

Agro-diversity and ethno-botanical distribution: A case study of Tarikhet Block, Kumaun Himalaya

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Abstract

Agro biodiversity play an important role in sustaining and strengthening food, nutrition and health and livelihood security all over the world. The study was conducted to document the agro-diversity and ethno-botanical distribution of Tarikhet block, Kumaun Hiamalya. A structured questionnaire survey, data on different aspect of agriculture diversity and ethno-botanical distribution were obtained. The present study showed 112 landraces including 82 plant species belonging to 64 genera and 31 families, which occupy a total of 105.5 ha land, could be revealed. Of the total 82 species, vegetables exhibited maximum diversity (28%) followed by fruits (25%), pulses (17%), spices (16%) and millets (6%) cereals (4%), and oils (4%). Total extent of crop coverage, maximum area covered by cereals (71.79±1.81 ha) and minimum area covered by oil (0.8±0.10 ha). Out of 31 families recorded, eight dominant families are Fabaceae (15 species), Cucurbitaceae, Poaceae (8 species each), Brassicaceae (7 species), Rosaceae (5 species), Solanaceae, Rutaceae (4 species each), Moraceae (3 species). Within the documented species, herbs (73%) cover the maximum number of species and shrub (1%) covers the minimum number of species. For each species, scientific and vernacular name, ethno-botanical values of species (Food, fodder, medicinal, fibre, fuel, religious, oils and spices) was provided.

Keywords: Agro-biodiversity, ethno-botanical distribution, land races, Tarikhet Block, Kumaun Hiamlalya

1. Introduction

The Indian Himalaya is the home of cultural and biological diversity and a paradise of important plants. In Himalaya, most of the people live in villages and use plants for medicine, food, fodder, fuel, timber, agricultural implements and various other purposes ^[1]. Uttarakhand is a part of Indian Himalayan Region (IHR) situated between the latitudes of 28°43'45"-31°8'10" N and the longitudes of 77°35'5"- 81°2'25" E ^[2] at the trijunction of Nepal, Tibet and India. It covers an area of 53,485 Km² with total forest area of about 65% of the total geographical area which is consisting 1.68% of the land area of the country ^[3]. Agricultural practices are the main stay of the people of Uttarakhand, Central and a large section of the Himalayan population largely depends upon agricultural based activities for their livelihood. Out of the total population, about 75-90% people are engaged either with the main occupation of agriculture or its allied practices, dominated by traditional subsistence cereal farming ^[4-10].

The Uttarakhand state is divided into two divisions, Kumaun and Garhwal Himalalya. The Kumaun Himalaya with an area of 38,000 sq km is rich in its agricultural flora having variation in crop diversity. Overall, the agro-diversity of Kumaun is often influenced by the crop composition and crop rotation. In general, along an altitudinal gradient, variations in agro-biodiversity are influenced by variations in a number of ecological factors and difference in agricultural practices ^[11]. Atkinson ^[12], Pande and Pande ^[13] documented the agri-diversity pattern and several varieties of cereals and millets of Kumaun Himalayan Like the traditional farming system, the traditional food system of Kumaun has received considerable attention. The cropping system in the region is rain-fed, irrigate and traditional. The cropping pattern were built around two major cropping

seasons locally called as Kharif (rainy season) and Rabi (winter season). Paddy (*Oryza sativa* L.), Maduwa (*Eleusine coracana* (L.) Gaertn.), Jhangora (*Echinochloa frumentacea* Link, Hort. Berol), Maize (*Zea mays* L.), Koni (*Setaria italica* (L.) P. Beauv.) Rajma (*Phaseolus vulagris* L.) and other pulses crops and vegetables were dominant rainy season crops. Wheat (*Triticum aestivum* L.), Jau (*Hordeum vulgare* L.), Sarson (*Brassica campestris* L.), and pulses like Masur (*Lens culinaris* Medik.), Chana (*Cicer arietinum* L.) were dominant crops of winter season.

Agro biodiversity is the beneficial interaction between living thing, land, technology and social system. It refers to the synergy system either by human-managed or biologically modified diversity for agricultural purposes ^[14]. Agro biodiversity play an important role in sustaining and strengthening food, nutrition, and health and livelihood security all over the world. Besides cultivation of crops, people collect wild edible and other important plants from natural habitats to meet their sustainable needs ^[15].

Ethno-botany has emerged as an important branch of study which focused on the utility of different plant species and their properties as food, medicines and other uses ^[16]. Ethno-botanical studies typically focus on recording the knowledge of traditional societies in remote places ^[17].

Land races are generally classified on the basis of morphological variation of plants, their parts and other characteristics qualities of plants such as: colours of plant parts such as roots, stem, flower and seed taste of fruits, ridges and furrows of fruits; erect, compact and drooping habit of inflorescence; branching pattern and habit of plants, maturation period of crop etc of cereals and are useful to conserve the agricultural genetic pool. Landraces differed in their popularity and in some cases traditional races of cereals and named after place and person (who cultivate that land

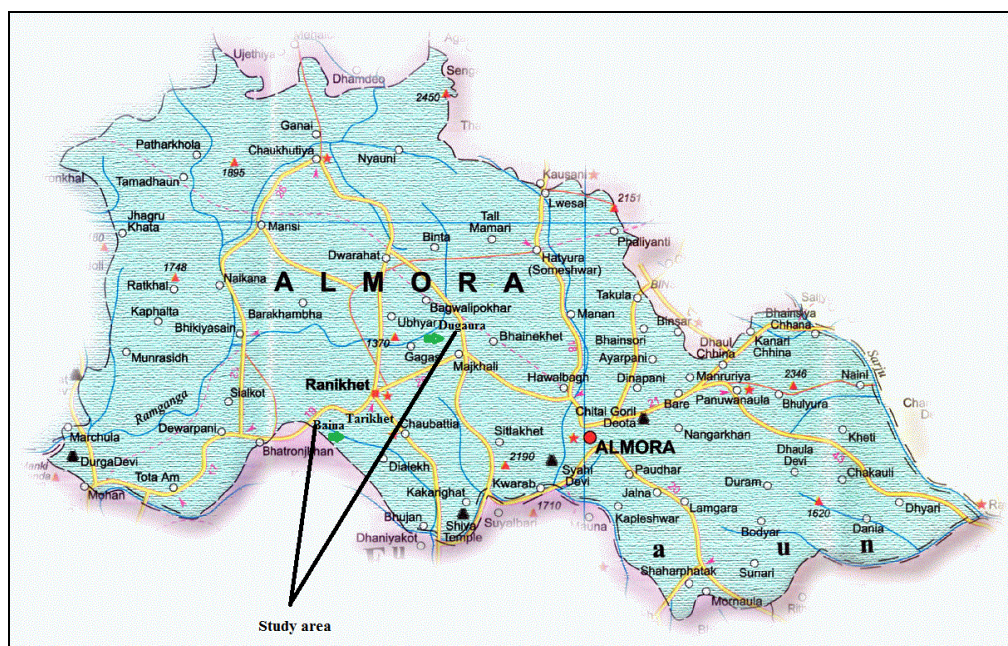
race). Some workers Atkinson [11], Pant and Negi [18], Bhatt and Chauhan [19] have been reported the land races of Rice (*Oryza sativa* L.) in Kumaun Himalayan region. Further, Samant [20] and Tewari and Das [21] also reported 17 and 04 varieties of this plant from Askot and Dhaula Devi area of Kumaun Himalaya.

The aim of the present study is to document agro-diversity and ethno-botanical distribution of the various plant species of Tarikhet block, Kumaun Himalaya with authentic scientific name, vernacular name, and family, use categories for further research.

2. Material and Methods

Geographical description of study area

The study was performed at Tarikhet block, district Almora (during March 2014- March 2015) approximately between 79°24'-79°29'E Longitude, 29°36'-29°42'N Latitude and with an altitude of 1300 m. The study area is bounded by Betalghat block towards south, Bhikiyasain block towards west, Dwarahat block towards North, Hawalbag block towards East (Figure 1:).



Source: <http://www.mapsofindia.com/mapsuttaranchaldistrictsalmora.htm>

Fig 1: Map of the study area

Agro-diversity and ethno-botanical surveys

The study was conducted in two villages of block Tarikhet viz. Dugaura, Bisht Kotli. A structured questionnaire survey, data on different aspect of agriculture diversity and ethno-botanical distribution were obtained from the study area. In study area, 10% of total households (People of different genders and age groups) were interviewed. Elderly people of selected households were targeted for questionnaires to access more information on agro-diversity and ethno-botanical distribution. Sample of each of the crop species/landraces was collected.

Samples collection

Beside questionnaire based surveys, samples of seeds of paddy, millets, pulses, spices, vegetables and oils producing plant varieties were collected from the study area. The site characteristic, source of collection and local name of each variety was noted at the time of collection. The sample of each variety was labelled and stored in polypropylene bags to ensure safety and deposited in State Biodiversity Board, Dehradun, and Uttarakhand.

Data analysis

The data were analyzed by one-way Analysis of Variance (ANOVA) and the means were compared by Duncan tests at

a level of significance of $p < 0.05$ using SPSS 16.0 statistical software. For all the observations, the mean values and standard deviations were also calculated.

3. Results and Discussion

The study revealed existence of 112 land races including 82 plant species belonging to 64 genera and 31 families of crops, which occupy a total of 105.5 ha land in investigated area (Table 1). Of the total 112 land races (Local Name of land races Table 2), 82 species belongs to vegetables exhibited maximum diversity (28%) followed by fruits (25%), pulses (17%), spices (16%) and millets (6%) cereals (4%), and oils (4%). A detail of proportional diversity distribution across diverse groups is shown (Figure: 2). While considering total extent of crop coverage, maximum area covered by cereals (71.79 ± 1.81 ha) and minimum area covered by oil (0.8 ± 0.10 ha). Out of 31 families recorded, eight dominant families are Fabaceae (15 species), Cucurbitaceae, Poaceae (8 species each), Brassicaceae (7 species), Rosaceae (5 species), Solanaceae, Rutaceae (4 species each), Moraceae (3 species) (Figure 3 :). Within the documented species, herb (73%) cover the maximum number of species, followed by tree (23%), climber (3%), and shrub (1%) (Figure 3). In the percent distribution of plant part used leaves were most commonly used part (29%)

followed by seed (28%), fruit (27%), straw (6%), bulb, rhizome and tuber (2% each), inflorescence, bark, root and stem (1% each) (Figure 5 :). Apart from the nutritional value of these crops species, they are also having some other ethno-botanical values (food, fodder, fuel, medicinal, religious, oil, spices). For each species, scientific and vernacular name, ethno-botanical distribution of species (Food, fodder, medicinal, fibre, fuel, religious, oils and spices) was provided (Table 3, Figure 6 :). Many species were found in more than a single community. During the study, it was found that the traditional knowledge was equally distributed between migrant and local inhabitants. It was also observed that traditional knowledge was greater in the age group of 30 to 60 years than below 30 years and more with women. Most of the agricultural crops thrived in the region are also used for other purposes i.e. medicinal, economic (Fuel, oil, spices etc.), fodder, religious, other than their nutritional values.

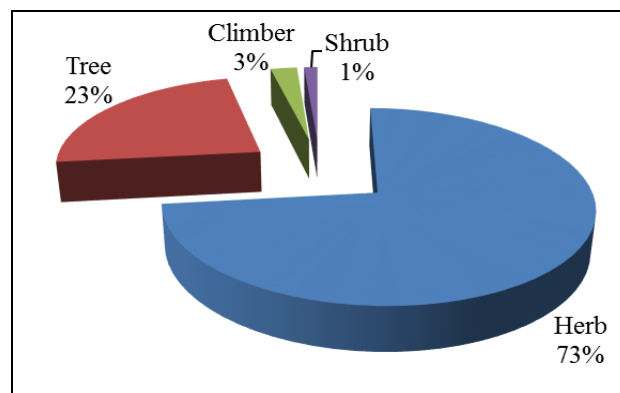


Fig 4: Habitat of plants species

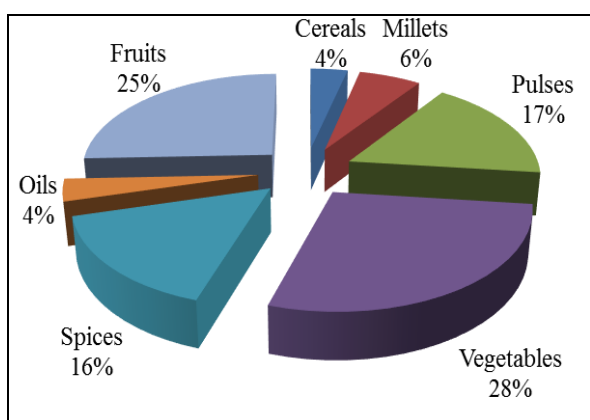


Fig 2: Proportional diversity distribution across diverse crop groups

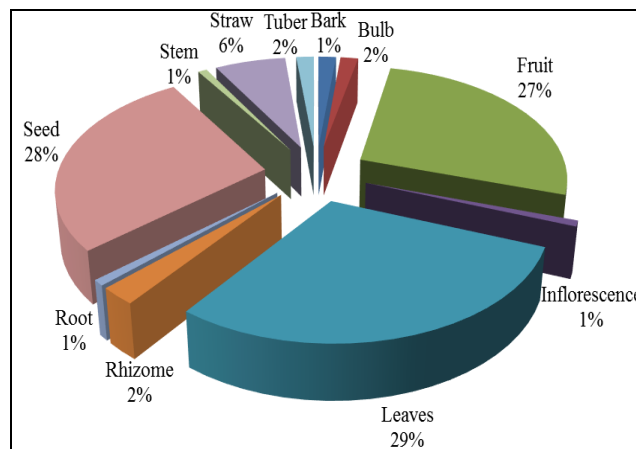


Fig 5: Percent distribution of plant part used

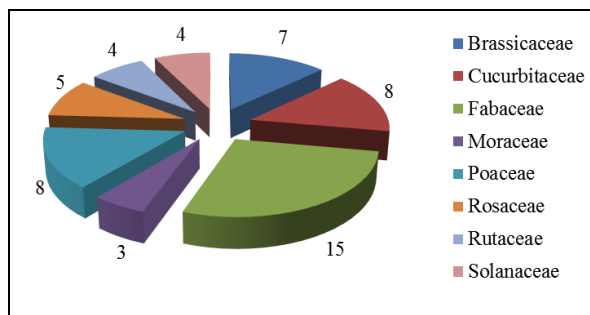


Fig 3: Top Eight Families belonging to plant species

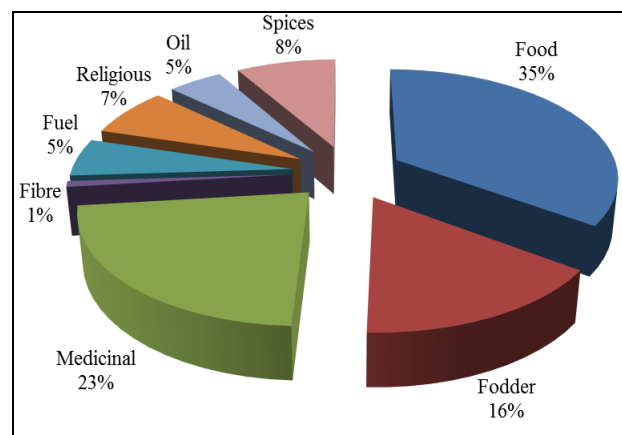


Fig 6: Ethno-botanical values of plant species





Plate 1: General Overview of the study area



Plate 2: Traditional Agricultural practices



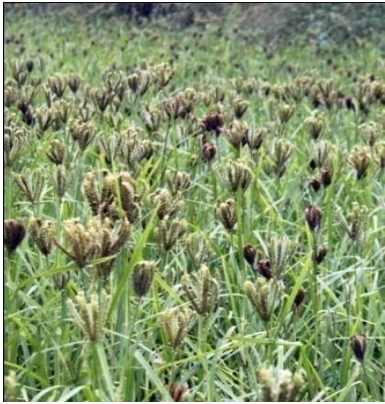
Oryza sativa



Triticum aestivum



Zea mays



Eleusine coracana



Echinochloa frumentacea



Setaria italic



Sorghum vulgare



Zingiber officinale



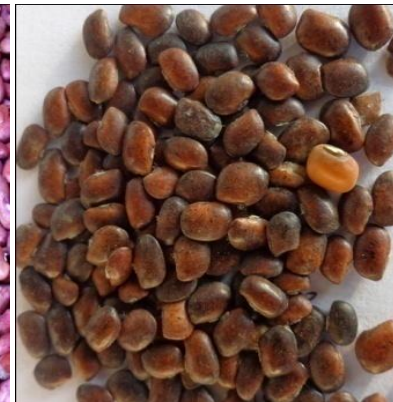
Curcuma domestica



Sesamum indicum



Phaseolus vulgaris



Macrotyloma uniflorum

Plate 03: Diversity of crops of Study area



Solanum tuberosum



Raphanus sativus



Solanum melongena



Cucurbita maxima



Lagenaria siceraria



Luffa cylindrica



Momardica charantia



Trichosanthes anguina



Colocasia esculenta

Plate 4: Diversity of Vegetables of Study area



Plate 5: Field Survey

Table 1: Diversity of crops and extent of area coverage in the study area.

S. No.	Name of crop	Number of land races/ Varieties	Extent of land area coverage (ha)
Cereals			
01	<i>Oryza sativa</i> L.	05	32±0.58
02	<i>Triticum aestivum</i> L.	03	39.67±1.20
03	<i>Zea mays</i> L.	02	0.12±0.03
Millets			
04	<i>Eleusine coracana</i> (L.) Gaertn.	04	16±2.52
05	<i>Hordeum vulgare</i> L.	02	0.12±0.04
06	<i>Echinochloa frumentacea</i> Link, Hort. Berol.	02	3.33±0.88
08	<i>Setaria italica</i> (L.) P. Beauv.	02	0.08±0.02
09	<i>Sorghum vulgare</i> (L.) Pers.	01	0.04±0.02
Pulses			
10	Pulses	18	0.88±0.02
Vegetables			
11	Vegetables	30	6.56±0.23
Spices			
12	Spices	15	4±1.53
Oils			
13	Oils	04	0.8±0.10
Fruits			
14	Fruits	24	1.9±0.47
	Total	112	105.5

Table 2: Land races/varieties of different crops

Name of crop	Common/ vernacular name of plant	Land races/ varieties
Cereals		
<i>Oryza sativa</i> L.	Paddy, Dhan	Dhaniya, Ratuwa, Basmati, Bageshwaree, Nauli
<i>Triticum aestivum</i> L.	Wheat, Gehun	Safed Gehun, Jhushi Gehun, Vikasak Gehun-(a) Chhota (b) Mota
<i>Zea mays</i> L.	Maize, Makka	Mungari, Murli
Millets		
<i>Echinochloa frumentacea</i> Link, Hort. Berol.	Baryard millet, Jhungra	Bhatkkahti, Nan
<i>Eleusine coracana</i> (L.) Gaertn.	Finger millet, Madua	Nangchuniya, Lal, Chaumasi, Madai
<i>Hordeum vulgare</i> L.	Barley, Jau	Jau, Jhusi Jau
<i>Setaria italica</i> (L.) P. Beauv.	Foxtail millet, Kauni	Peeli, Kali
<i>Sorghum vulgare</i> (L.) Pers.	Sorghum, Jowar	Safed
Pulses		
<i>Cajanus cajan</i> (L.) Mill.	Pigeon-pea, Arhar	Chhoti
<i>Cicer arietinum</i> L.	Chick pea, Chana	Chhota
<i>Glycine max</i> (L.) Merr.	Soyabean	Kaw, Safed
<i>Glycine soja</i> Sieb. & Zucc.	Bhatt	Kala bhatt
<i>Lens culinaris</i> Medik.	Lentil, Masur	Kali, Bhuri
<i>Macrotyloma uniflorum</i> (Lam.) verdc.	Horse gram, Gehat	Safed, Garua
<i>Phaseolus vulgaris</i> L.	Kidney bean, Rajma	Bhuri
<i>Pisum sativum</i> L.	Pea, Mattar	Kanyu
<i>Vicia faba</i> L.	Broad bean, Bakla	Chhoti
<i>Vigna aconitifolia</i> (Jacq.) Marechal.	Moth bean	Chhoti
<i>Vigna angularis</i> (Willd.) Ohwi & Ohashi.	Adjuki bean, Rayans	Safed, Lal
<i>Vigna mungo</i> (L.)	Black gram, Mash	Kali
<i>Vigna radiata</i> (L.) Wilczek	Green Moong	Hari
<i>Vigna unguiculata</i> (L.) Walp.	Blackeyed pea, Lobia	Lambi
Vegetables		
<i>Abelmoschus esculentus</i> (L.) Moench.	Lady's finger, Bhindi	Jhusiyaw
<i>Amaranthus frumentacea</i> Buch.-Ham.	Amaranthus, Cholai	Kali, Safed
<i>Benincasa hispida</i> (Thunb.) Cong.	Ash gourd, Bhuza	Bhuza
<i>Brassica campestris</i> L.	Yellow mustard, Sarson	Peeli
<i>Brassica oleracea</i> L. var. botrytis L.	Cauliflower, Phulgobhi	Himadri
<i>Brassica oleracea</i> L. var. capitata L.	Cabbage, Bandgobhi	Pragati
<i>Brassica nigra</i> Koch.	Black mustard, Lahi	Kali, Hari
<i>Chenopodium album</i> L.	Pigweed, Bathua	Lal

<i>Colocasia esculenta</i> (L.) Schott.	Elephant ear, Gaderi	Lal, Safed
<i>Cucumis melo</i> L. var. <i>utilissimus</i> Duth. & Fuller.	Snake cucumber, Kakree	Pahari
<i>Cucurbita maxima</i> Duch.	Pumpkin, Kaddu	Goal, Lamba
<i>Cyclanthera pedata</i> Schrader.	Wild cucumber, Ramkarela	Mith Karela
<i>Dioscorea bulbifera</i> L.	Potato yam, Gethi	Pahari Gethi
<i>Fagopyrum esculentum</i> (L.)	Buck wheat, Ugal	Lal Ugal
<i>Lagenaria siceraria</i> (Mol.) Standl.	Bottle gourd, Lauki	Tumari, Lambi
<i>Luffa acutangula</i> L.	Riged gourd, Torai	Mith Toria
<i>Lycopersicon esculentum</i> Mill.	Tomato, Tamatar	Anguri
<i>Momardica charantia</i> L.	Bitter gourd, Karela	Til karela
<i>Raphanus sativus</i> L.	Radish, Muli	Dudhi, Gol
<i>Solanum melongena</i> L.	Brinjal, Baigun	Lamba, Gol
<i>Solanum tuberosum</i> L.	Potato, Alu	Safed
<i>Spinacea oleracea</i> L.	Spinach, Palak	Chapar
<i>Trichosanthes anguina</i> L.	Edible Snake Gourd, Chichan	Dhari Dhar
Spices		
<i>Allium cepa</i> L.	Onion, Pyanj	Safed, Ranikhet
<i>Allium sativum</i> L.	Garlic, Lahsun	Safed
<i>Brassica juncea</i> (L.) Czern. & Coss.	Indian mustard, Rye	Kali, Lal
<i>Cannabis sativa</i> L.	Hemp, Bhang	Katua
<i>Capsicum frutescens</i> L.	Chilly, Mirch	Patli
<i>Cinnamomum tamala</i> Nees. & Eberm.	Indian Cassia, Tejpat	Tejpat
<i>Cleome viscosa</i> L.	Wild Mustard, Jakhya	Pahari
<i>Coriandrum sativum</i> L.	Coriander, Dhania	Pahari
<i>Curcuma domestica</i> Valet	Turmeric, Haldi	Haldi
<i>Mentha arvensis</i> L.	Corn Mint, Pudina	Pudina
<i>Perilla frutescens</i> (L.) Britt.	Perilla, Bhangjira	Bhangir
<i>Trigonella foenum-graecum</i> L.	Fenugreek, Methi	Pahari
<i>Zingiber officinale</i> Roscoe.	Ginger, Adrak	Safed
Oils		
<i>Brassica campestris</i> L.	Yellow mustard, Sarson	Peeli
<i>Linum usitatissimum</i> L.	Linseed, Alsi	Bhuri
<i>Sesamum indicum</i> L.	Sesame, Til	Kaw, Bhura
Fruits		
<i>Carica papaya</i> L.	Papaya, Papita	Pahari
<i>Citrus aurantifolia</i> (Christm.) Swing.	Key Lime, Kagji Nimbo	Chhota
<i>Citrus limon</i> (L.) Burm. f.	Limon, Nimboo	Bada
<i>Citrus reticulata</i> Blanco.	Mandarin, Santara	Pahari
<i>Citrus jambhiri</i> Lushington.	Rough lemon, Jamir	Jamir
<i>Emblia officinalis</i> Gaertn.	Myrobalam Emblic, Amla	Nan
<i>Eriobotrya japonica</i> (Thunb.) Lindl	Lukat	Gharalu
<i>Ficus auriculata</i> Lour.	Fig, Timil	Pankar
<i>Ficus palmata</i> Forsk.	The Fig, Bedu	Bedu
<i>Juglans regia</i> L.	Walnut, Akhrot	Kanthi, Danthi
<i>Mangifera indica</i> L.	The Mango Tree, Am	Chussu, Kanthi
<i>Morus alba</i> L.	Mulberry, Kimu	Gharalu
<i>Musa paradisiaca</i> L.	Banana, Kela	Mungari
<i>Prunus armeniaca</i> L.	The Apricot, Khubani	Kanthi
<i>Prunus domestica</i> L.	Plum, Pulam	Nan
<i>Prunus persica</i> (L.) Batsch.	The Peach Tree, Aru	Ashari, Bhadoe
<i>Psidium guajava</i> L.	The Guava Tree, Amrud	Lal
<i>Punica granatum</i> L.	Pomegranate, Darim	Jhungari
<i>Pyrus communis</i> L.	The Pear Tree, Nashpati	Gol
<i>Syzygium cumini</i> (L.) Skeels	Jamun	Chhota
<i>Vitis vinifera</i> L.	Grapes, Angur	Dane Wala

Table 3: Ethno-botanical distribution of species

S. No.	Botanical Name	Common/ vernacular name of plant	Family	Use category					
1.	<i>Oryza sativa</i> L.	Paddy, Dhan	Poaceae	F	Fo			R	
2.	<i>Triticum aestivum</i> L.	Wheat, Gehun	Poaceae	F	Fo	M		R	
3.	<i>Zea mays</i> L.	Maize, Makka	Poaceae	F	Fo				
4.	<i>Echinochloa frumentacea</i> Link, Hort. Berol.	Baryard millet, Jhungra	Poaceae	F	Fo	M			
5.	<i>Eleusine coracana</i> (L.) Gaertn.	Finger millet, Madua	Poaceae	F	Fo	M			
6.	<i>Hordeum vulgare</i> L.	Barley, Jau	Poaceae	F	Fo	M		R	
7.	<i>Setaria italica</i> (L.) P. Beauv.	Foxtail millet, Kauni	Poaceae	F	Fo	M			
8.	<i>Sorghum vulgare</i> (L.) Pers.	Sorghum, Jowar	Poaceae	F	Fo				
9.	<i>Cajanus cajan</i> (L.) Mill.	Pigeon-pea, Arhar	Fabaceae	F	Fo	M			
10.	<i>Cicer arietinum</i> L.	Chick pea, Chana	Fabaceae	F	Fo	M		R	

11.	<i>Glycine max</i> (L.) Merr.	Soyabean	Fabaceae	F	Fo	M				O		
12.	<i>Glycine soja</i> Sieb. & Zucc.	Bhatt	Fabaceae	F	Fo	M						
13.	<i>Lens culinaris</i> Medik.	Lentil, Masur	Fabaceae	F	Fo							
14.	<i>Macrotyloma uniflorum</i> (Lam.) verdc.	Horse gram, Gehat	Fabaceae	F	Fo	M						
15.	<i>Phaseolus vulgaris</i> L.	Kidney bean, Rajma	Fabaceae	F	Fo							
16.	<i>Pisum sativum</i> L.	Pea, Mattar	Fabaceae	F	Fo							
17.	<i>Vicia faba</i> L.	Broad bean, Bakla	Fabaceae	F	Fo							
18.	<i>Vigna aconitifolia</i> (Jacq.) Marechal.	Moth bean	Fabaceae	F	Fo							
19.	<i>Vigna angularis</i> (Willd.) Ohwi & Ohashi.	Adjuki bean, Rayans	Fabaceae	F	Fo							
20.	<i>Vigna mungo</i> (L.)	Black gram, Mash	Fabaceae	F	Fo	M				R		
21.	<i>Vigna radiata</i> (L.) Wilczek	Green Moong	Fabaceae	F	Fo	M						
22.	<i>Vigna unguiculata</i> (L.) Walp.	Blackeyed pea, Lobia	Fabaceae	F	Fo							
23.	<i>Abelmoschus esculentus</i> (L.) Moench.	Lady's finger, Bhindi	Malvaceae	F								
24.	<i>Amaranthus frumentacea</i> Buch.-Ham.	Amaranthu, Cholai	Amaranthaceae	F		M						
25.	<i>Benincasa hispida</i> (Thunb.) Cong.	Ash gourd, Bhuza	Cucurbitaceae	F								
26.	<i>Brassica campestris</i> L.	Yellow mustard, Sarson	Brassicaceae	F	Fo	M				O	Sp	
27.	<i>Brassica oleracea</i> L. var. botrytis L.	Cauliflower, Phulgobhi	Brassicaceae	F	Fo							
28.	<i>Brassica oleracea</i> L. var. capitata L.	Cabbage, Bandgobhi	Brassicaceae	F	Fo							
29.	<i>Brassica nigra</i> Koch.	Black mustard, Lahi	Brassicaceae	F								
30.	<i>Chenopodium album</i> L.	Pigweed, Bathua	Chenopodiaceae	F		M						
31.	<i>Colocasia esculenta</i> (L.) Schott.	Elephant ear, Gaderi	Araceae	F								
32.	<i>Cucumis melo</i> L. var. utilissimus Duth. & Fuller.	Snake cucumber, Kakree	Cucurbitaceae	F		M						
33.	<i>Cucurbita maxima</i> Duch.	Pumpkin, Kaddu	Cucurbitaceae	F	Fo					R		
34.	<i>Cyclanthera pedata</i> Schrader.	Wild cucumber, Ramkarela	Cucurbitaceae	F		M						
35.	<i>Dioscorea bulbifera</i> L.	Potato yam, Gethi	Dioscoreaceae	F		M						
36.	<i>Fagopyrum esculentum</i> (L.)	Buck wheat, Ugal	Polygonaceae	F		M				R		
37.	<i>Lagenaria siceraria</i> (Mol.) Standl.	Bottle gourd, Lauki	Cucurbitaceae	F		M						
38.	<i>Luffa cylindrica</i> (L.) M. Roem.	Rigid gourd, Torai	Cucurbitaceae	F								
39.	<i>Lycopersicon esculentum</i> Mill.	Tomato, Tamatar	Solanaceae	F								
40.	<i>Momardica charantia</i> L.	Bitter gourd, Karela	Cucurbitaceae	F		M						
41.	<i>Raphanus sativus</i> L.	Radish, Muli	Brassicaceae	F	Fo	M						
42.	<i>Solanum melongena</i> L.	Brinjal, Baigun	Solanaceae	F								
43.	<i>Solanum tuberosum</i> L.	Potato, Alu	Solanaceae	F		M						
44.	<i>Spinacea oleracea</i> L.	Spinach, Palak	Chenopodiaceae	F		M						
45.	<i>Trichosanthes anguina</i> L.	Edible Snake Gourd, Chichan	Cucurbitaceae	F								
46.	<i>Allium cepa</i> L.	Onion, Pyanj	Liliaceae	F		M					Sp	
47.	<i>Allium sativum</i> L.	Garlic, Lahsun	Liliaceae	F		M					Sp	
48.	<i>Brassica juncea</i> (L.) Czern. & Coss.	Indian mustard, Rye	Brassicaceae	F		M					Sp	
49.	<i>Cannabis sativa</i> L.	Hemp, Bhang	Cannabinaceae	F		M	Fi		R	O	Sp	
50.	<i>Capsicum frutescens</i> L.	Chilly, Mirch	Solanaceae	F							Sp	
51.	<i>Cinnamomum tamala</i> Nees. & Eberm.	Indian Cassia, Tejpat	Lauraceae	F		M					Sp	
52.	<i>Cleome viscosa</i> L.	Wild Mustard, Jakhya	Cleomaceae	F		M				O	Sp	
53.	<i>Coriandrum sativum</i> L.	Coriander, Dhania	Apiaceae	F		M					Sp	
54.	<i>Curcuma domestica</i> Valet	Turmeric, Haldi	Zingiberaceae	F		M			R		Sp	
55.	<i>Mentha arvensis</i> L.	Corn Mint, Pudina	Lamiaceae	F		M				O	Sp	
56.	<i>Perilla frutescens</i> (L.) Britt.	Perilla, Bhangjira	Lamiaceae	F		M				O	Sp	
57.	<i>Trigonella foenum-graecum</i> L.	Fenugreek, Methi	Fabaceae	F		M					Sp	
58.	<i>Zingiber officinale</i> Roscoe.	Ginger, Adrak	Zingiberaceae	F		M					Sp	
59.	<i>Brassica campestris</i> L.	Yellow mustard, Sarson	Brassicaceae	F	Fo	M			R	O	Sp	
60.	<i>Linum usitatissimum</i> L.	Linseed, Alsi	Linaceae	F		M	Fi			O	Sp	
61.	<i>Sesamum indicum</i> L.	Sesame, Til	Pedaliaceae	F						R	O	Sp
62.	<i>Carica papaya</i> L.	Papaya, Papita	Caricaceae	F		M						
63.	<i>Citrus aurantifolia</i> (Christm.) Swing.	Key Lime, Kagji Nimbo	Rutaceae	F		M				O	Sp	
64.	<i>Citrus limon</i> (L.) Burm. f.	Limon, Nimboo	Rutaceae	F		M						
65.	<i>Citrus reticulata</i> Blanco.	Mandarin, Santara	Rutaceae	F								
66.	<i>Citrus jambhiri</i> Lushington.	Rough lemon, Jamir	Rutaceae	F		M						
67.	<i>Emblica officinalis</i> Gaertn.	Emblic, Amla	Euphorbiaceae	F		M				R		
68.	<i>Eriobotrya japonica</i> (Thunb.) Lindl	Lukat	Rosaceae	F						Fu		
69.	<i>Ficus auriculata</i> Lour.	Fig, Timil	Moraceae	F	Fo	M			Fu	R		
70.	<i>Ficus palmata</i> Forsk.	The Fig, Bedu	Moraceae	F	Fo	M			Fu	R		
71.	<i>Juglans regia</i> L.	Walnut, Akhrot	Juglandaceae	F		M			Fu		O	
72.	<i>Mangifera indica</i> L.	The Mango Tree, Am	Anacardiaceae	F		M			Fu	R	Sp	
73.	<i>Morus alba</i> L.	Mulberry, Kimu	Moraceae	F	Fo				Fu			
74.	<i>Musa paradisiaca</i> L.	Banana, Kela	Musaceae	F	Fo	M				R		
75.	<i>Prunus armeniaca</i> L.	The Apricot, Khubani	Rosaceae	F	Fo				Fu			

76.	<i>Prunus domestica</i> L.	Plum, Pulam	Rosaceae	F	Fo		Fu		
77.	<i>Prunus persica</i> (L.) Batsch.	The Peach Tree, Aru	Rosaceae	F	Fo	M	Fu		
78.	<i>Psidium guajava</i> L.	The Guava Tree, Amrud	Myrtaceae	F		M	Fu		
79.	<i>Punica granatum</i> L.	Pomegranate, Darim	Punicaceae	F		M	Fu	R	Sp
80.	<i>Pyrus communis</i> L.	The Pear Tree, Nashpati	Rosaceae	F	Fo		Fu		
81.	<i>Syzygium cumini</i> (L.) Skeels	Jamun	Myrtaceae	F	Fo	M	Fu		
82.	<i>Vitis vinifera</i> L.	Grapes, Angur	Vitaceae	F		M			

(Abbreviation Used- F- Food, Fo- Fodder, M- Medicine, Fi- Fibre, Fu- Fuel, R- Religious, O- Oils, Sp- Spices)

Conclusion

Agriculture is the main stay of the people of Uttarakhand. The agricultural diversity of the state Uttarakhand is mostly dependent on rain. It is a fact that a large number of populations in this region is dependent on agriculture and apart from growing cereals, millets etc., and region is a crux for vegetables. Traditional agricultural crops are known to be her nutritional values and they are directly linked to the socioeconomic values of the societies. So the traditional crops and land races should be conserved in the research centers and gene banks. The present study is an initiative to document the agro-diversity and ethno-botanical distribution at Tarikhet block, Kumaun Himalaya. The data obtained will help to establish some traditional patterns for the target area in particular and the region in general. This is also an attempt to elaborate the possible reasons of specific trends/patterns. While discussing the wider implications of present study, an attempt has been made to develop an integrated approach for better understanding and analyzing agro-diversity and ethno-botanical distribution of the area.

Picture of general overview of study area, traditional agricultural practices, diversity of crops, vegetables and field survey are given in Photo plate: 1, 2, 3, 4, 5.

References

- Samant SS, Dhar U. Diversity, endemism and economic potential of wild edible plants of Indian Himalaya. *Int. J Sustain. Dev. & World Ecol.* 1997; 4:179-191.
- Uniyal BB, Sharma JR, Choudhary U, Singh DK. Flowering Plants of Uttarakhand (A Checklist). Bishan Singh Mahendra Pal Singh, Dehradun, 2007.
- Srivastava SK, Singh DK. Glimpses of the Plan wealth of Uttaranchal. Bishan Singh Mahendra Pal Singh, Dehradun, 2005.
- Maikhuri RK, Nautiyal N, Rao KS, Saxena KG, Semwal RL. Eroding traditional crop diversity imperils the sustainability of agricultural systems in central Himalaya. *Current Science* 1997; 73(9):777-782.
- Maikhuri RK, Nautiyal N, Rao KS, Saxena KG, Semwal RL. Changing scenario of Himalayan agro ecosystem: Loss of agro biodiversity, an indicator of environmental change in central Himalaya, India. *The Environmentalist* 2001; 21:2339.
- Sati VP. Natural resources management and food security in the Alaknanda basin of Garhwal Himalaya, 2008.
- Chandra A, Rakesh Kandari LS. Role of Rural and Tribal Women in Conservation of Village Ecosystem: A Case Study of Nanda Devi Biosphere Reserve, India, *Environment & We: An International Journal Science & Technology.* 2009; 4:29-34.
- Chandra A, Pardha Saradhi P, Maikhuri RK, Saxena KG, Rao KS. Traditional Agrodiversity Management: A Case Study of Central Himalayan Village Ecosystem. *Journal of Mountain Science.* 2011a; 08:62-74.
- Chandra A, Pardha Saradhi P, Rao KS, Saxena KG, Maikhuri RK. An Investigation into the Energy Use in Relation to Yield of Traditional Crops in Central Himalayas, India, *Biomass and Bioenergy* 2011b; 35:2044-2052.
- Bungla PS. Agri-diversity patterns and local food systems Along an Altitudinal Gradient of kuloor Watershed Kumaun Himalaya. Ph.D Thesis, Kumaun University, Nainital, 2012, 151.
- Maikhuri RK, Nautiyal N, Rao KS, Saxena KG, Semwal RL. Traditional crops in the central Himalaya. *Plant Genetic Resources Newsletter* 1999; 120:1-7.
- Atkinson ET. *The Himalayan Gazetteer*, Allahabad, 1882, I-X.
- Pandey PC, Pande HC. *Uttaranchal ki krishi jaiv vividhta evam tatsambandhi kuchh jankariya.* Bhag-1 (Kumaun). Bishen Singh Mahendra Pal Singh, Dehradun, India, 2004.
- Partap T, Sthapit B. Managing agrobiodiversity, farmers' changing perspectives and institutional resources in the Hindi Kush Himalayan region. *International centre for integrated mountain development, Kathmandu, Nepal*, 1998, 1-30.
- Nautiyal S, Bisht VK, Rao S, Maikhuri RK. The role of cultural values in agrobiodiversity conservation: a case study from Uttarakhand Himalaya. *J Human Ecol.* 2008; 23(1):1-6.
- Nautiyal AR, Nautiyal MC, Purohit AN. Harvesting herbs-2000-Medicinal and aromatic plants-An action plan for Uttarakhand. (BSMS Publishers, Dehradun), 1997.
- Hodges S, Bennett BC. The ethno-botany of *Pluchea carolinensis* (Jacq.) G. Don (Asteraceae) in the Botanicas of Miami, Florida. *Econ. Bot* 2006; 60(1):5-84.
- Pant KC, Negi KS. *Uttaranchal Ke Krishipayogi Paudhon Ka Sanrakshan.* Uttarakhand, 1992; 6:111-116.
- Bhatt JC, Chauhan VS. Phasalon ki Sathiya Kisme avam namo ki wyutpatti. 233-248. In: *Ethanobotany of Kumaon Himalaya* (Eds. P C Pande, D S Pikhariya and J C Bhatt) Scientific Publishers, (India) Jodhpur, 1999.
- Samant SS, Askot Vanya JEEV, Abhyaranya Ke Jaiv Vividhata. In: *Biodiversity of the Himalaya (Saiyojak: U. Dhar) G.B. Pant Himalyan Environment and Development, Kosi-Katarmal, Almora*, 1995, 11-27.
- Tiwari R, Das A. Documentation of Local crop varieties evolving a participation methodology, In: *using Diversity: Enhancing and Maintaining Genetic Resources on Farm* (Eds. Loise Sperling and Michael Loevinsohn). *International Development Research Centre, New Delhi*, 1996, 66-77.