Original Research Article

Ethno-botanical studies and survey of rare and endangered medicinal plants of Chang-La (17,688 ft) and Taglang-La (17,582 ft) region of Union Territory of Ladakh

Abstract

The paper deals with the ethno-botanical studies and survey of rare and endangered medicinal plants of Chang-La and Taglang-La and surrounding villages (Meru, Lato, Gya, Sasoma and Rumtse). Although the region looks barren and lifeless, it actually represents a treasure house of diversity of plants with high medicinal, aromatic value and also fulfils other useful purposes (such as food, fodder, fuel and ritual requirements). Predominant species of these areas are:- *Geranium wallichianum, Carum carvi, Aconogonom tortuosum, Cremanthodium elisii, Corydalis stricta, Oxytropis microphylla, Cicer microphyllum, Rosa webbiana, Caragana versicolor, Artemisia macrocephala, Dracocephalum heterophyllum, Hippophae rhamnoides, Astragalus tibetanus, Thalictrum foliolosum, Delphinium brunonianum.* The medicinal plants surveyed during tour was widely used in Sowa- rigpa system of Indian medicine for curing various diseases and ailments as it has no side-effects compared to allopathic medicines. The present paper documents ethno-botanical information of sowa-rigpa traditional medicinal usage by the local people. Around 54 medicinal plants species botanical name, sowa-rigpa name, medicinal use, family, habitat and part uses are enumerated in this paper.

Keywords: ethnobotany, sowa-rigpa, medicinal plants, Chang-La, Taglang-La, Ladakh

Introduction

The vegetation of Ladakh generally comes under sub-alpine, alpine, and high alpine zones and is dominated by annual and perennial herbs, followed by a few stunted shrubs and bushes; which differ remarkably from the rest of the Himalayas due to its existing unique, topographic, physiographic and climatic conditions. The climate of Ladakh is predominantly aridly characterized by low annual precipitation (50-300 mm), and cold due to high elevation and glacier-capped mountains. The annual average temperature of Ladakh is less than 10°C. The temperature may exceed at a lower elevation in summer. There are great diurnal variations in daily atmospheric temperature during the summer season ranging from 0°C to 35°C.

Ladakh is a newly formed Union Territory (on 5th August 2019), earlier being a part of erstwhile state of Jammu & Kashmir. It consists of two districts viz. Leh and Kargil which covers an area of more than 78,000 Km^2 which lies between 32°15`50 – 35°38`11 N latitudes and 75°36`73-78° 31`11 E longitudes at an elevation of 2700-7560m. The earliest records of the flora of Ladakh and western Tibet have been compiled by Stewart in 1916-17 (831 species in 66 families). Later, a total of 611 plant species from Ladakh (540 are dicotyledons, 65 monocotyledons, and 2 gymnosperms). According to the latest floristic, more than 1180 vascular plant taxa have been reported from the cold desert of Ladakh (Dvorsky *et al*., 2011).

The Indian Himalayan region is endowed with rich faunal and floral diversity. Most of the floral diversity of the region is high in valuable medicinal properties and forms a basis of traditional knowledge. Since, the ancient times people are well endowed with the information of curative properties of plants and have started using them for health care and these practices are a part of cultural folk tradition (Bhakuni and Pant, 2018).

Sowa-rigpa derived from Mongolian word “Am-rjay” means superior of all, commonly known as Amchi or Tibetan system of medicine and the practitioner of it is called Amchi. Amchi system of medicine is also very well known in Tibet, Mongolia, Bhutan, China, Nepal, Bhuriat Republic of Russia and Himalaya region of Himachal Pradesh and Sikkim in India. It was the only healing method during early times prior to the introduction of modern allopathic medicine. In the early days, every village had a healer locally known as Amchi (Lamo *et al*., 2019.). This knowledge and skill set was passed down from the father to the son in a family known as

"Lharjay" in most of the larger villages. Unlike today, anybody can pursue this discipline of traditional medicine. Amchis never charged for their services directly, patients offered them gifts in the form of wheat, barley and offered labour work during the time of harvesting the crops, etc (Gurmet, 2004). Rgyud-bzi, a fundamental text book of sowa-rigpa is believed to be taught by Buddha outlines a vast knowledge of medicine, basic principle of health and disease, method of diagnose disease and therapeutic approaches. The basic theory of sowa-rigpa is based on the principles of Jung-wa-lna (English- five elements, Sanskrit-Panch-mahabhuta) and Nespa gsum (English-three humours, Sanskrit-Tri-dosh) (Gonpo.,2008). In Ladakh, 80% of older peoples from the age of above 35 years still depend on the traditional system of medicine.

These practitioners detect and cure number of diseases through their own traditional knowledge (Hafeel and Shankar, 1999). The health care system of 80% populace of the developing world is still dependent on their surrounding vegetation/ forests and pastures. They rely on medicinal plants because of their effectiveness and cultural preferences in addition to absence of modern healthcare alternatives (Caniago and Siebert, 1998).

The increase in demand for medicinal plant has led to over exploitative collection of such plants from its natural habitat. causing threat to many valuable medicinal herbs which are already rare in nature (Swe and Win, 2005). Further, we are witnessing a sharp decrease in the biological diversity across the globe and our study area is no exception to the above trend. Medicinal and aromatic plants (MAPs) are regarded as vital constituent for maintaining human health since the dawn of civilization. The therapeutic values of some of these plants are mentioned in the old Indian scriptures.

At present, there is a growing demand for plant-based medicines, health products, pharmaceuticals, food supplements, cosmetic, *etc.* in the national and international markets (Maiti and Geetha, 2014), resulting in serious threats to many medicinal and aromatic plant. Recently, International Union for Conservation of Nature (IUCN) designed Conservation Assessment and Management Prioritization for the Medicinal Plants (CAMP) methodology revealed that about 112 species in Southern India, 74 species in Northern and Central India and 42 species in high altitude areas of Himalaya are threatened in the wild (Maiti and Geetha, 2014).

In the Indian Himalayan region, the reservoir of enormous natural resources of medicinal wealth and traditional knowledge has been explored for its multiple benefits (Mathur and Joshi, 2012). The traditional medicinal practice is inclusive of local practitioners and the use of herbal medicine by the tribal communities is influenced by various socio-culture practices, beliefs and benefits, support of traditional authority since their ancestral times. The tribal people have close relationship with their environment they are entirely dependent on it for their primary healthcare due to their remoteness.

The uncontrolled and illegal exploitation of Himalayan medicinal species is an appalling problem in the conservation practice (Bhadula *et al.,* 2002). Bio-industries are causing a serious damage to the wealth due to its over exploitative tendencies to the brink of complete depletion. It is anticipated that more than 90% of the entire herbal raw material is from the wild (Ved and Goraya, 2008). Therefore, sustainable use of the natural resources to ensure their availability for future generations is a challenge at present. The present rates of habitat loss, landscape alteration; extinction of the species, community and even loss of ecosystem, have prompted conservation biologists to devise methods and tools for species protection and preservation. The main aim of this survey is to develop and publish a resource database on the presence of certain ethno-medicinal plants diversity in Chang-La and Taglang-La and adjoining villages.

Methodology

Collection of data

A three day ethno-botanical studies and survey of rare and endangered medicinal plants has been carried out during the year 2021 in the month of September for the collection of specimen, their traditional usage in Amchi system of medicine, raw drug collection, herbarium specimen and vegetative propagules for trans-Himalayan herbal garden of NISR-Leh from various locations of Chang-La and surrounding villages of Taglang-La like Meru, Lato, Gya, Sasoma and Rumtse. The specimens were collected from different location with varying altitudes were photographed, collected, dried and documented in field survey book.

The medicinal specimens collected for herbarium were thoroughly cleaned and pressed under the old newspaper between the two wooden blocks and tightly tied them with ropes. Herbarium is a conservatory of material and data. The specimens in the herbarium carry valuable data on their labels. The material in the herbarium remains a permanent record of flora of these regions and in certain cases, where catastrophes or other factors have totally destroyed the vegetation the collections in the herbarium provide evidence of what once existed there. The information regarding traditional amchi knowledge related to plant resources, socio-economic and ethno-botanical information was recorded by interviewing the local amchi practioners, villagers and especially old aged persons. The information on usage of medicinal plants specimens their local names were recorded through discussions with the renowned amchi practioners and knowledgeable persons of the locality. The vegetative propagules collected from survey locations like *Rhodiola* sps., *Waldhemia tomentosa, Thylocospermum ceaspitosum* were planted in seedbed of trans-himalayan herbal garden of the Institute (NISR-Leh). The details have been highlighted in Table form in the discussion part giving the scientific names, family, habitat, life form, parts used and their traditional usage.

Study area

The present investigation has been carried out in two locations namely Taglang-La and surrounding villages of Taglang-La (Meru, Lato, Gya, Sasoma and Rumtse) and Chang-La in year 2021 during the month of September. The Taglang-La pass is situated on a elevation 5328 metres (17,480 ft) with coordinates 33°30′28″N 77°46′12″E is gateway to Leh-Manali highway heading south from Upshi to Taglang La is paved, with the exception of a very short (approximately 500 m) unpaved section just north of the pass.

The survey second location Chang-La is a high mountain pass in Ladakh at an elevation of 5,360 metres (17,585 ft) with coordinates 34°02′49″N 77°55′50″E in the Ladakh range between Leh and Shyok River valley which is 75 km away from Leh town. The data were obtained from native informants who were amchi, village elders and local people who have the knowledge of the therapeutic value of the plants. (Need a colorful map for showing location aslo with highlighted areas showing availability of medicinal plants)

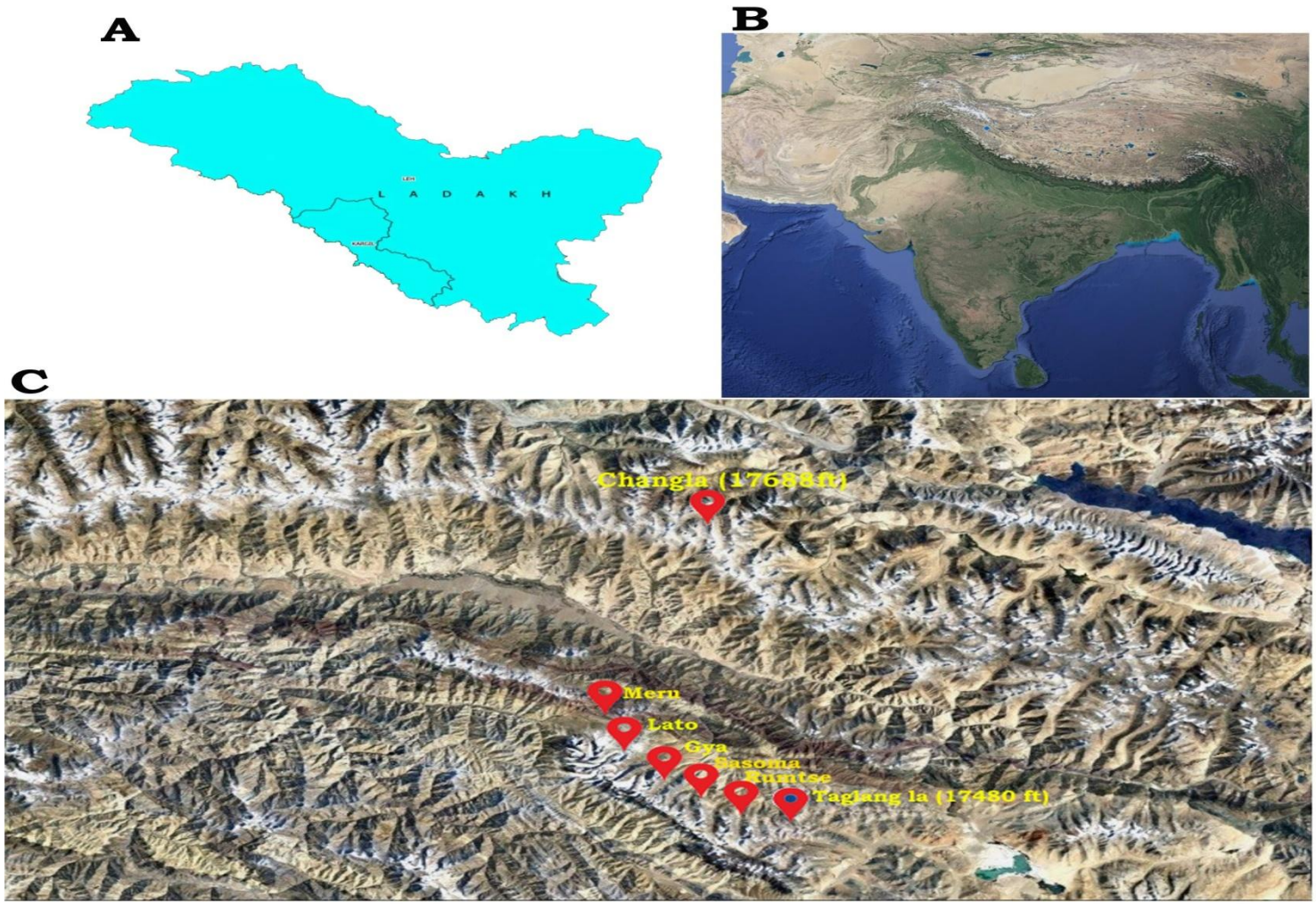

Fig 1 a, b, c. Location map of study area

Results and Discussion

Ethno-botany is a multidisciplinary science that deals with direct relationship between man and plants (Chaudhary *et al*., 2008) which records the history and status of human kind even while foretelling the future (Balakrishnan *et al*., 2009). In every ethnic group there exists a traditional healthcare system, which is culturally patterned. In rural communities healthcare seems to be first and foremost line of defense. The WHO has already recognized the contribution of traditional health care in tribal communities. In India there exists more than one million community based traditional workers and about 600,000 licensed medical practitioners of traditional systems like Ayurveda, Siddha, Unani and Sowa-Rigpa.

During the survey authors have collected 54 medicinal plant species from different locations. The collected specimens were used for treat different ailments in sowa-rigpa system of medicine by the rural households which constitute the majority of the survey area. The collected specimens were incorporated in table form (Table 1) with their sowa-rigpa uses, habitat, type, botanical name and their family. The survey data shows majority of plants species belongs to Asteraceae (12) family followed by Lamiaceae (7), Fabaceae (5), 3 each from Boraginaceae, Ranunculaceae, 2 each from Rosaceae, Polygonaceae, Geraniaceae, Crassulaceae and 1 each from Plumbaginaceae, Apiaceae, Ephedraceae, Onagraceae, Orobanchaceae, Solanaceae, Elaeagnaceae, Tamaricaceae, Zygophyllaceae, Plantaginaceae, Primulaceae, Saxifragaceae, Urticaceae. The medicinal plant species are mainly used to treat fever, inflammation and dermatological disorder. The roots followed by leaves, flower and whole plants are used as a raw material to prepare Sowa-rigpa medicine.

Regarding the life form, majority of medicinal plant species belongs to perennial herbs (39), followed by Sub-shrubs (6), shrubs (6), annual (2) and biennial (1). The data were obtained from native informants who were amchi, village elders and local people who have the knowledge of the therapeutic value of the plants.

Table 1. List of medicinal plant species available in Chang-La and Tag-Lang-La region of UT-Ladakh

S.No.	Scientific name	Family	Sorig/local name	Habitat	Life form	Parts used and uses
1.	*Acantholimon lycopodiodes (Longze)*	Plumbaginaceae	Longze	Dry stable slopes	Subshrubs	Plant ashes used to treat cardiac arrest
2.	*Aconogonon tortuosum*	Polygonaceae	Snya-lo	Sandy slopes, screes	Perennial herbs	Roots to treat dysentery, diarrhea with blooding
3.	*Arnebia euchroma*	Boraginaceae	Demok	Screes, stabilized slopes	Perennial herbs	Roots to treat pulmonary diseases, blood vomiting
4.	*Arnebia guttata*	Boraginaceae	Demok	Sandy deserts	Biennial or perennial herbs	Roots to treat hair loss, pulmonary diseases
5.	*Artemisia santolinifolia*	Asteraceae	Khampa-nagpo	Stony steppes	Subshrubs	Upper parts to treat swelling, epidemic fever, blisters
6.	*Aster semiprostratus*	Asteraceae	Lug-mig	Moist alpine grasslands	Perennial herbs	Flowers to treat epidemic fever, evil spirits
7.	*Astragalus densiflorus*	Fabaceae	Sad-rigs	Alpine meadows, grasslands	Perennial herbs	Upper parts used as decoction for skin diseases
8.	*Astragalus oplites*	Fabaceae	Zomo-shing	Stabilized slopes	Subshrubs	Aerial parts used for dermatological disorders
9.	*Caragana versicolor*	Fabaceae	Dama	Dry slopes, dry watersheds	Shrubs	Root and stem cortex to treat inflammation of nerves, nerve disorders (Dawa *et al.*, 2021)
10.	*Carum carvi*	Apiaceae	Kosnyot	Disturbed soil, field borders	Biennial herb	Seeds are used to treat cardiac disorders, increase appetite
11.	*Chrysanthemum arassanicum*	Asteraceae	Serpan	Dry stony stabilized slopes	Perennial herbs	Powdered flower used to control high fever
12.	*Cicer microphyllum*	Fabaceae	Sari	Stabilized slopes, stony screes	Perennial herbs	Aerial portion used as fodder for livestock
13.	*Circium arvense*	Asteraceae	Chang-tser	Sandy river sediments	Perennial herbs	Aerial parts used as anti-vomiting agent
14.	*Clematis tanguitica*	Ranunculaceae	Emong	Stony walls in settlements	Semi-erect shrubs	Upper parts to treat pulmonary diseases, lymph fluid
15.	*Cremanthodium ellisii*	Asteraceae	Ming-chan-nagpo	Snow beds, alpine meadows	Perennial herbs	Upper parts to treat larynx disorders, evil spirits
16.	*Dasiphora dryadanthoides*	Rosaceae	Span-chung	Stony places, dry	Shrubs	Flowers used in

				subalpine zones		gynecological disorders
17.	*Delphinium brunonianum*	Ranunculaceae	Chargot spos	Stony and gravel slopes	Perennial herbs	Upper parts to treat dermatological, cold cough
18.	*Dracocephalum heterophyllum,*	Lamiaceae	Gypsy-karpo	Sandy plains, stabilized slopes	Perennial herbs	Whole plant to treat oral diseases, liver diseases
19.	*Ephedra geradiana*	Ephedraceae	Tse-pat	Stony and rocky habitats	Subshrubs	Aerial parts used for pulmonary and liver diseases
20.	*Epilobium angustifolium*	Onograceae		Moist places	Perennial herbs	Upper parts to treat dropsy, arthritis and pimples (Dekhang, 2008)
21.	*Gentiana nubigena*	Gentianaceae	Spangyan-snonpo	Snow bed and moss rich springs	Perennial herbs	Flowers to treat epidemic fever, pharyngitis, cold cough
22.	*Geranium himalayense*	Geraniaceae	Ligadur	Mesic to wet river banks	Perennial herbs	Roots to reduce swelling in limbs, inflammation
23.	*Geranium regelii*	Geraniaceae	Gadur	Alpine meadows	Perennial herbs	Roots to treat epidemic fever
24.	*Hippophae rhamnoides*	Elaeagnaceae	Star-bu	River gravel deposits	Shrubs	Fruits to treat pulmonary diseases, high altitude diseases
25.	*Lactuca tartarica*	Asteraceae	Khala	Saline and sandy soils	Perennial herbs	Tender leaves used as vegetables by local people
26.	*Leontopodium ochroleucum*	Asteraceae	Targot	Dry slopes and dry meadows	Perennial herbs	Whole plant used as septic wounds
27.	*Lindelofia stylosa*	Boraginaceae	Nadma-jar	Dry loamy and stony slopes	Perennial herbs	Whole plant used against bone fracture
28.	*Menitskia tibetica*	Lamiaceae	Yakzas	Stony habitats	Perennial herbs	Dried whole plants used as roofing agent
29.	*Mentha royleana*	Lamiaceae	Phowa-res	Wet places along streams	Perennial herbs	Leaves used for stomach pain and appetizer
30.	*Myricaria elegans*	Tamaricaceae	Umbo	River banks, stream sides	Shrubs	Leaves and flowers to treat arthritis, headache
31.	*Nepeta discolor*	Lamiaceae	Shamalolo	Sandy sediments, exposed rocky slopes	Perennial herbs	Leaves decoction used against cold cough
32.	*Nepeta floccose*	Lamiaceae	Shangku-kuram	Sandy slopes, deserts	Perennial herbs	Leaves decoction against malaria (Dvorsky *et al.,* 2018)
33.	*Nepeta longibracteata*	Lamiaceae	Tiangku	Stony and gravel slopes	Perennial herbs	Leaves used to treat fever

						of stomach and lever
34.	*Oxytropis microphylla*	Fabaceae	Stag-sha-karpo	Semi-deserts, sandy plains	Perennial herbs	Leaves to subsides swelling and infectious fever
35.	*Pedicularis bicornuta*	Orobanchaceae	Kyang-shog-pa	Alpine meadows, loamy soils	Perennial herbs	Upper parts of plant used for vomiting, heal wounds, urine obstruction (Gurmet and Stobgais, 2016)
36.	*Peganum harmala*	Zygophyllaceae	Balti-shukpa	Disturbed habitats, desert areas	Perennial herbs	Seeds used against asthma, rheumatism
37.	*Perovskia abrotanoides*	Lamiaceae	Iskiling	Dry river beds, between large stones	Subshrubs	Leaves and flowers used as a aromatic plant
38.	*Physochlaina praealta*	Solanaceae	Thang-phrom-nagpo	Stony deserts, loamy slopes	Perennial herbs	Roots and fruits to treat bacterial diseases, diphtheria, inflammation
39.	*Plantago depressa*	Plantaginaceae	Tharam	Field margins, eutrophicated soils	Annuals or short lived perennials	Upper parts to treat dysentery, lymph fluid
40.	*Primula macrophylla*	Primulaceae	Shang-dril-snonpo	Snowbeds, wet spring areas	Perennial herbs	Flowers to treat fever of lungs, nerve disorders, dysentery of child (Drungtso and Drungtso, 2005)
41.	*Ranunculas natans*	Ranunculaceae	Churug-sbal-lak	Rivers, streams	Perennial herbs	Upper parts used to treat ligament and tendon disorders
42.	*Rheum spiciforme*	Polygonaceae	Lachu	Gentle stabilized areas	Perennial herbs	Roots are used to treat dermatological disorder, indigestion
43.	*Rhodiola imbricate*	Crassulaceae	Rholo-marpo	Mesic stony slopes	Perennial herbs	Roots to treat lung disorder, high altitude diseases (Chaurasia and Padma, 2003)
44.	*Rhodiola pamiroalaica*	Crassulaceae	Rholo	Screes and stony slopes	Perennial herbs	Roots used as tonic and infectious cough
45.	*Rosa webbiana*	Rosaceae	Sia	Dry stony slopes, rock crevices	Shrubs	Fruits and petals used as exorcizing evil spirits
46.	*Saussurea bracteata*	Asteraceae	Jarbag	Stony slopes, gravel areas	Perennial herbs	Leaves used against wounds
47.	*Saussurea ceratocarpa (Jurinea ceratocarpa)*	Asteraceae	Charok-nyungma	Wet to mesic meadows	Perennial herbs	Upper part used for stomach cancer

48.	*Saxifraga flagellaris*	Saxifragaceae	di-ta-sa-zin	Wet rock crevices	Perennial herbs	Whole plants used to treat inflammation of nerve
49.	*Senecio krascheninnikovia*	Asteraceae	Serpo-gudrus	Disturbed sites, gravel slopes	Annuals	Flowers to treat wounds and eczema
50.	*Silene gonosperma*	Caryophyllaceae	Luk-suk	Moraines, scree	Perennial herbs	Roots to treat nasal problem and hearing defects
51.	*Tanecetum fruticulosum (Ajania fruticulosa),*	Asteraceae	Khanser	Rock crevices	Subshrubs	Whole plant to treat swelling and inflammation of lymphs
52.	*Thylocospermum ceaspitosum*	Caryophyllaceae	Tagara-can	Stony river sediments, rock crevices	Perennial herbs	Whole plant used as fuel wood during winter season (Dorjey and Dolma 2021)
53.	*Urtica hyperborean*	Urticaceae	Za-tshod	Eutrophicated and disturbed shaded sites	Perennial herbs	Leaves used in cold diseases, blood diseases
54.	*Waldheimia tomentosa*	Asteraceae	Palu	Stabilized slopes, rock crevices	Perennial herbs	Both leaves and flower used to treat nerve disorder

Conclusion

The ethno-botanical study and survey of the location revealed that the people of the area have good knowledge of medicinal plants and their traditional usage in amchi system but due to the over exploitation of these species has not only degraded the local vegetation and the disappearing of natural beauty but also endangered certain species, and one has to travel miles to find them. Harsh climate and high altitude conditions and inaccessibility are the factors which force the people to depend on wild flora for healthcare. Therefore, there is dire need for the protection of this wealth of nature before it disappears from this planet.

Therefore, all efforts made to conserve the threatened herbal species and promote its cultivation by developing different agro-techniques either *in-situ* or *ex-situ* by the coordinated efforts of the research and development organizations would go a long way in improving the socio-economic status of and in preserving the traditional knowledge and resources of this region.

NOTE:

The study highlights the efficacy of "herbal" which is an ancient tradition, used in some parts of India. This ancient concept should be carefully evaluated in the light of modern medical science and can be utilized partially if found suitable.

COMPETING INTERESTS DISCLAIMER:

Authors have declared that no competing interests exist. The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

References

1. Abrol, B.K. and Chopra, I.C. 1962. Some vegetable drug resources of Ladakh (Little Tibet). *Current Science* **31**(8): 324-326.
2. Balakrishnan, V., Prema, P., Ravindran, K.C. and Robinson, J.P. 2009. Ethno-botanical Studies among Villagers from Dharapuram Taluk, Tamil Nadu, India. *Global Journal of Pharmacology*, **3**(1): 8-14.
3. Ballabh, B. and Chaurasia, O.P. 2007.Traditional medicinal plants of cold desert Ladakh-Used in treatment of cold, cough and fever. *Journal of Ethnopharmacology* **112**(2): 341-349.
4. Bhadula, S. K., Singh, A., Lata, H., Kuniyal, C. P. and Purohit, A. N. 2002. Distribution pattern, population diversity and propagation of some high altitude medicinal herbs from Garhwal Himalaya: Problem and Prospects for Conservation. High Altitudes of the Himalaya II (Biodiversity, Ecology, and Environment). In: (eds. YPS Pangtey). Gyanodaya Prakashan, Nainital, 2: 389-413.
5. Bhakuni, N and Pant, H. 2018. Scoping study of medicinal plants in Western Himalaya region and their role in traditional healthcare. *ENVIS Bulletin Himalayan Ecology,* 26: 71-73.
6. Caniago, I. and Siebert, S. 1998. Medicinal plants ecology, knowledge and conservation in Kalimantan, Indonesia. *Economic Botany,* 52: 229-250.
7. Choudhary, K., Singh, M. and Pillai, U. 2008. Ethno-botanical survey of Rajasthan-An Update, *American-Eurasian Journal of Botany*, **1**(2): 38-45.

8. Chaurasia, O.P. 1996. Cold Desert Plants Vol-1 Leh Valley published by Field Research Laboratory (FRL) DRDO, Leh (J&K). pg. no. 43.
9. Chaurasia, O.P. and Gurmet, P. 2003. A Checklist on medicinal and aromatic plants of trans-himalaya cold desert. Pg. no. 23.
10. Dawa, S., Gurmet, P., Stobgais, T. and Rinchen, T. 2021. Survey and Ethno-botanical Study of Medicinal Plants of Some Selected Villages of Singay-Lalok Region of Leh (UT Ladakh Region). *Asian Journal of Research in Botany*, **5**(2): 60-75.
11. Dekhang, T.D. 2008. A handbook of Tibetan Medicinal plants published by Tibetan Medical and Astrological Institute (Men-tsee-khang) Dharamsala, Himachal Pradesh, India. pg. no. 73.
12. Dorjey, K. and Dolma, P. 2021. Plants of Ladakh, A photographic guide published by Nature Conservation Foundation-India, Mysore.pg. no. 204.
13. Drungtso T. T. and Drungtso T.D. 2005. Tibetan English Dictionary of Tibetan Medicine and Astrology (Revised and Enlarged Edition) published by Drungtso publication. Pg. no. 483.
14. Dvorsky, M., Dolezal, J., Bello, De F, Klimesova, J. and Klimes, L. 2011.Vegetation types of East Ladakh: Species and growth form composition along main environmental gradients. *Applied Vegetation Science*, **14**(1): 132-147.
15. Dvorsky, M., Klimes, L., Dolezal,J., Wild, J. and Dickore, B.W. 2018. A field guide to the flora of Ladakh published by Nakladatelstvi Academia Centre of Administration and operations of the Czech Academy of Sciences Vodickova 40, 11000 Prague 1 Czech Republic. pg. no.166.
16. Gonpo, Y.Y. 2008. The basic tantra and the explanatory tantra from the secret quintessential instruction on the eight branches of the Ambrosia essence tantra.Pg. no.86.
17. Gurmet, P. 2004. Sowa-rigpa; Himalayan art of healing. *Indian Journal of Traditional Knowledge*, **3**(2): 212-218.
18. Gurmet, P. and Stobgais, T. 2016. A hand book on medicinal plants of Himalayas used in Sowa-rigpa published by National Research Institute of Sowa-Rigpa Central Council for Research in Ayurvedic Sciences Ministry of AYUSH, Govt. of India, New Delhi. pg. no. 276.

19. Hafeel, A. and Shankar, D.1999. Revitalizing indigenous health practices. *Compass Newsletter*: 28-29.
20. Kala, C.P. 2011. Floral diversity and distribution in the high altitude cold desert of Ladakh, India. *Journal of Sustainable Forestry*, **30**(5): 360-369.
21. Lamo,T., Stobgais,T., Gurmet,P.,Dolma,T.,Dawa,S., Angdus, T. and Chosdup, T. Medicinal Plants Biodiversity of some Selected Villages of Zanskar Valley (Ladakh region). *International Journal of Current Microbiology and Applied Sciences*, **8** (1): 829-837.
22. Maikhuri, R. K., Nautiyal, S., Rao, K. S. and Saxena, K. G.2000. Indigenous knowledge of medicinal plants and wild edibles among three tribal sub-communities of Central Himalayas, India. *Indigenous Knowledge and Development Monitor*, **8**(2): 7-13.
23. Maiti, S. and Geetha, K. A. 2014.Country status report on Medicinal and Aromatic Plants in India. In: Paper presented in Expert consultation on promotion of Medicinal and Aromatic Plants in the Asia-Pacific region: 101-123.
24. Mathur, A. and Joshi, H. 2012. Traditional remedies in Tarai region of Kumaon, Uttarakhand. *Indian Journal of Traditional Knowledge*, **11**(4): 652-657.
25. Swe, T. and Win, S. 20.05 Herbal gardens and cultivation of medicinal plants in Myanmar regional consultation on development of traditional medicine in the South East Asia region, Department of Traditional Medicine, Ministry of Health, Myanmar, Pyongyang, DPR Korea, 22-24 June, World Health Organization (Regional office for South-East Asia).
26. Ved, D. K. and Goraya, G. S., Demand and Supply of Medicinal Plants in India. p.125.

Fig.1. Collection of herbarium specimen and raw drug from different location

Fig. 2. Pictures of some important medicinal plants of Chang-La and Taglang-La

Waldhemia tomentosa

Silene gonosperma

Rhodiola imbricate

Thylocospermum ceaspitosum

Urtica hyperborea

Tanecetum fruticulosum

Delphinium brunonianum

Dracocephalum heterophyllum

Caragana versicolor

Gentiana nubigena