

Hypothesis Testing in Ethnobotany: 30 years After Phillips & Gentry's Seminal Work

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Ethnobotany, the study of plant-human interrelationships, has significantly developed in recent decades. Initially focused on documenting plant diversity and local community uses, the discipline has shifted toward understanding the factors influencing plant selection. There have been calls for theory-inspired, hypothesis-driven research in ethnobiology to enhance rigor (Gaoue et al. 2021). However, recent studies have predominantly relied on quantitative indices and statistical methods borrowed from ecology, often neglecting the development of a solid theoretical foundation.

In their seminal work in 1993, Phillips and Gentry proposed a hypothesis-driven approach, explicitly inspired by the apparency hypothesis, for ethnobotanical studies. This approach involves developing a priori hypotheses based on ethnobotanical and ecological information, followed by data collection to test these hypotheses. However, effectively utilizing the proposal by Phillips and Gentry remains an ongoing challenge. This editorial explores potential reasons for the limited adoption of the hypothesis-driven approach in ethnobotany.

The apparency hypothesis, initially proposed in plant-herbivore interactions, categorizes plants into "apparent" (visible) and "non-apparent" (less visible) groups. Apparent plants are typically dominant or perennial woody species, whereas non-apparent plants are often herbaceous or found in early ecological succession. According to the hypothesis, people are more likely to use readily available plants due to increased experimentation and cultural integration opportunities (Phillips and Gentry 1993). Additionally, in a chemical approach, the hypothesis suggests that non-apparent plants with highly bioactive compounds are more appealing for medicinal purposes. Several ethnobotanical studies have tested the predictions of the apparency hypothesis and found a positive correlation

between a plant's local importance and its environmental availability (Gonçalves et al. 2016). This evidence supports the idea that easily accessible plants are more commonly used. However, studies conducted in dry forests and semiarid regions have discovered weak or no relationships between plant availability and use.

Despite the demonstrated effectiveness of the hypothesis-driven approach, it still needs to be more widely employed in subsequent ethnobotanical studies. While many researchers have used techniques proposed by Phillips and Gentry, they often need to pay more attention to the core aspect of developing a priori hypotheses and subjecting them to testing (see Ramos et al. 2012). Several factors contribute to this limited adoption. More training in statistical analysis is one factor, as many ethnobotanists may need additional skills, leading them to avoid the hypothesis-driven approach. Moreover, some researchers may need to recognize the importance of hypothesis formulation, considering it unnecessary or limiting their research objectives. This lack of understanding hampers the widespread use of the hypothesis-driven approach.

Theoretical progress in ethnobotany has faced various obstacles, including confusion over time regarding the utilization of quantification and the quality of scientific research (Ferreira Júnior 2020). Since the 1990s, a branch of ethnobotanical studies known as "quantitative ethnobotany" has emerged, focusing on developing indices to quantify different aspects of plant knowledge and usage among different human groups. Numerous studies have multiplied, calculating these indices solely due to their quantitative appeal, but in practice, they fail to introduce any novelty or theoretical/methodological advancement to ethnobotany. Simply put, it has become popular to calculate these indices to determine, among other things,

the relative importance of plants and animals known or used by a specific social group.

To advance ethnobotany theoretically, it is crucial to recognize and embrace its interdisciplinary nature. This aspect is often overlooked when developing concepts, integrating perspectives from diverse disciplines, and understanding the studied phenomena (Gaoue *et al.* 2017; Albuquerque and Oliveira 2007). Understanding the interdisciplinary nature of ethnobotany entails integrating concepts, theoretical frameworks, and methodologies from multiple disciplines and moving beyond the disciplinary boundaries imposed by our training (see Albuquerque *et al.* 2020). Recent works by authors in the field have raised important questions that will shape the future of ethnobotanical research, addressing complex topics related to human-nature interactions (Albuquerque *et al.* 2019,a,b; Vandebroek *et al.* 2020), which challenge us to employ interdisciplinary investigations guided by hypotheses formulated by robust theoretical frameworks. Therefore, synthesizing existing theoretical research is crucial to advancing ethnobotany as a hypothesis-driven and theoretically grounded discipline. Doing so can enhance our understanding of human-plant interactions and contribute to the conservation and sustainable use of plant resources.

In summary, we can outline our arguments as follows:

1. Lack of theoretical rigor and a solid foundation: Ethnobotany frequently neglects the development of a robust theoretical framework, relying heavily on quantitative and statistical methods borrowed from ecology without sufficient theoretical grounding.
2. Limited adoption of the hypothesis-driven approach: Despite the demonstrated effectiveness of the approach proposed by Phillips and Gentry in 1993, there is a lack of utilization of hypothesis-driven research in ethnobotany. Many researchers fail to develop a priori hypotheses and subject them to rigorous testing.
3. Barriers related to training and statistical skills: Inadequate training in statistical analysis hinders the effective adoption of the hypothesis-driven approach, leading some researchers to avoid it altogether.
4. Lack of understanding of the interdisciplinary nature of ethnobotany: Although ethnobotany is inherently interdisciplinary, it often falls short in incorporating concepts and methodologies from other disciplines, thereby limiting its potential for advancement.

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