CASE STUDY ON GALO TRADITIONAL MEDICINAL KNOWLEDGE: NATIONAL AND INTERNATIONAL PERSPECTIVES

Abstract

Traditional knowledge (hereafter TK) based on medicinal plants has been recognized as one of the important assets inherited through generations by the local communities. Such knowledge is generally passed down to the next generation verbally, in the form of odes, poems, songs or myths and others. There is neither any documentation form of it nor is scientifically experimented but has been used by generations. However, due to an increase in population, deforestation, roads and railways, urbanization and unsustainable harvesting and collection from the wild, many useful plant species along with their uses are disappearing rapidly.

Unsustainable and injudicious extractions of these medicinal plants have pushed some of the important species towards extinction.TK have been exploited by pharmaceutical companies or bio-pirated, thereby harming the interest of indigenous people to whom such knowledge is regarded as their identity. In this paper the researchers made case studies on medicinal plants available at Baririjo circle of Upper Subansiri district in Arunachal Pradesh. The paper also deals with initiatives of government to protect medicinal plants and international conventions and legislations onTK and medicinal plants.

I Introduction

ARUNACHAL PRADESH, a State located on the north eastern tip of India with its borders touching China, Bhutan and Myanmar. This region is endowed with dazzling array of flora and fauna, which has more than 500 rare species of Orchids, are found in the dense jungles of Arunachal Pradesh.[1] It is inhabited by 26 major tribes and 110 sub tribes among whom the *Galo* is one of the major tribe in the state found mainly in West Siang, Lapa Rada, Lower Siang districts and some are also found in East Siang and Upper Subansiri Districts. The majority of the mountainous population of Arunachal Pradesh depends upon agricultural and forest resources for their livelihood, which these communities sustain with their rich and varied traditional ecological

1 Arunachal Pradesh State Portal, *available at:* https://arunachalpradesh.gov.in/index.html (last modified on Jan. 14, 2023).

knowledge.[2] The tribes have their own culture, tradition and medicinal system of treatment and knowledge acquired through close observation of nature. They are a store house of indigenous knowledge which is yet to be documented.

II Conceptual contexts

TK has not been defined under any laws in India. At international level WIPO has provided a working definition stating, TK is knowledge, know-how, skills and practices that are developed, sustained and passed on from generation to generation within a community, often forming part of its cultural or spiritual identity.

TK can be found in a wide variety of contexts, including: agricultural, scientific, technical, ecological and medicinal knowledge as well as biodiversity-related knowledge.[3]

Traditional medicine (hereafter TM) describes a group of health care practices and products with a long history of use. It frequently refers to medical knowledge developed by indigenous cultures that incorporates plant, animal and mineral-based medicines, spiritual therapies and manual techniques designed to treat illness or maintain wellbeing.[4]

TM tends to be practiced outside of allopathic medicine (also known as biomedicine, conventional or Western medicine), which is the dominant system of medicine in the developed world. In many cultures, TM functions as a comprehensive system of health care refined over hundreds or even thousands of years. Some of the best-known TM systems include traditional Indian (Ayurveda) medicine, traditional Chinese medicine (TCM), and traditional Arabic (Unani) medicine.[5]

The World Health Organization (WHO) defines traditional medicine as "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

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2 Chaudhry Pradeep, Dollo Mihin, 'Traditional Biodiversity Conservation and Natural Resources manangement System of some tribes of Arunachal Pradesh, India' 12(4) *Interdisciplinary Environmental Review* 2011, *available at*: https://www.researchgate.net/profile/Kenjum-Bagra/publication/251570561_Pradeep_Chaudhry_Mihin_Dollo_Kenjum_Bagra_and_Bamin_Yakang_2011_Traditional_biodiversity_conservation_and_natural_resource_management_system_of_some_tribes_of_Arunachal_Pradesh_India/links/56ceaf2408aeb52500c3751d/Pradeep-Chaudhry-Mihin-Dollo-Kenjum-Bagra-and-Bamin-Yakang-2011-Traditional-biodiversity-conservation-and-natural-resource-management-system-of-some-tribes-of-Arunachal-Pradesh-India.pdf (last visited Jan 30, 2023).

3 WIPO, Traditional Knowledge, *available at*: https://www.wipo.int/tk/en/tk/ (last visited on Jan. 30, 2023).

4 World Health Organization [WHO], "Fact Sheet No. 134: Traditional Medicine," (May 2003), *available at* http://www.who.int/mediacentre/factsheets/2003/fs134/en/. (last visited on Jan. 30, 2023).

5 Ryan Abbott, "Documenting Traditional Medical Knowledge", *available at:* https://www.academia.edu/Documenting_Traditional_Medical_Knowledge/from=cover_page (last visited on Feb. 10, 2023).

of health, as well as in the prevention, diagnosis, improvement or treatment of physical and mental illnesses.[6]

The widespread use of TM has resulted in traditional health care becoming a lucrative, multinational business. Billions of U.S. dollars are spent annually on traditional medicine in many developed countries. For example, in 2012, 32 billion dollars was spent in the United States of America on dietary supplements, an amount projected to increase to 60 billion dollars in 2021.[7]

In developing countries, more money is spent on TM than on allopathic care. Traditional medicines also contribute to the development of pharmaceutical treatments. As much as one-third to one-half of pharmaceutical drugs was originally derived from plants. Some prominent examples include digitalis, a popular cardiac medication, identified as the active component of the foxglove leaf; morphine and codeine, which alleviate pain, derived from cultivated opium poppy; and atropine, for disorders involving the autonomic nervous system, from the nightshade plant. The anticancer drug Taxol was derived from the bark of the Pacific yew tree, and Aspirin was isolated from willow bark. [8]

Traditional medicine does more than provide raw materials for pharmaceuticals—holders of traditional knowledge often have valuable knowledge for new drug development. New drug development is an expensive and risky venture. Pharmaceutical companies invest billions of dollars annually in the hope of developing new chemical entities that are safe and effective, and that can be manufactured in a cost effective way. It is estimated that for every 10,000 pure compounds that are biologically evaluated, only one achieves regulatory approval. A single approval can take upwards of a decade and cost hundreds of millions of dollars.

TK can provide valuable guidance in selecting and obtaining plant material of potential therapeutic interest. Bioactive compounds derived from currently used herbal medicines are more likely to have minimal toxicity, and a long history of clinical use suggests that herbal medicine may be clinically effective. Plant-derived compounds used as drugs are generally used in ways that correlate directly with their traditional uses as plant medicines.[9]

TK is integral to the identity of most local communities. It is the key constituent of a community's social and physical environment and as such, its preservation is of

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6 WHO, "Traditional Medicine: Definitions", WHO/EDM/TRM/2000.1, 2000, *available at*: http://www.who.int/medicines/areas/traditional/definitions/en/.(last visited on Jan. 30, 2023).

7 *Ibid.*

8 WIPO, Traditional Knowledge, *available at*: https://www.wipo.int/tk/en/tk/ (last visited on Mar. 5, 2023).

9 Ryan Abbott, "Documenting Traditional Medical Knowledge", *available at:* https://www.academia.edu/Documenting_Traditional_Medical_Knowledge/from=cover_page.

paramount importance. Attempts to exploit or bio-piracy of TK for industrial or commercial benefit can lead to its misappropriation and can prejudice the interests of its rightful custodians and today it is under threat in many parts of the world. Thus, there is a need to develop ways and means to protect and nurture TK for sustainable development in line with the interest of TK holders, as their rich endowment of TK and biodiversity plays a critical role in their health care, food security, culture, religion, identity, environment, trade and development.[10] Although government of India has developed TKDL incorporating a list of codified TK practices of India, but still there is need for a legislation to protect TK of various forms.

III Indigenous traditional knowledge concerns and awareness

Rapid loss of valuable ITK (Indigenous Traditional Knowledge) and illegal trading of wild and rare indigenous plants of Arunachal Pradesh is a serious concern for the State and community. Lack of adequate scientific knowledge and awareness has further accentuated the problem. Thus, there is urgent need for firm law on traditional knowledge in India as it is important to preserve the uniqueness of traditional knowledge of indigenous communities for their interest and also for conservation of their ecology.

This paper, explores three research questions which will be used as guidelines to obtain information. They are-

i. What is the traditional medicinal knowledge on plants of the Galo tribe of Arunachal Pradesh?

ii. Whether there have been any measures taken by the government of Arunachal Pradesh to protect TK?

iii. Whether TK is protected enough under laws in India?

Arunachal Pradesh is a 100% tribal State inhabited by various tribes and its sub- tribes. It is a home to about 500 species of medicinal plant reported so far, which is will not only cure our ailments but can also is a potential source of economy to the state.[11] So it is a non-argumentative fact that each tribe has various medicinal knowledge regarding wild plants which has been passed on to them from generation to generation or ancestors.

Likewise, since early period *Galo* tribe of Arunachal Pradesh have been practicing various kinds of traditional practices which is common among their community and one of them include use of medicinal plants like *Lasia Spinosa (L.) Thwaites* to cure stomach worms, *Zanthoxylum Rhetsa DC* used as fish poison, *Crassocephalumcreepifies(Bent)*

10 WIPO, 'Protecting India's Traditional Knowledge', *available at:* https://www.wipo.int/wipo_magazine/en/2011/03/article_0002.html, June 2011. / (last visited on Mar. 30, 2023).

11 Department of Environment and Forest, Government of Arunachal Pradesh, *available at*: https://arunachalforests.nic.in/medicinal_plants.html (visited on Mar. 7, 2023).

S. Moore, whose leaves are used as flies repellent and also to stop bleeding in case of any cut and many others which will further be discussed on this paper. Thus, that knowledge lies at the heart of a community's culture and identity.

The Department of Environment and Forest under Government of Arunachal Pradesh has overall responsibility to preserve its biodiversity. To promote cultivation, conservation and marketing of medicinal plants in Arunachal Pradesh, a board named Arunachal Pradesh State Medicinal Plant Board was established in November, 2011 under the Department of Environment and Forest. Some of their projects for cultivation of medicinal plants include creation of Herbal Garden at Raj Bhawan, Medicinal Plant Conservation Areas at Tawang, Ziro, Parshuram Kund and others.[12]

The Government of India has established a National Institute then in 2008 "The North Eastern Institute of Folk Medicine (NEIFM), now the North Eastern Institute of Ayurveda and Folk Medicine Research (NEIAFMR), at Pasighat, East Siang District, Arunachal Pradesh under Ministry of AYUSH with the objective to survey, document and validate folk medicine practices, remedies and therapies prevalent in the region with a view to revitalize, promote and harness these local health traditions for the wellbeing of wider public especially living in North Eastern Region. The activities of the institute will also help in protecting the knowledge and resources of folk medicines in the North Eastern Region.[13] But still no other initiatives have been taken by the government like preventing it from bio-piracy because they have been promoting marketing of plants or providing licenses to all self-proclaimed herbalist in various parts of the state.

At international level, the Convention on Biological Diversity calls all member states to protect TK of their local communities under article 8(j) and further Nagoya Protocol introduced the concept Prior Informed Consent (PIC). But when we look into the Indian scenario it has no substantive legislation for protection of medicinal plants but only a mention of it can be found under The Patent Act, 1970 under section 25 (1) (k) and 64 which provides for one of the grounds for revocation of patent.

Some of the recent legislation that came up to protect TK in India is the Biological Diversity Act, 2002, the Protection of Plant Varieties and Farmer's Rights Act, 2000, the Scheduled Tribe and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 and other legislations which protect all different forms of traditional knowledge has mentions in the Geographical Indications of Goods (Registration and Protection) Act, 1999, Copyright Act, 1956 and the Trademark Act, 1999.

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12 Arunachal Pradesh State Medicinal Plant Board, *available at*: https://apsmpb.com/ (last visited on Jan.12, 2023).

13 AYUSH: 'Measures taken by the Government for preservation of Ethnic and Tribal medicinal practices' *available at:* https://pib.gov.in/newsite/PrintRelease.aspx?relid=137966 (last visited on Feb. 10, 2023).

With bio-piracy being rampant and the cost of fighting litigation to combat such white-collar pirates running into millions of dollars, a strategy was developed by the Government of India (GOI), which took around eight years to materialize and be effective. Traditional Knowledge Digital Library or TKDL was established with the objective of incorporating a list of codified TK practices of India. This dynamic list includes more than 30 thousand medicinal formulations and is made available online to provide relevant information to patent and trademark examiners in offices of respective jurisdictions, refraining from a grant. The data is made available in five United Nations languages, *viz.,* French, German, English, Spanish and Japanese for convenience irrespective of the fact that data originated in languages like Sanskrit, Urdu, Persian and Hindi.[14]

This paper aims to make the following enquiries-

i. Legal contexts of traditional medicinal knowledge of the Galo tribe.

ii. To analyze the laws in India and the global framework.

The scheme used for this paper is partly doctrinal and empirical and it is largely based on first-hand information relating to generational traditional herbal knowledge of the Galo tribe of Baririjo Circle. Information on plants has been gathered from elders and the plant's specimens were identified from secondary sources like the Department of Forest, Department of Agriculture, journals, and some unpublished works. And the rest of Acts and Conventions are from the internet, websites, acts, journals, and articles. The paper examines a total of only ten species being used by the Galo tribe for medicinal purpose. The family name of the species, the local name, the part used, and a description of the way it is utilized among locals and also ethno medicinal properties are given after the botanical name. Thus establishment of statutory TK protection board at the State level is likely to prevent ITK from being misused and also conserve biological resources and biodiversity.

Brief on *Galo* tribe

The *Galo* are a central Eastern Himalayan tribe, who are descendants of Abotani and speak the Tani Galo language. The Galo people primarily inhabit West Siang, Lepa Rada, and Lower Siang districts of Arunachal Pradesh state in north eastern India, but they are also found in the south-western side of East Siang district, the South eastern side of Upper Subansiri district.

Galos live in harmony with nature and follows a religion called Donyi-Polo meaning the Sun and the Moon. White flags with sun emblazoned on them can be seen fluttering

14 Chakraborty Shambu Prasad and Kaur Ravneet "A Primer to Traditional Knowledge Protection in India: The Road Ahead" *Liverpool Law Review* (2021) 42:401-427, *available at:* http://doi.org/10.1007/s10991-021-09281-4 (last visited on Feb. 10, 2023).

outside the houses of the *Galos* who follow the religion of Donyi-Polo. The *Galo* tribe traces their origin to Abotani who is said to have handed down the skills of rice cultivation. They practice both shifting cultivation and wet rice cultivation. They celebrate an agricultural festival called Mopin, in month of April (Luki).

About Baririjo Circle

The plant species mentioned in this paper are entirely available in the Baririjo circle. This circle is located in Upper Subansiri district of Arunachal Pradesh. It is situated 55 km away from district headquarter Daporijo. Baririjo is the sub-district headquarters of Baririjo. Baririjo headquarters has a total population of 380 peoples, out of which male population is 190 while female population is 190. Literacy rate of Baririjo headquarter village is 76.05% out of which 77.89% males and 74.21% females are literate.[15]

The Upper Subansiri District derives its name from the Subansiri River which meanders through the entire length of the district. The Geographical Area of the district is 7,032.00 sq.km and the Population of the district is 83,448 as per 2011 Census. West Siang district falls at East and partly at South and the lower Subansiri district at West and Partly at South. The Mc Mohan line borders China to the north.The district is mountainous, rugged, and difficult terrain. The river Subansiri has intersected the terrain. Snow-capped mountains ranges in height from 7000ft. to 18000 ft. (above sea level) stand like a barrier at north, rich in *flora* and *fauna*. Three major tribes inhabit the Upper Subansiri District, namely, the Tagin, the Nyishi, and the Galo. There is a close correlation among the three tribes so far as their socio-economic aspects are concerned. Most of their traditions and customs have been handed down from generation to generation orally.[16]

IV Studies on folk medicinal plants and their uses by *Galo* tribe

In Arunachal Pradesh, each and every tribe has their unique connection with ecology surrounding them, be it related to sacred forest, taboos with regard to animals or use of some plants. Traditional herbal and Ayurvedic medicine comprise an important and prestigious form of treatment for various diseases and conditions in different locations all over the world from the beginning of human civilization on Earth. Several plants and their corresponding preparations have been used for various therapeutic purposes for a long time. Some of the plants used by the *Galo* tribe situated at Upper Subansiri area are as follows:

15 Indian Village Directory, Baririjo Circle, and Available at: https://villageinfo.in/arunachal-pradesh/upper-subansiri/baririjo/baririjo-h-q.html (last visited on Dec. 30, 2022).

16 Government of Arunachal Pradesh, Upper Subansiri District, *Available at:* https://uppersubansiri.nic.in/about-district/ (last visited on June 17, 2023).

Lasia Spinosa

Lasia Spinosa (L) Thwaites, often known as Pumro among the Galo tribe. It is found in Asia including Bangladesh, China, and the Indian subcontinent, Myanmar, Thailand, Indo-China, Indonesia, and Papua New Guinea. It is also known as Sibru in Assames, Kata-kachu in Bengali, Janum-Saru in Manipuri, Kohila in Sri Lanka, Zawangzang in Mizoram, and belongs to the *Araceae* family.

Briefly, *L. spinosa* is an aquatic or terrestrial plant, short-stemmed spiny heirs with underground rhizomes that usually occurs in wet forests, open marshes, wetlands, or in permanently standing water. *L. spinosa* is a large marsh plant with the stem stout 1m high and the leaves broadly arrow-shaped in outlines, 20-30cm long deeply divided into 4-6 pairs of narrow side lobes. The petiole is 30-40cm long, veins beneath the petiole and peduncle prickly.

Since early times *Galo* tribes have been using its leaves in smoked which then turned into powdered form for killing intestinal worms both in humans and animals, mostly for pigs.

L. spinosa is a medicinally important plant, traditionally used by different ethnic communities all over the world. There are various reports on *L. spinosa* medicinal and economical properties. Often used for treating colic, tuberculosis of lymph nodes, swollen lymph nodes, rheumatism/rheumatoid arthritis, injuries, snake bites, and insect bites, this plant is also recommended as effective for the treatment of sore throat, constipation, to purify the blood, on lung inflammation, bleeding cough, and uterine cancer. Rhizomes (roots) are most often used as a remedy for haemorrhoids and to confer protection for some of the above conditions, because of their high fibre content and antioxidant compounds.

Besides, leaves and stalks have demonstrated profound antihelminthic, anticathode, and ant nematode efficacy. The root decoction is also useful in gastrointestinal diseases and stomach ache, while also stimulating liver function. Paste from tender leaves is externally used in burns.[17]

Bambusa

Bamboo is commonly known as Eehe among the *Galo* tribe. In brief, bamboo, subfamily of tall treelike grasses of the family *Poaceae,* comprises more than 115 genera and 1,400 species. Bamboos are distributed in tropical and subtropical to mild temperate regions, with the heaviest concentration and largest number of species in East and Southeast Asia and on islands of the Indian and Pacific oceans. Bamboos are typically fast-

17 Hossain Rajib, Quispe Cristina: "Lasia Spinosa Chemical Composition and Therapeutic Potential: A Literature Based Review", *available at:* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8727140/ (last visited on Dec. 3, 2022).

growing perennials, with some species growing as much as 30 cm (1 foot) per day. Bamboos are used for a great variety of purposes, especially in East and Southeast Asia. The seeds of some species are eaten as grain, and the cooked young shoots of some bamboos are eaten as vegetables. The raw leaves are a useful fodder for livestock.[18]

At Baririjo Circle one can find various species of bamboo known by the names of Eehe Hini, Eehe Deeve, Eehe Hijo and others. The most identifiable are the *bambusa tulda* and *bambusa nutans* and *dendrocalamus Hamiltonii nees exMunro*.

Bamboo plants are unavoidable parts of culture of indigenous tribal living in Baririjo circle. Bamboos are used in making various handicrafts such as baskets, containers, chairs, and broom and also used for construction of tribal homes. Young shoots are eaten as fresh and even in dried form. It is also used for various ritual purposes. Therefore it can be said as one of the most exploited plants in the circle. But apart from this, one interesting traditional medicinal knowledge behind bamboo is that local communities of the particular circle use the outer green part of bamboo known as sheath, in cuts and also to stop bleeding. Sheath is peeled off with help of a blade or dao and turns into a fine green powdered form.

Dendrocalamus Hamiltonii Nees and ARN. Exmunro

It is known as EEPOM among the *Galo* Tribe. These are young sprouts present in bamboo plants themselves are edible among many Asian countries, in India especially among North-East people. It is also known as Pahari-Kako in Assamese. The liquid of fermented young bamboo shoots, apart from eating, are being used against bee bites and have anti-inflammatory properties.

Acorus Calamuslinn

It is known as talyo in the *Galo* tribe. *Acorus calamus Linn* known as sweet root and Vacha in Sanskrit is a mid-term, perennial, fragrant herb which is practiced in the Ayurvedic (Indian traditional) and the Chinese system of medicine. The plant's rhizomes are brown in color, twisted, cylindrical, curved, and shortly nodded. The leaves are radiant green, with a sword-like structure, which is thicker in the middle and has curvy margins.[19]

Traditionally, Rhizomes are used in the treatment of diarrhea and dysentery. This plant is also being practiced traditionally in the Indian Ayurvedic tradition, as well as

18 Bamboo Plant, *available at:* https://www.britannica.com/plant/bamboo (last updated on Jan. 9, 2023).

19 Vineet Sharma, Rohit Sharma, "Role of Vacha (Acorus calamus Linn) in Neurological and Metabolic Disorders: Evidence from Ethnopharmacology, Phytochemistry, Pharmacology and Clinical Study" 9(4):1176 *Journal of Clinical Medicines, J Clin Med* 2020 Apr., *available at:* https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7230970/.(last updated on Jan. 9, 2023).

in the Chinese system of medicine for analgesic, antipyretic, tonic, anti-obesity, and healing purposes; it is highly effective for skin diseases, along with neurological, gastrointestinal, respiratory, and several other health disorders. Rhizomes and leaves are found to be profusely practiced in the form of infusion, powder, paste, or decoction.[20]

Crassocephalum Crepidioides (Benth) S.Moore

In traditional way it is known as O-Jogen, O- in galo language means vegetable in common and Jogen is the name of the plant mentioned above. It is also known as red-flower rag leaf

The genus *Crassocephalum* belongs to *Asteraceae* family and is widely distributed in the tribe Senicioneae and represented by approximately 100 species in Asia, Africa, Australia, Malaysia, China, Nepal and Sri Lanka. Many of these species are widely used as food additives or in traditional medicines.[21]

Crassocephalum crepidiodes is traditionally used mostly during periods of shifting cultivation as repellent against flies and also used in cuts to stop bleeding any case any injury happens to any people working in the field. It is also an edible plant.

Crassocephalum crepidioides commonly known as thickhead or fireweed and used as oriental medicine for the treatment of cut and to cure diarrhoea. The plant parts have been used to treat fever, liver disorders such as hepatitis, indigestion and also as purgative and laxative. It has antioxidant, anti-inflammatory, antitumor and antibacterial properties. Phytochemical screening of this plant recorded the presence of alkaloids, diterpenes, tannins, coumarins, flavonoids, mucilage, reducing compounds and steroids.[22]

Canarium Strictium Roxb.

In the *Galo* community it is known as Jilum Enne. It is also known as black dammar, black dhup or Indian white Mahogany.

Canarium strictum is a large canopy tree with bipinnate leaves that is distributed across parts of India, Myanmar, and Yunnan province, China. It can grow up to about 40 m tall and is found in moist deciduous to semi-evergreen forests at altitudes ranging

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20 *Ibid.*

21 Soni Thakur, R. Koundal, "Volatile Composition and Cytotoxic Activity of Aerial Parts of Crassocephalum crepidioides growing in Western Himalaya, India", *Indian Journal of Pharmaceutical Science* 2019 Jan-Feb., *available at:* online URL: https://www.researchgate.net/publication/331492258.

22 Soni Thakur, R. Koundal, "Volatile Composition and Cytotoxic Activity of Aerial Parts of Crassocephalum crepidioides growing in Western Himalaya, India", Indian Journal of Pharmaceutical Science 2019 Jan-Feb., *available at*: online URL: https://www.researchgate.net/publication/331492258. (last visited on Jan. 9, 2023).

from about 750 m to 1400 m. Trees are polygamous and flowers are insect pollinated. Fruits are ovoid or ellipsoid drupes with one to three seeds. Seed predation has been reported to be very low (1%). *Canarium strictum* sheds its leaves during the months of December and January, and it is reported to be a late-secondary forest species.[23]

Among *Galo* tribes, the fruit of the *Canarium Strictium Roxb.*also known as Jilum is eaten by indigenous people and stem latex is used as mosquito repellent. In earlier times, its logs were used as construction material and timber but now it is banned by village councils as the tree is on verge of extinction and another reason is deer that used to be around the tree to eat ripen fruit are now difficult to be found and cause loss to village hunters.

On other hand, black dammar has been used traditionally to cure numerous ailments, including rheumatism, coughs, asthma, epilepsy, syphilis, hernia, fever, chronic skin diseases, and hemorrhage. Although no studies have been carried out on the synthesis of black dammar, synthesis of most constitutive resin in *Canarium* species is thought to be produced in the bark as a result of wounding. *Canarium strictum* was also harvested for its timber in the past, but logging was banned over 30 years ago and has stopped since then. The harvest of black dammar is permitted for trade in Kerala, but in Tamil Nadu, as a conservation measure, harvest is permitted only for personal or home use.[24]

Gloriosa Superba L.

This plant is known as Taek naan in *Galo* language. It is also known by name of climbing lily or Agnisikha in Assamese. Herbaceous climbers with tuberous roots. Leaves subsessile, alternate, opposite or whorled, 5-13 x 1.5-4 cm, ovate-lanceolate, base cordate or amplexicaul, apex acuminate, ending in a tendril.[25]

Glorriosa superba Linn, also known as Taek naan meaning lice killer. Its tuber and leaves are crushed and used to kill lice present in human hair.

This is an important medicinal plant, used as an antidote for snake poison and is in demand commercially. The tuber is poisonous, when consumed in high quantities.

23 Anita Varghese., and Tamara Ticktin, "Regional variation in non-timber forest product harvest strategies, trade, and ecological impacts: the case of black dammar (*Canarium strictum* roxb.) use and conservation in the Nilgiri Biosphere Reserve, India" 13(2) *Ecology and Society*, Art.11. *available at:* online http://www.ecologyandsociety.org/vol13/iss2/art11/.(last visited on Jan. 9, 2023).

24 Anita Varghese and Tamara Ticktin, "Regional variation in non-timber forest product harvest strategies, trade, and ecological impacts: the case of black dammar (*Canarium strictum* roxb.) use and conservation in the Nilgiri Biosphere Reserve, India" 13(2) Ecology and Society, Art.11., *available at:* http://www.ecologyandsociety.org/vol13/iss2/art11/.(last visited on Jan. 9, 2023).

25 India Biodiversity Portal, *available at*: https://indiabiodiversity.org/species/show/32193 (last visited on June 28, 2023).

Colchicines is the important alkaloid extracted from the seed and used in modern medicine. It is also the state flower of Tamil Nadu.[26]

Paris Polyphylla Sm.

Paris polyphylla is a rhizomatous herbaceous species belonging to the Melanthiaceae family. The genus comprises 24 species, which are distributed in Bhutan, China, India, Japan, Korea, Laos, Mongolia, Myanmar, Nepal, Russia, Thailand, Vietnam and Europe. China has the highest number of species (22 species) with 12 endemic species. In India the genus is represented by 2 species, *viz. P. polyphylla and P. thibetica.*[27] It is used in the treatment of fever, headache, burns, wounds and treatment of livestock diseases to neutralize poison.

Tacca Integrifolia Ker Gawl.

Among the *Galo* community it is known as Paser. *Tacca* is a bizarre flowering plant. The common species in Malaysian forests is T. integrifolia, popularly known as 'Bat Flower', because of its two erect white bracts with mauve to purple venation, which look like bat wings. Its local Malay name is keladi murai. Tacca integrifolia grows on the forest floor in deep shade and is widely distributed in lowland and hill forest in both Peninsular and East Malaysia.

It is herbaceous, rhizomatous, and has large green leaves (11-45 × 5-12 cm). The cluster of 7–14 flowers on a long stalk up to 75 cm tall is held above the leaves. The two upper bracts (3.5-9 × 2-6 cm) of the flower are inserted in the axil of one of the outer bracts, and are commonly called the 'bat wings'. The two outer bracts are sessile and arranged oppositely. The long filiform bracts like 'whiskers' hang beneath and can be as long as 30 cm.[28] Traditionally, its rhizomes and berries are used in the treatment of wound and stomach pain.

Tinospora Cordifolia Miers.

Tinospora species is known as Sweinkije among tribes and commonly known as the bile killer or Indian Tinospora. *Tinospora* species are succulent woody climbing shrubs, generally sending down long aerial roots from the host trees, where they spread. *Tinospora cordifolia (*Wild.) Miers ex Hook. F. and Thomas *(T. cordifolia)* is a herbaceous plant in the Menispermaceae family. It was described in ancient ayurvedic textbooks and is

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26 India Biodiversity Portal, *available at:* https://indiabiodiversity.org/species/show/32193 (last visited on Oct. 28, 2023).

27 Arun Kumarn Phurailatpam, Anju Choudry, "Paris polyphylla: An important endangered medicinal Plant of Himalayan Foothills", *available at*: https://www.intechopen.com/chapters/80896(last visited on Jan. 9, 2023).

28 Taccaintegrifolia Ker. Gawl, *available at*: https://www.researchgate.net/publication/341540046 (last visited on Jan. 10, 2023).

recommended in the treatment of a variety of diseases and for promoting health. *T. cordifolia* is commonly known as "Guduchi" ("to protect from disease" in Sanskrit) in India. The species is also known from other traditional medicinal systems, such as Chinese Traditional Medicine. Due to its high medicinal value and rejuvenating ability, it is also known as a "heavenly elixir."[29]

Tinospora cordifolia (Wild.) Miers , traditionally its stem or climber, is used for stomach ailment or for skin diseases. The herb is being used to treat dyspepsia, flatulence, gastritis, jaundice, diarrhoea, splenomegaly, and haemorrhoids, and other gastrointestinal issues. It also plays a part in the treatment of metabolic disorders including diabetes and kidney disease, though this is currently the subject of ongoing research. Intermittent fever, infections, urinary tract disorders, skin diseases, and eye diseases are among the conditions for which it is recommended. It is also used in the treatment of gout and rheumatoid arthritis when combined with other herbs. Bone fractures are treated with the well-ground whole plant.[30]

Zanthoxylum Rhetsa Dc.

Among the *Galo* tribe it is known as O. Onyoor. *Zanthoxylum rhetsa DC* belongs to the genus *Zanthoxylum* of the *Rutaceae* family. It is prevalent in subtropical areas of the world and distributed widely in Bangladesh, India, Sri Lanka, Indonesia, Malaysia, Vietnam and China (Hartley, 1966; Thu *et al.*, 2010). In Bangladesh, it is extensively distributed in Sylhet, Chittagong Hill Tracts, Cox's Bazar, Tangail and Gazipur and utilized by the traditional healers to treat different pathologies of local and tribal people (Yusuf *et al.*, 1994). The plant is also popular among numerous indigenous tribes of the Indian subcontinent and enjoys a number of uses in ethno botanical practice.[31]A deciduous tree with a large crown armoured with sharp prickles on the branches. Leaves are faintly aromatic. Flowers are small, light green and pale yellow. Fruits are bluish –black.[32]

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29 Karuppusamy Arunachalam, Xuefei, "Tinospora Crdifolia (Willd.) Miers: Protection Mechanisms and strategies against oxidative stress-related diseases" 283(Jan) *Journal of Ethnopharmacology*, (2022), *available at*: https://www.sciencedirect.com/science/article/abs/pii/S0378874121007698?via%3Dihub.(last updated on Jan. 9, 2023).

30 Karuppusamy Arunachalam, Xuefei, "Tinospora Crdifolia (Willd.) Miers: Protection Mechanisms and strategies against oxidative stress-related diseases", 283(Jan) *Journal of Ethnopharmacology* (2022), *available at:* https://www.sciencedirect.com/science/article/abs/pii/S0378874121007698?via%3Dihub. last visited on Jan. 10, 2023)

31 Farina Aziz, Fahad Imtiaz Rahman, "Zanthoxylum rhetsa (Roxb.) DC: A systematic review on traditional uses, phytochemistry, and pharmacology", Journal of Pharmacy and Pharmacognosy research, Vol. 10(1), 52-72, (2022) ISSN 0719-4250, *available at*: online URL: http://jppres.com/jppres. last visited on Jan. 10, 2023).

32 India Biodiversity Portal, *available at*: https://indiabiodiversity.org/species/show/20189 (last visited on October 30, 2023).

Zanthoxylum rhetsa DC. Also known as O. Onyoor whose leaves and fruits are both edible and also used for aromatic purpose, is also used as fish poisoning medicine. Even among other tribes, the plant has long been valued for its medicinal uses, and almost every part of the plant has its own function. It has been traditionally used in folk medicine to reduce toothache as the paste prepared from the plant produces a numbing sensation. The fruits are used to treat stomachache and diarrhoea and the juice of the bark is considered beneficial in vomiting, cough, dysentery and headache. In India, a paste made from the prickly thorns of *Z. rhetsa* is used by the Kannikar tribes (Tamil Nadu) to treat breast pain and to increase lactation in breastfeeding mothers. The extract prepared from the leaves is used as deworming agent by Naga tribes of North-East, India.[33]

V Initiatives taken by government of Arunachal Pradesh to protect traditional knowledge on medicinal plants

Arunachal Pradesh has the richest biogeographically province in the eastern Himalayan zone. The State has 20% species of country's fauna, 4500 species of flowering plants, 400 species of pteridophytes, 23 species of conifers, 35 species of bamboos, 20 species of canes, 52 Rhododendron species an more than 500 species of orchids and is considered as one of the 12 mega diversity "Hot Spots" in the world. Forests generate the largest employment and are the single largest source of revenue for the State. The Supreme Court had imposed certain restrictions on felling of trees in 1996, which has affected the revenue resources of the State. The Supreme Court has since allowed timber operations but has directed threat regeneration should be commensurate to the felling, and state government. is to ensure availability of sufficient funds for regeneration. The forestry sector has traditionally been one of the most organized sectors with more than a century old tradition of scientific management. There are over 500 species of medicinal plants reported so far from Arunachal Pradesh. They can not only cure our ailments but can also be a potential source of economy to the state. It will open up avenues in cultivation, processing, packaging, marketing and industrial application.[34] Thus the state government has taken various measures to safeguard those species including medicinal plants and some of them are as follows:-

Department of environment and forest

The Department of Environment and Forest under Government of Arunachal Pradesh is an old establishment in existence for more than 50 years whose overall responsibility

33 Farina Aziz, Fahad Imtiaz Rahman, "Zanthoxylum rhetsa (Roxb.) DC: A systematic review on traditional uses, phytochemistry, and pharmacology" *Journal of Pharmacy and Pharmacognosy Research* 10(1), 52-72, (2022) ISSN 0719-4250, *available at*: online URL: http://jppres.com/jppres. (last visited on Dec.17, 2023).

34 Government of Arunachal Pradesh, The Department of Environment and Forest, *available at:* https://arunachalforests.nic.in/index.html (last visited on Dec.17, 2023).

is to preserve and conserve rich fauna and flora of the State and its ecology as well. In order to promote cultivation, conservation, and marketing of medicinal plants in Arunachal Pradesh, a board named Arunachal Pradesh State Medicinal Plant Board (APSMPB) was established in November, 2011 under the Department of Environment and Forest. It was established with initiative taken by the government in order to promote medicinal plants sector, the Government of India has set up National Medicinal Plants Board (hereafter NMPB) on November 24, 2000. Currently the board is located in the Ministry of AYUSH (Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy), Government of India.

Objectives of NMPB

It focuses on *in-situ* and *ex-situ* conservation and augmenting local medicinal plants and aromatic species of medical significance. It promotes research and development, capacity building through training, raising awareness through promotional activities like creation of Home or school herbal gardens. The overall objective is the development of medicinal plants sector through developing a strong coordination between various ministries or departments implementation of policies and programs in medicinal plants.[35]

North Eastern Institute of Ayurveda and Folk Medicine Research (NEIAFMR)

It is an autonomous National Institute under the Ministry of Ayush, Government of India to function as apex research centre for all aspects of folk medicinal knowledge, thereby including medicinal plants. The Institute is located in Pasighat, in East Siang district of Arunachal Pradesh.

Objective of the institution:

To function as an apex research centre for all aspects of folk medicine knowledge with incorporation with other research centres.

To create an interface between traditional healers and scientific research.

Survey, documentation, and validation of folk medicine practices, remedies and therapies for possible usage in public healthcare and further research.

Generation of public awareness about the potentials of folk medicine for enhancing public health and rural communities in particular.

35 Ministry of Ayush, National Medicinal Plants Board, *available at*: https://nmpb.nic.in (last visited on Dec.17, 2023).

To enhance capacities upgrade skills of traditional healers to enable delivery of standardized healthcare services, increasing robustness and sustainability of the profession.[36]

The Union Cabinet accorded approval for establishment of the Institute on February 21, 2008 on the recommendations of the Steering Committee of the Planning Commission on AYUSH for the 11th Plan. The institute was established with the goal to strengthen and develop traditional healthcare practices for the benefit of the nation, with special focus on the North Eastern region. Then it was named as North Eastern Institute of Folk Medicine (NEIFM). During August, 2021 the Union Cabinet accorded approval to expand the mandate of the Institute and incorporated Ayurveda academic courses. With this, the Institute was changed to The North Eastern Institute of Ayurveda and Folk Medicine Research (NEIAFMR).

The Institute intends to document and assess Local Health Traditions, Healing Knowledge, Drugs Therapeutic product development based on Traditional knowledge, protection of Traditional Knowledge through IPR regime, support conservation and sustainable use of Traditional Practices, Biodiversity, *etc*. The Institute will also provide Undergraduate courses and quality patient care service under the Ayurvedic system of medicines. The institute has been registered as Society with the Government of Arunachal Pradesh under the Societies Registration Act, 1860.[37] The Union Minister of AYUSH, Government of India is the President of the Society. The Present President is Sarbananda Sonowal, Union Cabinet Minister, Ministry of Ayush, Ministry of Ports, Shipping, and Waterways. A Thematic Medicinal Plant garden is being developed in the campus of NEIFMR with an Aquatic pond, Orchidarium and Vermicompost tank which has a total of 109 species.[38]

In 2018, Arunachal Pradesh Chief Minister Pema Khandu stressed the need to legalize harvesting and trade of medicinal plants in the state to save the crops from over-exploitation. He stated that "Hundreds of medicinal plants face threats of extinction because of over- harvesting and destructive collection techniques and urge people to take up eco-friendly measures for conservation of biodiversity." He also sanctioned Rs. 15 crores for forest regeneration works in the state.[39]

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36 The North Eastern Institute of Ayurveda and Folk Medicine Research (NEIAFMR), the Annual report 2019-2020, *available at:* https://neiafmr.org.in/wpcontent/uploads/2022/02/Annual-Report-NEIFM-2019-20.pdf. (last visited on Jan. 20, 2023).

37 Ministry of Ayush, The North Eastern Institute of Ayurveda and Folk Medicine Research (NEIAFMR), *available at:* https://neiafmr.org.in/ (last visited on Dec.17, 2023).

38 The North Eastern Institute of Ayurveda & Folk Medicine Research (NEIAFMR), the Annual report 2019-2020, *available at*: https://neiafmr.org.in/wpcontent/uploads/2022/02/Annual-Report-NEIFM-2019-20.pdf. (last visited on Feb. 20, 2023).

39 Press trust of India (Itanagar), "Arunachal CM for legalizing harvest, trade of medicinal plants*" Business Standard*, May 24, 2018.

Knowing the importance of the medicinal plants and other flora and fauna, the local people of Baririjo circle came up with measures thus by forming various councils such as Yoka village council, Haider village council, Rumte development council and Kulo youth forum. These councils put several restrictions on individuals who trespass their community forest, except for locals of said villages. These councils have their own by-laws which imposes a range of fines if found violating their rules for various plants, animals and fishing in their territorial areas.

VI Indian legal position

The tribes of India constitute 8.2% of the total population. Our country has the largest number of tribes as compared to any other country. There are a variety of groups of tribes. According to the Anthropological Survey of India, there are 461 tribal communities, out of which 174 were identified as sub-groups. 212 tribes are found in different parts of India. This community is divided based on geographical location, languages, and race.[40] Thus by these figures one can assume the uniqueness in each tribe and also their rich and vast traditional knowledge and cultural expressions on various subjects.

The use of traditional medicine is even more substantial in the developing world. According to data provided to WHO, in India 70 percent of the population and in Ethiopia more than 90 percent of the population depend on TM for primary health care. It is reported that more than 70 percent of the population in Chile and 40 percent of the population in Colombia have used traditional medicine. In China, traditional medicine accounts for approximately 40 percent of all health care delivered.[41]

In this 21st Century era, the importance of traditional knowledge is being recognized worldwide but on other hand, is being misused by global communities in form of patent like in cases of turmeric and basmati patent case, bio-piracy by multi-billion dollar pharmaceutical companies and others due to which the indigenous people are reluctant to share their traditional knowledge with outsiders.

Understanding the importance of traditional knowledge, the international community came up with various conventions to provide protection to TK. Some of them are discussed below:

International conventions on protection of Tk regarding medicinal plants

United Nation's Convention on Biological Diversity, 1992

40 Tribes India, *available at*: https://www.tribesindia.com/tribal-people-in-india/ (last visited on Dec. 12, 2022).

41 Ryan Abbott, "Documenting Traditional Medical Knowledge", *available at*:https://www.academia.edu/Documenting_Traditional_Medical_Knowledge/from=cover_page, (last visited on Dec. 12, 2022.

The protection of traditional knowledge innovations and practices of indigenous and local communities has received increasing international attention since the adoption of the CBD in 1992. The Convention on Biological Diversity (CBD) is the principal international instrument which explicitly acknowledges the role of traditional knowledge, innovations and practices of indigenous and local communities' tangible and visible traditional life styles in biodiversity conservation and its sustainable development.

Article 8(j) puts a responsibility on all the member countries by stating- subject to its national legislation, respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilization of such knowledge, innovations and practices.[42]

Nagoya Protocol, 2010

The Nagoya Protocol is the first international instrument of particular relevance to indigenous and local communities' knowledge. The purpose of the protocol is to effectively implement one of the three core objectives of the Convention: the fair and equitable sharing of benefits arising from the utilization of genetic resources. It builds on the access and benefit-sharing provisions of the Convention, 1992.

The protocol contains significant provisions relating to traditional knowledge associated with genetic resources held by indigenous and local communities, as well as to genetic resources held by indigenous and local communities where the rights of these communities over these resources have been recognized. The Protocol sets out clear obligations to seek the prior informed consent of indigenous and local communities in these situations. It also provides for the sharing of benefits arising from the use of traditional knowledge associated with genetic resources, as well as benefits arising from the use of genetic resources in accordance with domestic legislation. Benefit sharing must be based on mutually agreed terms.

In addition, parties to the protocol must ensure that their nationals comply with the domestic legislation and regulatory requirements of provider countries related to access and benefit-sharing of traditional knowledge associated with genetic resources.[43]

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42 UN Convention on Biological Diversity, 1992, *available at*: https://www.cbd.int/doc/legal/cbd-en.pdf (last visited on Dec. 12, 2023).

43 Convention on Biological Diversity, 'Nagoya Protocol on Access and Benefit-Sharing and Traditional Knowledge', *available at* : https://www.cbd.int/traditional/Protocol.shtml (last visited on Dec. 12, 2023)

In India, there is an example of benefit-sharing in the case of Arogyapacha. During an ethno-botanical expedition in the tribal region of the Western Ghats in the state of Kerala, a team of scientists encountered the *Kani* practice of eating seeds of the wild plant Trichopus zeylanicus, and this gave them energy. The *Kani* tribe has used the plant, locally called 'Arogyapacha', for several years to help them through periods of physical exertion. Arogyapacha was investigated and finally a standardized drug based on the *Kani* knowledge of Arogyapacha was developed. The drug called "Jeevani" was released for commercial production in 1995.While transferring the technology for the production of the drug to a pharmaceutical firm, the Tropical Botanic Garden and Research Institute (TBGRI) agreed to share the license fee on a 50:50 basis. In addition to this, two per cent of the royalties from sales is to go to the tribal community.

Primary Health Care Declaration of Alma Ata, 1978

The importance of traditional medicine as a source of primary health care was first officially recognized by the World Health Organization (WHO) in the Primary Health Care Declaration of Alma Ata (1978) and has been globally addressed since 1976 by the Traditional Medicine Programme of the WHO.

Convention on safeguarding intangible heritages, 2002

This convention has defined the knowledge related to nature and environment as Intangible heritage under Article 2. Further, Article 1 sought for International Cooperation for safeguarding the TK of the local communities.

The declaration on the rights of indigenous people and traditional knowledge, 2007

The rights of the local communities over protecting, maintaining and promoting their TK have been recognized under this instrument as well as a responsibility has been entrusted upon the member states for taking adequate measures to protect such rights.[44]

The Beijing Declaration, 2008

In Beijing in November 2008, government officials representing Member States of WHO adopted a declaration that provides an endorsement of traditional medicine. The WHO Congress on Traditional Medicine was the first time that WHO Member State representatives came together solely to discuss traditional medicine and to prepare an advocacy document. In the Beijing Declaration, they recognized the role of traditional medicine in the improvement of public health and supported its integration into national health systems where appropriate. The declaration encourages governments to create or improve national policies on traditional medicine. It also promotes improved

44 Jayanta Boruah, "Role of National Biodiversity Authorities in the Protection of Intellectual Property Rights over Biological resources in India: A Legal Analysis", in Topi Basar's, 1(1) *Journal on Advanced Research in Intellectual Property Laws*', 181-182 (2020) National Law University and Judicial Academy, Assam, Guwahati, (2020).

education, research and clinical inquiry into traditional medicine, as well as improved communication between health care providers.

In May, 2009, the World Health Assembly (WHA), the governing body of WHO, noted the adoption of the Beijing Declaration and urged Member States to implement its policies. The WHA further directed WHO to provide support to Member States in implementing the Beijing Declaration.[45]

VII Protection of TK on medicinal plants in India

Although India does not have a special legislation on TK but its mention can be found in various Acts. Below are some of the Acts that protect medicinal plants-

The Patents Act, 1970

The Patent Act 1970 under section 3(p) clearly provides that an invention which in effect, is traditional knowledge or which is an aggregation or duplication of known properties of traditionally known component or components.The patent application on TK can be objected by way of opposition to patent before its grant under sec 25(1) and (2) of sub-clauses (d), (f), (j) and (k)-

(d) That the invention so far as claimed in any claim of the complete specification was publicly known or publicly used in India before the priority date of that claim.

(f) That the subject of any claim of the complete specification is not an invention within the meaning of this Act, or is not patentable under this Act;

(j) That the complete specification does not disclose or wrongly mentions the source or geographical origin of biological material used for the invention;

(k) That the invention so far as claimed in any claim of the complete specification is anticipated having regard to the knowledge, oral or otherwise, available within any local or indigenous community in India or elsewhere,

Any patent granted may be revoked under section 64 as follows;

(d) That the subject of any claim of the complete specification is not an invention within the meaning of this Act;

(e) that the invention so far as claimed in any claim of the complete specification is not new, having regard to what was publicly known or publicly used in India before the priority date of the claim or to what was published in India or elsewhere in any of the, documents referred to in section 13;

(f) that the invention so far as claimed in any claim of the complete specification is obvious or does not involve any inventive step, having regard to what was publicly

45 Ryan Abbott, "Documenting Traditional Medical Knowledge", *available at*: https://www.academia.edu/Documenting_Traditional_Medical_Knowledge/from=cover_page.

known or publicly used in India or what was published in India or elsewhere before the priority date of the claim;

(p) That the complete specification does not disclose or wrongly mentions the source or geographical origin of biological material used for the invention;

(q) that the invention so far as claimed in any claim of the complete specification was anticipated having regard to the knowledge, oral or otherwise, available within any local or indigenous community in India or elsewhere.[46]

The Biological Diversity Act, 2002

The Biological Diversity Act, 2022 was passed by the Parliament of India to protect biodiversity and its flora and fauna and facilitate the sustainable management of biological resources with local communities.

The Act was enacted to meet the requirement stipulated by the UN Convention on Biological Diversity (CBD), to which India is a party.

The Act's main objective is to ensure the conservation of biological diversity, sustainable use of its component and fair and equitable benefit-sharing of resources in order to prevent over usage or eventual destruction of nature.

In order to protect flora and fauna and to implement the objectives of the Act, it provides for establishment of three tier authorities, at national level there is National Biodiversity Authority (NBA), State Biodiversity Board (SBB) at state level and at local level Biodiversity Management Committees (BMC)[47].

Biological Diversity Rules, 2004

In exercise of the powers conferred by section 62 of the BDA, 2002, the Central Government has made the following rules-

Organize through mass media a comprehensive programme regarding conservation of bio-diversity, sustainable use of its components and fair and equitable sharing of benefits arising out of the use of biological resources and knowledge.

To build up databases and to create information and documentation system for biological resources and associated traditional knowledge through biodiversity registers and electronics databases, to ensure effective management, promotion, and sustainable uses.

The authority shall consult with the concerned local bodies and collect such additional information from the applicant and other sources before granting approval to any person for access to biological resources and associated knowledge.

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46 The Patent Act, 1970 (Act 39 of 1970).

47 The Biological Diversity Act, 2002 (Act 18 of 2003), ss. 8, 22, 41.

The formula for benefit sharing shall be determined on a case-by case basis.

Where biological resources or knowledge is accessed from a specific individual or a group of individuals or organizations, the Authority may take steps to ensure that the agreed amount is paid directly to them through the district administration. Where such individuals or group of individuals or organizations cannot be identified, the monetary benefits shall be deposited in the National Biodiversity Fund.[48]

Scheduled tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006

An Act to recognize and vest the forest rights and occupation in forest land in forest dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded; to provide for a framework for recording the forest rights so vested and the nature of evidence required for such recognition and vesting in respect of forest land.[49]

Under Chapter II of the Act it provides forest rights that include- rights to protect, regenerate or conserve or manage any community forest resource which they have been traditionally protecting and conserving for sustainable use, right of access to biodiversity and community right to intellectual property and traditional knowledge related to biodiversity and cultural diversity.[50]

There are some other acts that indirectly protect Traditional Knowledge involving medicinal plants include The Protection of Plant Varieties and Farmers' Right Act, 2001 and Geographical Indication of Goods (Registration and protection) Act, 1999. The above discussion included both the codified and un-codified traditional medicinal knowledge on plants but in India there is one particular law that regulates codified medicines (Ayurvedic, Siddha Unani)-

Drugs and Cosmetics Act of 1940

Traditional medicines may be regulated as prescription drugs, over-the-counter medicines or dietary supplements and marketed with medical, health or nutrient content claims respectively. Modern regulations on traditional medicine began with the Drugs and Cosmetics Act of 1940, which contained a separate chapter and rules for Ayurveda, Siddha and Unani drugs. The Act, amended in 2000, requires government licensing of manufacturers and sellers of traditional medicines. The central government is also empowered to inspect and analyze traditional medicines. Manufacturers of traditional medicines are now required to adhere to good manufacturing practices, as well as

48 Topi Basar, "Legal Protection of Traditional Knowledge in India: An Appraisal", in Gurdeep Singh's Delhi Law Review Vol. XXX 83-84, Faculty of Law, University of Delhi, Delhi (2011).

49 Scheduled tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (Act 2 of 2007).

50 *Id* s. 3 (i), (k).

requirements related to factory premises and heavy metal contents. Traditional medicine manufacturers are required to adhere to information contained in national pharmacopoeias and monographs. Safety requirements for traditional medicines are less strict than those applied to pharmaceuticals, and there is generally no submission requirement for clinical trials demonstrating safety and efficacy. The Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy (AYUSH) is primarily responsible for the regulation of traditional medicines[51].

A notable point is that all the Conventions or Acts provide either defensive or indirect protection only. The BDA, 2002 is more focused on genetic resources, the patent act provides an ambiguous take on the meaning of traditional knowledge and the Drugs and Cosmetic Act protects only the codified traditional medicines. So, there is an urgent need for sui generis legislation that particularly deals only with traditional knowledge on medicines both codified and uncodified.

Traditional Knowledge Digital Library (TKDL)

In June 1999, the then Planning Commission under the Central Government constituted a "Task Force on Conservation and Sustainable Use of Medicinal Plants". One of its objectives included identification of measures to facilitate the protection of "patent rights and IPR of medicinal plants". One among several recommendations of the Task Force was creation of a library to ensure collation of traditional knowledge on one platform, which is available digitally and is helpful in proving to the world that traditional medicinal knowledge with India is prior art due to which, patent applications based on such knowledge will not fulfil the criteria of novelty. Thus, a database of India's traditional knowledge, took birth.[52]

The TKDL was established by the Ministry of AYUSH in collaboration with the Council for Scientific and Industrial Research (CSIR).

The TKDL is a unique proprietary digital database that incorporates knowledge particularly related to medical science from diverse systems like Ayurveda, Unani, Siddha, and Yoga available in the public domain. Information related to healthcare is being documented by shifting and collating the information on traditional knowledge from the available literature existing in local languages. Currently, TKDL is based on 150 books of prior art involving the Indian system of medicine, available at a cost of around USD 1000. The TKDL database is available in different international languages,

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51 Ryan Abbott, "Documenting Traditional Medical Knowledge", *available at:*https://www.academia.edu/Documenting_Traditional_Medical_Knowledge/from=cover_page. (last visited on Jan. 20, 2023).

52 Saba, Protecting Traditional Knowledge- the India story till date, *available at:* https://www.scconline.com/blog/post/2018/04/23/protecting-traditional-knowledge-the-india-story-till-date/ (last visited on Feb. 15, 2022).

and thus is accessible to patent examiners in their own mother tongue. TKDL contains scanned images of medicinal formulations from ancient original texts, but does not have entire information present in the Indian systems of medicine. TKDL is a dynamic database rather than a comprehensive one, where formulations will be constantly added and continuously updated according to inputs from its users.[53]

In 2005, the TKDL expert group estimated that about 2000 wrong patents concerning Indian systems of medicine were being granted every year at international level, mainly due to the fact that India's traditional medicinal knowledge which exists in local languages such as Sanskrit, Hindi, Arabic, Urdu, Tamil, *etc.* is neither accessible nor comprehensible for patent examiners at the international patent offices.[54] Moreover many scholars have criticized the functioning of, TKDL with regards to its effectiveness to the public as well as the free access agreements signed by the patent offices of various countries.[55]

VIII Findings and suggestions

The North Eastern Institute of Ayurveda and Folk Medicine Research (NEIAFMR) which is located at Pasighat, its objective should be more publicized in order to attractresearchers to study their own folk medicines and promote conservation of TK.The Government of Arunachal Pradesh thoughincorporated TK as part of the curriculum for schools, colleges, universities, and research centres but in reality it is not available in every district of Arunachal Pradesh and the government should immediately ensure its availability.

The conservation programme for protection of medicinal plants should be done on a large scale by setting up or promoting herbal gardens and government should allocate funds in this regard to all local communities and especially should focus more on plants that are in verge of extinct, like in Baririjo circle, Gloriosa Superba L. and Paris polyphyla sm. focussing the government's interest to promote marketing of those medicinal plants, otherwise there will be a huge exploitation of plants.

There are many traditional healers based on herbal medicines who should be provided with licenses and incentives and the government enhances traditional medicines in

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53 Saikat Sen and Raja Chakraborty, "Traditional Knowledge Digital Library: A Distinctive Approach to Protect and Promote Indian Indigenous Medicinal Treasure", Current Science, VOL. 106, No. 10 (2014). 1340-1343, *available at:* https://www.jstore.org/stable/24102476.

54 V.K. Gupta, An Approach for Establishing a Traditional Knowledge Digital Library, 5 JIPR 307 (2000), *available at:* <http://nopr.niscair.res.in/bitstream/123456789/26010/1/JIPR%205%286%29%20307-319.pdf>, (last visited on Feb. 10, 2023).

55 Jigmee Wangchuk Bhutia, "Traditional Knowledge and its Protection in India: A Critical Analysis", in Topi Basar's "Traditional Knowledge and Cultural Expressions: National and Community Perspectives", National Law University and Judicial Academy, Assam, Guwahati (2019).

state- run hospitals.Awareness should be created among local communities to protect TK on medicinal plants, since in Arunachal most of this knowledge is orally transmitted, which might be a subject of bio-piracy.A special focus onnon-codified medicinal knowledge, its collection, documentation and framework to include in TKDL should be the priority of GOI. And even the Government of Arunachal Pradesh should also develop a base to protect all traditional knowledge,the same as TKDL for the state.

As suggested by various researches, there is a need for *sui generis* legislation to protect TK. Even after decades legal and policy development on TK and TCEs has not seen great progress. The respective States will have to take concerted effort in terms of policy making and preservation. A proper system to check bio piracy should be put in place especially in border areas.

IX Conclusion

There is an urgent need for protecting and promoting traditional knowledge. If this is accorded its rightful high priority on the national agenda, the government shall allocate a significant budget to facilitate the effective implementation of the Act. To conclude, one can say that India did prove itself as a role model for other countries in protecting biodiversity and traditional knowledge by successfully developing TKDL. But TKDL has been criticized by scholars stating that the creation of TKDL led to patents on various TK. This is a matter of further research.

Even the laws that are mentioned above are inadequate to protect and preserve the TK on medicinal plants. They only provide a defensive mechanism and it creates confusion whether all forms of traditional knowledge are protected within its ambit.

It is imperative to state that the IPR laws only protect documented TK and oral traditions are seen as public information that is freely available and say in case of Arunachal Pradesh TK are orally transmitted which requires urgent protection and documentation. This can only be done by creating special measures to promote these TK and retrospectively protect the rights of these peoples with a robust legal framework to implement benefit-sharing thus by enacting a *sui generis* legislation and also the young citizens to be assured of the economic viability of their ancestral knowledge.

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