



Conceptualizing Ethnobotany from Traditional Methods to Inclusive Ethnobotanical Research Practices

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Abstract

Different types of approaches are considered in collection and analysis of ethnobotanical data including qualitative and quantitative methods. Qualitative approaches in collecting ethnobotanical data include different types of interviews, group discussions, participatory workshops etc. The choice of a particular qualitative method will depend upon the context, phase, objective of study and the type of research question. Quantitative approaches like fidelity level, use value, informant consensus factor etc. provide

statistical confirmation and help in hypothesis testing and comparative analysis. Instead of wide use of quantitative techniques, the reliability, uniformity and redundancy of results is questionable. Most of the quantitative indices are derived from other disciplines and lack ethnobotanical context. This paper reviews various ethnobotanical methods and the gaps associated with these approaches.



Introduction

Ethnobotany describes interrelationships between man and plants. Ethnobotany focuses on plants which are medicinally important, have traditional knowledge and important in cultural practices. Ethnobotany is viewed as the study of utilitarian interconnections between man and plants in the surroundings (Harshberger, 1896). Historically, many compilations of medicinal plants in the form of books i.e. “De Materia Medica” by Discords in AD 77, “De Historia stirpium” by Leonhart Fuchs in 1542 etc. are available (Beck, 2005). Our Vedic literature i.e. Rigveda, Atharvaveda, Charak-vedic literature contained descriptions of many medicinal plants. Other important contributions in the field of ethnobotany are of Chopra i.e. A Glossary of Indian medicinal plant in 1775 and Jain i.e. Glimpse of Indian Ethnobotany in 1981 (Chopra *et. al.*, 1986 and Jain, 1981).

Despite the declining traditional knowledge, the studies in Indian ethnobotany have increased over time. As per study on mapping ethnobotanical research in India, total 2123 (1974-2018)

research papers have been published on Web of Science core collection database. These papers have been contributed by 5458 authors after the study of 105 tribes of India (Pathak and Bharti, 2020). Many international documents like The Shenzhen Declaration of Plant Sciences, Convention on Biological Diversity etc. encourage the significance of traditional knowledge of biodiversity for sustainable development of nature. In this regard, ethnobotany has tremendously helped in achieving the objective of conservation and sustainable approaches (Cheng *et. al.*, 2022).

Presently, ethnobotanical studies not only include conventional description of plants but go deep in creating a hypothesis and analysing a particular research question. Ethnobotany is multidisciplinary science in the sense that it derives concepts from various other related fields like botany, ecology, phytochemistry, anthropology, linguistics etc. Ethnobotany has contributed to the development of new and useful drugs and ethnobotany has gained more recognition as a means of identify novel compounds for exploitation (Eldeen *et. al.*, 2016). Seven out of 17 sustainable development goals are associated with



traditional ethnobotanical knowledge (Kumar *et. al.*, 2021).

The present article focuses on various qualitative and quantitative methods employed in ethnobotany. Additionally, the article reviews current gaps in these indices and suggests possible approaches for removing these gaps.

Literature Review

Qualitative approaches in ethnobotanical work

There exists a vast variety of data collection methods viz interview, Free listing, Guided Tour, Participant observations, Group discussions etc. (Fakchich and Elachouri, 2023).

Different types of interviews can be conducted depending upon the context and aim of ethnobotanical studies like informal, structured, semi-structured and un-structured. Informal interviews do not have proper structure and are kind of casual talk with the informants. These interviews are particularly important during the initial studies where ethnobotanists usually make notes of valuable information's and observations from the area and get acquainted with the area (Alexiades,

1996). Unstructured interviews are again conducted during initial studies, here the format of interview is followed while having minimum control on the responses of informants.

Structured interviews are based on a set format of questions which are to be asked from the informants. It could be in various ways like free listing, triad test or rank allocation etc. The type of questions and understanding of ethnobotanists for the particular culture is very crucial in determining the quality of ethnobotanical interview. The structured interviews are good to go for statistical analysis (Bernard, 1988).

In semi-structured interview, initially, every household in a particular region is interviewed and information is collected about gender, literacy, name of the plants and their uses in alimentation, abortive substances, crafts work, construction, ecology, fuel wood, forage, technology, veterinary uses etc. (Silva *et. al.*, 2014).



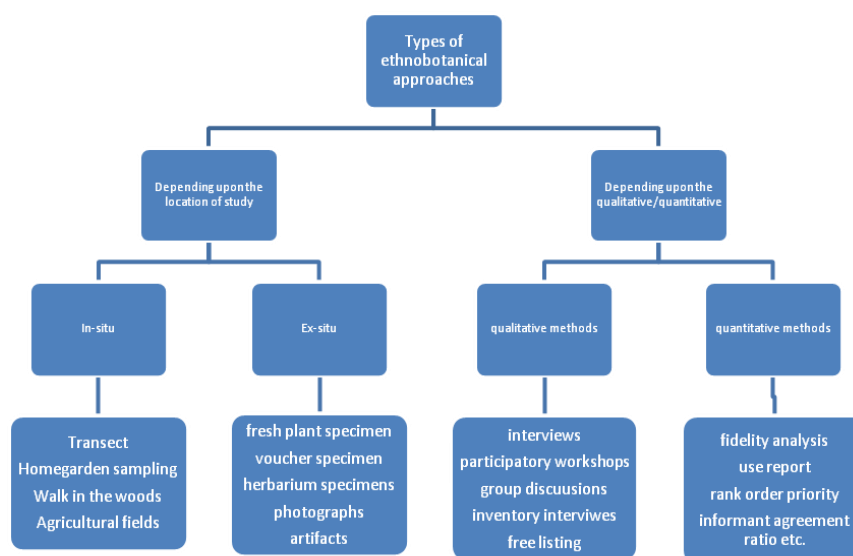
Characters	Informal	Unstructured	Semi-structured	Structured
Structure/Format	Absent	Present	Present	Present
Degree of predetermination of questions	No	Very less (Flexible but controlled)	Considerable	High
Amount of control on responses from informants	No	Minimum control	Considerable	High
Open/Closed questions	Questions are not created	Open	Almost closed	Closed
Applicability	Useful during initial studies	Useful in building initial rapport	Useful once the research objective is clear	Used during the later stages of ethnobotanical studies
References	Moeller <i>et. al.</i> , 1980	Fakchich and Elachouri, 2023	Alexiades, 1996	Corroto and Macia, 2021

Table 1: Table showing comparative account of various types of interviewing approaches in ethnobotany

Questions are created keeping in mind the ethnobotanical utilities which helps to keep the entire study focused. Since there are certain open ended questions related to the aim of study, hence these interviews provide in depth information and provide flexibility of questions being asked by researchers (Ruslin *et. al.*, 2022).

In inventory interview, here, instead of interviewing the every household in a particular region, one or two representative members who have deep knowledge of ethnobotany are taken for a particular region. Photographs of local plants are shown to these members and information is collected.

In participatory workshops, every member of a particular community is invited to participate in a workshop where the detailed photographs of plants found in the area and information is collected. The time, date and duration of workshop is communicated in advance. Even normal individual of a community who are not experts can participate. This method is comparatively fast method of ethnobotanical data collection. These types of interactions are particularly important in encouraging conservation and management strategies in the communities (Rodrigues *et. al.*, 2020).



Flowchart showing various approaches in ethnobotanical work



Participant observation, ethnographers live with the community they wish to learn about. They follow the same daily routine as the local people and closely document the interaction of people with plant (Nolan and Turner, 2011). Along with ethnobotany, cultivation, management and harvesting of plants could be studied (Deur and Turner, 2005).

Quantitative methods in ethnobotany

Historically, three different quantitative analysis methods had been used viz information consensus, subject allocation and uses totalled. Information consensus is an objective approach where the degree of redundancy in the utility of a specific plant

is calculated from the informants. In this approach, the informants are interviewed independently and repeatedness of use of plant species is noted. It is a time consuming process. Various quantitative parameters which are calculated involve Fidelity Level, Use Report, Rank Order Priority, Informant Agreement Ratio, Use Value, Family Use Value, Relative Frequency of Citation (RFC) etc. (Phillips, 1966). In fidelity level values shows the degree of popularity of a specific plant which is defined as ratio of number of participants who described the specific species for a particular use out of total number of participants who described the species for some other utility.

$$\text{Fidelity level} = \frac{\text{Use of the plant species for a particular major purpose}}{\text{number of informants who mentioned the plant for any use}} \times 100 \%$$

UR involves all the uses of a particular species informed by all the informants in a specific use category (Whitney *et. al.*, 2012).

IAR is a method to quantify the pharmacological effectiveness of a remedy and it is calculated as the ratio of total

number of informants who cited the particular remedy for the ailment by the total number of different remedies for the ailment.



$$IAR = \frac{\text{total number of informants who cited the particular remedy for specific ailment}}{\text{total number of different remedies for the specific ailment}}$$

RFC shows how often the informants cited and utilized each species (Reang *et. al.*, 2023).

$$RFC = \frac{\text{number of informants who mentioned the use of a particular species}}{\text{total number of informants}}$$

In order to calculate the overall utilities of a species, UV is calculated which is equal to the proportion of participants who mentioned the species out of the total number of participants interviewed (Kainer and Dureiya, 1992).

$$UV = \frac{\text{summation of number of uses of a particular species by a particular informant}}{\text{number of interviews of the particular informant for a particular species}}$$

$$\text{Overall use value} = \frac{\text{summation of use value}}{\text{number of informants interviewed for a particular species}}$$

FUV is calculated to know the average UV of individual species in a family.

$$FUV = \frac{\text{overall use value}}{\text{total number of species in a family}}$$

RUV is calculated for each informant for assessment of relative knowledge of informants and calculated as the proportion of use value of a particular species from each informant to the overall use values divided by number of times the informant was interviewed for the specific species (Phillips and Gentry, 1993).

$$RUV = \frac{\sum \frac{\text{use value}}{\text{overall use value}}}{\text{number of interviews of the particular informant for a particular species}}$$

In subject allocation method, the relative use value is assessed for the cultural significance. This is comparatively subjective as compared to informant consensus and less time consuming also. Subject allocation is a semi-quantitative method to know the impact of human management on ethnobotany. Berlin devised four categories i.e. cultivated, protected, wild but useful and culturally insignificant to show the spectrum of

$$ICS = \sum qie$$

Where q = quality value, i = intensity value and e = exclusivity value (Phillips and Gentry, 1993).

In use totalled method, instead of calculating the relative use value, the uses are simply totalled as per the plant category. Here the uses are not weighed and each use value is given equal importance.

In quantitative ethnobotany, both univariate and multivariate statistical analysis is used depending upon the number of variables considered. Depending upon the research interest, there are various multivariate statistical analysis methods like Correlation analysis,

human management on plants. Other categories of semi-quantitative ethnobotany include minor and major forest uses, edible, construction, medicinal etc. Index of cultural significance (ICS) is calculated for cultural significance and it is the summation of the product of use value, quality value, intensity and exclusivity value for each species (Turner, 1988).

regression analysis approaches, cluster method, principle component analysis etc. A large number of computer softwares are available to analyse the statistical parameters viz CANOCO, PC-ORD, R- Package (Casgrain, 1999), SAS (SAS Institute Inc.), SPSS (SPSS Inc.), TWINSpan (Hill, 1979), BMDP (BMDP Statistical Software Inc.) etc. (Hoft *et. al.*, 1999).

PCA (Principle Component Analysis) – It is a quantitative ethnobotanical parameter based on bioinformatics which analyse the effect of external factors like socioeconomic, ecological or environmental on the plant use categories.



Several external factors like ecosystem species diversity, population density, infrastructure development and remoteness of a particular area influence the ethnobotanical use patterns (Torre *et. al.*, 2012).

Discussions

The different researchers in ethnobotany have used different approaches in analysing the participants individual knowledge. Taking into account the literature published in ethnobotanical work, it lacks consistency and there is a vast diversity in the adoption of different methods. The majority of ethnobotanical research articles are published about the ethnobotany of tribes of developing world and to document the indigenous knowledge of people in remote areas, but in recent times, the real challenge is the reliability and creditability of the data (Reyes-García, 2007).

Interviews are conducted in many qualitative studies of ethnobotany which are advantageous in the form that these create a rapid inventory of flora of the locality but limited by the clarity of what to include or exclude while creating questionnaire. These studies lack

appropriate theoretical base, have disjointed information and present weak scientific reflections (Albuquerque and Hanazaki, 2009).

Secondly, majority of quantitative indices are adopted from related disciplines like anthropology, which are not designed by statistician as per the ethnobotanical objectives and lack the concepts of ethnobotanical research. Whether the quantitative measures can define the medicinal or cultural potential of a plant is doubtful. The quantitative measures are just numbers or values which are not answers but show a particular attribute in a defined sample size, methodology and indigenous locality. These indices also lacks important factors like sample size, availability of pharmaceutical drugs, degree of cure and severity of diseases treated (Leonati, 2022). Secondly, the idea of quantification is not new in ethnobotany, but the main objective is to make quantitative indices more inclusive instead of just percentage calculations. Quantitative indices created should be such that these include information on the informants population size, locality area, incorporation of quantitative



pharmacological parameters and quantitative ecological parameters like threatened species, effect of plant use, amount on pressure on natural resources etc. only if the quantitative indices are more inclusive, the numbers will show some significant results, otherwise these are just numerals and does not show any true dimension of nature.

At most care has to be taken while using the quantitative indices to compare different groups, since this can be done only if same methodological procedures were used in both the cases (Albuquerque and Hanazaki, 2009).

Ethnobotany is vast, dynamic and interdisciplinary science and it integrates data from botany, zoology, pharmacology, statistics, chemistry, medicines, anthropology etc. The approaches in ethnobotany should be not only deep and focussed but wide and multidimensional (Lach, 2014). It is difficult to create uniformity in experiments of ethnobotany and also to get redundant results with the same magnitude. Additionally, many researches just copy the information already available in literature instead of going for actual field visits. In the absence

of any standard protocol, many researches publish their articles without key information in ethnobotanical research like study area, informants, local names, voucher specimen etc. (Jain, 2023).

In recent times, there are lot of articles published in well reputed journals about the indigenous uses of lakhs of plants without having any information about the concentration, efficacy or toxicity of the plant. All the herbs are not beneficial for the body and many of them can cause undesirable effects and severe health effects on the body (Eldeen *et. al.*, 2016). There is no standard safety and quality protocols for the release of herbal medicines in the market.

Local communities, tribes are the primary source of ethnobotanical knowledge, so there should be proper protocols and these should be followed for the intellectual property rights of the informants. Since, now ethnobotanical knowledge bridges with the pharmacology and drug discovery, there should be legal provisions for the informants (Parul, 2022).

Conclusions

The methodology which is followed in a particular ethnobotanical work, whether



quantitative, qualitative, in-situ, ex-situ or combined with any other botanical discipline will depend upon the kind of research question and objective of the study. Although the use of quantitative parameters appears fascinating and also adds upon some more information upon the qualitative data, yet the reliability of data is still questionable. On one hand, ethnographers are moving towards solving individual ethnobotanical questions like effect of plant traits i.e. leaf size, leaf texture etc. on choice of selection of plants; effect of interplay between people and environment on local medical systems; and effect of rainfall gradient on useful species richness etc. but on the other side, the major indices used in quantitative ethnobotany lack proper ethnobotanical concepts (Vandebroek and Albuquerque, 2024). So, it is urgently required to revise the variables used in these indices and there should be approaches to make it more inclusive. There is urgent need of standardization at every step starting from sample collection, appropriate sample size, appropriate qualitative and quantitative technique depending upon the context. There should be collective efforts from

statistician and ethnographers to make indices more oriented towards ethnobotanical concepts. Numbers of variables considered should be increased in order to make the quantitative indices more realistic. One of the major issue i.e. lack of redundancy in ethnobotanical experiments can be solved by standardizing every step of ethnobotanical processes.

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