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The Biopiracy of Indigenous Ethnomedicinal Knowledge in India: Extractions, Injustices and Possibilities

Pranab Kumar Mandal[1]

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ABSTRACT

Background: As corporate bioprospecting has been a prominent strategy for medicinal modernities in India, the traditional herb-based ethnomedicinal practice of the Indigenous communities continues to be a largely marginalized and localized phenomenon. In the form of biopiracy, the Indigenous knowledge of traditional ethnomedicinal practices is dominantly replaced by widely capitalized modern healthcare practices where medicinal plants often meet scientific and technological experiments in a lab, only to be mixed with chemicals, fungus, biologically engineered mechanisms, artificial substances, *etc*. through a process of insolation. The commercialization of forest-based medicinal plants through modern experiments has not only been ecologically extractive, bio-precarious and therefore ecocidal, it has also combined political ecology of power, marginalization/exploitation of Indigenous ecologies and an overall subjectification of ethnobotanical ecologies.

Methods: The research has followed an extensive review of relevant literatures, case studies and statistical data pertaining to ethnomedicinal knowledge framework and traditional healing practices in India. This study was carried out from 2022 to 2026 at Badungduppa Kalakendra, Assam; Ramakrishna Mission Residential College, Narendrapur; Cooch Behar, West Bengal; Thiruvananthapuram, Kerala; and Chiang Mai University, Thailand.

Result: The findings of this research reveal a complex structure of the reception, corporatisation and sensitisation of ethnobotanical knowledge and bioprospecting practices in India. Although ethnobotanical healing practices still survive as a prominent mode of cultural and traditional healthcare in India, they face multidimensional challenges and adversities. Although the tribal communities are careful about the conservation of the medicinal plants and herbs, a wider conservational initiative on the part of the government is necessary to promote more sustainable harvesting, gathering, utilising and selling of medicinal plants. This research proposes that there should be community driven corporate promotion of ethnobotanical knowledge and traditional healing practices. This would also potentially check commercially extractive bioprospecting and biopiracy activities in modern healthcare industries in India and the globe.

Key words: Biopiracy, Ethnobotanical ecologies, Forest herbs, Indigenous ecologies, Political ecology.

INTRODUCTION

Indigenous knowledge of ethnomedicine has been empirical, oral and intergenerational. In some cases, there are specific individuals in the communities, chosen from a particular family of practitioners, who assume the role of a folk/local healer with specific knowledge of medicinal plants, herbs and their applications. Despite the rise of modernities in medicinal knowledge and practices, such as “genomics and combinatorial chemistry” (Torri and Herrmann, 2011), traditional ethnobotanical knowledge continues to be an important source of knowledge in the “agrochemical and pharmaceutical industry, where almost a quarter of sales are based on products with a natural origin” (Timmermans, 2003). The pharmaceutical companies prefer “isolation and direct use of active medicinal constituents” along with “semisynthetic drugs” and the production of “synthetic pharmacologically active compounds” from natural resources (Torri and Herrmann, 2011). Farnsworth (1988) argues that one out of four pharmaceutical products are prepared from plants.

Bioprospecting refers to the dependence on biodiversity for commercially valuable genetic and biochemical resources (Beattie *et al.*, 2011). This is a scientifically and technologically developed method of extracting/collecting useful medicinal, agrochemical, biotechnological elements from plants, microorganisms and animals, or any form of biological resources. As it is developed for commercial benefits of agrochemical and pharmaceutical industries, it often violates ethical considerations and benefits of local communities. In fact, the indigenous peoples have been denied access to the commercialization of their community knowledge regarding ethnobotanical practices. Their role in this growing herbal sector is anything but marginal and negligible-leading to the biopiracy of their knowledge. Biopiracy refers to the

[1]Department of English, Ramakrishna Mission Residential College, Narendrapur, Kolkata-700 103, West Bengal, India.

Corresponding Author: Pranab Kumar Mandal, Department of English, Ramakrishna Mission Residential College, Narendrapur, Kolkata-700 103, West Bengal, India. Email: pranab.mandal@rkmrc.in ORCID: 0000-0002-5243-1270

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bioprospecting activities without the consent of local community or without acknowledging the contribution of the local ethnobotanical knowledge in corporate modernities (Mgbeoji, 2006).

It may also lead to further debates on the relationship between local ethnobotanical knowledge or biodiversity, bioprospecting and biopiracy of corporate companies-how far acknowledgements or benefits should be attributed to local communities and their ethnobotanical knowledge systems by the corporate agencies which industrialize based on local indigenous ethnobotany. Usually, the poorest and the weakest section of any society in the world, the indigenous communities suffer this economic loss in a more acute manner. Although scholars such as Torri and Herrmann (2011) advocate the possibilities of local indigenous enterprises of ethnobotanical practices, they lay out diverse challenges such endeavours would encounter, especially when it comes to counter with the technological availability, financial support, scientific skills and commercial knowledge of corporate agencies.

India is one of the 12 mega biodiversity centres in the world with around 10% of the world's biodiversity resources which are spanned across 16 agro-climatic zones where 7500 species of medicinal plants have been identified to date (Senthilkumar and Murugesan, 2012). The forest, wetlands and marine ecosystems in India have been particularly rich in biodiversity. There are rich biodiversity regions that have "extremely high rates of endemism," where "33% of Indian plant species are endemic" (2011). The bioprospecting practices in these biodiverse regions in India open up diverse possibilities of corporate-community collaborations in ecosystem conservation as well as collaborative ethnobotanical enterprises which mutually benefit the industry, community and the ecosystem. Instead, in reality, this has given rise to the biopiracy of folk medicines and autocratic bioprospecting of indigenous ethnobotanical knowledge. Whereas corporate-community collaboration can contribute to sustainable developments in local indigenous contexts, discriminatory and autocratic bioprospecting is ecologically precarious and environmentally exploitative. Therefore, an intersection of bioprospecting, environmental sustainability, corporate-community collaboration and ethnobotany can foster a key framework of traditional ethnobotanical knowledge and modern ethno-healing practices.

MATERIALS AND METHODS

This study adopts a qualitative research methodology to examine the role and challenges of ethnomedicinal practices among different Indigenous communities in India. The research has followed an extensive review of relevant literatures, case studies and statistical data pertaining to ethnomedicinal knowledge framework and traditional healing practices in India. The study has also applied interpretative qualitative approach to understand the formation, transmission, exploitation of ethnobotanical knowledge, conservation strategies and corporate practices of biopiracy. This study was initiated at Badungduppa Kalakendra in Goalpara, Assam in 2022 and later carried from 2024 to 2026 at Ramakrishna Mission Residential College, Narendrapur; Cooch Behar, West Bengal; University of Kerala, Thiruvananthapuram and Chiang Mai University, Thailand.

RESULTS AND DISCUSSION

In a study on ethnomedicinal plants in the Himalayan region of Uttarakhand, Kandpal *et al.* (2024) contend that ethnomedicinal healthcare through wild herbs has been the primary mode of healthcare in remote areas, especially because of unavailability of modern healthcare facilities, difficulties in reaching out to urban healthcare centers and poverty in marginalized communities. Sarma *et al.* (2021) point out that at least "500 million people in India directly or indirectly depend on medicinal plants derived drugs". It is also estimated that around "7000 species of the plants are used for medicine in India in the traditional system of medicine" (Bisen *et al.*, 2025).

Traditional ecological knowledge (TEK) of local people has been considered by Community Biodiversity Conservation scholars as an effective measure for Community Biodiversity Conservation (Torri and Herrmann, 2011). TEK has also been applied in the successful management of local ecological resources and thus, approved as a local measure of environmental sustainability. As the local communities depend heavily on local ecosystems such as water, land, hill and forest ecosystems for their livelihood, the local people's knowledge of sustainable use of natural resources is crucial. It has been noted that the local people's treatment of the ecosystem has been mostly reverential and therefore, conservational and sustainable. World Health Organisation observes that traditional medicine is "the sum of all the knowledge and practices, whether explicable or not, used in the diagnosis, prevention and elimination of physical, mental or social imbalance and relying exclusively on practical experience and observations handed down from generation to generation, whether in oral or in written form" (Torri and Herrmann, 2011).

As the knowledge of ethnobotanical medicines and healing practices is primarily drawn from indigenous communities, concerns relating to their intellectual property rights and biodiversity conservation have also been raised by scholars and activists over time (Timmermans, 2003). The Convention of Biological Diversity (CBD) acknowledges "the contribution of indigenous communities to knowledge about the utilisation of biodiversity" (Shiva, 2001). It is highlighted that although traditional ethnobotanical medicines are commonly plant-based and derived from nature, they are not easily and randomly available to anyone and everyone; rather, they are formulated over time through indigenous knowledge and folk healing practices (Kandpal *et al.*, 2024). As Elisabetsky (1997) comments, to "transform

a plant into a medicine, one has to know the correct species, its location, the proper time of collection (some plants are poisonous in certain seasons), the solvent to use (cold, warm or boiling water; alcohol, addition of salt, *etc.*), the way to prepare it (time and conditions to be left on the solvent) and finally, posology (route of administration, dosage)."

In the context of ethnobotanical medicinal practices in India, there are codified or widely acknowledged plant-based herbal sciences such as Ayurveda, as well as non-codified or community-specific tribal/indigenous practices of traditional medicines by folk/local healers. These non-codified ethnobotanical healthcare practices are diverse and community-specific with different sets of practices depending on different natural resources in different local ecosystems. The non-codified tribal/ indigenous/folk ethnobotanical healthcare is developed through traditional beliefs, norms, oracles and experiments of the community which practices it. These traditional healing practices are usually unrecognized by governments and modern healthcare practitioners, although the importance of medicinal herbs in healthcare is widely accepted. This has opened up opportunities for poor tribal/ indigenous people to sell important medicinal herbs as a means of strengthening their economic stability. However, it has been also observed that in India, "less than 30 of the medicinal plants utilized by the industry are under commercial cultivation" and "80,000 metric tons a year of certain plant varieties are being collected from the wild"- indicating very strong bioprospecting and biopiracy practices at corporate levels at the cost of huge biodiversity exploitations (Torri and Herrmann, 2011).

The practice of using this local ethnobotanical knowledge for commercial gains through industrial productions without acknowledging the local communities or sharing the profits with them has led to what is called the biopiracy of ethnobotanical knowledge. The bioprospecting of indigenous/local knowledge and resources without compensating the local communities or the primary stewards and conservers of them has caused ethical violations. The cases of biopiracy are more evident in developing countries-estimated at $4.5 billion per annum as per a report by Christian Aid and $5.4 billion as per a report of the United Nations Development Programme (Torri and Herrmann, 2011). In India, it is assumed that the entire indigenous knowledge system of the country is a victim of biopiracy because of colonisation. There are restrictions imposed by the Indian government upon access and commercial selling of select medicinal herbs in forests. For example, there are restrictions upon the Kani Tribe in the South Indian state of Kerala to access a medicinal plant called *Trichopus Zeylanicus* which is available in the forest and is used for the preparation of an herbal medicine called Jeevani. The Forest Department has made this imposition upon the tribal community to protect the valuable medicinal plant from over-extraction and extirpation from the community's commercial selling to pharmaceutical companies.

There are also global instances where the government itself participates in the bio-trade of medicinal plants with corporate agencies and deprives the indigenous communities that have been surviving upon that plant for community healthcare for ages (Kuipers, 1997). In fact, governments and corporate agencies are the key players of biotrade of traditional medicinal plants in the world- always depriving the local communities of any opportunity to gain any share of the profit or protect their sovereignty upon the traditional medicinal plants and traditional healing practices (Guite, 2023). With the rise of ecotourism and fascination for nature trails in recent times, biodiversity extraction and consequent loss of medicinal plants have become a tragic reality. In India, there are government initiatives that not only restrict biotrade of medicinal plants but also the scope for biomedical research. The National Ethical Guidelines for Biomedical and Health Research Involving Human Participants published by the Indian Council of Medical Research in 2017 mentions that "when a folklore medicine/ethnomedicine is ready for commercialization after it has been scientifically found effective, benefit sharing should be ensured and the legitimate rights/share of the tribe or community from which the knowledge was gathered should be taken care of appropriately while applying IPRs and patents for the product" (2017).

Some ethnobotanical contexts and traditional healing practices in India

In Rasikbill of Cooch Behar in the East Indian state of West Bengal, tribal communities such as Rava, Santal and Oraon commonly use 57 plant species from 34 families for ethnomedicinal purposes (Mandal *et al.*, 2020). There are around 32 ailments that these communities cure with ethnomedicinal plants, for example, cough, cold, cuts, wounds, diabetes, skin issues, intestinal worms, stomach issues, jaundice and dysentery. These traditional healing practices are mostly continued by the elders of these communities, with the younger generations largely drawn towards modern healthcare facilities. Some of the most used medicinal plants of these communities (Mandal *et al.*, 2020) are *Andrographis Paniculata* (local name: Kalmegh; decoction of leaf used orally consumed for treating jaundice, cough and cold), *Hygrophila Schumach* (local name: Kulekhara; liquid extraction of leaf to increase the level of haemoglobin in blood), *Justicia adhatoda* (local name: Bansak; liquid extraction of leaf to treat cough and cold), *Iresine herstii* (local name: Raktalal; extraction of leaves as well as crushed leaves applied directly to wounds and cuts), *Artemisia culgaris* (local name: Titepati; extraction of leaves as well as crushed leaves use to treat bleeding nose, asthma problem and brain diseases).

The Jagmandal forest areas in the central Indian state of Madhya Pradesh are predominant dwelling place of Indigenous communities such as Gond, Baiga, Pradhan, Kol, Agariya andh, Bhaina, *etc*. which heavily depend upon

forest-based medicinal plants and herbs for their traditional healing practices. In a study conducted from 2020 to 2022, it was found that these communities use "162 plant species from 60 familie to treat around 43 diseases or therapeutic purposes" (Jhariya and Pawar, 2024). The greatest number of medicinal plants belonged to the Fabaceae family, followed by other families such as Rubiaceae, Zingiberaceae, Apocynaceae *etc* and the wild herbs, plants and shrubs were found to be used to treat various diseases like "astringency, rheumatism, skin disease, diarrhoea jaundice, diabetes, diuretics" *etc*. (Jhariya and Pawar, 2024). For example, wild herbs like *Abelmoschus Manihot* (local name: Van-Bhindi; used to treat menstrual issues), *Achyranthes aspera* (local name: *Chirchira*; used to treat Asthma and Hair related issues), *Agave sisalana* (local name: *Kataki*; used to treat fever and skin diseases) and*rographis paniculata* (local name: *Kalmegh*; used to treat Malaria), *Drimia indica* (local name: *Jangli-Pyaj*; used to treat eye issues, kidney issues, piles and skin diseases) and shrubs like *Abutilon glaucum* (local name: *Kakai-pandai*, used as Antipyretic), *Aristolochia indica* (local name: *Easwarmool*; used as an antiseptic), *Eulaliopsis binata* (local name: *Soom-Ghans*; used as antidote), *Flemingia macrophylla* (local name: *Bhaisatad Kala*; used to treat ulcer), *etc*. are some of the commonly used medicinal plants and herbs by these communities (Jhariya and Pawar, 2024). The communities also harvest some of the medicinal plants such as *Diospyros melanoxylon* (local name: *Tendu*; used to treat Diarrhoea), *Phyllanthus emblica (*local name: *Amla*; used as Laxative), *Senna tora* (local name: *Chakoda* Purgative; used as Purgative) and *Swertia angustifolia (*local name: *Chirayata*; used as Antipyretic), which have high economic values in terms of selling to corporate agencies. The communities also consume plan-based foods, often as part of their regular diet, to sustain good health, to enhance immunity system and to prevent illness. However, over extraction of medicinal plants in these regions has also endangered the sustainability of the plants and the overall ethnomedicinal practice of these tribal communities.

The Rabha community in Assam in Goalpara in the Northeast Indian state of Assam is also known for its forest-based ethnomedicinal practices (Mandal, 2025). Goalpara has a dense forest cover of Himalayan sal, which stretches from the Garo Hills of Meghalaya. The Rabhas are originally an animist tribe which believes in the potent energies of spirits, deities and demons in the forest. They believe in the supernatural power of their forest deity called Banamali whom they worship for "health and harmony" as well as "death and disease" (Sarma, 2019). It is their custom to offer ceremonial oblation to their ancestral spirits who, according to them, live in the sal trees. In all their community rituals such as marriage, funeral and other sacred rites, they make offerings to the spirits and deities in the sal forest. They build canopies with sacred groves in the forest, known as *thaan* in Rabha, which is believed to be the dwelling place of their great ancestress. The sacred groves consist of at least five sal trees and is "often located around a water body" where the forest priests, referred to as *ojhas* perform rituals and the Rabha people gather to offer oblation (2019). Because of their animistic faith, they consider every flora and fauna in the forest as sacred and things of reverence. Even at the time of the modern healthcare services, the Rabhas continue to largely depend on traditional forest-based healing practices. One of the major medicinal plants that the Rabha people commonly use from the sal forest is "*Sugandhamantri*, a rhizomatous aromatic herb" which heals "pain, inflammation and septic" and which also has several "analgesic, antidepressan and antifungal benefits" (2019). The Rabhas usually collect the herbs from the forest, "extract its oil, then mix the oil with saw dust and wrap the same around a bamboo stick" (2019) and apply the mixture to cure ailments when necessary. Overall, the Rabha people's ethnobotanical healing practices based on the sal forest are not just "confined to extracting forest resources for preparation of medicine," but in its treatment of the forest "as a live entity with metaphysical manifestations" (2019). The forest priests or the *ojhas* are regarded as the traditional healers who advise the herbs and herb-based healing practices of the villagers. The resins are also used as medicines for diarrhoea, dysentery, swelling, bleeding and skin diseases. The Rabhas are careful not to destroy what they depend upon, as they believe in the environmental dictum that the earth produces enough to meet everyone's needs and one should not be greedy to exploit it. The Rabha's community's knowledge of the forest ecosystem and use of forest-based ethnomedicines are well-developed. For them "health is a psychic state of well-being that is made possible by physical access to trees and herbs often found in the sacred groves" (Sarma, 2022). Therefore, there has not been any established marketing channel for ethnomedicinal plants in Assam (Buragohain *et al.*, 2025).

In all these contexts and various other indigenous ethnomedicinal contexts in India, a lack of interest in ethnobotanical knowledge or traditional healing practices is noted among the younger generations of these communities. Although the tribal communities are careful about the conservation of the medicinal plants and herbs, a wider conservational initiative on the part of the government is necessary to promote more sustainable harvesting, gathering, utilising and selling of medicinal plants.

Possibilities of sustainable bioprospecting in India

In a study conducted in 2009, "the global market for botanical and plant-derived drugs is expected to increase from $19.5 billion in 2008 to $32.9 billion in 2013, an annual growth rate of 11.00 per cent" (Buragohain *et al.*, 2025). However, India's share in this global ethnomedicinal trade was just 0.50 per cent (Buragohain *et al.*, 2025; Geisler, 2012). In this context, corporate-community collaborations

may yield commercial benefits as well as conservation of ethnomedicinal plants. For example, Gram Mooligai Company Ltd. (GMCL) operates in Tamil Nadu as an intermediary between cultivators/gatherers and buyers of medicinal plants in professional terms. The name of the company Gram Mooligai means "Village Herbs" in Tamil-suggesting the company's emphasis on the sustainable marketing of rural ethnobotanical herbs for viable commercial exposures. The company collects ethnobotanical herbs from local farmers and gatherers and supplies them to renowned pharmaceutical companies such as Himalayan Drug Company, Natural Remedies, *etc.* (Torri and Herrmann, 2011). It also facilitates in selling of locally produced ayurvedic medicines in the communities under the name of "Village Herbs" (2011). GMCL takes measures for the sustainable production of medicinal herbs and herbal medicines, as well as sharing the financial gains with the local farmers and providers.

There is another organisation named Foundation for the Revitalization of Local Health Traditions (FRLHT) which attempts to revive the indigenous ethnobotanical healthcare practices in local communities in the South Indian state of Karnataka. This organisation also works towards conserving medicinal plants and promoting the values of ethnobotanical medicines in local healthcare. It has worked in collaboration with local governments and communities to conserve medicinal plants in forests (2011). It conserves medicinal plants in 55 identified areas across forests and altitude zones in South India, where it also serves as a gene bank of diverse medicinal plants. The company takes care of "around 2,000 medicinal plant species, which represent 50% of the medicinal plant diversity of the five states and significantly includes over 75% of the RED Listed Species of these states with detailed floristic studies on medicinal plant diversity including the threatened, traded and endemic plants" (Torri and Herrmann, 2011). According to the director of the company, Dr Padma Venkat, the company seeks to find a balance between "traditional healing methods which depend on subjective parameters like taste, smell and unwritten knowledge to determine the quality of the ingredients and the efficacy of medicines" and modern methods of providing objective healthcare (2011).

Both GMCL and FRLHT are key players in conserving as well as marketing local ethnobotanical knowledge and medicinal plants in India. By encouraging community-based enterprises and facilitating community-company encounters on ethnobotany, these organisations have also promoted traditional healing practices among rural and urban communities through awareness campaigns on traditional medicinal plants and herbs. Their efforts in educating the community farmers and herbs-gatherers in terms of sustainable management of medicinal plants, intermediating in getting appropriate prices from companies for raw ethnobotanical resources and partnering with the communities in selling the locally produced traditional medicines in accessible rural and urban healthcare centres have made them exemplary agencies of conserving and sustainable marketing of local ethnobotanical knowledge and resources.

It may be noted that FRLHT, along with a Madurai/ Tamil Nadu-based NGO named Covenant Centre for Development (CCD) has also documented the traditional healing practices of a sect of traditional folk healers named *Naattu Vaidhyars* in the South Indian state of Kerala, who have been curing various diseases through local medicinal plants and herbs in dedicated manners. *Naattu* refers to local or native and *Vaidhyar* refers to traditional practitioners or healers, coming from the Sanskrit word *Vaidya* meaning local physician, mainly of Ayurveda tradition. FRLHT and CCD have documented over 700 traditional healing practices, 578 ethnomedicinal formulas, traditional food recipes and 13,000 folk healing knowledge and experiences. Interestingly, CCD, under its project "Revitalization of Local Health Traditions" has also developed a Medicinal Plants Conservation Park in Sevayoor, Tamil Nadu, which is a kind of an Ethno-Medicine Forest spread over 33 acres of land with a huge collection of more than 500 medicinal plant species. It may also be noted that in the Chamoli district of Uttarakhand, the Herbal Research Development Institute has established an Herbal Museum to promote "the conservation of rare and endangered indigenous medicinal plant species" (Kandpal *et al.*, 2024). CCD has also actively engaged local communities in participating in its initiatives for ethnobotanical conservation and promotion of traditional healing practices. It has organised training programmes, community outreach programmes, conservation workshops and related awareness campaigns. It also analyses and monitors changes in community health, especially in connection with folk medicines. CCD has also dedicated training programs to encourage rural women to develop medicinal gardens in the backyards of their houses and apply medicinal plants in home remedies. The women are particularly trained with the knowledge of nurturing traditional medicinal plants and applying them to cure common diseases. This initiative not only conserved, nurtured and promoted medicinal plants and traditional healing practices in rural and urban households but also opened possibilities for economic sustenance as well.

CONCLUSION

CCD's exemplary work in promoting the ethnobotanical knowledge and traditional healing practices in Kerala signposts the necessity of the same in other regional contexts in India, which have rich heritage of such knowledge and practice. As ethnobotanical healing practices still survive as a prominent mode of cultural and traditional healthcare in India, they face multidimensional challenges and adversities. Although the tribal communities are careful about the conservation of the medicinal plants

and herbs, a wider conservational initiative on the part of the government is necessary to promote more sustainable harvesting, gathering, utilising and selling of medicinal plants. As the overall reception, corporatisation and sensitisation of ethnobotanical knowledge and bioprospecting practices in India are complex, there should be community driven corporate promotion of ethnobotanical knowledge and traditional healing practices-which would potentially check commercially extractive bioprospecting and biopiracy activities in modern healthcare industries in India and the globe.

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Informed consent

NA.

Conflict of interest

The author declares that he does not have any conflict of interest.

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