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REVIEW ARTICLE

RECENT DEVELOPMENT ON ETHNOPHARMACOLOGICAL PRACTICE IN MEDICINAL PLANTS: A CRITICAL REVIEW

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ABSTRACT:

Ethno pharmacology and natural product drug discovery remains a significant hope in the current target-rich, lead-poor scenario. Commonly, industrial drug discovery process makes use of medium and high throughput bioassay screening platforms for discovering promising compounds for a particular target, ethno pharmacology goes the opposite way where anecdotal efficacy of medicinal plants is put to test in the laboratory trying to understand the pharmacological basis of culturally important plants. In this article, critical review on ethnopharmacological practice in medicinal plants has been discussed.

KEYWORDS: Ethnopharmacology, Medicinal Plants, Pharmaceuticals.

INTRODUCTION:

The drug discovery process has become very complex and capital-intensive and companies with lead discovery as a greater bottleneck. The usual distinctions between breakthrough and me-too drugs may not be very meaningful and today the pharmaceutical industry is technology intensive, not as innovative due to shortage of new lead structures with the strict regulatory processes adding more years to the discovery cycle and increasing cost due to post approval or post-marketing withdrawals. Random screening of plants used traditionally by pharmaceutical industries to discover new leads or drugs is expensive and time consuming but the ethno directed approach to traditional knowledge has been extremely useful in screening and identification of bioactive compounds with valuable application in drug development. This has significantly increased the chances of discovery of new biomolecules with potential therapeutic application while reduction in the cost and time involved in this process. There is also increased demand due to problems with drug resistant microorganisms, side effects of modern drugs, and emerging diseases with no available treatment knowledge of the indigenous people can give new sources. The ethno pharmacology knowledge, its holistic approach supported by experiential base can serve as an innovative and powerful discovery engine for newer, safer and affordable medicines.

Many traditional preparations have been used for years and claimed to be the most potent and effective dosage forms but very few scientific studies are carried out on these products due to lack of communication amongst traditional healers, physicians and scientists. Malpractice in scientific method of ethno pharmacology is based on carelessly carried out bioassays using high concentrations of an extract or a natural product to demonstrate a pharmacological response.

CRITICAL REVIEW OF LITERATURE-RECENT DEVELOPMENT:

Assimopoulou AN and Trifan A (2024). Indeed, ethnopharmacologists focus on documenting the knowledge related to the local and traditional medicines, thus contributing to better healthcare at a community level. In addition, their studies should comply with the national and international laws and agreements (the Convention on Biological Diversity and subsequent treaties and regulations including the Nagoya Protocol), in order to promote sustainable harvesting and cultivation practices (access to local medicinal plants), to ensure the availability of these resources for future generations, and most importantly, to warrant benefit sharing with local communities. Traditional remedies discovered through ethnopharmacological research can serve as sources of

new leads and inspiration for developing new drugs. The contribution of ethnopharmacology is widely acknowledged and credited and can further leverage to integrating traditional practice into modern healthcare systems and for the next-generation of therapeutics. [1]

El Oihabi, K., Boutagayout, A., El Kamli, T., Bouiamrine, E. H., El Mouzazi, I., & Bour, A. (2024). Ethno-pharmacology delves into ancestral medicinal and aromatic plant (MAP) knowledge, which is crucial in folk medicine and community health. This ethno-pharmaceutical study focused on exploring the use of MAPs in the Meknes and Khenifra regions. A questionnaire targeted 149 respondents, gathering data on MAP usage, preparation methods, adverse effects, and influencing factors. Predominantly, users aged 30-45 in urban areas utilized MAPs with a balanced gender distribution. Lamiaceae was the most utilized plant family, primarily for gastrointestinal disorders. Rosemary (47%), star anise (46.3%), and thyme (43.6%) were the most commonly used. Sourcing methods included gathering from the wild (47.9%), herbalists (43.8%), and pharmacies (17.1%). The decoction (63.8%) was the favored preparation, often consumed short-term or regularly (68.5%) as part of the daily diet. Adverse health effects included vomiting (47.3%) and diarrhea (29.7%), underscoring the importance of understanding herbal remedies-drug interactions, given that 54% reported concurrent use of drugs. Media (54.4%) significantly influenced the MAP recipe choice, in contrast to the minimal influence of phytotherapy (16.10%). This study underscores the importance of MAPs in the studied regions and the necessity for their safe and effective use. It highlights the significant role of media and intergenerational transmission in traditional recipe selection, emphasizing the pivotal roles of culture and communication in preserving traditional medicinal practices. [2]

Tsioutsiou EE, Cheilari A and Aligiannis N (2023). Throughout centuries, traditional herbal medicine and the employment of medicinal plants have constituted an important tool for the treatment and prevention of numerous diseases. The present study focuses on the collection of ethnopharmacological data regarding the uses of medicinal plants for the treatment of dermatological ailments in various villages of Mount Pelion, Greece. More specifically, the study area is represented by the city of Volos and villages located in Central West Pelion and has not been investigated up to now. The information on the medicinal uses of the various species was obtained through extensive semistructured interviews or the completion of specific questionnaires by the informants. Although the Covid-19 pandemic caused difficulties and obstacles in carrying

out this research procedure, 60 informants were recruited and interviewed (36 women and 24 men). Their age range was between 31 and 97 years and their educational level was characterized by great diversity (primary, secondary, and higher education). The elaboration of the gathered information included the calculation of some quantitative indices, such as Fidelity Level (FL), and Informant Consensus Factor (FIC). Moreover, the relative importance of each reported species was identified by calculating the Use Value (UV). The interviews revealed 38 plant taxa belonging to 27 plant families reported to be used in the study area exclusively against skin diseases. The plant family mostly mentioned by the informants was Hypericaceae, followed by Plantaginaceae and Amaryllidaceae, while among the most popular methods of application are cataplasms, compresses, and topical application of decoction or raw plant material. Some of the most cited species are *Hypericum perforatum* L., *Quercus coccifera* L., and *Plantago* sp., traditionally used to treat skin problems such as eczema, wounds, and insect stings. The present ethnopharmacological study is the first documentation of ethnobotanical knowledge of this area that points out the traditional uses of medicinal plants against skin ailments. [3]

Courric, E. (2023). The island of Grande-Terre is a French overseas region that belongs to the Guadeloupean archipelago, a biodiversity hotspot with unique flora. Herbal medicine is widely used in the island for therapeutical purposes; however, there is a significant knowledge gap in the records relating to medicinal plants and their associated uses. Ethnobotanical survey methodology using quantitative parameters (informant consensus factor, species use value, relative frequency of citation, frequency use of a treatment and plant for an ailment) provided insights into the traditional medicinal use of a given plant. Ninety-six different plant species distributed among 56 families were identified and 523 remedies were documented in the survey. After data filtering, 22 plants species were associated with 182 remedies. The most frequent plant families were Poaceae, Myrtaceae, Cucurbitaceae and Rubiaceae. Aerial parts of these plants were the most common parts of the plant used for the remedies and the most frequent mode of administration was oral ingestion. This study highlights a valuable traditional knowledge of folklore medicine and helps to document and preserve the association of a plant with—and its use frequency for—a given ailment. These findings might be the starting point for the identification of biologically active phytochemicals to fight common health debilities. [4]

Pirintzos S, Panagiotopoulos A, Bariotakis M, Daskalakis V, Lionis C, Sourvinos G, Karakasiliotis I, Kampa M, Castanas E. (2022). Ethnopharmacology, through the description of the beneficial effects of plants, has provided an early framework for the therapeutic use of natural compounds. Natural products, either in their native form or after crude extraction of their active ingredients, have long been used by different populations or explored as invaluable sources for drug design. The transition from traditional ethnopharmacology to drug discovery has followed a straightforward path, assisted by the evolution of isolation and characterization methods, the increase in computational power, and the development of specific chemoinformatic methods. The deriving extensive exploitation of the natural product chemical space has led to the discovery of novel compounds with pharmaceutical properties, although this was not followed by an analogous increase in novel drugs. In this work, we discuss the evolution of ideas and methods, from traditional ethnopharmacology to *in silico* drug discovery, applied to natural products. We point out that, in the past, the starting point was the plant itself, identified by sustained ethnopharmacological research, with the active compound deriving after extensive analysis and testing. In contrast, in recent years, the active substance has been pinpointed by computational methods (*in silico* docking and molecular dynamics, network pharmacology), followed by the identification of the plant(s) containing the active ingredient, identified by existing or putative ethnopharmacological information. We further stress the potential pitfalls of recent *in silico* methods and discuss the absolute need for *in vitro* and *in vivo* validation as an absolute requirement. Finally, we present our contribution to natural products' drug discovery by discussing specific examples, applying the whole continuum of this rapidly evolving field. In detail, we report the isolation of novel antiviral compounds, based on natural products active against influenza and SARS-CoV-2 and novel substances active on a specific GPCR, OXER1. [5]

Şen, Gökhan, Akbulut, Sefa and Karaköse, Mustafa. (2022). This study is aimed at determining some of the plants traditionally used in the treatment of diseases by the local people living in Kastamonu province center and surrounding villages. A face-to-face questionnaire was applied and semi-structured interviews were conducted with 52 informants, 34 women and 18 men. Identification of 92 plants belonging to 41 families has been confirmed and their medicinal uses have been recorded. The most used families were Rosaceae (13 taxa), Asteraceae (11), and Lamiaceae (11). The most preferred folk recipes of medicinal plants was decoction (55 taxa) and in preparations and applications, the most used were the leaves (45 taxa). According to the

International Classification of Primary Care categories, plants were the most used for digestive disorders (37 taxa), respiratory disorders (27 taxa), and urological disorders (24 taxa). The highest use-value was recorded for *Urtica dioica* (0.519), and highest relative frequency citation was recorded for *Tilia rubra* subsp. *caucasica* (0.231). Male genital diseases had the highest informant consensus factor value (0.83). New areas of use were also determined for *Pilosella leucopsilon* subsp. *pilisquama*, *Galium palustre*, and *Astragalus nitens*. With this study, new information for folkloric medicines is presented and the usage of herbal drugs in the study area are enhanced. [6]

Singh, A. (2022). Traditional medicine is a body of knowledge, skills, and practices based on traditional cultures' presumptions, beliefs, and experiences in order to maintain their health. Traditional herbal treatments are highly valued among many rural or indigenous people in many underdeveloped nations. According to the World Health Organization, about 80% of the world's population relies on traditional medicine, with 60% of rural Indians using herbal treatments. During the previous five years, utilization of herbal supplements grew from 2.5% to 12 percent. The assessment of novel medications, particularly phytochemically derived materials, has opened up a large arena for study and has aided India's shift from traditional to modern medicine. Tannins, alkaloids, carbohydrates, terpenoids, steroids, flavonoids, and phenols are some of the chemical components found in medicinal plants that have a distinct physiological effect on the human body. Medicinal plants do not only exhibit natural therapeutic properties, but also provide natural prevention against various diseases. As a result, we are attempting to summarize, gather the number of plants, and their ethnopharmacological qualities in this complete review study research. [7]

Senkardes, I. (2022). This pharmaceutical ethnobotanical research was carried out in Taşköprü District in Kastamonu, in northern Anatolia. It assembles the elaborations of plants used as folk medicines, and the ethnopharmacological data collected in the course of in-person semi-structured interviews with an open-ended questionnaire. The study's aims were two-fold: gathering and identifying plants that the local inhabitants use therapeutically, and recording information related to traditional folk medicine (primarily for humans, and if extant for animals). The plants were gathered during several outings between May 2016 and July 2018. The organization of the data was based on the userreports (UR) and was done according to the ICPC-2 classification. In addition,

cultural importance index (CI) and informant consensus factor (FIC) calculations were made for the data collected. The research identified 101 plant taxa of 31 families used in folk medicine. Of these, 89 were wild and 12 were cultivated taxa. In total, 499 medicinal uses were determined. The CI values indicated that the most significant medicinal plant specimens were *Pinus nigra* subsp. *pallasiana* (0.78), *P. sylvestris* var. *hamata* (0.75) and *Plantago lanceolata*, *P. major* subsp. *intermedia* and *P. major* subsp. *major* (0.58 each). The most prevalent families were Asteraceae (2.14), Rosaceae (1.93), Pinaceae (1.81) and Plantaginaceae (1.74). Respiratory system (0.95), skin and subcutaneous tissue (0.94), nervous system (0.92) and circulatory system disorders (0.88) and ethnoveterinary uses (0.89) had the highest FIC values. The most frequently used preparation process was observed to be decoction (38.4%) and the most commonly utilized plant parts were aerial (21%). Along with recording 20 plant taxa as medicinal plants for the first time, this study documented a total of 303 new therapeutic uses. This study concludes with the finding that traditional knowledge of medicinal plants remains prevalent in Tarras particularly among its rural inhabitants. [8]

Zeidali, E. et al. (2021). Traditional medicine has a long history and plays an important role in the Kurdish community in Sarvabad county, Kurdistan province, Iran. Despite the great diversity of medicinal plants, cultural history, and variety of herbal medicine uses among Kurdish tribes, very few cohesive ethnopharmacological studies of this unique region are available in the scientific literature. Our study tried to gather medicinal plant species and document the associated indigenous knowledge of the ethnic groups in the Sarvabad district for the first time. Ethnobotanical data were collected from 92 local informants through semi-structured questionnaires, open interviews, and field surveys during a period of two years (2018-2020). The statistical analysis included use reports (UR) for each species, and informant consensus factor (FIC) to evaluate the data. The plant use reports, and quantitative data analyzed demonstrate that the relative importance of plant species and shared knowledge of herbal therapies among Kurdish communities of the Sarvabad county is still rich. A systematic study and evaluation of the biological activity of highly consumed plants, could identify the possible mechanism of action. [9]

Zeidali, E. et al. (2021). Ethnopharmacology studies natural medicines derived from plants and other substances that have been traditionally used by groups of people to treat various human diseases. Various environmental conditions (from Tropical to Temperate condition) of Iran have

made this country one of the major parts of plant diversity in the world. Plants have played an important role in Iranian people's life. The study is located in Chaharmahal and Bakhtiari province in western Iran (31°9' to 32°38' N and 49°30' to 51°26' E) with an area of 16,332 km² and a population of about 895,263. Endemic plants were collected during 2017-2019 from different locations in Chaharmahal and Bakhtiari province. Most of the studied regions were situated in orchards, highlands and neighboring farmlands. The plant raw materials were cleaned, dried and fixed at room temperature. In this study, a number of 61 native plant species with medicinal properties were collected during three years. Among the 70 people that were interviewed (mean age of 60 years old), 61 species of vascular plants were identified for treatment of various human ailments. Ethnopharmacology report is made consisting of species names, vernacular names, popular uses of the plants and their pharmacological properties. Identifying plant classification (taxa) was done in Chaharmahal and Bakhtiari Agricultural Research Center and the Iranian Research Institute of Plant Protection. The results showed that most of the collected species belonged to Asteraceae (12 species). Other families are included: Fabaceae (seven species), Brassicaceae (five species), Lamiaceae and Solanaceae (four species). This study shows the high herbal biodiversity of the medicinal plants in Iran as well as a fascinating potential for profitable studies on medicinal plant breeding, chemistry and pharmacology of the feature drugs. [10]

Dutta, T. et al. (2021). The discipline 'urban ethnopharmacology' emerged as a collection of traditional knowledge, ancient civilizations, history and folklore being circulated since generations, usage of botanical products, palaeobotany and agronomy. Non-traditional botanical knowledge increases the availability of healthcare and other essential products to the underprivileged masses. Intercultural medicine essentially involves 'practices in healthcare that bridge indigenous medicine and western medicine, where both are considered as complementary'. A unique aspect of urban ethnopharmacology is its pluricultural character. Plant medicine blossomed due to intercultural interactions and has its roots in major anthropological events of the past. Unani medicine was developed by Khalif Harun Al Rashid and Khalif Al Mansur by translating Greek and Sanskrit works. Similarly, Indo-Aryan migration led to the development of Vedic culture, which product is Ayurveda. Greek medicine reached its summit when it travelled to Egypt. In the past few decades, ethnobotanical field studies proliferated, especially in the developed countries to cope with the increasing demands of population expansion. At the same time, sacred groves continued to be an important method of conservation across several cultures

even in the urban aspect. Lack of scientific research, validating the efficiency, messy applications, biopiracy and slower results are the main constraints to limit its acceptability. Access to resources and benefit sharing may be considered as a potential solution. Indigenous communities can copyright their traditional formulations and then can collaborate with companies, who have to provide the original inventors with a fair share of the profits since a significant portion of the health economy is generated by herbal medicine. Search string included the terms 'Urban' + 'Ethnopharmacology', which was searched in Google Scholar to retrieve the relevant literature. The present review aims to critically analyse the global concept of urban ethnopharmacology with the inherent plurality of the cross-cultural adaptations of medicinal plant use by urban people across the world. [11]

Magalhães, P.K.A. et al. (2021). The aim of this research is to make a survey of the socio-environmental characteristics and the ethnobotanical study of medicinal plants used in a traditional community in the Brazilian Northeast, Alagoas. The study was made based on visits with the application of a questionnaire with questions related to the socio-economic element and on the diversity of plants used in herbal medicine. The research was made from March/2019 to February/2020, where families and interviewed plant exhibitors were interviewed for botanical identification. The studied community, which were 24 interviewees, was compiled by residents of the Quilombola community from Pau D'arco in Arapiraca city - Alagoas. Residents interviewed, 15 (62.5%) attended between 56 to 80 years, 11 interviewees about 46% were born in the community and 13 (54%) had a fundamentally incomplete nature. At the end, there were mentioned 30 plant species used for phytotherapeutic purposes, from which presents bigger usage as plants against arterial hypertension (*Salvia rosmarinus* Schleid), diabetes Mellitus (*Croton heliotropiifolius* Kunth), pain and inflammation (*Alternanthera tenella* Colla), present the biggest number of species in the community. The species cited are related to numerous medicinal uses, among which there will be predominant associations associated with cardiovascular and inflammatory processes. The tea is the main way of preparing plants. It is perceived that medicinal plants are only widely used by this Quilombola community of and growth of the crops in the backyard are considered a tradition. [12]

Süntar, I. (2020). Ethnopharmacology can be basically defined as “the interdisciplinary scientific exploration of the biologically active agents that are traditionally employed”. Therefore, the

ethnopharmacological approach is based on a body of work that spans several disciplines such as botany, chemistry, and pharmacology. This includes field observations, descriptions of the utilization and bioactivities of folk remedies, botanical identification of the plant material as well as phytochemical and pharmacological research. Investigations of the indigenous remedies and their possible effects have attracted attention of many researchers for ages. Drug discovery from natural sources in the light of ethnopharmacological studies has an important role in the development of current therapeutic systems. Plants, animals and minerals are among the natural products that have been the basis in the treatment of many diseases for centuries. Recently, much attention has been paid to pharmacognostical, phytochemical and pharmacological studies of traditional medicinal plants. Moreover, biological activity potential of natural medicines has been investigated in many preclinical and clinical studies, revealing diverse biological effects of a wide range of plant derived compounds in various classes of chemical groups. The majority of the natural sources whose active compounds are currently employed actually has an ethnomedicinal use. Therefore, recently, many of the pharmaceutical companies have renewed their strategies in the field of natural product research in order to bring out potential sources and new molecules for the drug development. For the discovery and development of novel, safe and affordable medicines, the ethnopharmacological knowledge could be beneficial thanks to its approach that could be supported by experimental base. In the present study, ethnopharmacological aspects of herbal medicine and plant-based drug discovery process will be emphasized and important issues in their use as complementary medicine will be mentioned. [13]

Dapar, M.L.G., Alejandro, G.J.D., Meve, U. et al. (2020). The Philippines is renowned as one of the species-rich countries and culturally mega diverse in ethnicity around the globe. However, ethnopharmacological studies in the Philippines are still limited especially in the most numerous ethnic tribal populations in the southern part of the archipelago. This present study aims to document the traditional practices, medicinal plant use, and knowledge; to determine the relative importance, consensus, and the extent of all medicinal plants used; and to integrate molecular confirmation of uncertain species used by the Agusan Manobo in Mindanao, Philippines. Documenting such traditional knowledge of medicinal plants and practices is highly essential for future management and conservation strategies of these plant genetic resources. This ethnopharmacological study will serve as a future reference not only for more systematic

ethnopharmacological documentation but also for further pharmacological studies and drug discovery to improve public healthcare worldwide. [14]

Sharafatmandrad, M., Khosravi Mashizi, A. (2020). The purpose of this study was to gather ethnopharmacological information on plants used by the pastorals of southeastern Iran. The relationships between ecological value of the plant species and ethnobotanical indices were investigated. The loss of medicinal plants and its effective factors were also determined under nomadism and sedentary pastoralism. Ethnopharmacological information of plants was collected through interviews with 85 local people including nomads (43%) and sedentary pastorals (57%). Ethnobotanical indices including relative frequency of citation (RFC), relative importance (RI), cultural value (CV), and use value (UV) were estimated. Canopy cover and density of plant species were measured at 60 sampling plots in the enclosure, nomadic rangelands and sedentary pastorals rangelands. The Importance Value Index (IVI) and Relative Loss Index (RL) were estimated for both nomadic and sedentary pastoral rangelands. Pearson correlation coefficient was used to investigate the relationship between ethnobotanical indices and IVI of plant species. The Bayesian networks was used to investigate the relationship between ethnobotanical indices and plant species loss. In total, 156 medicinal plant species of 50 families were identified in the region by locals. Positive correlation was observed between ethnobotanical indices (RFC and RI) and ecological index (IVI). The mean decline of the ecological importance of medicinal species in sedentary pastoral rangelands was approximately three times higher than in nomadic rangelands. Bayesian networks showed that cultural value, seed exploitation and aerial parts exploitation had direct relationships with species loss in both nomadic and sedentary pastoral rangelands. *Bunium persicum*, an ecologically and socially important species, had been extensively harvested (more than 60%) in the both nomadic and sedentary pastoral rangelands, making it a priority species in future conservation programs. Medicinal plants had high ecological value and were severely exploited, threatening sustainability of arid and semiarid ecosystems. Local pastorals not only use medicinal plants as herbal remedies but also consider them as a source of income. Popular plants with multiple medicinal uses were more susceptible to loss. Higher medicinal knowledge of pastorals did not help to mitigate medicinal plant loss, requesting new plans to aware them to the circumstances that often leads to species removal from community. Given the importance, abundance and widespread use of medicinal plants, further studies can provide a basis for their conservation and for identifying new therapeutic effects of plants in the region. [15]

Vadivalagan, A., Kannan, R. (2020). Indigenous traditional knowledge is an integral part of the culture and history of a local community. The present study is aimed to document the ethno medicinal plants used for various ailments by the Urali tribe and rural people living in Kadambur hills. The research work is mainly focused on gathering information on traditional usage of plants from the tribal community inhabiting in the area. A total of 80 plant species belonging to 40 families used by them as herbal medicines to cure various common ailments. 25 plants were herbs followed by 24 trees, 15 shrubs and 16 climbers and leaves 43 followed by fruits 12, whole plant 12, bark 9, roots 8, seed 4, flower 4, stem 2, tuber, rhizomes and aerial part 1. The indigenous information of medicinal plants has important potential for research and the discovery of modern medicines. The potential ethno medicinal plants could be conserved and further validation need for better utilization and provisions of the documented knowledge. [16]

CONCLUSION:

Ethno pharmacology is a highly diversified approach for drug discovery which involves the observation, description and experimental investigation of indigenous drugs and their biologic activities that is based on botany, chemistry, biochemistry, pharmacology, and other disciplines contributing to the discovery of natural products with biologic activity. Traditional medicine is the sum total of the knowledge, skills, and practices based on the theories, beliefs, and experiences indigenous to different cultures, whether explicable or not, used in the maintenance of health as well as in the prevention, diagnosis, improvement or treatment of physical and mental illness. Traditional medicine covers a wide variety of therapies and practices which vary from country to country and region to region. In some countries, it is referred to as "alternative" or "complementary" medicine. India has a rich ancient heritage in traditional medicine. Indian *Materia medica* provides abundant information on ethnic folklore practices and traditional aspects of therapeutically important natural products.

REFERENCES:

1. Assimopoulou AN and Trifan A (2024). Editorial: Global excellence in ethnopharmacology: europe. *Front. Pharmacol.* , 15, 1368610. doi: 10.3389/fphar.2024.1368610
2. El Oihabi, K., Boutagayout, A., El Kamli, T., Bouiamrine, E. H., El Mouzazi, I., & Bour, A. (2024). Ethno-Pharmacological Study on Medicinal and Aromatic Plants Commonly Used in the Fez-Meknes and Beni Mellal-Khenifra regions: Insights from Pharmacy-Based Surveys. *Tropical*

Journal of Natural Product Research (TJNPR), 8(2), 6279–6290.
<https://doi.org/10.26538/tjnpr/v8i2.28>

3. Tsioutsiou EE, Cheilari A and Aligiannis N (2023). Ethnopharmacological study of medicinal plants used against skin ailments on Mount Pelion, central Greece. *Front. Pharmacol.* , 14, 1225580. doi: 10.3389/fphar.2023.1225580
4. Courric E, Brinvilier D, Couderc P, Ponce-Mora A, Ménil-Mamert V, Sylvestre M, Pelage JH, Vaillant J, Rousteau A, Bejarano E, et al. (2023). Medicinal Plants and Plant-Based Remedies in Grande-Terre: An Ethnopharmacological Approach. *Plants.* 12(3), 654. <https://doi.org/10.3390/plants12030654>
5. Pirintsos S, Panagiotopoulos A, Bariotakis M, Daskalakis V, Lionis C, Sourvinos G, Karakasiliotis I, Kampa M, Castanas E. (2022). From Traditional Ethnopharmacology to Modern Natural Drug Discovery: A Methodology Discussion and Specific Examples. *Molecules*, 24, 27(13), 4060. doi: 10.3390/molecules27134060.
6. Şen, Gökhan, Akbulut, Sefa and Karaköse, Mustafa. (2022). Ethnopharmacological study of medicinal plants in Kastamonu province (Türkiye). *Open Chemistry*, 20(1), 873-911. <https://doi.org/10.1515/chem-2022-0204>
7. Singh, A. (2022). A Review of various aspects of the Ethnopharmacological, Phytochemical, Pharmacognostical, and Clinical significance of selected Medicinal plants. *Asian Journal of Pharmacy and Technology*, 12(4), 349-0. doi: 10.52711/2231-5713.2022.00055
8. Senkardes, I. (2022). An Ethnobotanical study of medicinal plants in Taşköprü (Kastamonu–Turkey). *Front. Pharmacol.*, 13:984065. doi: 10.3389/fphar.2022.984065
9. Hosseini SH, Sadeghi Z, Hosseini SV, Busmann RW. (2022). Ethnopharmacological study of medicinal plants in Sarvabad, Kurdistan province, Iran. *J Ethnopharmacol*, 24, 288,114985. doi: 10.1016/j.jep.2022.114985.
10. Zeidali, E. et al. (2021). Ethnopharmacological survey of medicinal plants in semi-arid rangeland in western Iran. *Cent. Asian J. Plant Sci. Innov.* , 1(1), 46-55.

11. Dutta, T. et al. (2021). Advancing urban ethnopharmacology: a modern concept of sustainability, conservation and cross-cultural adaptations of medicinal plant lore in the urban environment. *Conservation Physiology*, 9(1), coab073. <https://doi.org/10.1093/conphys/coab073>
12. Magalhães, P.K.A. et al. (2021). Ethnobotanical and ethnopharmacological study of medicinal plants used by a traditional community in Brazil's northeastern. *Braz. J. Biol.*, 82, 1-11. <https://doi.org/10.1590/1519-6984.237642>
13. Süntar, I. (2020). Importance of ethnopharmacological studies in drug discovery: role of medicinal plants. *Phytochem Rev* , 19, 1199–1209. <https://doi.org/10.1007/s11101-019-09629-9>
14. Dapar, M.L.G., Alejandro, G.J.D., Meve, U. et al. (2020). Quantitative ethnopharmacological documentation and molecular confirmation of medicinal plants used by the Manobo tribe of Agusan del Sur, Philippines. *J Ethnobiology Ethnomedicine*, 16, 14. <https://doi.org/10.1186/s13002-020-00363-7>
15. Sharafatmandrad, M., Khosravi Mashizi, A. (2020). Ethnopharmacological study of native medicinal plants and the impact of pastoralism on their loss in arid to semiarid ecosystems of southeastern Iran. *Sci Rep*, 10, 15526. <https://doi.org/10.1038/s41598-020-72536-z>
16. Vadivalagan, A., Kannan, R. (2020). Ethnopharmacological Studies on the Medicinal Plants Used By Urali Tribes of Kadambur Hills, Sathyamangalam, Erode District, Tamil Nadu, India. *Journal of Plant Science & Research*, 7(1), 1-6.