Medicinal plants used in management of certain ailments by the Monpas of Dirang, Arunachal Pradesh, India

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Abstract

The Monpas of Arunachal Pradesh, India has rich traditional knowledge on traditional medicines, while, the current study attempts to document the traditional knowledge on the medicinal plants used by them. The field and herbarium techniques were followed to obtain the essential information on the use of medicinal plants. The collected plant species were identified with the consultation of taxonomic literature Floras and Herbaria. Altogether 16 medicinal plant species belonging to 13 families were reported to be used by the Monpa community of this region. Leaves (32%) were the most frequently used plant part, while the flowers (5%) were the least. A total of 16 different medical conditions were reported to be neutralized using these plants. As it was claimed by the locals, these medicinal plants are considered to have no side effects and have multiple health benefits. The plant species *Oenanthe javanica*, with the highest CIs (Cultural Importance Index) and URs (Use Report) score was reported to be the culturally most significant plant among all the medicinal plants used by the Monpas of this region. Moreover, ICF (Informants Consensus Factor) values specified that there was high agreement in the use of plants in the headache and gastro-intestinal ailments category among the users. The rich bio-resources of this region may be further explored to widen the potentiality of herbal medicines.

Keywords: herbal drug; indigenous knowledge; plant resources; tribal medicines

Introduction

India is one of the major Biodiversity centres of the world and is enriched by about 45,000 plant species (Hussain and Hore, 2008). The tribal communities residing in the country depend on the forest resources for their livelihood and use their indigenous knowledge to harvest the rich bioresource (Ramakrishnan et al., 2000). The entire Eastern Himalayan has been rated as one of the top 12th global Biodiversity Hotspots (Meyer et al., 2000).

The State of Arunachal Pradesh of this region is considered as the hub centre of potential plants with an officially recorded list of more than 500 species (Sarmah et al., 2000). The state comprises all the characteristic vegetation types of the country, thus, the region is also considered to be the centre of medicinal and aromatic plants (Kaul and Haridasan, 2000).

The indigenous knowledge on ethnomedicines of Arunachal Himalaya is very rich and diversified among the tribes (Dolo et al., 2006). Likewise, the Monpa community of this state has rich traditional...
knowledge on medicine. Through this research, an effort has been made to document the traditional knowledge on medicinal plants used by the Monpa community of Arunachal Pradesh. The study also focused on the use of the plant-based medicine as well as non-medicinal practices including spiritual healings.

Materials and Methods

Study area, ethnology, and culture

Dirang in West Kameng District, Arunachal Pradesh is situated at 26° 28’ N to 29° 30’ N latitude and 91° 31’ E to 97° 30’ East longitude. The region resides on the bank of the Kameng river with an average altitude of 4900 ft AMSL.

This beautiful hill station is inhabited by the Monpa ethnic community, sharing their traditions and heritage with Western Bhutan. The Monpa belongs to the Tibeto-Mongoloid racial stock and believes in reincarnation and transmigration of the soul (Nima et al., 2011). They perform several dramatic dances of which “Achilamu” is the most popular. The Lossar (the local new year) and Choskar are among the major religious festivals celebrated once a year (Figure 1).

The Monpas are agriculturists, practice both shifting and settled types of cultivation (Nima et al., 2011). Raring of Livestock such as yaks, cows, pigs, sheep, seasonal fishing, and hunting of wild animals are the primary source of income.
Demography of informants
A total of 50 informants were interviewed; of these, 35 were male and 25 were female (Table 1). The informants were categorized into five different age groups, i.e., 30-40, 40-50 and 50-60 (Table 1).

| Table 1. Demographic characteristics of informants |
| --- |
| **Factor** | **Categories** | **Remarks** | **Percentage** |
| Sex | Male | 35 | 58% |
| | Female | 25 | 42% |
| Age | 30-40 | 12 | 24% |
| | 40-50 | 15 | 30% |
| | 50-60 | 14 | 28% |
| | >60 | 9 | 18% |

Field survey and data collection
The field and herbarium techniques were followed (Jain and Rao, 1977) to obtain the essential information on the use of medicinal plants. The survey was done with the help of questionnaires, which was followed by group interviews for comparative statements and authentication about particular plant species used in curing ailments. The necessary information on plants and part/parts used in curing different ailments were also recorded.

To authenticate the collected information, a survey was also conducted to visit the river banks, where the local people usually collect the medicinal plants. Further, the nature of ailments and symptoms were recorded through oral descriptions stated by the villagers. An ethnobotanical market survey was done to assess the commercial feasibility of certain species and information on their uses was collected from the local herbal traders. The collected plant species were identified with the consultation of taxonomic literature and Floras (Bentham and Hooker, 1977) and Herbaria of BSI (Itanagar). The Scientific name of the plants was cross-verified visiting the website www.theplantlist.org.

Analysis of quantitative data
Informant Consensus Factor (Logan, 1986) was calculated using the formula: 
\[ \text{IFC} = \frac{\text{Nur} - \text{Nt}}{(\text{Nur} - 1)} \]
Where “Nur” refers to the total number of use reports for each disease cluster and “Nt” refers the total number of species used for that cluster. This formula was used to determine the consensus among the respondents and to find out the homogeneity in the documented information. The URs was calculated for each species in the data set (Prance et al., 1987). The CIs was also calculated for all the collected plants (Tardio and Pardo-de-Santayana, 2008). All the calculations were done using ‘ethnobotanyR’ software.

Results and Discussion

Taxonomic evaluation of the reported medicinal plants
A total of 16 medicinal plant species belonging to 13 families were reported to be used by the tribal community of this region for the treatment of various ailments (Table 2 and Figure 6). The family Lamiaceae was reported with 3 species and Piperaceae with 2 species; ratio of the family to species of the rest was maintained at 1:1 (Figure 2). As depicted in Figure 3, the life forms of the collected plants include herbs (47%), trees (27%), shrubs (13%) and climbers (13%).
Table 2. Ethnomedicinal and other uses of collected medicinal plants of Dirang, Arunachal Pradesh

| Sl. No. | Botanical Name (Voucher No) | Local Name | Plant Parts | Medicinal uses | Mode of administration | Dosage | Traditional uses | ICF value |
|---------|-----------------------------|------------|-------------|----------------|------------------------|--------|------------------|-----------|
| 1       | *Alnus nepalensis* D.Don (LW/001/2019) | Zaitoloma | Lf | Cure cancer | The Tea prepared from dried leaves can be consumed. | Twice a day | Preparation of butter tea | 0.67 |
| 2       | *Artemisia nilagirica* (C.B.Clarke) Pamp. (LW/002/2019) | Khanmay | Pl | Helps in blood clotting and is also used in aromatherapy | The paste of boiled leaves is advised to apply directly, The raw leaves enhance blood clotting, while, boiled leaves cure skin inflammation, | Thrice a day | - | 0.77 |
| 3       | *Drynaria propinqua* (Wall. ex Mett.) Bedd. (LW/003/2019) | So | Rt | Cure fever and cold | The juice of crushed rhizome is administered orally. | Twice a day | - | 0.63 |
| 4       | *Gaultheria fragrantissima* Wall. (LW/004/2019) | Shakshingma | Lf. St | Cure gum related problems | Fresh berries are eaten raw. | Twice a day | Stem for brushing teeth and raw berries as fruit | 0.67 |
| 5       | *Gaultheria* sp (LW/005/2019) | Seu nyongbu | Fr | Cure digestion problem | Fresh berries are eaten raw. | Twice a day | Raw berries as fruit | 0.74 |
| 6       | *Houttuynia cordata* Thunb. (LW/006/2019) | Memrang | Pl | Improves blood and cures gastric problems | Fresh leaves are advised to be taken orally. | Twice a day | Raw leaves and stem as vegetable | 0.61 |
| 7       | *Hypericum uralum* Buch.-Ham. ex D.Don (LW/007/2019) | Kanchang tsema | Pl | Cure headache | The juice of leaves is administered orally. | Once a day | Fresh leaves are eaten raw | 0.75 |
| 8       | *Litsea cubeba* (Lour.) Pers. (LW/008/2019) | Nyeh | Sd | Cure dysentery | Powdered seeds are mixed with tea. | Twice a day with tea | Spice and flavoring agent | 0.78 |
| 9       | *Oenanthe javanica* (Blume) DC. (LW/009/2019) | Zingtuk | Pl | Cure gastric and heart-related problems | Decoction prepared from boiled in water, juice is administered orally. | Once a day | Whole plant is edible and consumed raw or boiled | 0.38 |
| 10      | *Ophiocordyceps sinensis* (LW/010/2019) | yartsegombu | Pl | Cure body ache | The raw/dried plant is advised to be taken orally. | Twice a day | Seed flour is used in the preparation of several traditional food items | 0.63 |
| 11      | *Phragmites australis* (Cav.) Trin. ex Steud. (LW/011/2019) | Nhey | Sd | Use in treatment of diabetes | Decoction prepared from the powdered seeds and water. | Once a week | - | 0.68 |
| 12      | *Rhododendron arboreum* Sm. (LW/012/2019) | Youdong mendo | Fl | Cure piles | Decoction of the little amount of powdered flower and water is consumed. | Twice a day | Wood is burned in rituals | 0.67 |
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| No. | Taxonomy & Collection Details | Part | Use | Administration | Frequency | Form | Consensus Factor |
|-----|--------------------------------|------|-----|----------------|-----------|------|-----------------|
| 13  | *Rosa sericea* Wall. ex Lindl. (LW/013/2019) | Fr   | Cure jaundice, headache, hypertension | Fresh berries can be eaten raw. | Twice a day | Raw berries as fruit | 0.63 |
| 14  | *Swertia chirayita* Roxb. (LW/014/2019) | Lf   | Cure cold and fever | Raw juice of boiled stem is administered. | Twice a day | - | 0.65 |
| 15  | *Vaccinium glaucoalbum* Hook. f. ex C.B. Clarke (LW/015/2019) | Fr   | Cure diarrhoea | The juice of the fresh berries is advised to consume after and before the meal. | Twice a day | Raw berries as fruit | 0.63 |
| 16  | *Zanthoxylum simulans* Hance (LW/016/2019) | Sd   | Decreases blood pressure | Decoction of powdered seeds is administered orally. | Twice a day | Spice and flavoring agent | 0.63 |

Note: FL=flower, Fr=fruit, Lf=leaf, Sd=seed, Rt=root, St=stem, Pl=whole plant, ICF=Informant Consensus Factor

**Figure 2.** Family distribution of the medicinal plants used by the Monpas of Arunachal Pradesh

**Figure 3.** Life forms of the medicinal plants used by Monpas of Arunachal Pradesh
Medicinal application of the collected plants

Monpas of this region are still depending on the plants for healing purposes. These plants were reported to be used in curing several diseases for many decades. Also, the properties such as easy accessibility, effectiveness, easily processed at a very affordable price make these traditionally available medicines more reliable and locally acceptable. The detail on these medicinal plant species including local name, plant parts used, medicinal properties, mode of administration, and their traditional uses are described in Table 2.

Several plant parts were used in curing ailments (Figure 4). Leaves (32%) were the most frequently used plant part, while the flowers (5%) were the least. A total of 16 different medical conditions were reported to be addressed using these plants (Figure 5). These diseases comprise heart-related problems, high/low blood pressure, gums-related problems, indigestion, gastric, diarrhoea, blood clotting, headache, body ache, cancer, jaundice, piles, cold and fever, diabetes, aromatherapy, and hypertension. As per the local healers, these plants have several modes of administration, of which, decoction is the most common method of administration.

![Figure 4](image_url)  
**Figure 4.** useful parts of the medicinal plants used by the Monpas of Arunachal Pradesh in curing ailments

![Figure 5](image_url)  
**Figure 5.** Common diseases neutralized using medicinal plants by the Monpas of Arunachal Pradesh
Apart from being used in the preparation of herbal drug formulation, medicinal purposes, these plants also have other utilities. For instance, *O. javanica* and *H. cordata* are consumed as vegetables. The leaves of *A. nepalensis* are used in the preparation of traditional butter tea. Likewise, *Z. simulans* and *L. cubeba* are used as edible spices and flavouring agents while preparing traditional cuisines, the stem of *G. fragrantissima* is used as toothbrush, the raw berries of *Gaultheria* sp. and *V. glaucoalbum* are edible, the wood of *R. arboreum* are burned in rituals, Seed flour of *P. australis* is used in the preparation of varieties of traditional cuisines. Additionally, some of these medicinal plants have several records of their utility other than their therapeutic uses. *H. cordata* was also reported to have anti-bacterial and anti-inflammatory activities (Sekita et al., 2016). *O. javanica* is a valuable herb consumed by most Asian countries for food (Lu and Li, 2019). *A. nepalensis*, are also commonly been used in traditional agroforestry systems for shade, fodder, fuelwood, and timber (Rana et al., 2018). Rhodojuice, a processed juice of *R. arboreum* flower is recognized and now widely popular among the Indians (Srivastava, 2012). *P. australis* have multiple utilities including food, fodder, construction, fuel, fiber, etc (Zang et al., 2016).

It was also informed that these medicinal plants are considered to have no side effects with multiple health benefits. Despite their use as medicines, these plant species have been extensively used as vegetables, in religious ceremonies, and food plants as well. There was, however, no written documentation of this knowledge as it is transmitted only through oral communication.

![Image of medicinal plants](image)

**Figure 6.** Some of the medicinal plants used by the Monpas of Dirang, Arunachal Pradesh in curing various diseases

ICF values specified that there was high agreement in the use of plants in headache and gastro-intestinal ailments category among the users. It corroborates with the findings of Namsa et al. (2011), where they reported gastro-intestinal diseases exhibiting high IFC value among the Monpas of Khalaktang region of Arunachal Pradesh. The Radial bar plot of CIs (Cultural Importance index) is depicted in Figure 7, where, *O. javanica* with a score of 4.08 was recorded to be culturally the most important among the medicinal plants used
by Monpas of Dirang, Arunachal Pradesh. Likewise, the radial bar plot of URs per species depicted in Figure 8 also concludes *O. javanica* to be the medicinal plant with the highest URs (204) among all the medicinal plants used by the Monpas of Dirang.

**Figure 7.** Radial bar plot of CIs (Cultural Important index): *O. javanica* reported to be culturally most important plant among the medicinal plants used by the Monpas of Dirang, Arunachal Pradesh.
There are ample research works on the listing of the traditional uses of medicinal plants from the Himalayas. There are, however, very few literature records on the use of traditional medicines by the Monpas of Arunachal Pradesh. Haridasan et al. (1990), in the influential works produced in 1998 and 1990, widely listed medicinal as well as edible plants of the Monpa and other tribes of Arunachal Pradesh. Kar and Borthakur (2008), during their investigation, reported a total of 35 plants were recorded to be used against dysentery, diarrhoea, and cholera by the tribes of the erstwhile Kameng District. Paul et al. (2010) reported 34 Rhododendron taxa during their field survey, of which 9% taxa had medicinal values. Namsa et al. (2011) listed about 50 plant species and recorded their ethnobotanical uses among the Monpa tribe of Kalaktang circle of West Kameng district of Arunachal Pradesh. Chakraborty et al. (2017) reported 53 plant species from this region having ethnopharmacological importance.

Conclusions

The Monpas of this region have demonstrated their knowledge as potential users of plant-based therapy to cure various ailments. There is, however, a potential threat to these plants as a result of the increasing trend of habitat fragmentation of plants, cultural deviation, and acceptance of modern allopathic medicines. Thus,
there is a need for awareness among the locals to conserve these medicinal plants in natural ecosystems with appropriate measures. Additionally, these rich resources may be further explored to widen the potentiality of herbal medicines.

**Authors’ Contributions**

Conceptualization: LW; Writing and editing of original draft: TW; Supervision and validation: ST. All authors read and approved the final manuscript.

**Ethical approval** (for researches involving animals or humans)

Not applicable.

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**Conflict of Interests**

The authors declare that there are no conflicts of interest related to this article.

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