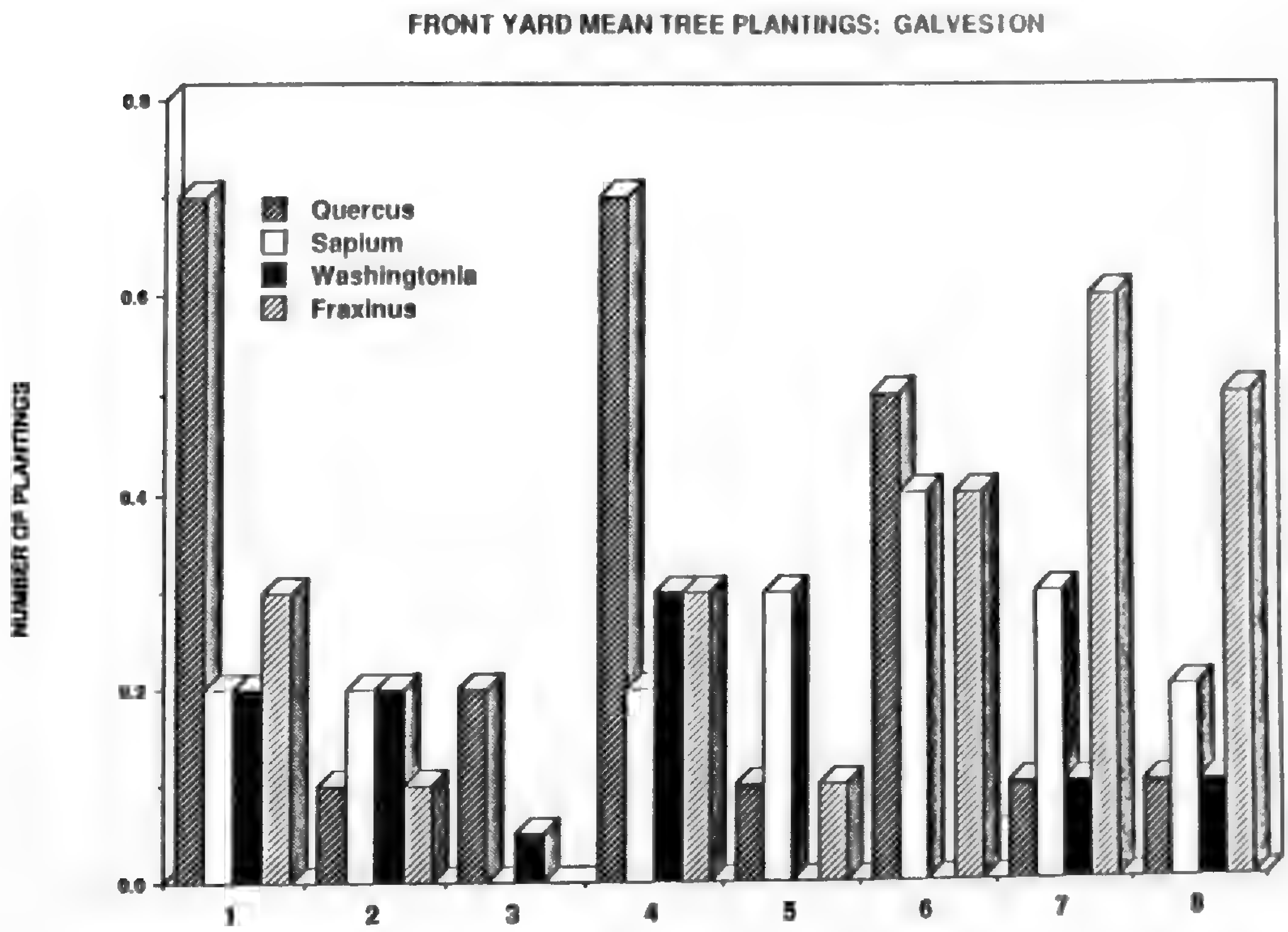


FIG. 9.—Habitat zones based on exposure to Gulf of Mexico. Front yard mean tree plantings: Galveston.

soft wood trees have proved vulnerable to storm damage. Residents who do not prefer oaks also avoid hardy, native trees such as the southern Magnolia *(Magnolia grandifolia)* because the debris from these trees is considered messy. Seasonal litter requires added maintenance and occasionally causes mechanical problems for lawn mowers. Interviews with Galveston residents brought out that yards requiring fewer hours of maintenance fit better into schedules where both adults are working.

CONCLUSION

Galveston residents have been altering plantscapes since the 1830s. Pre-1900 residental patterns were destroyed by the 1900 storm. But preferences for early woody species introductions are found in front yards today. Planting patterns found in neighborhoods represent themes of tropical and European tastes. Public plantings represent a blend of these components. Galveston island continues to be altered by residents and by civic institutions. Down island developments reflect little of the urbanized patterns. Analysis of the new horticultural style emerging in residential planting preferences will be useful in understanding the continuing process of urban planted landscape evolution.

ACKNOWLEDGEMENTS

I wish to thank Sammy Ray, Jim McCloy, James Webb, and Pat Wallace of Texas A&M at Galveston for facility use and support during field work. Thanks are extended to Clarissa Kimber for guidance in the study and Galveston residents for their cooperation. The Rosenberg Library Galveston Texas History Center staff were a great help. Abstract translations were provided by Janice Glascock, Joseph Velo and Jean-Jacques Blanchot.

LITERATURE CITED

BAKER, D.W.C. 1935. A Texas scrap book. The Steck Company, Austin, TX.

BANDLIER, F. (trans.) 1964. The journey of Alvar Nunez Cabeza de Vaca. Rio Grande Press, Chicago, IL.

BOMAR, G.W. 1983. Texas weather. Univ. Texas Press, Austin, TX.

CARSON, E. 1952. U.S. Department of Commerce Meteorologist letter to Walter Grover 8-21-1952 *in* archieves of Rosenberg Library, Galveston Texas History Center, Galveston, TX.

Civilian and Galveston Gazette, The. 1842. Galveston, TX.

CORRELL, D.S. and M.C. JOHNSTON. 1972. Manual of Vascular Plants of Texas. Univ. Dallas Press, Richardson, TX.

CROSBY, A. 1986. Ecological Imperialism: The biological expansion of Europe 900-1900. Studies in environment and history. Cambridge Univ. Press, Westport, CT.

CZESLOCHOWSKI, J.S. 1982. The American landscape tradition. Dutton. New York, NY.

DAVIS, A. 1981. Galveston's Bulwark Against the Sea: History of the Galveston Seawall. Corp. of Army Engineers, P.O. Box 1229, Galveston, TX.

DEXTER, W.W. 1900. Picturesque Galveston. Clarke and Courts. Galveston, TX.

Flakes Bulletin. 1868. March 29, 1868. Galveston, TX.

FORNELL, E.W. 1961. The Galveston Era: The Texas crescent on the eve of seccession. Univ. Texas Press, Austin, TX.

Galveston City Directory. 1886. 1-13.

Galveston Daily News. 1886. 1-13.

__________. 1907. 5-3.

GATSCHET, A.S. 1891. "The Karankawa Indians: The Coast People of Texas," Archaeological and ethnographic papers of the Peabody Museum, Vol. 1:2. Harvard Univ. Kraus Reprint Company. Milwood, NY.

GROVER, WALTERS PAPERS. Rosenberg Library, Galveston Texas History Center Archives. Galveston, TX.

HAYES, C. 1879. History of the Island and City of Galveston. Vol. 1. Cincinnati, Ohio. 1974 Reprint. Jenkins & Garrett Press, Austin, TX.

HEAD, E. 1987. pers. comm. Corresponding Secretary. International Oleander Society. Galveston, TX.

HUGILL, P. 1986. English landscape tastes in the United States. Geographical Review, 76:4. American Geographical Society of New York, NY.

JELLICOE, SIR G. and S. JELLICOE. 1987. The landscape of man: Shaping the environment from prehistory to the present day. Thames and Hudson. New York, NY.

KENAMORE, J. 1987. Crusaders for health and beauty: The Women's Health Protective Association. Rosenberg Library. Galveston Texas History Center. Galveston, TX.

LEIGHTON, ANN. 1986. Early American Gardens. Univ. Massachusetts Press. Amherst, MS.

MCCOMB, D. 1986. Galveston: A history. Univ. Texas Press. Austin, TX.

MORTON, R. *et a.* 1983. Living with the Texas Shore. Duke Univ. Press. Durham, NC.

MUELLER, O. (trans.) 1935. Dr. Ferdinand Roemer. Texas: With particular reference to German immigration and the Physical appearance of the country. Standard Printing Company. San Antonio, TX.

National Oleander Society Brochure. Elizabeth Head Corresponding Secretary, P.O. Box 3431. Galveston, TX.

NESBITT, R. 1985. Bob's Reader. Letter Shop. Galveston, TX.

__________. 1976. The Port of Galveston bicentennial appointment calendar and compedium for 1976. Galveston, TX.

PLEASANTS, C. 1966. Galveston: The Oleander City. Exposition Press. New York, NY.

SANDUSKY MAP. 1985. Rosenberg Library. Galveston Texas History Center. Galveston, TX.

SCHMID, J.A. 1975. Urban vegetation: A review and Chicago case study. Univ. Chicago Geography Research paper No. 161. Chicago, IL.

STEENBERGHEN, T.M. 1988. The spontaneous vegetation in urban residential gardens of Galveston, TX. MS thesis. Texas A&M Univ. Geography. College Station, TX.

WILLIAMS, S.M. Papers. 23-0867. Rosenberg Library. Galveston Texas History Center. Galveston, TX.

WEEMS, J.E. 1957. A Weekend in September. Texas A&M Univ. Press. College Station, TX.

APPENDIX A

AGAVACEAE
Yucca carnerosana (Trel.) McKelv.
Yucca spp. L.

ANACARDIACEAE
Mangifera indica L.
Rhus glabra L.

APOCYNACEAE
Carissa grandifolia (E.H. Mey) A. DC.
Nerium Oleander L.

AQUIFOLIACEAE
Ilex cornuta Lundl. & Paxt.
Ilex decidua Walt.
Ilex vomitoria Ait.

ASTERACEAE
Iva frutescens L.

BERBERIDACEAE
Nandina domestica Thunb.

BIGNONIACEAE
Campsis radicans (L.) Seem. ex Bur.
Catalpa bignoniodes Walt.

BUXACEAE
Buxus microphylla Siebold & Zucc.
Buxus sempervirens L.

CAPRIFOLACEAE
Abelia Graniflora 'Edward Groucher' (Andre) Rehd.
Lonicera japonica Thunb.
Sambucus canadensis L.

CELASTRACEAE
Euonymus japonica Thunb.
Euonymus japonica 'aureomarginata' Thunb.
Euonymus japonica 'dwarf' Thunb.

CONVOLVULACEAE
Ipomoea alba L.

CUPRESSACEAE
Juniperus communis L.
Juniperus spp. L.
Thuja sp. L.

CYCADACEAE
Cycas circinalis L.

Appendix A (continued)

ELAEGNACEAE
Elaegnus angustifolia L.

ERICACEAE
Rhododendron sp. L.

EUPHORBIACEAE
Sapium sebiferum (L.) Roxb.

FABACEAE
Mimosa bracaatinga Hoehne.
Wisteria floribunda (Willd.) DC.
Wisteria sinensis (Sims) Sweet

FAGACEAE
Quercus nigra L.
Quercus virginiana Mill.
Quercus spp. L.

HAMAMELIDACEAE
Liquidambar styraciflua L.

JUGLANDACEAE
Carya illinoinensis (Wang.) K. Koch.

LABIATAE
Salvia leucophylla Greene.

LAURACEAE
Cinnamomum camphora (L.) J. Presl.
Persea americana Mill.

LYTHRACEAE
Lagerstroemia indica L.

MAGNOLIACEAE
Magnolia grandiflora L.

MALVACEAE
Hibiscus rosa-sinensis L.
Hibiscus syriacus L.

MELIACEAE
Melia azedarach L.

MORACEAE
Ficus carica L.
Ficus elastica Roxb. ex Hornem.
Morus alba 'striblingii' L.
Morus nigra L.

Appendix A (continued)

MUSACEAE
Musa acuminata Colla

MYTACEAE
Callistemon citrinus R. Br.
Psidium guajava L.

OLEACEAE
Forsythia suspensa (Thunb.) Vahl
Fraxinus arizonica Torr.
Jasminum humile L.
Ligustrum quihoui Carriere
Oleo europaea L.

ONAGRACEAE
Fuschia magllanica Lam.

PALMAE
Phoenix canariensis Hort. ex Chabaud.
Phoenix dactylifera L.
Phoenix reclinata Jacq.
Sabal mexicana Mart.
Sabal texana (Cook) Becc.
Washington filifera (L. Linden) H. Wendl.
Washington robusta H. Wendl.

PLANTANACEAE
Plantanus occidentalis L.

PINACEAE
Pinus taeda L.

PITTOSPORACEAE
Pittosporum tobira (Thunb.) Ait.
Pittosporum tobira 'variegated' (Thunb.) Ait.
Pittosporum tobira 'dwarf' (Thunb.) Ait.

PODOCARPACEAE
Podocarpus macrophyllus (Thunb.) D. Don

POLYGONACEAE
Antignon leptopus Hokk & Arn.

ROSACEAE
Malus pumila Mill.
Photinia fraseri 'Red Robin' Dress.
Prunus americana Marsh.
Prunus laurocerasus L.
Prunus persica (L.) Batsch.
Prunus serotina J.F. Ehrh.

Appendix A (continued)

Pyracantha coccinea M.J. Roem.
Raphiolepis indica (L.) Lindl.
Rubus trivialis Michx.

RUTACEAE
Citrus limonia 'Meyer' Osbeck
Citrus sinesis (L.) Osbeck.
Zanthoxylum americanum L.

SALICACEAE
Populus sargentiii Dode.
Salix nigra L.

SOLANACEAE
Brunfelsia australis Benth.

THEACEAE
Camellia japonica L.

ULMACEAE
Celtis laevigata Willd.
Ulmus parvifolia Jacq.
Ulmus rubra Muhleng.
Ulmus sp. Mirb.

VERBENACEAE
Callicarpa americana L.
Lantana montevidensis (K. Spreng.) Briqu.
Vitex trifolia L.

VITACEAE
Vitis labrusa L.

BOOK REVIEW

Beyond Domestication in Prehistoric Europe: Investigations in Subsistence Archaeology and Social Complexity. Graeme Barker & Clive Gamble, eds. Studies in Archaeology Series. New York: Academic Press, 1985. Pp. xx, 282. $58.50.

The stated objective of this volume is "to investigate how subsistence theories and techniques that were developed for the earlier periods of prehistory up to the first farmers, can be applied to more complex societies in later prehistoric Europe" (p. 2), a goal that is admirably accomplished, to a greater or lesser extent, by each contributor. Virtually all of the authors are well steeped in scientific archaeology, demonstrating an extensive knowledge of scientific procedures and the application of relevant material and studies from non-archaeological sources in their analyses.

In addition, these studies are noteworthy for a variety of reasons. First of all, they deal with a period and a geographical area which are poorly understood and often neglected in the archaeological literature. Second, the scope of each contribution is broad and/or regional—there is not a single site report here; rather, these are synthetic, comparative studies drawing on a multitude of published and unpublished reports and studies for data and analyses. Each brings together information from many sites to formulate models or draw conclusions which have significance well beyond the borders of the regions under consideration. Third, most focus on the relationships between subsistence and aspects of social complexity, particularly social stratification and the roles of elites, important subjects generally ignored by archaeologists who are usually content to make vague statements about status based on the differential quality of grave goods and the presence or absence of monumental architecture. And finally, one is impressed by the extent to which the authors demonstrate familiarity with the ethnographic and ethnological literature and their ability to utilize the ethnographic analogy in their analyses. All of this and more is covered in the editors' introductory essay, "Beyond Domestication: A Strategy for Investigating the Process and Consequence of Social Complexity."

"Patterns in Faunal Assemblage Variability," by J.M. Maltby, is a comprehensive look at factors affecting the variability of animal bone assemblages in archaeological collections. Maltby correctly points out the consistent neglect of food exchanges by archaeologists otherwise concerned with trade, and he calls for greater attention to the implications of animal bones for trade. In a critique of existing studies he argues persuasively that many interpretations are far too simplistic and fail even to take into account logical alternative explanations, to say nothing of more imaginative solutions. While he does not explicitly offer a formal model for the study of animal bones, he manages to provide, indirectly, a comprehensive scheme for faunal analysis which, if widely adopted, would certainly yield valuable results. In his enumeration of problems facing the bone specialist he mentions several which appear insurmountable, but overall his approach makes good sense and it could revolutionize paleozoology. Ultimately he demonstrates that faunal remains can be the basis for understanding aspects of social organization and culture rarely linked to such data: settlement pattern, modes of production, trade and redistribution, and even value systems.

Roger Cribb's "The Analysis of Ancient Herding Systems: An Application of Computer Simulation in Faunal Studies" is also concerned with faunal remains, but it is much narrower in scope. Cribb describes a computerized simulation model for the study of ancient herding systems, demonstrating it with several sets of data. The model, called FLOCKS, can be used to predict herd sizes and certain aspects of herding strategies on the basis of animal bones and teeth recovered archaeologically. Although there are serious limitations to this model—which may be addressed in Cribb's planned refinement—and a full understanding of it requires some knowledge of higher mathematics and the fundamentals of computer simulation, it represents a fascinating new departure and shows considerable promise.

Of all the contributions, perhaps the one of most interest to the readers of this journal is Martin Jones's "Archaeobotany Beyond Subsistence Reconstruction." Although he is primarily concerned with demonstrating that the proper unit of archaeological analysis should be the total environment of a site rather than just the immediate area of settlement, Jones bases his arguments on studies of botanical remains recovered from the excavation of fields and other non-traditional contexts usually overlooked by archaeologists. He maintains that important aspects of human behavior can be determined from an understanding of the relationships between human beings and plants, and demonstrates this with case data from sites in the upper Thames River valley of southern England. He offers substantive conclusions based on the analysis of this material and ends up with a suggestion for additional applications of this approach. Among other highlights of this chapter is a useful sketch of a cereal plant showing those components which survive carbonization and are identifiable in archaeological analyses.

"Land Tenure, Productivity, and Field Systems," by Andrew Fleming, relies on the ethnographic analogy more than most of the other studies in this volume, drawing from, among others, the famous work of Arensberg and Kimball on rural Ireland. It is also a highly quantitative analysis. Using archaeological data from a sizeable region in southern England, Fleming shows how aspects of land use and labor organization can be developed by looking at field systems in the larger picture, thus echoing some of Jones's points. He makes a convincing case for collective farming in late Neolithic Britain and suggests that later cultural developments in northwestern Europe can be linked to the relative prosperity engendered by this efficient cooperative economy, rather than as a result of outside influences.

By examining the role of internal social (as opposed to cultural) factors in the transition from the Neolithic to the Iron Age in northeastern Europe (a region often considered a social and cultural backwater in this period), Marek Zvelebil attempts to fill an important gap in the archaeological literature with "Iron Age Transformations in Northern Russia and the Northeast Baltic." He divides the period under consideration (500 B.C.-A.D. 1200) into four segments and develops a profile of social and economic structure for each, based on aspects of subsistence suggested by the archaeological record. The result clearly illustrates major evolutionary developments and suggests that core-periphery factors (with the exception of the introduction of iron), including the occasional presence of the Romans, were of less significance than internal factors, such as social complexity and economic intensification, for such developments as craft specialization, surplus production, regional markets, and, ultimately, social and political hierarchies—all hallmarks of later Iron Age society.

In "Regional Survey and Settlement Trends: Studies from Prehistoric France," Nigel Mills recognizes that most environments can (and often do) support a variety of subsistence systems. Mills calls for a broader geographical perspective in archaeology in which the distinction between simple and complex societies is subordinated to a regional approach where emphasis is placed on understanding human interaction with the environment. He applies this framework to two case studies: a group of Neolithic sites in southern France, and a set of Iron Age sites in central France. In the first case he is able to show that demographic and cultural variations conventionally attributed to environmental changes are more likely to have occurred as a result of internal social and cultural developments unrelated to changes in climate and other environmental factors. In case two he clarifies the issues and provides new explanations for the appearance of large political/social/economic centers in the later Iron Age. In both cases he draws extensively from the modern ethnographic and scientific records and suggests that modern demographic and other cycles have clear parallels in antiquity.

''Social Factors and Economic Change in Balearic Prehistory, 3000-1000 B.C.,'' by James Lewthwaite, looks at the ''marginal'' area of the Balearic Islands, evaluating the utility and validity of four models of social differentiation and population increase. Lewthwaite reviews virtually all the archaeological research carried out in the islands and constructs an impressive profile of settlement evolution there. In the end he rejects most of the features of the four models, arguing that equal attention must be paid to subsistence and on-subsistence factors in any analysis. Of particular importance, in Lewthwaite's opinion, are maritime connections with the rest of southern Europe (including such islands as Sardinia and Sicily) as well as entrepreneurial activities, both internal and external.

Working with very sparse data (animal bone fragments and carbonized grains), Klavs Randsborg, in ''Subsistence and Settlement in Northern Temperate Europe in the First Millennium A.D.,'' correlates herding and agricultural practices with aspects of the environment and such social and economic factors as the impact of the Romans over an enormous area—most of northern and part of central Europe. He is able to determine some general trends in the cultivation of five grains—wheat, barley, rye, oats, and millet—and correlates each with various environments and chronological periods. Transformations in settlement pattern are linked to subsistence strategies and environmental factors such as climatic change and soil types. He also reviews briefly some of the problems related to differential preservation of botanical remains in archaeological contexts.

This important collection is enhanced by the generally high quality of editing and printing. Each article is well-organized and well-written. There are good maps, tables, graphs, and drawings throughout, as well as a comprehensive and very useful index. Although its appeal is limited, this volume should prove invaluable to archaeologists working in western and northern Europe, and it is a model of good synthetic analysis.

Peter S. Allen
Department of Anthropology and Geography
Rhode Island College
Providence, RI 02908

Please see pages 129-131 for additional details.

J. Ethnobiol. 9(1):51-63 Summer 1989

SPECIAL PROBLEMS IN AN ETHNOBOTANICAL LITERATURE SEARCH: *CORDYLINE TERMINALIS* (L.) KUNTH, THE "HAWAIIAN TI PLANT"

CELIA EHRLICH
Department of Anthropology
State University of New York at Buffalo
Amherst, NY 14261

ABSTRACT.—The different kinds of references to plants used by botanists, ethnographers and linguists may confuse ethnobotanists who are trying to follow species through the literature. Changes in botanical nomenclature, use of unfamiliar local and common names, and inadequate differentiation of varieties cause difficulties for researchers looking for references to particular plants. Problems encountered in a search for *Cordyline terminalis* (L.) Kunth, the "Hawaiian **ti** plant," illustrate these difficulties and point to some ways of resolving them.

RESUMEN.—La diversidad de las alusiones a plantas que emplean los botánicos, los etnógrafos y los linguistas tiende a confundir a los etnobotánicos que procuren rastrear ciertas especies en las publicaciones científicas. Los cambios de nomenclatura botánica, el uso de términos locales y raros y nombres propios y la distinción insufiente entre las subdiviones dificultan la busca de referencias a plantas determinadas de parte de los investigadores. Los problemas encarados en la exploración de *Cordyline terminalis* (L.) Kunth, "Hawaiian **ti** plant," demuestran esos obstáculos a la vez que indican ciertos métodos para superarlos.

RESUME.—Les différentes sortes de références aux plantes dont les botanistes, les ethnographes et les linguistes se servent peuvent rendre perplexe l'ethnobotaniste occupé à suivre des espèces à travers la littérature. Les changements de nomenclature botanique, l'emploi de noms locaux ou populaires peu familiers, et la différentiation insuffisante entre variétés posent des problèmes à ceux qui sont en train de chercher des références à une plante déterminée. Les problèmes rencontrés au cours de recherches sur *Cordyline terminalis* (L.) Kunth, "Hawaiian **ti** plant," illustrent ces difficultés et indiquent des moyens de les résoudre.

INTRODUCTION

Recognizing the difficulties of a botanical search.—Botanists, ethnographers and linguists record observations about plants in different ways. While trying to locate all references to the Hawaiian **ti** plant, *Cordyline terminalis* (L.) Kunth, I have recognized sources of confusion arising from this diversity—difficulties which would attend any similar search. My search is preliminary to a larger study of the species as a constant with variations in names, uses and contexts. Plants like **ti**, easily propagated from cuttings, have furnished the staple foods of Oceanic peoples (Sauer 1952). By detailing some of the difficulties in following the **ti** plant, I hope to help others identify plants in the writings of different kinds of specialists.

Plant literature searches and their uses.—Economic botanists, prehistorians, ethnographers and linguists all use native names of plants from published sources (e.g.

Burkill 1935; Barrau 1965; Yen 1974). Through analysis of the distributions of plant names, they find evidence of migration pathways of peoples and the points of origin of the plants themselves. Merrill (1946) recognizes the potential of names—especially Asian names—for botanical work. Conklin (1963) and Sturtevant (1964) use plant names as an aid to understanding human relationships and attitudes. Berlin, Breedlove and Raven (1974) and Brown (1982) analyze native naming as linguistic classification. Other linguists make creative use of botanical terms in their work on proto-languages (e.g. Blust 1983); a dictionary of Austronesian words summing up several studies of Proto-Oceanic, Proto-Melanesian, Proto-Polynesian etc., includes names for **ti** and other plants (Wurm and Wilson 1975:45).

Several authors have offered guidelines for keeping the records straight. Mead (1970) advises anthropologists to collect specimens and have them classified both by natives and by taxonomists rather than introduce errors into the literature. Whistler (1985) prompts botanists to check the accuracy of native names they add to herbarium specimens. But little has been written about ways and means of using or correcting the literature as it is.

*Appearance of **ti**.*[1] —Common names like "cabbage palm" or "victory palm" probably refer to the superficial resemblance between **ti** and small palm trees, with leaves clustering at the ends of uniform stalks marked by regularly spaced leaf scars (Fig. 1). The color varies from bright cherry red to blood-red to purplish, and from light yellowish green to dark green. The finely parallel-veined leaves may be striped or plain, varying greatly in length and width according to variety. The first Hawaiian ti was green. The height of the plant at maturity varies from 1-4 m. Individual plants in Tonga live to be 40 years old or more. **Ti** flowers infrequently, with a sweet-smelling terminal inflorescence followed by small baccate fruits.

*Why study **ti**?*—**Ti** is interesting ethnobotanically because it has been important in ceremonials of very different cultures. It was ". . . among the objects of greatest use in the ritual of Polynesia" (Oliver 1974:108). It had general applicability in all the rites of the New Guinea Kapauku (Pospisil 1964:34). Tsembaga Maring people, in Papua New Guinea, planted or uprooted it to signal change in the stages of their ritual cycle (Rappaport 1968).[2] Rappaport (1968:231) quotes personal communication with H.C. Conklin to the effect that **ti** was important in Ifugao rituals in the Philippines. Others have commented about uses of **ti** by other peoples. Petard (1946) and Leenhardt (1946) have focused attention on the species in Polynesia and New Caledonia respectively, and others have referred to it in Malaysia, Southeast Asia, Indonesia, New Guinea, the Philippines and Melanesian islands. Sauer mentions it as an example of early multipurpose domesticates nurtured in his Southeast Asian "cradle of agriculture" (1952:27).

In Hawaii, there is ". . . continuing belief that fresh leaves of green **ti** possess some mystical quality that can protect against spirits, lift **kapus** (taboos) and call down the blessing rather than the wrath of the gods" (Pukui, Haertig and Lee 1972:190). Micronesian magicians chanted to **ti** plants, naming various causes of death and expecting the plant to tremble in response to the right cause (Brower

—(Photographs by Paul Ehrlich.)

FIG. 1.—Flowering red **ti** in the garden of the Bishop Museum, Honolulu. Young green **ti** beside the access road to Waimea State Park, Oahu.

1974). In New Caledonia, the plant symbolized the perenniality of the social life of the clan (Leenhardt 1946:192). Malays ascribed occult powers to **ti**, especially to the red varieties (Burkill 1935:662). Toradja of Sulawesi treated the plant as holy, ". . . the magic herb par excellence" (Adriani and Kruyt 1951:35).

*Uses of **ti**.*—**Ti** leaves were a source of leaf girdles in western and central Polynesia, although the Hawaiian hula skirt may have been introduced late by Gilbert Islanders (Handy and Handy 1972:225). The plant furnished food—the cooked rhizome is rich in fructosans (Barrau 1961:60). For unknown reasons, most Melanesians did *not* eat it (Leenhardt 1946:193). One might guess that the role of the plant in sorcery made it appear dangerous. Fiji is like Polynesia; some people there did eat **ti** rhizomes. **Ti** makes good fences because it cannot easily be moved without leaving traces. The leaves make wrappers for small articles and for food cooked in earth ovens. Stalks of **ti** are ideal swatters for mosquitoes. Mundane uses for the plant abound. But the reason for using this particular plant in the rituals of so many different peoples remains a mystery. It looks as though the plant had acquired a reputation for efficacy with spirits even before the peoples became differentiated. If so, the patterns of names, varieties and uses should reflect, at least to some extent, the prehistory of the peoples.

BOTANICAL IDENTIFICATION

Distribution.—Van Balgooy (1971:179) summarizes the places in the Pacific from which *Cordyline* is "reliably recorded," "doubtfully indigenous" and "not reported." The former include the Mascarene islands, East Asia, Southeast Asia, Malesia, the Philippines, New Guinea, Australia, New Caledonia, Norfolk island, the Kermadecs, New Zealand and South America. The genus is "doubtfully indigenous" in the Bismarcks, Solomons, New Hebrides, Loyalties, Carolines and Polynesia. It has not been reported from Eurasia, Santa Cruz, the Chatham Islands, the Bonins or the Marianas.

Origin.—Uncertainly, experts say that **ti** is probably native to Southeast Asia (Baker 1875:538; Smith 1979:151). However, Yen (1987:8) has suggested recently that it may have been domesticated first in New Guinea. Ridley (1924:331) also proposed a New Guinea origin, maintaining that **ti** on the Malay Peninsula was always cultivated. I have seen no opinion as to how one *Cordyline* species got to Brazil. The plant grows easily from stem cuttings or from rhizomes, and, in some varieties, from seed. In Hawaii, where the earliest known variety is green, **ti** seeds are apparently infertile, however (Yen 1987:10). It would be interesting to find out whether the South American species produces fertile seeds.

Botanical status.—Formerly placed in the family Liliaceae (e.g. Brown 1914), the genus *Cordyline* recently has been classed in the Agavaceae by most botanists (e.g. Cronquist 1981). The Agavaceae differ from the Liliaceae primarily in growth habit (Cronquist 1981:1220). *Dracaena, Nolina, Sansevieria* and probably *Cordyline* differ from *Yucca* and *Agave* on serological grounds, but resemble them in other ways, so the classification of these groups is difficult (Conquist 1981:1221).

Hutchinson established a tribe, Dracaeneae, joining *Dracaena, Cohnia,* and *Cordyline* (1973:664). Dahlgren, Clifford and Yeo (1985:147-49) put *Cordyline* into the Asteliaceae because the genus *Cohnia* forms a link between *Astelia* and *Cordyline.* However, the spinulose pollen that characterizes the Asteliaceae is not present in *Cordyline.*

Morphologically, *Cordyline* differs from *Dracaena.* Tomlinson and Fisher (1971) conclude that *Cordyline* is a natural genus, with embryo growth markedly different from that of most monocots in that a "rhizome bud" emerges from the seedling at an early stage and takes over. The axis of the plant grows both from the top and from the bottom of the seedling in opposite directions. *Dracaena* does not have such taproots but, like *Cordyline,* has another characteristic unusual for monocots—secondary thickening in its stem and true roots. *Cordyline* leaves also tend to be more flexible than *Dracaena* leaves because of structural differences. To a layman, however, these differences are insignificant. Nurserymen tend to lump the two genera, and it is not surprising that the general public should do the same.

The correct name for a species is the earliest published name of all type specimens that fit the species concept, but botanists do not agree as to the correct species epithet for this plant. Table 1 shows that the plant Smith calls *C. terminalis* was once called *C. fruticosa* A. Chev., and before that, *Taetsia fruticosa* Merr. Kunth usually is credited for first using the name *Cordyline terminalis* (which he applied to the plant Linnaeus had called *Asparagus terminalis),* but Fosberg (1985) has questioned this attribution because the type specimen was a *garden* plant, not collected in the wild, and concludes that *Cordyline fruticosa* A. Chev. is correct after all. Only a botanist well versed in nomenclature is likely to be current with such fine points of taxonomy. While the genus *Cordyline* has achieved the status of conserved name among professional botanists, the species designation *terminalis* has not. I am using *Cordyline terminalis* for the present because the Botanical Congress of 1983 (Voss ed. 1983) accepted this species name rather than *Cordyline fruticosa.*

Even if both generic and specific terms had special sanction, an ethnobotanist would have to search the literature for all the names the plant had been called, correctly or incorrectly. I have 15 references to *C. fruticosa;* 10 to *Dracaena terminalis* (L.) or *Dracaena ferrea* (L.) (both often used to distinguish red from green varieties); and five to *Taetsia fruticosa* as well as 65 to *Cordyline terminalis.* I also found references to *C. terminalis* under *Terminalis,* the name Rumphius used in the manuscript he sent to Europe from Amboy Island in 1696 (Merrill 1917:16). Rumphius named four varieties of *Terminalis* (1741, 1755).

PROBLEMS OF AN ETHNOBOTANICAL SEARCH

Synonyms.—The objective of a botanical synonymy is to provide a minimal historical run-down on the nomenclature of the plant. A synonymy for botanists should list older names which have been applied incorrectly and discarded. "Synonymy" to a botanist does not imply, of course, that it is proper to substitute one species name for another. An ethnobotanist should realize that an author may have written about *Terminalis, Charlwoodia* or *Calodracon,* and recognize these

TABLE 1.—Synonymy of *Cordyline Terminalis:* Agavaceae.
—(Adapted from A.C. Smith 1979:149)

Genus:	*Cordyline terminalis* Commerson ex Juss.
Species:	*Cordyline terminalis* (L.) Kunth in Abh. Konigl. Akad. Wiss. Berlin 1842.
Derivation:	*Convallaria fruticosa* L. Herb. Amb. 16, 1754, Amoen. Acad. 4:126. 1759.
	Asparagus terminalis L. Sp. Pl. ed. 2. 450, 1762.
	Dracaena terminalis Lamm. Encycl. Meth. Bot., 2:324. 1786; B.E.V. Parham in Agr. J. Dept. Agr. Fiji 13:42. 1942.
	Cordyline jacquini Kunth in Abh. Konigl. Akad. Wiss. Berlin 30. 1842.
	Cordyline sp. Seem. in Bonplandia 9:260. 1861, Viti, 443. 1862.
	Cordyline jacquinii Kunth ex Seem. Fl. Vit. 311. 1868. Drake, I11. Fl. Ins. Mar. Pac. 319. 1892.
	Dracaena sepiaria Seem. Fl. Vit.t. 94. 1868.
	Cordyline terminalis var. sepiaria Baker in J. Linn. Soc. Bot. 14:540. 1875; Engl. in Bot. Jahrb. 7:488. 1886.
	Taetsia fruticosa Merr. Interpret. Rumph. Herb. Amb. 137. 1917. A.C. Sm. in Sci. Monthly, 73:14. Fig. 1951.
	Cordyline fruticosa A. Chev. Cat. Pl. Jard. Bot. Saigon, 66. 1919; non Goepp. (1855).

as pre-Linnaean names for **ti**. Dictionaries and encyclopedias are necessary adjuncts to floras and most other botanical works. Anthropologists, however, may not know where to look for proper synonymies. Species designations always refer to herbarium specimens, and change when scholars discover that earlier classifications of those specimens have been inappropriate. Different names then refer to the same plant, but again, the earlier names persist in the literature.

I have learned to look for all the names botanists have called **ti** plants, correctly or incorrectly. The maze of names referring to **ti** may be a "worst case" in that a common name of the plant, "dracaena," is the botanical name for a closely related genus, but otherwise, it is probably typical.

Common names/native names.—I had difficulty identifying **ti** when described by anthropologists, usually not themselves taxonomists, who have used common or native names with little description of their referents. Although reported native and common names are notoriously unreliable, I have sometimes been able to evaluate them. Extensive lists of native names are usually helpful, especially when pronunciation is unambiguously indicated. Now that linguists are able to identify cognates in different languages with considerable sophistication, lists of native names offer a good deal of information. Many ethnobotanists have profited from the writings of linguists in analyzing such lists. Even when diacritical marks or exact phonetic transcriptions are lacking, a list of native names may be useful. Translated, they may reveal the native attitude towards the plant.

Native names may reflect classification systems different from the Linnaean—may indicate interests taxonomists find irrelevant (Brown 1982). A plant with many varieties, like **ti**, may have names that denote different paradigmatic levels (Dentan 1988). Categorization may depend on perceived resemblance to basic members rather than the exclusive characteristics botanists look for (Rosch 1978: 35-41). But linguists also have problems identifying plants in the literature. Before analyzing native categories. linguists must find out whether the plant an author mentions is or is not **ti**.

*Why don't they mention **ti**?*—If *Cordyline, Taetsia* and *Dracaena* are absent from what purports to be a comprehensive flora of an island, the author of the flora may mean either that the plants have not been found in that locality or that they are not wild there. If plants of these genera do not grow there, references to them by non-specialists are probably erroneous. If they do grow there, but only as cultivated plants, that is relevant information. Authors help when they say whether or not their works include feral plants.

Varieties.—Part of an ethnobotanist's task is to find all the cultivated varieties (more properly "cultivars") in each locality. Smith (1979:152) judges that the existence of "innumerable cultivars" make infraspecific classification of **ti** varieties pointless. Herbarium labels on specimens of the plant may or may not cite the color of the plant when it was living, which would matter little if anthocyanin pigments did not tend to vanish in herbarium specimens. The information is not often germane to the taxonomist's task, but it is important because ethnic uses of plants are often specific to particular varieties distinguished by leaf color. In Tonga, where many ornamental varieties have been introduced recently, the "old" ones were probably the green **si futu**, the reddish **si kula**, and the two-tone **si tongotongo**. The first has especially good, sugary rhizomes for cooking in earth ovens; the second adds red color to leis and dance skirts; and the last has especially long leaves for the same purpose. These varieties all persist around abandoned house sites and plantations. An ethnobotanist has to ask why each variety of the species was cultivated. People probably had a culturally defined reason for perpetuating each variety (R.I. Ford pers. comm. 1986).

PROBLEMS IN IDENTIFYING TI IN THE LITERATURE

Dracaena terminalis.—In his work on the Lau Islands of Fiji, Hocart (1929:107) refers many times to dracaena and *Dracaena,* once to *Dracaena terminalis.* This last occurs under a subheading "Sugar Cane," and continues with information about making sugar from the root. How many other "sugar canes" in the literature are **ti** is hard to say, but *Dracaena terminalis* here identifies Hocart's "dracaena" as *Cordyline terminalis.* If Codrington (1891:20-21) had given this much information, one could identify the "kind of sugar cane" that "gave rise to humans" in a Melanesian myth. On the Polynesian island of Niue (Thomson 1901:86) and in Guadalcanal (Hogbin 1979:16), myths do have humans originating from a **ti** plant. In Tahiti, it was the **ti** plant that arose from a human shin bone (Henry 1928:421).

''Crotons,'' ''dracaenas'' and ''cordylines.''—Besides **ti**, the common name for *C. terminalis,* ''dracaena,'' is especially confusing since there is actually a genus *Dracaena.* Hocart's ''dracaena'' (1929:107) refers only to *Cordyline.* Plants in the genus *Dracaena,* also in the Agavaceae, are tropical ornamentals that grow in some parts of the Pacific as well as in Africa. The original Socotra ''dragon's blood tree'' was *Dracaena cinnabari* Balf., while the Teneriffe ''dragon's blood tree,'' which supposedly lived to be 6000 years old, was *Dracaena draco* L. (Willis 1919:228). A writer might use ''dracaena'' in the belief that it was a scientific name. When Williamson [1924(1):320] wrote of a ''***tii***'' plant and called it a ''dracaena,'' he probably meant a **ti**; ''***tii***'' is Proto-Oceanic for ''CORDYLINE (SPECIES)'' (Wurm and Wilson 1975:45).

Some British writers appear to have used ''croton,'' another tropical genus, as an all-purpose term for tropical plants with colorful leaves. ''Croton'' may refer to *Dracaena, Pleomele* or *Cordyline* as well as to true *Croton* (L.) or *Codiaeum variegatum* Blume. To Fortune (1963:114), working on the island of Dobu, off Papua New Guinea, a green **ti** was apparently *C. terminalis,* while a red one was a ''croton.'' Fortune identified the greens **pies** plant collected by an old women magician, as *C. terminalis* ''. . . commonly known by its Polynesian name, the **ti** plant.'' Trobrianders used to travel to Dobu to collect it for use in garden magic. But then he says that **ti** is ''. . . allied to the crotons planted over graveyards amongst the Massim, although the Massim use colored crotons in preference to the green *Cordyline terminalis.*'' He continues, complaining that Codrington (1891) referred repeatedly to the use of crotons by the Solomon Islands, but did not say ''. . . whether he meant *Cordyline terminalis* or one of the the colored varieties'' (1963:115). Possibly Fortune was confused because the original Hawaiian **ti** was green.

Another anthropologist, Chowning (1963), speaks of a ''croton group'' which includes *Cycas* as well as *Codiaeum* and *Cordyline* and is used for magico-religious purposes in Melanesia. Berndt (1962) worked among the Fore of Highland New Guinea collecting information about activities using unidentified ''red and green crotons.'' Whether the fact that Gajdusek later (1976) found cordylines among Fore indicates that Berndt's ''crotons'' were cordylines in problematic. Blust (1983-84:108) confirms that ''croton'' has been used as a generic term for *Cordyline, Pleomele* and *Dracaena.*

Mead (1947:409-412), while walking around a New Guinea Arapesh village with two young boys, recorded what they told her about plants. In her text, she gives the native names, but also ''croton'' and ''dracaena,'' the latter sometimes in italics and sometimes not. By and large, she avoids guessing at scientific names and gives both common and native ones. Was ''dracaena'' a common name for *Cordyline?* Tuzin (1976:9) mentioned ''crotons, cordylines and flowers'' being used by Arapesh at a later date, describing the ''crotons'' as ''marbled,'' which probably meant that he did distinguish *Codiaeum* or *Croton* from *Cordyline.* Tuzin apparently substituted "cordyline" for Mead's "dracaena."

Austronesian/native names.—Wurm and Wilson (1975) list "CORDYLINE (SPECIES)" with its names in Proto-Oceanic ***(ntiRi*** and ***tii),*** Proto-Malaitan ***(dili)*** and Proto- Polynesian (tii), and also "DRACAENA *(Cordyline)*" as Proto-Oceanic ***(ntiRi)*** and Proto-Malaitan ***(dili),*** suggesting that while "DRACAENA" could be *Cordyline,* "CORDYLINE" could not be *Dracaena.*

The missionary ethnographer, W.G. Ivens, who lived for many years in the Solomon Islands, wrote extensively about native use of "dracaena" without giving a scientific name. However, he also gave his own translation of a lullaby about a "little bird of dracaena" in which the native word for "dracaena" was **dili** (1927:105). Since ***"dili"*** is Proto-Malaitan for ti, Ivens apparently meant *Cordyline,* not *Dracaena,* by the word "dracaena." Kwara'ae, another group of people in the Solomons, use ***dili*** not only for *C. terminalis,* but as "a religious term for applying magic" (Whitmore 1966:120). That the same word should be used for the plant by chance seems unlikely. "**Dilly**" appears elsewhere as an alternative native name for the red **nahogle,** one of two plants always found near the altars where natives of Santa Ysabel in the Solomons carried out human sacrifice (Lagasu 1986:49). **Nahogle** was probably a variety of **ti.**

Pidgin English.—Pidgin English names are helpful insofar as they cover a wide area and have the same referent. New Guinea pidgin for *cordyline* appears as "tanket," "tanget," "tangget," "tangket" or "tanked." In a brief encyclopedia entry, Lawrence (1972) identifies "tangket" as *C. terminalis* and comments that *Dracaena angustifolia,* which Brown (1914:277) reclassified as a *Pleomele,* occurs only wild, while *Cordyline* is cultivated. Most New Guinea specialists restrict the pidgin term to *Cordyline,* although Mead (1940:398) suggests that "nettles" and "dracaenas" might be "tanggets" too. A "tangget" in this sense is a plant used in magic, especially sorcery. *C. terminalis* in Tagalog is "tungkod," which means "cane of priests" (Co and Teguba 1984:272). Native names for **ti** in several other languages refer to "priests." Native names together with pidgin can provide good identification. There may be several native names for a single pidgin one, often distinguishing different varieties or uses. The native name is the more specific.

Asian names.—I looked for references to *C. terminalis* in Asia, since many botanists point to Southeast Asia as its probable point of origin. The Chinese common name in Pinyin notation is **tie shu** (Chung 1924:11; Ch'en 1937:104). The most valuable sources give the name of the plant in Latin, in English and in Chinese characters, from which a skilled linguist can sometimes infer hidden meanings. For unknown reasons, the characters for *C. terminalis* translate as "iron tree." There are various forms of the names, both in Chinese and in English, but Lin (pers. com. 1986) has determined that they are all fundamentally the same. The character for *Cordyline* also denotes "vermilion," which is odd because all the plants I saw growing along the coast between Shaghai and Canton were green. Red ones are common in Hong Kong (pers. obs.).

A "common-name problem" arises in that the palm-like (but totally unrelated) cycad, *Cycas revoluta* Thunbg., is also "iron tree" in several Chinese sources. Even the Chinese characters say "iron tree," with slight variations. Once source gives an entirely different Chinese name for *Cycas* in Goa, without providing the characters (Soares 1963). I suspect that reports of *Cordyline* and *Cycas* have been muddled in the literature from an early date. Bretschneider, a physician who compiled a large work on early plant explorers in China, does not mention *Cordyline,* although he gives three English transcriptions of Chinese names for *Cycas revoluta:* **titsju, tie shu** and **tie tsiao** [1898(1):27]. Bretschneider was citing Rumphius, about whose identifications there has been much confusion, probably through no fault of his own (Merrill 1917). The reason Chowning (1963) found *Cycas, Cordyline* and *Codiaeum variegatum* to be a "croton group" may have been that "iron plants" were lumped together in some very early Asian culture. I am hoping to find a reasonable explanation for the Chinese association of vermilion and iron with **ti** plants in the final assembly of uses and names.

Names and varieties.—Tongans I interviewed (Sept.-Jan. 1987-88), did not recognize all of the dictionary names (e.g. **si tauvalu**) mentioned by Churchward (1949). One "variety" of **ti** listed in Churchward, **si matale'a** (meaning "tiny"), may be **si futu** growing under poor conditions, e.g. shortly after people have removed the root or horses have eaten all the leaves. **Si melo** has brown leaves—naturally dried brown leaves. Several recently imported varieties have names not in the dictionary. Tongans recognize that specimens of *Dracaena* in their gardens are recent introductions.

Variable spelling.—In the Fijian Dictionary Project, Geraghty (pers. comm. 1987) has carefully mapped the names for varieties of different color separately, indicating where each one is used for what. Churchward (1959) mentions three spellings for the Tongan name, usually **si,** but sometimes **chi** (Martin 1827) or **ji** (West 1865). But is **rau tea** (Firth 1967:154, 174, 216, 243, 360, 434) the same as **rau ti,** the name for *Cordyline fruticosa/terminalis* (Firth 1985:521)? Few authors have written extensively enough for such apparent errors to show up.

Human Relations Area Files, Category 824, Ethnobotany.—Under "Ethnobotany," this collection of excerpts from the writing of many ethnographers (Murdock *et al.* 1967) offers easy access to information about plants, subject to the limitations just described. Coders cannot improve on the quality of the original material. Checking Category 824 allows researchers to locate and scan a wider area than the one of primary interest. However, it may be risky to conclude that a plant is unimportant in a culture because no ethnographers covered by the Human Relations Area Files mention it.

CONCLUSIONS

For the task of identifying *C. terminalis* in the literature, botanical, linguistic and anthropological clues have all been useful. Information from each discipline has helped solve puzzles that arise because of the specialized styles of reporting in others. Anthropologists and other non-botanists may have no idea how frequently scientific names change. Common names also cause confusion. To cope with literature from all these specialists, ethnobotanists must know both the jargon and methods of reporting of each; words like "type" and "synonym," for instance, can easily mislead a person trained only in ethnology. The best strategy for finding older botanical names is to look first in a recent flora that covers the area of interest. Older works mentioned there may contain additional synonyms not published in the recent flora.

Botanists could help by noting the appearance of living plants and recording native as well as common names. A "red dracaena" is probably not *Dracaena* at all, for example.

Ethnographers could make their writings more useful by including several kinds of information about plants—descriptions as well as English common, native and pidgin names.

Lexicographers could help a great deal by pinpointing the venue of varietal names they obtain in the field, noting the most salient characteristics of each plant to which they refer. Like botanists and ethnographers, they need to exercise caution in attaching native and common names to botanical species.

Practically speaking, ethnobotanists have to work with materials that are full of errors of different kinds, but sometimes, by combining information from several disciplines, they can correct the errors. The expectations and conventions of those who write about plants in specialized disciplines are different. The records they leave are different. So anyone looking for all possible references to a particular plant needs special skills and strategies in order to find them.

ACKNOWLEDGEMENTS

I wish to thank Dr. Richard Zander, Curator of Botany at the Buffalo Museum of Science for his generous help. My advisor, Dr. Robert Dentan, and Frada Naroll read the paper and made helpful suggestions. I profited from personal contact with Drs. Jacques Barrau, Richard I. Ford, F. Raymond Fosberg, Paul Geraghty, Terence Hays, Karl Hutterer, and Peter Stevens. I thank Lin Zi-yu for the analysis of Chinese characters. Editor W. Van Asdall and readers Cecil Brown, Michael Carr and Nancy Turner have all made good suggestions, which I have tried to take.

NOTES

[1]For convenience, I refer to *Cordyline terminalis* as **ti** except for direct quotes or discussion of taxonomic matters.

[2]A footnote in this work (Rappaport 1968:213) first prompted me to investigate **ti**.

LITERATURE CITED

ADRIANI, N. and A.C. KRUYT. 1951. The Bare'e-speaking Toradja of Central Celebes (the East Toradja). Transl. J.K. Moulton. N. Holland. Uit. Maatschappi, Amsterdam.

BAKER, J.G. 1875. Mr. J.G. Baker on Asparagaceae. J. Linn. Soc. 14:538-545.

BARRAU, J. 1961. Subsistence agriculture in Polynesia and Micronesia. B.P. Bishop Mus. Bull. 223, Honolulu.

LITERATURE CITED (continued)

__________. 1963. Witnesses of the past. Pp. 282-294 *in* Plants and the migrations of Pacific peoples; a symposium (J. Barrau, ed.) B.P. Bishop Mus., Honolulu.

BERLLIN, B., D. BREEDLOVE and P.H. RAVEN. 1974. Principles of Tzeltal plant classification: an introduction to the botanical ethnography of a Mayan-speaking people of Highland Chiapas. Academic, New York.

BERNDT, R.M. 1962. Excess and restraint: social control among a New Guinea mountain people. Univ. Chicago Press, Chicago.

BLUST, R. 1983-84. Austronesian etymologies I, II. Oceanic Ling. 19:1-18; 22-23:29-149.

BRETSCHNEIDER, E. 1898. European botanical discoveries in China. Vol. I. Sampson, Low and Marston, London.

BROWER, K. 1974. With their islands around them. Holt, Rinehart and Winston, New York.

BROWN, C.H. 1982. Growth and development of folk botanical life-forms in Polynesian languages. J. Polynes. Soc. 91:213-243.

BROWN, N.E. 1914. Notes on the genera *Cordyline, Draceana, Pleomele, Sansevieria* and *Taetsia*. Kew Bull. 1914:273-279.

BURKILL, I. 1935. A dictionary of the economic products of the Malay Peninsula. Crown Printers, London.

CH'EN, J. 1937. Illustrated manual of Chinese trees and shrubs. Ag. Assoc. China, Nanking.

CHOWNING, A. 1963. Proto-Melanesian plant names. Pp. 39-44 in Plants and the migrations of Pacific peoples, a symposium (J. Barrau, ed.) B.P. Bishop Mus., Honolulu.

CHUNG, H.H. 1924. A catalogue of trees and shrubs of China, I. Mem. Sci. Soc. China, Shanghai.

CHURCHWARD, C.M. 1959. Tongan dictionary. Oxford Univ. Press, New York.

CO, L.L. and M. TEGUBA. 1984. Common medicinal plants of the Cordillera region (Northern Luzon), Philippines. Chestcore, Baguio City.

CODRINGTON, R.H. 1972. The Melanesians: studies in their anthropology and folklore. Reprint Dover, New York. First publ. 1891.

CONKLIN, H.C. 1962. Lexicographical treatment of folk taxonomies. Pp. 119-141 *in* Problems in lexicography: report of the Conference on Lexicography held at Indiana University, November 11-12, 1960. Publication no. 21, Indiana Univ. Res. Center in Anthrop. and Ling. (F.W. Householder and S. Saporta, eds.). Bloomington.

__________. 1967. Ifugao ethnobotany, 1905-1965: the 1911 Beyer-Merrill report in perspective. Econ. Botany 21:243-272.

CRONQUIST, A. 1981. An integrated system of classification of flowering plants. Columbia Univ. Press, New York.

DAHLGREN, R.M., H.T. CLIFFORD and P. YEO. 1985. The famililes of the monocotyledons: structure, evolution and taxonomy. Springer, Berlin.

DENTAN, R.K. 1988. Ambiguity, synecdoche and affect in Semai medicine. Soc. Sci. Med. 27(8):857-877.

FIRTH, R. 1967. The work of the gods in Tikopia. Second edition. Humanities Press, New York.

__________. 1985. Tikopia-English Dictionary. Oxford Univ. Press, New York.

FORD, R.I. 1978. Ethnobotany: historical diversity and synthesis. *In* The nature and status of ethnobotany. (R.I. Ford, ed.) Univ. Michigan Press, Ann Arbor.

FORTUNE, R. 1963. Sorcerers of Dobu. E.F. Dutton, New York.

FOSBERG, F.R. 1985. *Cordyline fruticosa* (L.) Chevalier (Agavaceae). Baileya 22:180-181.

GAJDUSEK, D.C., ed. 1976. Correspondence on the discovery and original investigations on kuru: Smadel-Gajdusek correspondence, 1955-1958. DHEW Publ. 76-1168. NIH, Bethesda

HANDY, E.E.C., E.G. HANDY and M. PUKUI. 1972. Native planters of old Hawaii, their life, lore and environment. B.P. Bishop Mus. Bull. 223, Honolulu.

HENRY, T. 1928. Ancient Tahiti. B.P. Bishop Mus. Bull. 48, Honolulu.

HOCART, A.M. 1929. Lau Islands, Fiji. B.P. Bishop Mus. Bull. 62, Honolulu.

HUTCHINSON, J. 1973. The families of flower ing plants. 3rd. edition. Vol. 2, The monocotyledons. Clarendon, Oxford.

IVENS, W.G. 1927. Melanesians of the South-east Solomon Islands. Kegan Paul, Trench and Trubner, London.

LAGUSU, H. 1986. Smoke and ashes for the Knabu gods. Pp. 48-55 in Pacific rituals: living or dying. (G. and B. Deverell, eds.). Inst. Pac. Studies, Suva.

LATUKEFU, S. 1974. Church and state in

LITERATURE CITED (continued)

Tonga. Australian Nat. University Press, Canberra.

LAWRENCE, P. 1972. Tangket. P. 1110 in Encyclopedia of Papua and New Guinea (P. Ryan, ed.). Melbourne Univ. Press, Melbourne.

LEENHARDT, M. 1946. Le ti en Nouvelle-Caledonie. J. de la Societe des Oceanistes 2:192-193.

LIN, Z-y. n.d. Analysis of Chinese characters for two plants.

MARTIN, J. 1981. Tonga Islands: William Mariner's account. 4th ed. Vava'u Press, Tonga.

MEAD, G.R. 1970. On the improper usage of common names when giving botanical data. Am. Antiq. 35(1):108-109.

MEAD, M. 1940-1947. The Mountain Arapesh. Anthrop. Papers, Am. Mus. Nat. Hist. 37:409-410; 40:398.

MERRILL, E. 1946. On the significance of certain Oriental plant names in relation to introduced species. Chron. Bot. 10:(3-4): 295-315. First publ. 1937.

____________. 1917. An interpretation of Rumphius' Herbarium Amboinense. Dept. of Ag. and Nat. Resources, Manila.

MURDOCK, G.P. et. al. 1967. Outline of cultural materials. 4th ed. Human Relations Area Files: New Haven.

OLIVER, D.L. 1974. Ancient Tahitian society, I., Univ. Hawaii Press, Honolulu.

PETARD, P. 1946. *Cordyline terminalis:* Ethnobotanique et medecine Polynesienne. J. de la Societe des Oceanistes 2:194-208.

POSPISIL, L. 1951. Kapauku Papuans and their law. Yale Univ. Press, New Haven.

PUKUI, M., E.W. HAERTIG and C.A. LEE. 1972. Nana I ke kuma. I, II. Queen Lil'uokalani Children's Center, Honolulu.

RAPPAPORT, R.A. 1968. Pigs for the ancestors. Yale Univ. Press, New Haven.

RIDLEY, H. 1924. Flora of the Malay Peninsula IV. London.

ROSCH, E. 1978. Principles of categorization. Pp. 35-41 *in* Cognition and categorization. Erlbaum: Hillsdale, N.J.

SMITH, A.C. 1979. Flora Vitiensis nova. Vol. I. Pacific Trop. Bot. Gard. Honolulu.

SOARES, F.A. 1963. Common Chinese names of some Macao plants. Garcia de Orta, 2(3):573-591.

STURTEVANT, W. 1964. Studies in ethnoscience. *In* Transcultural studies in cognition. (A.K. Romney and R.G. Andrade, eds.) Am. Anth. 66 (pt. 2):99-131.

THOMSON, B. 1901. Note upon the natives of Savage Island or Niue. J.A.I. 31:86.

TOMLINSON, P.B. and J.B. FISHER. 1971. Morphological studies in *Cordyline* (Agavaceae): introduction and general morphology. J. Arnold Arbor. 52:459-478.

TUZIN, D. 1976. The Ilaheta Arapesh: dimensions of unity. Univ. Calif. Press, Berkeley and Los Angeles.

VAN BALGOOY, M.M.J. 1971. Plant geography of the Pacific. Blumea Supplement, Vol. 4. Leyden.

VOSS, E.G., ed. 1983. International code of botanical nomenclature. Bohn, Scheltema and Holkema, Utrecht.

WAGNER, R. 1972. Habu: the innovation of meaning in Daribi religion. Univ. Chicago Press, Chicago.

WEST, T. 1865. Ten years in South-central Polynesia: being reminiscences of a personal mission to the Friendly Islands and their dependencies. London.

WHISTLER, W.A. 1984. Annotated list of Samoan plant names. Econ. Botany 38:464-489.

WILLIAMSON, R.E. 1924. The social and political systems of Central Polynesia, I, II. Cambridge Univ. Press, New York.

WHITMORE, T.C. 1966. Guide to the forests of the British Solomon Islands. Oxford Univ. Press, New York.

WILLIS, J.C. 1919. A dictionary of the flowering plants and ferns. Cambridge Univ. Press, Cambridge.

WURM, S. and B. WILSON. 1975. English finderlist of reconstructions in Austronesian languages (Post-Brandstetter). Series C no. 33, Pac. Ling. Australian Nat. Univ., Canberra.

YEN, D. 1974. The sweet potato and Oceania: an essay in ethnobotany. B.P. Bishop Mus. Bull. 236.

____________. 1987. The Hawaiian ti plant *(Cordyline fruticosa)* (L.); some ethnobotanical notes. Waimea Arb. and Bot. Gard., 14(1):8-11.

BOOK REVIEW

Numerical Methods in Quaternary Pollen Analysis. H.J.B. Birks & A.D. Gordon. Orlando, FL: Academic Press, 1985. Pp. viii, 317. $70.00.

In 1986, I reviewed Birks and Gordon's book for *Geoarchaeology* (Davis 1986). I concluded then that it was "an excellent summary of the pre-1983 literature on quantitative pollen analysis," but I faulted its lack of microcomputer implementations of the numerical techniques treated in the text. Since then I have used the book in my own research and as a reference for an introductory pollen class, and now I have an even higher opinion of the text than in 1986. Partly, this is due to the availability of the appropriate software—but more about that later.

Numerical Methods is clearly-written and relatively error-free, but it is not particularly easy to read. The "journal article" style of the text is broken up by long lists of references. Although these are used appropriately and their value is obvious, the references are very distracting for beginning readers. Furthermore, the authors assume familiarity with mathematical and statistical techniques. Without advanced preparation and guidance, the book would be difficult for students in an introductory palynology class. I use it as a reference, not as a primary text.

The book begins with a succinct introduction to Quaternary pollen analysis and the preparation of the pollen diagram. Chapter Two treats the basic statistics. The remaining four chapters deal with the areas of palynology that have been the focus of numerical inquiry: diagram zonation, sequence matching, analysis of surface samples, and quantitative interpretation of fossil sequences. Each topic is thoroughly discussed, and examples are provided using data sets from Scotland and North America. The authors compare the relative merits of various approaches to each problem without unfair bias toward the many techniques they have developed.

The field of numerical analysis is an active one, and many valuable papers have been written since *Numerical Methods* was published. The book is not out-of-date in its general coverage, but many recent papers, e.g., Overpeck *et al.* (1985) and Hill (1979), should be included in the second edition.

Sadly, numerical methods in general and Birks and Gordon's book in particular have not evoked much interest from archaeological palynologists. Despite the great number of samples that have been analyzed, I know of very few papers containing numerical analyses of pollen samples from archaeological sites (Ackerly's dissertation [1986] is an example), yet surely the interpretations of these reports would have benefitted from such analyses. Both the palynologists and the contractors are to blame. The vast majority of papers on archaeological palynology are unpublished site reports, and often the goals of archaeological pollen analysis do not lend themselves to numerical analysis. In the Southwest, many samples are studied only to establish the presence of distinctive cultigens. However, numerical analyses could be very beneficial in problems such as the interpretation of the age and season of occupation of archaeological sites, and of the functions of site structures and features.

Birks and Gordon's text can serve as a guide to the appropriate numerical techniques for the investigation of these problems, but the techniques themselves must be readily available before they receive wide application. Happily, the situation is much better than it was when I first reviewed the book. All of the programs mentioned in the text now have been adapted for the microcomputer by John Birks, who has distributed these on a limited, personal-use basis. Some of the programs have been translated to BASIC by Lou Maher (University of Wisconsin-Madison), who also has made the programs available to interested persons.

As an example of the potential applications, I will use some of Maher's programs to analyze two data sets collected from two stratified cultural middens near El Portal in Yosemite National Park (Davis 1984). These neighboring sites are in similar environmental settings and cover roughly the same time period. An example of a use of numerical techniques would be to pool the two sets to produce a combined pollen diagram, using the program SLOTSEQ. In Figure 1, the samples from MRP 250 are marked with asterisks in the deteriorated pollen column; the other samples are from MRP 382. The solution is based on 16 pollen types (4 not shown in Fig. 1), and a different sequence results if deteriorated pollen is not included. Note that the program correctly positions sample 16 (95 cm depth from MRP 250, 2360±140 yr B.P., BETA 8747), above sample 17 (80 cm depth from MRP 382, 2430±90 yr B.P., BETA 8752).

Another question one might ask of these data is, "When did the major changes take place in the environment?" This is the problem addressed by zonation, and two general approaches exist. One tactic is to plot dissimilarities between adjacent samples (p. 52). Larger values indicate greater change. This is illustrated at the extreme right of Figure 1. The greatest change is between samples 20 and 21, with a secondary peak between samples 17 and 18. A second tactic is to group samples into homogeneous clusters. The results of the program CONSLINK are shown in the left margin of Figure 1. The major groups are samples 1-17 and 18-24, with minor divisions of samples 1-5 and 6-17, and 18-20 and 21-24. These could be labeled, e.g., the "historic" (1-5), "main occupation and early historic" (6-17), "early occupation" (18-20), and "pre-occupation" (20-34) zones. The greatest change coincides with the beginning of site occupation, with a relatively smooth transition from Indian to Park Service occupation.

Other clustering techniques such as SPLITINF and SPLITLSQ emphasize different aspects of the data and produce different cluster diagrams, and within CONSLINK one can choose from three different measures of dissimilarity and two kinds of amalgamation. Each technique may suggest interpretations that may not have occurred to the investigator. As these tools become more accessible, Birks and Gordon's text will become increasingly valuable to the archaeological palynologist, as a guide, as a reference, and as an inspiration.

REFERENCES CITED

ACKERLY, N.W. 1986. Toward the discrimination of economic and non-economic pollen spectra from archaeological sites. Ph.D. dissertation, Arizona State University.

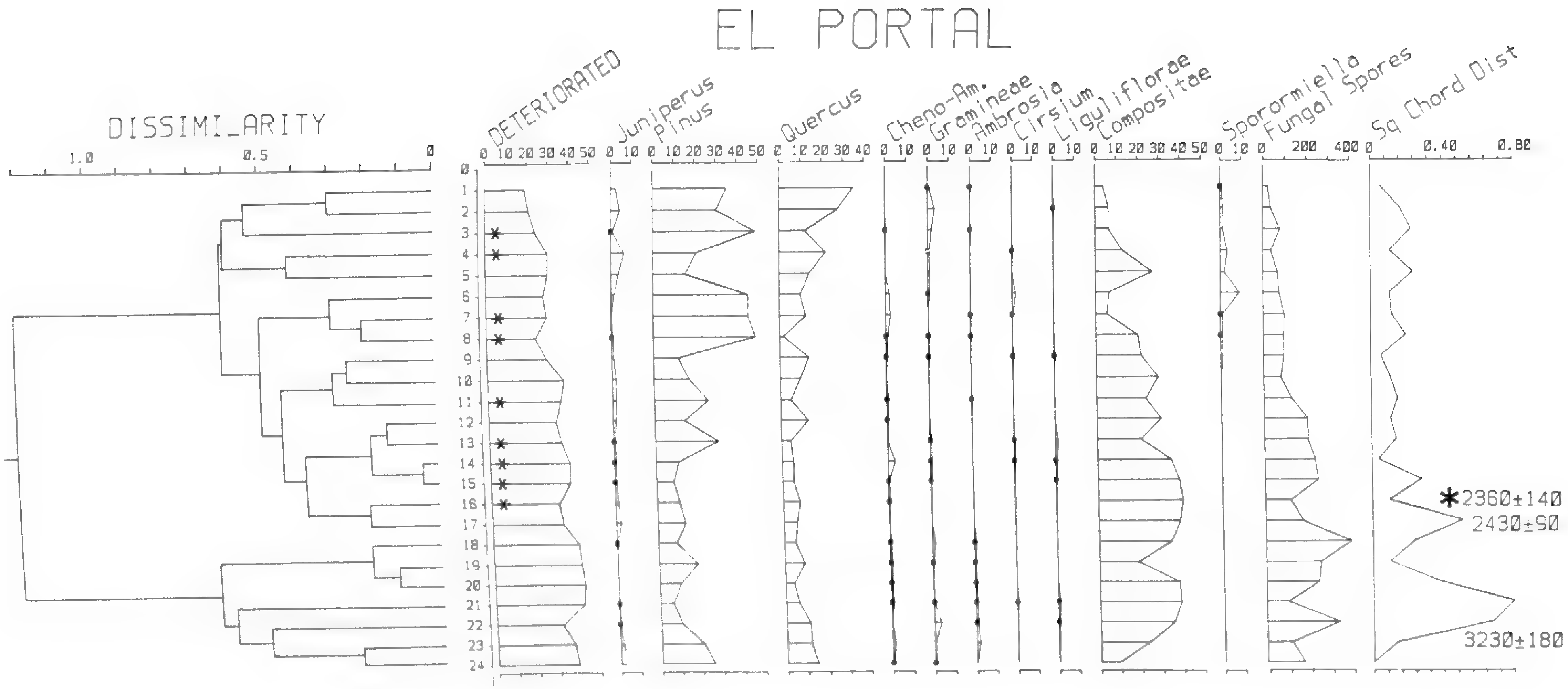


FIG. 1.—Percentage pollen diagram from sites MRP 382 and MRP 250 near El Portal, Yosemite National Park, California. Asterisks in deteriorated column mark samples from MRP 250, other samples are from MRP 382. Radiocarbon dates for MRP 250 (with asterisk) and MRP 382 are shown at right margin. Dissimilarity (calculated as squared chord distance) between adjacent samples is plotted as right-most curve. The dissimilarity diagram on the left margin is based on squared chord distance between samples and groups of samples, and the least-similarity agglomeration, using a program written by L.J. Maher.

DAVIS, O.K. 1984. Pollen analysis of two archaeological sites at El Portal, Yosemite National Park. Report to Linn Riely and Scott Carpenter.

__________. 1986. Review of: Numerical Methods in Quaternary Pollen Analysis by H.J.B. Birks and A.D. Gordon. Geoarcheology 1:393-394.

DAVIS, O.K., S.T. HALL, J. SCHOENWETTER and G.J. WEST. 1988. A bibliography of southwestern Quaternary palynology. Ms.

HILL, M.O. 1979. DECORANA, a fortran program for detrended correspondence analysis and reciprocal averaging. Cornell University, Department of Ecology and Systematics.

OVERPECK, J.T., T. WEBB III and I.C. PRENTICE. 1985. Quantitative interpretation of fossil pollen spectra: dissimilarity coefficients and the method of modern analogs. Quaternary Research 23:87-108.

Owen K. Davis
Department of Geosciences
University of Arizona
Tucson, AZ 85721

J. Ethnobiol. 9(1):69-110 Summer 1989

"ALL BERRIES HAVE RELATIONS" MID-RANGE FOLK PLANT GROUPINGS IN THOMPSON AND LILLOOET INTERIOR SALISH

NANCY J. TURNER
Research Associate
Botany Unit
Royal British Columbia Museum
Victoria, B.C. V8V 1X4

ABSTRACT.—A total of 79 diverse, mid-range folk groupings for plants in Thompson and 38 in Lillooet, two Interior Salish language groups of British Columbia, are inventoried and discussed within the context of "intermediate taxa" as defined by Berlin, Breedlove and Raven (1973) in their General Principles of folk biology. These mid-range groupings are more restricted than general "life-form" level categories in their application but broader and more inclusive than basic "generic" level taxa pertaining to perceptually distinct types of plants. Between Thompson and Lillooet, and among them and other northwestern North American native groups studied, the mid-range groupings exhibit similarities in quality and scope.

Some would qualify as true "intermediate" taxa *sensu* Berlin and his coworkers, but many are defined primarily by utilitarian or other special purpose traits and are related through affiliation rather than inclusion. Some are overlapping, both amongst themselves and with reference to the superimposing general classes. Some contain members which, while perceptually distinct, are unnamed at a more restricted level. This is especially true for plants of low cultural significance. A number of the mid-range groupings show evidence of recent expansion or semantic alteration to accommodate new plants and plant products following contact of traditional native and European cultures.

RESUMEN.—Un total de 79 diversas agrupaciones vulgares del nivel medio para plantas in Thompson y 38 en Lillooet, dos grupos linguísticos de Salish Interior de Columbia Britanica, se inventarian y se discuten en el contexto de "grupos intermedios" como definidos por Berlin, Breedlove, y Raven (1973) en su Principios Generales de la biologia vulgar. Estas agrupaciones del nivel medio son mas restringidos en sus empleos que las categorías generales de "forma de vida," pero son más anchas y más inclusivas que los grupos fundamentales del nivel del "géneros," cuales pertenecientes a grupos de plantas perceptualmente distintas. Entre Thompson y Lillooet, y entre ellos y otros grupos indígenos estudiados del noroeste de América del Norte, las agrupaciones del nivel medio presentan semejanzas de calidad y de alcance.

Unas agrupaciones se calificarían de veras como "grupos del nivel medio" segun Berlin y sus colaboradores, pero muchas se definen principalmente por carácteres utilitarios o de otros usos especiales, y se relatan por afiliación en vez de inclusión. Unas sobreponen otras agrupaciones del mismo nivel y también los grupos generales del nivel más alto. Unas tienen miembros que no tengan nombres en el nivel restringido aunque se perciben como distintas. Este es de veras especialmente para plantas de baja significación cultural. Unas de las agrupaciones del nivel medio muestran evidencia de expanción reciente o de alteración semántica para incluir nuevas plantas y productos de plantas después del contacto de las culturas indígenas y europeas.

RESUME.—On inventorie un total de 79 divers groupes populaires du rang moyen des plantes dans Thompson et 38 dans Lillooet, deux groupes linguistiques du Columbie Britannique, et les discute dans le contexte des "groupes intermédiaires" comme defini pour Berlin, Breedlove, et Raven (1973) dans ses Principes Généraux de la biologie populaire. Ces groupes du rang moyen sont plus restreindus que les catégories généraüse des "formes de la vie," mais sont plus large et plus inclusifs que les groupes du rang de "genre," qui ont rapport au types des plantes qui on percevoit comme distincts. Entre Thompson et Lillooet, et entre elles et autres groupes linguistiques étudiés du Nord-ouest de l'Amérique du Nord, les groupes du rang moyen exhibent des ressemblances de qualité et de porteé.

Quelques groupes qualifierient vraiment comme groupes "intermédiaires" suivant Berlin et ses collaborateurs, mais plusieurs se definent principement par des traits utilitaires ou d'autre usage spécial et sont apparentes par l'affiliation au lieu de l'inclusion. Quelques-uns se chevauchent, aussi bien avec ses mêmes qu'avec les classes généraux du rang superieur. Quelques-uns ont des membres que sont sans nom au rang plus restreindu, quoique l'on les percevoit comme distincts. C'est particulairement vrai chez les plants de moins importance culturel. Quelques-uns des groupes du rang moyen montrent de l'évidence de l'aumentation récente ou de changement sémantique après le contacte des cultures natives et européene.

INTRODUCTION

> . . . The ***sx̣ʷusum*** [soapberry] is a relative of ***ƚaʕâse*** [squaw currant]—sticky, red berries. It's got the same kind of woolly [scurfy] leaves. I don't know if it has any other relatives. That's the only one I know that's similar to it, and the old people always say, "That's ***sx̣ʷusum***'s relative." You see, all berries have relations . . . (Annie York, Spuzzum, B.C., tape transcript, 1975).

The above quotation by Annie York, a native Thompson speaker and plant specialist, is representative of a perceived, apparently traditional, relationship between two distinct types of plants—soapberry and squaw currant—in the Thompson worldview. It is this type of association, termed "mid-range grouping," that is the subject of this paper. Mid-range groupings are identified in this study by their intermediate range of inclusiveness in Thompson and Lillooet folk plant classifications. Viewed in a broadly interpreted hierarchical scheme, these groupings are more general than basic "generic" taxa denoting individual kinds of plants (e.g., soapberry and squaw currant) and less inclusive than the general categories at the "life-form" level (e.g. "berry"), as described previously (Turner 1987).

The existence in folk biological taxonomic systems of midlevel folk categories was first noted by Berlin, Breedlove and Raven (1968) who identified them as "intermediate" taxa. Mid-range groupings have since been verified in many field studies (as cited by Berlin 1986; also, Turner 1974; Turner *et al.* 1983). According to the framework of folk classification for biological systems as described by Berlin and his colleagues, their "intermediate" taxa are arranged hierarchically below major life-form categories and above taxa of generic rank (cf. Berlin 1972, 1974; Berlin, Breedlove and Raven 1968, 1973, 1974). At first, such categories were believed to be infrequent, and almost always "covert," or unnamed:

> . . . We have found such [intermediate] taxa to be invariably rare in natural folk taxonomies, and . . . the classes are not linguistically labeled . . .

> 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. This question can only be resolved by further research. (Berlin, Breedlove and Raven 1973:216).

However, Berlin and his colleagues identified over 70 midlevel covert plant taxa in their research on Tzeltal ethnobotany, and, despite their initial doubts about establishing such taxa as an absolute category type, they later stress (1973:226) that, "The recognition of unlabelled midlevel taxa can be of considerable importance in understanding fundamental principles of native classification and should not be ignored . . ." In a later paper, Berlin (1976) identifies as many as 40 such groupings from Aguaruna folk botany. Recently, on the basis of more complete evidence, Berlin (1986) again stresses his conviction that, " . . . taxa of intermediate rank are common and fundamental categories of real systems."

In his research on folk biological classification Brown (1984, 1986) has so far given little recognition to mid-range groupings in describing ethnobiological ranks: "There is a sixth ethnobiological rank not represented [in Brown's Figure, based on Berlin's framework] . . . since affiliated [i.e., intermediate] classes are very rarely found in biological taxonomies." (Brown 1984:5; see also Brown 1986:1). Hunn (1982) and Randall (Randall and Hunn 1984), who are critical of Brown's "life-form universals" as being unrealistic reflections of actual folk taxa, recognize that there is a "welter of utilitarian and ecologically defined supregeneric taxa [most of which do not meet Brown's criteria for life-forms] which most peoples rely on to organize their knowledge of the natural world" (Hunn 1982). They describe several taxa, including two named, rather major categories in Sahaptin, "salmon/steelhead" and "coniferous tree" (Hunn and French 1984; Randall and Hunn 1984), which can be interpreted broadly as taxa of a mid-range level.

Hunn (1982), Randall (1976), and other researchers (cf. Bright and Bright 1965; Price 1967; Morris 1984) have presented data that contradict or at least render less certain the contentions of Berlin and his colleagues that ranked, hierarchical folk biological classification systems based on perception of overall morphological similarities are universal and are the only valid framework for folk taxonomies. Classes based on utilitarian features, and relationships through affiliation, association, and "sphere of influence" rather than stringent hierarchical inclusion are perceived by many researchers to play a significant role in folk biotaxonomies. As will be seen, data presented in this study support the views of Hunn (1976, 1982) and others that relationships based on affiliation and utility are important components of folk plant classification systems.

In previous ethnobotanical research in Northwestern North American languages, I have noted in several different languages the existence of "intermediate"[1] folk plant categories (cf. Turner 1974; Turner and Efrat 1982; Turner *et al.* 1983). Some of these groupings are labelled. Some are indicated by mutually or exclusively applied terminology. Some, like the "intermediate" categories described by Berlin (cf. 1976), are only "implicit," or covert, and are not actually named in any formal way. Some, unnamed in the native language itself, have been designated by English folk terms, possibly reflecting a post-contact convergence of native and English folk categories (Turner 1974). Furthermore, mid-range groupings that I have identified are highly variable in scope (i.e., number of named or unnamed but perceptually distinct included members) and level of generality. Some could almost be considered at the level of "life-form" categories, since they are quite broad and are not actually included within any larger, more general category, except the "unique beginner," which is cognitively valid but unnamed by any free standing term (Turner 1987). However, these general groupings do not fit the criteria for life-forms as defined by Berlin *et al.* (cf. 1973), namely being "labelled by linguistic expressions which are lexically analyzed as primary lexemes . . ." and they may not contain many, or any, named members. Some mid-range groupings may actually encompass other, less inclusive mid-range groupings in a tiered hierarchical situation. Some could be considered as broad "generic" complexes, but, again, they do not conform to the criteria of Berlin *et al.* for taxa of generic rank, since they often incorporate two or more restricted folk taxa which are themselves labelled by primary lexemes.[2]

Names for mid-range plant groupings, when they do occur, are frequently polysemous with names for salient "generic" taxa included within them or which typify them. For example, in Nitinaht, a Wakashan language related to Nootka, the names for salmonberry[3] and Pacific silverweed can also be applied more generally to broader categories for which they are core representatives: "berries" and "edible roots" respectively. Similarly, the name for "any prickly or thorny plant" is also used in a more restricted sense for "thistles." In the first two cases, a derivation of the more general names from the "generic" level names by process of expansion of reference can be readily assumed. However, in the last, it is unclear whether the name for thistles was derived from the more general term through restriction of reference, or vice versa; the term itself means 'sharp plant' (Turner *et al.* 1983).[4]

PRESENT RESEARCH

In this paper, I will describe and provide examples of mid-range plant groupings within the linguistic and cognitive systems of Lillooet and Thompson, language groups of the Interior division of the Salish language family. This work is part of a broader study comparing many ethnobotanical features of Lillooet and Thompson, groups which are closely related ecologically and culturally as well as linguistically (cf. Turner 1987, 1988a, 1988b). Their traditional economies were based on hunting, fishing and gathering of plant products. Except for growing native tobacco, they were non-agricultural, but they did practice controlled burning for habitat maintenance.

Data for this study were obtained through interviews with native speakers of Lillooet and Thompson, most of them elderly (65-85 years old). Interviews were carried out over a period of many years—since 1972 for Lillooet and 1973 for Thompson (see Turner 1987 for a list of people interviewed, as well as a map of the study area). Earlier ethnobotanical accounts, especially by James Teit (1906; Steedman 1930; unpubl. research notes, 1896-1918), were also incorporated. Descriptions of Lillooet "intermediate" categories were included in Turner (1974), but these are reviewed in light of more recent investigations. Thompson folk plant classes are discussed in Turner *et al.* (1988, in press), which represents a compilation of ethnobotanical data for Thompson. Turner *et al.* (1985) contains a similar compilation for Lillooet.

Work on this project was done in collaboration with several linguists specializing in these languages (see Turner 1987). Interviews were carried out in English, but plant taxa were usually referred to by their native names, or simply by using growing or freshly picked specimens as samples for discussion. Mid-range plant groupings were identified and inventoried by various means, primarily through informal conversations about plants (growing and provided as fresh samples), discussions about their native names and associated terminology with native speakers, and questions to native speakers about the relationships and attributes of individual plant species and folk plant taxa at all levels of generality.[5] Secondarily, analyses of folk plant names, with input by collaborating linguistic specialists, perceptions of native categories by these linguists, particularly J. van Eijk and L. C. Thompson (pers. comm. 1972-1986)[6], and literature surveys were also used.

One Thompson speaker, Annie York (AY), has demonstrated an unusually detailed and insightful knowledge of traditional plant categories, arising from many years of intense study as a young woman with several native plant specialists, coupled with her own gifted intelligence, experience and recollective capacity. She was interviewed on many occasions by myself and Dr. Thompson over a more than ten-year period concerning her perception of Thompson folk plant classification. Much of her knowledge has been corroborated by other Thompson people and by information reported by Teit, but, especially for mid-range groupings, her evaluation of traditional perceptions seems unequalled at present. She contributed much to the data presented here; the assumption is made that at least a substantial portion of her taxonomic beliefs were derived from cultural teachings rather than being individual and restricted to her alone. Her remarks were often accompanied, as in the introductory quotation, by an assertion that "That's what the old people say." Our conversations with AY and other native consultants were taped and transcribed; hence any quotations by them are word-for-word.

DESCRIPTION OF MID-RANGE GROUPINGS IN THOMPSON AND LILLOOET

Thompson and Lillooet plant classification systems seem to exhibit a wide-scale hierarchical structure, similar in general form to the framework of folk classification for biological systems as described by Berlin, Breedlove and Raven (cf. 1973). As will be seen, however, Thompson and Lillooet folk groupings within this general structure do not always conform to the folk taxa of Berlin and his collaborators. General plant categories in Thompson and Lillooet, at the "life-form" and "unique beginner" levels of inclusion, have been discussed in a previous paper (Turner 1987). Subordinate to these broad classes, but still more general than the hundreds of basic "generic" level taxa in these languages, are a multitude of associations and linkages among plants, some of which correspond with the intermediate taxa of Berlin *et al.* (1973).

It would be impossible to enumerate or describe completely all of these mid-range groupings, because many represent fleeting and casual associations, varying perceptually from one person to another, from one locality to another, or over time. Like the covert categories of Berlin *et al.* (1968; Berlin 1976) and Randall (1976), many are unnamed. However, some seem quite enduring, being recognized by at least two members of the language community interviewed independently, or by one person, such as AY, during two or more well-spaced interviews. Many are encoded in the languages by simple or complex terms (see Tables 1 and 2).

TABLE 1.—*Examples of broad mid-range plant groupings in Thompson. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk*.)*

Associated native term[1]	English approximation (given by NT)	Botanical equivalent (criteria for recognition)[2]	Plants included (according to native consultants)
p̓e/p̓éy̓le tək q^{w}***zêm*** ('frog moss') (generic for green peltigera)	"thallose lichens" (or sometimes any lichens)	thallose lichens (1)	lung lichen, dogtooth lichens, rock tripe, parmelia, wolf lichen
q^{w}***zem-éyq***^{w} ('tree-moss')	"tree mosses and lichens"	none (6)	black tree lichen (to some), tree hair, stolon moss, and other bryophytes and lichens growing on trees
n/q^{w}***zem-úym̓x***^{w} [3] ('ground-moss')	"ground mosses and lichens"	none (6)	reindeer lichen, rhacomitrium, hair-moss and other bryophytes and lichens growing on the ground
k̓ə̣s-t tə(k) q̓ám̓es ('bad (pine) mushroom')	"inedible mushrooms"	none (4a)	lactarius, russula, and other species considered inedible or poisonous
q̓ám̓es (generic for pine mushroom); ***məƛ̓qíʔ*** (generic for "cottonwood mushroom") (NV)*	"edible mushrooms"	mostly basidiomycetes (4a)	pine mushroom, "cottonwood" mushroom, "slimy mushroom; commercial mushrooms

TABLE 1.—*Examples of broad mid-range plant groupings in Thompson. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk**.) (continued)

Associated native term[1]	English approximation (given by NT)	Botanical equivalent (criteria for recognition)[2]	Plants included (according to native consultants)
s/kel-ule?-éyq^w ('great-horned-owl-wood')	"tree fungi"	Polyporaceae (7)	bracket, or shelf fungi (espec. larger types)
ƛ̓ux^wn (generic for *E. hyemale)*	"horsetails"	*Equisetum* spp. (7)	common and giant horsetails, scouring rushes
none	"ferns"	various fern families	bracken, sword fern, lady fern, spiny wood fern, and others
wmex tək ƛ̓e?km̓îx tək sγêp ('it lives forever tree')	"evergreen trees"	Gymnospermae (1)	red cedar, junipers, pines, spruces, firs, and other evergreens
kəm̓-ẏ-êke? ('conifer needles')	"needle-bearing trees"	Pinaceae, Taxaceae (1)	true firs, larch, pines, spruces, hemlocks, yew
məɬpêke? u?ex tək sγêp ('it's stripped off tree')	"deciduous trees"	none (2)	maples, alders, dogwood, willows, larch
?esc̓ək̓qîn̓ke? tək sγêp ('it has catkins tree')	"catkin-bearing trees"	Betulaceae, Salicaceae (2)	alder, birch, willow, cottonwood
none*	"potatoes"	none (4b)	wapato ("swamp potato"), yellow avalanche lily, spring beauty ("Indian potato"), garden potato and other corm or tuber producing edible plants
q^wlêwe(?) generic for nodding onion)*	"onions"	*Allium* spp. and other Liliaceae (plus 1 *Carex)* (4b)	**nodding onion,** Hooker's onion, cluster lily, cultivated onion, small indet. sedge

TABLE 1.—*Examples of broad mid-range plant groupings in Thompson. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk**.) (continued)

Associated native term[1]	English approximation (given by NT)	Botanical equivalent (criteria for recognition)[2]	Plants included (according to native consultants)
k̓ə̣̂lwet (generic for false Solomon's-seal)	"false Solomon's-seal and relatives"	*Smilacina* spp., *Streptopus* spp., *Disporum* spp. in Liliaceae (4a)	**false** and star-flowered **Solomon's-seal,** twisted stalk, fairybells
ƛ̣̓léñtx^w^ (generic for tule)	"bulrushes"	none (6)	tule, cattail, scouring rushes, round-stem rushes
s/ɬaʔx̣-âns tək stuyt-úym̓x^w^ ('ground-growth food')*	"green vegetables"	none (4b)	**cow-parsnip,** burdock and rhubarb (both introd.), fireweed, salmonberry, thimble-berry, "Indian celery"
kéw-k^w^u (generic for big sagebrush)	"sagebrushes"	*Artemisia* spp. and *Chrysothamnus* (4a)	**big sagebrush,** pasture and field wormwoods, wild tarragon, western sage, rabbitbrush
none	"balsamroot and relatives"	various members of Asteraceae (1)	**balsamroot,** woolly sunflower, arnicas, brown-eyed Susan, sunflowers
ʔesntɬ-úym̓x^w^ tək stuyt-úym̓x^w^ 'trailing-on-the-ground ground-growth'	"ground-creepers"	none (2)	orange honeysuckle, trailing wild blackberry, kinnikinnick, twinflower
none*	"highbush cranberry and relatives"	none (2)	**highbush cranberry,** snowball bush (introd.), red-osier dogwood, ninebark
ʔik-éɬp (generic for for kinnikinnick)	"kinnikinnick and relatives"	none (2)	**kinnikinnick,** twinflower, false box, prince's-pine, pyrolas

TABLE 1.—*Examples of broad mid-range plant groupings in Thompson. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk*.)* (continued)

Associated native term[1]	English approximation (given by NT)	Botanical equivalent (criteria for recognition)[2]	Plants included (according to native consultants)
none	"Labrador-tea and relatives"	various members of Ericaceae (1)	**Labrador-teas,** swamp-laurel, false azalea, white-flowered rhododendron
none*	"bush-size huckleberry relatives"	*Vaccinium* spp. (taller types) (4a)	**black huckleberry,** red huckleberry, Alaska and oval-leaved blueberries, commercial blueberries
ʔimîxʷ (generic for dwarf mountain blueberry)	"low-growing blueberry relatives"	*Vaccinium* spp. (low types) (4a)	**dwarf mountain blueberry,** grouseberry, Cascade, velvet-leaved and bog blueberries
n-təƚ/tƚ-úy̓m̓xʷ ('trailing-over-the ground')*	"peavines"	various members of Fabaceae (4a)	vetches, milk-vetches, wild peas, clovers, garden peas
s/x̣ə̂k̓iʔt (generic for fireweed)	"fireweed and relatives"	none (2)	**fireweed,** willowherbs, evening-primrose, goldenrods, louseworts
s/q̓ʷuq̓ʷyêp (generic for wild strawberry)*	"strawberry and relatives"	*Fragaria* spp. and one *Rubus* (4b)	wild strawberries, trailing wild raspberry, domesticated strawberry
none*	"cherries"	*Prunus* spp., *Oemleria,* and *Rhamnus* (4b)	**choke cherry,** bitter cherry, cultivated cherry, cascara (for some), Indian-plum
none*	"raspberry and relatives"	*Rubus* spp. (4a)	wild and garden raspberries, blackcap, salmonberry, logan-berry
stx̣-âƚp (generic for various willows)	"willows"	*Salix* spp., plus *Elaeagnus* (7)	willows, silverberry

TABLE 1.—*Examples of broad mid-range plant groupings in Thompson. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk*.)* (continued)

Associated native term[1]	English approximation (given by NT)	Botanical equivalent (criteria for recognition)[2]	Plants included (according to native consultants)
none	"poisonous plants"	none (3)	Indian-hellebore, water hemlock, mountain bells, rein orchid, death camas, baneberry, anemone
s/ĉúm̓-ms-s e p̓ə̣ṣk̓e? ('hummingbird's sucking-substance')	"hummingbird flowers"	none (4b)	**shrubby penstemon,** penstemons, orange honeysuckle, campanulas, collomia, columbine, Indian paintbrushes
n-kʷə/kʷaẋm̓-ús ('spring-salmon eye')(generic for various buttercups)	"buttercup-like flowers"	none (2)	buttercups, large-leaved avens, cinquefoils, yellow monkey-flower
s-wəl̓/wl̓-íqt ('rash-causing')	"rash-causing plants"	none (3)	poison-ivy, stinging nettle, clematis, buttercups, devil's-club
mlá-mn (tək stuyt-úym̓xʷ) ('medicine (ground-growth'))	"medicinal plants"	none (3)	Indian-hellebore, devil's-club, goat's-beard, and many others
mlá-mn-s e x kʷis-it ('medicine for childbirth')	"childbirth medicines"	none (3)	rattlesnake plantain, prince's-pine, pyrolas
mtol-t-úym̓xʷ tək s/tuyt-úym̓xʷ ('clotted-substance-under-the-water ground-growth')	"(fine) water plants"	none (6)	green algae, pond-weeds, (marine algae); (some overlap with next class)
ntuyt-úym̓xʷ ('water ground-growth')	"(broad-leaved) water plants"	none (6)	**skunk-cabbage,** yellow pond-lily, water knot-weed, and other aquatic plants

TABLE 1.—*Examples of broad mid-range plant groupings in Thompson. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk*.)* (continued)

Associated native term[1]	English approximation (given by NT)	Botanical equivalent (criteria for recognition)[2]	Plants included (according to native consultants)
pəs/pês pet s/tuyt-úym̓xʷ ('swamp ground-growth')	"swamp grasses"	none (6)	**"cut-grass,"** sedges, reed canary grass, rushes (sometimes tule, cattail and horsetails)
q̓apúxʷ ('nut') (orig. generic for hazelnut)*	"nuts"	none (4b)	hazelnut (orig.). plus many types of imported nuts, espec. walnuts
c̓q̓-ə́p ('it sticks')*	"burr-fruited plants"	none (4b)	hackelia, stickseed, burdock (introd.), (bedstraw, by some)
ƛ̓áq̓ƛ̓əq̓-t ('spines') (generic for thistles)	"spiny (low) plants"	none (4b)	devil's-club, thistles, rose, spruce, gooseberry
q̓ə/q̓e?n-êłp ('thorn plant')*	"thorny (large) bushes or trees"	none (4b)	black hawthorn, Pacific crabapple, holly, locust, maytree (last 3 introd.)

[1]Orthography for Thompson terms is based on the system used by L.C. and M.T. Thompson (cf. Turner et al., 1984), but some of the markings showing word analyses are omitted here for simplicity. Botanical equivalents for common English names used are given in Appendix 1. Abbreviations: equiv. - equivalent; espec. - especially; excl. - excluding; introd. - introduced; orig. - originally; spp. - species; LT - Lower Thompson dialect; UT - Upper Thompson dialect; NV - Nicola Valley Thompson. (Unless specified, terms occur in all dialects).

[2]A description and summation of these values is given in Table 4.

[3]Annie York, and some other Thompson speakers, also recognize named categories of "long moss," "short moss," "rock moss," "water moss" and "swamp moss," or "creek moss" (Turner et al., 1988 in press). It is debatable whether these should be considered as mid-range or "generic" level folk taxa. Some, at least, have recognizably different members, but these are unnamed at any more restricted level. The "long" types were preferred for use in chinking log houses for insulation.

Tables 1, 2, and 3 provide examples of some of the mid-range groupings seen in Thompson and Lillooet folk plant classifications. For convenience these are separated into borad, more general groupings (with roughly more than three included "generic" level plant types as recognized by native speakers—Tables 1 and 2) and smaller, more restricted, mostly including two or three "generic" level plant types (Table 3). The introductory quotation provides an example of the

TABLE 2.—*Examples of broad mid-range plant groupings in Lillooet. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk*.)*

Associated native term[1]	English approximation	Botanical equivalent (recognition category no.)	Plants included
(s-)q̓ə́m̓s-álqʷ ('tree/wood-(pine-) mushroom')	"tree fungi"	Polyporaceae, plus *Pleurotus* ("type") (4a)	bracket or shelf fungi (many types); oyster mushroom
q̓ə́m̓s-úlm̓əxʷ ('ground-(pine-) mushroom')	"inedible mushrooms"	none (4a)	lactarius species, russula species, and many others
(s-)q̓ə́m̓s (generic for pine mushroom-P); ***(s-)məƛ̓-áqaʔ*** (FR)	"edible mushrooms"	mostly basidio-mycetes (4a)	pine mushroom, "cottonwood" mushroom, "slimy mushroom"; commercial mushrooms
(s-)č̓ə́kʷaʔ (generic for spiny wood fern)	"lacy ferns"	Aspleniaceae (1)	lady fern, spiny wood fern, oak fern, (bracken)
qʷláwaʔ (generic for nodding onion, also called 'real/ original onion')*	"onions"	*Allium* spp., plus some other liliaceous spp. (4a)	nodding and Hooker's onions, garden onions, mariposa lily ("sweet onions"), death camas ("poison onions")
súx̌ʷəm (generic for balsamroot)	"sunflower-like flowers"	various members of Asteraceae (1)	balsamroot, arnicas, brown-eyed Susan, sunflowers
approx. ***káw-kʷu*** (generic for big sagebrush)	"sagebrushes"	*Artemisia* spp., *Chrysothamnus* (4a)	big sagebrush, pasture wormwood, field wormwood, rabbit-brush
none*	"blueberries and huckleberries"	*Vaccinium* spp., excl. *V. oxycoccus* (4a)	red and black huckle-berries, Alaska, dwarf, bog and oval-leaved blueberries, commercial blueberries
piys-úpəzaʔ ('pea-shoots'; borr. fr. English "peas")*	"pea-vines"	climbing spp. of Fabaceae (4a)	wild peas, vetches, garden peas, sweet-peas

TABLE 2.—*Examples of broad mid-range plant groupings in Lillooet. (Where one member is dominant, it appears in boldface. Recently expanded categories with introduced members are indicated by an asterisk**.) (continued)

Associated native term[1]	English approximation	Botanical equivalent (recognition category no.)	Plants included
kəlq-âž (generic for large-flowered wild rose spp.)*	"roses"	*Rosa* spp. (4a)	Nootka wild rose, swamp wild rose, dwarf wild rose, garden roses
cícq-až (edible shoots)	"raspberry-like plants"	*Rubus* spp. (4a)	salmonberry, raspberry, (blackcap), thimbleberry
tx̌áłp-až (generic for several willow species)	"willows"	*Salix* spp., plus *Cornus* sp. (4b)	all true willow species; red-osier dogwood ("red willow")
məx-máx ('sharp'; sometimes generic for thistles - P)	"thorny or prickly plants"	none (4b)	thistles, gooseberries, devil's-club, rose, black hawthorn
q̓áp̓x̌ʷ 'nut' (orig. generic for hazelnut)*	"nuts"	none (4b)	hazelnut (orig.), plus imported nuts (e.g. walnuts, almonds, cashews, peanuts)
approx. ***sp̓áčən*** (generic for Indian-hemp)*	"twine plants"	*Apocynum* spp., plus unrelated types (4b)	Indian-hemp, spreading dogbane, stinging nettle, (sometimes milkweed), commercial fibres (e.g., hemp)
wəpəx-ílmaxʷ ('plant-growing-under-the-water')	"water-plants"	none (6)	wild forget-me-not, monkeyflower, water knotweed, and many others
káłwat (P); or **mlomn** (FR)	"medicines"	none (3)	Indian hellebore, baneberry, anemone, black twinberry, and many others
p̓əʕp̓iʕtálckzaʔ ('frog-leaves')	"round-leaved herbaceous plants"	none (2)	wild lily-of-the-valley, pyrola, broad-leaved plantain

[1]Orthography for native names is from Van Eijk (1985), as used in Turner *et al.* (1985). Abbreviations are as in Table 1; P - Pemberton Lillooet dialect; FR - Fraser River dialect.

TABLE 3.—*Examples of restricted, mostly two- or three-membered mid-range groupings in Thompson and Lillooet. (Where one member is more dominant, it appears in boldface. Recently defined categories, arising from introduction of new types, are indicated by an asterisk*. Recognition criteria category numbers, described in Table 4, are shown at the end of each listing.)*

Thompson:

''sword fern type'' (**sword fern,** deer fern) (1)
''bracken fern type'' (**bracken,** lady fern, spiny wood fern) (1)
''junipers'' (**Rocky Mountain juniper,** common juniper, sometimes yew) (4b)
''cedars'' (**western red cedar** (fullsize), yellow cedar, krummholtz red cedar) (1)
''true firs'' (**subalpine fir,** grand fir, amabilis fir—LT only) (4a)
''pines'' (whitebark pine, lodgepole pine, white pine, ponderosa pine) (1)
''avalanche lily type'' (**yellow avalanche lily,** white fawn lily, queenscup, bog orchid) (2)
''rice-roots'' (chocolate lily, missionbells, yellowbells) (4a)
''rhubarb''* (cow-parsnip, domesticated rhubarb) (4b)
''celery''* (''Indian celery,'' domesticated celery) (4b)
''carrots''* (''wild carrot,'' domesticated carrot) (4b)
''twine plants'' (**Indian-hemp,** spreading dogbane, milkweed) (4b)
''large-bitter-taprooted plants'' (**balsamroot,** chocolate-tips) (4b)
''Oregon-grapes'' (LT only) (**tall Oregon-grape,** common Oregon grape) (4a)
''alders'' (**red alder,** mountain alder) (4a)
''black twinberry type'' (**black twinberry,** mock orange) (4b)
''elderberries'' (**blue elderberry,** red elderberry) (4a)
''dogwood type'' (**flowering dogwood,** bunchberry; not red-osier dogwood) (1)
''soapberry type'' (**soapberry,** squaw currant) (2)
''heathers'' (red mountain heather, white mountain heather, crowberry) (6)
''shiny-leaved, broad-leaved evergreen shrubs'' (pink rhododendron, salal, snowbrush) (2)
''currants''* (**northern black currant,** trailing currant, stink currant, red-flowering currant, domesticated red and black currants) (4a)
''gooseberries''* (coastal and interior wild gooseberries, domesticated gooseberry) (4a)
''swamp parsnips'' (**water-hemlock,** water-parsnips, silverweed, bugleweed) (4b)
''spring beauty type'' (**spring beauty,** Siberian miner's-lettuce, ?broomrape) (6)
''bitterroot type'' (**bitterroot,** Columbia and dwarf bitterroots, miner's-lettuce, ?twayblade) (6)
''oceanspray type'' (**oceanspray,** buckbrush) (2)
''raspberries''* (wild raspberry, domesticated raspberry) (4a)

TABLE 3.—*Examples of restricted, mostly two- or three-membered mid-range groupings in Thompson and Lillooet. (Where one member is more dominant, it appears in boldface. Recently defined categories, arising from introduction of new types, are indicated by an asterisk*. Recognition criteria category numbers, described in Table 4, are shown at the end of each listing.)* (continued)

"thimbleberry type"* (**thimbleberry,** wineberry) (4a)

"blackberries"* (trailing wild blackberry, Himalayan and domesticated blackberries) (4a)

"mountain-ash"* (mountain-ash, rowan) (1)

"spiraeas" (hardhack, pyramid and flat-topped spiraeas) (1)

"alumroot type" (small-flowered alumroot, **cylindrical alumroot,** foamflower) (1)

"tobacco"* (wild tobacco, commercial tobacco) (4a)

"saprophytic plants" (**Indian-pipe,** pinesap, coral fungi) (6)

Lillooet:

"junipers"(**Rocky mountain juniper,** common juniper) (4a)

"cedars" (**red cedar,** yellow cedar) (1)

"pines" (whitebark pine, lodgepole pine, white pine, ponderosa pine; unidentified pinelike tree of high elevations - P) (1)

"true firs" (**subalpine fir,** grand fir, amabilis fir - P only) (4a)

"wild rice" (chocolate lily, (?)missionbells) (4a)

"bulrushes" (tule, cat-tail, (horsetails)) (7)

"sweet potatoes"* (yellow avalanche lily, silverweed, commercial sweet potatoes) (3)

"maples" (vine maple, Rocky Mountain maple, broadleaved maple) (1)

"rhubarb"* (cow-parsnip, domesticated rhubarb) (4b)

"celery"* ("Indian celery," domesticated celery) (4b)

"carrots"* ("wild carrot," domesticated carrot) (4b)

"parsnips"* (sweet cicely, water-parsnip, domesticated parsnip) (4a)

"alders" (**red alder,** mountain alder) (1)

"currants"* (**northern black currant,** trailing currant, stink currant, red-flowering currant, domesticated red and black currants) (4a)

"gooseberries"* (coastal and interior wild gooseberries, domesticated gooseberry) (4b)

"potatoes"* (spring beauty, tiger lily, domesticated potatoes) (4b)

"evergreen low shrubs" (false box, snowbrush) (4b)

"strawberries"* (wild strawberries - 2 spp., domesticated strawberry) (4a)

"raspberries"* (wild raspberry, domesticated raspberry) (4a)

"blackberries"* (trailing wild blackberry, Himalayan and domesticated blackberries) (4a) latter, few-membered grouping or complex. This type of grouping is also described for Sahaptin by Hunn and French (1984).

Altogether, 79 mid-range plant groupings are identified for Thompson and 38 for Lillooet. The considerably higher number of Thompson mid-range associations is partly a result of the existence of a more detailed ethnobotanical inventory for Thompson, especially due to the wealth of information recorded earlier by James Teit (cf. Turner 1987; Turner *et al.* 1988, in press), and the substantial input of Annie York. However, it may also reflect a greater real botanical diversity within Thompson territory which is reflected in turn in the complexity of the system devised to organize botanical information. The number of basic, or "generic" level folk taxa in Thompson and the general level of cultural significance of plants is also apparently higher in this language compared with Lillooet, or with other neighboring languages (Turner 1988a).

Except for the greater numbers and generally more detailed and defined groupings of Thompson, the mid-range groupings of Thompson and Lillooet are generally similar and often virtually identical. This is not surprising considering the close geographical, ecological, cultural and linguistic ties between these native groups. Except for specific examples, the two languages are considered together in the following description and discussion.

As with the case cited earlier for Nitinaht "berries" and "roots," names for many of the Thompson and Lillooet mid-range groupings are derived through expansion of reference of a name for a particularly salient folk "genus" and are polysemous with the "generic" name. In fact, Hunn (pers. comm. 1988) suggests that many such cases could as well be treated as generics with type-specific polysemy. Others are named through some modification of more general terminology, or by the use of an independently derived name for the grouping, pertaining to similarities in morphology, use, habitat, or usually to a combination of these characteristics. Some of those not actually named are implied by common application of specialized terminology. For example, in Thompson, there is a term for "clustered needles" which is applied only to pines, even though there is no all-inclusive term for the four pine species in the mid-range grouping, "pines." Pines are, however, recognized as a discrete and related group, at least by AY and some others.

One common kind of mid-range grouping is the "membership by association," or "sphere of influence" type (cf. also Hunn and French 1984; Bright and Bright 1965). Here, a primary type of plant, usually of high cultural significance and having a "generic" name, is a focal taxon ("type") for a group of species in some way identified with it, usually either by appearance or function, or both. AY calls this primary plant the "boss" or "chief" of the group. This is the usual situation when the name for the mid-range grouping is polysemous with a "generic" level name. Hence, ***qʷláwaʔ*** in Lillooet and ***qʷléwe(ʔ)*** in Thompson is both the "generic" level name for nodding onion (often called ***qʷlawa[ʔ]-ʔúl*** 'real/original onion'[7] in Lillooet) and a general name for various types of onions, both native and domesticated. In Lillooet, even death camas, which is toxic, and mariposa lily, which has no onion odour, are included, at least at the present time. In Thompson, a small unidentified sedge was included in this taxon. At present, native people less familiar with traditional plants are inclined to use the term only for domesticated onions.

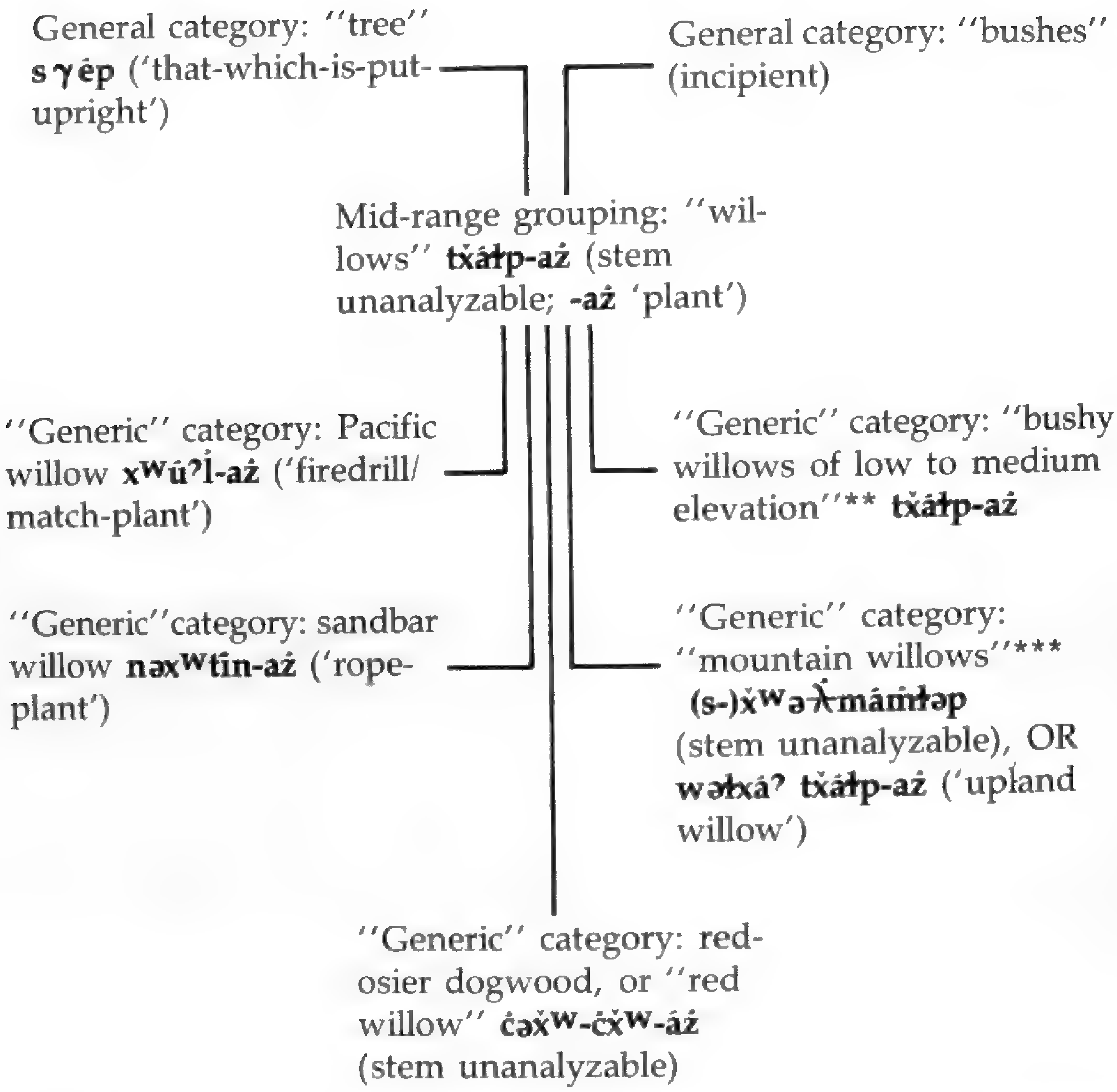
Other examples of ''type'' taxa around which mid-range associations are formed (occurring in more-or-less parallel fashion in both Lillooet and Thompson) include: big sagebrush, as the ''type'' for the ''sagebrush'' class; black huckleberry as the ''boss'' of the ''blueberries and huckleberries,'' (as well as of the entire ''life-form'' level taxon ''berries/fruits;'' Turner 1987); balsamroot as the ''boss'' of a group of ''balsamroot-like flowers;'' Indian hemp as the ''type'' of a small group of stem-fibre ''twine'' plants; hazelnut as the ''type'' for ''nuts;'' and false Solomon's-seal as the ''type'' for a group of similar looking liliaceous plants in related genera *(Smilacina, Streptopus, Disporum).*

The secondary members within such taxa, if they are named at all, are often called after the primary member, frequently, in Thompson, simply by the addition of the term, ***s/núk̓ʷeʔ-s e . . .*** (lit. 'friend/relative/cousin of . . .') to the name of the ''type'' plant. If it is a smaller plant, the term . . . ***e scméẏts*** ('child of . . .') might be used. For example, kinnikinnick is called ***ʔik-éɬp*** in Thompson. The other plants in the class of ''kinnikinnick and relatives'' (i.e., prince's-pine, false box, pyrolas, and twinflower) are often called ***s/núk̓ʷeʔ-s e ʔik-éɬp*** ('friend/relative of kinnikinnick'). In this case, all of these ''satellite'' species also have one or more alternative ''generic'' level names. In other such categories they often do not.[8] As Hunn (pers. comm. 1988) points out, these sociological metaphors are very frequently noted in many diverse ethnobiologies.

Another commonly applied term of association in Thompson is the suffix ***-úpeʔ***, meaning 'tail end,' 'bottom,' or 'root.' Not only can it refer to the root of any plant, but also, in some contexts it seems to imply 'grows together with' or 'related to.' Burdock, for example, is called 'cow-parsnip root/tail end,' and queenscup is called 'yellow avalanche lily root/tail end.'

Berlin (1972) notes that association categories such as those described here are common at all taxonomic levels in folk taxonomies. Association of non-culturally significant plants with similar culturally important plants is a common method of horizontal expansion of taxonomic hierarchies. Mid-range groupings may be quite ephemeral, and may evolve rapidly to accommodate changes in relative importance of various plants. Their versatility is demonstrated by the rapidity with which introduced weeds and domesticated plants have been incorporated into native taxonomic schemes. In some cases, such as with ''potatoes,'' ''onions,'' and ''parsnips,'' the taxa have apparently merely expanded from existing traditional mid-range groupings incorporating a number of native members of varying cultural importance. Others have actually arisen where there was no pre-existing class (see Table 3 for examples).

Many mid-range groupings reflect close botanical relationships, often at the genus level, of included members. Berlin (1976) notes that at least a relationship at the family level is characteristic of most of the intermediate plant taxa delineated in Aguarana folk botany. In Thompson and Lillooet, however, there are some notable exceptions. For example, in both languages the ''willows'' category includes a variety of *Salix* species, several having ''generic'' level names, but it also includes silverberry and/or red-osier dogwood (widely known as ''red willow'' among native people)[9] (see Fig. 1). Similarly, in Thompson, large-leaved



*The Thompson ''willows'' category is similar, but, at least according to AY, red-osier dogwood, or ''red willow'' is recognized as not actually being a kind of willow. However, silverberry, or ''silver willow,'' in Elaeagnaceae, is considered to be a type of willow. This species is not common in Lillooet territory. There is an additional midlevel category between ''trees'' and Pacific willow in Thompson: **məɬpéke' u'ex tək sγép** ('it's stripped off tree') ''deciduous trees.''

**Including Scouler's willow, Sitka willow, Hooker's willow, and many other *Salix* spp. of lower elevations.

***Including *Salix glauca, S. barclayi, S. scouleriana* (when growing at upper elevations).

FIG. 1.—Schematic diagram of mid-range folk grouping, ''willows,'' in Lillooet.*

avens is usually grouped with ''buttercup-like flowers'' and AY, at least, considers cascara with the ''cherries'' and trailing raspberry with ''strawberries.''

The suggested criteria for recognizing and distinguishing the various mid-range groupings[10] are summarized in Table 4. These are seldom simple. As the table shows, the majority of the mid-range classes listed (63% in Thompson; 76% in Lillooet) appear to be defined on the basis of a combination of common characters. These include those under ''Criteria for recognition'' numbers 4a, 4b, 6, and 7 in the table. The largest groups, in fact, reflect common utilization combined with morphological similarity, either superficial or botanically based (i.e., Criteria numbers 4a and 4b). Only a few of the groupings reflect a single-purpose, single-track classification based on one type of feature (e.g., having edible nuts, or deciduous leaves; cf. Criteria numbers 1, 2, 3, and 5). Even in instances, such as "poisonous plants" in Thompson (Criteria number 3), where this situation is largely true, a closer examination reveals at least a partial association of members on the basis of two or more traits in common. AY stressed that in the "poisonous

TABLE 4.—*Criteria for recognition of mid-range plant groupings in Lillooet and Thompson. (For detailed inventory of groupings, see Tables 1, 2 and 3.)*

Criteria for recognition	Number of Taxa Thompson (Total: 79)	Number of Taxa Lillooet (Total: 38)	Examples (from Tables 1, 2 and 3)
1. morphological similarity (reflecting close botanical relationships)	14	6	Li and Th: "pines"; Li: "maples"; Th: "balsamroot relatives"
2. morphological similarity (perceived but not necessarily reflecting botanical relationships)	11	1	Li: "evergreen low shrubs"; Th: "highbush cranberry relatives"
3. similar "use or function" only	4	2	Li: "medicines"; Th: "poisonous plants"
4. combination of common morphological and "use" traits:	37	27	
a. where morphological similarity reflects botanical relationship	19	17	Li and Th: "inedible mushrooms," "onions"; Th: "true firs"
b. where morphological similarity does not reflect botanical relationship	18	10	Li: "potatoes," "thorny . . . plants"; Th: "green vegetables," "hummingbird flowers"
5. common habitat type only	0	0	
6. combination of common habitat and morphological similarity	10	1	Li: "water-plants", Th: "spring beauty relatives"; "saprophytic plants"
7. combination of common habitat, use and morphological traits	3	1	Li: "bulrushes"; Th: "tree fungi," "willows" (mostly)

plants'' association, three of the included numbers in particular—Indian-hellebore, mountain bells, and rein orchid—were closely related. As well as being toxic, they are, in fact, morphologically similar, being herbaceous monocotyledons with an upright habit, small greenish flowers in a terminal cluster and parallel-veined leaves. (The morphological traits were not specified by AY, who noted only that they are ''relatives.'') Similarly, the ''childbirth medicines,'' rattlesnake plantain, prince's-pine and pyrolas, although defined on the basis of ''use'' and hence included in Criteria number 3, do share similar morphological features and habitat, although again, this similarly is not necessarily specified by native speakers as a reason for the plants being related.

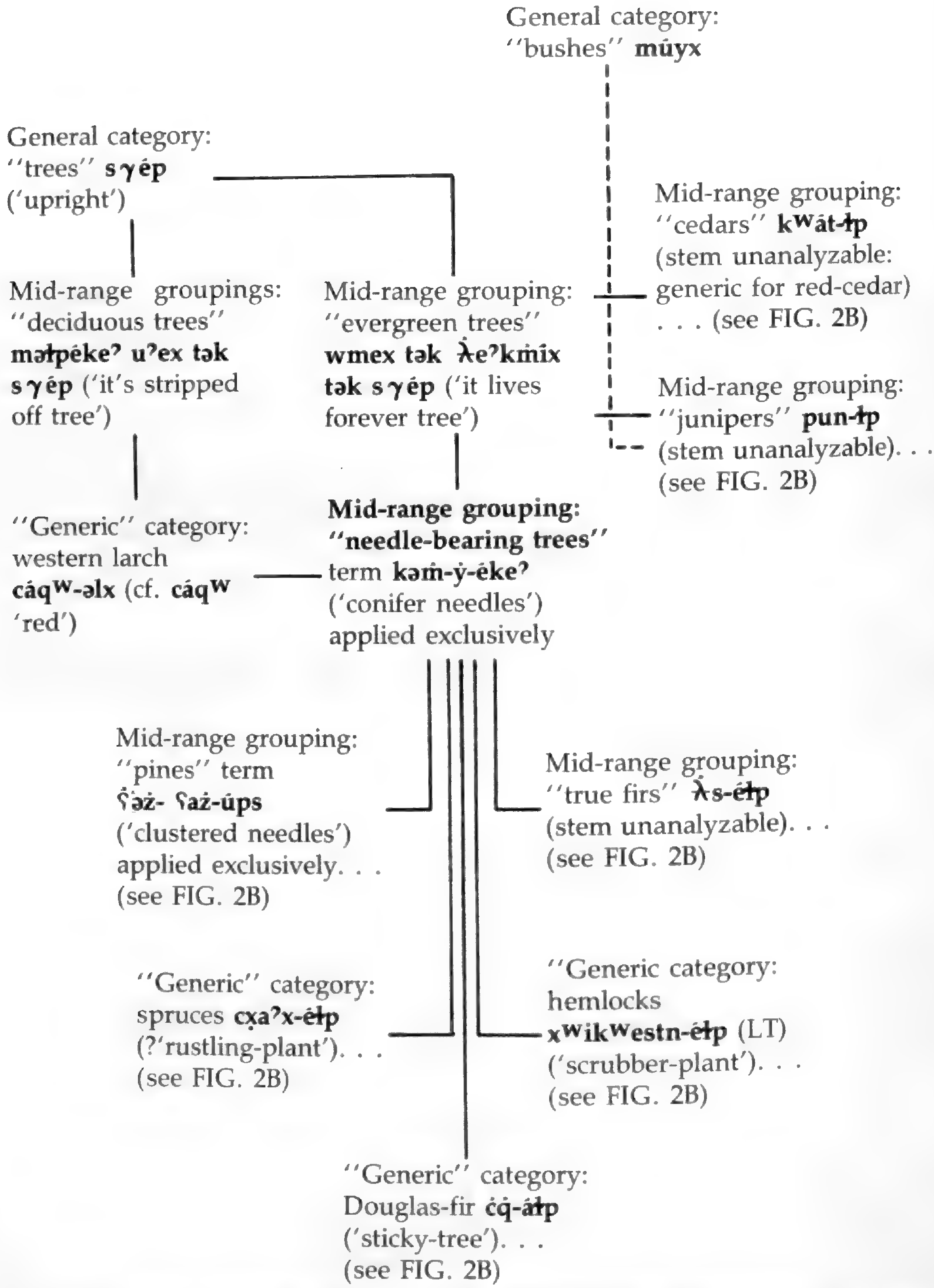
Some mid-range groupings are definite subsets of more general categories. For example, the Lillooet and Thompson classes of ''inedible mushrooms'' are in each case readily perceivable subcategories of the general class ''mushrooms,'' and the mid-range category name actually incorporates the more general name.[11] Similarly, the Lillooet classes, ''junipers,'' ''cedars'' and ''pines,'' and the Thompson classes, ''evergreen trees,'' ''junipers,'' ''cedars'' and ''needle-bearing trees'' (the latter incorporating ''true firs'' and ''pines''), are seen by native speakers as subclasses of the general folk taxon ''tree'' in each language. In fact, except for the common juniper, which has a shrubby habit, the members of these mid-range groupings are considered in both languages to be the ''core,'' or ideal representative taxa for the major ''tree'' class which includes them (Turner 1987, 1988b). Figures 2 and 3 show the relationship of the various mid-range groupings within the general classes of ''mushrooms'' and ''trees.'' The ''trees'' classification also shows an example of ''tiering,'' or hierarchical inclusion of one mid-range grouping within another.

As another example, in each language there are several mid-range groupings (e.g., ''onions,'' ''sweet potatoes,'' and ''parsnips'' in Lillooet, and ''potatoes,'' ''onions,'' and ''swamp parsnips'' in Thompson) which are subclasses of an incipient major plant class of ''edible roots'' (cf. Turner 1987). Although the ''edible root'' class is unnamed by most Thompson speakers, AY used a term ***sƚaʔx̣âns tək k̓ʷmiʔxʷêp*** ('root food') for it, and said that this was a subclass of another class of food, ***sƚaʔx̣âns tək stuytúym̓xʷ*** ('food ground-growth'), which is in turn apparently a subclass of a broadly inclusive taxon, 'ground-growth' (described in Turner 1987). Perhaps this situation is reflective of an earlier, original taxonomic system in Thompson, before the 'ground-growth' taxon evolved to its present, generally held perception as ''weeds,'' or ''low herbaceous, broad-leaed plants of low cultural importance.'' From AY's perspective, ''medicines,'' too, should be considered within the major 'ground-growth' class; her definition is much broader than that usually given by most present day Thompson speakers, who equate ***stuytúym̓xʷ*** ('ground-growth') with ''weeds.'' AY once said, in a discussion of false Solomon's-seal, '' . . . ***kạƚ̓wet*** . . . is counted as medicine, so it's ***stuytúym̓xʷ***.'' This original, broad 'ground-growth' class did not seem to include the ''berries/fruits'' category. Even ''strawberries,'' which are herbaceous, were not considered to be in this class, according to AY: '' . . . strawberries don't come under ***stuytúym̓xʷ*** . . . A strawberry is ***sq̓ʷîyt*** ['fruit']. That's why . . . ***sq̓ʷiyt*** is the first key word, and then ***sq̓ʷuq̓ʷy̓êp*** ['strawberry'].'' Hunn (pers. comm. 1988) points out that this statement implies a rank ordering of distinctions, with 'fruit,' a largely utilitarian category, taking precedence [see also Hunn (1982) for further discussion].

Examples of other mid-range groups included within broader, more extensive groupings include (in Thompson; boldface denotes major plant class - see Turner 1987): "hummingbird flowers" and "buttercup-like flowers . . ." in **"flowers"**; "thallose lichens," "tree mosses . . ." and "ground mosses . . ." in **"mosses"**; "deciduous trees" (including "catkin-bearing trees") in **"trees"**; "ground-creepers," "peavines," "water-plants" (2 taxa) and (sometimes) "swamp grasses" in **"low, herbaceous, broad-leaved plants . . ."**; "highbush-cranberry and relatives," "Labrador-tea and relatives," and "bush-size huckleberry relatives" in **"bushes."** In Lillooet, relationships are more obscure, but similar examples occur.

Other mid-range groupings, both expanded and restricted, in both languages do not necessarily fall within broader categories (i.e., at the "life-form" level). Some are excluded from general taxa (as described in Turner 1987) altogether, some traverse the boundaries between two or more such general taxa, and some are identified with one to another general taxon depending on their life cycle stage or the cultural context in which they are viewed. It is debatable, for example, whether the Thompson mid-range grouping "green vegetables" is actually included within any more general taxon except at the highest level, the unique beginner. In fact, cow-parsnip and fireweed, two of the most important members of this grouping, are specifically excluded by most native speakers from any general taxon, even though the class name, 'ground-growth food,' implies inclusion in the "low, herbaceous, broad-leaved plants . . ." category (lit. 'ground-growth'; cf. Turner 1987). Fireweed, and even cow-parsnip, could also conceivably be considered as "flowers," since they have relatively conspicuous blooms, but in fact at the stage when they have the highest cultural salience, their edible stage, they are not blooming.[12] To carry this idea further, other members of this "green vegetable" taxon, salmonberry and thimbleberry, are, at their fruiting stages, core members of the "berries/fruits" "life-form" level taxon. However, at the "edible shoot" stage, in early to mid spring, they are perceptually more closely aligned with cow-parsnip and fireweed.[13] As seen in Table 3, none of the "life-form"/"suprageneric" groupings is purely morphological (Criteria numbers 1 and 2, per Table 4) or purely utilitarian (Criteria number 3) but almost all reflect some compromise between the two types of criteria.

Several other of the groupings in Tables 1, 2 and 3 show a similar overlapping of category boundaries, with some included members being referable to one major taxon, some to another, and some excluded altogether. This duality of classification is reflected in comments of native speakers themselves. For example, in commenting on yarrow, MJ said, "That's good for anything." It's a **flower.** It's a **medicine** too." Perhaps this statement alone is indicative that the "medicine" class, which is here included (Table 1) as a broad "mid-range" category on the basis of AY's previously cited inclusion of medicines within the general 'ground-growth' category, should actually be considered at the same taxonomic level as "flowers," which I previously treated as a general category, comparable in scope to "tree" and "grass" (Turner 1987). Schematically, this complex relationship can be shown as follows:



*LT - Lower Thompson; unless otherwise specified, native terms are known in all dialects of Thompson. Due to restrictions of space and page format, the various groupings are spread over two figures: A and B. Position on the page is not necessarily representative of relative position in a hierarchy, although A includes the more general groupings, B the more restricted groupings.

FIG. 2A, 2B.—Schematic diagram of folk categories for "coniferous trees", a mid-range complex, in Thompson.*

Mid-range grouping: "pines" term
ʕəẑ- ʕaẑ-úps
('clustered needles')
applied exclusively

"Generic" category: lodgepole pine
qʷˀit(-éɬp)(stem unanalyzable)

"Generic" category: whitebark pine
s/ck̓-éˀiɬp (UT)
(pinenut-plant)

"Generic" category: ponderosa pine
s/ʔétqʷ-ɬp (stem unanalyzable)

"Generic" category: white pine
zíxʷe, zixʷeh-éɬp
(stem unanalyzable)

"Generic" category: spruces
cx̣aˀx-éɬp
(?'rustling-plant')

"Specific" category: Sitka spruce
cx̣aˀx-éɬp-ˀuy (LT)
('original-spruce')

"Specific" category: Engelmann spruce
xˀ-úym̓xʷ peɬ cx̣aˀx-éɬp (LT)
('upland spruce')

"Specific" category: "silver spruce"
ˀest/piq-áyqʷ tək cx̣aˀx-éɬp
('silver spruce')

Mid-range grouping: "true firs"
ƛ̓s-éɬp (stem unanalyzable)

"Generic" category: grand fir
ƛ̓əx-ƛ̓x-éke? ('sweet branch')(and other names)

"Generic" category: subalpine fir (and amabilis fir - LT)
ƛ̓s-éɬp

"Generic" category: hemlocks
xʷikʷestn-éɬp (LT)
('scrubber-plant')

"Specific" category: western hemlock
xʷikʷestn-éɬp (LT)

"Specific" category: mountain hemlock
xˀ-úym̓xʷ peɬ xʷikʷestn-éɬp (LT)
('upland hemlock')

"Generic" category: Douglas-fir **ĉq̓-áɬp**
('sticky-tree')

"Specific" category: coastal Douglas-fir (LT) **ĉq̓-áɬp**

"Specific" category: ordinary interior Douglas-fir
ĉq̓-áɬp

"Specific" category: sugar-bearing interior Douglas-fir
s-qə-qeˀm-éɬp
('breast-tree')

Mid-range grouping: "junipers"
pún-ɬp (stem unanalyzable)

"Generic" category: Rocky Mt. juniper
pún-ɬp

"Generic" category: common juniper
ĉiĉx̣-ĉax̣-t (stem unanalyzable)

"Generic" category: western yew
ƚéˀxʷ-elp (LT), OR **ck-íñek**
(?'hew-weapon')

Mid-range grouping: "cedars" **kʷát-ɬp**
(stem unanalyzable; generic for red-cedar)

"Generic" category: yellow-cedar (called **kʷát-ɬp**; "real" name not recalled)(LT)

"Generic" category: western red-cedar
kʷát-ɬp (or variants)

"Specific" category: ordinary red-cedar
kʷát-ɬp

"Specific" category: krumholtz form of red-cedar (no special name)

General category:
"mushrooms and fungi"
q̇ám̓es ('pine mushroom')
(LT. UT); OR **məƛ̓qîʔ**
('cottonwood mushroom')
(NV)

Mid-range grouping:
"edible mushrooms"
(basidiomycetes)
q̇ám̓es ('pine mushroom')
(LT. UT); OR **məƛ̓qîʔ**
('cottonwood mushroom')
(NV). . . (see FIG. 3B)

Mid-range grouping:
"puffballs" **s/neyîʔ pe̓ɬ c̓q̓ʷústn** ('ghost's face-powder'); OR **s/neyiʔ peɬ q̇ám̓es** ('ghost's (pine-) mushroom'). . . (see FIG. 3B)

Mid-range grouping:
"poisonous mushrooms"
kə̣s-t tə(k) q̇ám̓es
('bad (pine mushroom') . . .
(see FIG. 3B)

Mid-range grouping:
"tree fungi"
s/kel-uleʔ-éyqʷ
('great-horned-owl-(of)-tree/wood'). . .
(see FIG. 3B)

General category:
"low herbaceous plants"
stuyt-úym̓xʷ
('ground-growth')

Mid-range grouping:
"saprophytic plants"
(no special name)

"Generic" category:
coral fungi
(no special name)

"Generic" category:
Indian-pine
s/q̇awm peɬ tkə́y̓ (LT)
('wolf's urine')

(unclassified substance)

"Generic" category:
witch's butter
?s/ƛ̓əq̓ʷp-éyqʷ-tn
('product-of-tree-coming-to-be-split open')

*LT - Lower Thompson; UT - Upper Thompson; NV - Nicola Valley Thompson; unless otherwise specified, native terms are known in all dialects of Thompson. See also format note, FIG. 2.

FIG. 3A, 3B.—Schematic diagram of folk categories for mushrooms and fungi in Thompson, showing the relationship of mid-range groupings to more general and more restricted classes.*

Mid-range grouping: "edible mushrooms" (basidiomycetes) **q̓ám̓es** ('pine mushroom')(LT. UT); OR **məƛ̓qí?** ('cottonwood mushroom') (NV)

"Generic" category: pine mushroom **q̓ám̓es** (stem unanalyzable)

"Generic" category: "cottonwood" mushroom **məƛ̓qí?** (unanalyzable)

"Generic" category: "slimy-top" mushroom **łətx-e?** ('slimy-thing')

"Generic" category: chanterelle **qʷaqʷíxʷe?** ('little-fish-gills')

"Generic" category: ?St. George's mushroom **n/ki?ki?x̣-qín** ('thunder-(storm)-head')

"Generic" category: commercial field mushroom **q̓ám̓es pəł séme?**, OR **məƛ̓qí? pəł séme?** ('whiteman's mushroom')

"Generic" category: shaggy mane (no special name; or sometimes same as ?St. George's mushroom

"Generic" category: oyster mushroom **q̓ám̓es-éyqʷ** ('tree/wood-(pine-) mushroom')

"Generic" category: residual unnamed edibles** **q̓ám̓es** ('pine mushroom') (LT. UT); OR **məƛ̓qí?** ('cottonwood mushroom')(NV)

Mid-range grouping: "poisonous mushrooms" **k̓əs-t tə(k) q̓ám̓es** ('bad (pine) mushroom')

"Generic" category: *Lactarius ?resimus* **n/k̓əpxʷ-qín** ('hole-in-the-top')

"Generic" category: russula (unidentified) **n/cəq-qín** (?'red-top')

"Generic" category: residual unnamed inedibles** **k̓ə̣s-t tə(k) q̓ám̓es** ('bad (pine) mushroom')

Mid-range grouping: "tree fungi" **s/kel-ule?-éyqʷ** ('great-horned-owl-(of)-tree/wood')

"Generic" category: unidentified willow fungus **kel-ule?-éyqʷ e s/tx̣-áłp** ('willow's owl-wood')

"Generic" category: Indian paint fungus **kel-ule?-éyqʷ e xʷikʷestn-éłp** (LT) ('hemlock's owl-wood')

"Generic" category: oyster mushroom **q̓ám̓es-éyqʷ** ('tree/wood-(pine-) mushroom')

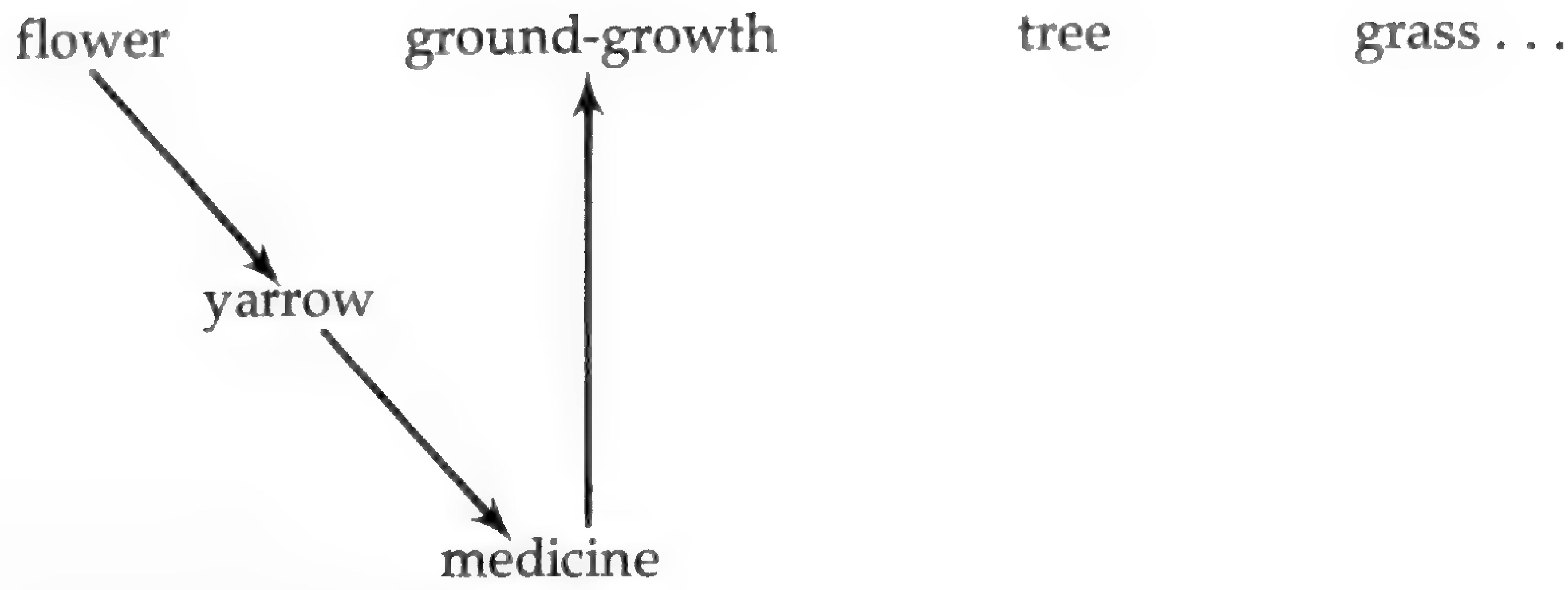
"Generic" category: residual class of tree bracket fungi** **s/kel-ule?-éyqʷ** ('great-horned-owl-(of)-tree/wood')

Mid-range grouping: "puffballs" **s/neyí? pəł c̓qʷústn** ('ghost's face-powder'); OR **s/neyí? pəł q̓ám̓es** ('ghost's (pine-) mushroom')

"Generic" category: giant puffball (no special name)

"Generic" category: various smaller puffballs **s/neyí? pəł c̓qʷústn** ('ghost's face-powder'); OR **s/neyí? pəł q̓ám̓es** ('ghost's (pine-) mushroom')

**Residual unnamed inedibles include inky caps; residual unnamed edibles include Lake's bolete; residual tree bracket fungi include many different types of tree bracket fungi, mostly Polyporaceae, including sulfur fungus, *Polyporus* spp., *Ganoderma* spp., and *Laricifomes* spp.



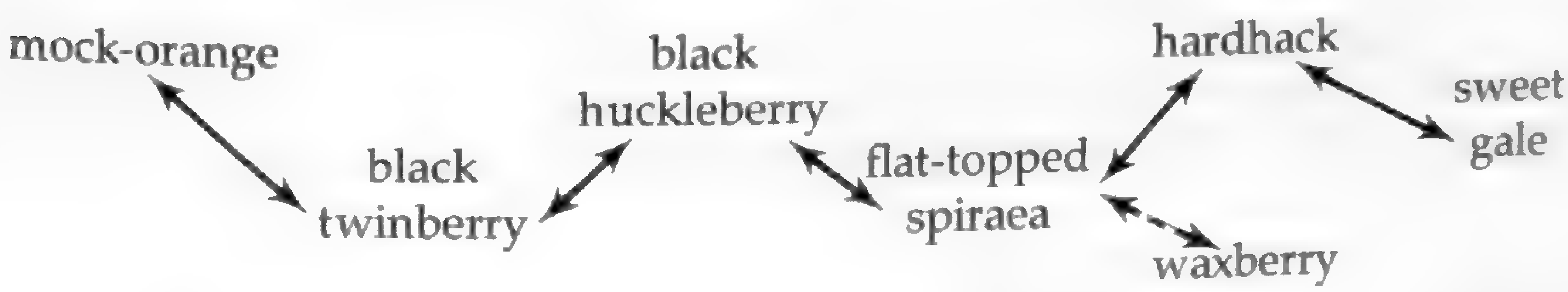
''Willows'' in both languages contain one member, Pacific willow, which is classed as a ''tree,'' whereas most other members are considered ''bushes'' (Fig. 1). Similarly, the Thompson classes ''junipers'' and ''dogwood type,'' both bi-typic, each contain a ''tree'' member, Rocky Mountain juniper and flowering dogwood respectively. The other members, however, are referable to different ''life-form'' level taxa: ''bush'' in the case of common juniper, and 'ground-growth' for bunchberry. AY commented about the dogwoods: ''Yes, the little one's ***stuyt-úym̓x***^{w} ['ground-growth'], [But not] the big one. No, that's ***sγép*** ['tree'], . . . because it's got a big tree.''[14]

Among the mid-range groupings themselves are several examples of dual membership of individual types of plants, not just inclusion in two hierarchically related mid-range groupings but joint membership in two otherwise mutually exclusive taxa. Western larch in Thompson (this tree does not grow in Lillooet territory) is at once classed as a ''needle-bearing tree'' and a ''deciduous tree,'' just as it is in English folk taxonomy. It is known as an anomaly; AY once commented, ''The one [needled tree] that's by itself is [larch] . . . it has no relations . . . because she sheds her pins. No other trees [i.e., ''(typical coniferous) tree''] does that.'' Similarly, in both languages, oyster mushroom, a gilled species which commonly grows in tiers on cottonwood trunks, is considered both an ''edible mushroom'' and a ''tree fungus.'' In Thompson, water-hemlock is classed both as a ''swamp parsnip'' (and is in fact the ''boss'' of this class) and a ''poisonous plant.'' Orange honeysuckle is both a ''ground-creeper'' and a ''hummingbird flower,'' and burdock, an introduced species, is classed both as a ''cow-parsnip relative'' and a ''burr-fruited plant.'' Balsamroot is the ''boss'' of a group of look-alike flowers, ''balsamroot and relatives,'' but is also classed together with chocolate-tips on the basis of the morphological similarity of their edible taproots and the similar harvesting and cooking techniques used for them.

Although these relationships are often represented by synonymous names for such species as orange honeysuckle and burdock, one cannot always discern the nature of a perceived taxonomic relationship from a name. Just as few people would consider ''skunk-cabbage'' in English folk taxonomy to be ''a kind of'' cabbage, so Thompson people would not consider bracken and other lacy ferns, which are sometimes called ''red-cedar-boughs'' to be ''a kind of'' red-cedar. The affiliation between ''skunk-cabbage'' and ''cabbage,'' and between ''lacy ferns'' and ''red-cedar'' is real, but is not one of inclusion. Rather, a semantic relationship of ''like cabbage,'' ''like a skunk,'' or ''like red-cedar'' is implied. One must use a combination of questions to native speakers such as, "Is X a kind of Y?" to determine whether a hierarchical relationship or some other type association is implied by the nomenclature. Linguistic analysis is nevertheless a useful tool because it may identify the existence of a relationship, without necessarily specifying its character.

Plants within a given association or complex are not always considered to be related to the same degree. Red huckleberry is included in the Thompson class of "bush-size huckleberry relatives," but is not considered by AY to be as closely related as the other members: "Those [red huckleberries] are related to [oval-leaved and Alaska blueberries] . . . but just the same, it's really a lonely bush, that. You can't class it with [high-bush cranberry] either, because [that's] a different thing. It's more of a big bush. So red huckleberry is by itself." Within the class of "pines," lodgepole pine is said to be more closely related to ponderosa than it is to white pine, and white pine more closely related to ponderosa than to lodgepole pine. Whitebark pine is perceptually separated slightly from the other three.[15]

There are also plants which are regarded as "links" between two different taxa, neither of which is seen to be related to the other. Hence, B is related to A, and also to C, but A and C are unrelated, except through B. There are several examples of these "linking plants," most provided by AY. Commenting on black twinberry, AY said, "She's related to the [black huckleberry] and she's also related to the [mock-orange]. It [mock-orange] doesn't have any berries, but the stick looks alike and it's used the same way . . . [as medicine for bleeding hemorrhoids]." Flat-topped spiraea is also perceived to be related to black huckleberry and is called "little huckleberry plant" in both languages. However, AY also believes it to be a relative of hardhack, which she calls "monkeybush." Hardhack, she maintains, is related to sweet gale. Neither is seen to be related to huckleberry, and sweet gale is not related to flat-topped spiraea. (Flat-topped spiraea is also seen to be "similar to" but "not really related to" waxberry, which is a bush that "stands by itself.")[16] Schematically, this complex can be shown as follows:



A similar case exists for common twistedstalk, which "stands between" (AY's words) false Solomon's-seal and Indian-hellebore. It can be called with ***kə̣l̓wet*** ("generic" for false Solomon's-seal and its relatives), or ***s/núk̓ʷeʔ-s e kə̣l̓wet*** ('friend/relative of false Solomon's-seal'). or ***s/núk̓ʷeʔ-s e qʷn-éɬp*** ('friend/relative of Indian-hellebore'). If the last name is used, Indian-hellebore can be referred to as ***xʔ-úym̓xʷ peɬ qʷn-éɬp*** ('upland ***qʷn-éɬp***'), and twistedstalk can be placed in binary opposition to it as ***zecín peɬ qʷn-éɬp*** ('lowland ***qʷn-éɬp***'). Similarly, Indian-plum is said to "stand between" saskatoon and "cherries," and bog blueberry between kinnikinnick and other "low-growing blueberry relatives" (AY).

DISCUSSION

The various criteria perceived in this study for delineating mid-range folk groupings are similar to those demarcating the general taxa of Thompson and Lillooet I reported earlier (Turner 1987). In both cases, they represent a basic discrepancy of views on the nature of folk taxa amongst various researchers. Berlin and his colleagues strongly believe that " . . . there universally exist in all phytotaxonomic systems a basic, fundamental hierarchic organization of taxa based on overall habit of growth or gross morphology" (pers. comm., letter from B. Berlin, September 1973). They would not consider some of the various "life-form" level and mid-range groupings described in Turner (1987) and in the present report, nor some of those described in Turner (1974) for Haida, Bella Coola and Lillooet, as true taxonomic categories. Any taxa based on utilitarian, rather than strictly morphological, criteria they would refer to as "quasi-taxonomic" categories that should be treated separately and not as part of the basic taxonomy. Hence, they would not recognize the "life-form" level categories, "berry/fruit," or "edible roots and underground parts" as being equivalent to "tree," "bush," "grass," and other categories based on gross morphological characters. Nor would they acknowledge as true taxa such mid-range categories in Thompson as "inedible mushrooms," "potatoes," "onions," "green vegetables," "poisonous plants," "hummingbird flowers," "rash-causing plants," "medicinal plants," "nuts," "burr-fruited plants," "spiny (low) plants," and "thorny (large) bushes or trees," because all of these are defined, at first sight, by single features.

Such classes could indeed be perceived as "special purpose" categories, as opposed to "general purpose" categories directly underlaid by discontinuities in nature (cf. Hunn 1977; Brown 1984). However, on close examination, most of these categories do have gross morphological similarities that are inextricably intertwined with their utilitarian or other special purpose attributes. For example, in the case of "spiny (low) plants" in Thompson and "thorny or prickly plants" in Lillooet, as with similar categories in Nitinaht, Bella Coola and Haida, shared morphological features (bushy, medium height, often woody and armed with spines or prickles) are superimposed with cultural significance in a way that might not be immediately obvious. Almost all of the members in these cultures are associated with protection from evil spirits, sickness, death, ghosts and malevolent people (cf. Turner 1974, 1982; Turner *et al.* 1983).

From my observations, these non-conforming classes are perceived by native people in the same way, at the same time, and in conjunction with "real" intermediate taxa (*sensu* Berlin; i.e. those based on the perception of overall morphological similarities among a set of folk generic taxa). To regard them as "not belonging" to a "real" folk taxonomic system would result, in my opinion, in an artifact of the researcher's creation (cf. Hunn 1982). If we are trying to understand the complex organizational strategies used by peoples belonging to a particular cultural group, we should be considering *all* the puzzle pieces, not just those that fit into a structure we can readily identify with.

As pointed out earlier (Turner 1987), the closely ingrained nature of "special purpose" and "general purpose" categories is illustrated in Haida by the term ***xil***, meaning simultaneously 'leaf' and 'medicine.' Incorporated into many plant names in Haida, it is also a "life-form" level term for leafy, herbaceous plants. A similar, though somewhat more obscure, situation can be seen for a mid-range grouping in Thompson and Lillooet. The Thompson term, ***kə̣l̓wet,*** is both a basic, "generic" level name for false Solomon's-seal and a mid-range name for a class of "false Solomon's-seal and relatives." AY and other Thompson speakers know the plant as "having a root . . . but counted as medicine . . . ***stuyt-úym̓xʷ*** ('ground-growth')." The Thompson term ***mlâ-mn*** and Fraser River Lillooet ***mlomn*** both mean 'medicine.'[17] However, in the Pemberton Lillooet dialect, the general name for medicine is ***kâl̓wat,*** a cognate form of the Thompson name for false Solomon's-seal. Incidentally, the Lillooet name for this plant is completely different from and unrelated to the term for 'medicine.' The plant was used as a good luck charm, especially in fishing, but was apparently not as important medicinally as it was in the Thompson area. The ***kə̣l̓wet - kâl̓wat*** semantic shift is significant because it is another illustration of a close cognitive relationship between a plant used for medicine, on the one hand, and a general class of medicinal plants on the other. Where does one draw the line between the taxonomic and utilitarian features of this plant, given the apparent evolution of the Pemberton Lillooet term for "medicine" from the folk taxon name?

Even with the "general purpose" mid-range groupings, as has been shown, there are examples of overlapping and dual membership in more general classes depending on cultural context, growth stage, or botanical features. This is contrary to the mutually exclusive, hierarchically arranged folk taxa of Berlin and his colleagues. Hunn (1976) argued that strict taxonomic inclusion would be expected to be the exception rather than the rule in a classification based on diverse criteria. The data presented here conform to his theoretical expectation in this regard.

Many of the mid-range groupings of the Thompson and Lillooet identified here, like a number of the general plant categories I described previously (Turner 1987), contain perceptually distinct members which are nevertheless unnamed at a more basic level. Sometimes, the entire membership of a mid-range taxon is unnamed (e.g. "ground mosses and lichens" in Thompson), or only one or two prominent members are named at a more basic, restricted level (e.g. "tree mosses and lichens" in Thompson, where black tree lichen and tree hair are named, but the others are not)[18]. "Inedible mushrooms," "swamp grasses," and "water plants" are similar types of classes, where only one or two species are named even though many kinds are distinguished. In virtually all of these cases there is a positive correspondence between cultural significance of a plant and naming at a basic, "generic" level.[19]

The features of mid-range plant groupings described for Thompson and Lillooet are similar to those of other native groups of northwestern North America. Mid-range groupings of Nuxalk (Bella Coola), Haida, and Nitinaht (Ditidaht) and Hesquiat (both Nuu-chah-nulth, or Nootkan), for example, seem to exhibit the same type of mixing of "single purpose" and "general purpose" categories, overlapping and cross-referencing of classes, and non-naming of group members that are not culturally significant.

In terms of historical development, Thompson and Lillooet mid-range groupings may well, in most cases, be among the last types to develop in a language, as suggested by Berlin (1972; Berlin *et al.,* 1973). However, some may be more fundamental and older than the "generic" level categories they encompass at present. This would be particularly true for the classes that do not contain named members even when many "kinds" are recognized by native speakers. Another class that seems both widespread and basic and may well have developed early in the evolution of folk plant taxonomies is the "spiny and prickly plants" category. Even my young daughter, who at 18 months was barely talking at all, developed her own class of "spiny and prickly plants," which she called "ow," an obviously functional name relating to pain-avoidance. In her universe, "ow" included thistles, blackberries, roses and cactus, each of which she recognized as different; thistles have seed fluff to blow, blackberries have fruit to eat, and roses have flowers to smell. She recognized "ow" members both growing and illustrated in books. As an interesting parallel, in recent ethnobotanical work on Chilcotin, I was told, quite spontaneously, by a native speaker looking at prickly-pear cactus on the ground: "That is in the ***kwes*** ['spines'] family." Other plants she named as belonging to this "family" were: wild rose, thistles, and black hawthorn.

Native people I have worked with have no problems with the heterogeneous means they have developed for classifying the plant kingdom. Anomalies and overlapping of classes are accepted as a matter of course (AY). In their discussions people jump readily and effortlessly from one level of generality to another, using polysemous terminology, synonymous names, drawing multi-dimensional linkages among plants, developing new taxa and expanding and adjusting existing taxa to fit new situations. The introduction of new plants and plant products has resulted in obvious shifts in native folk taxonomies. This form of acculturation is unfortunate, but the changes can be regarded as evolutionary developments, and from them can be learned what the nature of past changes and developments in folk classification systems would have been like.

In his discussion on utilitarian/adaptationist perspectives in folk biological classification, Hays (1982, p. 93) summarizes his views, which seem to fit well the multi-faceted nature of the Thompson and Lillooet mid-range groupings I have described: "My own belief is that we will ultimately understand folk classification systems as products of a number of complex, interacting factors: biological discontinuities in nature, chance historical events, 'utilitarian' human concerns, human cultural concerns in a broader sense, intellectual curiosity, and constraints deriving from the nature of human perception and cognition." Morris (1984), too, states that ". . . it is important to recognize that functional criteria are intrinsically linked to taxonomic ordering," and stresses that functional classes are an integral part of folk biological classification, and Hunn (1982) points out that even the "classic" Tzeltal life-forms are not defined without regard for utilitarian factors.

SUMMARY AND CONCLUSIONS

In Thompson and Lillooet Interior Salish folk classification, mid-range plant groupings, more inclusive and less basic than "generic" level folk taxa and more restricted than general classes at the "life-form" level, are common and varied.

In all, 79 of these groupings have been inventoried for Thompson and 38 for Lillooet. There are undoubtedly many more yet to be described. They are categories of convenience, established probably in many cases quite spontaneously, and based on observed similarities of many different types and dimensions. Many of the groupings exhibit similar traits to the intermediate folk taxa described by Berlin and his colleagues, in level of inclusiveness, in being delineated largely by overall morphological similarities and, sometimes, in being unnamed, or "covert." The groupings are quite variable, even amongst individual speakers within the groups and do not seem to have as high a level of salience or usage as either the general "life-form" level categories (cf. Turner 1987) or basic "generic" level categories. Many exhibit features (i.e., incorporation of English nomenclature and/or introduced or cultivated members) indicating recent change or expansion following European contact and the collateral introduction of new plants and plant products.

However, like some Thompson and Lillooet general, "life-form" level categories (cf. Turner 1987), many of the mid-range groupings in these languages differ in significant ways from the intermediate taxa described by Berlin, Breedlove and Raven in their folk taxonomic model (cf. Berlin *et al.* 1973). The majority are named, although often these names are polysemous with the "generic" level name for the most salient member or are "binomial" terms with a "life-form" level name as head. Some are defined mainly, but not usually exclusively, by utilitarian rather than morphological criteria. Many "overlap," both among each other and within the more inclusive "life-form" level classes which contain their members. Many contain recognized but unnamed members, and this lack of "generic" level names is usually correlated with low cultural significance of the plants involved. These characteristics are generally similar to those of mid-range groupings described for other northwestern North American native languages (Turner 1974; Turner and Efrat 1982; Turner *et al.* 1983), and follow a pattern similar to more general "life-form" level categories in Thompson and Lillooet (Turner 1987).

ACKNOWLEDGEMENTS

I am indebted to the members of the Thompson and Lillooet speech communities, who shared their knowledge and experience and made this research possible. Annie York of Spuzzum, B.C. is particularly acknowledged. The others are mentioned by name in Appendix 1 of Turner (1987). Salishan linguists Dr. Laurence C. Thompson, M. Terry Thompson, Dr. Jan van Eijk and Randy Bouchard were extremely helpful in providing information and accurate transcriptions of plant names. I am grateful to Drs. Eugene Hunn, Gary Palmer, and Cecil Brown for their critical reading of the manuscript and many helpful suggestions, and to Dr. Brent Berlin for his continuing help and interest in my research.

This work was funded by a grant from the Social Sciences and Humanities Research Council of Canada (No. 410-84-0146).

NOTES

[1]In previous writings (cf. Turner 1974), I have referred to these groupings using the term, "intermediate," as defined by Berlin and his colleagues. However, as has been pointed out by Hunn (pers. comm. 1988), Brown (pers. comm. 1987) and Palmer (pers. comm. 1988), it is confusing and inaccurate to use this term for the mid-range groupings described here.

[2]Brown (1987), who does not recognize many bona fide intermediate categories, has proposed a new ethnobiological rank, the folk subgenus. His suggested scheme would render at least some of the mid-range groupings categories here as folk generics, which have expanded in reference to incorporate two or more ''folk subgenera.''

[3]Scientific names for plant species mentioned are given in Appendix 1.

[4]There is a similar ''prickly or thorny plants'' category in Sahaptin, with thistles as the ''type.'' Derivation of the term, from restricted to general or vice versa, is also unclear (E. Hunn, pers. comm. 1987).

[5]Usual questions when discussing a particular plant specimen were: ''Does this plant [X] have any relatives?'' and ''Are there different kinds of X?'' These questions invariably lead to a positive or negative response, with examples and descriptions: ''Yes, X is close to Y because . . .,'' or ''X stands between Y and Z.'' and ''There is another kind [of X] with white flowers [for example, instead of yellow] . . .'' This type of questioning is tedious and can be boring for the native consultant. It has to be done carefully and over an extended period in order to maintain interest and prevent fatique.

[6]Van Eijk and Thompson are both well versed in culturally oriented elicitation techniques, and hence their interpretations of folk categories based on linguistic analyses and discussions with Thompson and Lillooet speakers are highly relevant.

[7]Note that the use of single quotation marks for native categories denotes a literal translation of a native term, whereas double quotations are used when an English approximation or interpretation is given, or if there is no original native equivalent.

[8]E. Hunn (pers. comm. 1987) argues that these groupings of ''relatives of X'' do not necessarily constitute a taxon despite the common linguistic designation, as they have in common primarily their separate linkages to the ''boss''. He would call such a cluster, at best, a complex or chain. Still, in most cases there is a perceived morphological similarity (e.g., low growing; small, leathery, elongated or obovate evergreen leaves in the ''kinnikinnick and relatives'' group) that links these plants together in a perceptual category.

[9]The origin of the name ''red willow'' is unknown, and may be post-contact, since many rural non-native people also use it. Hence, the inclusion of red-osier dogwood within the ''willow'' taxon may be a recent concept. Hunn (pers. comm. 1988) points out that in Sahaptin, red-osier dogwood is not regarded as ''willow,'' although the folk English ''red willow'' is applied for this plant.

[10]These criteria are sometimes more inferred than specified in so many words by native consultants, and in the case of the botanical relationships (in a scientific sense) referred to in Criteria numbers 1, 2, 4a, and 4b, these are superimposed by the researcher. One might argue that a botanist's bias is inevitable in such a scheme, but every effort was made in this study override personal prejudices and report groupings as perceived and described by native Thompson and Lillooet speakers.

[11]The ''life-form'' names for ''mushroom,'' in Lillooet (Pemberton dialect) and Thompson (Lower dialect), ***(s-)q̓əm̓'s*** and ***/q̓ám̓es*** respectively, are in turn derived through expansion of reference of the ''generic'' level term for the most salient type of mushroom in the lower dialect regions of both languages, the pine mushroom.

[12]In Sahaptin, the difference between a plant which is classed as a ''flower'' and any flowering plant, is indicated by statements translating, '''It *is* a flower'' versus, ''It *has* a flower'' (E. Hunn, pers. comm. 1987).

[13]This situation is also true in some other Northwestern languages. In Hesquiat Nootka, for example, a salmonberry plant can be called either ***m̓aš-mapt*** ('salmonberry-shoots-plant') or ***qawaš-mapt*** ('salmonberry-fruit-plant'), depending on the context (Turner and Efrat 1982).

[14]Hunn (1976) described precisely this type of situation.

[15]This situation fits well the model based on *degrees* of similarity and difference as described by Hunn (1976).

[16]Hunn (1977) describes exactly this "chaining" situation in Tzeltal folk zoology, and first analysed this phenomenon in 1973 in a working paper on Gull Classification. Hays (1974) also notes "chaining" in Ndumba plant classification.

[17]Thompson ***mlā-mn*** and Lillooet ***mlomn*** are related to Shuswap "***melômn***" and Okanagan-Colville "***merimstn,***" also meaning "any medicine" (Palmer 1975; Turner, Bouchard and Kennedy, 1980). Apparently, at some stage of Interior Salish language development, the name(s) for subalpine fir developed from the general name(s) for "medicine."

[18]Some might argue "ground mosses and lichens," having no named members, should be considered a folk generic. Perceptually, however, native people view it as the same type of category as "tree mosses and lichens" which does contain named members, and place it in opposition to the latter grouping.

[19]Hunn (pers. comm. 1988) remarked upon the similarity of these cases to what he described (1977) in Tzeltal folk zoology, e.g. "butterfly," in which a heterogenous folk generic is divided in a rather ad hoc fashion by simple criteria. Hunn suggested treating these monotypic divisions of the generic as "varietals" directly included in generics. The case cited here for different types of mosses (see also Table 1, Note 3) might be construed as a "life-form" with directly included "varietal" taxa. In this interpretation, Hunn suggests, a "varietal" taxon is not simply a first order subdivision of a folk specific but rather a type of taxonomic division with definitive psychological properties.

LITERATURE CITED

BERLIN, B. 1972. Speculations on the growth of ethnobotanical nomenclature. Lang. Soc. 1:51-86.

__________. 1974. Further notes on covert categories and folk taxonomies: a reply to Brown. Amer. Anthropol. 76(2):327-331.

__________. 1976. The concept of rank in ethnobiological classification: some evidence from Aguaruna folk botany. Amer. Ethnol. 3:381-399.

__________. 1986. Comment on: The growth of ethnobiological nomenclature by Cecil H. Brown. Current Anthropol. 27(1):12-13.

__________, D.E. BREEDLOVE and P.H. RAVEN. 1968. Covert categories and folk taxonomies. Amer. Anthropol. 70:290-299.

__________. 1973. General principles of classification and nomenclature in folk biology. Amer. Anthropol. 75(1):214-242.

__________. 1974. Principles of Tzeltal Plant Classification. Academic Press, New York.

BRIGHT, J. and W. BRIGHT. 1965. Semantic structures in northwestern California and the Sapir-Whorf Hypothesis. Amer. Anthropol. 67(5):249-258.

BROWN, C.H. 1984. Language and Living Things. Uniformities in folk classification and naming. Rutgers Univ. Press, New Brunswick, N.J.

__________. 1986. The growth of ethnobiological nomenclature. Curr. Anthropol. 27(1):1-19.

__________. 1987. The folk subgenus: a new ethnobiological rank. J. Ethnobiol. 7(2): 181-192.

HAYS, T.E. 1974. Mauna: explorations in Ndumba ethnobotany. Unpubl. Ph.D. dissert. (Anthrop.), Univ. Washington.

__________. 1982. Utilitarian/adaptationist explanations of folk biological classification: some cautionary notes. J. Ethnobiol. 2(1): 89-94.

LITERATURE CITED (continued)

HUNN, E.S. 1976. Toward a perceptual model of folk biological classification. Amer. Ethnol. 3:508-524.

___________. 1977. Tzeltal Folk Zoology: The classification of discontinuities in nature. Academic Press, New York.

___________. 1982. The utilitarian factor in folk biological classification. Amer. Anthropol. 84(4):830-847.

___________ and D.H. FRENCH. 1984. Alternatives to taxonomic hierarchy: the Sahaptin case. J. Ethnobiol. 4(1):73-92.

MORRIS, B. 1984. The pragmatics of folk classification. J. Ethnobiol. 4(1):45-60.

PALMER, G. 1975. Shuswap Indian Ethnobotany. Syesis 8:29-81.

PRICE, P. 1967. Two types of taxonomy: a Huichol ethnobotanical example. Anthropol. Linguist. 9(7):1-28.

RANDALL, R.A. 1976. How tall is a taxonomic tree? Some evidence for dwarfism. Amer. Ethnol. 3:543-553.

___________ and E.S. HUNN. 1984. Do life-forms evolve or do uses for life? Some doubts about Brown's universals hypothesis. Amer. Ethnol. 11(2):329-349.

STEEDMAN, E.V. (ed.) 1930. The ethnobotany of the Thompson Indians of British Columbia. Based on field notes of J.A. Teit. Bur. Amer. Ethnol., 30th Annu. Rpt., 1908-1909:445-522, Washington, D.C.

TEIT, J.A. 1896-1918. Plant names of Thompson Indians. Unpubl. field notes, microfilm. Amer. Philosoph. Soc., Boas Coll., S 1b.s. Philadelphia, PA.

___________. 1906. The Lillooet Indians. Mem. Amer. Mus. Nat. Hist., Vol. II, Pt. 5. G.E. Stechert, New York.

TURNER, N.J. 1974. Plant Taxonomies and Ethnobotany of Three Contemporary Indian Groups of the Pacific Northwest. (Haida, Bella Coola and Lillooet). Syesis, Vol. 7, Suppl. 1. British Columbia Prov. Mus., Victoria.

___________. 1982. Traditional use of devil's-club *(Oplopanax horridus;* Araliaceae) by native peoples in western North America. J. Ethnobiol. 2(1):17-38.

___________, R. BOUCHARD, D.I.D. KENNEDY & J. VAN EIJK. 1985. Ethnobotany of the Lillooet Indians of British Columbia. Unpubl. rpt., Royal B.C. Mus., Victoria.

___________. 1987. General plant categories in Thompson and Lillooet, two Interior Salish languages of British Columbia. J. Ethnobiol. 7(1):55-82.

___________. 1988a. "The importance of a rose": evaluating cultural significance of plants in Thompson and Lillooet Interior Salish. Amer. Anthropol. 90(2):272-290.

___________. 1988b. Ethnobotany of coniferous trees in Thompson and Lillooet Interior Salish of British Columbia. Econ. Bot. 42(2):177-194.

___________, R. BOUCHARD & D.I.D. KENNEDY. 1980. Ethnobotany of the Okanagan-Colville Indians of British Columbia and Washington. British Columbia Prov. Mus. Occas. Pap. No. 21, Victoria.

___________ and B.S. EFRAT. 1982. Ethnobotany of the Hesquiat Indians of Vancouver Island. Cultural Recovery Pap. No. 2, British Columbia Prov. Mus., Victoria.

___________, J. THOMAS, B.F. CARLSON and R.T. OGILVIE. 1983. Ethnobotany of the Nitinaht Indians of Vancouver Island. British Columbia Prov. Mus. Occas. Pap. No. 24, Victoria.

___________, L.C. THOMPSON, M.T. THOMPSON and A. YORK. 1988. In press. Knowledge and Usage of Plants by the Thompson Indians of British Columbia. Royal British Columbia Museum Memoirs, Victoria.

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names)

alder, mountain *(Alnus crispa)*
alder, red *(Alnus rubra)*
algae, green *(Spirogyra* spp. and other species)
almond *(Prunus dulcis)*
alumroot, cylindrical *(Heuchera cylindrica)*
alumroot, small-flowered *(Heuchera micrantha)*
anemone, Pacific *(Anemone multifida)*
arnica *(Arnica* spp.)
avalanche lily, yellow *(Erythronium grandiflorum)*
avens, large-leaved *(Geum macrophyllum)*
balsamroot *(Balsamorhiza sagittata)*
baneberry *(Actaea rubra)*
bedstraw *(Galium triflorum, G. aparine)*
birch *(Betula papyrifera)*
bitterroot *(Lewisia rediviva)*
bitterroot, Columbia *(Lewisia columbiana)*
bitterroot, dwarf *(Lewisia pygmaea)*
blackberries *(Rubus* spp.)
blackberry, Himalayan *(Rubus procerus)*
blackberry, trailing wild *(Rubus ursinus)*
blackcap *(Rubus leucodermis)*
blueberry, Alaska *(Vaccinium alaskaense)*
blueberry, bog *(Vaccinium uliginosum)*
blueberry, Cascade *(Vaccinium deliciosum)*
blueberry, commercial *(Vaccinium* spp.)
blueberry, dwarf mountain *(Vaccinium caespitosum)*
blueberry, oval-leaved *(Vaccinium ovalifolium)*
blueberry, velvet-leaved *(Vaccinium myrtilloides)*
bolete, Lake's (mushroom) *(Suillus lakei)*
bracken fern *(Pteridium aquilinum)*
broomrape *(Orobanche fasciculata)*
brown-eyed Susan *(Gaillardia aristata)*
buckbrush *(Ceanothus sanguineus)*
bugleweed *(Lycopus uniflorus)*
bunchberry *(Cornus canadensis)*
burdock *(Arctium minus)*
buttercups *(Ranunculus glaberrimus, R. repens, R. sceleratus* and other *Ranunculus* spp.)

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names). (continued)

camas, death *(Zigadenus venenosus)*
campanulas *(Campanula rotundifolia, C. media)*
carrot, domesticated *(Daucus carota)*
cascara *(Rhamnus purshiana)*
cashew *(Anacardium occidentale)*
cat-tail *(Typha latifolia)*
cedar, western red- *(Thuja plicata)*
cedar, yellow- *(Chamaecyparis nootkatensis)*
celery, domesticated *(Apium graveolens)*
cetraria (lichen) *(Cetraria* spp. and related spp.)
chanterelle *(Cantharellus ?cibarius)*
cherry, bitter *(Prunus emarginata)*
cherry, choke *(Prunus virginiana)*
cherry, domesticated *(Prunus avium, P. cerasus)*
chocolate lily *(Fritillaria lanceolata)*
chocolate-tips *(Lomatium dissectum)*
cinquefoils *(Potenilla gracilis, P. glandulosa, P. anserina)*
clematis, white *(Clematis ligusticifolia)*
clovers *(Trifolium pratense, T. repens,* and other *Trifolium* spp.)
cluster lily *(Triteleia hyacinthina)*
collomia *(Collomia linearis)*
columbine, red *(Aquilegia formosa)*
cottonwood, black *(Populus balsamifera* spp. *trichocarpa)*
''cottonwood'' mushroom *(Tricholoma populinum)*
cow-parsnip *(Heracleum lanatum)*
crabapple, Pacific *(Malus fusca)*
cranberry, highbush *(Viburnum edule)*
crowberry *(Empetrum nigrum)*
currant, domesticated black *(Ribes nigrum)*
currant, domesticated red *(Ribes rubrum)*
currant, northern black *(Ribes hudsonianum)*
currant, red-flowering *(Ribes sanguineum)*
currant, squaw *(Ribes cereum)*
currant, stink *(Ribes bracteosum)*
currant, trailing *(Ribes laxiflorum)*
''cut-grass'' *(Scirpus microcarpus)*
devil's-club *(Oplopanax horridus)*
dogbane, spreading *(Apocynum androsaemifolium)*

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names). (continued)

dogwood, flowering *(Cornus nuttallii)*
dogwood, red-osier *(Cornus stolonifera;* syn. *C. sericea)*
Douglas-fir *(Pseudotsuga menziesii)*
Douglas-fir, coastal *(Pseudotsuga menziesii* var. *menziesii)*
Douglas-fir, Interior *(Pseudotsuga menziesii* var. *glauca)*
elderberry, blue *(Sambucus cerulea)*
elderberry, red *(Sambucus racemosa)*
evening-primrose *(Oenothera perennis)*
fairybells *(Disporum* spp.)
false azalea *(Menziesia ferruginea)*
false box *(Paxistima myrsinites;* also spelled *Pachystima)*
false Solomon's-seal (see Solomon's-seal, false)
fawn lily, white *(Erythronium oreganum)*
fern, bracken (see bracken)
fern, deer *(Blechnum spicant)*
fern, lady *(Athyrium filix-femina)*
fern, oak *(Gymnocarpium dryopteris)*
fern, spiny wood *(Dryopteris assimilis* and related spp.)
fern, sword *(Polystichum munitum)*
fir, amabilis *(Abies amabilis)*
fir, "balsam" *(Abies* spp.)
fir, grand *(Abies grandis)*
fir, subalpine *(Abies lasiocarpa)*
firs, true *(Abies* spp.)
fireweed *(Epilobium angustifolium)*
foamflower *(Tiarella unifoliata)*
forget-me-not *(Myosotis laxa)*
fungi, bracket or shelf *(Polyporus* spp., *Fomes* spp., *Ganoderma* spp.)
fungi, coral *(Clavaria* spp. and related spp.)
goat's-beard *(Aruncus dioicus)*
goldenrods *(Solidago canadensis, S. spathulata)*
gooseberry, coastal *(Ribes divaricatum)*
gooseberry, domesticated *(Ribes uva-crispa)*
gooseberry, interior *(Ribes irriguum, R. inerme)*
grouseberry *(Vaccinium scoparium)*
hackelia *(Hackelia ?diffusa)*
hair-moss *(Polytrichum juniperinum* and related spp.)
hardhack *(Spiraea douglasii)*

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names). (continued)

hawthorn, black *(Crataegus douglasii)*
hazelnut *(Corylus cornuta)*
heather, red mountain *(Phyllodoce empetriformis)*
heather, white mountain *(Cassiope mertensiana)*
hemlock, mountain *(Tsuga mertensiana)*
hemlock, western *(Tsuga heterophylla)*
highbush cranberry *(Viburnum edule)*
holly *(Ilex aquifolium)*
honeysuckle, orange *(Lonicera ciliosa)*
horsetail, common *(Equisetum arvense)*
horsetail, giant *(Equisetum telmateia)*
horsetails *(Equisetum* spp.)
huckleberry, black *(Vaccinium membranaceum)*
huckleberry, red *(Vaccinium parvifolium)*
Indian-hellebore *(Veratrum viride)*
Indian-hemp *(Apocynum cannabinum)*
Indian-pipe *(Monotropa uniflora)*
Indian-plum *(Oemleria cerasiformis)*
''Indian celery'' *(Lomatium nudicaule)*
Indian paint fungus *(Echinodontium tinctorium)*
Indian paintbrush *(Castilleja* spp.)
inky cap (mushrooms) *(Coprinus* spp.)
juniper, common *(Juniperus communis)*
juniper, Rocky Mountain *(Juniperus scopulorum)*
kinnikinnick *(Arctostaphylos uva-ursi)*
knotweed, water *(Polygonum amphibium)*
Labrador-tea *(Ledum groenlandicum; L. glandulosum* also included)
lactarius (mushroom) *(Lactarius ?resimus, L. ?torminosus* and related spp.)
larch, western *(Larix occidentalis)*
lichen, black tree *(Bryoria fremontii)*
lichen, dogtooth *(Peltigera canina* and related spp.)
lichen, lung *(Lobaria pulmonaria)*
lichen, reindeer *(Cladina* spp.)
lichen, wolf *(Letharia vulpina)*
lily-of-the-valley, wild *(Maianthemum dilatatum)*
locust *(Robinia pseudoacacia)*
loganberry *(Rubus ursinus* var. *loganobaccus)*
louseworts *(Pedicularis bracteosa, P. racemosa)*

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names). (continued)

maple, broadleaved *(Acer macrophyllum)*
maple, Rocky Mountain *(Acer glabrum)*
maple, vine *(Acer circinatum)*
mariposa lily *(Calochortus macrocarpus)*
maytree *(Crataegus oxyacantha)*
milk-vetches *(Astragalus miser* and related spp.)
milkweed *(Asclepias speciosa)*
miner's-lettuce *(Claytonia perfoliata)*
miner's-lettuce, Siberian *(Claytonia sibirica)*
missionbells *(Fritillaria camschatcensis)*
mock-orange *(Philadelphus lewisii)*
monkeyflower, yellow *(Mimulus guttatus)*
moss, stolon *(Isothecium stoloniferum)*
mountain bells *(Stenanthium occidentale)*
mountain-ash *(Sorbus sitchensis)*
mushrooms (see under individual types)
mushrooms, commercial *(Agaricus campestris)*
ninebark *(Physocarpus capitatus)*
oceanspray *(Holodiscus discolor)*
onion, domesticated *(Allium cepa)*
onion, Hooker's *(Allium acuminatum)*
onion, nodding wild *(Allium cernuum)*
orchid, bog *(Habenaria dilatata)*
orchid, rein *(Habenaria stricta)*
Oregon-grape, common *(Mahonia nervosa)*
Oregon-grape, tall *(Mahonia aquifolium)*
oyster mushroom *(Pleurotus ostreatus)*
parmelia (lichen) *(Parmelia* spp. and related spp.)
parsnip, domesticated *(Pastinaca sativa)*
peanut *(Arachis hypogaea)*
peas, garden (or field) *(Pisum sativum)*
peas, wild *(Lathyrus nevadensis, L. ochroleucus, L. latifolius)*
penstemon, shrubby *(Penstemon fruticosus)*
penstemons *(Penstemon confertus, P. procerus, P. serrulatus)*
pine, lodgepole *(Pinus contorta)*
pine, ponderosa *(Pinus ponderosa)*
pine, white *(Pinus monticola)*
pine, whitebark *(Pinus albicaulis)*

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names). (continued)

pine mushroom *(Tricholoma magnivelare,* syn. *Armillaria ponderosa)*
pinesap *(Hypopites monotropa)*
plantain, broad-leaved *(Plantago major)*
poison-ivy *(Rhus radicans)*
pond-lily, yellow *(Nuphar polysepalum)*
pondweeds *(Potamogeton* spp.)
potato, domesticated *(Solanum tuberosum)*
prince's-pine *(Chimaphila umbellata)*
puffballs, smaller types *(Lycoperdon* spp., *Bovista* spp.)
puffball, giant *(Calvatia gigantea)*
pyrolas *(Pyrola* spp.)
queenscup *(Clintonia uniflora)*
rabbitbrush *(Chrysothamnus nauseosus)*
raspberry, garden *(Rubus idaeus)*
raspberry, trailing *(Rubus pedatus)*
raspberry, wild *(Rubus idaeus)*
rattlesnake plantain *(Goodyera oblongifolia)*
reed canary grass *(Phalaris arundinacea)*
rhacomitrium (moss) *(Rhacomitrium canescens)*
rhododendron, pink *(Rhododendron macrophyllum)*
rhododendron, white-flowered *(Rhododendron albiflorum)*
rhubarb *(Rheum rhabarbarum)*
rock tripe (lichen) *(Umbilicaria* spp. and related spp.)
rose, dwarf wild *(Rosa gymnocarpa)*
rose, Nootka wild *(Rosa nutkana)*
rose, swamp wild *(Rosa pisocarpa)*
roses, wild and domesticated *(Rosa* spp.)
rowan *(Sorbus aucuparius)*
rush, round-stem *(Juncus ensifolius)*
rushes *(Juncus* spp.)
rushes, scouring (see scouring rushes)
russula (mushroom) *(Russula* spp.)
St. George's mushroom (?) *(Tricholoma gambosum)*
sage, western *(Artemisia ludoviciana)*
sagebrush, big *(Artemisia tridentata)*
salal *(Gaultheria shallon)*
salmonberry *(Rubus spectabilis)*
saskatoon berry *(Amelanchier alnifolia)*

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names). (continued)

scouring rushes *(Equisetum hyemale* and related spp.)
sedges *(Carex* spp.)
shaggy mane mushroom *(Coprinus comatus)*
silverberry *(Elaeagnus commutata)*
silverweed *(Potentilla anserina* spp. *anserina)*
silverweed, Pacific *(Potentilla anserina* spp. *pacifica)*
skunk-cabbage *(Lysichitum americanum)*
''slimy'' mushroom *(Hygrophorus* sp.)
snowball bush *(Viburnum opulus* var.)
snowbrush *(Ceanothus velutinus)*
soapberry *(Shepherdia canadensis)*
Solomon's-seal, false *(Smilacina racemosa)*
Solomon's-seal, star-flowered *(Smilacina stellata)*
silverberry *(Elaeagnus commutata)*
spiraea, flat-topped *(Spiraea betulifolia)*
spiraea, pyramid *(Spiraea pyramidata)*
spring beauty *(Claytonia lanceolata)*
spruce, Engelmann *(Picea engelmannii)*
spruce, ''silver'' (unidentified; possibly *P. glauca* X)
spruce, Sitka *(Picea sitchensis)*
stickseed *(Lappula redowskii, L. echinata)*
stinging nettle *(Urtica dioica)*
strawberry, domesticated *(Fragaria* X *ananassa)*
strawberries, wild *(Fragaria vesca, F. virginiana)*
sunflower *(Helianthus annuus)*
swamp-laurel *(Kalmia microphylla)*
sweet cicely *(Osmorhiza chilensis)*
sweet gale *(Myrica gale)*
sweet potato *(Ipomoea batatas)*
sweet-pea (wild) *(Lathyrus latifolius)*
tarragon, wild *(Artemisia dracunculus)*
thimbleberry *(Rubus parviflorus)*
thistles *(Cirsium* spp.)
tiger lily *(Lilium columbianum)*
tobacco, commercial *(Nicotiana tabacum)*
tobacco, wild or native *(Nicotiana attenuata)*
tree hair *(Alectoria sarmentosa* complex)
tule *(Scirpus acutus)*

APPENDIX 1. Scientific names of plant species mentioned in this paper (in alphabetical order of English common names). (continued)

twayblade *(Listera cordata)*
twinberry, black *(Lonicera involucrata)*
twinflower *(Linnaea borealis)*
twistedstalk, common *(Streptopus amplexifolius)*
vetches *(Vicia sativa, V. americana* var. *truncata)*
walnut, English *(Juglans regia)*
wapato *(Sagittaria latifolia)*
water-hemlock *(Cicuta douglasii)*
water-parsnip *(Sium suave)*
waxberry *(Symphoricarpos albus)*
''wild carrot'' *(Lomatium macrocarpum)*
willow, Hooker's *(Salix hookeriana)*
willow, Pacific *(Salix lasiandra)*
willow, ''red'' (see dogwood, red-osier)
willow, sandbar *(Salix exigua)*
willow, Scouler's *(Salix scouleriana)*
willow, Sitka *(Salix sitchensis)*
willowherbs *(Epilobium ciliatum* and related spp.)
willows *(Salix* spp.)
wineberry *(Rubus phoenicolasius)*
witch's butter (fungus) *(Tremella mesenterica)*
woolly sunflower *(Eriophyllum lanatum)*
wormwood, field *(Artemisia campestris* spp. *borealis)*
wormwood, pasture *(Artemisia frigida)*
yarrow *(Achillea millefolium)*
yellowbells *(Fritillaria pudica)*
yew, western *(Taxus brevifolia)*

BOOK REVIEW

Plants in Indigenous Medicine and Diet: Biobehavioral Approaches. Nina L. Etkin (ed.). Bedford Hills, NY: Redgrave, 1986. Pp. xi, 366. $24.95.

Most ethnobiologists enter the field with backgrounds in either the social or the biological sciences; rarely do workers have adequate training in both sides of our interdisciplinary field. Much of the literature reflects this unfortunate lack of breadth, and is, in Etkin's words, "botanically uninformed or anthropologically naive." Botanists often make extensive lists of medical and other uses for plants without exploring further the cultural roles these plants play. Pharmacologists tend to view medicinal plants as they would modern pharmaceuticals, assuming that one particular constituent of a plant must be responsible for its apparent efficacy. Anthropologists frequently regard medicinal plants and animals as mere cultural objects, ignoring physiological effects of native treatments.

In an excellent and inspiring introductory chapter, Etkin reviews some of the exceptions, studies that address the interactions among culture, environment, and physiology. She discusses the false dichotomy between food and medicine, how differences between native and Western theories of disease causation affect treatment, and how plant components considered inert by pharmacologists may, indeed, have significant physiological effects. She also reviews various ideological bases for plant selection, e.g., the hot/cold and yin/yang balance theories, and the Doctrine of Signatures.

Unfortunately, the rest of the book does not meet the high standards set forth in the introduction. All of the 16 papers are interesting, and most make valuable contributions to the literature. A few, however, are extremely broad, superficial reviews, or summaries of longer works published elsewhere. A few of these latter cannot be fully understood without referring to the longer publications. In others, the data are too raw or anecdotal. Some of the papers even exhibit the same kind of narrowly focused approach decried by the editor in the introduction. She specifically expresses misgivings about broad-sweeping listings such as those made here by Duke ("Folk Anticancer Plants Containing Antitumor Compounds") and Elwin-Lewis ("Therapeutic Rationale of Plants Used to Treat Dental Infections"). She is quick to point out, of course, that these types of studies are important for other reasons, which is entirely correct. However, listings such as these have been made for years and constitute nothing new, and certainly not the "biobehavioral" approach as outlined by Etkin.

There are a few glaring methodological problems in a few of the papers. For example, the article by Trotter and Logan ("Informant Consensus: A New Approach for Identifying Potentially Effective Medicinal Plants") relies too heavily on modern social science methodology at the expense of botanical and pharmacological insight. The authors state that in their study of medicinal herbs sold in Mexican-American markets in South Texas, some of their specimens were identified by looking up the common names in standard reference works. One of the plants they discuss is *oregano,* identified as *Oriogonum vulgare.* Martínez (1979) lists 16 different plants in four botanical families known by this name (or a compound of it) in Mexico. One of these *(Lippia berlandieri)* has even been sold as oregano in the United States (Robert Bye, pers. comm.). The specimens in question may indeed be *O. vulgare,* but anyone interested in following up on their results cannot be certain of this.

The central thrust of Trotter and Logan's paper is also open to criticism. They suggest that by interviewing hundreds of informants and selecting those plants most consistently recommended for a specific ailment, one can predict that these species will be most likely to have demonstrable physiological efficacy. The point is that the choice of which plant to use is based at least in part on empirical observations by the users, and that the sum total knowledge of a broad cross-section of the population may be greater than the knowledge of any one individual. This is likely to be correct. It is important to note, however, that all of the species so identified in their study are very well-known species, and most have already been analyzed rather thoroughly. This will likely be the case wherever their technique is applied. Any plant so well-known to the large number of people required by their statistical methods will probably already have attracted the attention of researchers. It is extremely unlikely that a local endemic could be singled out by their methods.

The question of differences between Western and native concepts of disease causation appears in several of the papers. For example, Ortiz de Montellano ("Aztec Medicinal Herbs: Evaluation of Therapeutic Effectiveness") states that while 30% of the plants used by the Aztecs for the treatment of headaches are effective by biomedical standards, more than 90% are successful in producing the effects desired according to emic etiological beliefs. There is, of course, a parallel in the history of Western medicine: leeches worked very well in drawing blood, but the bloodletting itself was ineffectual in alleviating the patients' symptoms. The question arises of which definition is more useful. I think the answer depends on the circumstances and on the goal of the investigator. Should the pharmacologists in search of new plant-derived medicines test only those species reported to be used in the treatment of the illness under study, or should she/he focus on plants that produce a desired physiological reaction? Most screening programs have utilized the former approach, but the latter seems more promising.

On the other hand, a health worker attempting to improve the health care of traditional peoples must be able to distinguish between effective and ineffective treatments from the standpoint of Western concepts of disease etiology. Some writers have shown a tendency to attribute more efficacy to native healing systems than they deserve. Some native treatments are of little or no value, while others are detrimental to the patients' health. While the study of such remedies can be valuable in helping us understand various cultures, a health worker must be able to draw upon centuries of clinical studies in order to gauge effectiveness and to prescribe improvements in treatment. This is not to say that all native treatments are usless; biomedical researchers sometimes dismiss native remedies as ineffective because practitioners of biomedicine fail to understand the mechanisms of action. Western medicine has learned a great deal from traditional healers, and can still learn a lot more. The converse, however, is certainly true as well.

Elwin-Lewis relies too heavily on "phylogenetic groups" as an organizing scheme without adequately explaining what these groups are or why they are used. It is true that species that are closely related frequently share the same or similar chemical constituents, but the author takes this idea a bit too far. Convergent evolution has often produced similar compounds in members of taxa only distantly related.

As a reviewer, I should point out that I discovered numerous minor typographical errors in the book and one table which was completely mislabelled. The title of the table on p. 49 should read "Plants Used to Treat Dental Caries Ordered by Phylogenetic Group."

In summary, I wholeheartedly applaud the interdisciplinary approach outlined in the introduction, but I am disappointed that some of the papers do not represent ideal examples of this methodology.

REFERENCE CITED

MARTÍNEZ, MAXIMINO. (1979). Catálogo de nombres vulgares y científicos de plantas mexicanas. México: Fondo de Cultiva Económica.

Joseph E. Laferrière
Department of Ecology and Evolutionary Biology
University of Arizona
Tucson, AZ 85721

BOOK REVIEW

Peyote Religion: A History. Omer C. Stewart. Norman: University of Oklahoma Press, 1987. Pp. xvii, 454. $29.95.

There has been a vast literature published on peyote. Only a few of the items have gone even superficially into the history of the growing religious use among American Indians of the peyote cactus *(Lophophora williamsii).* Stewart, a student of the religious use of peyote for half a century, offers us for the first time a thorough historical evaluation of the rapid spread north of the Mexican border of this native cult. He not only considers the history of the use of the cactus in North America north of its normal distribution (mostly in Mexico and Texas), but he examines the efforts of some of the backward states of the west and southwest to legislate against the Indians' right to utilize this non-addictive and physically more or less harmless hallucinogenic plant in their worship services.

The book is readable, yet thorough. It is based not only on Stewart's personal studies of the peyote cult but on many unpublished and obscure documents relative to various aspects of the history of the sacramental Indian use of the plant. It is a book that every scientist interested in plants or phytochemicals, as well as sociologists, anthropologists, historians, and others, should read.

Richard Evans Schultes
Professor Emeritus
Botanical Museum of Harvard University
Cambridge, MA 02138

In Memoriam
C. EARLE SMITH, JR.

C. Earle Smith, Jr. was born on March 8, 1922 in Boston, Massachusetts. His sudden death as the result of an automobile accident occurred on the 19th of October, 1987 in Tuscaloosa, Alabama. He is survived by his wife and four children.

Dr. Smith is recognized internationally as a pioneer in the field of Archaeobotany/Paleoethnobotany and he was undoubtedly among the most active of its researchers.

He was educated at Harvard University, Cambridge, Massachusetts, where he received his B.A. (cum laude, 1948), M.A. (1951) and Ph.D. (1953).

Between 1946 and 1953 he was an assistant in the Gray Herbarium and the Botanical Museum of Harvard University. From 1953 to 1958 he was Assistant Curator of the Botany Department, Philadelphia Academy of Natural Sciences, as well as Acting Director of the Taylor Memorial Arboretum, Chester, Pennsylvania. From 1959 to 1961 he was Assistant Curator in the Botany Department of the Field Museum of Natural History in Chicago, and from 1962 until 1969, he held the position of Senior Research Botanist in the Agricultural Research Service of the United States Department of Agriculture, Beltsville, Maryland. From 1970 until his death, he was Professor of Botany and Anthropology at the University of Alabama, Tuscaloosa, Alabama, where he also served as Chairman of the Anthropology Department between 1981 and 1986.

Dr. Smith's contribution in research and field work was extensive as his bibliography of publications and unpublished manuscripts indicates. His field experiences took him to Mexico, Central America, South America (especially Colombia and Peru), Europe, the U.S.S.R., Southeast Asia, Africa, Australia, the Pacific, as well as the United States. His archaeobotanical research in Mexico includes projects carried out in the Sierra de Tamaulipas, the Tehuacan Valley, the Valley of Oaxaca, the Nochixtlan Valley, the Basin of Mexico, and the Puuc region of Yucatán.

Dr. Smith's direct collaboration with the Institute for Anthropological Research, National Autonomous University of Mexico, began in 1978, when he collaborated in the development of what was at that time an incipient paleoethnobotanical laboratory. His participation over the years included the creation of comparative collections, training of qualified research personnel and orienting projected research programs.

Those of us in Mexico who had the opportunity to work closely with him in the field and laboratory, join our colleagues elsewhere in the world in remembering him for his enthusiasm, patience, good humor and generosity.

Emily McClung de Tapia
Laboratorio de Paleoetnobotánica
Instituto de Investigaciones Antropológicas
Universidad Nacional Autonóma de México

ABRIDGED MINUTES OF THE EDITORIAL BOARD MEETING OF THE SOCIETY OF ETHNOBIOLOGY RIVERSIDE, CA 30 MARCH 1989

The meeting, called to order at 10:00 a.m., was attended by Willard Van Asdall (Chair), Alejandro de Avila B., Brent Berlin, Cecil Brown, Timothy Johns, Gary Martin, Gary Nabhan, Darrell Posey, Amadeo Rea, Jan Timbrook, Mollie Toll, and Elizabeth Wing. Alejandro de Avila B. was added to the editorial board in 1988, then made Associate Editor. He has greatly assisted with manuscripts written in Spanish. David Harris, Department of Environmental Studies, University of London was added to the board in 1988.

Languages of Abstracts

Effective with Volume 9, Number 1 (Summer 1989) all paper published in the *Journal* will be accompanied by abstracts in English, Spanish, and French. We encourage authors submitting manuscripts to have their abstracts translated. If this is not possible, the editor will arrange for translations; it must be emphasized that it will be of great help if the authors can take responsibility for these translations. Alejandro de Avila B. will check for accuracy and style for translations into Spanish and we are still trying to find someone to check the French.

Languages of Published Papers

During 1988 Cecil Brown circulated a questionaire asking the membership: (1) Would you approve of the occasional publication of articles in the *Journal of Ethnobiology* in the Spanish language if they were accompanied by an abstract in English? and (2) Would you approve of having Spanish abstracts for all articles published in English? For Question 1, of 166 responding, 145 (74%) answered yes and 43 (26%) answered no. For Question 2, of 169 responding, 145 (86%) answered yes and 21 (12%) answered no.

ANNOUNCEMENT

The *Journal of Ethnobiology* is now accepting manuscripts in Spanish.

Effective immediately, the *Journal* will accept manuscripts in Spanish. All manuscripts in Spanish should be submitted to Associate Editor Alejandro de Avila B. who will supervise their review, and, if accepted for publication, will edit them (see inside front cover for his address).

The concensus of the Board was that if the publication of abstracts in Spanish and French and of articles in Spanish works out well, it will next consider the publication of full length articles in other languages in an effort to broaden the international scope of the *Journal*.

Contributors Please Note

Authors are encouraged to include a note on what taxonomic authority they are following, e.g., Index Kewensis. Please give complete scientific names, which, for plants at least, includes the authors of the names.

TIMOTHY CHARLES PLOWMAN
17 November 1944 - 7 January 1989

''Now cracks a noble heart. Good night, sweet prince, and flights of angels sing thee to thy rest.''

—Hamlet

Ethnobotany has lost one of its most devoted disciples and beloved practitioners with the tragic passing of Timothy Plowman. A man of generosity and kindness, modesty and honour, his untimely death has cut short a remarkable career of immense promise. Already far on the way as one of the most discerning, original and effective naturalists of our century, Tim was a gentleman, a friend of everyone, an understanding and devoted teacher, a scholar of extraordinary depth, a tireless and demanding researcher happy to share his experience and counsel with whoever sought his advice.

Tim Plowman's interest in and love of plants developed as a child growing up in the temperate woodlands surrounding Harrisburg, Pennsylvania. An avid collector even as a boy, his passion for plants grew into the central metaphor of his life. After attending college at Cornell University he went as a graduate student to the Botanical Museum of Harvard University where he worked under the direction of Richard Evans Schultes. Such was his promise that even before enrolling in the graduate school, Tim was dispatched by Professor Schultes to the Amazon on an expedition that would define the course of his professional life. In the fall of 1966 Tim returned from Brazil flush with excitement and fully committed to spending the rest of his life in pursuit of the mysteries of the tropical rainforest. Having received his Master's Degree in 1970, he undertook for his doctoral dissertation a revision of the genus *Brunfelsia* (Solanaceae). His thesis, which included a comprehensive chapter on the ethnobotany of the genus, was based on over 15 months of continuous fieldwork in Central and South America and the Caribbean.

By the time his Ph.D. was officially conferred in 1974, Tim was already deeply involved in the project for which he will always be remembered—a 15 year effort to decipher the complex taxonomy of *Erythroxylum* and to study the ethnobotany of coca, the sacred leaf of the Andes and the notorious source of cocaine. Of Tim's 80 published scientific papers, 46 are related to his work on *Erythroxylum* and his position as the world's authority on the genus enabled him to speak eloquently and powerfully in defense of the traditional use of coca by beleaguered indigenous peoples of the Andes and Northwest Amazon.

Tim left Harvard for the Field Museum of Natural History in 1978 where he became tenured in 1983, and was appointed curator in 1988. If Tim grew up at the Botanical Museum at Harvard, he came into his own at the Field Museum and his years there were both the happiest and most productive of his remarkable career. His interdisciplinary interests in systematics, ethnobotany and ethnopharmacology led him to interact with an increasingly diverse group of scholars which included not only fellow botanists but also archaeologists, phytochemists, ethnographers and pharmacologists. In addition to carrying out an active scien-

Photograph by Wade Davis

Tim Plowman while on a botanical expedition in Peru.

tific research program as co-principal investigator of the National Science Foundation Projeto Flora Amazonica, he served on the editorial boards of numerous journals including *Flora Neotropical Monographs, Advances in Economic Botany, Journal of Psychoactive Drugs* and *Journal of Ethnpharmacology.* Between 1984-1988 he was Co-Editor-in-Chief of the *Journal of Ethnopharmacology* and the Scientific Editor of *Fieldiana*. He was vice president of the Beneficial Plant Research Association, a Fellow of the Linnean Society, and a member of many professional societies including the American Society of Plant Taxonomists, Society of Economic Botany, Council of Biology Editors, Society of Ethnobiology and the New England Botanical Club. As chairman of the Botany Department of the Field Museum of Natural History (1986-1988) Tim secured a substantial increase in National Science Foundation funding for the herbarium and developed a new facility for the curation of economic collections. His enthusiasm, spirit of cooperation, professional rigor and passionate commitment to botany proved infectious and under his leadership, morale at the Botany Department soared.

Credentials alone, however, present but a shadow of the man who affected so many lives in such profound ways. For Tim, life was but a vehicle for seeking understanding and for expressing freedom. If there is a word to describe Timothy Plowman it would be freedom, and he lived with the conviction that every person had the right to pursue his or her own path unshackled of the burdens of social convention. Equally at ease in the tranquil world of plants or amidst the society of people, Tim had a charisma hot to the touch, and those privileged to have spent time with him often developed a respect that bordered on reverence. For he was a true renaissance scholar, a man out of time, whose breadth of interests and passions went far beyond the boundaries of his beloved field of botany.

But it is as a botanist and intrepid plant explorer that Tim will be best remembered. He spent over five years of his life in the most remote and inhospitable regions of the Andes and Amazon, making over 15,000 collections of unsurpassed quality. Typically he always considered his time in the field as a privilege, and he never failed to remember his fellow botanists toiling away in the less romantic confines of the herbaria. Tim seemed to have a roladex in his head that recorded the name of every specialist in every group of plants, and he constantly was on the lookout for specimens that might prove useful to a distant colleague. He collected everything. His voucher specimens were not only complete, but aesthetically beautiful and whenever possible he augmented them with invaluable collections of live material. Living plants, many new to science and collected first by Tim, may be found in botanical gardens throughout the world.

In the rainforests of the Amazon Tim felt the fullness of life. He marvelled at the thousand themes, the infinitude of form, shape and texture that so clearly mocked the terminology of temperate botany. He always travelled in the forest as a student and his commitment to ethnobotany grew in part from his direct experience with the indigenous peoples who understood the plants in ways that he believed he could only hope to emulate. To be in the forest, he said, was to be in Eden, and to say the names of the plants was to recite the names of the Gods. He believed that all forms of life were manifestations of the sacred. Hence for Tim biological and cultural diversity represented far more than the foundation of stability, they were articles of faith, fundamental truths that indicated the way things were supposed to be.

Tim had a special affinity for Indians, and his uncanny ability to gain their trust and confidence was one measure of the deep respect he had for their way of life. He empathized with their worldview which defined man as but one element inextricably linked to the whole of creation. It was this unique cosmological perspective, he believed, that enabled the Indians to comprehend implicitly the intricate ecological balance of the forest he loved so dearly. Tim viewed with pain, dismay and increasing anger this other worldview, one in which man stands apart, that now threatens the forest with devastation. It was one of his fondest hopes that the lessons of ethnobotany might ultimately facilitate a dialogue between these two worldviews such that folk wisdom might temper and guide the inevitable development processes that today ride roughshod over much of the earth. The many of us who loved him as a brother and respected him as a colleague can do no better service to his memory than to continue our own struggles to make this dream of his a reality.

Wade Davis

Publications of Timothy C. Plowman:

1. Folk uses of New world aroids. Economic Botany 23:97-122. 1969.
2. Latua pubiflora: magic plant from southern Chile. Bot. Mus. Leafl. Harvard Univ. 23:61-92. 1971.
3. Four new Brunfelsias from northwestern South America. Bot. Mus. Leafl. Harvard Univ. 23:245-272. 1973.
4. Latua. In H. Schleiffer, ed. Sacred narcotic plants of the New World Indians. Hafner Press. New York. Pp. 134-138. 1973.
5. Two new Brazilian species of Brunfelsia. Bot. Mus. Leafl. Harvard Univ. 24:37-48. 1974.
6. Cannabis: an example of taxonomic neglect. Bot. Mus. Leafl. Harvard Univ. 23:337-367. 1974. (with R.E. Schultes, W.E. Klein & T.E. Lockwood).
7. Nutritional value of coca. Bot. Mus. Leafl. Harvard Univ. 24:113-119. 1975. (with J.A. Duke & D. Aulik).
8. Cannabis: an example of taxonomic neglect. In V. Rubin, ed. Cannabis and culture. World Anthropology Series. Mouton Publishers. The Hague, Pp. 21-38. 1975. (with R.E. Schultes, W.E. Klein & T.E. Lockwood).
9. Orthography of Erythroxylum. Taxon 25:141-144. 1976.
10. Tommie Earl Lockwood, an obituary. Solanaceae Newsletter 3:22. 1976.
11. Systematics and biogeography of Brunfelsia, abstract. The Biology and Taxonomy of the Solanaceae Abstract Volume. University of Birmingham, England. P. 40. 1976.
12. Systematics of the genus Brugmansia, a summary of the work of Tommie E. Lockwood. The Biology and Taxonomy of the Solanaceae Abstract Volume. University of Birmingham, England. P. 54. 1976.
13. Brunfelsia. In L.H. Bailey Hortorium, ed. Hortus Third. Macmillan Co. New York. P. 185. 1976.

14. Determination of cocaine in some South American species of Erythroxylum using mass fragmentography. Phytochemistry 16:1753-1755. 1977. (with B. Holmstedt, E. Jaatmaa & K. Leander).

15. Brunfelsia in Ethnomedicine. Bot. Mus. Leafl. Harvard Univ. 25:289-320. 1977.

16. Book Review: Cocaine: a drug and its social evolution. The Apothecary 90(1):44. 1978.

17. Virola as an oral hallucinogen among the Boras of Peru. Bot. Mus. Leafl. Harvard Univ. 25:259-272. 1978. (with R. E. Schultes & T. Swain).

18. Chromosome numbers in neotropical Erythroxylum (Erythroxylaceae). Bot. Mus. Leafl. Harvard Univ. 26:203-209. 1978. (with L. Rudenberg & C.W. Greene).

19. IOPB Chromosome Report LX: Erythroxylaceae. Taxon 27:224. 1978. (with L. Rudenberg & C.W. Greene).

20. Cocaine in blood of coca chewers. Bot. Mus. Leafl. Harvard Univ. 26:199-201. 1978. (with B. Holmstedt, J.E. Lindgren & L. Rivier).

21. A new section of Brunfelsia: Section Guianenses Plowman. In J.G. Hawkes, ed. Systematic notes on the Solanaceae. Bot. J. Linn. Soc. 76:294-295. 1978.

22. Cocaine in blood of coca chewers. J. Ethnopharmacol. 1:69-78. 1979. (with B. Holmstedt, J.E. Lindgren & L. Rivier).

23. The genus Brunfelsia: a conspectus of the taxonomy and biogeography. In J.G. Hawkes, R.N. Lester & A.D. Skelding, eds. The biology and taxonomy of the Solanaceae. Academic Press. New York. Pp. 475-491. 1979.

24. Coca pests and pesticides. J. Ethnopharmacol. 1:263-278. 1979. (with A.T. Weil).

25. Botanical perspectives on coca. J. Psychedelic Drugs 11:103-118. 1979.

26. IOPB Chromosome Reports LXIII. Brunfelsia (Solanaceae). Taxon 28:268-269.

27. The ethnobotany of Brugmansia by T.E. Lockwood. J. Ethnopharmacol. 1:147-164. 1979. (ed. with R.E. Schultes).

28. The identity of Amazonian and Trujillo coca. Bot. Mus. Leafl. Harvard Univ. 27:454-468. 1979.

29. Aspectos botanicos de la coca. In F.R. Jeri, ed. Cocaina 1980: Actas del seminario interamericano sobre aspectos medicos y sociologicos de la coca y la cocaina. Pacific Press. Lima. Pp. 100-117. 1980.

30. Botanical perspectives on coca. In F.R. Jeri, ed. Cocaine 1980: Proceedings of the interamerican seminar on medical and sociological aspects of coca and cocaine. Pacific Press. Lima. Pp. 90-115. 1980.

31. Letter from Brazil. Field Museum Bulletin 51(7):24-25. 1980.

32. Coca. Field Museum Bulletin 51(6):17-21. 1980.

33. Chamairo: Mussatia hyacinthina, an admixture of coca from Amazoninan Peru and Bolivia. Bot. Mus. Leafl. Harvard Univ. 28:253-262. 1980.

34. Indole alkaloids in Amazonian Myristicaceae: field and laboratory research. Bot. Mus. Leafl. Harvard Univ. 28:215-234. 1980. (with B. Holmstedt, J.E. Lindgren, L. Rivier, R.E. Schultes & O. Tovar).

35. Amazonian coca. J. Ethnopharmacol. 3:195-225. 1981.

36. Five new species of Brunfelsia from South America (Solanaceae). Fieldiana Botany, n.s., No. 8:1-16. 1981.

37. Brugmansia (Baum-Datura) in Sudamerika. In G. Volger, ed., Rausch und Realitat: Drogren in Kulturvergleich. Materialienband zu einer Ausstellung des Rautenstrauch-Joest-Museums fur Volkerkund der Stadt Koln. 2:436-443. 1981.

38. Fate of cocaine in the Lymantriid Eloria noyesii, a predator of Erythroxylum coca. Phytochemistry 20:2499-2500. 1981. (with M.S. Blum & L. Rivier).

39. The identification of coca (Erythroxylum supp.): 1860-1910. Bot. J. Linn. Soc. 84:329-353. 1982.

40. Heliconia zebrina: a new name for a handsome Peruvian Heliconia (Musaceae). Baileya 21:149-157. (with W.J.E. Kress & H. Kennedy).

41. Biosystematics and evolution of cultivated coca (Erythroxylaceae). Systematic Botany 7:121-133. 1982. (with B.A. Bohm & F.R. Ganders).

42. The effects of field preservation on alkaloid content of fresh coca leaves. (Erythroxylum spp.). J. Ethnopharmacol. 6:287-291. 1982. (with M.J. Balick & L. Rivier).

43. Three new species of Erythroxylum (Erythroxylaceae) from Venezuela. Brittonia 34:442-457. 1982.

44. Cocaine and cinnamoylcocaine content of thirty-one species of Erythroxylum (Erythroxylaceae). Ann. Bot. (London) 51:641-659. 1983. (with L. Rivier).

45. Collecting in the Upper Amazon. Field Museum Bulletin 54(3):8-13. 1983.

46. Erythroxylaceae. In S.A. Mori, B.M. Boom, A.M. de Carvalho & T.S. dos Santos. Southern Bahian Moist Forests. Bot. Rev. 49:214-215. 1983.

47. The effects of field preservation on alkaloid content in fresh coca leaves (Erythroxylum spp.). Atti del II Seminario Internazionale sulle Piante Medicinali ed Aromatiche. Citta de Castello. Pp. 81-86. 1983. (with M.J. Balick & L. Rivier).

48. New species of Erythroxylum from Brazil and Venezuela. Bot. Mus. Leafl. Harvard Univ. 29:273-290. 1983.

49. Morphological studies of archaeological and recent coca leaves (Erythroxylum spp.). Bot. Mus. Leafl. Harvard Univ. 29:297-341. 1983. (with P.M. Rury).

50. Useful plants of the Siona and Secoya Indians of eastern Ecuador. Fieldiana Botany n.s., 15:1-63. 1984. (with W.T. Vickers).

51. The ethnobotany of coca (Erythroxylum spp., Erythroxylaceae). In G.T. Prance & J.A. Kallunki, eds. Ethnobotany in the Neotropics. Advances in Economic Botany 1:62-111. 1984.

52. The origin, evolution and diffusion of coca (Erythroxylum spp.) in South and Central America. In D. Stone, ed., Pre-Columbian Plant Migration. Papers of the Peabody of Archaeology and Ethnology 76:125-163. 1984.

53. Alkaloids of some South American Erythroxylum species. Phytochemistry 24:2285-2289. 1985. (with Y.M.A. El-Imam & W.C. Evans).

54. Brunfelsamidine: a novel convulsant from the hallucinogenic plant Brunfelsia grandiflora. Tetrahedron Letters 26:2623-2624. 1985. (with H.A. Lloyd, H.M Fales, M.E. Goldman, D.M. Jerina & R.E. Schultes).

55. A new species of Erythroxylum (Erythroxylaceae) from Suriname and Venezuela. Phytologia 58:172-177. 1985.

56. Cocaine in herbal tea. J. Amer. Med. Assoc. 255(1):40. 1986. (with R.K. Siegel, M.A. Elsohly, P.M. Rury & R.T. Jones).

57. New taxa of Erythroxylum (Erythroxylaceae) from the Amazon Basin. Suplemento, Acta Amazonica 14(1/2):117-143. 1984. (appeared in 1986).

58. A new species of Lasiadenia (Thymelaeaceae) from Venezuela. Brittonia 38(2):114-118. (with L.I. Nevling, Jr.).

59. Coca chewing and the botanical origins of coca (Erythroxylum spp.) in South America. Pp. 5-33. In D. Pacini & C. Franquemont, eds. 1986. Coca and Cocaine: Effects on people and policy in Latin America. Co-published by Cultural Survival, Cambridge, Massachusetts, and Latin American Studies Program, Cornell University, Ithaca.

60. Four new species of Erythroxylum from northeastern Brazil. Brittonia 38(3): 189-200. 1986.

61. Type photographs at Field Museum of Natural History. Taxon 35:932-934. 1986. (with W.E. Grime).

62. Ten new species of Erythroxylum (Erythroxylaceae) from Bahia, Brazil. Fieldiana, Botany, n.s., 19:1-41. 1987.

63. Book review: Economic and medicinal plant research, edited by H. Wagner, H. Hikino & N.R. Farnsworth. American Scientist 75(2):207-208. 1987.

64. Type photographs at Field Museum of Natural History (reprinted). Taxon 36:425-428. 1987. (with W.E. Grime).

65. Book review: Cocaine: a drug and its social evolution, revised edition, by L. Grinspoon & J.B. Bakalar. Quarterly Review of Biology 62:224-225. 1987.

66. Book review: Le genre Inga (Legumineuses, Mimsoideae) en Guyane Francaise. Systematique, Morphologie des formes juvenile, Ecologies, by Odile Poncy. Economic Botany. 40(4):501-502. 1987.

67. Flavonoid variation in Erythroxylum. Phytochemistry. 18 pp. (with B.A. Bohm, T. Loo and K.W. Nichols). 47(3):833-837. 1988.

68. Erythroxylaceae. In R.A. Howard, ed. Flora of the Lesser Antilles. Harvard University Press. 4:543-551. Harvard University, Cambridge. 1988.

69. New species and a new combination of Erythroxylum (Erythroxylaceae) from

Amazonian Peru. Contribution to the study of the flora and vegetation of Peruvian Amazonia. XIV. Candollea. 43(1):421-431. 1988.

70. New taxa of Erythroxylum (Erythroxylaceae) from the Venezuelan Guayana. Brittonia 40(3):256-268. 1988.

71. Erythroxylaceae. In G. Harling & L. Andersson, eds. Flora of Ecuador. 44 pp.

72. Erythroxylaceae. In J.A. Steyermark, ed., Flora of the Venezuelan Guayana. 27 pp. Missouri Botanical Garden. Accepted for publication.

73. Erythroxylaceae. In W.D. Stevens, ed. Flora de Nicaragua. Missouri Botanical Garden. 18 pp. Accepted for publication 12 Feb 1987.

74. Erythroxylaceae. In B. Hammel & M. Graham, eds. Manual Flora of Costa Rica. Missouri Botanical Garden. 12 pp. Submitted for publication 22 May 1987.

75. Erythroxylaceae. In W. Burger, ed. Flora Costaricensis. Fieldiana Botany, n.s. Submitted to editor 22 May 1987.

76. A revision of the South American species of Brunfelsia (Solanaceae). 434 pp., 115 figs. In preparation.

77. The Ethnobotany of Chinchero, an Andean Community in Southern Peru. (with Christine Franquemont, *et al.)*, 148 pp., 36 figs. Fieldiana Botany, n.s. Submitted for publication.

NEWS and COMMENTS

NEWS:

POSEY AND KAYAPO RELEASED

The Brazilian Supreme Court has granted habeas corpus petitions filed on behalf of Darrell A. Posey, Paulinho Paiakan, and Kube-i Kayapo. Thus the charges against them under the Brazilian Foreign Sedition Act (*Journal of Ethnobiology* 8(2):223) have been dropped. The murder of environmentalist and rubber tapper union activist Francisco "Chico" Mendes Filho at his home in Xapuri, Acre, Brazil, 22 December 1988, however, brings home the fact that environmental politics in Brazil are played for high stakes. The National Wildlife Federation is awarding a special Conservation Achievement Award posthumously to Mr. Mendes Filho for "his lasting contribution to global conservation." The United Nations recognized his efforts on behalf of tropical forest conservation in 1987.

—*Anthropological Newsletter* April 1989, pg. 15
International Wildlife 19(2):29-30, March-April 1989

OREGON SCHOOLGIRL'S "ARREST" A CASE OF SOUR GRAPES

Eleven-year-old Sally Johnson was surprised when Oregon State trooper Rod Beach pulled her school bus over and demanded that she identify herself. She was shocked when he boarded the bus and asked, "Can I have your lunch?" "Am I going to be arrested?" she asked. No, but he confiscated the grapes her mother had packed for her that morning. Sally's mother heard of the federal warning about cyanide contaminated Chilean grapes too late that morning, so had called the state patrol to intercept the bus carrying Sally and the Pleasant Valley School choir en route to a concert engagement.

—UPI, Seattle *Post-Intelligencer* March 16, 1989, pg. C-1

52 MILLION TREES IN GUATEMALA EQUAL ONE POWER PLANT IN CONNECTICUT

Applied Energy Resources, Inc., of Arlington, Virginia, in cooperation with the World Resources Institute purposes to invest $16 million to plant 52 million trees in Guatemala over the next 40 years to mitigate the atmospheric CO_2 load to be generated over the life span of a power plant they plan to build in Connecticut.

—*International Wildlife* 19(2):29, March-April 1989

Ironic given Guatemala's despicable human rights record: Ed.

THE TEXAS PEYOTE HARVEST, A THRIVING MICRO-INDUSTRY

National Public Radio on March 8, 1989 aired a feature by John Burnett on the state-licensed harvest of peyote cacti (*Lophophora williamsoni*) in south Texas, the primary source of supply of this sacramental plant for the 200,000 members of the Native American Church. The harvest is concentrated in the vicinity of Rio Grande City, Webb Co., Texas and is tightly regulated by the state Department of Public Safety which "accounts for each button in triplicate." Pickers earn $80-$90 per 1000 "buttons" which are dried in the sun on plywood sheets in

Ornaldo Reynosa's backyard. Reynosa also mainatains a peyote shrine in his yard that draws a steady stream of peyotists. Free-lance pickers risk arrest for a third degree felony.

ANNOUNCEMENTS

WORKSHOP IN ETHNOBOTANY to be conducted by Dr. Richard I. Ford, Dean of Research and Professor of Anthropology, University of Michigan at Southern Methodist University's Fort Burgwin Research Center, Taos, New Mexico July 30-August 5, 1989. The course will provide intensive instruction in modern techniques of archaeobotany using the Taos area as a laboratory. For more information contact Dr. Patricia Crown, Department of Anthropology, Southern Methodist University, Dallas, TX 75275 (505-983-5342).

THIRTEENTH ANNUAL ETHNOBIOLOGY CONFERENCE of the Society of Ethnobiology will be in Phoenix, AZ, March 21-24, 1990 (see pages 129-131). The Desert Botanical Garden and the Department of Anthropology of Arizona State University will co-host the meetings. For information contact Gary Nabhan at the Garden, 1201 N. Galvin Pkwy., Phoenix, AZ 85008 (602-941-1225).

SOCIEDAD ARGENTINA DE BOTANICA announces the third Argentinian and sixth Latin American symposium on pharmacological botany, to be held May 6-12, 1990 at Corrientes, Argentina. A session on "Botany and Ethnobotany" is planned. For further details contact Ing. Agr. Gustavo C. Giberti, Comisión Organizadora del III Simposio Argentino y VI Latinoamericano de Farmacobotánica, Colegio Oficial de Farmacéuticos y Bioquímicos de la Capital Federal, Rocamora 4045, 1184—Buenos Aires, ARGENTINA.

TRADITIONAL KNOWLEDGE AND RENEWABLE RESOURCE MANAGEMENT in Northern Regions, edited by Milton Freeman and Ludwig N. Carbyn, has been published recently by the Boreal Institute for Northern Studies. The volume is based on a Boreal Institute workshop on "Knowing the North." Contributions cover the environmental ethics of the Chisasibi Cree, reindeer pastoralism in Norway, self-regulation of an Athapaskan salmon fishery in Alaska, and Canadian and Alaskan co-management arrangements involving traditional and Western scientific resource management strategies. The volume is available for US$24 from the Boreal Institute at CW401, Biological Sciences Bldg., University of Alberta, Edmonton, Alberta T6G 2E9, CANADA (403-432-4999/4512).

WORLD CONSERVATION STRATEGY 2 ANNOUNCED. On urging by the Indigenous Survival International (ISI), the World Conservation Strategy promulgated jointly by the International Union for the Conservation of Nature (IUCN), the World Wildlife Fund (WWF), and the United Nations Environment Programme (UNEP) has been revised to recognise a significant role for indigenous peoples in conservation and sustainable development. A draft chapter for this World Conservation Strategy was published in "Tradition, Conservation and Development, Occasional Newsletter of the Commission on Ecology's Working

Group on Traditional Ecological Knowledge," No. 6, October 1988. Contact Dr. Graham Baines, Chairman, IUCN/COE Traditional Ecological Knowledge Working Group, at 32 Nargong Street, The Gap, Brisbane 4061, AUSTRALIA (07-300-1167) for more details.

CONSERVATION OF ZULU MEDICINAL PLANTS SUBJECT OF STUDY. Dr. A.B. Cunningham of the Institute of Natural Resources, University of Natal, Pietermaritzburg, Republic of South Africa, writes in the "Tradition, Conservation and Development" newsletter of a recently completed two-year study to develop a conservation policy on commercially exploited Zulu medicinal plants, a study jointly funded by herbalists, herb traders, and government conservation departments. Dr. Cunningham calls for drafting and implementing international ethical guidelines relating to the acquisition and exploitation of customary knowledge. He cites the example of bee soporifics developed by native bee-keepers as having potential application to the control of aggressive African bees. He argues that any patent agreements derivative of this traditional discovery should "include a clause ensuring that a proportion of the financial returns should go into a fund for educational or legal resources of the group who had the knowledge in the first place."

C. EARLE SMITH, JR. MEMORIAL ISSUE

Volume 10, Number 1 (Summer 1990) is planned as a dedication to the memory of C. Earle Smith, Jr. ("Smitty"). The Society of Ethnobiology has established a special fund to receive voluntary contributions in Smitty's name to underwrite this issue. Please send checks payable to the Society of Ethnobiology to Cecil H. Brown (Secretary/Treasurer), Department of Anthropology, Northern Illinois University, DeKalb, IL 60115, USA.

At the same time, the *Journal* welcomes papers to be considered for publication in the memorial issue. Send manuscripts to the Editor by December 1, 1989, to allow time for review and revision (see inside front cover for address).

SOCIETY OF ETHNOBIOLOGY THIRTEENTH ANNUAL CONFERENCE

CALL FOR PAPERS — FILMS — REGISTRATION

March 21-24, 1990

Arizona State University
Tempe, Arizona
Desert Botanical Garden
Phoenix, Arizona

SCHEDULE

Wednesday, March 21
Afternoon .... Registration and Ethnobiological Films
Evening .... Reception

Thursday, March 22
All Day .... Plenary and Technical Sessions
Evening .... ASU Open House and Ethnobiological Films

Friday, March 23
All Day .... Technical Sessions and Workshops
Evening .... Banquet and Desert Botanical Garden Open House

Saturday, March 24
All Day .... Field trips to Tonto Basin Digs and Agave Fields, or
Half Day .... Hispanic Medicinal Herb Markets and Gardens

REGISTRATION FEES: Preregistration (before February 15) — $25 Student, $30 Regular. Late Registration (after February 15) — $30 Student, $40 Regular.

DEADLINE FOR ABSTRACT SUBMISSIONS FOR PRESENTED PAPERS, POSTER PAPERS, FILMS AND VIDEOS: January 15, 1990 (early submissions encouraged).

INSTRUCTIONS/GUIDELINES: In order to present a paper, poster or film, one or more authors must be members of the Society. For regular membership, please send $20 checks payable to the Society to: Dr. Cecil Brown, Society of Ethnobiology, c/o Dept. of Anthropology, Northern Illinois University, DeKalb, IL 60115.

Oral presentations will be 20 minutes plus questions, except for novel interdisciplinary papers selected for the plenary session. Films and videos should state format (16mm, 35mm, VHS ½ or ¾, BETA, etc. and time length). All films and videos should have been produced in the last four years on topics clearly ethnobiological.

LAWRENCE AWARD

The Society of Ethnobiology will offer an award in honor of Barbara Lawrence for the best paper submitted by a student for presentation at the annual meeting. Papers on any subject within the realm of ethnobiology are eligible for the competition. The prize will be a significant honor for the recipient and comes with a substantial monetary award.

The prize honors Barbara Lawrence who was curator of Mammals at the Museum of Comparative Zoology. She was one of the first to recognize the potential of collections of animal remains associated with human habitation sites and was on the forefront of advocating analysis of these assemblages. Her work on aboriginal dogs and her studies of faunal remains excavated from sites in Turkey are particularly well known.

The high standards held by Barbara Lawrence will be the guiding principal in choosing the award-winning paper. The competition is open to any member who is a student (or has held the Ph.D. degree less than one year). Papers submitted for this competition can be presented in orally or in a poster session.

Manuscripts submitted for this competition must be single authored; joint efforts will not be considered. Manuscripts are judged solely on quality, originality, and presentation of research. They should follow the *Journal of Ethnobiology* format and should be sufficiently precise and documented to enable the reviewing committee to judge their merits. Manuscripts are limited to eight double spaced, typed pages including a required abstract but excluding copies of figures, tables, and references.

Papers submitted for this competition should be acompanied by a cover letter indicating that the author is a Society member and he/she meets the criteria listed above. The deadline for receipt of papers is 15 January 1990.

REGISTRATION AND ABSTRACT FORMS

Registration and abstract forms will be mailed to the Society of Ethnobiology membership and to others on our mailing list. If you do not receive them, they may be obtained by writing to the address given below. Please direct all correspondence regarding the Thirteenth Annual Conference, including the Lawrence Award, to: Ethnobiology Conference, c/o Dr. Gary Nabhan, Desert Botanical Garden, 1201 North Galvin Parkway, Phoenix, AZ 85008, U.S.A.

HOTEL AND TRAVEL OPTIONS

Phoenix and Tempe are in the Salt River Valley of the Sonoran Desert. We are served by Sky Harbor International Airport, AMTRAK, and Greyhound Bus Lines.

A block of rooms has been reserved for "The Desert Botanical Garden" at the Howard Johnson, Tempe. Call (602) 967-9431 for reservations.

A group travel rate by train from Chicago has been arranged by Keith Crotz. Call (309) 274-5254 if you are interested.

January 27, 1989

Dr. Willard Van Asdall, Editor
Journal of Ethnobiology
Arizona State Museum
The University of Arizona
Tucson, Arizona 85721

Dear Will,

I am pleased to see my paper in print. The *Journal* did a nice job of typesetting and reproduction of the photographs. One problem arose because of a change suggested by one of the reviewers. The order of two figures was changed since the paper and figures were first submitted: figures four and five were reversed in order. Unfortunately, the original photographs were not marked with the new figure numbers as they were not returned to me. In the printed paper figure four appears with the photograph for figure five and the caption for figure four, and figure five appears with the photograph which should be figure four. I would appreciate it if the *Journal* could print an erratum to clarify this in the next issue.

Regards,

Leslie

Leslie M. Johnson Gottesfeld

ERRATUM

I regret the errors in the paper by Gottesfeld and Anderson, **"Gitksan traditional medicine: Herbs and healing"** (Vol. 8, No. 1). The errors referred to in the above letter occur on pages 23 and 27: the caption for Fig. 4 on page 23 should read **"Freshly gathered wild calla *hisgahldaatsxw*** *(Calla palustris).*" and the caption for Fig. 5 on page 27 should read **"Dried *gahldaats* root slice** *(Nuphar polysepalum).*" Please make the corrections in your copies of the *Journal*.

—W.V.

NOTICE TO AUTHORS

The *Journal of Ethnobiology* accepts papers on original research in ethnotaxonomy and folk classification, ethnobotany, ethnozoology, cultural ecology, plant domestication, zooarchaeology, archaeobotany, palynology, dendrochronology and ethnomedicine. Authors should follow the format for article organization and bibliographies from articles in this issue. All papers should be typed double-spaced with pica or elite type on 8½ x 11 inch paper with at least one inch margins on all sides. The ratio of tables and figures to text pages should not exceed 1:2-3. Tables should not duplicate material in either the text or graphs. All illustrations are considered figures and should be submitted reduced to a size which can be published within a journal page without further reduction. Photographs should be glossy prints of good contrast and sharpness with metric scales included when appropriate. All illustrations should have the author(s) name(s) written on the back with the figure number and a designation for the top of the figure. Legends for figures should be typed on a separate page at the end of the manuscript. Do not place footnotes at the bottom of the text pages; list these in order on a separate sheet at the end of the manuscript. Metric units should be used in all measurements. Type author(s) name(s) at the top left corner of each manuscript page; designate by handwritten notes in the left margin of manuscript pages where tables and graphs should appear.

If native language terminology is used as data, a consistent phonemic orthography should be employed, unless a practical alphabet or a more narrow phonetic transcription is justified. A brief characterization of this orthography and of the phonemix inventory of the language(s) described should be given in an initial note. To increase readability native terms should be indicated as ***bold-face italics*** to contrast with the normal use of *italic* type for foreign terms, such as latin binomials. If necessary, the distinction between lexical *glosses*, i.e., English language approximations of a term's referential meaning, and precise English equivalents or definitions should be indicated by enclosing the gloss in single quotation marks.

Authors must submit two copies of their manuscript plus the original copy and original figures. Papers not submitted in the correct format will be returned to the author. Submit your manuscripts to:

DR. WILLARD VAN ASDALL, Editor
Journal of Ethnobiology
Arizona State Museum, Building 26
University of Arizona
Tucson, Arizona 85721

NEWS AND COMMENTS

Individuals with information for the "News and Comments" section of the *Journal* should submit all appropriate material to Eugene Hunn, Department of Anthropology, DH-05, University of Washington, Seattle, Washington 98195.

BOOK REVIEWS

We welcome suggestions on books to review or actual reviews from the readership of the *Journal*. Please send suggestions, comments, or reviews to Terence E. Hays, Department of Anthropology and Geography, Rhode Island College, Providence, Rhode Island 02908.

SUBSCRIPTIONS

Subscriptions to the *Journal of Ethnobiology* should be addressed to Cecil H. Brown, Department of Anthropology, Northern Illinois University, Dekalb, Illinois 60115-2854. Subscription rates are $40.00, institutional; $20.00 regular members, for U.S., Canada, and Mexico; foreign subscribers add $8.00. Write checks payable to *Journal of Ethnobiology*. Defective copies or copies lost in shipment will be replaced if written request is received within one year of issue.

CONTENTS