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Floristic diversity and an account of traditional knowledge of Kukshow - a hidden hamlet in the Trans-Himalayan cold desert of Kargil, Ladakh, India

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Abstract

Cold desert region often remains secluded from the major habitation due to topographical, climatic and cultural barriers. Despite these constraints Ladakh stores rich, unique and endemic flora with unheard unequalled ethnobotany. This study focuses on first time documentation of flora and associated ethnobotany of Kukshow village in Kargil district of Ladakh. Fifty-eight plant species were documented from the study area belonging to 30 families. The habit of the flora comprised of mainly herbs (42), shrubs (8) and along with a few trees (8). Of them, 24 plant species have been utilized by the locals, whereas for other species fruit, bark, wood, leaves, seeds, stems or flowers were being used for various purposes. Such documentation from an inaccessible area of the Ladakh landscape is valuable and will act provide the baseline information for further investigation. Moreover, an early inventory is essential before this valuable information is lost along with the coming vagaries of environmental degradation in the future. This current information on plants used by native communities could be promulgated to the new generation for awareness and sustainable utilization of plants.

Keywords: Cold desert, Ethnobotany, Inventory, Native community, Sustainability

1. Introduction

The Indian Himalayan Region (IHR) has been considered as a crucial hotspot of the biological diversity (Myers *et al*., 2000). Union Territory of Ladakh and the Lahaul - Spiti region of Himachal Pradesh account for more than 90% area of Indian cold desert, the remaining 10% area lies in the states of Uttarakhand and Sikkim (Saxena *et al*., 2011; Jishtu and Goraya, 2020). The high altitude (2438 AMSL to 7135 AMSL), jarring natural environment of Ladakh is designated by extreme temperature (-30°C to +30°C), excessive radiation, strong winds, low precipitation (<100 mm/yr^{-1}), low humidity and massive desolate landscape, rough topography, steep and vertical glaciated slopes, minimum forest cover and shrunk pasture lands at high ascent (Chaurasia and Singh, 1996; Kumar *et al*., 2009). The region lying amidst the great Central Himalayas and the mountains encircling Tibetan plateau is often referred to as the "Dust Bowl of India" (Jishtu *et al*., 2003). Human settlements residing in these difficult areas have stood secluded due to inaccessible terrain and discordant climatic conditions. As a result, an eccentric culture and traditions were born and shaped in this region (Uniyal *et al*., 1973). Plants have been used by humans and this relationship has existed ever since the emergence of human civilization. Near about 3,50,000 plant species have been identified till date, out of which 35,000 are still being used worldwide for medicinal use and mere 0.5% have been chemically investigated (Comer and Debus, 1996). Traditional knowledge

about plants and their association with man is generally passed verbally from one generation to another or is imbibed from their spiritual manuscripts (Malik *et al*., 2011a&b; Buth and Navchoo, 1988). Ethnobotany is a multidisciplinary science that agrees with direct relationship between man and plants. The use of plants in restoring and healing is as old as man himself (Hedberg, 1987). Nonetheless, the cold arid areas lying in the Indian Trans-Himalaya have not received adequate attention till date. Multitude ethnic and tribal groups with mosaic culture domiciled in the remote and isolated parts of Ladakh offer a great scope for ethnobotanical studies. The Trans-Himalayan community is no more cut off from urban settlements and therefore, communal and cultural transformation has already begun. Consequently, the locals are shifting towards materialism and modernization (Norberg-Hodge, 1999). Before these fragile habitats (Kala and Manjrekar, 1999; Chauhan *et al*., 2020; Jishtu *et al.,* 2022) are long lost due to destructive harvesting of medicinal plants, uncontrolled tourism and grazing pressure, it is essential to document this crumbling traditional knowledge and floristic attributes in this region. This study focuses on a remote, far flung Kukshow village of Kargil district of Ladakh. We have tried to document the local flora and traditional knowledge from the village of Kukshow for the very first time.

2. Materials and methods

Kukshow village is located in the Trans-Himalayan region, between the Zanskar and the Ladakh ranges of the cold desert area. It is an off-road village which remains hidden from the world but still harbors are a treasure house of unique flora along with its rich culture. Geographically, the village is located at an elevation of 3,472 m and lies between longitudes and latitudes of 34.44836° N and 76.62428° E respectively (GPS coordinates were recorded using GARMIN-GPS MAP 65s). The village is sparsely populated with nearly 432 people living in 57 households. The vegetation of this region is an ad mixture of more oasitic vegetation and lesser of desert vegetation. Oasitic vegetation mainly comprise of native species growing along the water streams in addition to some non-native flora along the cultivated fields while the desertic vegetation is made up of plants adapted to very scanty rainfall and extremes of temperature.

A number of primary and secondary sources were used to document the information of the study area. Primarily, a general reconnaissance of the study area to familiarize with the topographic features, broad vegetation types, floristic components and logistics was undertaken. The primary surveys comprised of documenting floral wealth of the region. The survey was carried out during 2020-2021. A simple questionnaire was framed for the collection of data on ethnobotany. The villagers were interviewed and group discussions were also organized. Informal interactions were carried out with the inhabitants of the village, targeting elder folks in particular. Traditional knowledge in relation to the use of plants such as food, beverage, medicine, timber, fodder and fuel was documented. Majority of information was gathered from the elderly people as their experience in this context is more relevant. Usual methods of herbarium preparation as suggested by Jain and Rao (1993) were adopted during collection and processing of plant specimens collected during field surveys. Preliminary identification of the plant specimens and enumeration of information was done with the help of various floras and other published literature (Stewart, 1916; Chaurasia and Singh, 1996; Srivastava and Shukla, 2015; Gurmet and Stobgias, 2016; Jishtu and Goraya, 2020). Attempts have been made to adopt the most recent and correct nomenclature by referring to Plants of the World Online (www.plantsoftheworldonline). The herbarium specimens will be deposited in DD Herbarium and National Research Institute on Sowa Rigpa (NRISR), Leh.

3. Results and discussion

Over all 58 plant species were documented from the study area along with their diverse ethnobotanical usage (Table 1). The entire flora belonged to 30 families; most dominant family being Asteraceae (6 species) followed by Polygonaceae (5), Salicaceae (4), Fabaceae (4), Lamiaceae (3), Rosaceae (3) and Scrophulariaceae (3). The other families comprised of either 2 or 1 species each (Fig. 1). As far as the habit of the plant is concerned a majority of plants were herbs (42), shrubs (8) and a few trees (8) (Fig. 2). Among them, 24 plant species, whole plant is utilized and for other plants either fruits, bark, wood, leaves, seeds, stems or flowers are used for various day to day purpose (Fig. 3). A few plant species namely *Acantholimon lycopoidioides* (Girard) Boiss. (Endangered), *Betula utilis* D. Don (Endangered), *Dactylorhiza hatagirea* (D. Don) Soó (Critically Endangered), *Lancea tibetica* Hook.f. & Thomson (Rare) and *Physochlaina praealta* (Decne.) Miers (Vulnerable) comes under International Union for Conservation of Nature (IUCN) threat categories, were reported from the study area (Goraya and Ved, 2017). *Aquilegia fragrans* Benth., *D. hatagirea*, *Podophyllum hexandrum* Royle, *B. utilis* and *Juniperus semiglobosa* Regel are among the rare species reported from the study area (Plate 2).

Table 1. Details of plants enumerated from the study area

Sl. No.	Scientific name	Local name	Family	Habit	Habitat	Ethnobotanical importance	Part(s) used*	Collection No.
1.	*Acantholimon lycopodioides* (Girard) Boiss.	*Longze/burche*	Plumbaginaceae	Herb	Dry rocky slopes	Fuel	WP	HFRI-Herbarium 6445
2.	*Achilea millefolium* L.	*Chuang*	Asteraceae	Herb	Along pathway	Astringent and treats gum swelling	WP	HFRI-Herbarium 6419
3.	*Aconogonum tortusum* (D. Don) H. Hara	*Nyalo*	Polygonaceae	Herb	Open slopes	Treats dysentery and diarrhoea. Cooked as vegetable.	R	HFRI-Herbarium 6401
4.	*Anaphalis triplinervis* (Sims) C. B. Clarke	*Spra-rgod*	Asteraceae	Herb	Dry rocky slopes	Heals wound	F	HFRI-Herbarium 6415
5.	*Aquilegia fragrans* Benth.	*Cho-cho*	Ranunculaceae	Herb	Moist places	Ornamental, cooked as vegetable, leaves are put in "*lassi*" (buttermilk) to make "*Dantur*".	FF	HFRI-Herbarium 6402
6.	*Arnebia euchroma* (Royle ex Benth.) I. M. Johnst.	*Demok*	Boraginaceae	Herb	Dry rocky slopes	Red dye obtained from the roots which is used for colouring traditional clothes and local dishes.	R	HFRI-Herbarium 6401
7.	*Artemisia brevifolia* Wall. Ex DC.	*Khampa*	Asteraceae	Herb	Cultivated fields and along pathways	Burnt as *dhoop*, acts as an insecticide and kept beneath mats. Brooms are also made out of it.	WP	HFRI-Herbarium 6446
8.	*Articum lappa* L.	*Shiking/pizums*	Asteraceae	Herb	Open slopes	Plant paste is applied to treat blisters, pimples and burns.	WP	HFRI-Herbarium 6405

9.	*Betula utilis* D. Don	*Stakpa*	Betulaceae	Tree	Along water streams	Sacred tree and the bark is place inside "*tabiz*" (charm) to be worn by locals. Bark is burnt and mixed with water and sugar and it treat cold and cough.	B	HFRI-Herbarium 6407
10.	*Bistorta affinis* (D. Don) Greene	*Rambu*	Polygonaceae	Herb	Open slopes	Treats dysentery and diarrhoea. Flowers are used in religious ceremonies.	WP	HFRI-Herbarium 6414
12.	*Bistorta macrophylla* (D. Don) Sojak	*Pangram*	Polygonaceae	Herb	Open slopes and cultivated fields	Strengthens body and treats diarrhoea.	WP	HFRI-Herbarium 6406
13.	*Capparis spinosa* L.	*Kabra*	Capparidaceae	Herb	Dry rocky slopes	Ripe fruits are eaten raw and made into pickle. The extract of the plant is a constituent of Liv-52.	WP	HFRI-Herbarium 6408
14.	*Carum carvi* L.	*Kosnyot*	Apiaceae	Herb	Cultivated fields and grasslands	Seeds are used as condiment too flavour local dishes and increases appetite.	Se	HFRI-Herbarium 6409
15.	*Chenopodium album* L.	*Sneu*	Amaranthaceae	Herb	Cultivated fields and along pathways	Eaten as vegetable	L&S	HFRI-Herbarium 6447
16.	*Cicer microphyllum* Royle ex Benth.	*Seri*	Fabaceae	Herb	Cultivated fields and grasslands	Fodder plant	L&S	HFRI-Herbarium 6448
17.	*Codonopsis clematidea* (Schrenk) C. B. Clarke	*Phak-phak mo*	Campanulaceae	Herb	Cultivated fields and grasslands	Flowers are eaten raw as they taste sweet and roots treat stomach-ache and enhance digestion.	WP	HFRI-Herbarium 6410
18.	*Corydalis flabellata* Edgew.	*Yadukma*	Papavaraceae	Herb	Rocky slopes and along pathways	Fodder for goat after the plant has been in flowering. If eaten prior to flowering it tends to kill the livestock.	L	HFRI-Herbarium 6449
19.	*Dactylorhiza hatagirea* (D. Don) Soó	*Angulakpa*	Orchidaceae	Herb	Moist places	Health tonic	R	HFRI-Herbarium 6411

20.	*Echinops cornigerus* DC.	*Aczema*	Asteraceae	Herb	Dry rocky slopes	Paste of leaves is made to cure wounds and dry flowers are used for decoration.	L&F	HFRI-Herbarium 6412
21.	*Elagnus angustifolia* L.	*Sarsing*	Elaeagnaceae	Shrub	Cultivated fields and along pathways	Oil is extracted from roots and is used as hair tonic. Fruit is edible.	R&Fr	HFRI-Herbarium 6413
22.	*Epilobium angustifolium* L.	*Byapnchuste*	Onagraceae	Herb	Cultivated fields and moist places	Ornamental	F	HFRI-Herbarium 6450
23.	*Euphrasia officinalis* L.	*Kaukngch*	Scrophulariaceae	Herb	Moist places	Infusion of dried herb treats conjunctivitis.	WP	HFRI-Herbarium6403
24.	*Geranium pratense* L.	*Gugchuk/ spoldo*	Geraniaceae	Herb	Moist places	Leaf extract treats fever and dysentery and flowers are used for decoration purpose. Roots yields dye which is used to dye traditional dresses.	L,R&F	HFRI-Herbarium 6428
25.	*Heracleum pinnatum* C. B. Clarke	*Spru*	Apiaceae	Herb	Along pathway	Roots treat inflammation and pain caused by fever. A constituent xanthotoxin-a from the plant is used in sun tan lotion and possess anti-leucodermal properties.	R	HFRI-Herbarium 6451
26.	*Hippophae rhamnoides* subsp. *Turkestanica Rousi*	*Charma/ tsemang*	Elaeagnaceae	Shrub/ small tree	Along streams and wastelands	Leaves, fruits and seeds possess anti-ageing properties and are effective treating cold. It is used as fodder plant. It is also used as biological fence. Leaves are used in tea.	WP	HFRI-Herbarium 6452
27.	*Hyoscymus niger* L.	*Lantang*	Solanaceae	Herb	Along pathway and wastelands	Seeds are used to relieve pain and the plant is known to cause hallucinations.	Se	HFRI-Herbarium 6430

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28.	*Juglans regia* L.	*Akhrot*	Juglandaceae	Tree	Cultivated lands	Edible nut	F	HFRI-Herbarium 6453
29.	*Juniperus semiglobosa* Regel	*Shukpa*	Cupressaceae	Tree	Dry rocky slopes	Fragrant leaves used on auspicious occasions and "*Zem*" (a barrel to store milk) is made (Plate 1 c).	L&W	-
30.	*Lancea tibetica* Hook.f. & Thomson	*Raikse/ chagna*	Scrophulariaceae	Herb	Moist places	Extract prepared from the plant is used as a tonic.	WP	HFRI-Herbarium 6416
31.	*Lonicera spinosa* (Decne.) Jacquem. Ex Walp.	*Brama*	Caprifoliaceae	Shrub	Cultivated fields and along pathways	Plant is put on roof and dried and later burnt as fuel.	WP	HFRI-Herbarium 6454
32.	*Medicago lupulina* L.	*Bukshuk/ol*	Fabaceae	Herb	Cultivated fields and along pathways	Treats cold, cough and fever and is also cooked as vegetable.	WP	HFRI-Herbarium 6431
33.	*Melilotus officinalis* (L.) Lam.	*Gyaspos dmanpa*	Fabaceae	Herb	Cultivated fields and along pathways	Used as fodder and used to treat swelling and bacterial diseases.	R, L&F	HFRI-Herbarium 6441
34.	*Mentha longifolia* (L.) L.	*Phuloging*	Lamiaceae	Herb	Cultivated fields and moist places	Used to prepare chutney and thukpa.	L	HFRI-Herbarium 6455

35.	*Myricaria elegans* Royle	*Umbo*	Tamaricaceae	Shrub	Sandy slopes and along water streams	Treats headache, stomach pain and diarrhoea.	L&F	HFRI-Herbarium 6427
36.	*Oxyria digyna* (L.) Hill	*Lamanchu/ skururu*	Polygonaceae	Herb	Moist places	Leaves are eaten raw and chutney is prepared. It is rich in vitamin C.	L&S	HFRI-Herbarium 6456
37.	*Oxytropis microphylla* (Pall.) DC	*Stag-sha-nagpo*	Fabaceae	Herb	Open slopes	Aromatic oil is prepared.	WP	HFRI-Herbarium 6457
38.	*Papaver nudicaule* L.	*Shondro*	Papaveraceae	Herb	Moist places	Considered holy and is burnt as *dhoop* on auspicious occasions like "*Snola*" festival (Plate 1 a).	WP	HFRI-Herbarium 6458
39.	*Parnassia cabulica* Planch. ex C. B. Clarke	*Dnyultig*	Parnassiaceae	Herb	Open slopes and cultivated fields	Used to treat hepatic diseases.	L, S&F	HFRI-Herbarium 6459
40.	*Peganum harmala* L.	*Sepan*	Zygophyllaceae	Herb	Open slopes and wastelands	Seeds are burnt as *dhoop* and known to keep away evil spirits and are also used to bathe child. Seeds are narcotic and treat fever and stomach complaints.	Se	HFRI-Herbarium 6426
41.	*Physochlaina praealta* (Decne.) Miers	*Langthang*	Solanaceae	Herb	Rocky slopes and along pathways	Seeds are narcotic and the entire plant is source of atropine.	WP	HFRI-Herbarium 6460
42.	*Podophyllum hexandrum* Royle	*Demokushu*	Berberidaceae	Herb	Moist places	The entire plant is used to treat gynaecological disorders and the ripe fruit treats high altitude sickness.	WP	HFRI-Herbarium 6425

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43.	*Populus nigra* L.	*Ulat*	Salicaceae	Tree	Cultivated lands	Construction material for house.	W	HFRI-Herbarium 6462
44.	*Prunus armeniaca* L.	*Chuli*	Rosaceae	Tree	Cultivated fields and along pathway	Fruits are either eaten raw or in dried form. Oil is extracted from seeds and is a good hair tonic.	Fr&Se	HFRI-Herbarium 6424
45.	*Ribes orientale* Desf.	*Askuta*	Grossulariaceae	Shrub	Cultivated fields and along pathways	Dried plant is put on roofs as it won't rot.	WP	HFRI-Herbarium 6463
46.	*Rosa foetida* Herrm.	*Shia marpo*	Rosaceae	Shrub	Along water streams and pathways	Planted as ornamental hedge and the flowers are used to make garlands and offered to local deity on "*Snola*" festival.	WP	HFRI-Herbarium 6464
47.	*Rosa webbiana* Wall. ex Royle	*Shia karpo*	Rosaceae	Shrub	Rocky slopes and along pathways	Flowers used for ornamental purpose and used to make garlands and offered to local deity on "Snola" festival. Covering of the root gives red color to tea and is a local tea substitute. Residue left after burning the stem is applied on rashes.	WP	HFRI-Herbarium 6423
48.	*Rumex patientia* L.	*Shoma*	Polygonaceae	Herb	Along water streams and pathways pathways	Purgative & vermifuge	WP	HFRI-Herbarium 6465
49.	*Salix alba* L.	*Malchang*	Salicaceae	Tree	Cultivated fields and along pathways	Wood is used to make ladder and ceiling of houses. Wood is used as fuel.	W	HFRI-Herbarium 6466

50.	*Salix fragilis* Forssk.	*Brook chang*	Salicaceae	Tree	Cultivated fields and along pathways	To make "*Chepo*" (a basket usually carried on back). Handles of implements and ceiling of houses is made up from its wood.	S&W	HFRI-Herbarium 6467
51.	*Stachys tibetica* Vatke	*Yakzas*	Lamiaceae	Herb	Along pathway	Tea made out of this plant reduces headache.	WP	HFRI-Herbarium 6422
52.	*Tanacetum dolichophyllum* (Kitam.) Kitam.	*Kamchu*	Asteraceae	Herb	Rocky slopes and along pathways	Dried leaves and flowers are source of essential oil.	L&F	HFRI-Herbarium 6421
53.	*Taraxacum officinale* F.H.Wigg.	*Han*	Asteraceae	Herb	Moist places	Leaves are cooked as vegetable. Health tonic is also known to be prepared from the plant.	WP	HFRI-Herbarium 6420
54.	*Thalictrum foliolosum* DC.	*Bhonkshna*	Ranunculaceae	Herb	Cultivated fields and moist places	Used to treat bacterial diseases.	WP	HFRI-Herbarium 6418
55.	*Thymus serphyllum* L.	*Tumbrak*	Lamiaceae	Herb	Grasslands	Leaves are fragrant and are used to flavour food items.	L	HFRI-Herbarium 6468
56.	*Triticum aestivum* L.	*Jau/gro*	Poaceae	Herb	Cultivated fields	Plant is offered to local deity. Grains are used as food and local drink *chang* is prepared from its grain.	Se	HFRI-Herbarium 6469
57.	*Urtica hyperborea* Jacquem. ex Wedd.	*Zozot*	Urticaceae	Shrub	Rocky slopes and along pathways	Young leaves are cooked as vegetable in summers and dried and stocked for use in the winter months.	L	HFRI-Herbarium 6470
58.	*Verbascum thapsus* L.	*Serbi*	Scrophulariaceae	Herb	Open slopes and wastelands	Treats asthama and frost bite.	WP	HFRI-Herbarium 6417

**WP - Whole plant, R - roots, F - flowers, L&S - Leaves and stems, B - Bark, Se - Seeds, L&F - Leaves and flowers, R&Fr - Roots and fruits, Fr - Fruits, L&W - Leaves and wood and W - Wood*

Plate 1. a. *Shondro* flower (*Biebersteinia odorata* Stephan) being worn by the locals on "*Snola"* festival; b. *Gurgur* made out of wood of *Populus ciliata* Wall. ex Royle; c. *Zem* made out of wood of *Juniperus semiglobosa* Regel; d. House ceiling made out of wood of *Populus ciliata* Wall. ex Royle

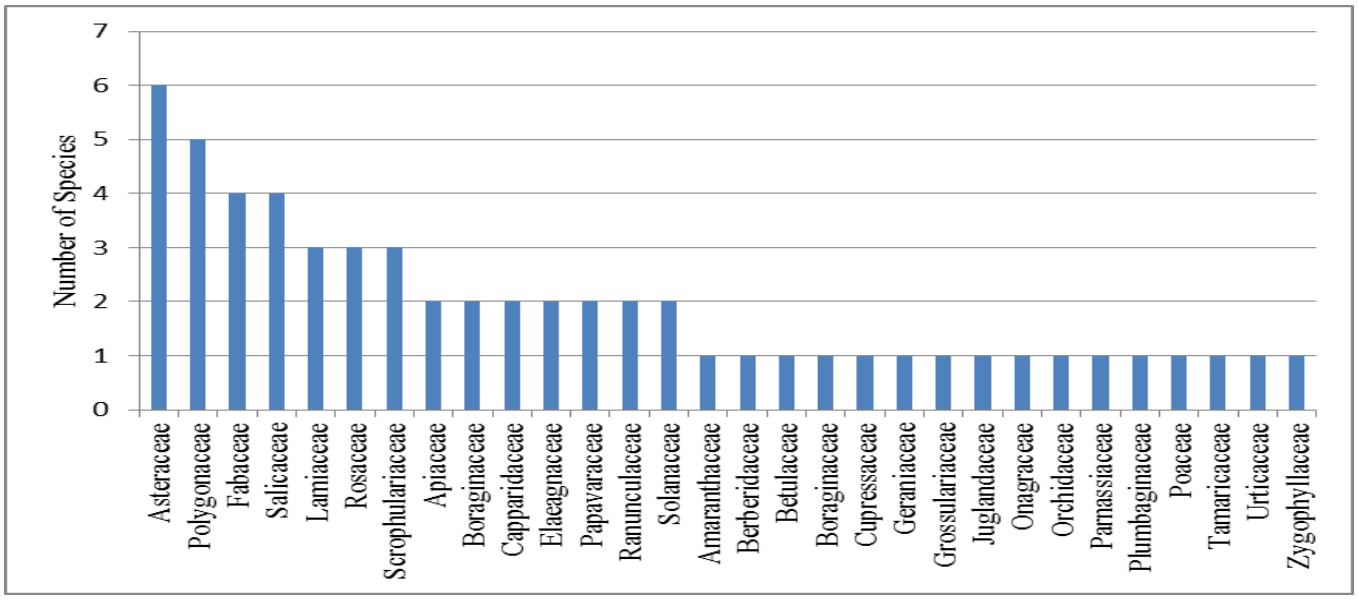

Fig. 1. Family wise representation of the flora

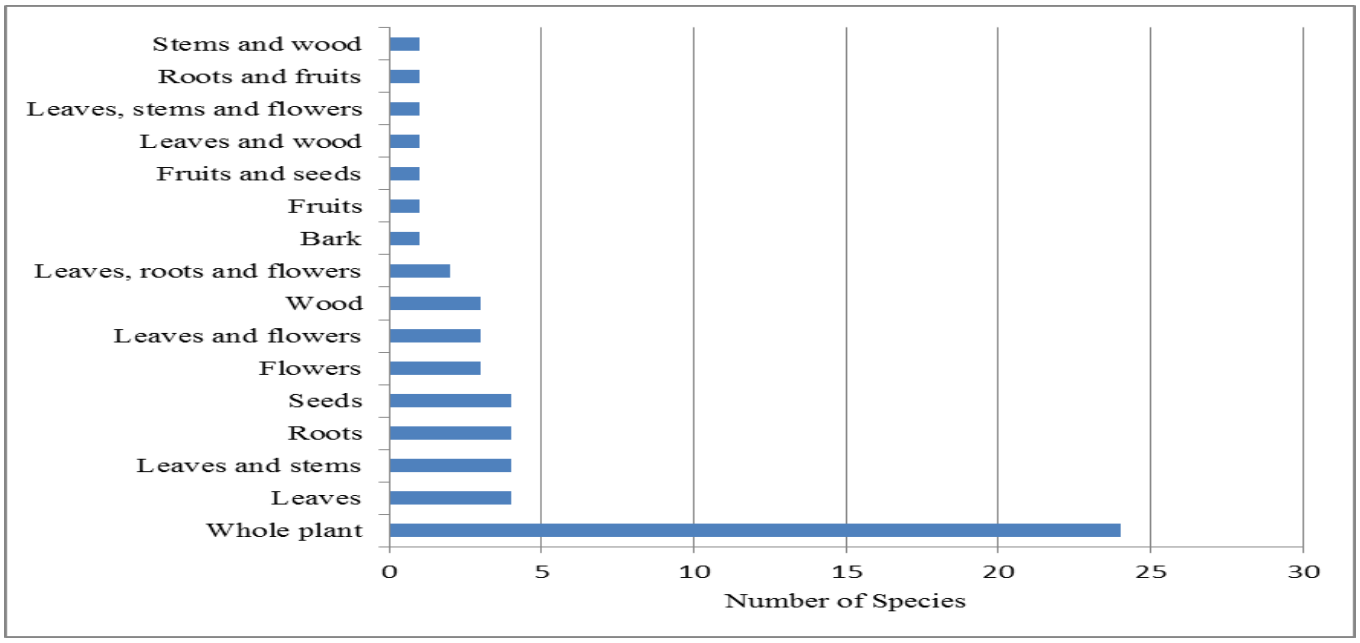

Fig. 2. Different plant parts used locally by the community

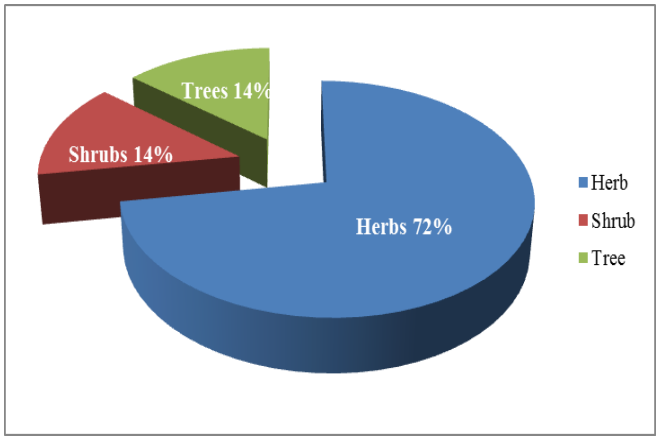

Fig. 3. Habit wise representation of flora from study area

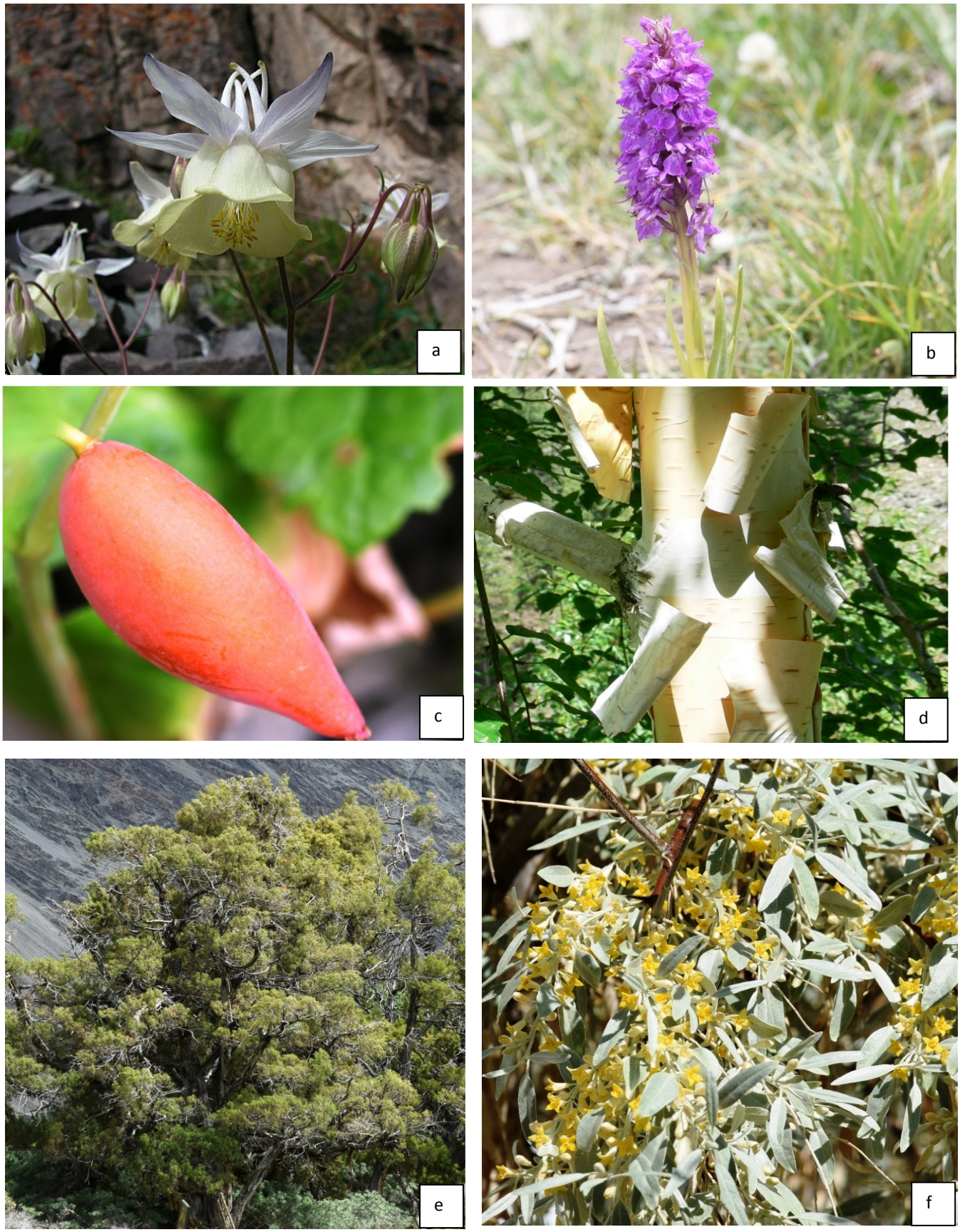

Plate 2. a. *Aquilegia fragrans* Benth.; b. *Dactylorhiza hatagirea* (D. Don) Soo; c. *Podophyllum hexandrum* Royle; d. *Betula utilis* D. Don; e. *Juniperus semiglobosa* Regel; f. *Elagnus angustifolia* L.

4. Conclusion

This short-term study adds to the floristic diversity of the cold desert region and the precious ethnobotanical data contributes to the fading knowledge. It brings forth the far-flung village of the cold desert landscape of Ladakh into the fore front. The indigenous communities harbor infinite ethnobotanical knowledge as it is directly related to their sustenance. This knowledge directly contributes to sustainable development. Comprehensive knowledge possessed by the local communities is liable to erosion as it is passed from one generation to another by word of mouth. Modernization is one major cause for this depletion. Therefore, this study forms the baseline for future quantitative analysis of flora and ethnobotany along with conservation measures which can be adopted to protect this invaluable apprehension. Not only will it help in formulation of novel drug but also will boost pharmaceutical sector. Therefore, it is evident from the present study that Kukshow region in the Trans-Himalaya is house to various unique and endemic flora.

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