THE VALUE AND POTENTIAL OF ETHNOBOTANY

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The science of ethnobotany is almost a non-science, because it is a division of anthropology which has derived largely from history. In the early days of the science, ethnology consisted primarily of travellor's tales and the science of archaeology consisted of exploration of classical buildings and Classical works of art. During that period, ethnobotany and archaeological botany, for all intents and purposes, did no exist. References to plants in travellor's stories tended to be exagerations of the bizarre. Plant remains encountered in archaeological excavation were ignored, or, if they were found in quantity and well-preserved like the wheat recovered in Egyptian tombs, they gave rise to stories such as that of the germination seeds which had been incapable of germination for many millenia.

Within the last twenty years, ethnobotany in all its aspects has come into good repute. Former lists of plant names, compiled by recording native names given by informants and then looking up corresponding scientific names in an enclyclopaedia or dictionary, have now been surplanted by the careful collection of plant specimens, identified by qualified botanists, in conjunction with a study of local linguistics. (Berlin, *et al.*, 1974). Other ethnobotanical studies record the nutrition values of food plants in a local dietary system or record the use of the plants employed by a particular group of people. As long as the recorded information is supported by herbarium specimens of the plants collected in the field at the same time, so that there is no confusion regarding the correct scientific name for the plant in question, the fund of valuable information in ethnobotany will grow.

The beginnings of archaeological botany date from the discovery of tombs in Egypt and Peru, where dry climates had resulted in the preservation of dessicated grave offerings. However, the early plant remains were discussed without any regard to context in chronology or culture. The drought which exposed the remains of the Swiss lake dwellings in Europe also exposed many plant remains which had been deposited by the lake waters. Until recently, it was assumed that plant remains could not be recovered from open sites or in areas of high rainfall-nor were there many botanists who were willing to look at fragments discovered by an archaeologist! During the 1940's, several events changed the course of archaeological botany. Junius Bird's excavations in Huaca Prieta, Peru, disclosed plant remains in a coastal fishing village which dated to 2,500 BC, and they included some of the earliest cultivated plant parts known from that time from an American site (Whitaker & Bird, 1949). All of the plant material exposed in the excavation of Bat Cave, New Mexico, in the United States in 1947 was saved at the insistence of a botany student on the expedition. From this material, the first evolutionary sequence of maize was reconstructed, which illustrated the changes in this premier American crop from 2,500 BC to AD 1500 in New Mexico (Mangelsdorf & Smith, 1949; Smith, 1950). Since that beginning, the techniques for recovery of archaeological plant remains have progressed to the extent today that we are able to recover seeds less than 1 mm in diameter, from wet habitats where only carbonized plant parts are found (Linares, *et al.*, 1975).

Collection of Ethnobotanical Information

During the past several years, techniques have evolved for the collection of ethnobotanical information in such a manner that much of the information is genuine. Perhaps the most important facet of the investigation is the initial accumulation of background collection, that is a selection of the cultivated and the wild plants of the area to be studied. Following the preliminary introductions with the leading men of the locality (Presidente Municipal, Alcalde, Jefe de Policía and others), the best pursuit is general plant collecting. Utilizing a guide, who may be be a woodsman of the area for longer trips into the forest, or the local children around a settlement, a general collection of plant material is made in a large plastic bag. Each afternoon, this is brought into the settlement to be sorted in public and placed in the plant press, to flatten and partially dry. During the process of making complete notes about the biology and the plants, the local children and adults gather to see what is taking place. Within a short while, many persons are volunteering information about the plants going into the press. Often someone will volunteer to guide the ethnobotanist to see some particularly important (to the guide) plant, and many people will bring specimens of medicinal plants. Young persons will disclose that their parents employ certain plants for one use or another. The discussion on the street around the ethnobotanist provides checks of the information, because one person will challenge another over plant identities and usage.

This process works equally well for the collection of information to check later notes made for a study of the ethnography of a living people, or to be used as background for the interpretation of archaeological botanical remains. In fact, for the latter, it is most important that the local survey of wild and cultivated plants is thorough, because very often the information volunteered by a curious group of local people will include references to those plants formerly used but today nearly forgotten. Sometimes this relates to a species of plant which is relatively common in the archaeological fill. Perusal of the reports of archaeological botanists who study cultivated plants which were grown millenia ago in the past are still available in the local market. Many of the merchants in the market are very pleased to be able to help the ethnobotanist identify unusual local crops, and they will often introduce the botanist to a person who grows the plants, so that he can see not only the source plant itself, but also techniques for cultivation and harvesting.

Children are among the best informants. Everywhere, they are proud of their community and of their relatives. They wish to tell the ethnobotanist all the unsual things which they know. A friendly ear will often provide excellent rewards. It sometimes also provides amazingly intimate information. It is best not to pay children for information, unless the ethnobotanist has enough sweets or chewing gum to give something to every child in the group. Many parents do not wish children to receive anything of value unless a definite formal arrangement has been made with the parent's knowledge. Adult informants, of course, expect to be rewarded for their value to the ethnobotanist if they spent a substantial amount of time providing service. However, the most trustworthy information is frequently that which is volunteered during the preparation of herbarium specimens, through casual conversations in the market or on the street corner. As in the United States, one always has to be carefull of information volunteered in a bar!

Value of Ethnobotanical and Archaeologica Botanical Information

In many ways, the archaeological botanical information which has been developed from dried plant material or from carbonized plant material has already proven its value. On the other hand, the potential value of ethnobotanical information has not been developed. This is relatively easy to illustrate through suggestive examples from Mexico.

For many years, the leadership in nutritional research has been centered in Europe and the United States, or the training for nutrition research has been in these areas of the world. As a consequence, nutritionists have developed a dietary pattern which has been accepted as a standard for both the components of the diet (i.e., amounts of carbohydrates, proteins, vitamins and minerals which must be ingested for good health) and for the energy level of the diet (the number of kilocalories needed for normal daily tasks and growth or replacement of tissues). In fact, two standards exist for calories, one based on measurements made of populations in northern Europe and another based on measurements of basal metabolism and food intake. The populations utilized for these studies were of Caucasian stock and European extraction.

In the nutritional literature for the world, the figures produced in these studies have now been adopted as standards of comparison. Even the World Health Organization bases estimates and predictions on these standards.

Some years ago, Dr. Aubrey W. Williams became interested in the dietary pattern which he found in villages in Mexico. In order to study the food intake of his associates and friends in three villages, he attempted to make as exact a record as possible (Williams, 1973). From data on 130 individuals. Williams found that the average daily energy intake was about 1,450 calories. When this was compared with the Normal Canadian Diet, often utilized as a standard, it became apparent that the adult males should have been starving and unable to work, because a Canadian male doing hard labor has a calorie intake of about 4,000 calories daily. By actual observation, in fact, not only were the Mexican adult males accomplishing all of the hard labor entailed in their positions as farmers, but neither were any other members of these communities observed to exhibit any stress which could be interpreted as starvation from an inadequate calorie intake.

Unfortunately the compostions of the diets for the people in the three Mexican villages were not calculated from a standard table nor were facilities available to ascertain the true proportions of carbohydrates, proteins, fats, vitamins and minerals. If these proportions had been compared, it is probable that differences from the Normal Canadian diet Would have been found.

This immediately points to one of the values of an exact knowledge of the food energy needs of people in every portion of the world. Nutritional patterns cannot be accurately assessed until the actual needs of the local populations are known. In times of famine, the amount of food needed to sustain the population of the three Mexican villages examined would be much less than would be needed by the people of three villages in Canada if the latter people were of European extraction. If they were of American Indian background we would have no accurate knowledge of their daily calorie needs.

Another facet of the nutritional needs of people around the world concerns the pattern of carbohydrates, proteins, etc., which is needed for normal functioning of these individuals. We are already aware of culturally biased food needs, such as the uselessness of providing animal proteins for the Hindu people of India or elswhere, because they do not eat animal proteins. We also are aware that many persons of

Chinese or African extractions lack the enzymes known as lactases, so that it would be useless to supply these people with milk which they cannot digest. From my own observations, I suspect that many Africans are completely healthy and normal while subsisting on a diet with a very large carbohydrate component and a low protein component, but this has never been examined in sufficient detail to be proven.

It is evident that the collection of exact nutritional information around the world is a pressing need. World population is growing in many areas, and food produced in other areas will be needed to feed the increase. Without a precise knowledge of specific dietary requirements, much effort and money may be wasted in producing too much of the incorrect kinds of foods. As I have already mentioned, the provision of food for emergencies cannot be economically and intelligently realized without a knowledge of the specific nutritional needs of a people.

The usefulness of archaeological botany has already been proven. The initial use of information about plants from an archaeological site concerns the environment of an area over the period of time represented by the deposit from which the plant remains were recovered. Over very long periods of time, the climate of any area of the earth's surface has changed markedly. Over the shorter periods of time represented by the archaeologically recoverable evidences for human occupations, climatic change may have been relatively minor. In Mexico, some of the longest chronological series known have been found. The excavations of the caves and open sites in the Tehuacan Valley provide a record of human occupation from probably about 10,000 BC with a record of plant use from about 7,000 BC. Faunal remains from the earlier levels record a change which is probably climatic, but no plant remains were recovered from the oldest level of Coxcatlan Cave. From the five caves of the Tehuacan Valley from the 7,000 BC level upward to AD 1,500 an interesting assortment of plant remains were recovered. The species represented in this collection indicate that no major change in the species composition of the flora occurred and, therefore, it is unlikely that a prolonged major change in the climate occurred. The earliest plant remains represent species which are still present in the flora of the valley.

The plants found in the Tehuacan Valley excavations represent raw materials, foods, and medicines of the people who occupied the caves. From this standpoint, the plant remains provide a reasonably clear picture of the food preferences of the cave occupants throughout the entire period. It does not provide a key to the population level. So far as nutritional pattern is concerned, it provides a suggestion, but it is possible and probable that other elements of diet are not represented among the plant remains recovered. One of the aspects of diet which is clearly indicated, is a gradual change in dietary intake from largely wild plant foods in the early levels to a large proportion of cultivated plant foods in the later levels. For example, maize is first found in levels dated to about 5,000 BC. However, at this level maize is scanty, the cobs are very small with few kernels, and it cannot have been an important food plant. The evidence is that the major grain was seed of *Setaria*, which was gradually replaced by maize as improvements made this a more productive cereal.

When combined with the faunal remains (Flannery, 1967), the two sets of evidence indicate a change in the protein component of the diet in Mexico at an early time. The hunting of animals supplied a substantial part of the dietary protein in the early levels of occupation when most of the plant portion of the diet was gathered from the wild vegetation. As more reliance was placed on cultivation to supply food resources, apparently the amount of available animal protein decreased, perhaps due to too intensive hunting. The protein deficiency was compensated for by the increased use of beans in the upper habitation levels until the diet stabilized on a pattern of maize, beans, squash, chilis and avocados, with additional foods as they are available in the Valley-very much like the pattern of diet for rural people in the area today.

Another facet of the activities of the early inhabitants of the Tehuacan Valley is indicated by the remains of fiber plants. Apparently from an early period, the processing of plant parts into fiber was a part of human activities in the area. *Hechtia* and *Tillandsia* in the Bromeliaceae were obviously intensively used, but the most important fiber extractions seems to have centered around the various species of Agave which grow in the area. The amount of leaf fragments and partially processed segments of *Agave* present in several of the caves indicates a level of activity far above the amount of fiber extraction which might be needed to supply the needs of the number of inhabitants which we can estimate for the caves. From about 3,000 BC upward, another introduction in the valley adds to the impression of large amounts of resources in fiber production. At his time, cotton was apparenttly brought into the Valley. We have no evidence from the early plant remains nor from the wild vegetation today that *Gossypium* has ever been a native plant in the area.

Perhaps the most important facet of information provided by archaeological plant remains is a biological one. From the early plant remains, it is possible to ascertain which of the remains come from cultivated plants and which were probably collected from wild plants, so long as cultivation permits selection and morphological change. In the case of vegetatively propagated species like *Opuntia* and *Agave*, morphological change does not become apparent because all derivations from the same parental stock will be identical morphologically. When morphological change does occur in species normally planted as annual crops from seed, both the evolutionary progression due to selection and the early wild type forms are identifiable, as we have seen in maize. From this kind of information it is possible to identify related species in cultivation or in the wild plant population. In terms of present day breeding programs for the cultivated crops of the world, this becomes paramount knowledge. The early cultivated forms and the wild species include far more variability and resistance to insect attacks, fungi, bacteria and virus than the highly inbred modern agricultural varieties. On the other hand, they are closely enough related so that it is possible to interbreed these lines of descent to make the modern crop more productive or increase its resistance to a number of pests and diseases. Almost always, the area of origin of the cultivated plants is also the area were the most variable germplasm still abounds. It is important to be able to recognize secondary centers of variation so that these may also furnish gemplasm variability for plant breeding programs.

The extreme importance of finding and preserving biological variability for crop plant species cannot be sufficiently emphasized. In recent years, the major goald of such programs as the improvement of maize has been the distribution of genetically engineered hybrid strains which are remarkably uniform. It is true that they are more *productive* than the old local races of maize, but the old races of maize had accumulated variability which included resistance to the local strains of disease organisms, and even during seasons of severe infestation, part of the crop was harvestable. When a disease attacks the new uniform strains, all of the plants are susceptible and none are harvested. The archaeological plant remains have pointed the way to reinstating useful kinds of variability back into the crops!

SUMMARY

Ethnobotany has become a reputable branch of anthropological research which is of potential value not only for the reconstruction of plant use in the past through the study of archaeological botanical remains, but also for the understanding of modern nutritional patterns and needs among local populations. The origins of archaeological botany and the reconstruction of past subsistence patterns in the New World are discussed. In addition, some of the problems of interpreting human dietary needs based on nutritional standards set for modern populations of different racial extraction and regional adaptation are considered. Finally, it is suggested that the preservation of indigenous crops in a particular region may be of great importance in providing the necessary genetic variability and resistance to local pests and diseases, since modern improved strains may have lost their ability to withstand such attacks in exchange for their increased productivity.

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