

## Diversity, Endemism and Potential values of Wild Edible Plants of Khokhan Wildlife Sanctuary in Himachal Pradesh, North Western Himalaya, India

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**ABSTRACT:** Local people of a particular area use variety of wild plants for food, medicines, and products. According to the information of local people, the utilisation of plants as a food and medicine, some of these plants have been documented. However, information about the use of many wild edible plants has yet to be documented. Therefore, the current study is an effort to document the plants (wild edibles) of Khokhan Wildlife Sanctuary, which is situated in Kullu District, Himachal Pradesh. A total of 111 plants (wild edibles), comprising 42 families and 74 genera, were documented. Among them, trees (18 spp.) shrubs, (27 spp.) herbs (65 spp.) and fern (01 spp.) of wild edibles were recorded. From the all species, 71 species were native, 22 near endemics, 02 endemics and rest were non-natives to (IHR) Indian Himalayan Region. Numerous parts, like, leaves, fruits, seeds, roots, whole plants, flowers, tuber, rhizome, etc. were used by the local inhabitants. Over utilization and environment deprivation can affect the survival of wild edible plants. Therefore, for protection of wild edible plants, habitat ecology studies, conventional and *in vitro* propagation practices, plantation of wild edible in their natural habitat, programs regarding awareness and education for local inhabitants and Forest Department have been proposed.

**Keywords:** Utilization pattern, Nativity, Endemism, Indigenous uses, Frequency, Wild Edibles, Khokhan Wildlife Sanctuary.

## INTRODUCTION

Local communities of worldwide, collected the wild edible plants which are non-cultivated form their wild habitat and used primarily for medicine, nutrition, substantiate diet and other various needs (Shaheen *et al.*, 2017). During the course of human history, these plants (wild edible) have played a major role in different geographic areas of the world (Sekeroglu *et al.*, 2006). Indigenous rural as well as tribes communities of the worldwide have traditional & cultural component for the consumption and utilization of wild edible plants (Samant and Dhar 1997). In Himalayan regions, native forests are easy to access, naturally free and simple to use which fulfil about 76% natural resources needs of local people (Chettri and Sharma 2006).

The Himalaya supports, angiosperms (8,000 species), gymnosperms (44 species) and pteridophytes (600

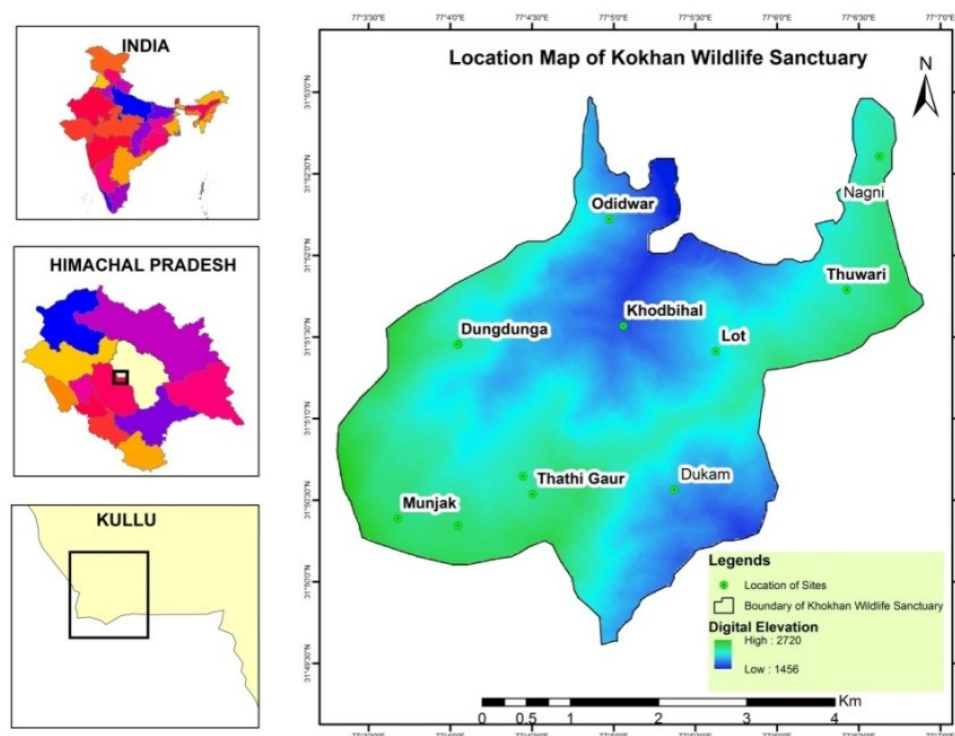
species) (Singh and Hajra 1996; Samant *et al.*, 1998a). Himachal Pradesh a part of Trans and North-Western Himalaya covers 55,673 km<sup>2</sup> area. The State is divided in three distinct regions *i.e.* Greater Himalaya/Alpine Zones, Inner Himalaya/Mid Mountains and Outer Himalaya/the Shiwaliks. Geographically, being a part of the IHR, the state has been gifted with rich biodiversity. Presence of high species abundance and different community structure makes Himachal Pradesh as mesmerizing reservoirs of floral diversity in Himalaya (Aswal and Mehrotra 1994). The natives living in the remote areas have been utilizing the forest resources in the form of medicine, agricultural tools, fodder, fuel, timber, fibre, gums, resins, religious purposes and for many other purposes since time immemorial (Samant and Dhar 1997). Amongst the above uses, these plants (wild edible) play a vital role in diet because they are phytochemically as well as

nutritionally loftier than some traditional foods which obtained from plants (Assefa and Abebe 2011; Vanzani *et al.*, 2011) thus, took worldwide support in their uses in disease and health management practices. In India or other developing countries, these plants (wild edible) provide an alternative income source to local inhabitants (Shrestha and Dhillon 2006). Utmost of these plants (wild edible) and their method of consuming are limited to certain local inhabitants/local groups and are unknown to others and population of these plants decreasing due to various reasons such as diminishing of natural resources, people's migration from rural areas, and altering cultural practices (Rao *et al.*, 2015). Due to fast deterioration of customary awareness related with wild edibles and dependence on a small number of crops, valuation and assessment of these plants are significant.

A survey of the literature reveals that many studies have been conducted on wild edible plants (wild edible) in IHR. (Gaur & Semwal 1983; Samant *et al.*, 2001a; Samant & Dhar 1997; Ballabh *et al.*, 2007; Chaithanya *et al.*, 2015; Chandra *et al.*, 2013; Jana and Chauhan 1998; Rashid *et al.*, 2007; Sundriyal *et al.*, 1998, 2011; Tiwari *et al.*, 2010; Singh *et al.*, 2023 and in Himachal Pradesh (Negi & Subramani 2015; Sharma *et al.*, 2018; Lata *et al.*, 2016; Pant *et al.*, 2014; Sen *et al.*, 2013; Sharma *et al.*, 2013; Singh *et al.*, 2014; Jhamta *et al.*, 2019; Bharti *et al.*, 2021; Prakash *et al.*, 2020), but in specific, nobody explored these plants (wild edible) in

Khokhan Wildlife Sanctuary of Himachal Pradesh. Therefore, it is essential to document the variety of wild edibles that the local inhabitants of the Sanctuary use this knowledge for future research and development projects, as well as free reference. In light of these gaps, efforts have been undertaken in the current study to; (i) assess diversity and distribution pattern of wild edibles; (ii) analysis on endemism and nativity; (iii) Analyze the traditional practices and native uses; and (iv) provide suitable management strategies.

**Study area.** The (KhWLS) Khokhan Wildlife Sanctuary in Kullu district of Himachal Pradesh is the site of the current study (Fig. 1). The Khokhan Wildlife Sanctuary, which covers an area of 14.94 km<sup>2</sup> with an altitudinal range of 1,500–2,787 m amsl, is home to a variety of sub-tropical, temperate, and sub-alpine habitats, animals, and populations. Its latitudes are 31°50'10"N–31°53'24"N and its longitudes are 77°03'21"–77°06'55" E. There is 50 mm of snowfall, 875 mm of annual rainfall, and temperatures ranges between -10°C to 25°C. Sub-tropical Chir Pine forests, western mixed coniferous forests, and moist temperate deciduous forests constitute the majority of the vegetation. Sanctuary support a wide range of sensitive biodiversity elements, such as orchids, aromatic and medicinal plants, rare, wild edibles, endemic plants, endangered, native plants and unique faunal species.



**Fig. 1.** Map of Khokhan Wildlife Sanctuary, Kullu district, Himachal Pradesh.

## METHODOLOGY

The current study based on extensive and intensive surveys carried out in the Khokhan Wildlife Sanctuary from 2016 and 2023. Periodically, surveys

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and visits were conducted to neighbour villages, namely Churgran, Lot, Rulgi, Chowkidhar, Kharka, and Janahal. Local residents were interviewed and one of the local knowledgeable people was hired for surveys

and collection of the wild edible plants samples from their natural habitats. Samples of every species were collected, and information regarding each species like habitat, habit, altitudinal range, local uses, and frequency of use pattern was generated. The method of interviews was open ended and informal instead of using strict questionnaire. The language used to interact with the informants was the local dialect of the study area, *i.e.* *Kulluvi*, and, in some cases, Hindi. Local and regional floras were used to identify the samples of wild edible plants (Aswal and Mehrotra 1994, Chowdhary and Wadhwa, 1984; Singh and Rawat 2000; Sharma and Dhaliwa 1997). Additionally, information about indigenous uses was gathered from the available literature, Samant & Dhar (1997); Sharma *et al.*, (2018); Jhamta *et al.* (2019); Prakash *et al.* (2020); Thakur and Gupta (2020); Bharti *et al.* (2021); Gajurel *et al.* (2023). The nomenclature and nativity were obtained from International Plant Name Index, the Plant List and Index Kewensis. Endemic species were those restricted to the Indian Himalayan region, whereas near-endemic species had wider distributions in the neighboring countries.

## RESULTS

**Diversity and distribution pattern.** A total of 111 species (Angiosperms: 108; Gymnosperms: 03; Pteridophytes: 01) of wild edible plants belonging 42 families and 74 genera were reported (Table 1). A total of 18 trees, 01 fern, 27 shrubs, and 65 herbs were documented (Fig. 2). The most abundant wild edible families were Rosaceae (17 spp.), which was followed by Asteraceae (12 spp.), Apiaceae and Polygonaceae (06 spp., each), Adoxaceae and Lamiaceae (06 spp., each), Balsaminaceae and Ericaceae (04 spp., each), Berberidaceae, Caryophyllaceae, Elaeagnaceae and Moraceae (03 spp., each), and Brassicaceae, Chenopodiaceae, Geraniaceae, Urticaceae and Pinaceae (02 spp., each). Among the genera, *Viburnum* (05 spp., each), *Cirsium*, *Impatiens* and *Rubus*, (04 spp., each), and *Berberis*, *Plantago* and *Prunus* (03 spp., each) were the rich genera of species (Table 1).

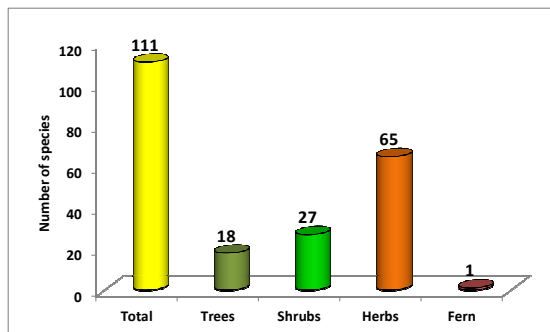


Fig. 2. Distribution of life form.

**Habitat wise distribution of wild edibles.** Among documented wild edible plants, majority (91 spp.) were occurred in shady moist habitat, followed by dry (68 spp.), degraded (58 spp.), riverine (43 spp.), rocky (35 spp.) and bouldary (29 spp.) habitats (Fig. 3).

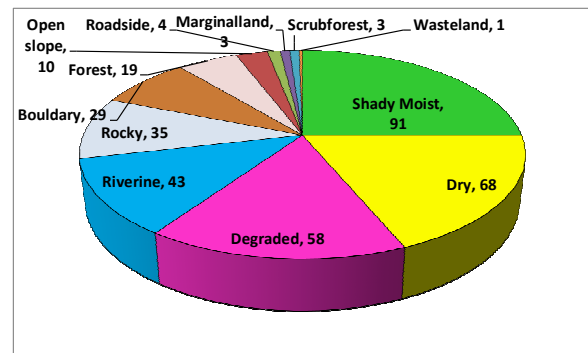


Fig. 3. Habitat wise distribution of wild edibles in Khokhan Wildlife Sanctuary, Himachal Pradesh.

**Nativity and endemism.** Seventy-one species of wild edibles were native to the Himalayan region, while the rest species were non-natives. Two species, *Elsholtzia flava* and *Angelica glauca*, were discovered endemic to the Indian Himalayan Region, while 22 other species were found near endemic (Table 1 and Fig. 4).

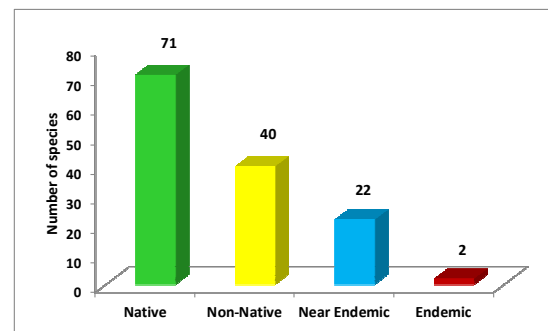
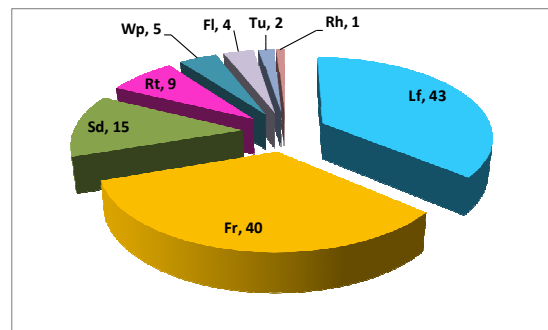


Fig. 4. Nativity and endemism.

**Utilization Pattern.** Local inhabitants consumed wild edible plants in the form of boiled, raw, roasted, fried, spice cooked or in the form of oil, and jams & pickles. Various parts namely, leaves, fruits, seeds, roots, whole plants, flowers, tuber, rhizome, etc. were used by the local inhabitants. Amongst the parts used, leaves (43 spp.) were used maximum, followed by fruits (40 spp.), seeds (15 spp.), roots (09 spp.), whole plant (05 spp.), flowers (04 spp.), and tubers (02 spp.) (Fig. 5. and Table 1.).



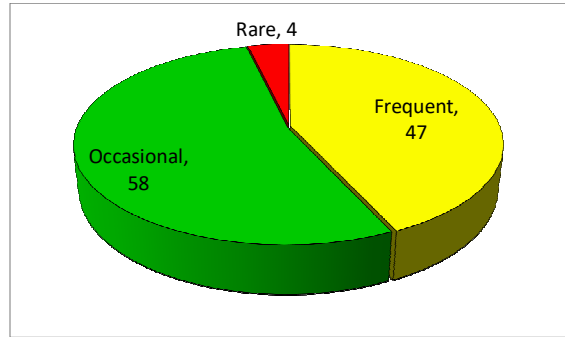
Abbreviations Used: Lf = Leaf; Sd=Seed; Rt = Root; Rh = Rhizome Wp = Whole Plant; Fr= Fruits; Fl=Flower; and Tb=Tuber

Fig. 5. Plant component usage statistics.



Out of the total reported species, 63 were eaten as raw, while 48 were eaten as cooked, *i.e.*, roasted, boiled as vegetables, soup, flavouring agents etc. The majority of plants (39 spp.) were eaten as ripe fruits, 37 spp. as vegetables, and 11 spp. as tea.










**Frequency of use pattern of wild edibles.** Of the total wild edibles plants, maximum 58 species were used occasionally, 47 species frequently and 04 species were used rarely (Fig. 6).










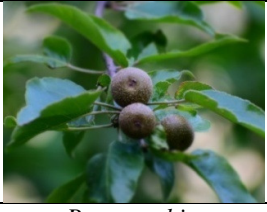

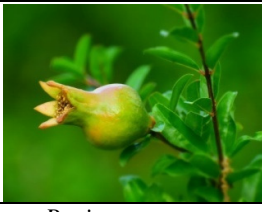








**Fig. 6.** Wild edibles use pattern frequency in Khokhan Wildlife Sanctuary, Himachal Pradesh.

**Indigenous uses and traditional practices of wild edibles.** The local inhabitants utilize different parts of the plants *i.e.*, leaf, fruit, whole plant, root, tuber, flower, seed, aerial part, fruiting body, rhizome, etc. Various parts of wild edibles are consumed in different seasons. Mostly the raw eaten plants were consumed as

a fruit, such plants include *Berberis lycium*, *B. chitria*, *B. aristata*, *Elaeagnus conferta*, *E. parvifolia*, *Ribesglaciale*, *Juglans regia*, *Fragaria nubicola*, *Duchesnea indica*, *Rubus biflorus*, *R. foliolosus*, *R. ellipticus*, *R. niveus*, *R. paniculatus*, *Ficus palmata*, *F. sarmentosa*, *Morus serrata*, *Punica granatum*, *Pyrus pashia*, etc. The processed form includes cooked, fried, roasted, tea, grinded, dried, boiled, pickle, oil, etc. The leaves of *Sonchus asper*, *Urtica dioica*, *U. hyperborea*, *Phytolacca acinosa*, *Chenopodium album* *C. foliosum*, *Dipsacus inermi*, *Fagopyrum acutatum*. Fruits of *Pistacia chinensis* subsp. *Integerrima*, *Ficus palmata* *F. sarmentosa*, Aerial parts of *Diplazium esculentum* were cooked and eaten as vegetable. A delicious *chatni* was prepared from flowers of *Rhododendron arboreum*, whole plant of *Selinum wallichianum* and *Origanum vulgare*, buds and flower of *Bauhinia variegata* and seeds of *Punica granatum*. In addition to this, flour was obtained from the seeds of *Aesculus indica* is used to make chapatti and Halwa. Some species *i.e.*, *Allium wallichii*, *Bupleurum candollei* *Mentha longifolia* *Thymus linearis* and *Elsholtzia fruticosa* were used as spices. Some of the species are also oil yielding like *Juglans regia*, *Corylus jacquemontii*, *Elsholtzia fruticosa*, *Prinsepia utilis* and *Pinus roxburghii*. With this, these plants were also used as medicine, fuel, fodder, religious, fibre, agricultural tools, timber, soap, insecticide, etc.

		
<i>Rubus ellipticus</i>	<i>Urtica dioica</i>	<i>Rhododendron arboreum</i>
		
<i>Duchesnea indica</i>	<i>Prinsepia utilis</i>	<i>Ficus palmata</i>
		
<i>Cannabis sativa</i>	<i>Rubus niveus</i>	<i>Oxalis corniculata</i>

		
<i>Thymus linearis</i>	<i>Diplazium esculentum</i>	<i>Trifolium repens</i>
		
<i>Origanum vulgare</i>	<i>Phytolacca acinosa</i>	<i>Cotoneaster microphyllus</i>
		
<i>Taxus wallichiana</i>	<i>Zanthoxylum armatum</i>	<i>Rosa macrophylla</i>
		
<i>Pyrus pashia</i>	<i>Juglans regia</i>	<i>Punica granatum</i>
		
<i>Aesculus indica</i>	<i>Berberis aristata</i>	<i>Berberis lycium</i>
		
<i>Geranium wallichianum</i>	<i>Fragaria nubicola</i>	<i>Fagopyrum acutatum</i>

#### Some important wild edible plants of Khokhan Wildlife Sanctuary in Himachal Pradesh

#### DISCUSSION

About 20,000 species of plants are used as wild edibles across the globe and 1532 edible wild species are reported from India (Reddy, 2007), of which over 675 species grow in the Indian Himalayan Region (Samant

and Dhar 1997; Pal *et al.*, 2014). The local inhabitants residing in surrounding villages of sanctuary are well versed with the utilization of native flora. The present study provides the first hand information about distribution pattern, diversity, nativity, indigenous uses, endemism, and local practices of wild edibles in



Khokhan Wildlife Sanctuary, district Kullu, Himachal Pradesh. The presence of 111 species of wild edibles in the area shows great socio-economic significance. The results are comparatively high with the finding of other workers (111 species) from Cold Desert Biosphere Reserve in Himachal Pradesh (Sharma *et al.*, 2018), (71 species) from Shikari Devi wildlife Sanctuary (Bodh *et al.*, 2019), (103 species) from rural communities of Shimla District (Jhamta *et al.*, 2019). The presence of 71 native species, 22 near-endemic species, and two endemic species shows that the area has significant conservation value. Because these species have long been utilized by locals to manage their health and

nutrition, they may provide a good source for fulfilling the enormous nutritional demands of the area's rising population of these plants through proper experimentation and sustainable management. The extensive collection and selling of several of these species has a possibility to uplift local people income. The locals inhabitants are the only ones who have traditional knowledge and practices of wild edibles but this limited to these local people only. In view of this, present study described the distribution pattern, diversity, local uses and traditional practices of these wild edibles plants of Khokhan Wildlife Sanctuary.

**Table I. Distribution pattern, part (s) used, endemism, nativity and indigenous uses of wild edible plants in Khokhan Wildlife Sanctuary of Himachal Pradesh**

Family/ Taxa	Local Name	AR (m)	Habitat /s	LF	Nativity	End	Part used	Indigenous uses	Frequency of use
<b>Angiosperms</b>									
<b>Adoxaceae</b>									
<i>Viburnum cotinifolium</i> Don	Dab	1600-2500	1,2,3,8	Sh	Reg Himal	NE	Fr	Ripe Fruits are consumed	Frequent
<i>V. erubescens</i> Wall. ex DC.		2000-2700	1,7	Sh	Reg Himal Ind Or		Fr	Ripe Fruits are consumed	Frequent
<i>V. grandiflorum</i> Wall. ex DC.	Padara	2500-2700	1,2	Sh	Reg Himal	NE	Fr	Ripe Fruits are consumed	Frequent
<i>V. mullaha</i> Buch.-Ham. ex Don		1600-2500	1,2,3	Sh	Reg Himal		Fr	Ripe Fruits are consumed	Frequent
<i>V. nervosum</i> D. Don	Tilenal	2200-2700	1,7	Sh	Reg Himal	NE	Fr	Ripe Fruits are consumed	Frequent
<b>Alliaceae</b>									
<i>Allium wallichii</i> Kunth		1500-2700	1	H	Reg Himal		Lf	After drying the leaves are used as a condiment in curries and pickles	Occasional
<b>Anacardiaceae</b>									
<i>Pistacia chinensis</i> ssp. <i>integerrima</i> (J. L. Stewart ex Brandis) Reech.f	Kakare	1500-2200	2,3	T	Reg Himal Aegypt Persia		Fr	Young shoots and leaves – cooked and used as a vegetable	Occasional
<b>Apiaceae</b>									
<i>Angelica glauca</i> Edgew.	Chaura	2000-2700	1	H	Reg Himal	E	Rh, Rt	Seeds and root stocks are used to add to the flavour of food	Occasional
<i>Bupleurum candollei</i> Wall. ex DC.		2500-2700	1,4	H	Reg Himal	NE	WP	Whole plant utilized as condiment.	Rare
<i>Centella asiatica</i> (L.) Urb.	Brahmi	1500-1600	2,4	H	Reg Trop et Sub Trop		WP	A tonic tea is made from the leaves	Rare
<i>Chaerophyllum reflexum</i> Aitch.	Khelti	2100-2700	3,6	H	Reg Himal		Rt	Fresh roots are eaten straight with milk as a high-nutrition dish.	Frequent
<i>Heraclium candicans</i> L.	Badiyacha	1800-2700	1,8	H	Reg Himal		Lf	Tender shoots loaded with curd are consumed.	Frequent
<i>Selinum wallichianum</i> (DC.) Raizadz & Saxena	Bhutkeshi	2500-2700	1,2	H	Reg Himal	NE	WP	Used to make chutney.	Occasional
<b>Asparagaceae</b>									
<i>Asparagus racemosus</i> Willd.	Sansarpali	1500-1700	1,2	H	Ind Or Afr Trop Austr		Tu	Tubers are eaten	Occasional
<b>Asteraceae</b>									
<i>Anaphalis triplinervis</i> (Sims.) Cl.		1500-2700	1,2,3	H	Reg Himal		Fl	Raw flower buds are consumed in salads.	Occasional
<i>Artemisia maritime</i> L.	-	2300-2700	1, 2, 3, 4, 7	H	Europe Reg Caucas Sibir		Lf	Extract from fresh and dry leaves is utilized.	Occasional
<i>Cirsium wallichii</i> DC.		1800-2500	1,2,3,4,5, 6	H	Reg Himal	NE	Rt	Root and stem are consumed as food.	Occasional
<i>C. falconeri</i> (Hk.f.) Petr.	Bhoosh	1900-2700	2, 3, 4, 5, 7, 12	H	Reg Himal		Rt	Root and stem are consumed as food.	Occasional
<i>C. japonicum</i> (Thunb.) Fisch. ex DC.	-	1900-2500	1,5, 4, 6	H	Reg Himal China Japan		Rt	Root and stem are consumed as food.	Occasional

<i>C.verutum</i> (D.Don) Spreng.	-	1600-2500	1,5	H	Reg Himal		Rt	Root and stem are consumed as food.	Occasional
<i>Galinsoga quadriradiata</i> Ruiz & Pav		1500-1600	2,4	H	Am Bor		Lf	Young leaves are cooked and utilized as vegetable	occasional
<i>G. parviflora</i> Cav.		1500-2500	4,5	H	Mexic North Am		Lf	Young leaves are cooked and consumed as vegetable	Occasional
<i>Myriactis nepalensis</i> Less.		1800-2700	1,2,3,4,5,7	H	Reg Himal As Centr		Lf	As a vegetable, use fresh leaves.	Frequent
<i>Sonchus asper</i> Hill.		1500-2200	1,2,4	H	Cosmop		Lf	Young leaves eaten raw or in a salad	Occasional
<i>S. oleraceus</i> L.		1500-1800	2, 4	H	Cosmop		Lf,	Young leaves eaten raw or in a salad	Occasional
<i>Taraxacum campylodes</i> G.E. Haglund		1500-2700	1,2,4,5,7	H	Am Trop		WP	Young leaves are boiled and prepared like spinach, while the entire plant is eaten raw but tastes harsh.	Occasional
<b>Balsaminaceae</b>									
<i>Impatiens amphorata</i> Edgew.		1500-1800	2,5	H	Reg Himal		Sd, Lf	Raw leaves and seeds are consumed.	Occasional
<i>I. bicolor</i> Royle	-	2000-2700	2,5	H	Reg Himal		Sd, Lf	Raw leaves and seeds are consumed.	Occasional
<i>I. glandulifera</i> Royle		2200-2700	1,2,3,6,7	H	Reg Himal		Sd, Lf	Raw leaves and seeds are consumed.	Occasional
<i>I. sulcata</i> Wall.		2000-2700	1,3,4,5	H	Reg Himal	NE	Sd, Lf	Raw leaves and seeds are consumed.	Occasional
<b>Berberidaceae</b>									
<i>Berberis aristata</i> DC.	Kasmal	1800-2700	1,2,4,7	Sh	Ind Or	NE	Fr, Lf	Flowers, foliage, and fruits are consumed raw.	Occasional
<i>B.chitria</i> Buch.-Ham. exLindl.	Kasmal	2100-2700	1,2	Sh	Reg Himal		Fr, Lf	Flowers, foliage, and fruits are consumed raw.	Occasional
<i>B. lyceum</i> Royle	Kasmal	1500-2200	1,2,3,4,5	Sh	Reg Himal	NE	Fr, Lf	Flowers, foliage, and fruits are consumed raw.	Occasional
<b>Brassicaceae</b>									
<i>Capsella bursa-pastoris</i> (L.) Medik		1500-2700	1,2,4	H	Reg Temp		Lf	Leaves and flower directly utilized.	Occasional
<i>Lepidium apetalum</i> Willd.	-	2000-2600	1, 5, 13	H	Reg Himal		Lf	Young leaves are utilized as green vegetables.	Occasional
<b>Caesalpiniaceae</b>									
<i>Bauhinia variegata</i> L.	Kariyala/ Kachnar	1500-1700	1	T	Ind Or Burma China		Fl	Buds and flowers are used as vegetable and various dishes like chutney and pickles.	Frequent
<b>Cannabaceae</b>									
<i>Cannabis sativa</i> L.	Bhang	1500-2000	1,2,4,6,9	H	As Centr Reg Himal Bor Occ		Sd	Roasted bhang seeds and local wheat seeds are combined and consumed.	Frequent
<b>Caprifoliaceae</b>									
<i>Lonicera angustifolia</i> Wall. ex DC.		2500-2700	1,7	Sh	Reg Himal	NE	Fr	Ripe Fruits utilized	Occasional
<i>L. quinquelocularis</i> Hardw.	Jammu	1500-2700	1,3,4	Sh	Reg Himal		Fr	Consumed ripe Fruits	Occasional
<b>Caryophyllaceae</b>									
<i>Silene conoidea</i> L.		1500-2700	4,7	H	Europe Oriens		Lf	Young leaves are utilized as green vegetables.	Frequent
<i>Silene vulgaris</i> (Moench) Garcke	-	2100-2700	1, 13	H	Europe Afr Bor Reg Himal		Lf	Young leaves are utilized as green vegetables..	Frequent
<i>Stellaria media</i> (L.) Vill.	Bariyala	1500-2000	1,7	H	Reg Temp		AP	Aerial parts cooked as a vegetable	Occasional
<b>Chenopodiaceae</b>									
<i>Chenopodium album</i> L.		1500-2500	1,4,6	H	Reg Temp et Trop		Lf	Young leaves are utilized as green vegetables.	Frequent
<i>C. foliosum</i> (Moench) Asch.		1500-2700	1,4,6	H	Reg Bor et Austr		Lf	Young leaves are utilized as green vegetables.	Frequent
<b>Convolvulaceae</b>									
<i>Convolvulus arvensis</i> L.	-	1600-2300	2, 11	H	Geront temp		Sd	Seeds consumed both raw and fried.	Occasional
<b>Corylaceae</b>									

<i>Corylus jacquemontii</i> Decne.	Shroi	1800-2700	1, 2	T	Europe Or As Min Reg Himal	NE	Sd	Seeds and seed oil are palatable and dried fruits with an excellent nutritional value.	Frequent
<b>Dioscoreaceae</b>									
<i>Dioscorea deltoidea</i> Wall. ex Kunth		1600-2700	1,2,3,4,7	H	Ind Or		Tu	Tubers are consumed as a vegetable	Frequent
<b>Dipsacaceae</b>									
<i>Dipsacus inermis</i> Wall.		2200-2700	1,2,4	H	Reg Himal		Lf	Vegetables are prepared from tender leaves.	Occasional
<b>Elaeagnaceae</b>									
<i>Elaeagnus conferta</i> Roxb.	Geai	1500-1800	1,2,4,7	Sh	Ind Or	NE	Fr	Edible fruits are used to make juice, jam, and tea, while dried leaves are used in tea making.	Frequent
<i>E. parvifolia</i> Wall. ex Royle	Geai	1600-2400	1,5	Sh/T	Japan		Fr	Edible fruits are used to make juice, jam, and tea, while dried leaves are used in tea making.	Frequent
<i>Hippophae salicifolia</i> D. Don	Chutare, Charma	2200-2600	2, 5, 4	T	Nepal		Fr	Edible fruits are used to make juice, jam, and tea, while dried leaves are used in tea making.	Frequent
<b>Ericaceae</b>									
<i>Rhododendron arboretum</i> Sm.	Brash	1500-2200	1,2,3,5,7	T	Reg Himal		Fl	Flowers are used for making Juice and Chatni	Occasional
<i>Trifolium pratense</i> L.	Malori	1800-2500	4,5	H	Europe As Temp		Lf	Leaves are consumed as vegetables.	Occasional
<i>T. repens</i> L.	Malori	1600-2700	1,6,8	H	Geront Bor Temp		Lf	Leaves are consumed as vegetables.	Occasional
<i>Trigonella emodi</i> Royle ex Benth.	Mithugha	1600-2700	1,2,4,6,7,8	H	Reg Himal		Lf	Leaves are consumed as vegetables.	Occasional
<b>Geraniaceae</b>									
<i>Geraniumnepalense</i> Sw.	Jibrughas s	1500-2500	1,2,3,4,5,6,9	H	Ind Or China		Rt	Roots utilized to make tea	Occasional
<i>G. wallichianum</i> D. Don ex Sw.		2600-2700	1,2,3,5,6,8	H	Reg Himal	NE	Rt	Roots utilized to make tea	Occasional
<b>Grossulariaceae</b>									
<i>Ribes glaciale</i> Wall.		1900-2700	1	Sh	Reg Himal		Fr	Fruits are utilized.	Occasional
<i>R. alpestre</i> Wall. Ex Decne.	Chalendhar	1600-2700	1, 5, 11	Sh	Europe Afr Bor Reg Himal		Fr	Fruits are utilized.	Occasional
<b>Hippocastanaceae</b>									
<i>Aesculus indica</i> Coleb. exCamb.	Khanor	1800-2600	1	T	Reg Himal	NE	Fr	Flour is mixed with wheat flour to make Chapati and Halwa	Occasional
<b>Juglandaceae</b>									
<i>Juglans regia</i> L.	Akhrot	1600-2000	1,4,7	T	As Occ Reg Himal	NE	Fr, Fl	Edibles include dried fruits, essential oils, and flowers used as a green vegetable.	Frequent
<b>Lamiaceae</b>									
<i>Elsholtzia flava</i> (Benth.) Benth.	Pothi, Jaunkra	1600-2000	1,2,4	Sh	Reg Himal	E	Sd	Seeds used raw or pickled	Occasional
<i>E. fruticosa</i> (Don) Rehd.	Pothi, Jaunkra	1600-2200	1,2,4	Sh	Reg Himal		Sd	The ground seeds are used to flavor food as a condiment, and the seeds are often extracted to make edible oil.	Occasional
<i>Mentha longifolia</i> (L.) Huds.	Podina	1500-2700	4,6	H	Europe As Bor		Lf	Leaf utilized as a condiment or chatni.	Frequent
<i>Origanum vulgare</i> L.	Bantulsi	1600-2700	1,2,3,4,5,7,8	H	Europe As		WP	Used as a spice as well as for chutney making.	Frequent
<i>Thymus linearis</i> Benth.	Ban jira	2000-2700	1,2,4,8	H	Europe As et Afr Bor		Lf	Leaf utilized as condiment.	Frequent
<b>Malvaceae</b>									
<i>Malva verticillata</i> L.		1500-2000	1,2,6,8	H	Europe As et Afr Bor		Lf	The leaves are utilized for green vegetables.	Occasional
<b>Moraceae</b>									
<i>Ficus palmate</i> Forsk.	Fegra	1500-2000	1,2	T	Afr Trop Arab Ind Or		Fr	Fruits are eaten as a vegetable	Frequent
<i>F. sarmentosa</i> Ham. ex Sm.	Debra, Denbere	1600-2600	1,2,3,7	Sh	Reg Himal		Fr	Fruits are eaten as a vegetable	Frequent
<i>Morus serrata</i> Roxb.	Cheemu, Paharitut	1500-2000	1,4,5	T	Reg Himal	NE	Fr	Ripe fruits are edible	Frequent



<b>Oxalidaceae</b>									
<i>Oxalis acetosella</i> L.	Malori	2000-2500	1, 2, 4	H	Reg Bor Temp		Lf	Leaves are eaten raw as vegetable	Occasional
<i>Oxalis corniculata</i> L.	Malori	1600-2200	1,2,5	H	Amphig Temp et Trop		Lf	Leaves are eaten raw as vegetable	Occasional
<i>O. latifolia</i> Hk.f.		1500-2500	1,4,7,8	H	Mexic		Lf	Leaves are eaten raw as vegetable	Occasional
<b>Phytolaccaceae</b>									
<i>Phytolacca acinosa</i> Roxb.	Zharka	2000-2500	3,7	H	Reg Himal China		Lf	Leaves are cooked and consumed as a vegetable	Frequent
<b>Plantaginaceae</b>									
<i>Plantago asiatica</i> L.	Ishabgol	1600-2700	4, 5, 7	H	Europe As et Am Bor		Lf	Fresh leaves are consumed as rows and cooked.	Occasional
<i>P. lanceolata</i> L.	Isabgol	1700-2400	1,4,5,6	H	Reg Himal		Lf	Fresh leaves are consumed as rows and cooked	Occasional
<i>P. ovata</i> Forssk.	-	1700-1900	1, 2, 5, 7, 11	H	Reg Mediterr Oriens		Lf	Fresh leaves are consumed as rows and cooked	Occasional
<b>Poaceae</b>									
<i>Setaria pumila</i> (Poir.) Roem. exSchult.		1500-2500	6, 8, 13	H	Europe As Trop		Sd	In the same manner as rice is used, seeds can be eaten sweet or savory. They can also be powdered and added to porridge, cakes, puddings, and other dishes.	Occasional
<b>Podopyllaceae</b>									
<i>Sinopodophyllum hexandrum</i> (Royle) T.S. Ying	Ban Kakri	2100-2700	1,3,5,7	H	Reg Himal		Fr	Ripe fruits are consumed.	Occasional
<b>Polygonaceae</b>									
<i>Fagopyrum acutatum</i> (Lehm.) Mansf. ex K. Hammer	Ban Paphra	1600-2700	1,4	H	Reg Himal China		Lf	Green vegetable leaves and seed flour are used to make the regional delicacy thotha, which is eaten with aloo curry..	Frequent
<i>Persicaria amplexicaulis</i> (D.Don) Ronse Decr.		1500-2600	1,2,3,4,6, 7	H	Reg Himal		Rt	Roots utilized as a tea substitute	Occasional
<i>Rheum australe</i> D. Don	Chuchi	2300-2700	3, 4	H	Reg Himal	NE	Lf	The local cuisine bhusoi, which is eaten with ghee and aloo curry, is made from a mixture of dry leaves and shoot parts combined with wheat flour seeds.	Frequent
<i>Rumex hastatus</i> Don	Malori	1500-1800	2,3,5,9	H	Reg Himal		Lf	Young, tender leaves prepared like vegetables.	Frequent
<i>R. nepalensis</i> Spr.	Malora	1800-2700	1,2,4,5,6	H	As Occ Ind Or Malaya Afr Austr		Lf	Young, tender leaves prepared like vegetables.	Frequent
<b>Punicaceae</b>									
<i>Punica granatum</i> L.	Daru	1500-2200	1,2,7	T	Europe Austr Maurit		Sd	Seeds are eaten raw as Chutney	Frequent
<b>Rosaceae</b>									
<i>Cotoneaster microphyllus</i> Wall. Ex Lindl.	Chinchri	2000-2700	1,2,4	Sh	Reg Himal		Fr	Fruits are eatable	Occasional
<i>Duchesnea indica</i> Focke		1600-2500	1,2,3,4,5, 9	H	Ind Or Malaya China		Fr	Fruits are eatable	Occasional
<i>Fragaria nubicola</i> L.		1500-1800	1,2,5,6	H	Reg Temp		Fr	Fruits are edible, and the roots are used to make tea.	Frequent
<i>F. vesca</i> L.	Bhumphal	1600-2700	1,2,5,6	H	Reg Temp		Fr	Fruits are edible, and the roots are used to make tea.	Frequent
<i>Prinsepia utilis</i> Royle	Bekhal	1600-2600	1,2,4,5	Sh	Reg Himal		Fr	Fruits are eaten and oil is obtained	Occasional
<i>Prunus armeniaca</i> L.	Shada, Khumani	1500-2200	1,5	T	Reg. Caucas		Sd, Fr,	Both seeds and fruits are edible.	Frequent

<i>Prunusc erasoides</i> Don	Paja	1500-2200	1	T	Reg Himal		Fr	Fruits can be utilized	Frequent
<i>P. cornuta</i> Steud.	Jammu	2100-2700	1,5	T	Himal Occ		Fr	Fruits can be utilized	Frequent
<i>Pyrus pashia</i> Buch.-Ham. ex Don	Kainth, Shegal	1500-1800	1,2,3,4,5	T	Reg Himal		Fr	Fruits can be utilized	Frequent
<i>Rosa macrophylla</i> Lindl.		2200-2700	1,2,3,4,7	Sh	Reg Himal China	NE	Fr	Fruits can be utilized	Frequent
<i>R. moschata</i> Herrm.	Kuja/ Shami	1800-2300	1,2,3,4,5,7	Sh	Reg Himal China		Fr	Fruits can be utilized	Frequent
<i>R. sericea</i> Lindl.		2000-2700	1,2	Sh	Reg Himal		Fr	Fruits can be utilized	Frequent
<i>Rubus biflorus</i> Buch.-Ham. ex Sm.	Akhaey/ Heer	1500-2500	1,2	Sh	Reg Himal		Fr	Fruits can be utilized	Frequent
<i>R. ellipticus</i> Don	Akha	1500-1800	1,2,3,4,5	Sh	Ind Or		Fr	Fruits can be utilized	Frequent
<i>R. niveus</i> Thunb.	Akha	1800-2600	1,3	Sh	Reg Himal		Fr	Fruits can be utilized	Frequent
<i>R. paniculatus</i> Sm.	Kalanche, Kala akha	1500-2600	1,4	Sh	Reg Himal	NE	Fr	Fruits can be utilized	Frequent
<b>Rutaceae</b>									
<i>Zanthoxylum armatum</i> DC.	Tirmara, Trimbar	1500-1800	2,4,7	Sh	Reg Himal China		Sd	Seeds are ground into a powder and used as a condiment.	Occasional
<b>Saxifragaceae</b>									
<i>Bergenia ciliata</i> (Haw.) Sternb.	Pashan bhed	1600-2700	1,2,3,5	H	Reg Himal	NE	Lf	Dried leaves are utilized to make tea.	Occasional
<b>Ulmaceae</b>									
<i>Celtis australis</i> L.	Khirk	1500-2000	1,2,3,5,7	T	Europe As Temp Ind Or		Fr	Fruits are edible.	Occasional
<b>Urticaceae</b>									
<i>Urtica dioica</i> Jacq. Ex Wedd.	Kugsh/ Bicchubuti	1500-2300	1,2,4,5	H	RegBor Temp		Lf	Vegetable is made from leaves	Frequent
<i>Urtica hyperborea</i> Jacq. ex Wedd.		1500-2100	1,2,4	H	Reg Himal		Lf	Vegetable and soup is made from leaves	Occasional
<b>Gymnosperms</b>									
<b>Pinaceae</b>									
<i>Pinus roxburghii</i> Sarg.	Chir	1500-2200	1,2,3,4,5	T	Reg Himal	NE	Sd	Seeds are edible and oil is obtained	Rare
<i>P. wallichiana</i> A.B. Jack.	Kail	2000-2700	1,2,3,4,5	T	Reg Himal	NE	Sd	Seeds are edible.	Rare
<b>Taxaceae</b>									
<i>Taxus wallichiana</i> Zucc.	Rakhala/ Talispatra	2400-2700	1,2,3	T	Reg Himal		Fr	Fruits are edible, while the bark is used to prepare tea.	Occasional
<b>Pteridophytes</b>									
<b>Athyriaceae</b>									
<i>Diplazium esculentum</i> (Retz.) Sw.	Linger	1500-1800	1,2,4,5	Fn			Frd	Aerial parts used as vegetable.	Occasional

**Abbreviations used:** AR=Altitudinal range; T = Tree; H = Herb; LF=Life forms; Sh = Shrub; Ind Or = Indian Oriental; Bor = Borealis; Reg Himal = Himalayan Region; Arct = Arctic; Centr = Central; Turkist = Turkistan; Temp = Temperate; et = And; As = Asia; Afr = Africa; Geront = Gerontia; Trop = Tropical; N. Zel = New Zealand; Amphig = Amphigaea; Madag = Madagascar; Orient = Oriental; Austr = Australia; Amer = America; Arab = Arabia; Maxic = Maxico; Polynes = Polynesia; Occ = Occidentalis; Subtrop = Subtropical; Cosmop = Cosmopolitan; Afghan = Afghanistan; Hisp = Hispan; Min = Minor Alger = Algeria; E = Endemic; NE = Near Endemic; Rt= Root; Fr= Fruit; Lf=Leaf; Fl= Flower; Rh = Rhizome; Sd = Seed; Frd = Frond; Tu = Tuber; WP= Whole plant; 1 = Shady Moist; 2 = Dry; 3 = Rocky; 4=Degraded; 5 = Riverine; 6=Forest; 7 = Bouldary; 8 = Open slope; 9=Roadside; 10=Epiphyte; 11 = Marginall and; 12=Wasteland; and 13 = Scrubforests

## CONCLUSIONS

Present study showed that the traditional wisdom about the use of wild edibles still exists among the local communities residing around the Sanctuary. The local inhabitants are the store house of traditional knowledge particularly about the use of wild edible plants. They depend on wild edibles, not only for food and nutrition, but also for income generation. But, gradually disappearing traditional knowledge, habitat degradation, overexploitation, shifting environmental condition and traditional practices of local people have necessitated the need for conservation and management of this diversity by the local people, Central and State Government Organizations, NGOs, and

adequate documentation of indigenous knowledge and traditional practices. Study on the population ecology of the important wild edibles, formulation and dissemination of adequate knowledge, potential of these plants (wild edible); education and awareness programs regarding sustainable utilization of these species (wild edible) for the inhabitants; and development of conventional and in vitro propagation protocols of wild edibles for mass scale propagation and their establishment and maintenance in the in situ and ex situ conditions have been suggested.

## FUTURE SCOPE

In the Khokhan Wildlife Sanctuary of Himachal Pradesh such detailed study on assessment of diversity

and distribution pattern, analysis on endemism and nativity and traditional practices and native use of wild edibles was not done by earlier any workers. So current study will provides first hand information about various wild edible plants present in the study area. The value addition programs as well as marketing policy for the local people to sale the products can uplift their income. For the conservation of these species, studies on habitat ecology, development of conventional and in vitro propagation protocols; introduction in the natural habitats are required.

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