Diversity, distribution and indigenous uses of wild edible plants used by the tribal community (Pangwal) in Pangi valley, Chamba of Himachal Pradesh, North-Western Himalaya

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Abstract

The native communities of the Indian Himalayan Region are largely dependent on plant resources for their sustenance. Among the economically important plants, wild edibles are consumed as raw, roasted, boiled, fried, cooked or in the form of oil, spice and seasonal material i.e., jams and pickles. The local communities have rich knowledge base indigenous uses and traditional practices, but require proper documentation for their long time conservation. The present study is an attempt to assess the wild edibles of Pangi valley, located in Chamba District of Himachal Pradesh. Total 124 wild edibles, representing 68 genera and 41 families were recorded. Of these, 09 species were represented by trees, 33 shrubs, 77 herbs, 1 fern and 03 fungi. Of the total species, 63 species were native, 10 near endemic, 03 endemic and other are non-native to the Indian Himalayan Region. Various parts namely, whole plants, stem, rhizome, tuber, bark, aerial part, leaves, flowers, fruits, roots, etc. were used by tribal communities in various forms. Over utilization and habitat degradation may result in local extinction. Therefore, for the conservation of these species, studies on habitat ecology, development of conventional and in vitro propagation protocols; introduction in the natural habitats and awareness among the tribal communities have been suggested.

Keywords: Tribal communities, wild edibles, diversity, distribution, utilization pattern, nativity

Introduction

Himalayan Region is one of the youngest mountains and identified biodiversity hotspot of the world (Nyaupane et al., 2014). The Indian Himalayan Region (IHR) is one of the mega-diverse bio-geographic regions of India, stretches about 3,000 km in length and 220-300 km in width. It covers nearly 17% of the geographical area and 3.8% of India’s population (1, 2). The IHR supports about 8,000 flowering plants species (1, 2). The region supporting diverse habitats provides varied ecological niches and microclimates not only for plants and animals, but also for human beings. It is a reservoir of biodiversity which is readily utilized by the rural and tribal communities as source of medicine, food (wild edible), fodder, fuel, timber, making agriculture tools, religious and various other purposes (1, 2). The region is inhabited by a number of rural communities or groups, which are mostly dependent on the wild plant resources. Use of wild plants as a source of food is an important part of culture of native communities that live in the tribal areas. These wild edibles play an important role for the nutritional requirement of tribal population in remote parts of the country. Like other regions of the IHR, Pangi valley of Chamba district, Himachal Pradesh is also rich in medicinal, aromatic and wild edible plants wealth. The tribal communities residing in Pangi valley also use wild edible plants as source of food and depend on this resource to meet their food needs for sustenance. The cold and harsh climatic conditions and long freezing winters prevalent in cold arid zones enforced Tribal and Mongolian communities to search for wild edible plants as a source of food. Utilization of wild edible plants as food source by tribal communities residing in Pangi valley is more significant for them as they do not have year long easy access as well as normal availability and supply of other regular food resources in comparison to rural people residing in other regions (1, 2).
Different parts, such as tender shoots, leaves, stems and underground parts of these plants are being used as fresh or in dehydrated form. Some of the wild edible plants are placed to solar dehydrazion as emergency vegetables for prolonged winters. Because of intense sunlight, the leaves, roots and shoots are dehydrated under shade having adequate ventilation. August - September months are the period of solar dehydration because of quick and satisfactory dehydration occurs due to low humidity during this period. Low temperature allows products thus formed to be consumed during winters without spoilage. Also, tribal people consume different parts of wild edibles such as roots, leaves, stems, flowers, etc., either raw or in cooked form i.e., roasted, boiled, fried or as flavoring agent, oil, spice, pickles, jams or in the form of tea, juice etc. [5-9]. However, there is considerable change in life style as well as eating stuff and style of tribal communities, but still wild edibles form major part of their diet. Keeping in view, the potential of these edible plant species, it is very essential to promote wild edibles not only as source for livelihood sustenance, but also as a source of income generation for the tribal communities [5-9]. Today the knowledge regarding these wild edibles and their use remain restrained to these tribal communities especially only to older people.10 The review of literature reveals that several studies have been carried out on wild edible plants across the IHR [5-7, 9-23, 24-26] and in Himachal Pradesh [5, 16, 18, 21, 22, 24]. In particular, none of the workers have investigated the wild edible plants of Pangi valley in Himachal Pradesh. Therefore, it is permitted to document the indigenous knowledge among tribal communities of the region regarding the invaluable and nutrient rich wild edible plant wealth and ensuring their long lasting existence. Considering the importance of invaluable edible plant wealth and gradually diminishing traditional knowledge related to their use, an attempt has been made to: (i) assess the diversity and distribution pattern of wild edible plants; (ii) analyze nativity and endemism; (iii) document the indigenous uses and traditional practices; and (v) suggest suitable management options.

Study area
Present study was conducted in Pangi Valley (latitudes; 33°04'56"N to 76°20'11"E longitude) of the Chamba district in Himachal Pradesh. Pangi valley is sandwiches between altitudinal range from 2,100-6,200 m amsl and total area 1601 km². The area is characterized by deep river valleys and steep mountain slopes typically exhibits temperate, sub-alpine, alpine climate and glaciers. Most of the area (approx. 68%) falls under sub-alpine and alpine-zones, which remain snow covered during winter months. The lowest temperature in Pangi Valley goes below the freezing point i.e., up to -10°C and the highest temperature was recorded around 35°C. The yearly rainfall is recorded between 200-400 mm [3-4]. Pangi valley is rich in biodiversity. The vegetation comprises of temperate coniferous evergreen and broad leaved deciduous forests, alpine scrub and alpine herbs which support a large number of ecologically and economically important biodiversity elements including orchids. Pangi Valley, a subdivision of Chamba district is the remote high-altitude area and one of the most beautiful and unique valley in the Northwestern Himalaya. The river Chandra-bhaga (Chenab) flows through deep narrow gorge in the Pangi Valley. It originates from Baralacha glacier in Lahaul-Spiti district and enters in Pangi Valley near Karhu Nala. The valley covers Killar, Purthi, Sechu-Nala, Sach and Kumar-Parnar Forest Divisions and very well known for diverse habitats, climatic conditions and rich biodiversity. The villages in the valley are located between 2,100-3,500 m amsl. Roads are poor, with, few of them surfaced. The Saach Pass at an altitude of 4,500 m amsl is open for vehicular traffic between mid-June and October, but closed due to heavy snow fall during rest of the month of a year. The Valley is mostly inhabited by Pangwal and Bhoti communities belonging to mostly Hindu communities with a few Buddhists communities. The tribal people are called the “Pangwal.” The high altitude villages of Pangi Valley are called Bhatories and their residents are referred to as “Bhoots.” These people are mostly Buddhists and have Tibet-Mongolian features. Adjoining hills of Pangi Valley towards the southern side are visited frequently by migratory pastoralist tribal Gaddis and nomadic Gujjars with their herds. These migrants go to higher altitudes in summer along with their herds for grazing. They also collect different parts of various wild edibles, medicinal and aromatic plants for their own use and trade. The tribal communities consisting in Pangi valley also utilize wild edibles as food and depend on this resource to meet their food needs during lean period.

Fig 1: Map of Pangi Valley in Chamba District, Himachal Pradesh
Methodology
The present study was based on extensive and intensive surveys conducted from 2015 to 2018 in the Pangi valley tribal villages namely, Kuthal, Sach, Ghesal, Hillor, Sechu, Mohji, Chasak, Chasak-Bhatori, Hillu, Purthi, Than, Mindhal, Kumar, Parmar, Parmar-Bhatori, Luj, Dharwas, Sural, Sural-Bhatori, Punto, Kariyas, Hudan and Hudan-Batori were visited and surveyed time to time. The knowledgeable people were interviewed, and one among them was hired for survey and collection of the wild edible plants' samples from their natural habitats. The samples of each species were collected and each species, information on altitudinal range, habit, habitat indigenous uses, traditional practices market value and frequency of utilization was generated. Interviews followed informal method and open ended rather than a strict questionnaire. The language used while interacting with the informants was the local dialect viz., Pangwali and Bhoti in certain cases, Hindi also. The samples of the wild edibles species were identified with the help of local and regional floras [26-31]. Also, information on indigenous uses was collected from the available literature [3-7, 9-23-25]. Index Kewensis, International Plant Name Index and The Plant List were followed for the nomenclature and nativity. The species restricted to the Indian Himalayan Region were considered as endemic and those with extended distribution to the neighbouring countries were considered as near-endemic.

Table 1: Profile of the informants of Pangi valley, Chamba District of Himachal Pradesh

| S. No. | Name          | Village | Gender | Age | Occupation                   |
|--------|---------------|---------|--------|-----|------------------------------|
| 1.     | Amar Nath     | Kuthal  | Male   | 35  | Agriculture                  |
| 2.     | Moti Ram      | Kuthal  | Male   | 70  | Local Vaid                   |
| 3.     | Heer Chand    | Kuthal  | Male   | 75  | Agriculture/Horticulture     |
| 4.     | Amar Chand    | Kuthal  | Male   | 77  | Local Vaid                   |
| 5.     | Hans Raj      | Kuthal  | Male   | 45  | Ayurveda Pharmacist          |
| 6.     | Chhangu Ram   | Kuthal  | Male   | 68  | Agriculture                  |
| 7.     | Sita Devi     | Kuthal  | Female | 53  | Agriculture                  |
| 8.     | Channi Ram    | Kuthal  | Male   | 77  | Local Vaid                   |
| 9.     | Lobh Chand    | Sach    | Male   | 55  | Peon of veterinary           |
| 10.    | Gur Diyal     | Sach    | Male   | 62  | Agriculture                  |
| 11.    | Russi Devi    | Sach    | Female | 53  | Agriculture                  |
| 12.    | Hello Devi    | Sach    | Female | 30  |农业 Local Panchayat Pradhan |
| 13.    | Bal Dev       | Sach    | Male   | 62  | Agriculture/Horticulture     |
| 14.    | Mahatam Chand | Sach    | Male   | 30  | Agriculture                  |
| 15.    | Chhangu Ram   | Hillor  | Male   | 62  | Agriculture                  |
| 16.    | Devi Singh    | Hillor  | Male   | 42  | Agriculture                  |
| 17.    | Butti Devi    | Hillor  | Female | 39  | Teacher                      |
| 18.    | Sant Ram      | Mojhi   | Male   | 70  | Agriculture                  |
| 19.    | Dhan Ram      | Mojhi   | Male   | 60  | Agriculture                  |
| 20.    | Sham Lal      | Mojhi   | Male   | 55  | Agriculture                  |
| 21.    | Dhari Ram     | Mojhi   | Male   | 53  | Agriculture                  |
| 22.    | Devi Chand    | Mojhi   | Male   | 53  | Agriculture                  |
| 23.    | Prem Lal      | Mojhi   | Male   | 60  | Agriculture                  |
| 24.    | LokNand       | Hillor  | Male   | 55  | Agriculture                  |
| 25.    | Jotu Ram      | Hillor  | Male   | 45  | Agriculture                  |
| 26.    | Sun Vir       | Hillor  | Male   | 42  | Agriculture                  |
| 27.    | Jhankhu Ram   | Hillor  | Male   | 62  | Agriculture                  |
| 28.    | Sukh Devi     | Hillor  | Female | 70  | House Wife                   |
| 29.    | Nand Lal      | Hillor  | Male   | 85  | Shopkeeper                   |
| 30.    | Sesar Chand   | Hillor  | Male   | 75  | Compounder/Pharmacist        |
| 31.    | Vishak Chand  | Hillu   | Male   | 75  | Agriculture                  |
| 32.    | Ram Jeet      | Hillu   | Male   | 32  | Agriculture                  |
| 33.    | Chhiring Tashi| Hillu   | Male   | 33  | Agriculture                  |
| 34.    | Nand Lal      | Chasak  | Male   | 65  | Local Vaid                   |
| 35.    | Lal Chand     | Chasak  | Male   | 63  | Agriculture                  |
| 36.    | Nuri Devi     | Chasak  | Female | 80  | House Wife                   |
| 37.    | Lekh Ram      | Shun    | Male   | 60  | Agriculture                  |
| 38.    | Devi Das      | Shun    | Male   | 55  | Agriculture                  |
| 39.    | Film Dei      | Shun    | Female | 48  | House Wife                   |
| 40.    | Amar Nath     | ParmarBhatori | Male | 62  | Agriculture                  |
| 41.    | Dawa Ram      | ParmarBhatori | Male | 65  | Agriculture                  |
| 42.    | Karam Lal     | ParmarBhatori | Male | 70  | Agriculture                  |
| 43.    | Funchung      | ParmarBhatori | Male | 77  | Buddhist (Amchii)            |
| 44.    | Chhee Ching   | ParmarBhatori | Male | 79  | Buddhist (Amchii)            |
| 46.    | Dhiyan Singh  | Luj     | Male   | 55  | Agriculture                  |
| 47.    | Amar Singh    | Luj     | Male   | 45  | Agriculture                  |
| 48.    | Hans Raj      | Luj     | Male   | 44  | Agriculture                  |
| 49.    | Mansa Ram     | Luj     | Male   | 65  | Agriculture                  |
| 50.    | Dhiyan Chand  | HUDAN   | Male   | 65  | Agriculture                  |
| 51.    | Parmoli Devi  | Sural   | Female | 72  | House Wife                   |
| 52.    | Thulu Ram     | Kawas   | Male   | 58  | Agriculture                  |
| 53.    | Karam Lal     | Kawas   | Male   | 45  | Agriculture                  |
54. Amar Nath Kawas Male 58 Agriculture
55. Ram Lal Kawas Male 65 Agriculture
56. Jai Dass Than Male 48 Agriculture
57. Man Dasi Than Female 52 House Wife
58. Bans Ram Mindhal Male 63 Agriculture
59. HeerNand Mindhal Male 70 Agriculture
60. Gulab Chand Mindhal Male 65 Agriculture
61. Lekh Chand Mindhal Male 75 Agriculture
62. Narender Kumar Punto Male 35 Pradhan Gram Panchayat
63. Moti Ram Ghesal Male 65 Agriculture

Results

Diversity and distribution pattern

Total 124 species (Angiosperms: 116; Gymnosperms: 04; Pteridophytes: 01 and Fungi 03) of the wild edible plants belonging to 40 families and 68 genera were recorded (Table 1). Out of total, 77 species of herbs, 33 shrubs, 10 trees, 01 fern and 03 fungi were recorded (Fig.1 and Table 2). The dominant wild edible families were Rosaceae (16 spp.), followed by Polygonaceae (09 spp.), Alliaceae and Berberidaceae (07 spp., each), Apiaceae (06 spp.), Asteraceae, Fabaceae and Grossulariaceae (05 spp., each), and Brassicaceae (04 spp.). Among the genera, Allium and Berberis (07 spp., each), Ribes and Rosa (05 spp., each), Viburnum, Amaranthes, Cirsium, Arnebia, Codonopsis, Lonicera, Chinopodium, Malva, Plantago, Rheum, Rubus and Prunus (03 spp., each) were the species rich (Table 2).

Habitat wise distribution of wild edibles

Of the total wild edibles, maximum (105 spp.) were found in dry habitat, followed by rocky (81 spp.), shady moist (69 spp.), degraded (57 spp.), bouldary (56 spp.), dry alpine slope (24 spp.), moist alpine slope (17 spp.) and riverine (08 spp.) habitats (Fig.3. and Table 2).

Nativity and endemism

Of the total wild edibles, 63 species were natives and remaining were non-natives to the Himalayan Region. 10 species were found to be near endemic and 03 species i.e., Angelica glauca, Allium stracheyi and Codonopsis climatidea were endemic to Indian Himalayan Region (Table 2 and Fig.3).

Utilization Pattern

Various parts namely, whole plants, stem, rhizome, tuber, bark, aerial parts, leaves, flowers, fruits, roots, etc. were used by the tribal communities. Amongst the parts used, leaves and fruits (44 spp., each) were used maximum, followed by roots (27 spp.), aerial parts (21 spp.), stems (16 spp.), seeds (12 spp.), flowers (11 spp.), whole plants (06 spp.) and bulbs (03 spp.) (Fig.3. and Table 2). Out of total recorded species, 41 species were consumed in raw form, whereas 45 species were consumed in cooked form, i.e., roasted, boiled as vegetables, soup flavouring agents, etc. Maximum species (43 spp.) were used as ripe fruits, followed by vegetables (28 spp.).
Fig 3: Habitat wise distribution of wild edibles in Pangi Valley of Himachal Pradesh

Fig 4: Nativity and endemism of wild edibles in Pangi Valley of Himachal Pradesh

Fig 4: Statistics of plant parts used as food Pangi Valley of Himachal Pradesh

Utilization Pattern
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Frequency use pattern of wild edibles
Of the total wild edibles, maximum 72 species were used occasionally, 39 species frequently and 15 species were used rarely (Fig. 5. and Table 2.).

Abbreviations Used: Lf=Leaf; AP=Aerial part; Fr=Fruit; St=Stem; Rt=Root; Wp=Whole Plant; Fl=Flower; Tb=Tuber and Sd=Seed.
| Plant Name                      | Image                                                                 |
|--------------------------------|----------------------------------------------------------------------|
| Pinus gerardiana               | ![Pinus gerardiana](image)                                            |
| Pinus gerardiana (Seeds)       | ![Pinus gerardiana (Seeds)]                                          |
| Allium semenovii               | ![Allium semenovii](image)                                           |
| Rheum australe                 | ![Rheum australe](image)                                             |
| Rheum austral (Bhussi)         | ![Rheum austral (Bhussi)]                                            |
| Fragaria nubicola              | ![Fragaria nubicola](image)                                          |
| Fagopyrum esculentum (Thotha)  | ![Fagopyrum esculentum (Thotha)]                                     |
| Chaerophyllum reflexum         | ![Chaerophyllum reflexum](image)                                     |
| C. reflexum (Rhizome)          | ![C. reflexum (Rhizome)]                                             |
| Angelica glauca                | ![Angelica glauca](image)                                            |
| Mentha longifolia              | ![Mentha longifolia](image)                                          |
| Crataegus songarica            | ![Crataegus songarica](image)                                        |
| Artemisia maritima             | ![Artemisia maritima](image)                                         |
| Peziza vasiculosa              | ![Peziza vasiculosa](image)                                          |
| Berberis aristata              | ![Berberis aristata](image)                                          |
| Diplazium esculentum           | ![Diplazium esculentum](image)                                       |
| Juglans regia                  | ![Juglans regia](image)                                              |
| Rosa macrophylla               | ![Rosa macrophylla](image)                                           |
Some important wild edible plants of Pangi valley, Chamba District of Himachal Pradesh
### Table 2: Diversity, distribution, part used, nativity, endemism and indigenous uses of wild edibles in Pangi Valley of Himachal Pradesh

| Family/Taxa | Local Name | Habitats | Altitudinal range (m) | Life Form | Nativity | Parts used | Indigenous uses and traditional Practices | Frequency of use |
|-------------|------------|----------|-----------------------|-----------|----------|-----------|---------------------------------------------|------------------|
| **Alliaceae** |            |          |                       |           |          |           |                                             |                  |
| *Allium caeruleum* Schrenk. | - | VII, VIII | 3500-4300 | H | Afr As Temp | Ap, Rt | Used as condiment. | Rare |
| *A. caroliniannum* DC. | - | II, VIII | 2200-3800 | H | Reg Himal | Ap, Rt | Fresh leaves used as a flavouring agent in food. | Rare |
| *A. humile* Kunth. | Farn | I, II, III | 3000-4000 | H | Reg Himal | Lf | Fresh leaves used as a flavouring agent in food. | Rare |
| *A. przewalskianum* Regel | - | 3700-3900 | H | Tibet Occ | Bb | Fresh leaves used as a flavouring agent in food. | Rare |
| *A. semenovii* Regel | Shuan | VII, VIII | 3500-4500 | H | Reg Himal As | Lf | Fresh leaves in summer and dry leaves in winter used as a flavouring agent in food. | Frequent |
| *A. stracheyi* Baker | - | II, VIII | 3000-4500 | H | Reg Himal | Bb, Lf | Used as condiment. | Rare |
| *A. wallichii* Kunth. | - | I, II, IV, V | 2600-3300 | H | Reg Himal | Bb, Lf | Fresh shoots and leaves in summer and dry leaves in winter used as a flavouring agent in food. | Rare |
| **Adoxaceae** |          |          |                       |           |          |           |                                             |                  |
| *Viburnum cotinifolium* D. Don | Rajhal | I, II, III, IV | 2400-3600 | Sh | Reg Himal | Fr | Ripe Fruits edibles | Frequent |
| *V. grandiflorum* Wall. | Talanj | I, II, III, IV | 2700-3600 | Sh | Reg Himal | Ap | Ripe Fruits edibles | Frequent |
| *V. nervosum* D. Don | Talanj | I, II, III, IV | 2700-3300 | Sh | Reg Himal | Lf | Ripe Fruits edibles | Frequent |
| **Amaranthaceae** |          |          |                       |           |          |           |                                             |                  |
| *Amaranthus cruentus* L. | Bhabri | II | 3000-3900 | H | Southern Mexico | St, Lf | Fresh shoots and leaves used as vegetable in summer and dry used as vegetable in winter and dry roasted seed mixed with curd or milk or honey used as food. | Frequent |
| *A. hybridus* L. | Bhabri | II | 2100-2600 | H | Am Bor | Sd, Lf | Fresh shoots and leaves used as vegetables in summer and dry used as vegetable in winter and dry roasted seeds mixed with curd or milk or honey used as food. | Frequent |
| *A. spinosus* L. | Bhabri | II | 3000-3600 | H | Reg Trop | St, Lf | Fresh shoots and leaves used as vegetable in summer and dry used as vegetable in winter and dry roasted seeds mixed with curd or milk or honey used as food. | Frequent |
| **Apiaceae** |          |          |                       |           |          |           |                                             |                  |
| *Angelica glauca* Edgew. ** | Choura | I, IV, V | 2000-3000 | H | Reg Himal | Rf | Dry roots used as flavouring agent in food and root powder used for snakes repellents. | Occasional |
| *Bupleurum candoli* Wall.ex DC. | Nimla | II, IV, V, VII, VIII | 2400-4000 | H | Reg Himal | Sd | Used as condiment. | Rare |
| *Carum carvi* L. | Gurr or Gyaju | I, II, IV, V | 3000-3500 | H | Europe Oriens As Bor | Sd, Fr, Rt, St | Seeds are most widely used food additive, tea making, popular spice and flavoring agent in food. | Frequent |
| *Bunium persicum* (Boiss.) B.Fedtsch. | Kala Zeera | I, II, IV, V | 2100-3200 | H | East Mediter South As | WP | Seeds are most widely used food additive, tea making popular spice and flavoring agent in food. | Frequent |
| *Chaerophyllum reflexum* var. *acuminatum* (Lindl.) Hedge & Lamb. | Tila | I, II, IV, V | 2100-3500 | H | Reg Himal | Rt, St | Fresh roots directly eaten with milk as high nutrition food. | Frequent |
| *C. villosum* Wall.ex DC. | Harda | I, II, IV, V | 2100-3500 | H | Reg Himal | Rt, St | Fresh roots directly eaten with milk as high nutrition food. | Frequent |
| **Asteraceae** |          |          |                       |           |          |           |                                             |                  |
| *Artemisia maritima* L. | Sehs | II, IV, V, VIII | 2500-3800 | H | Europe Reg Caucas Sibir | Lf, Sd | Fresh and dry leaves extract directly taken. | Occasional |
| *Cirsium falconeri* (Hk.f.) Petrak. | Kantta | II, III, IV | 2700-4300 | H | Reg Himal | Rt, St | Roots and stems directly taken as food. | Occasional |
| *C. wallichii* DC. | Kantta | II, III, IV | 2100-2500 | H | Reg Himal | Rt, St | Roots and stems directly taken as food. | Occasional |
| *C. veratum* (D.Don) Spreng. | Kantta | II, III, IV | 3000-3700 | H | Reg Himal | Rt, St | Roots and stems directly taken as food. | Occasional |
| *Myriactis nepalensis* Less. | - | I, III, IV | 2100-2800 | H | Reg Himal As Centr | Lf, Ap | Fresh leaves used as vegetable. | Frequent |
| **Balsaminaceae** |          |          |                       |           |          |           |                                             |                  |
| *Impatiens sulcata* Wall. *| Halu | I, II, III, IV, V | 2100-4000 | H | Reg Himal | Sd, AP | Leaves and seeds are eaten as raw. | Occasional |
| **Berberidaceae** |          |          |                       |           |          |           |                                             |                  |
| *Berberis aristata* DC. | Kiamal | I, II, III, IV, V | 2100-3000 | Sh | Reg Himal Ind Or | Lf, Fr, Fr | Fruits, leaves and flowers are directly eaten. | Occasional |
| Genus                    | Species | Common Name | Distribution | Uses                                      | Frequency   |
|--------------------------|---------|-------------|--------------|-------------------------------------------|-------------|
| *B. lycium* Royle        |         |             | Reg Himal    | Young leaves used as vegetable.           | Frequent    |
| *B. chinia* Buch.-Ham.ex. Lindl. |    |             | Reg Himal    | Young leaves used as vegetable.           | Frequent    |
| *B. jaesckieana* C.K. Schneid.* |    |             | Reg Himal    | Young leaves used as vegetable.           | Frequent    |
| *B. kunavarensis* Royle* |         |             |              | Used for making pickles and food colouring agents. | Frequent    |
| *Lonicera angustifolia* Wall. ex DC. |    |             | Europe As     | Ripe Fruits are eaten.                    | Occasional  |
| *Lonicera caerulea* L.  |         |             | Europe As     | Ripe Fruits are eaten.                    | Occasional  |
| *Lonicera quinquelocularis* Hard. |    |             | Europe As     | Ripe Fruits are eaten.                    | Occasional  |
| *Chenopodium album* L.   |         |             | Europe        | Young leaves used as green vegetable.     | Frequent    |
| *C. foliolosum* Moench Asch. |    |             |              | Young leaves used as green vegetable.     | Frequent    |
| *C. botrys* L.           |         |             |              | Young leaves used as green vegetable.     | Frequent    |
| *Corylus jacqemontii*Decne. |    |             | Reg Himal    | Young leaves used as vegetable, flower buds used as flavouring agent and ripe fruits eaten as row. | Frequent    |
| *Corylus avellana* L.    |         |             | Reg Himal    | Young leaves used as vegetable, flower buds used as flavouring agent and ripe fruits eaten as row. | Frequent    |
| Family | Species | Country | Season | Uses |
|--------|---------|---------|--------|------|
| Elaeagnus conferta Roxb. | - | I, II | 2100-2600 | Sh | Ind Or | Fr, AP, Lf, Ud | Fruits are edible and used for making juice, jam and dried leaves utilized for making tea. | Occasional |
| E. parvifolia Wall. ex Royle | - | I, II | 2100-3000 | Sh | Japan | AP, Lf, Ud | Fruits are edible and used for making juice, jam and dried leaves utilized for making tea. | Occasional |
| E. rhomnoides (L.) A.Nelson | - | II, III, IV | 2800-3500 | Sh | Europe As Temp | Lf, Fr | Fruits are edible and used for making juice, jam and dried leaves utilized for making tea. | Occasional |
| Hippophae salicifolia D.Don | Charm | II, III, IV | 2100-2800 | T | Reg Himal | Lf, Fr | Fruits are edible and used for making juice, jam and dried leaves utilized for making tea. | Frequent |
| H. triflora Schhd. | Charm | II, III, IV | 3000-3800 | Sh | Europe As Temp | Lf, Fr | Fruits are edible and used for making juice and jam. | Frequently |
| Ericaceae | Rhododendron anthopogon D.Don | - | I, II, VII, VIII | 3000-4300 | Sh | As Bor Reg Himal | Lf | Leaves used for making tea. | Occasional |
| Geraniaceae | Geranium wallichianum D.Donex Sweet | - | I, II, III, IV | 2100-3500 | H | Reg Himal | Rt | Roots used for making tea. | Occasional |
| | G. nepalense Sw | Lajjar | I, II, III, IV | 2100-3500 | H | Reg Himal | Rt | Roots used for making tea. | Occasional |
| Grossulariaceae | Ribes alpestrae Royle ex Decne. | - | I, II, III, IV | 2200-3600 | Sh | Europe Afr Bor Reg Himal | Fr | Fruits are edible. | Occasional |
| | R. glaciale Wall. | - | IV, V, VI, VII, VIII | 2400-4000 | Sh | Reg Himal | Fr | Fruits are edible. | Occasional |
| | R. himalense Royle ex Decne | - | I, II, III, IV | 2400-3000 | Sh | Europe Afr Bor Reg Himal | Fr | Fruits are edible. | Occasional |
| | R. nigrom L. | - | I, II, III, IV | 3000-4000 | Sh | Europe Afr Reg Bor Himal | Fr | Fruits are edible. | Occasional |
| | R. orientale Desf. | - | I, II, III, IV | 2100-3600 | Sh | Reg Himal | Fr | Fruits are edible. | Occasional |
| Juglandaceae | Juglans regia L. | Tharo, Akhrot | I, II, III, IV, V, VI | 2100-2800 | T | As Occ Reg Himal | Fr | Dry fruits and essential oil are edible and flowers used as green vegetable. | Frequent |
| Lamiaceae | Origanum vulgare L. | Marua, Jangli ajwain | II, III, IV, V, VI | 2100-3500 | H | Europe As et Afr Bor | Lf | Leaf used as condiment. | Frequent |
| | Mentha longifolia L. | Manshoni | I, II, III, IV, V | 2100-4000 | H | Reg Bor Temp | Ap | Leaf used as condiment and chattni. | Frequent |
| | Thymus linearis Benth. | Sunauni | II, III, IV, V | 2500-4000 | H | Reg Himal Pakistan | Ap | Leaf used as condiment. | Frequent |
| Leguminosae | Cicer microphyllum Benth. | Jagli Matter | II, III | 2400-2800 | H | Reg Himal As | Fr | Fruits used as edibles. | Occasional |
| | Hedysarum cachelariumin Baker | - | II, VIII | 2800-3800 | H | Reg Himal | Wp | Fruits are edibles. | Occasional |
| | Medicago falcata L. | - | II, III | 2800-4500 | H | Geront Bor Temp | Fl, Ap | Leaves used as vegetables. | Occasional |
| | M. lupulina L. | - | II, III | 3200-3900 | H | Geront Bor Temp | Fl, Ap | Leaves used as vegetable. | Occasional |
| | Trifolium repens L. | Malori | I, II, III | 2100-3600 | H | Europe As Temp | AP | Leaves used as vegetable. | Occasional |
| | T. pretense L. | Malori | I, II, III | 2100-2500 | H | Reg Himal | Ap | Leaves used as vegetable. | Occasional |
| | Trigonella eanoi Bent. | Methuhaa | II, III, IV | 2100-3200 | H | Reg Himal | Ap | Leaves used as vegetable. | Occasional |
| Malvaceae | Malva neglecta Wall. | Sachal | II, III, IV, V | 2100-2800 | H | Europe As Bor | Lf | Leaves used for green vegetable. | Occasional |
| | M. parviflora L. | Sachal | II, III, IV, V | 2500-2800 | H | Europe As Bor | Lf | Leaves used for green vegetable. | Occasional |
| | M. verticillata L. | Sachal | II, III, IV, V | 2500-3500 | H | Europe As Bor | Lf | Leaves used for green vegetable. | Occasional |
| Orchidaceae | Dactylorhiza hatagirea (D.Don) Soo | Hathpanja | I, II, IV, V | 2800-4000 | H | Reg Himal | Rt | Tubers eaten. | Occasional |
| Plantaginaceae | Plantago depressa Wild. | - | II, IV, V, VIII | 3100-3850 | H | Sibir | Lf | Young leaves eaten as row and cooked. | Occasional |
| | P. asiatica ssp. erous (Wall.)Z.Yu Li | - | II, IV, V | 2100-2700 | H | Europe As et Am Bor | Lf | Young leaves eaten as row and cooked. | Occasional |
| | P. himalatica Pilger, * | - | II, IV, V | 2000-3200 | H | Reg Himal | Lf | Young leaves eaten as row and cooked. | Occasional |

*Poaecoe | Occasional |
| Family                  | Genus/Species                          | Author                          | Distribution          | Part Used                  | Property                          | Notes                                      | Frequency   |
|-------------------------|----------------------------------------|---------------------------------|-----------------------|----------------------------|-----------------------------------|-------------------------------------------|-------------|
| *Polygonaceae*           | *Setaria viridis* (L.) P. Beauv.       | -                               | II, IV, V             | 2800-3700                  | H                                | Cosmop                                    | Seeds cooked or eaten with rice.          | Occasional |
|                         | *Fagopyrum acutatum* (Lehm.) Mansf. ex K. Hammer* | Bhesa                           | I, II, III            | 2100-2800                  | H                                | Reg Himal                                | Leaves used as green vegetable and flour of seeds used for making local dish thotha which is eat with aloo curry. | Frequent   |
|                         | *F. esculentum* Moench.                | Fhoon                           | I, II, III, VIII      | 2100-4200                  | H                                | Europe As Bor                            | Leaves used as green vegetable and flour of seeds used for making local dish thotha which is eat with aloo curry. | Frequent   |
|                         | *Oxyria digyna* (L.) Hill              | -                               | II, IV, V             | 3000-4800                  | H                                | Reg Bor                                  | Leaves eaten as vegetable.               | Occasional |
|                         | *Persicaria alpina* (All.) H. Gross    | Chaudh                          | I, II, III, IV, V, VII, VIII | 2100-3500           | H                                 | Reg Himal                                | Leaves and roots eaten directly.         | Rare        |
|                         | *P. wallichii* Greuter&Burdet**        | Gor-Chaudh                      | I, IV, V, VI          | 3500-3800                  | H                                | Ind Or (Indian Subcontinent, As Trop)    | Leaves and roots eaten directly.         | Rare        |
|                         | *Rheum australe* D. Don*              | Pawain                          | I, II, III, IV, VII, VIII | 3000-4200            | H                                 | Reg Himal                                | Dry leaves and shoots mixed with seeds of wheat, (Rheum part, 40% and Wheat part, 60%), flour of mixture used for making local dish bhussi, which is eaten with ghee and aloo curry. | Frequent   |
|                         | *R. spiciforme* Royle                  | Chukri                          | I, II, III, IV, VII, VIII | 3000-5000            | H                                 | Reg Himal                                | Shoot eaten directly as salad.           | Rare        |
|                         | *R. webbianum* Royle*                  | Chukri                          | I, II, III, IV, VII, VIII | 2200-4100            | H                                 | Reg Himal                                | Shoots eaten directly as salad.          | Rare        |
|                         | *Rubus acetosus* L.*                   | Amri                            | I, II, III, IV, V, VII, VIII | 2100-4000           | H                                | Europe As Bor                            | Leaves and shoots used for flavouring agent in green vegetable and directly eaten. | Rare        |
| *Rosaceae*               | *Cotoneaster microphyllus* Wall. ex Lindl.* | Ban Siaua                      | I, II, IV, V           | 2500-2800                  | Sh                               | Reg Himal                                | Fruits are edible.                        | Occasional |
|                         | *Crataegus songarica* K. Koch           | Pinyat                          | I, II, III, IV, V     | 2100-3000                  | T                                 | As Aus                                   | Fruits are edible and used for local wine making. | Frequent   |
|                         | *Fragaria rubicola* Lindl. ex Lacaita  | Anchula                         | I, II, IV, V          | 2100-4000                  | H                                | Europe California                       | Fruits edible and roots used for making tea. | Frequent   |
|                         | *F. veva L.*                           | Anchula                         | I, II, IV, V          | 2100-2300                  | H                                 | Reg Temp                                 | Fruits edible and roots used for making tea. | Frequent   |
|                         | *Rubus cachinensis* Tratt.             | Kantyas                         | I, II, IV, V          | 2200-2700                  | Sh                               | Europe                                   | Fruits edible.                           | Frequent   |
|                         | *R. niveus* Thumb.                     | Kantyas                         | I, II, IV, V          | 2200-3500                  | Sh                               | Reg Himal                                | Fruits are edible.                       | Frequent   |
|                         | *Rosa multiflora* Weihoe & Nees        | Kantyas                         | I, II, IV, V          | 2100-3000                  | Sh                               | Reg Himal                                | Fruits are edible.                       | Frequent   |
|                         | *Potentilla atrsangusoria* G. Lodd. ex D. Don* | -                              | II, VII, VIII        | 3000-3600                  | H                                 | Reg Himal Bur                           | Md (Healing of wounds)                  | Occasional |
|                         | *Prunus armeniaca* L.                 | Cheer                           | I, II, III            | 2100-2800                  | T                                 | Reg Caucas                               | Fruits and seeds are edible.              | Frequent   |
|                         | *P. cerasoides* D. Don                 | Loyara                          | I, II, I              | 2100-2700                  | T                                 | Reg Himal                                | Fruits are edible.                       | Frequent   |
|                         | *P. cornutia* (Wall. ex Royle) Steud.  | Jamuna                          | I, II, III            | 2200-3000                  | T                                 | Europe As Bor                           |                                        |            |
|                         | *Rosa moschata* Herrm.                 | Kuja                            | I, II, IV, V          | 2100-2700                  | Sh                               | Orien                                    | Fruit part also called rose hip are edible, seeds used for tea making. | Occasional |
|                         | *R. foliosa* Nutt. ex Torr. & A.Gray  | Galab                           | I, II, IV, V          | 2100-3500                  | Sh                               | Japan                                    | Fruit part also called rose hip are edible, seeds used for tea making. | Occasional |
|                         | *R. macrophylla* Lindl.                | Galab                           | I, II, IV, V          | 2100-3200                  | Sh                               | Reg Himal China                         | Fruit part also called rose hip are edible, seeds used for tea making. | Occasional |
|                         | *R. sericea* Lindl.                    | Galab                           | II, IV, V, VII, VIII | 2100-3800                  | Sh                               | Reg                                      | Fruit part also called rose hip are edible, seeds used for tea making. | Occasional |
|                         | *R. webbianum* Wall. ex Royle          | Galab                           | II, IV, V, VII, VIII | 2100-3500                  | Sh                               | Reg Himal                                | Fruit part also called rose hip are edible, seeds used for tea making. | Occasional |
| *Saxifragaceae*          | *Bergenia ciliata* (Haw.) Sternb.      | Shapdoci                        | I, IV, V              | 2100-2500                  | H                                 | Reg Himal China                         | Dried leaves used for making tea.        | Occasional |
|                         | *B. stracheyi* (Hk.f. & Th.) Engl.     | Shapdoci                        | I, IV, V, VII, VIII   | 3000-4000                  | H                                 | Reg Himal                                | Dried leaves used for making tea.        | Occasional |
| *Ulmaceae*               | *Celtis tiverandra* Roxb.              | Khadak                          | I, II, IV, V          | 2100-2800                  | T                                 | As Tem China                            | Fruits are edible.                       | Frequent   |
| *Urticaceae*             | *Urtica dioica* L.*                    | Aahan                           | I, II, III, IV, V     | 2100-2800                  | H                                 | Reg Bor Temp                            | Leaves used as green vegetable.          | Frequent   |
|                         | *U. hyperborea* Jaqc. ex Wedd.         | -                               | 3300-4600             | H                                 | Reg Himal                                | Leves used as green vegetable and soup.  | Occasional |
| *Xanthorrhoeaceae*       |                                        |                                 |                       |                            |                                   |                                           |                                        |            |
### Eremurus himalaicus Baker

|     | Pryau | I, III, IV, V | 2100-3200 | H | Reg Himal Russia | Ap, Rt | Tender shoots eaten as a vegetable and in later stage, the roots used as vegetable. | Occasional |

### Gymnosperms

#### Ephedraceae

| *Ephedra gerardiana* Wall. ex Stapt. | Dharchiyu | II, VII, VIII | 2400-4500 | Sh | Reg Himal China | Fr | Ripe fruits eaten. | Occasional |

| *E. intermedia* Schrenk & C.A.Mey. | Chayau | II, VII, VIII | 3000-4300 | Sh | Reg Himal China | Fr | Ripe fruits eaten. | Occasional |

### Pinaceae

| *Pinus gerardiana* Wall. ex Lamb. | Miri, Chilgoza, Neoja | I, II, IV, V | 2100-3000 | T | Reg Himal | Fr | Dry seeds edible, oil rich in carbohydrates and proteins. | Frequent |

| *P. wallichiana* A. B. Jacks. | Chia or Kail | I, II, IV, V, VI, VII, VIII | 2100-3936 | T | Reg Himal | Fr | Seeds are edible. | Rare |

### Pteridophytes

#### Athyriaceae

| *Diplazium esculentum* (Retz.) Sw. | Ksrod or Lingdu | I, IV, V | 2100-2700 | Fn | As Amer | Ap | Aerial parts used as vegetable. | Occasional |

### Fungi

#### Morchellaceae

| *Morchella esculenta* (L.) Pers. | Bhunt or Gucchhii | I, III, IV, V | 2100-3200 | Fi | Reg Himal Amer | Wp | High nutritional value, eaten as vegetable. | Occasional |

#### Agaricaceae

| *Agaricus campestris* Michael Kuo. | Hoor | I, II, III, IV, V | 2100-4000 | Fi | Reg Himal Amer | Wp | High nutritional value, eaten as vegetable. | Occasional |

### Pezizaceae

| *Peziza vesiculosa* Bull. | Khoi or Knifdu | I, III | 2100-3000 | Fi | Reg Himal Europe | Wp | High nutritional value, eaten as vegetable. | Rare |

**Abbreviations used:**

- T= tree; Sh= shrub; H=Herb; Fn= Fern; Fi=Fungi, RegHimal= Himalayan Region; As= Asia; Afr= Africa; Austr= Australia; Amer= America; Trop= Tropical; Bor= Borealis; Occ= Occidentalis; Argent= Argentina; Temp= Temperate; Cosmop= Cosmopolitan; N. Calid= North Calidonia; Mediter= Mediterranean; Calif=California; Subtrop=Subtropical; Geront= Gerontia; Cult= Cultivated; Amphig= Amphigaea; Min= Minor; Centr= Central; Arct= Arctic; Alp= Alpine; Philipp= Philippin; Afghan= Afghanistan; Turkist= Turkistan; et= And; Polynes= Polynesia; Madag= Madagascar; Pacif= Pacific; Lf= Leaf; Bk= Bark; Wp= Whole Plant; Fl= Flower; Fr= Fruit; Sd= Seed; Wd= Wood; Inf= Inflorescence; St= Stem; Frd= Frond; AP=Aerial part; Rh= Rhizome; *= Near Endemic; **= Endemic; I=Shady moist; II=Dry; III=Degraded; IV=Rocky; V=Bouldary; VI= Riverine; VII=Moist alpine slope and VIII=Dry alpine slope.
Indigenous uses and traditional practices of wild edibles

Wild edibles are consumed as raw, roasted, boiled, fried, cooked or in the form of oil, spice and jams and pickles. Tribal communities have their own unique traditional ways of utilizing exclusive plant wealth of region. Most of the wild edibles have medicinal values. They not only serve as nutritional source, but also help in curing various ailments, thereby, serving dual purpose for the tribal communities of Pangi valley. Different parts of wild edibles are utilised in different seasons. For instance fresh leaves were eaten in summer and dry leaves in winter. Among the notable wild edibles, Fresh and dry leaves of Allium seminovii were used as a flavouring agent in food, also used in cooking stomach disorders during pregnancy. Fresh and dried shoot and leaves of Amaranthus species as vegetable and dry roasted seeds mixed with curd or milk or honey as source of food, also for curing diarrhoea, leucorrhoea and skin diseases. Dry roots of Angelica glauca as flavouring agent and root powder for curing dysentery, stomach problems, vomiting and snake repellent. Seeds of Carum carvi used as spice and tea making, which also help to control fever, cold, cough, constipation and fat control and average market price of seeds is about 1000-1500/Kg. Seeds of Bunium persicum used as spice and tea making which also help to control fever, cold, cough, constipation and fat control and average market price of seeds is 4000-5000/Kg. Fresh roots of Chaerophyllum reflexum var. acuminitum were directly eaten with milk as high nutritional food and roots are used for stomach complaints, and seeds infusion used in body pain and average market price of rhizomes is 500-600/Kg. Fresh and dry leaves of Artemisia maritima use for tea making, which helps to infection control, insecticide, aromatic, gems killing, essential oil and stomach pain. Fruits, leaves and flowers of Berberis spp. are directly eaten and also used for snake bite, boils, eye complaints, dysentery, malaria, stomach diseases and jaundice. Seeds of Corylus jacqemontii use as source of dry fruits and seeds oil has high medicinal value and nutritional value dry fruit and Average market price of dry fruit is about 1200-1500/Kg. Dry fruits and essential oil of Juglans regia were eaten, flowers were used as green vegetables, also help in frost bite, rheumatism, sores of toes, toothache, after traditional processing of oil, remaining product called Mathini which is rich source of nutrition for locals during winter and average market price of dry fruit is about 1000-1500/Kg. Leaves of Mentha longifolia used as condiment and for making Chattni also used as carminative and digestion. Pinus gerardiana seeds are highly nutritious dry fruits and used for dressing of wounds, ulcer, rheumatism, antiseptic, cold, cough, influenza. Average market price of dry fruit is about 2500-3000/Kg. Leaves of Fagopyrum acutatum & F. esculentum used as green vegetables and flour of seeds used for making local dish ‘Thotha’ which is eaten with alloo curry and helps in curing heart problems and diabetes. Dry leaves and shoots of Rheum australe were mixed with seeds of wheat (Rheum part 40% and Wheat part 60%) and flour of mixture is used for making local dish called ‘Bhusoii’ eaten with ghee and alloo curry, also helps in abdominal pain, appetizer, asthma, bronchitis, fever, laxative, eye diseases, piles, skin diseases, sprain, swelling, ulcer and wounds. Dried leaves of Bergeinia species were used for making tea and roots for treating gall bladder stone and kidney stone. Aerial parts and roots of Eremurus himalacus helps in constipation and digestion, in early stage aerial parts eaten as vegetable and in later stage the roots also used as vegetable.

Discussion
Like other parts of the Indian Himalayan Region, the Pangi valley supports representative, natural, unique, ecologically and economically important species, mostly representative species of Great Himalayan Range. The Himalayan ecosystems provide various services to the mankind. Among the provisioning services, the wild edibles play an important role for the food security of native communities. The IHR is rich in edible plants and supports 675 wild edible plants. This nutrient rich edible plant wealth is fully utilized by the inhabitants of IHR especially by those belonging to remote and tribal areas. The tribal communities of Pangi valley utilize wild edible plants as food, raw, roasted, vegetables and cooked or boiled. In view of the importance of wild edibles for the food security of tribal communities, the present study was conducted, and provides detailed information on diversity, distribution pattern, nativity, endemicism, indigenous uses and traditional practices of wild edibles in Pangi Valley, Chamba district of Himachal Pradesh. Occurrence of 124 species of wild edibles in the area shows high importance for the tribal communities. Occurrence of 63 native 10 near endemic and 03 endemic species revealed high conservation value of the area. Use of various plant parts in dietary system revealed that these species are highly valuable for tribal communities. Sustainable use of these species would help in maintaining their population in the area. The present study has highlighted the dependence of tribal communities on wild edible plants as food sources, medicinal and supplement. These wild edible plants also act as source of food and rich nutrition for Shepherds and Gaddis from lower Himalaya who visit this region during June to September. The wild edibles also have high medicinal properties. These properties increase the potential of these wild edibles not only as food source or supplement but also as source of income generation for tribal communities. But, traditional knowledge and practices regarding these wild edibles have remained restricted to these tribal communities especially only to old tribal people. In view of this, present study documented the diversity, distribution pattern, indigenous uses and traditional practices of wild edibles of Pangi valley.

Conclusion
In view of above, taking into account the incredible importance of this unique plant wealth, sheer dependence of tribal communities on these wild edibles as food or supplement in time of scarcity or adverse climatic conditions and day by day disappearing indigenous knowledge, overexploitation, habitat degradation, changing environmental condition and traditional practices, there is a need for conservation and management of this wealth by the local inhabitants, NGOs, Central and State Government Organizations, and proper documentation of indigenous knowledge and traditional practices. Investigation of nutraceuticals of edible parts, study on the population ecology of the important wild edibles, formulation and dissemination of proper information compendium based on appropriate evaluation of nutrient and economic potential of these edible plants; education and awareness programs regarding sustainable utilization of these species for the tribal communities; and development of conventional and in vitro propagation protocols of wild edibles for mass multiplication and their establishment and maintenance in the in situ and ex situ conditions are recommended.
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