Bioprospecting in Garhwal Himalayas, Uttarakhand

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The term bioprospecting has been widely used to assess the economic potential of different plant species and their value-addition. Our folklore with embedded cultural heritage has tremendous possibilities and potential for bioprospecting. Among the over 8000 species of flowering plants growing in the Himalaya, nearly 4000 are identified from the Garhwal Himalayan region. This part of region enjoyed a significant place throughout its history. This region enriched with diverse vegetational wealth and indigenous wisdom of resource use, if subjected to bioprospecting may prove to be a boon for the society.

Keywords: Bioprospecting, conservation, environment, sustainable development, traditional wisdom.

THERE is worldwide realization of social awareness on biodiversity conservation issues. Numerous national and international conferences and meetings have been held on the subject. The Earth Summit, organized through the participation of more than 140 countries in Rio De Janeiro over 15 years ago in June 1992, produced Agenda 21, a blueprint from international cooperation on environment and sustainable development. The conference ultimately resulted in the holding of the Convention on Biological Diversity (CBD), for global commitment towards the conservation of biological diversity and the sustainable and equitable sharing of its benefits arising from the use of genetic resources. Recently, the term bioprospecting has emerged as a new tool for capitalization of traditional wisdom and available natural resources.

The World Resource Institute (WRI) defined bioprospecting as 'Exploration of commercially valuable genetic and biochemical resources'[1]. It is felt that the term bio-prospecting should include the cultivation of traditional concepts with contemporary tools, techniques and prospective. It should cover the unconditional welfare of biodiversity itself, with the communities where knowledge is taken through bioprospecting.

The Western concept of adding value through bioprospecting actually hides the removal and destruction of the cultural and social values of indigenous plants and knowledge of the ecosystem as whole. Simpson *et al.*[2] considered biodiversity in the context of the Western concept of bioprospecting and found that the incentive for biodiversity conservation on the basis of benefits of bioprospecting is not tenable because the value of the benefits is small.

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Thus it is important to treat bioprospecting in the context of a strong benefit-sharing system among industries/ firms, the ecosystem and the projected communities in such manner as that the sharing of knowledge for bioprospecting will multiply the faunal and floral diversity of that region and enrich the cultural and moral ethics with sustained life-support systems.

The present article attempts to highlight the issue of bioprospecting, especially in the Garhwal Himalayas, Uttarakhand, because traditional knowledge on resource use could not be utilized for the larger benefit of the society for long and so far the knowledge has remained confined to the region. The results reported here are the outcome of an extensive study of the literature on Garhwal flora, its uses and beliefs. Information has also been gathered from local people by an ethnobotanical survey in parts of Uttarkashi, Tehri and Chamoli districts, Uttarakhand. Bioprospecting during the study was confined to non-timber forest products of the region.

Garhwal Himalayas

The Garhwal Himalayas has been a centre of spiritual knowledge, religiosity and pilgrimage from ancient times as mentioned in the *Skanda Purana*. The region is rich in bioresources and fascinating folk culture as well as diverse flora and fauna due to its distinct meteorological, geographic, geological and ecological patterns.

Interestingly, it was an English Army Officer, Major General Thomas Hardwicke, who made the first authentic attempt to collect plants from the region in 1796. He collected plants from Alaknanda valley[3]. His maiden effort was followed by those of Felix Vincent Rapper and William Spencer Webb, who collected plants from another part of Garhwal region, namely Yamanotri area during

Table 1. Some important wild plants used in traditional system of medicine in Garhwal Himalayas having potential for bioprospecting

Botanical name	Vernacular name	Part used/mode of application	Uses
Aconitum atrox	Mitha bish,	Paste of rhizome fried in ghee (clarified butter) is applied externally	Rheumatism, neuralgia, paralysis, rheumatic and purpeural fever
A. heterophyllum	Atibish	Root powder mixed with honey and galls of *Pistacia ichinjuk* (kakarsingi) is applied externally	Fever, cough, chills, stomach disorders and diarrhoea
Actaea acuminata	Mamira	Decoction of roots	Bronchial inflammation
Angelica glauca	Choru	Root stocks	Flatulence, colic
Asparagus filicinus	Jhirni	Powder of dried tuberous roots	Sexual debility and urinogenital disorder
Bergenia stracheyi	Shilpari	Root decoction and juice of leaves	Kidney stones, sores, swellings and jaundice
Dactylorrhiza hatagirea	Salampanja	Powder of roots	Cuts and wounds
Dioscorea bulbifera	Genthi	Tubers	Bronchial cough
Dioscorea deltoids	Tairu	Rhizomes	Spermetonorrhoea
Euphorbia hirta	Dudhibari	Entire plant with curd	Piles
Hedychium accuminatum	Kapoorkachri	Purified root powder	Dyspepsia and piles
Megacarpea polyandra	Barmoola	Roots	Fever, stomach disorders
Picrorrhiza kurroo	Kutki	Root powder	Sever coughing, fever and stomach disorder
Rhododendron anthopogon	Bhotiachai	Decoction of leaves	Coryza and catarrh
Thymus linearis	Van ajwain	Extracts of leaves and floral buds	Asthmatic cough
Valeriana jatamansii	Sameva	Roots	Epilepsy, hysteria
Zanthoxylum acanthopodium	Timru	Seed-powder and stem bark	Toothache, tooth decay

Source: Kandari and Gusain[7].

1802–03. Subsequently, J. F. Royle, the then superintendent of Saharanpur Botanical Garden, collected plants from Dehradun and described them in his illustrations of the botany and other branches of natural history of the Himalayan mountains and the flora of Cashmere during 1833–40 (see Rau[4] and Babu[5]).

With the establishment of the Botanical Garden at Saharanpur in 1820 and the Forest School in Dehradun during 1878–81, the vegetational exploration in the region received a new impetus[6]. The contributions of Richard Starchey and J. E. Winterbottom in this regard, who instituted the first ever herbarium of plants found in this part of Himalaya, have been noteworthy. They published a catalogue on the plants of the region in the *Atkinson Gazetteer*. It is comprised of about 2000 species and still considered to be one of the best plant collections from this part of the Himalayas.

Bioprospecting

The Garhwal Himalayas along with Kumaun and a part of Himanchal Pradesh has unique characteristics of three provinces – Tibetan in the north, Upper Gangetic Plain in the south and eastern Himalayan provinces in the east. More than 8000 species of flowering plants grow in the Himalayas, with nearly 4000 species identified from the Garhwal Himalayan region along with great diversity[7]. Despite its vegetational wealth, this part of the region enjoyed a significant place throughout its history. Some of the historical, archaeological and anthropological evidences prove the presence of human civilization during Mesolithic age (5000 BC) or Megalithic age (2600 BC). The first known historical race of Garhwal is Kole, which descended from Munda. Subsequently, the Kirata, Khasas, Sakas and many other races like Tangana, Partagana, Naga, Huns and Bhotia had intermixed and settled down in Garhwal Himalaya[8]. These human races prospected the bioresources traditionally.

This region is represented by various tribes and communities with distinct dialects, cultures as well as traditional features, now locally identified as Dasolic, Maj-kummayys, Nagpuria, Salani, Jaunsaris, Bandhani, Raathi, Syura, Tehriyal, in different districts[9]. Each of these groups has its own wisdom about the ethnic use of flowering and non-flowering plants. The indigenous flora utilized by the communities has substantial influences on their culture, customs, craftsmanship, ethos, religious rites, socio-cultural beliefs, food habits, settlement patterns and various other resource-based practices.

There are various plants and plant parts used in religious observances, traditional healthcare practices, in preparation of beverages, fruits and vegetables, as spices and condiments, extraction of oils, gums, resins and natural dyes, production of fuel, fodder and fibre, and preparation of diverse handicraft objects. Some of them are listed in Tables 1–5.

Bioprospecting in the Garhwal Himalaya may not only provide raw materials for pharmaceuticals, but for various other plant-based industries in the field of arts, crafts and homemade edible food items such as jam, jelly, juice, etc.

Table 2. Some important wild edibles of Garhwal Himalayas (vegetables, fruits, seeds/grains, spices and condiment, oils and beverages) having potential for bioprospecting

Botanical name	Vernacular name	Part used	Uses
Angelica glauca	Chora	Underground part	Edible
Asparagus filicinus	Jhinjan	Tuberous roots	Edible
Cyperus rotundus	Motha	Underground part	Edible
Dioscorea bulbiflora	Genthi	Rhizome	Edible
Orchis latifolia	Hatajari	Roots	Edible
Vigna vexillata	Pholi	Underground part	Edible
Adhatoda zeylanica	Basing	Young shoots/leaves	Edible
Amaranthus caudatus	Marchhu	Young shoots/leaves	Edible
Bergenia ciliate	Patharchhata	Young shoots/leaves	Edible
Oxalis corniculata	Chalmosi	Young shoots/leaves	Edible
Rheum australe	Archa	Young shoots/leaves	Edible
Rumex hastatus	Kilmoru	Young shoots/leaves	Edible
Smilax glaucophylla	Kanjolya	Young shoots/leaves	Edible
Urtica dioeca and *U. parviflora*	Kandali	Young shoots/leaves	Edible
Bauhinia purpurea	Guiral	Flowers	Edible
Bombax ceiba	Semwal	Flowers	Edible
Woodfordia fruticosa	Dhaula	Flowers	Edible
Ficus auriculata	Timla	Unripe fruit	Edible
Aegle marmelos	Bel	Fruit	Edible when ripe
Aesculus indica	Pangar	Fruit	Eaten roasted
Cornus capitata	Bhamor	Fruit	Eaten when ripe
Elaeagnus angustifolia	Giwain	Fruit	Eaten raw/ripe
Fragaria vesca	Bhuin kaphal	Fruit	Eaten raw/ripe
Grewia optiva	Vimal	Fruit	Eaten raw/ripe
Myrica esculanta	Kaphal	Fruit	Eaten raw/ripe
Prunus sp.	Chula/payan/jamni	Fruit	Eaten raw and ripe
Rhus parviflora	Titnulya	Fruit	Eaten raw
Cannabis sativa	Bhang	Seeds/grains	Eaten raw and roasted
Cleome viscose	Jakhya	Seeds/grains	Used as spices
Impatiens balsamina	Manjruya	Seeds/grains	Eaten raw
Juglans regia	Akhore	Fruit	Dry fruits
Allium griffthianum	Jambo	Seeds/grains	Spices and condiments
A. humile	Laadu	Seeds/grains	Spices and condiments
Alpinia galanga	Kalji	Rhizome	Spices and condiments
Angelica glauca	Choru	Seeds/grains/roots	Spices and condiments
Mentha arvensis	Pothya	Leaves	Spices and condiments
Zanthoxylum acanthopodium	Timru	Fruits/seeds	Spices and condiments
Brasica napus	Lahiya	Seeds	Oil
B. juncea	Rai		
Prunus armeniaca	Chula	Seeds	Oil
Buxus wallichiana	Papri	Leaves/barks	Non-alcoholic beverage
Cassia occidentalis	Chakunda	Seeds	Non-alcoholic beverage
Hippophae rhamnoides	Amlich	Fruits	Non-alcoholic beverage
Punica granatum	Darim	Fruits	Non-alcoholic beverage and chatni
Rhododendron anthopogon	Botyachaa	Leaves	Non-alcoholic beverage
Rhododendron arboreum	Burans	Flowers (petals)	Non-alcoholic beverage
Taxus baccata	Thuner	Bark and leaves	Non-alcoholic beverage
Viola sp.	Somaya	Leaves	Non-alcoholic beverage
Andrachne cordifolia	Bhotti	–	Alcoholic beverage
Bupleurum falcatum	Tirmiri	–	Alcoholic beverage
Datura stramonium	Dhatura	–	Alcoholic beverage
Hemidesmus indicus	Morchiyapar	–	Alcoholic beverage
Rubas ellipticus	Hinsar	–	Alcoholic beverage
R. niveus	Kali hinsar	–	Alcoholic beverage
Taraxacum officinale	Karhatu	–	Alcoholic beverage

Source: Kandari and Gusain[7].

Although wild edible plants are not consumed in large quantities, their nutritional value and role in local communities cannot be ignored. Maikhuri *et al.*[10] have estimated about 13 potential wild species including *Rhododendron arboretum* (Burans), *Myrica nagi*, *Hippophae rhamnoides* and *Rubus ellipticus* with several cultivated species of *Citrus*,

Table 3. Some important fibre-yielding plants from Garhwal Himalayas

Botanical name	Vernacular name	Part used	Uses
Agave cantala	Cantala	Stem	Fibre for rope, basket, mat, etc.
Boehmeria platyphlla	–	Stem	-do-
Cannabis sativa	Bhangla	Stem	-do-
Cissampelos pareira	Pani bel	Stem	-do-
Girardiana palmate	–	Stem	-do-
Grewia optiva	Vimal	Stem	-do-
Hibiscus canabinus	Bimli/ambari	Stem	-do-
Urtica parviflora	Kandali	Stem	-do-
Bauhinia vahlii	Mallu	Bark	-do-
Ichnocarpus frutescence	Kalidudhi/bel kamu	Bark	-do-
Marsdenia roylei	Shengori	Stem/bark	Fibre for fishing, etc.
Cryptolepis buchananii	Singhi/medha singhi	Stem/bark	-do-
Porana ciliate	Safed bel	Stem/bark	-do-

Source: Kandari and Gusain[7].

Table 4. Plants from Garhwal Himalayas with prospects for use in handicrafts

Botanical name	Vernacular name	Part used for
Aesculus indicus	Pangar	Cooperage, toys, etc.
Buxus semipervirons	Papri	Wood is used for making cricket bats, hockey sticks and other sports items
Cannabis sativa	Bhangla	Ropes and cordage
Cedrus deodara	Deodar	Boxes, bed, etc.
Chimonobambusa falcate or *Arundinaria falcata*	Go-ringal	Baskets and other handicraft items
Dendrocalamus strictus	Tham	-do-
Grewia optiva	Vimal	Ropes and cordage, etc.
Ichnocarpus frutescens	Belkarm	Baskets, etc.
Rhododendron arboreum	Burans	Cooperage and other domestic items
Taxus baccata	Thuner	Boxes and other domestic items
Thamnocalamus spathiflora or *Arundinaria spathiflora*	Deo-ringal	Baskets and other handicraft items

Table 5. Plants used as dyes, insecticides, piscicides and in the making of brooms

Botanical name	Vernacular name	Part used	Uses
Berberis aristata	Kingore	Wood and roots	Dyes (yellow)
B. chitria	Chotar	Wood and roots	Dyes (yellow)
Cornus capitata	Bhamore	Stem	Red
Juglans regia	Akhore	Leaves and fruits	Yellow dye
Mallotus philippenensis	Ruina	Ripe fruits	Orange dye
Myrica esculenta	Kaphal	Stem	Brown dye
Prinsepia utilis	Bhekhal	Fruits	Blue dye
Arisaema tortuosum	Meen	Tubers	Insecticides/piscicides
Butea fructicosa	Dhak	Seeds	Insecticides
Hedera nepalensis	Laglya	Leaves	Repellents
Cedrus deodara	Deodar	Seeds	Repellents
Murraya koenigii	Gandhela	Leaves	Repellents
Zanthoxylum acanthopodium	Timru	Fruits	Insecticides/piscicides
Diploknema butyracea	Cheura	Seeds	Piscicides
Houttyunia cordata	Machhalia	Entire plant	Piscicides

Source: Kandari and Gusain[7].

etc. having great prospects for utilization from the Garhwal Himalayas.

Conclusion

Traditional knowledge is an integral part of our country. India's magnificent past and its immense vegetational wealth places the country among the mega-biodiversity centres of the world. Unlike other developed Asian countries such as Japan, Korea and China, we have not been able to capitalize much on our natural resources and inherited wisdom. For developing countries like India, there is an urgent need to identify at least the existing bioresources and traditional wisdom to prevent biopiracy and

building up capabilities to utilize natural resources and capitalize on the grassroots knowledge for potential rural economy.

It would be an emerging sector for future research and development programmes, enabling us to make use of biodiversity for noble causes and conservation.

The Garhwal Himalayas which is enriched with diverse vegetational wealth and indigenous wisdom of resource use, if subjected to bioprospecting may prove to be a boon for the society.

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