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Tapping Our Heritage of Ethnobotanical Lore¹

RICHARD EVANS SCHULTES²

The Space Age is upon mankind. It beckons to incredibly strange and promising areas of new discovery. It is wonderful to be alive at such a time and to dream about what may be ahead in learning. Some of us hope, however, that space study will not lessen the attention given to the many fields anchored on this small globe. One of the many fields of this kind is investigation of the Plant Kingdom as it relates to the liberation of man from pain and sickness.

How are we to proceed in furthering our understanding of this phase of the plant sciences? There are three main methods which may be followed: one is basically bibliographic; two are concerned primarily with field work. Both the bibliographic and the field methods may sometimes of necessity or advantageously be interwoven. These three paths of research are: 1) a survey of the literature for reports of therapeutic uses of or beliefs about plants; 2) the chemical investigation of definite floras or of chosen families or genera of plants in the search for new active principles; 3) the field study of ethnobotany amongst primitive peoples.

Primitive man everywhere lived close to nature. An important—yes, an essential—part of his equipment was a deep and discerning acquaintance with the flora around him. This acquaintance led inevitably to experimentation. From the experimentation there gradually accrued a knowledge of properties, useful and harmful, of many plants. And this knowledge,

tested by time, grew into an integral part of culture and was passed on from generation to generation. Some of it is still with us to-day. It may not, however, be here long.

Civilization is on the advance in many, if not most, primitive regions. It has long been on the advance, but its pace is now accelerated as the result of world wars, extended commercial interests, increased missionary activity, widened tourism. The feverish road-building in Latin America gives us an example of how fast penetration is proceeding. The fact that what our political leaders euphemistically call "progress" is often synonymous with destruction of natural resources is beside the point here. What does concern us is the progressive divorcement of primitive peoples to a greater or lesser degree from dependence upon their immediate environment. The arrival and cheap availability of the aspirin pill, for example, seems often to start an astonishing disintegration of native medical lore. The rapidity of this disintegration is frightening—I doubt that even the field anthropologist is fully aware of its pace. That the aspirin may be more beneficial than herbs and magic is not ours to consider here. What does interest us academically and practically is how to salvage some of the medico-botanical lore before it shall have been forever entombed with the culture that gave it birth.

ETHNOBOTANY—the study of plants as they relate to human affairs, especially amongst primitive peoples—is not new. The world's literature from earliest written records is replete with references to useful or harmful plants, especially those endowed with supposedly curative powers. And some cultures, such as the Peru-

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vian, which had not invented writing, have left us a rich heritage of archaeological material from which much may be gleaned. The Sumerian ideograms, dating back to 4000 B.C., refer to plant uses. The Ebers Papyrus, written in Egypt about 1500 B.C., is a rich ethnobotanical manuscript. The oldest Chinese source seems to be Erh-ya, a book on nature studies, written in 3000 B.C.; other ancient Chinese sources are the Book of Poems, the *Svu-ching*, of 1000 B.C. and the *Ben-tsaio*, an early herbal, dating from 1250 A.D. In India, the sacred Vedas (1500-1000 B.C.) give us many references to plant uses. The classical world of the Mediterranean, set in a not-too-rich flora, made extensive use of the Plant Kingdom in alleviating and presumably curing human ills. The medico-botanical lore of the cultures of Asia Minor, Greece and Rome, including that of the Biblical peoples, is too well known to detail here. As a result of the studies to interpret Dioscorides and other classical writers which occupied the attention of European doctors and botanists until about 1600, probably little of an ethnobotanical nature written by the Greeks escaped the attention of the Europeans of the Middle Ages.

The discovery of the New World led to more than extension of geographic knowledge. Reports of the plants of the new lands and their curious uses helped free herbalists from slavish repetition of the classical writers. The 16th and 17th Centuries are especially rich in writings with references to New World plants, ranging from incidental but sometimes highly significant references in reports of travellers, missionaries or explorers to extensive volumes by specialists on natural history. These are too numerous to enumerate. The conquest of Mexico, for example, gives us outstanding examples of this kind of literature. Some of the most valuable references to Aztec medicinal plants appear in the writings of the cleric Sahagún, whose pen covered a vast ex-

pense to create the work called "Historia General de las Cosas de Nueva España." These old clerics had an orderly method which allowed them to cover, even though with extreme prejudice, an astounding range of topics. Many similar works, though few so extensive, came out of Mexico of the post-conquest years, and these have not yet really been adequately studied. There is little, however, which can compare in thoroughness, accuracy and detachment to the "Nova Plantarum, Animalium et Mineralium Mexicanorum Historia," written between 1570 and 1575 by Dr. Francisco Hernández, physician to the King of Spain. Accurate though stylized drawings of plants are accompanied by extremely detailed accounts of the plants and their uses. There is a wealth of information here which still bears investigation. In addition to the old writings that did see publication, there are manuscripts which, because they have never been printed, are even more worthy of investigative study.

How important it is that one of our starting points in studying medico-botanical lore lies in a critical examination of this published and unpublished emporium may be illustrated by two recent advances in Mexican ethnobotany. These advances, had the reports of the old chroniclers been taken seriously by modern investigators, would not have been recent.

Time has frequently erased, through extinction or absorption, the cultures and peoples on which old reports were based. This is, however, not always the case. In a few fortuitous instances, descendants still live in the same region and are culturally little changed. If the peoples and cultures are gone, then, of course, no amount of field work today can uncover corroboration of old records of plant uses. On the other hand, if the peoples and cultures be still available for study, then careful field investigation may uncover similar uses persisting into the present, and we may oftentimes learn much more

by modern studies than the old chroniclers were able to write down for posterity. This is borne out in our experience in Mexican ethnobotanical studies, and especially in two cases which we shall consider now.

Sahagún and other non-technical writers reported the use as a sacred hallucinogen of a lentil-like seed borne on a climber and called *ololiuqui* amongst the Aztecs. One edition of Sahagún's writings pictures a twiner with a swollen root. Most of the chroniclers were men of the church and they railed violently against this "diabolic seed" valued by the pagan Indian as a divine messenger capable of taking man's mind to spirit realms. In his more technical manner, Hernández described *ololiuqui* in detail, pointing out its therapeutic and psychotomimetic use and giving us a drawing which unmistakably puts *ololiuqui* into the Convolvulaceae, the family of the morning glory. Notwithstanding the insistence of several Mexican botanists in the past century that *ololiuqui* was, in fact, referable to the convolvulaceous *Rivea corymbosa*, no corroboration came from field work. In 1915, the American economic botanist Safford categorically stated that *ololiuqui* could not be referred to the Convolvulaceae but that it must represent *Datura meteloides*, a well known narcotic employed in Mexico and the American Southwest as an hallucinogen. Safford argued that no narcotic member of the Convolvulaceae was known; that the intoxication induced by *ololiuqui* was similar to that induced by *Datura*; and that the convolvulaceous flower, trumpet-shaped, might pass superficially for a flower of *Datura*. Safford went so far as to doubt the value of certain early Mexican accounts of ethnobotany when he stated: "A knowledge of botany has been attributed to the Aztecs which they were far from possessing. . . . The botanical knowledge of the early Spanish writers, Sahagún, Hernández, Ortega and Jacinto

de la Serna, was perhaps not much more extensive: their descriptions were so inadequate that even to the present day the chief narcotic of the Aztecs, *ololiuqui*, which they all mention, remains unidentified."

It was not until the early 1940's that, on the basis of specimens of *Rivea corymbosa* which I discovered growing in the dooryard of a curandero in northeastern Oaxaca, modern field work vindicated the accuracy of the observations of the early Spanish chroniclers. So far as I know, chemical examination of *Rivea corymbosa* has not yet uncovered the active principle, but work is still being continued, and the results may turn out to be of a more far-reaching nature than we might normally expect.

I would also cite here the interesting case of the sacred psychotomimetic mushrooms of Mexico. As with *ololiuqui*, the early chroniclers spoke of their use in religious rites as a kind of sacrament inducing visual hallucinations. Called *teonanacatl* or "flesh of the gods," these fungi drew special wrath and persecution from ecclesiastical authorities. Half a dozen chroniclers mentioned them. One of these, Sahagún, has unusually detailed descriptions of the intoxication; and one of his writings published crude illustrations of the narcotic mushrooms. Hernández wrote of three kinds which the natives worshipped.

Notwithstanding the relatively numerous and forceful Spanish reports, nothing was known of the identity of the mushrooms until recently. Persecution drove the mushroom cult into hiding. The first attempt to identify *teonanacatl* was made in 1915 when Safford asserted that it was really the peyote cactus. The dried, brown, discoidal head or "button" of *Lophophora Williamsii*, he wrote rather unconvincingly, resembled "a dried mushroom so remarkably that at first glance it will even deceive a mycologist." As with *ololiuqui*, Safford's outstanding reputation stamped

his views with authority and, despite the denials of Reko, a physician and amateur botanist of Mexico, his conclusions were widely accepted.

It was not until the 1930's that the first steps towards identification came. Weitlaner, an engineer of Mexico City, collected specimens in Oaxaca; though poorly preserved, these were identified at Harvard as representing the mushroom genus *Panaeolus*. The next year, Reko and I found *Panaeolus sphinctrinus* and *Stropharia cubensis* employed by the Mazatecs of Oaxaca, and I published a note on the first of these as apparently the major hallucinogenic mushroom of the region. My work then took me to the Amazon for twelve years, and I never returned to Oaxaca to follow up the research. Perhaps this was providential. Fifteen years later, Mr. R. Gordon Wasson and his wife, keen amateur mycologists, read my papers and began a series of meticulously planned expeditions to Oaxaca. He sensed the need for an intensive, all-inclusive study of the sacred mushrooms and their uses, so he enlisted the collaboration of specialists. The resulting research, woven by Wasson into an intricately interrelated whole, will long hold a high place as an outstanding model of what concerted and thoroughly executed ethnobotanical investigations can accomplish. The Wasson group, including the French mycologist, Heim and the Swiss chemist, Hofmann, has established the use as hallucinogens of seven species and varieties of mushrooms belonging to the genera *Conocybe*, *Psilocybe* and *Stropharia*. Their studies covered botany, ethnology, archaeology, linguistics, musicology, religion and chemistry. The chemical studies have established the presence in *Psilocybe* of an active principle, psilocybine, an acidic phosphoric acid ester of 4-hydroxydimethyltryptamine, allied to such compounds as bufotenine and serotine; and the first known naturally-occurring indole derivative containing phosphorus. The

work on these mushrooms has opened up long vistas in many fields of research.

The important consideration for us at this point, however, is the timing of research into ololiuqui and teonanacatl. With the rapidity of penetration and acculturation in Mexico, it is certain that we have arrived in the nick of time. I am convinced that another quarter of a century might have doomed to extinction much if not all of the ethnobotanical lore surrounding the sacred mushrooms in many if not all of the mountain areas where it still flourishes. It has lain available to us for 400 years had we but taken seriously the early reports. How fortuitous our arrival! Will it be as fortuitous with other perhaps equally fascinating and rewarding medicobotanical lore? Few of us could have been ready to accept the fantastic reports of the early writers on the unearthly effects of the sacred mushrooms. Now we know how true they were. We can no longer afford to prejudge reports of aboriginal uses of plants simply because they seem to fall beyond our limit of credence.

Notwithstanding the fact that primitive peoples do possess a valuable understanding of the properties of plants, we realize that their knowledge has been optimistically exaggerated in the past and that it must be far from complete. We could not expect it to be otherwise. It, therefore, behooves us to carry out our own phytochemical studies of the flora in general. This study is probably best done along two paths: 1) intensive examination of families and genera known to be rich in active principles—alkaloids, glucosides, resins, etc.; and 2) a systematic examination, species by species, of a random sampling of floras.

Much has been done in the study of groups rich in active principles. It is not of recent inception, but it has been greatly intensified in recent years. This intensification of research has been directed especially towards alkaloidal groups, partly

because of improved phytochemical techniques. An excellent summary, published recently by Willaman and Schubert, stresses the important advances made and points out the promise that future investigation holds. They tabulate the presence or absence of alkaloids in 250 families, stating that "about 950 alkaloids have been isolated and named from two percent of all species which have been tested for them." Similar efforts with glucosides and other principles might be equally rewarding.

The phytochemical study of every species represented in a restricted geographic area or vegetational zone would seem likewise to be a basically sound approach. It requires, however, a somewhat more concerted botanical attack and must be backed up with very extensive chemical and pharmacological laboratory facilities. A few attempts along this line of attack have been sporadically carried out. Such a survey of the flora of Queensland for alkaloids has been under way since the 1940's by Australian scientists. Similar, though more conservative, alkaloidal surveys of floras are reported for North Borneo and the Argentine. I am aware of at least one American drug company now active in this kind of research with a survey of flora of Pennsylvania and about to undertake a study of plants collected in the rich flora of Colombia in South America. The results from this type of investigation are certain to be full of surprises, such as the recent discovery in the silver maple, *Acer saccharum*, of an indole alkaloid: gramine. It may be a long while before the pieces in such a puzzle fall into place, but the method is indeed a challenging one.

Perhaps the most satisfying way of studying ethnobotany is direct investigation amongst primitive peoples. Insofar as this method is time-consuming, it is not easy, but it cannot be called difficult or hazardous. Only in the sensational books written for self-glorification by intrepid

"explorer-writers" do these difficulties and hazards assume a gargantuan status. The generalized idea of the explorer is wrong. His is a job much like the bank teller's. The anthropologist or botanist willing to work and travel for long periods, or the missionary living permanently amongst natives, has unparalleled opportunities for learning something of the plant medicines of the region. And of these, perhaps, the botanist has the easiest entrée. Most natives become intensely curious at the botanist's ceaseless plant collecting. This curiosity creates a rapport between botanist and native, a common denominator leading to an easier exchange of conversation and ideas concerning plant uses.

I can, of course, speak only of the American tropics, but I do believe that similar conditions prevail elsewhere. The rather prevalent concept that witch-doctors have secrets which they guard zealously is in general unfounded. This impression results probably from the natural reticence of many natives in the presence of civilized man whom they feel to be superior. In connection with their medical practices, they may have experienced that white man's patronizing or even deprecating brush-off; and this is hardly conducive to openness in discussion. Much can be accomplished if the ethnobotanical investigator treats natives as a gentleman should. He must realize that, far from being the superior individual, he—the civilized man—is in many respects far inferior to the native in the native's own environment. In my twelve years of almost permanent residence and exploration in the northwest Amazon, I never found natives unduly reticent or resentful of any interest which I expressed in their medicinal or narcotic plants. I discovered that the farther I moved from small towns and mission stations, the more openly did the Indian discuss these matters. It went even farther than frank discussion: I very often partook of native

narcotics along with Indians in their rituals and dances and was frequently able to witness the treatment of disease by a witch doctor and to discuss it with the practitioner. The example of oral contraceptives in a case in point. Far from white man's influence, the native will discuss and point out the plants used as oral contraceptives; but within the sphere of missionary influence or commercial centres, it is absolutely impossible to discuss the question, although I strongly suspect that many of the civilized or acculturated natives know and use the plants.

It would be far beyond the scope of this short talk to consider methods of carrying out field work in ethnobotany. They vary with the region; with the kind of people and their degree of acculturation; with the wealth of the flora and our understanding of it; with the time available for the study; with the size of the investigating group; with the type and extent of training of the principal investigator.

There is one all-important condition which all good field work should demand; voucher specimens for the identification of every plant for which an important use is reported. The field of native drug plants, especially, is an example of this basic need. Much of the excellent chemical work done on various native medicinal plants during the past sixty years is value-

less to-day because it cannot be repeated. No voucher herbarium specimens backed up the botanical determination of the material under analysis. In fact, the so-called "determination" was made often not by a botanist but by a chemist or even by an office executive, from a vernacular name.

There remains to say a word about the best preparation for ethnobotanical research. Outstanding contributions can be and have been made by men of various degrees of preparation in sundry fields. The anthropologist—if he pay heed to the botanical necessities of this research—may be admirably trained. I should say that the ideal training, however, would be basically botanical with ample backgrounds in ethnology and ethnography on the one hand, and in plant chemistry and pharmacology or medicine on the other. A facility in learning languages would likewise be helpful. Such a combination cannot frequently be found, and few universities now apparently look with favour on such an interdisciplinary training. But when a scientist with this or similar preparation does appear, we would be negligent if we did not make every effort to channel his research energies into the general field of study of the interrelationship between man and his plant environment.