

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

Tonlong WANGPAN*, Leiki WANGMU, Sumpam TANGJANG

Department of Botany, Rajiv Gandhi University, Rono Hills, Doimukh, Arunachal Pradesh,
India; twangpan@gmail.com (*corresponding author); leikiwangmu95@gmail.com; sumpam.tangjang@rgu.ac.in

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

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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.



Figure 1. Study area: Map of West Kameng District, Arunachal Pradesh showing the location of Dirang valley

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: $IFC = \frac{Nur - Nt}{(Nur - 1)}$. 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	<i>Alnus nepalensis</i> 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	<i>Artemisia nilagirica</i> (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	<i>Drynaria propinqua</i> (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	<i>Gaultheria fragrantissima</i> 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	<i>Gaultheria</i> 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	<i>Houttuynia cordata</i> Thunb. (LW/006/2019)	Memrang	Pl	Improves blood and cures gastric	Fresh leaves are advised to be taken orally.	Twice a day	Raw leaves and stem as vegetable	0.61
7	<i>Hypericum uralum</i> 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	<i>Litsea cubeba</i> (Lour.) Pers. (LW/008/2019)	Nych	Sd	Cure dysentery	Powdered seeds are mixed with tea.	Twice a day with tea	Spice and flavoring agent	0.78
9	<i>Oenanthe javanica</i> (Blume) DC. (LW/009/2019)	Zingruk	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	<i>Ophiocordyceps sinensis</i> (LW/010/2019)	yartsegonbu	Pl	Cure body ache	The raw/dried plant is advised to be taken orally.	Twice a day	-	0.63
11	<i>Phragmites australis</i> (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	Seed flour is used in the preparation of several traditional food items	0.68
12	<i>Rhododendron arboreum</i> 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

13	<i>Rosa sericea</i> Wall. ex Lindl. (LW/013/2019)	Akpu seu	Fr	Cure jaundice, headache, hypertension	Fresh berries can be eaten raw.	Twice a day	Raw berries as fruit	0.63
14	<i>Swertia chirayita</i> Roxb. (LW/014/2019)	Chirata	Lf	Cure cold and fever	Raw juice of boiled stem is administered.	Twice a day	-	0.65
15	<i>Vaccinium glaucoalbum</i> Hook. f. ex C.B. Clarke (LW/015/2019)	Fepchang	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	<i>Zanthoxylum simulans</i> Hance (LW/016/2019)	Yerma	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

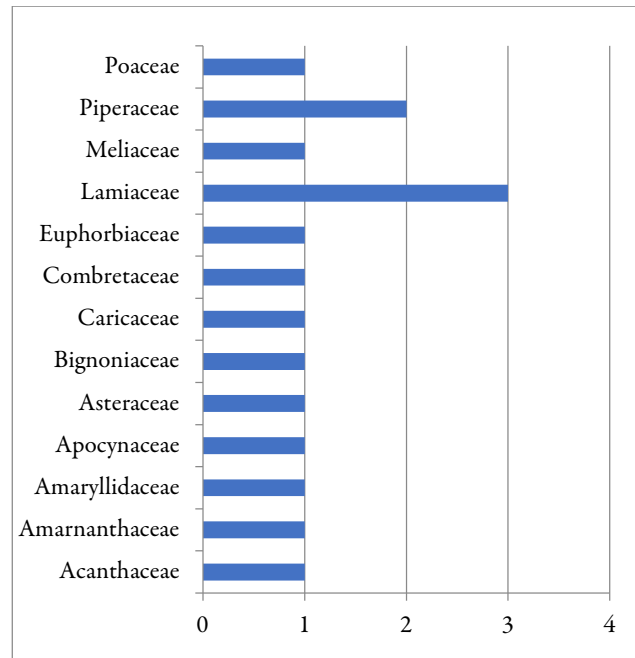


Figure 2. Family distribution of the medicinal plants used by the Monpas of Arunachal Pradesh

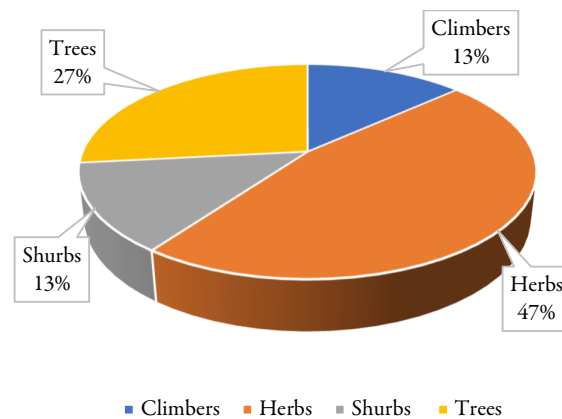


Figure 3. Life forms of the medicinal plants used by Monpas of Arunachal Pradesh

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.

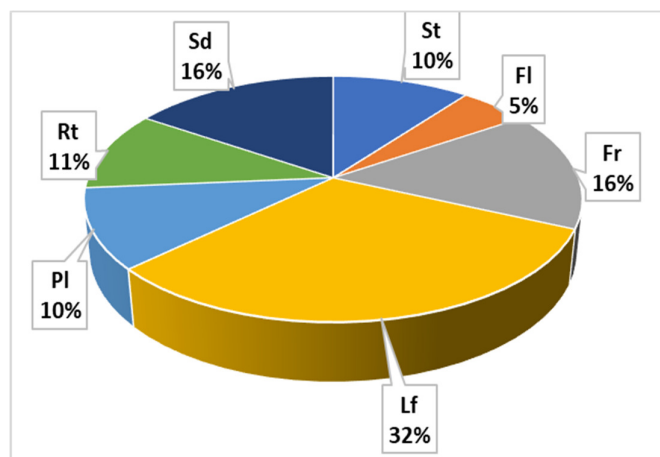


Figure 4. Useful parts of the medicinal plants used by the Monpas of Arunachal Pradesh in curing ailments

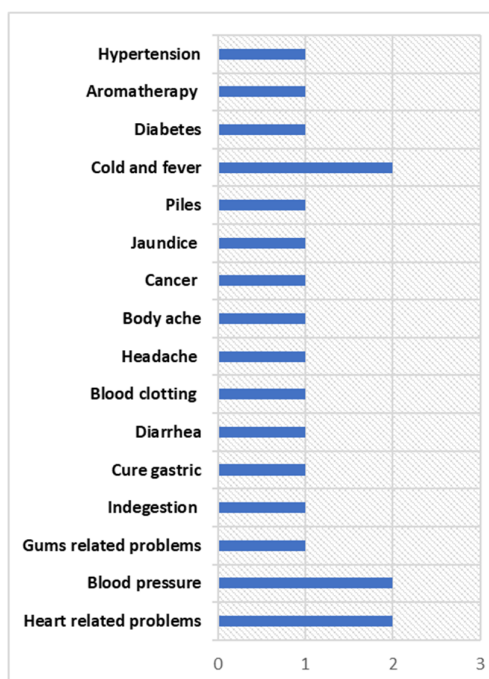


Figure 5. Common diseases neutralized using medicinal plants by the Monpas of Arunachal Pradesh

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.



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.

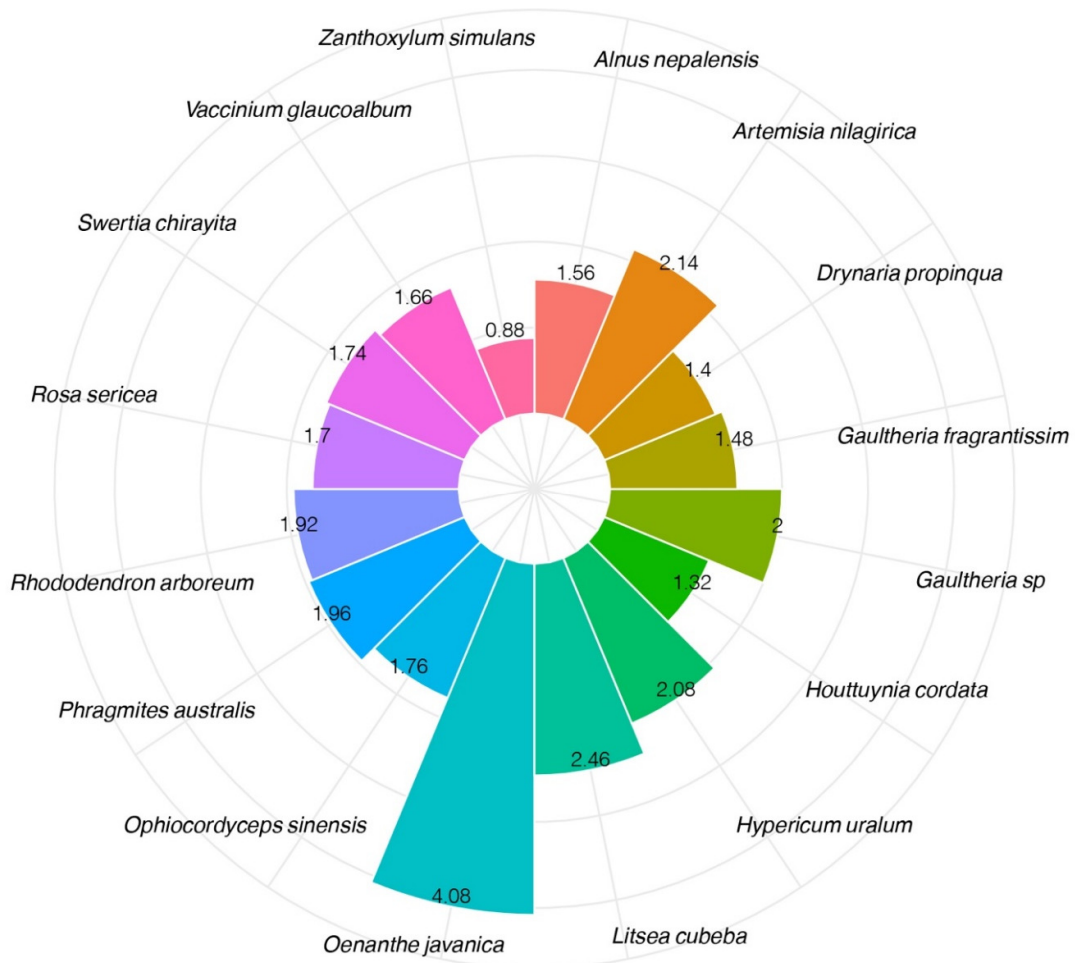


Figure 7. Radial bar plot of CIs (Cultural Important index): *O. javanica* reported to be culturally most important plant among the medicinal plants used by the Monpas of Dirang, Arunachal Pradesh

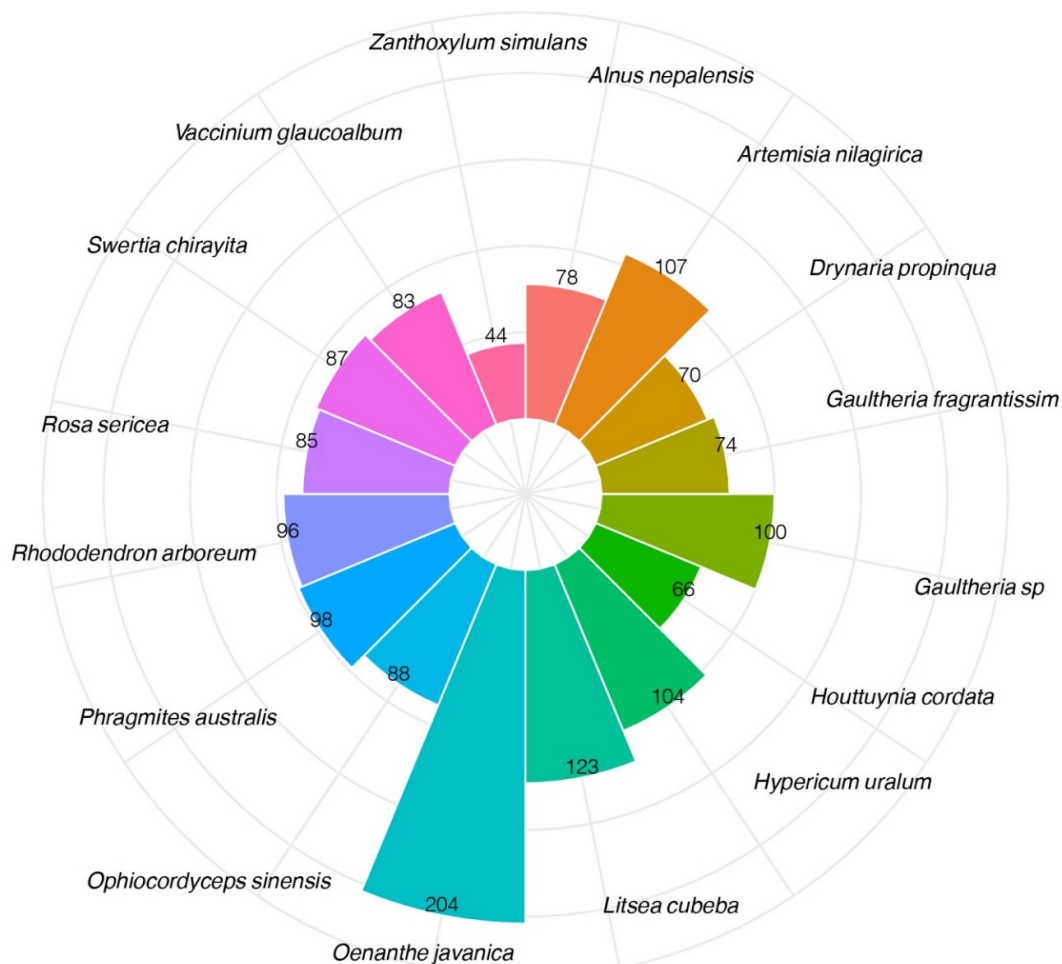


Figure 8. Radial bar plot of URs (Use Reports): *O. javanica* recorded with the highest use reports among the medicinal plants used by the Monpas of Dirang, Arunachal Pradesh

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.

References

- Bentham G, Hooker JD (1875). Flora of British India. In: Reeve L. & Co. (Eds). Henrieta Street, Convent Garden, London.
- Chakraborty T, Saha S, Bisht NS (2017). First report on the ethnopharmacological uses of medicinal plants by Monpa tribe from the Zemithang Region of Arunachal Pradesh, Eastern Himalayas, India. *Plants* 6(1):13. <http://doi.org/10.3390/plants6010013>
- Dollo M, Choudhury D (2006). Eco-cultural heritage of Arunachal Pradesh. National seminar interpreting the heritage of the north east India (INTACH). New Delhi, pp 42-59.
- Haridasan K, Bhuyan LR, Deori ML (1990). Wild edible plants of Arunachal Pradesh. *Arunachal Forest News* 18:1-8.
- Hussain S, Hore DK (2008). Collection and conservation of major medicinal plants of Arunachal Pradesh. *Indian Forester* 134(12):1663-1679.
- Jain SK, Rao RR (1977). *A Hand Book of Field and Herbarium Methods*. Oxford and IBH Publishing Company, New Delhi.
- Kar A, Borthakur SK (2008). Medicinal plants used against dysentery, diarrhoea and cholera by the tribes of erstwhile Kameng district of Arunachal Pradesh. *Natural Product Radiance* 7(2):176-181.
- Kaul RN, Haridassan K (2000) Forest types of Arunachal Pradesh: A preliminary study. *Journal of Economic and Taxonomic Botany* 9(2):379-389.
- Lu C, Li X (2019). A Review of *Oenanthe javanica* (Blume) DC. as traditional medicinal plant and its therapeutic potential. *Evidence-Based Complementary and Alternative Medicine* 6495819:1-17. <https://doi.org/10.1155/2019/6495819>.
- Meyer N, Mittermeier R A, Fonseca GAB, Kent J (2000). Biodiversity hotspots for conservation priorities, *Nature* 3(24):853-858. <https://doi.org/10.1038/35002501>

- Namsa ND, Mandal M, Tangjang S, Mandal SC (2011). Ethnobotany of the Monpa ethnic group at Arunachal Pradesh, India. *Journal of Ethnobiology and Ethnomedicine* 7(31):1-14. <https://doi.org/10.1186/1746-4269-7-31>
- Paul A, Khan ML, Das AK (2010). Utilization of Rhododendrons by Monpas in Western Arunachal Pradesh, India. *Journal of the American Rhododendron Society* 64:81-84.
- Pranc GT, Balee W, Boom BM, Carneiro RL (1987). Quantitative ethnobotany and the case for conservation in Amazonia. *Conservation Biology* 1(4):296-310. <https://doi.org/10.1111/j.1523-1739.1987.tb00050.x>
- Ramakrishna PS, Chandrashekara UM, Eiouard C, Guilmoto CZ, Maikhuri RK, Rao KS, Sankar S, Saxena KG (2000). Mountain biodiversity, land use dynamics and traditional ecological knowledge. (UNESCO), Oxford & IBH, New Delhi, pp 352.
- Rana SK, Rana HK, Shrestha KK, Sujakhu S, Ranjitkar S (2018) Determining bioclimatic space of Himalayan alder for agroforestry systems in Nepal. *Plant Diversity* 40(1):1-18. <https://doi.org/10.1016/j.pld.2017.11.002>
- Sarmah A, Haridasan K, Bisht NS (2000) Development of medicinal plants and economic venture of in Arunachal Pradesh, prospects and constraints. *Arunachal Forest News* 18(1-2):85-90.
- Sekita Y, Murakami K, Yumoto H, Mizuguchi H, Amoh T, Ogino S, ... Kashiwada Y (2016). Anti-bacterial and anti-inflammatory effects of ethanol extract from *Houttuynia cordata* poultice. *Bioscience, Biotechnology, and Biochemistry* 80(6):1205-1213. <https://doi.org/10.1080/09168451.2016.1151339>
- Srivastava P (2012). *Rhododendron arboreum*: An overview. *Journal of Applied Pharmaceutical Science* 02(01):158-162.
- Takhtajan A (1969). Flowering Plants, Origin and Dispersal. Tr. Jeffery, Edinburgh.
- Tardío J, Pardo-de-Santayana M (2008). Cultural importance indices: a comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain) 1. *Economic Botany* 62(1):24-39. <https://doi.org/10.1007/s12231-007-9004-5>
- Zhang S, Lin S, Shen A, Chen H, Wang F, Huai H (2016). Traditional knowledge on “Luchai” [*Phragmites australis* (Cav.) Trin. ex Steud. and *Arundo donax* L.] and their dynamics through urbanization in Yangzhou area, East Chin. *Indian Journal of Traditional Knowledge* 15(4):580-586.



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