

VOUCHER SPECIMENS IN ETHNOBIOLOGICAL STUDIES AND PUBLICATIONS

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ABSTRACT.—Voucher specimens are a critical part of ethnobiological studies. They physically and permanently document data and form the basis for review or reassessment of the original study. An adequate voucher specimen must have diagnostic characters, be preserved in the condition, be accompanied by appropriate field data, and be maintained and readily accessible in a suitable repository institution. Planning *prior* to the collection of specimens is essential. Because they differ from taxonomic samples, special attention must be given to the collection and maintenance of ethnobiological specimens. In ethnobiological studies, the scientific name is based upon the identification of the voucher specimen and serves as the crucial link between folk knowledge and Western science.

INTRODUCTION

The voucher specimen is a critical component of ethnobiological studies. It provides the documentation for the scientific identity of the biological material about which observations and data are recorded. To date, voucher specimens have been accepted in some, but not all, disciplines of natural history. With the need to maximize the value and use of these collections, the Association of Systematics Collections has published a report² on voucher specimen management (Lee *et al.* 1982).

A voucher specimen is an organism or sample thereof "which physically and permanently documents data in an archival report by: (1) verifying the identity of the organism(s) used in the study; and (2) by doing so, ensures that a study which otherwise could not be repeated can be accurately reviewed or reassessed" (Lee *et al.* 1982:5). In order for a voucher specimen to fulfill its function, it must: "(1) Have recognized diagnostic characters that are appropriate to the level of identification in the report. Specific life stages or body parts may be required. (2) Be preserved in good condition by the investigator/collector according to acceptable practice. (3) Be thoroughly documented with field and/or other relevant reports. (4) Be maintained in good condition and be readily accessible in suitable repository institution" (Lee *et al.* 1982:7). The following points need to be emphasized so that a voucher specimen meets the requirements. First, the material preserved is a sample of the organism or the population that is actually studied. Second, the sample is adequate for identification and is deposited in an institution where it is cared for and made available to researchers. Third, essential data collected with the sample are physically associated with the specimen. Fourth, the archival report (published or unpublished) makes reference to the voucher specimen. Further details on the practice and justification of voucher specimens are found in Lee *et al.* (1982).

For the ethnobiologist, voucher specimens are essential to his/her work. The specimen is the basis for identifying the organism. Matching a common name with a scientific name is not identification (see Mead 1970). The identification to at least the species level provides western scientists a common basis for comparison of biological, ecological, and cultural data as well as for reevaluation of the information. Although occidental scientific identification, classification, and nomenclature have their limitations, they are more easily applied on a universal level than folk taxonomies.

With an accurate identification, the scientific name becomes the crucial link between people with folk knowledge and people trained in western sciences. Researchers can correlate and compare information generated and modified by generations of humans with that derived from more recent occidental scientific pursuits. The scientific name is the primary structure for bridging two cultures and for facilitating the mutually beneficial exchange of information. The return of knowledge to communities from which it originated is a critical component of ethnobiology today (Gomez-Pompa 1982; Toledo 1982) and can take many forms (e.g., native author publications, cultural rescue programs, health improvement projects, etc.).

The use and appreciation of voucher specimens have been greatest among biological taxonomists. Consequently, they have set the standards for the formation and management of these materials. As other disciplines such as ethnobiology, ecology, and environmental impact studies develop the role of voucher specimens expands—and so too do the potential uses and the problems of application.

The verification of identification and the change of the name (because of more accurate identification, up-dating nomenclature, or revised classification) are most efficiently carried out when the specimen is available to taxonomic specialists through normal channels such as revision of the holdings of recognized repositories or museum collections. Consequently the value of the specimen constantly increases for the taxonomist as well as for the ethnobiologist who can periodically consult his/her specimens for current identifications or annotations. Also, the specimen may yield more data such as chemical, ecological, and structural information for subsequent studies that were not part of the original investigation (e.g., Condon and Whalen 1983; McCain and Hennen 1986). Other disciplines may also benefit from the specimens as sources of data not otherwise tapped in their work. For example, biogeography can be aided by distributional data from collections of an ethnobiological study in an inaccessible area.

The early developmental and pre-reproductive forms of plants and animals are frequently encountered in ethnobiological studies and are not usually acceptable as specimens by taxonomists. However, the plants and animals may be in a non-reproductive state at the stage of recognition and employment by native people. Consequently, taxonomists are often reluctant (and sometimes refuse) to identify and manage such ethnobiological material. This frustrating problem can actually be resolved to the benefit of both the ethnobiologist and the taxonomist. Often structural characteristics, such as juvenile leaves of edible herbs, have been ignored by taxonomists and are not considered to be important or diagnostic. But these same characters may be critical to traditional people who rely upon the tender plants for food. Rather than considering this situation as an impasse to multidisciplinary cooperation, it provides fertile ground for contribution of new data to both areas of investigation. Looking at plant population studies of seedlings as an example, ecologists needed an easy system for identifying in a non-destructive manner germinating seeds and seedlings (Duke 1969). Such characters and life stages were not routinely considered by taxonomists. When the forms of germination and the types of seedlings demonstrated repeatable patterns, taxonomists began to incorporate these characters into their descriptions and identification keys. With ethnobiologists working with native people who are keenly aware of the characteristics of the various life cycle stages of plants and animals, sufficient stimulus should be

present to encourage our colleagues to critically examine underutilized chemical, structural, ecological, and life history features.

CATEGORIES OF VOUCHER SPECIMENS

A voucher specimen for organisms that are studied or observed may consist of one or more of the following categories (Lee *et al.* 1982:6-7): (1) the actual organism (whole or part); (2) a sample of one or more individuals (whole or part) from a population; (3) a representation of the organism or its characters (e.g., photographs, sound recordings, etc.), although it may not be adequate but may be the only alternative that is practical and/or legal; (4) an associated specimen that is biologically or functionally related (e.g., pollen preparations, fiber slides, stomach contents, pathogens, etc.) of the organism; and (5) a corroborative specimen that provides additional data or characters (e.g., from the same individual or population but at a different time or stage in the life cycle) to a previously collected voucher specimen.

For the ethnobiologist, the voucher specimen should be the organism actually studied or a sample that originated from the same population at the time of observation (categories 1 and 2). This specimen should reflect the characters, characteristics, and stage of life cycle about which the informant or collaborator provides information. Often the condition of the specimen may not reveal the diagnostic features (usually reproductive parts) that are required by the taxonomist for identification. Therefore, every effort should be made to *also* obtain a corroborative specimen that is collected from the same organism or population from which the original voucher specimen originated. This can be done by marking and recollecting later the organism or population in order to obtain material with reproductive and other taxonomically important features. In some cases the organism can be cultured, grown or raised until it reaches maturity, such as the case with a fresh root or seeds which can be planted and later pressed with flowers, fruits, and leaves for an herbarium specimen. In all cases, cross reference should be made between the original voucher specimen and the corroborative specimen and their relationship clearly noted. Sometimes, different collection numbers for the two specimens may be made but the connection between them should be specifically stated. Other times, the same collection number can be used for the two specimens but the different collection dates are noted as well as the relationship.

The other category of voucher specimens that is useful to the ethnobiologist is the associated specimen. Often the material under study (e.g., sample, phytoliths, wood fiber, seeds, exudates, bone tissue, etc.) is not the main character studied by the taxonomist but is the basic evidence used by the ethnobiologist. In such cases, a voucher specimen of the organism(s) is made according to the standard accepted by the experts studying that taxonomic group. Then, the special preparations of the parts (e.g., pollen, tissue sections, chemical extracts, etc.) are made from the voucher plant or animal specimen and analyzed. The results (products and data) are deposited along with a cross reference to the voucher specimen. Such special preparations may require separate management in ancillary collections such as those for pollen (palynological collection), wood (xylarium), fruits and seeds, stomach contents, etc. These associated specimens are linked directly to regular museum collections available to taxonomists. Also, the associated specimen should be duplicated so that one remains at the designated repository with the original voucher specimen and the other forms part of the investigator's comparative collection. Such collections with selective parts and data are then used to identify (by comparison and degree of similarity) unknown materials from archaeological or contemporary sources. These comparative collections should include the distinctive parts that would be encountered in pre-processed, processed, utilized, and discarded conditions.

Today most collections of organisms are made so as to reflect the range of variation of characters of taxonomic and evolutionary significance. When an ethnobiologist produces voucher specimens, his/her collection should be a representative sample of the population. Also extra efforts should be made to obtain sufficient quantity of the parts required to make the associated specimens from each voucher specimen. Hence an adequate number of mice or herbs should be collected if associated collections of teeth or seeds are to reflect significantly the variation in these parts.

When using the comparative collection to identify unknown materials, the degree of similarity, the identity confidence, and the level of identification should be determined by establishing a basic set of quantitative and qualitative characteristics for each known taxon. Thus the identification can be determined objectively to a specific degree of accuracy. When reporting the new identification reference should be made to the characters used and the source of the comparative collection, including the citation of its voucher specimens. When reporting the identification of a previously unknown organism, one may not be 100% confident of the determination. The degree of confidence may be expressed by listing only the name of the taxonomic level at which one is sure. For example, if you are confident that the fruits are those of the member of a family, you may cite *Chenopodiaceae*. If you believe that they are members of a given genus, can report *Chenopodium* sp., or the subgenus if possible (e.g., *Chenopodium*, subgen. *Chenopodium*). Should you be confident that the material is of the species, you can provide the name with the generic name, specific epithet and the author (e.g., *Chenopodium album* L.).

But what if you are not sure about this identification? If the original material is in good condition and is more similar to that species than others in the area (but the other species may have indistinguishable fruits), one can report it as *Chenopodium* aff. *album* L. where "aff." means affinity. Bohrer and Adams (1977) suggest the use of the term type (i.e., *Chenopodium album* type) but that may be confusing since the type concept refers to nomenclatural type in taxonomic studies where there are specific rules, procedures and categories of types (Ride *et al.* 1985; Voss *et al.* 1983). If the original material is of poor condition but appears similar to the verified sample in the comparative collection, one can cite the identification as *Chenopodium* cf. *album* L. where "cf." means compare (Bohrer and Adams 1977).

This approach using corroborative and associated specimens has been involved in the early development of ethnobotany in the United States and Mexico. During the 1870s and 1880s, Major J. W. Powell and Dr. Edward Palmer obtained seed collections of edible grasses and herbs of the Southern Paiute Indians (Bye 1972). The seeds were collected from the Indian gathering baskets as well as from the prepared foods. This material serves as the voucher specimens. Dr. A. Gray and S. Watson grew the seeds and obtained herbarium specimens from the reproductive plants. This material serves as the corroborative specimen, upon which the identifications were based. Dr. Palmer extended this approach in his Mexican studies (Bye 1979) by collecting plant products at various stages of preparation and in the forms of exchange and storage (e.g., market bundles) while also obtaining herbarium specimens of the plants in the natural condition. In order to distinguish the former specimens from the herbarium collections, Palmer called them "case specimens".

PREPARATION OF VOUCHER SPECIMENS

Each taxonomic group of plants and animals requires special preparation in order to make an acceptable voucher specimen. Many plants and animals have relatively simple methods of preparation in terms of sampling, selecting material, killing, fixing, and preserving the items. Other groups require considerable effort, materials, and equip-

ment. Lee *et al.* (1982: Appendix I) presents a list of references to preparation of major taxonomic groups. It is always best to consult *prior* to the collection of specimens a taxonomic specialist in order to obtain advice and training. It is preferable to seek directions from the repository of the specimens so that the material will meet their specifications.

Apart from the actual preserved organism, the basic data accompanying it (i.e., physically attached to the specimen or to the collection archives) should include (Lee *et al.* 1982:15-16): (1) a unique sample designation such as a collection number for each sample collected at one place and time where each collector or project maintains a sequential, non-repeating numbering system; (2) the position of the sample collection (including: country, state and other political subdivisions; natural geographic location such as river system, sea, etc.; local place name(s); international location designation such as latitude and longitude or Universal Transverse Mercator grid; altitude or depth; and habitat); (3) the date (and time when appropriate) of collection; (4) the name of the collector (and other appropriate donor identification including project, station, and field number); (5) the identity to the lowest taxonomic level, such as to species where feasible; and (6) methods of collection and preparation, where appropriate (e.g., sample as a result of traditional harvesting technique; from cooking pot; from market stand; etc.).

Ethnobiological collections require additional data. Vernacular names should be designated and the language and etymology noted when possible. Specific terms or cultural characteristics should be recorded in the language used to obtain the information; if possible, the original phraseology should be retained. A summary of these data can be provided in the investigator's native tongue. Reference can be made to the name of the informant or collaborator, supplementary or confirming information provided by others, as well as other pertinent data sought in the study.

DEPOSITION OF THE VOUCHER SPECIMENS

A critical element of a voucher specimen is that it be deposited, maintained properly, and available to researchers. Consequently, an investigator should consult the primary repository and the collection curator *prior* to obtaining specimens. Such advance-planning will assure that the sample is adequate for the study and that the specimens will be accepted in the collection and will be useful to the investigator and other researchers. In some cases, an institution may require fulfillment of certain prerequisites such as condition of the specimens, proper collecting permits, payment of handling fee, minimum sample size, etc. Also the investigator will benefit by knowing specifically what and how to collect as well as by having the institution make the contacts with appropriate taxonomists or having the specimens made available to specialists. If the ethnobiologist makes personal contact with a specialist, he/she should be sure that the specimens will be deposited in an appropriate repository (and not in a private collection) or that duplicates of the voucher specimens will be deposited according to the criteria above.

Many ethnobiologists have faced the difficulties of finding museum collections with adequate parts of material for study and comparison. Hence, many of us have generated specimens that would be considered associated specimens as part of individual comparative collections. We have also faced the frustration of curators who do not appreciate these specimens or whose institutions cannot support adequate curation of specimens that do not fit their current practice. Until ethnobiological collections become more acceptable and supportable, what are we to do? First, follow the initial step above—make contact with the taxonomist or curator *prior* to the study. If part of your collections are in a form such that they meet the requirements of current curatorial practices, the curator and institution may be willing to match your donation with an ancillary collection support. If that fails, do not give up on the original voucher specimens—make and deposit

them. Then with the duplicated associated specimens, seek other institutions where your duplicates will be incorporated into the appropriate ancillary collections. If your vouchered associated specimens do not find their way to an official repository, share them with a colleague. The main points are to: (1) deposit your original or corroborative voucher specimens in a proper repository, (2) link them with your associated specimens and (3) have duplicates of the specimens apart from those in your comparative collection available to others. One should realize that curators of museum collections do not receive adequate support or recognition for what they have now. This problem was one of the primary reasons for the Association of Systematics Collections' effort to publicize the importance of such materials (Lee *et al.* 1982).

CITATION OF VOUCHER SPECIMENS

The existence of voucher specimens and the publication of the results based upon the studied organisms are interdependent. Therefore ethnobiological reports in forms of articles, books, and contract reports should include: (1) the scientific name of the plants and animals, and (2) the citation of the voucher specimen(s). In the case of the scientific name, it should be reported at the most accurate taxonomic level possible. Usually the species is accepted as the most useful taxon. Intraspecific taxa (e.g., subspecies, variety, cultivar, etc.) should be used where possible. The specific and infraspecific epithets should be followed by the author in order to complete the scientific name. The voucher specimen must be cited by a distinct identifier which includes: (1) a unique number for the specific item (e.g., collector's name and collection number or accession number assigned by the repository), and (2) an identifier for the repository. This identifier may be the name of the institution and its subunit or collection or, as in the case of major institutions, a code designation or abbreviation. A list of references on repositories for various taxonomic groups and their abbreviations is listed in Lee *et al.* (1982: Appendix II). An example of a voucher specimen citation is:

Datura innoxia Miller, R. Bye & E. Linares 13,101, MEXU. The herbarium specimen of jimsonweed (*Datura innoxia* Miller) was collected by R. Bye and E. Linares, has their collection number of 13,101, and is deposited in the Herbario Nacional of the Universidad Nacional Autónoma de México. By convention (Council of Biology Editors Style Manual Committee 1983), the collector name(s) and number(s), like the generic name and the specific and subspecific epithets, are printed in italics or written underlined. If one's study includes others' collections, then the collector, collection number, and repository are cited in a similar manner with an exclamation mark (!) following the repository's abbreviation (e.g., MEXU!).

CONCLUSIONS

In ethnobiological publications using names of organisms, the scientific name (to the most accurate taxonomic level) should be reported in addition to the native name(s). The name should be based upon the identification which in turn is documented by a voucher specimen. The voucher specimen serves to verify the identification, to update the identification and nomenclature, and to provide additional data, especially as techniques advance or if the study is not repeatable. Various categories of voucher specimens exist. In addition to the original voucher specimen which may contain ethnobiologically important features but may not have taxonomically diagnostic traits, the corroborative specimen may be required to provide more critical characters. Associated specimens may be useful in forming comparative collections for identifying processed or archaeological biological materials.

The preparation of voucher specimens requires consultation with taxonomic experts and curators in advance of collection. Ethnobiological specimens need basic museum data along with other label data which are physically associated with the specimen or the collection. In order to fulfill their function as voucher specimens, samples have to be deposited at a repository where they will be maintained and will be available to researchers. In archival reports, studies based upon biological organisms should include the scientific name (including the author) as well as the citation of the voucher specimen [which is indicated by a distinct identifier: a unique number of the specific item as well as the name or abbreviation of the repository].

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NOTES

¹Served as chairman of Characterization of Voucher Specimens Committee for the Council of Curatorial Methods of the Association of Systematics Collections.

²"Guidelines for Acquisition and Management of Biological Specimens" can be ordered from the Association of Systematics Collections, Museum of Natural History, University of Kansas, Lawrence, Kansas 66045.

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