BIOSCIENCES BIOTECHNOLOGY RESEARCH ASIA, June 2017. Vol. **14**(2), p. 625-630

A Brief Overview of Vegetation of Pangi Valley (Chamba, Himachal Pradesh): A High Altitude Region of Northwest Himalaya, India

Harminder Singh and Puneet Kumar*

Botanical Survey of India, Northern Regional Centre, Dehradun - 248 195, Uttarakhand, India.

http://dx.doi.org/10.13005/bbra/2487

(Received: 15 June 2017; accepted: 28 June 2017)

Preliminary survey was conducted in the Pangi Valley which is an an high altitude region of Northwest Himalaya, India. Pangi Valley has been least studied for floristic studies except for few cytological and ethnobotanical studies. Pangi was excluded in Flora of Chamba District and there is not much information on the vegetation. With the ever increasing population and, stress on natural resources for human needs, Pangi is now headed to a road for development. This area which hold enormous potential of vast floral and faunal genetic diversity requires to be explored before it is too late. The current attempt aims to present a general overview of the vegetation and information about some important plants of this geographically important cold desert region of India.

Keywords: Chamba, Himalayas, medicinal plants.

Pangi valley lies in the north-western extremity of Himachal Pradesh in the Chamba district. This is a cold arid region in the Trans Himalayas where rough terrain, scanty rainfall, harsh weather conditions and heavy snowfall are prominent features. Pangi is a high altitudinal remote tribal area with an eye catching natural beauty. It is bordered by two mountain ranges i.e. the Great Himalayan Range and the Pir Panjal Range and drained by river Chandrabhaga. Geographically the area lies between 32º 12' 41" to 32º 47' 59" N latitude and 76º 13' 56" to 76º 47' 48" E longitude with an elevation ranges from 2006 to 6168m (average elevation 4008 m), spreading over an area of 1600 sq km.

Pangi valley is a part of Pangi tehsil of Chamba district with its headquarters at Killar. Killar can be reached by road from Chamba via Sach Pass, from Udaipur and from Dharwas. The high altitudinal passes remain close during most of the months of a year (October- June) due to heavy snowfall cutting the valley from rest of the country. Due to these geographical and climatic barriers Pangi has been remotely developed, culturally isolated and has preserved its untouched biological diversity. Chandrabhaga (Chennab) flows in the south north direction cutting the valley into two almost equal halves. The river on its due course through the valley forms deep narrow gorges and valleys with steep slopes. Number of small streams also called *Nallas* flow through the entire valley and some are major tributaries of Chennab (Sechu Nalla, Luj Nallla, Twan Nalla, etc). These small streams form a criss cross pattern in the valley which is life supporting system for faunal and floral elements of the valley.

Pangi lies in the semi arid zone of inner Himalayas. This is a rain shadow area as high mountain peaks do not allow the heavy monsoon winds to reach the valley making the climatic conditions harsh. Most of the precipitation here is in the form of snow fall along with avalanches. The temperature shows great fluctuation during the different months of the years. It takes a dip below mercury during the colder months of the year i.e. winters accompanied by strong winds. Summers are warmer with temperature rise of more than 25° C. Pangi valley comes under cold and dry zone as per agro climatic conditions.

* To whom all correspondence should be addressed.
E-mail: puneetbotcyto@gmail.com

Pangi is sub divided into three major (Hudan, Sural, Saichu) and four minor valleys. The region is remotely habituated with villages at far distance. The region is habituated mostly by Bhot and Pangwal tribal people. The higher altitudinal sub valleys are called *Bhatoris*. Hinduism and Buddhism are the two major religions followed along with worship of local deities. Pangwali and Bhoti are the spoken languages. Saichu Tuan Nala Wild Life Sanctuary has been established in the valley for the protection and conservation of wildlife and plant wealth of the valley. The WLS is spread over a wide area 390.29 square kilometres, with an altitudinal range of 2500 to 6072 meters including glaciers and high alpine grasslands. This is home to endangered snow leopards. Some of them are *Capra sibirica* (Ibex), *Hemitragus jemlahicus* (himalayan thar), *Ursus arctos* (brown bear), *Ursus thibetanus* (black bear), *Moschus chrysogaster* (musk deer), *Uncia uncia* (snow leopard). The birds include the Monal and Cheer pheasants, Himalayan western tragopan, Snow peacock, Himalayan woodpecker, Snow pigeon, and Black beaded jay.

Pangi Valley has been least studied for floristic studies (Watt 1881); for cytological studies which remained confined to of dicot plants (Kumar *et al*., 2011; Rana *et al*., 2012, 2013; Singhal *et al*., 2009, 2011a, 2011b); for ethnobotanical studies (Rana *et al.* 2014; Dutt *et al.* 2014). Bhattacharya and Uniyal (1980) reported very few species from Pangi locality and more stress was laid on Trilokinath region. Pangi was excluded in Flora of Chamba District (Singh and Sharma 2006) and there is no comprehensive account of vegetation. With the ever increasing population and, stress on natural resources for human needs, Pangi is now headed to a road for development. This area which hold immense potential of vast floral and faunal genetic diversity needs to be accessed before it is too late. The study aims to present a general overview of the vegetation of this geographically important cold desert region of India.

Intensive field surveys and rapid sampling of vascular plants from different localities of Pangi Valley was done to explore the area from 2015-2016. A precise note was made on common plant species along with relevant details. Species identification was done consulting regional floras Flora of British India (Hooker 1872-1897), Flora of Lahaul-Spiti (Aswal and Mehrorta 1994), Flora of Cold Deserts of western Himalayas V-1 and V-2 (Murti 2001; Shrivastava and Shukla 2015), Flora of Kullu (Dhaliwal and Sharma 1999), Flora of Himachal Pradesh (Chowdhery and Wadhwa 1984), Flora of Chamba (Singh and Sharma 2006). Further confirmation of the plant specimens has been done from Herbaria, Botanical Survey of India, Dehra Dun (BSD) and Forest Research Institute, Dehradun (DD). Photographs were taken for important plants.

Pangi is rich in terms of floral diversity and is home to some rare, endemic and endangered plant species. It is thickly forested at lower altitudes. *Pinus*, *Cedrus*, *Picea, Abies, Taxus, Juniperus, Populus, Salix, Juglans, Betula* and *Acer* are the dominant tree species in the valley area. The higher altitudes above 4500 meters remain snow bound and are a glacier region. Herbaceous elements are most frequently found in the moist forest slopes near streams or the untouched areas such as subalpine and alpine grass lands or the valley bottom i.e. deep gorges and river banks. The herbaceous flora is dominated by elements belonging to plant families Fabaceae, Asteraceae, Poaceae, Rosaceae etc.

The plants of the high altitudinal cold desert valley have gone under a number of morphological, ecological and physiological adaptations to survive in the harsh climatic conditions prevailing in valley. These are, development of a deep and strong extensive root system, underground modified stem i.e. rhizomes and bulbs, stunted growth with shrubby appearance, frost resistance, accumulation of starch grains in chloroplasts, vegetative reproduction with reduced sexual life cycle and an efficient seed dispersal mechanism.

The vegetational wealth of Pangi Valley can be categorized into the following types:

Himalayan Temperate Vegetation

This type of vegetation occurs in an altitudinal range of 2000–2,800 m. The vegetation comprises of Himalayan temperate type. *Abies spectabilis, Acer pentapomicum, Cedrus deodara, Juniperus macropoda, Picea smithiana*, *Pinus gerardiana, Pinus wallichiana and Taxus wallichiana* form the tree canopy. *Populus ciliata* and *Salix viminalis* are the broad leaf planted tree species. Herbs and shrubs are constituted by *Allium humile*, *Alliaria officinalis*, *Arabidopsis*

thaliana, *Berberis lycium, Caltha palustris, Daphne oleoides, Epilobium angustifolium, Geranium nepalense, Lonicera quinquelocularis, Prunus cornuta, Ribes orientale, R. nigrum, Rosa webbiana, Rubus saxatilis, R. foliolosus, R. macilentus, Sisymbrium orientale*, *Asplenium trichomanes* and *Sorbus foliosa.* Many species of *Artemisia* such as *Artemisia brevifolia, A. maritime* and *A. parviflora, A.vulgaris* form dense scrubby vegetational cover over vast the slopes in the valley.

Sub Alpine Vegetation

This type of vegetation occurs in an altitudinal range of 2,800–3,800 m. The major floral taxa found are *Aconitum ferox, Allium humile, Angelica glauca, Aralia cachemirica, Arnebia benthamii, Aesculus indica, Berberis pseudoumbellata, B. jaeschkeana, Betula utilis, Bupleurum falcatum, Cardmine impatiens, C. macrophylla, Corylus jacquemontii, Elymus dahuricus, Ephedra gerardiana, Eritrichium canum, Erysimum melicentae, E. hieraciifolim, Dactylis glomerata, Geranium wallichianum, Impatiens glandulifera, Juglans regia, Malus baccata, Oxyria digyna, Pedicularis pectinata, Picrorhiza kurroa, Plantago depressa, Polygonatum multiflorum, P. verticillatum, Potentilla atrosanguinea, Primula denticulata, P. macrophylla, , Prunus cornuta, Ranunculus laetus, Rhododendron campanulatum, Ribes orientale, Saussurea costus, S. auriculata, Tanacetum gracile, T. tomentosum, Thlapsi alpestre* and *Verbascum thapsa.*

Alpine Vegetation

This type of vegetation starts from 3,800 m onwards, the vegetation is mainly dominated by species of *Aconitum heterophyllum, A. rotundifolium, Agrostis vinealis, Arnebia euchroma, Aquilegia pubiflora*, *Capparis himalayensis, Cassiope fastigiata*, *Cortia depressa, Delphinium cashmerianum, D. vestitum, Dracocephalum heterophyllum, Elymus nutans, E. dahuricus, Fritillaria roylei, Heracleum wallichii, Myricaria squamosa, Corydalis meifolia, Geranium wallichianum, Impatiens brachycentra*, *Inula royleana, Iris kumaonensis, Jurinea macrocephela, Meconopsis aculeate, Picrorhiza kurroa, Polygonum affine, Primula macrophylla, Ranunculus hyperboreus, Rheum australe, R. moorcroftianum, R. spiciforme, Rhodiola imbricata, Rhododendron anthopogon, R. campanulatum, Saussurea graminifolia, S. obvallata, S. gossypiphora, Selinium tenuifolium* and *Trollius acaulis*.

The entire Himalayan belt is known as treasure house for many medicinal, aromatic, edible and aesthetic plants from time immemorial. Tribal people of Pangi Valley mostly depend on the wild plants as medicines for various ailments. Rana *et al.* (2014) documented 67 ethno medicinally important plant species from the valley whereas Dutt *et al.* (2014) have documented 45 species as ethno medicinally important. Some important medicinal plants found in the valley like *Aconitum heterophyllum* (Patis, Ativisa), is a highly traded ayurvedic plant used as an anthelmintic,

Fig. 1. (a-k): a) A view of snow covered Sach Pass, 4,420 m a.sl.; b) Alpine slopes showing the vegetation in Harbi Dhar in the Sechu Tuan Wildlife sanctuary; c) A view of Pine forest; c) Snow clad peaks and Betula (*Bhojpatra*) forest of slopes; d) A branch of *Pinus gerardiana* with female cone; e) *Aconitum heterophyllum*; f) *Sinopodophyllum hexaandrum* (Ban Kakri); g) *Asplenium trichomanes*; h) *Vicia tenuifolia*; i) *Oxyria digyna*; j) *Verbascum thapsus*

Table 1. List of some selected plants from the Pangi Valley with field number, name of species, family, locality, latitude, longitude, altitude, and habitat and brief morphology notes.

S. No.	Field no.	Name of Species	Family	Locality	Latitude	Longitude	Altitude	Habitat brief morphology notes	Collector
1.	127103	*Plantago depressa* Willd.	Plantaginaceae	Eco Sensitive Zone near Twan	33° 01.821' N	76° 37.150' E	3006 m	On open slopes, Annual tufted herb; leaves rosulate; inlorescence spike	Puneet Kumar
2.	127104	*Galinsoga parviflora* Cav.	Asteraceae	Eco Sensitive Zone near Twan	33° 01.821' N	76° 37.150' E	3006 m	Annual branched herb; leaves opposite; capitulum with white toothed ray florets and yellow disc florets	Puneet Kumar
3.	127107	*Chenopodium album* L.	Chenopodiaceae	Eco Sensitive Zone near Twan	33° 01.821' N	76° 37.150' E	3006 m	On open slopes, Annual; erect, branched herb; ribbed, green to purpl- red stem	Puneet Kumar
4.	127109	*Geranium nepalense* Sweet	Geraniaceae	Eco Sensitive Zone near Twan	33° 01.821' N	76° 37.150' E	3006 m	Perennial trailing or ascending herb; white flower, violet anthers	Puneet Kumar
5.	127110	*Malva verticillata* L.	Malvaceae	Eco Sensitive Zone near Twan	33° 01.821' N	76° 37.150' E	3006 m	On open slopes, Herb; rough to touch; leaves lobed, lobes rounded;light pink flower	Puneet Kumar
6.	127115	*Erigeron canadensis* L.	Asteraceae	Eco Sensitive Zone near Twan	33° 01.790' N	76° 37.181' E	3040 m	River Bed, open places, Annual erect herb; branched above; hairy; capitulum with white ray florets	Puneet Kumar
7.	127117	*Descurainia sophia* (L.) Webb ex Prantl	Brassicaceae	Eco Sensitive Zone near Twan	33° 01.790' N	76° 37.181' E	3040 m	Dry open places, waste placesAnnual herb; branched, erect; light yellow flower; fruits	Puneet Kumar
8.	127118	*Silene vulgaris* (Moench) Garcke	Caryophyllaceae	Eco Sensitive Zone near Twan	33° 01.790' N	76° 37.181' E	3040 m	Open, slightly moist places, Perennial herb; greyish green; stem weak; leaves lancelate to ovate; inflated calyx; white petals	Puneet Kumar
9.	127119	*Malva neglecta* Wallr.	Malvaceae	Eco Sensitive Zone near Twan	33° 01.790' N	76° 37.181' E	3040 m	Dry open places, Common; perennial herb;long tap root; leaves rounded, serrated; white flowers with pink tinge	Puneet Kumar
10.	127122	*Dianthus angulatus* Royle	Caryophyllaceae	Eco Sensitive Zone near Twan	33° 01.790' N	76° 37.181' E	3040 m	Dry open slopes, Perennial clum forming grass like herb; leaves narrowly linear; light pink flowers, limb fimbriate	Puneet Kumar
11.	127124	*Sedum ewersii* Ledeb.	Crassulaceae	Eco Sensitive Zone near Twan	33° 01.790' N	76° 37.181' E	3040 m	Among boulders, rocky slopes, Perennial herb; leaves opposite, sessile, succulent; pink flowers	Puneet Kumar
12.	127125	*Aconitum heterophyllum* Wall. ex Royle	Ranunculaceae	Eco Sensitive Zone near Twan	33° 01.784' N	76° 37.286' E	3059 m	Moist slopes, Biennial herb; erect stem; leaves heteromorphic,	Puneet Kumar
13.	127129	*Epilobium angustifolium* L.	Onagraceae	Eco Sensitive Zone near Twan	33° 01.804' N	76° 37.163' E	3037 m	Dry open river side sandy slopes, Perennial herb; erect stem; leaves spirally arranged; pink flowers in termial racemes	Puneet Kumar
14.	127132	*Origanum vulgare* L.	Lamiaceae	Eco Sensitive Zone near Twan	33° 01.804' N	76° 37.163' E	3037 m	Dry open slopes, Perennial herb; erect stem, branched; opposite leaves;flower light pink	Puneet Kumar
15.	127133	*Lotus corniculatus* L.	Leguminaceae	Eco Sensitive Zone near Twan	33° 01.804' N	76° 37.163' E	3037 m	Dry open sandy slopes, Annual herb; straggling; flower yellow, papilionaceous corolla	Puneet Kumar
16.	127135	*Taraxacam officinale* (L.) Weber ex F.H.Wigg.	Asteraceae	Eco Sensitive Zone near Twan	33° 01.804' N	76° 37.163' E	3037 m	Open moist sandy places, Perennial scapose herb; leaves all radical, sessile, lobed; capitulum solitary, yellow	Puneet Kumar
17.	127149	*Pteridium revulutum* (Blume) Nakai	Dennstaedtiaceae)	Along Tarund Nalla towards Chogalu Dhar	33° 02.635' N	76° 37.340' E	3176 m	Abundant in forest area	Puneet Kumar
18.	127152	*Meconopisis aculeata* Royle	Papaveraceae	Along Tarund Nalla towards Chogalu Dhar	33° 03.289' N	76° 37.125' E	3239 m	Under shade of boulders along nala spiny herb ;bluish flower with golden yellow anthers	Puneet Kumar
19.	127163	*Rosularia alpestris* (Kar. & Kir.)	Crassulaceae	Along Tarund Nalla towards Chogalu Dhar	33° 03.047' N	76°37.262' E	3183 m	On rocks near river bed, small herb; succulent leaves; pinkish flowers	Puneet Kumar
20.	127164	*Aconitum heterophyllum* Wall. ex Royle	Ranunculceae	Along Tarund Nalla towards Chogalu Dhar	33° 03.047' N	76° 37.262' E	3183 m	On open slopes near water stream	Puneet Kumar
21.	127166	*Taraxacum officinale* (L.) Weber ex F.H.Wigg.	Asteraceae	Along Tarund Nalla towards Chogalu Dhar	33° 02.555' N	76° 37.149' E	3089 m	On moist sandy slopes	Puneet Kumar
22.	127168	*Thymus linearis* Benth.	Lamiaceae	Along Tarund Nalla towards Chogalu Dhar	33° 02.555' N	76° 37.149' E	3089 m	On sandy slopes	Puneet Kumar
23.	127176	*Polygonum polystachyum* Wall. ex Meisn.	Polygonaceae	Along Tarund Nalla towards Chogalu Dhar	33° 02.999' N	76° 37.247' E	3108 m	Moist places along stream; pink flowers	Puneet Kumar
24.	127184	*Potentilla argyrophylla* Wall. ex Lehm.	Rosaceae	Along Tarund Nalla towards Chogalu Dhar	33° 02.995' N	76° 37.247' E	3203 m	Moist slopes	Puneet Kumar
25.	127193	*Euonymus fimbriatus* Wall ex Roxb.,	Celasteraceae	Along Tarund Nalla towards Chogalu Dhar	33°02.598' N	76° 37.190' E	3134 m	In open forest area along nalla, also present along with *Betula* and *Lonicera* species, tree; fruit winged	Puneet Kumar
26.	127205	*Betula utilis* D. Don	Betulaceae	Along Tarund Nalla towards Chogalu Dhar	33° 02.598' N	76° 37.190' E	3134 m	On moist slopes, inflorescence a catkin	Puneet Kumar

27.	127210	*Verbascum thapsus* L.	Scrophulariaceae	Along Tarund Nalla towards Chogalu Dhar	33° 02.635' N	76° 37.339' E	3175 m	Abundant in open dry slopes	Puneet Kumar
28.	127241	*Spiraea canescens* D.Don	Roasceae	Along Jambu Nalla towards Ghatitar	33° 01.157' N	76° 38.403' E	3301 m	Open dry slopes	Puneet Kumar
29.	127243	*Sorbaria tomentosa* (Lindl.) Rehder.	Roasceae	Along Jambu Nalla towards Ghatitar	33° 01.157' N	76° 38.403' E	3301 m	Dry rocky open slopes; bushy	Puneet Kumar
30.	127255	*Hyssopus officinalis* L.	Lamiaceae	Along Jambu Nalla towards Ghatitar	33° 01.617' N	76° 39.172' E	3490 m	Open dry slopes, violet flowers; quadangular stem	Puneet Kumar
31.	127256	*Impateins brachycentra* Kar. & Kir.	Balsaminaceae	Along Jambu Nalla towards Ghatitar	33° 01.617' N	76° 39.172' E	3490 m	Moist shady places, white flower	Puneet Kumar
32.	127258	*Sinopodophyllum hexandrum* (Royle) T.S. Ying	Berberidiaceae	Along Jambu Nalla towards Ghatitar	33° 01.630' N	76° 38.713' E	3302 m	Shady moist places, fruit orangish red	Puneet Kumar
33.	127259	*Juniperus semiglobosa* Regel	Cupressaceae	Along Jambu Nalla towards Ghatitar	33° 01.635' N	76° 38.741' E	3386 m	Rocky slopes, small tree; fruit globose	Puneet Kumar
34.	127287	*Arceuthobium minutissimum* Hook.f.	Santalaceae	Sechu Dhar	32° 59.137' N	76° 34.211' E	2992 m	On *Pinus wallichina* branches, small branched greenish parasite	Puneet Kumar
35.	127291	*Trifolium repens* L.	Legumінaceae	Sechu Dhar	32° 58.795' N	76° 34.373' E	3090 m	Moist wet places, flower white, leaves trifoliate	Puneet Kumar
36.	127296	*Inula orientalis* Lam.	Asteraceae	Sechu Dhar	32° 58.795' N	76° 34.373' E	3090 m	Wet places along water stream, yellow ray florets	Puneet Kumar
37.	127304	*Picea smithiana* (Wall.) Boiss.	Pinaceae	Sechu Dhar	32° 59.137' N	76° 34.211' E	2992 m	Along with Pinus wallichiana moist places, male & female cone	Puneet Kumar
38.	127311	*Polygonatum verticillatum* . (L.) All	Convallariaceae	Harbi Dhar	32° 58.358' N	76° 35.350' E	3350 m	Shady places forest, three leaves per node, worled three peduncles arising from node each bifruticating further into two	Puneet Kumar
39.	127333	*Aralia cachemirica* Decne.	Araliaceae	Harbi Dhar	32° 58.994' N	76° 34.210' E	3054 m	Moist shady, stony places in coniferous forest, not common; compound leaves; white flower in umbel inflorescence	Puneet Kumar
40.	127336	*Malus baccata* (L.) Borkh.	Rosaceae	Harbi Dhar	32° 58.700' N	76° 34.533' E	3220 m	Open slopes, tree, common name - *Leaar*, fruit eaten when ripen	Puneet Kumar

antiinflammatory, analgesic, astringent, antipyretic and febrifuge. The tubers are used in trade as a result the whole plant is uprooted. As per ICUN it is a critically endangered species with decreasing population proposed to be included under CITES. This species is found growing both wild and cultivated in the valley. *Jurinea macrocephala* (Dhup) is a commercially exploited plant used as incense. *Picrorrhiza kurrooa* locally called Karu or Kour is an endangered, ayurvedic plant used to cure asthma, diarrhea, jaundice and also used in stomach diseases (trade prohibited under CITES). *Sinopodophyllum hexandrum* (Ban Kakri) critically endangered plant found growing in the sub alpine and alpine region of valley. The rhizome is of the plant yields a neurotoxin called podophyllin used in medicinal treatments. It is illegal to trade the plant in India under CITES (2014). *Meconopsis aculeata* (CR) another endangered medicinal plant used in tradition Tibetan medicine.

Pinus gerardiana, (chilgoza pine, *noosa*, *neoza*) is native to the north-western Himalayas, found in eastern Afghanistan, Pakistan, and northwest India (Kinnaur, Himachal Pradesh and Luj area in Pangi Valley), is a an economically important species growing at elevations between 1800 and 3350 metres along with blue pine (*Pinus wallichiana*) and deodar (*Cedrus deodara*). The species is cultivated for its nutritious nuts. According to ICUN it is near endangered species with restricted natural distribution. The seeds of the plant are expensive and are a source of income to the local people here. *Corylus jacquemontii* is a Himalayan endemic taxa and its seed are eaten in the valley. There is popular proverb in this context "*Pangi ki Thangi*" highlighting the importance of the plant in the region.

Some high alpine plants such as *Delphinium* sp., *Juniperus* sp., *Meconopsis* sp., *Saussurea* sp., and *Rosa* sp., have aesthetic value, used in religious places and on other important occasions.

The grasslands are major source of feeding to the livestock here acting as very efficient soil binder and help prevent soil erosion in the region. Grasses like *Bromus, Brachypodium, Phleum, Poa, Festuca, Digitaria, Stetaria, Elymus, Alopecurus, Phacelurus, Triticum, Avena, Hordeum and Arundo* etc form a major soil cover in the region. These are very important component of the ecosystem

in the valley. However, activities such as entry of large livestock for grazing in summer to valley from adjoining areas and dependence of people on wood as a fuel are the activities noted down during collection trip which may pose threat to local flora in a long term if not checked on time. Man and nature conflict is evident. There is a need of more efforts to study the fragile ecosystem of this region of North Western Himalaya. However, there are a few threats to note. i) unchecked deforestation and use of forest wood as a fuel, ii) grazing by the livestock from surrounding areas is goes unchecked, iii) ever increasing agriculture on slopes where ever possible and replacement of native forest by *Salix* and other broad leaf species poses a serious threat to local flora and fauna of the valley.

As the road connectivity is getting better with years, once a remote tribal area, Pangi is now set on path of development in terms of Infrastructure, economy, education, communication etc. However as the region is tribal and most of the local economy is directly or indirectly dependent on the natural resources, there is a near threat to the biological wealth of the region. There is need to put in more efforts for conservation and protection of biological resources in this magnificent valley of inner Himalayas so that its cultural and biological heritage is conserved for the future generation.

ACKNOWLEDGEMENT

Authors are greatly thankful to SERB-DST-Start up Research Grant (Young Scientists) (vide SERB sanction No. SB/YS/LS-182/2014 dated 08 September, 2015) for funding the study and to Director, Botanical Survey of India for providing necessary facilities.

REFERENCES

1. Aswal, B. S., Mehrotra, B.N. (ed.): Flora of Lahaul-Spiti (A Cold Desert in Northwest Himalaya). Bishen Singh Mahendra Pal Singh, Dehra Dun. 1994.
2. Bhattacharya, U.C., Uniyal, B.P. A botanical tour to Pangi and Trilokinath in the Upper Chennab. *J. Bombay. Nat. Hist. Soc.* 1982; **79**(1): 57-78.
3. Chowdhery, H.J., Wadhwa, B.M. (ed.): Flora of Himachal Pradesh: Analysis. Vols. 1-3. Botanical Survey of India. Calcutta. 1984.
4. Dhaliwal, D.S., Sharma, M. (ed.): Flora of Kullu District (Himachal Pradesh). Bishen Singh Mahendra Pal Singh, Dehra Dun, India. 1999.
5. Dutt, B., Nath, D., Chauhan, N.S., Sharma, K.R., Sharma, S.S. Ethno-medicinal Plant Resources of Tribal Pangi Valley in District Chamba, Himachal Pradesh, India. *Intl J. Bio-resource Stress Management*. 2014; **5**(3): 416-421.
6. Hooker, J.D. Flora of British India. (ed.): L. Reeve & Co. Ltd. England. 1872-1897.
7. Kumar, P., Singhal, V.K., Rana, P.K., Kaur, S., Kaur, D. Cytology of *Ranunculus laetus* Wall. ex Royle from cold desert regions and adjoining hills of North-west Himalayas. *Caryologia.* 2011; **64**: 25-32.
8. Murti, S.K. (ed.): Flora of cold deserts of Western Himalaya. Vol. I. Botanical survey of India, Calcutta, India. 2001.
9. Rana, P.K., Himshikha, Kumar, P., Singhal, V.K., Gupta, R.C. Impact of reciprocal translocations and non-synchronous disjunction of chromosomes on pollen fertility in Astragalus chlorostachys from northwest Himalayas (India). Cytologia. 2012; 77: 173-179.
10. Rana, P.K., Kumar, P., Singhal, V.K. Spindle irregularities, chromatin transfer and chromatin stickiness during male meiosis in *Anemone tetrasepala* Royle Ranunculaceae). *Turk. J. Bot.* 2013; **37**: 167-176.
11. Rana, P.K., Kumar, P., Singhal, V.K., Rana, J.C. Uses of Local Plant Biodiversity among the Tribal Communities of Pangi Valley of District Chamba in Cold Desert Himalaya, India. *Scientific World Journal.* 2014.
12. Shrivastava, S.K., Shukla A.N. (ed.): Flora of cold deserts of Western Himalaya. Vol. II. Botanical survey of India, Calcutta, India. 2015.
13. Singhal, V.K., Rana, P.K., Kumar, P. Syncytes during male meiosis resulting into '2n' pollen grains formation in *Lindelofia longiflora* var. *falconeri*. *J. Syst. Evol.*. 2011b; **49**: 406-410.
14. Singhal, V.K., Rana, P.K., Kumar, P., Kaur, D. Persistent occurrence of meiotic abnormalities in a new hexaploid cytotype of *Thalictrum foetidum* L. from Indian cold deserts. *Biologia.* 2011a; **66**: 458-464.
15. Singhal, V.K., Kumar, P., Kaur, D., Rana, P.K. Chromatin transfer during male meiosis resulted into heterogeneous sized pollen grains in Anemone rivularis Buch.-Ham. ex DC. from Indian cold deserts. Cytologia. 2009a ; 74: 229-234.
16. Singh, H., Sharma, M. (ed.): Flora of Chamba District (Himachal Pradesh). Bishan Singh Mahendra Pal Singh, Dehra Dun, India, 2006.
17. Watt, G. Notes on the vegetation of Chamba State and British Lahaul with descriptions of new species. *Bot. J. Linn. Soc.* 1881; **18**: 368-382.