Research Article
AMERICAN JOURNAL OF PHARMACY AND HEALTH RESEARCH
www.ajphr.com
2014, Volume 2, Issue 9
ISSN: 2321–3647(online)

Some Important Herbaceous Medicinal Flora of Alpine and Sub-Alpine Ecosystem of Western Himalaya

Kshirod Kumar Ratha[1]*, W. Rungsung[1], Sreya Dutta[1], G.C. Joshi[2], Jayram Hazra[1]
1.National Research Institute of Ayurvedic Drug Development, CCRAS, 4 CN Block, Sector-V, Kolkata-700091 (W.B), India.
2. Regional Research Institute of Himalayan Flora, Thapla, Ranikhet, Uttarakhand.

ABSTRACT

The alpine and subalpine region of western Himalaya has long been known as one of the world richest treasuries of medicinal plants due to its diverse topographic and climatic conditions. The alpine meadows and subalpine forest ecosystem support mainly medicinal herbs which are very significant for traditional system of medicine. The present study is the outcome of decades of survey carried out in the high altitude region of alpine and subalpine area of Uttarakhand. It evaluated the important herbaceous medicinal plants existing in the region along with their specific habitat, phenology pattern and uses.

Keywords: Herbaceous medicinal plants, alpine and subalpine ecosystem of Himalaya, Uttarakhand.

*Corresponding Author Email drkkratha.ayu@rediffmail.com,
Received 16 August 2014, Accepted 28 August 2014

Please cite this article as: Ratha KK. *et al*., Some Important Herbaceous Medicinal Flora Of Alpine And Sub-Alpine Ecosystem Of Western Himalaya. American Journal of Pharmacy & Health Research 2014.

INTRODUCTION

Plants have been playing a pivotal role in the healthcare of mankind since time immemorial. According to the World Health Organization, 80% of the world's population uses traditional medicine.[1] Himalaya, an important mega biodiversity hotspot in the world, harbours the most sacred and potent medicinal plants described in Ayurvedic system of Medicine. 1748 medicinal plants are reported from Indian Himalaya Region.[2] The medicinal plants collected by the Ayurvedic physicians from the high altitude regions constitute 35.7% of all the plant species of alpine and sub-alpine Himalaya.[5] The pharmaceutical sector in India at present is using 280 medicinal plant species, of which 175 are from the Indian Himalayan Region (IHR)[3]. The maximum number of species is reported from Uttarakhand[4]. Nearly thirty species from the Garhwal Himalaya have been listed as threatened in the India Red Data Books, of which 24 species are from high alpine region.[6, 7] The plant species which are threatened in this region are *Aconitum, Angelica, Berberis, Dactylorhiza, Thalictrum, Hedychium,* etc. Apart from the disappearance of plants, traditional knowledge is also being lost.[8, 9] The western Himalaya in general and Garhwal and Kumaon Himalaya in particular have been extensively surveyed by a number of workers in post-independence period of India, viz. Rau (1963), Semwal and Gaur (1981). Kala and Gaur (1982), Naitahni (1984), Kala (1998), Gaur (1999),Maikhuri (2000) and Gangwar (2008).[10-17] The present study deals with the alpine and sub-alpine ecosystem of western Himalaya and the diversity of herbaceous medicinal flora, including their local names, distribution, phonological pattern, ecological habitat and indigenous uses.

MATERIAL AND METHOD

Study site

Studies were carried out in the high altitude pastures and grassy slopes in Kumaon and Garhwal regions of Uttarakhand (locally known as "Bugyal"), situated at 3000-3500 masl and lying between altitude $28^0$43'N and $31^0$2'N and longitude $77^0$34'E and $81^0$03'E, the vegetations of which are chiefly herbaceous in composition. The areas covered were Milam, Kaphni, Sunderdhunga, Pindari and Chhiplakedar in Kumaon Himalaya and Ali-Bedini, Tungnath, Valley of Flowers, Kedarnath, Dayara, Har Ki Doon, Kushkalyan, Niti and Mana in Garhwal Himalaya (Uttarakhand).

Collection of data

The present paper is an extract of the extensive medico-ethno botanical survey carried out during 2009-2013. Only the highly valuable and commercially important medicinal plants of herbaceous

nature were taken into consideration. General information on geology, climate, vegetation, vernacular names, useful parts, ecological habitat and phenology were gathered from the informants during field trips usually conducted during June- October. The data collected were authenticated from the available literatures and identification of the plant species was confirmed after cross checking with the herbarium of RRIHF, Thapla (Acronym –RKT, Uttarakahand). Voucher specimens of the species were also subsequently deposited in the Herbarium of RRIHF for record. The details of the information collected are presented in a tabulated form (Table-1).

Geology and Soil

Geologically the region falls under Greater Himalaya or Himadri system and lies to the north of the main central thrust (MCT) belt with a large proportion of the land under perceptual snow. The main rock components are of crystalline and metamorphic nature with sedimentary deposits dating back to the Palaeozoic age. The soil of alpine zone is of flauvioglavial in origin and itstexture ranges from granite sandy loam to clayey loam. [18]

Climate

No definite meteorological data for the alpine and subalpine region are available. The highland above 4500m is covered with snow all the year round. The study sites were usually found coveredby snow from November to April.Main types of season usually witnessed in the region are: (i) Rainy season: Starts from late-June to Mid-September.The monsoon is mild and cloud bursts are common in August-September. Drizzling is invariably followed by snow in alpine region. The rainfall is scanty. Hail storms, blizzard and extremely frigid condition noticed at very high regions. (ii) Winter season:Starts from November to April, receives heavy snowfall causing inaccessible to the region.However, the region shows a typical climate with very glaring sun. Strong winds at noon followed by overcastting sky and mild drizzling. Morning is generally clear and nights are cold even in summer. The mean annual temperature recorded at timber line is 7^0C and at alpine region varies from -10^0C to 15 ^{0}C.The average annual rainfall received at alpine region is 2400 mm, of which maximum is witnessed during July-September.

Vegetation

High altitude landscape in the western Himalaya plays a pivotal role in maintaining ecological balance and it represents an ecological transition zone between fundamentally low land and high altitude ecosystems. Thus, this zone separates two floristically distinct regions. i.e., the scrub and meadows on the upper limit above 3500m,so-called the alpine region and on the lower side in between 2800-3500m, Sub-alpine zone.

Sub alpine vegetation

The sub alpine dominated by tree species like *Abiesspectabilis, Quercussemicarpifolia, Betulautilis, Acer, Taxuswallichiana, Rhododendron arboreum* and shrubs like *Rhododendron campanulatum, Vibrunumnervosum, Ribes, Rosa,Skimmia, Cotoneaster, Juniperus* and *Salix* species. Herbs appear in forest gaps only for a short duration. Dominant herbs of the region are *Plantgobrachyphyla, Rumexnepalensis, Persicaria Wallichi, Cirsiumverutum, Roscoea*spp, *Hedychium* spp. and some orchids. This zone has mixed climate of alpine and temperate region and vegetation of this region remained less explored due to inaccessibility.

Alpine vegetation

The alpine pastures called "Bugyal" holds collectively a group of cushioned and velvety herbs called as "Bug". The ground layer of alpine vegetation consists of Bug, herbs and grasses. The dominating herbs found at 4000masl composed of exposed rocks are *Euphorbia stracheyi, Rheum webbianum, Rheum emodi, Saussureaobbovallata, Saussurea gossipiphora* etc. Sunny slopes of alpine region consist of *Ranunculus, Delphinium, Corydalis, Arnebia, Potentilla, Saxifraga, Astragalus, Gentiana, Swertia* etc. Shady slopes mainly harbor *Aconitum, Angelica, Pleurospermum, Pleurospermum, Parnassia* species. Main species of glacial slopes are *Epilobium, Oxyria , Saxifraga* and the alpine snow desert line have species like *Androsace, Saussurea, Cremanthodium, Corydalis, Christolea*group.

It has been observed that more than 1000 species are found above 3300m and last limit of vegetation is 5400 masl.Dominant families of angiosperm are Asteraceae, Graminae, Ranunculaceae, Rosaceae, Saxifragaceae, Gentianaceae, Cruciferae. Prominent genera noticed are *Polygonum, Astragalus, Saxifraga, Corydalis, Anemone, Gentiana, Potentilla, Primula* etc.

RESULT AND DISCUSSION

In the present investigation, only the important herbaceous medicinal plants in terms of vernacular names, phenology, ecological habitat, uses and parts used are described (Table-1). A check list of 43 important medicinal herb species belonging to 38 genera and 18 families is prepared. Whereas as per the data available in the RKT herbarium, a total of 3858 plant species belonging to 1409 genera and 191 families were reported from the areas studied. It is also found that, medicinal herbs of higher altitude region are dominant with families like Asteracea, Liliaceae, Apiaceae, Ranunculaceae and Orchidaceae. The rare and endangered medicinal herbaceous taxa of the region as per Red Data Book are *Aconitum deinorrhizum, A. Falconeri, A. Ferox, Allium stracheyi, Inula racemosa, Nardostachy sgrandiflora, Picrorhiza kurroa*

Table-1: Enumeration of medicinal herbs of alpine and sub-alpine western Himalaya

Name of the species	Families	Vernacular Name	Ayurvedic Name	Part/sused*	Flowering Fruiting	Habitat**	Action & uses	Field book no.
							Abdominal pain	38183
Aconitum ferox Wall.ex Spring	Ranunculaceae	Bish	Vatsanabha	Rt	Aug-Sept	TL	,Vomiting, Arthritis, fever, Body ache, Aphrodisiac	
*Aconitum herterophyllum*Wall	Ranunculaceae	Atis	Ativisha	Rt	Aug-Sept	A	Diarrhoea, fever, body ache, vomiting, dyspepsia	38166
Allium stracheyi Baker	Alliaceae	Pharan	Jambu	Lf	July-Sept	TL, A	Used as carminative, flavouring and condiment	38017
Angelica archangelica Linn.	Apiaceae	Archa	Canda	Rt	July-Aug	SF, TL	Indigestion, flatulence,anorexia	38088
Angelica glauca Edgew	Apiaceae	Choru, Gandryan	Choraka	Rt	July-Aug	SF, TL	Carminative, expectorant, used as spice	38323
Arisaema flavum(Forssk.)Schott	Araceae	Bang		Rz	June-Sept	SF	Wound, Snake bite	38634
Arnebia benthamii (Wall. ex G. Don)	Boraginaceae	Balchar Pati,	Gojivha	Rt	May-Sept	A	Hair tonic, Arthritis,Cardiac disease	38037
*Artemisia maritima*L.	Asteraceae	Safedpurcha	Gandha	Rt	July-Sept	SF	Boil, fever	38542
Aster asteroides(DC.) Kuntze	Asteraceae			Rt	June-Aug	A	Haemorrhage	37801
Bergenia Stracheyi (Hook. f. and Thomson) Engl.	Saxifragaceae	Siilphari, Silphora	Pashanabheda	Rz	July-Sept	SF, TL	Urolithiasis, Menorrhagia	36530
Bunium persicum B. Fedtsch	Apiaceae	Bhotiyajeera		Sd	June-Sept `	A,SF	Used as condiment	38449

Carum carvi Linn	Apiaceae	Thoya	Krsna-jiraka	Seed	June-Sept `	A	Used as spice, and flavouring agent	38244
*Chaerophyllum villosum*Wall. ex DC.	Apiaceae	Ginjari		Rt	June-Aug	SF	Cuts and wound	38809
Corydalis govaniana Wall.	Fumariaceae	Bhutkesi	Bhutakeshi	Rz	May-Aug	SF, A	Arthritis, Skin disease,tonic	38357
Dactylorhiza Hatagirea (D. Don)	Orchidaceae	Salampanja		Tb	June-Aug	TL, A	Debility, Semen disorder, Leucorrhoea, Wound	38870
Delphinium Cashmerianum Royle	Ranunculaceae	Nirbishi	Tagara	Rt,Fl.	April-Sept	TL, SF	Blood purifier, Toothache heart problems, cough, typhoid, malaria, pneumonia fever, Snakebite, eye redness	38453
Fritillaria roylei Hook	Liliaceae	Kakoli	Ksira-kakoli	Bb	June-Sept	A	Asthma, Bronchitis, Weakness	38355
Hedychium Spicatum Buch.-Ham. ex Sm.	Zingiberaceae	Sathi	Karchura	Rz,Sd	Sept-Oct	SF	Neuromuscular disorder, Abortificient	37850
*Heracleum candicans*Wall. ex DC.	Apiaceae	Gandhraj		Fr, Rt	June-Aug	SF	Aphrodisiac Eczema, ring worm, leucoderma.	38126
*Hyocyamus niger*L.	Solanaceae	*Bantam akhu*	Parasika Yavani	Sd ,lf	June-Aug	A	Insomnia, pain, asthma	38584
*Inula racemosa*Hook.f.	Asteraceae	Ma bu	Puskaramula	Rt	July-Sept	A	Cough, asthma, worm	37816
Jurinea dolomiaea Boiss.	Asteraceae	Dhooppjhar		Lf.	July-Sept	A	Wound, Fever	38416
Lilium polyphyllum D.Don	Liliaceae	Kaliharai	Kakoli	Bb	June-Aug	A	General debility	38518
*Malaxis musciferа*Lindl.	Orchidaceae	Jeevak, lahsunia	Rishavaka	Rt	Aug-Oct	SF	Tonic, Bronchitis	37855
Nardostachys jatamansi DC.	Valerianaceae	Masi	Jatamansi	Rh	July-Oct	A	Incense, joint pain, epilepsy, Hysteria, Palpitation	37820

Onosma bracteatum Wall	Boraginaceae	Goozaban	Gojihva	Rt	June-Aug	SF	Tonic, abdominal pain	38968
*Origanum vulgare*L.	Lamiaceae	Van-Tulsi	Marubakah	WP	Sept-Oct	SF	Urinary disorders ,Bronchitis, diarrhoea	36638
Paris polyphylla Sm.	Liliaceae	Satua	Haimavati/ Sveta Vacha	Rt	June-Oct	SF	Diarrhoea, Dysentery	37840
*Picrorhiza kurroa*Royle ex. Benth.	Scrophulariaceae		Katuki	Rt	June-Sept	A, R,SF	Abdominal pain, High fever	37808
Pleurospermum angelicoides(Wall. ex DC.) Benth. ex C.B.Cl.	Apiaceae	Chippi		Rt	June-Sept	A,SF	Dyspepsia, Ascariasis, Dysentery and Gastric trouble.	38908
*Podophyllum hexandrum*Royle	Podophyllaceae	Bankakri	Vanatrapusa	Rt	June-oct	SF, A	Ulcers, cuts, wounds. purgative, skin diseases	37812
Polygonatum cirrhifolium(Wall.)	Liliaceae	Mahameda	Mahameda	Rt	Aug-Sept	SF	General debility	37815
Polygonatum verticillatum(L.) All.	Liliaceae	Meda	Meda	Rt	June-Sept	SF	Tonic, Leucorrhoea, Tuberculosis	37817
*Potentilla fulgens*Wall. ex Hook.	Rosaceae	Bajradanti		Rt	June-Sept	SF	toothache and Pyorrhea.	37818
*Rheum webbianum*Royle	Polygonaceae	Tartri	Amlaparni	Lf, Rt	June-Sept	A, R,B	Anorexia, Swelling	37857
Rheum australe D. Don	Polygonaceae	Dolu	Revatchini	Rt	June-Sept	A, R,B	Fracture of bone, Trauma, Sprain	37878
*Roscoea alpina*Royle	Zingiberaceae	Kakoli	Kakoli	Rt.	June-Sept	SF	Tonic	37889
Saussurea obovallata(DC.) Edgew.	Asteraceae	Brhamkamal		Sd, Fl.	June-Oct	A, R	Jaundice, Semen disorder	39102
Saussurea lappa C.B. Clarke	Asteraceae	Kuth	Kustha	Rz	June-Sept	SF, A	Leprosy, Skin disease, Dysentery	39110

Selinum wallichianum(DC.) Raizada and H.O.Saxena	Apiaceae	Bhutkesi	Muramansi	Rt	June-Oct	SF, R	Muscular pain,swelling	39132
Swertia chirayata Kast	Gentianaceae	Chirayata	Kiratatiktta	WP	Aug-Nov	SF	Blood ailments, fever, wound, worm infestation, skin disease	37866
Thalictrum foliolosum DC.	Ranunculaceae	Mamira	Piyaranga	Rt	June-Oct	SF	Wound, Swelling, Uterine tumour,	37239
Thymus linearis Benth.	Lamiaceae	Van-Ajwain	Aranyajeeraka	Fl, WP	June-Sept	SF	whooping cough, bronchitis, throat and mouth infections, indigestion, flatulence	33867

*Part/s used: Lf- Leaf; WP- Whole plant; Fl- Flower; Fr- Fruit; Sd- Seed, Tb- Tuber; Rz- Rhizome, Bb- Bulb
** Habitat: SF-Sub alpine forest, TL- Timberline ecotone , A-Alpine meadow, R- Rocky edges and slopes

(Vulnerable), *Angelica nubigena (*Indeterminate*)* and *Saussurea costus* (Endangered).Other rare medicinal herbs are *Gentiana kurroo, Podophyllum hexandrum, Fritillaria Roylei, Lilium polyphyllum, Meconopsis* and *Rheum* species[19]. These plants need proper conservation as they constitute a major portion of formulation in Traditional medicine. Habitat protection of all alpine medicinal plants is urgently needed for the conservation of high altitude herbs. Commercial exploitation of entire plants, root, rhizome, tuber, bulbs, seed and fruit also cause the extinction of many species. Excessive grazing by migratory Gujjars, collection of species for herbarium, chemical screening and recent stress of tourist are also causing scarcity of these herbs.

CONCLUSION

The bio-resources of high altitude medicinal plants which have rich economic and medicinal potentials are rapidly declining and thus need to be protected from degradation. They are the chief source of food for herbivorous, medicine for the local inhabitant and also play an important support to traditional medicine. Hence, there is a need to generate conservation consciousness among the general public, tourists and personsinvolved. Indiscriminate collection of plants of the region should be checked and streamlined. The virgin areas should be conserved as 'Biosphere Reserves'. In situ conservation would be the best measure for conserving these rare medicinal herbs.

ACKNOWLEDGEMENT

We express our deep sense of gratitude to the Officer- In charge of RRIHF, Thapla (Uttarakahand) and local people of the investigated areas for the vast information provided concerning our survey work.

REFERENCE

1. Jain SK, Saklani A .Observations on Ethno-botany of the Tons Valley Region of Uttarkashi District of North-West Himalayas, Mountain Res. Dev. 1991; 11: 177-183.
2. Samant SS, Dhar U, Palni LMS, Medicinal Plants of Indian Himalaya: Diversity Distribution and Potential Value. Gyanodaya Prakashan; Nainital, 1998.
3. Dhar U, Rawal RS, Upreti J. Setting priorities for conservation of medicinal plants - A case study in the Indian Himalaya. Biol Conserv 2000, 95:57-65
4. Kala CP. Revitalizing traditional herbal therapy by exploring medicinal plants: A case study of Uttaranchal State in India. In Indigenous Knowledge: Transforming the Academy, Proceedings of an International Conferences Pennsylvania: Pennsylvania State University; 2004: 15–21

5. Ratha KK, Mishra SS, Arya JC, Joshi GC. Impact of Climate change on diversity of Himalayan Medicinal Plant: A threat to Ayurvedic system of Medicine. International Journal of Research in Ayurveda & Pharmacy, 2012, 3(3): 1-5.
6. Rao RR. Biodiversity in India (Floristic aspects).Dehra Dun: Bishen Singh Mahendra Pal Singh; 1994.
7. Nautiyal, M.C. Cultivation of medicinal plants and Biosphere reserve management in alpine zone. In, R.S Ramakrishan (Ed.). P.S., Purohit, A.N., Saxena, K.G., Rao, K.S. and Maikhuri, R.K. (eds.), Conservation and Management of Biological Resources in Himalaya. New Delhi: Oxford & IBH; 1996:569-583.
8. Dubey NK, Kumar R, Tripahti P. Global Promotion of Herbal Medicine: India's Opportunity, Cure Med, 2004, 86: 37-41.
9. Semwal DP, Saradhi PP, Kala CP, Sajwan BS , Medicinal Plants Used by Local Vaidyas in Ukhimath Block, Uttarakhand, Ind. J. Trad. Knowl. 2010; 9(3): 480-485.
10. Rau MA. The vegetation around Jumonotri in Tehri Garhwal, U.P. Bulletin of Botanical Survey of India 1963; 5: 277-280
11. Semwal JK, Gaur RD. Alpine flora of Tungnath in Garhwal Himalaya. Journal of Bombay Natural History Society 1981;78:498-512
12. Kala SP, Gaur RD. A contribution to the flora of Gopeswar (Chamoli-Garhwal).In, Paliwal GS (ed.). The vegetation wealth of Himalaya, Delhi: Puja publisher;1982:
13. Naithani BD. Flora of Chamoli vol.1-2, Dehradun; Botanical survey of India; 1984.
14. Kala CP, Rawat GS, Uniyal VK. Ecology and Conservation of the valley of flowers National Park, Garhwal Himalaya. Dehradun: Wild life Institute of India; 1998.
15. Gaur RD. Flora of District Garhwal, North West Himalaya (With Ethnobotanical Notes).Srinagar Garhwal: Transmedia; 1999.
16. Maikhuri RK, Nautiyal S, Rao KS, Saxena KG. Indigenous knowledge of medicinal plants and wild edibles among three tribal sub-communities of Central Himalayas, India. Indigenous Knowledge and Development Monitor 2000; 8(2): 7-13.
17. Gangwar KK, Deepali ,Gangwar RS. Ethno medicinal Plant Diversity in Kumaun Himalaya of Uttarakhand, India. Nature and Science 2008; 8(5):66-78.
18. Joshi GC, Tewari KC, Tewari VP. Alpine environs around Kumaon and Grahwal in Central Himalaya India with special reference to herbal resources. Bull Med Ethnobot Res 1995; 16 (3-4):114-122.

19. Nayar MP, Sastry ARK. Red Data Book of Indian Plants Vol. I-III. Calcutta: Botanical Survey of India; 1990.