

Review Article

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Conservation of Plant Biodiversity through Indigenous Knowledge in Rural Household: A Review

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ABSTRACT

Indigenous knowledge (IK), which is variously referred to as 'traditional knowledge', 'local knowledge', 'folk knowledge' etc., refers to that body of knowledge developed by local and indigenous communities over time in response to the needs of their specific local environment. This indigenous knowledge is really important in conserving the biological resources existing in different altitudinal and climatic variations. The indigenous communities of Kanyakumari use thirty plant species belonging to 29 genera and 22 families specifically in the treatment of various skin diseases viz., dandruff, eczema, impetigo, leprosy, rash, scabies etc. *Saraca asoca* plant becomes vulnerable since it is frequently used for the treatment of scabies. The local people of Uttarakhand, Dev Bhoomi (Land of God), performs so many rituals on which so many plants have important roles like *Ficus religiosa*, *Azadirachta indica*, *Ocimum sanctum*, *Centella asiatica*, *Curcuma longa*, *Cynodon dactylon* etc. Other than that 19 plants species have been identified can be used for religious as well as medicinal purposes are *Aegle marmelos*, *Artemisia nilagirica*, *Capsicum annum*, *Cedrus deodara*, *Curcuma longa*, *Cynodon dactylon*, *Euphorbia ligularia*, *Mangifera indica*, *Musa paradisiaca*, *Ocimum sanctum*, *Piper betle*, *Tagetes erecta*, *Urtica dioica*, *Zanthoxylum aromatum* etc. The diverse indigenous knowledge existing in our country largely affects the sustainability of the local people in favour of environment but, due to globalization these indigenous knowledge is in the verge of extinction. Hence there is real urgency to preserve this unique indigenous knowledge and biodiversities through implementation of the policies and modern technologies and skills for sustainable development of the country. The full paper discussed different applications of diversified plant based indigenous knowledge and their conservation to achieve sustainability.

Keywords

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Introduction

Indigenous knowledge and biodiversity are complementary phenomena essential to

development of human beings. Indigenous knowledge is the local knowledge held by indigenous peoples or local knowledge unique to a given culture or society. The diverse

indigenous knowledge regarding sustainability of rural people with several aspects largely depends on environment. Environment is an invaluable award from God and it is our responsibility to manage the natural resources carefully. Different plant species largely influence the diverse indigenous knowledge of local people. The deliberate maintenance of diversity in domesticated and non-domesticated plants provides an important opportunity for systematic in situ maintenance of genetic resources in different parts of the world. Informal agricultural research and development systems provide another opportunity for national agricultural research and extension services to work with the creative interests and activities of farmers and other rural people. The ethnic communities of different parts of the world are utilizing indigenous traditional knowledge for their survival from time immemorial.

Indigenous people are very near to the nature and use varieties of skills and ways to conserve the natural resources. Indigenous Technology Knowledge is the art of using natural resources for the survival by the local people who are living very near to forests, river and is passed from one generation to another. So maintenance of natural diversity largely nourishes the attributes of indigenous knowledge.

Conservation of plant biodiversity affecting indigenous knowledge

There are so many plant species that largely support the livelihood of rural people with food, medicinal herbs, artifacts, biofence and so many fields of their day to day needs. But due to globalization and environmental threats they are being extinct. So conservation of these plant biodiversity can be done by several ways. Conservation of plants having ethno-medicinal uses.

Conservation of plants having important roles in religious activities as well as rituals.

Conservation of plants having important roles in manufacturing different agricultural implements and fishing implements.

Conservation of plants having important roles in controlling stored grain pests.

Conservation of plants being used in management of disease pests.

Conservation of plants having important roles in dye preparation.

Conservation of plants being used in treatments of domestic animals.

Indigenous knowledge in conservation of ethno-medicinal plants

India has a long history and tradition as well as rich heritage of using ethno-medicinal plants for health care and beauty in improving the quality of life. Religious harmony of India encounters so many communities in different parts of country (Table 1 and 2). The indigenous knowledge of them for using different ethno-medicinal plants is interestingly interlinked with the science of 5000 years old Ayurveda of traditional India. Conservation of this knowledge will enrich biodiversity of India.

Indigenous knowledge in religious purpose and rituals

Uttarakhand, the mountainous state of Indian Himalayan Region (IHR) is famous for its religious culture, traditions and pronounced as Dev Bhoomi (Land of Gods). People of this state are highly religious and variety of rituals related to God, Goddess are performed in various ways, round the year by the local people in which plants have their defined

roles and importance. Hindu scriptures utilises a wide range of plants like *Ficus religiosa*, *Azadirachta indica*, *Ocimum sanctum*, *Centella asiatica*, *Curcuma longa*, *Cynodon dactylon* etc.

Indigenous knowledge and practice of Artifacts by the Bankariya people of Nepal

Bankariya people are skilled to make halo (plough), juwa (yoke) and khamari by the sadan wood.

They have also the knowledge of making *doko* (basket), *makuro* (to put on the mouth of the oxen during ploughing), *perungo*, *bhakari*, *sipring* (for fishing) and *furlung* (fish carrier), *damlo* (halters), *namlo* (tumpline) etc.

They make the tapari (plates) and duna (bowls) of the leaves of the saal (*Shorea robusta*).

They make the theki (wooden pot to store the milk) by the tuni (*Toona ciliate*). They use the stem of the saal (*Shorea robusta*) to make the window, door, barriers etc.

Indigenous knowledge and practice of fishing implements by local people in the Pachmarhi Biosphere Reserve of India

Though fishing is not the primary occupation of the local people of the region, often they involve themselves in it. Most of the tools are made up of bamboo. Fishing tools such as, 'mer', 'jakni' and 'dhuti' are used by the local people. Apart from the tools, they use some parts of tree species as fish poison.

The most important trees used for fish poison are bark of *Chloroxylon swietenia* and root of *Aegle marmelos*, *Casearia tomentosa* and both bark and seeds of *Melia azedarachta*. The required tree part is collected by cutting or by chopping.

Indigenous knowledge to manage disease – pests

Some of the natural insecticides

Neem (*Azadirachta indica*): It is a tree native to India and Pakistan, but planted widely around the world for its use as a natural pesticide. It also acts as a fungicide, nematicide and bactericide. Commercial products made with neem include Bioneem, Margoan-O, Biotrol and Nimex. It has been used effectively on over 100 leaf-eating insects. Mature neem seeds after washing and complete drying are used for this purpose. Twelve handfuls of dry seeds (or use 500 grams per 10 litres water) should be grinded into a fine powder. The powder should be mixed in 12 litres of water and soaked overnight. After straining the liquid should be applied.

Anona y guanábana, custard apple and soursop (*Annona squamosa*, *A. muricata*): Two handfuls of seeds should be dried and grinded into a fine powder. Then it should be mixed with 4 litres of water and soaked overnight.

Chilli (*Capsicum frutescens*): Two handfuls of seeds should be dried and grinded into a fine powder, mix with 2 litres of water and soak overnight. Tobacco (*Nicotiana tabacum*): Tobacco contains nicotine which acts as an insecticide. After collection of healthy and fresh leaves, they should be dried and 80 grams of dry leaves and stems should be mixed in one litre of water and soak for two days.

Piretro, pyrethrum (*Chrysanthemum cinerariifolium*): A widely cultivated annual flower which contains active ingredient. 100 grams of fully opened dried flowers should be mixed in 1 litre of water and soaked for one day.

Ajo, garlic (*Allium sativum*): Finely chop 3 bulbs of garlic and mix with 10 litres of water. It can be stored for up to two weeks unstrained.

Mata ratón, cacaute, gliricidia (*Gliricidia sepium*): Roots, seeds and leaves are poisonous to rats and other small animals. It acts as an insecticide against aphids.

Some of the natural mixtures protect from viral diseases

Bougainvillea (*Bougainvillea spectabilis*): 200 grams of fresh leaves should be mixed per litre of water in a blender for 5-10 mins. It is used against several virus diseases in tomatoes and beans.

Dahlia (*Dahlia pinnata*): 150 grams of fruit should be mixed in one litre of water.

Ginkgo (*Ginkgo biloba*): 1 kg of dry leaves and roots in should be mixed in one litre of alcohol and it should be soaked for 24–36 hours. After that the mixture should be filtered and diluted with 15 litres of water.

Espinaca, spinach (*Spinacea oleracea*): 200 grams of fresh plant leaves should be mixed in one litre of water and it should be soaked for one day.

Some of the natural fungicides

Papaya (*Carica papaya*): 1 kg of dry leaves should be chopped finely and mixed with one litre of water and stand overnight. After that it should be diluted with four litres of water.

Ajo y cebolla, garlic and onion: (*Allium sativum*, *A. cepa*). 500 grams of finely chopped material should be mixed in 10 litres of water and is allowed for fermentation for one week. After that it should be diluted to another 10 litres of water.

Canavalia (*Canavalia* sp.): Canavalia has been shown to kill the nests of leaf-cutter ants.

The ants do not eat the leaves they cut, but use the leaves to grow a fungus which the ants eat. Canavalia leaves prevent the fungus from growing, and this starves the ants.

Traditional food grain storage practices in Punjab utilizing traditional knowledge

In case of wheat grain storage matchbox was kept inside the storage bin to protect wheat grains from attack of storage insect pests like khapra beetle (*Trigoderma ganarium*) and Dhora (*Callosobruchus* sp), though this practice was scientifically disagreeable to most of the experts.

Use of *neem* leaves along with wheat grains or rubbing the *neem* leaves along the wall of storage structure (bukhari) before the storage of wheat proved scientifically good as *neem* leaves have insecticidal properties.

Use of neem leaves, husk, salt, camphor was also reported either singly or in combination to prevent food grains from insect infestation.

Leaves of *aak* (*Calotropis procera*) plant were also used for safe storage of wheat as *aak* leaves might act as insect repellent.

For storage of wheat grains for seed purpose the practice of filling them into gunny bag and storing them in wheat straw was proved scientifically sound to avoid the attack of Dhora (*Callosobruchus* sp) and khapra beetle (*Trigoderma ganarium*).

Moth bean and moong (*V. radiata*) were stored by mixing with ash to avoid the attack of khapra beetle (*Trigoderma ganarium*) was also proved scientific as ash contains silica (SiO_2) which acts as insect repellent.

Table.1 Indigenous knowledge used for ethno-medicinal purpose in Jammu and Kashmir and Kanyakumari

Local name	Botanical name	Uses
<i>Vasampu</i>	<i>Acorus calamus</i>	Pounded rhizomes along with <i>Curcuma aromatica</i> rhizomes and <i>Azadiracta indica</i> leaves applied against eczema.
<i>Premathandu</i>	<i>Argemone mexicana</i>	Pounded seeds along with rhizomes of <i>Curcuma aromatica</i> and <i>Acorus calamus</i> made into paste is applied on different skin diseases.
<i>Thannervitta nkizhangu</i>	<i>Asparagus racemosus</i>	Tuber along with the leaves of <i>Plumbago indica</i> made into paste is applied on different skin diseases.
<i>Vembu</i>	<i>Azadiracta indica</i>	Flowers boiled in gingili oil (<i>Sesamum indicum</i>) is applied on head against dandruff.
<i>Asogam</i>	<i>Saraca asoca</i>	Paste prepared from dried flowers boiled with coconut oil and then cooled is applied against scabies.
<i>Phut Kanda</i>	<i>Achyranthes aspera</i>	Root powder in small quantity effective against indigestion and gastric problems.
<i>Bari Ghanar</i>	<i>Amaranthus gangeticus</i>	Plant seeds cooked with maize floor, curd and a little salt is given in diarrhoea and dysentery.
<i>Amaltas</i>	<i>Cassia fistula</i>	Cassia pulp is kept in water for two days and given as laxative for habitual constipation.
<i>Batwa</i>	<i>Chenopodium album</i>	Cooked leaves relieve stomach pains.
<i>Kunchi</i>	<i>Fragaria vesca</i>	Roots are eaten for better digestion and bowl movement.
<i>Bana</i>	<i>Vitex negundo</i>	Roots extract used in dyspepsia and flowers are used in diarrhoea.
<i>Pudhina</i>	<i>Mentha longifolia</i>	Dried leaves and young twigs recommended against dysentery and diarrhoea.
<i>Punkumaram</i>	<i>Pongamia pinnata</i>	Crushed bark paste boiled in gingili oil is applied against rash.
<i>Tout</i>	<i>Morus alba</i>	Fruits used against dyspepsia.
<i>Thankuni</i>	<i>Centella asiatica</i>	Leaves Chronic venous insufficiency, psoriasis, and minor wounds.

Source: Kinston *et al.*, 2007 and Rasid, 2012.

Table.2 Indigenous knowledge and medicinal plants used by Vaidyas in Uttarakhand, India

Local name	Botanical name	Uses
<i>Bel</i>	<i>Aegle marmelos</i>	Dried fruit is mixed with sugar is taken orally during fever and cold.
<i>Neelkanth</i>	<i>Ajuga bracteosa</i>	Leaf extract before meal is used for acidity and indigestion.
<i>Pyaz</i>	<i>Allium cepa</i>	Bulb extracts mixed with <i>Mentha</i> leaves extract is used for ear pain; also useful in headache, high blood pressure and epilepsy.
<i>Lahsun</i>	<i>Allium sativum</i>	Bulb extract mixed with mustard oil and boiled is taken orally as well as applied externally in case of arthritis and joints pain.
<i>Meen</i>	<i>Arisaema intermedium</i>	Root powder mixed with water is consumed while stem extract is applied externally in fever, bodyache, vomiting, dehydration, intestinal pain and skin infection.
<i>Jhirna</i>	<i>Asparagus curilius</i>	Root extract is taken orally to relieve from urinary infection.
<i>Kala zeera</i>	<i>Carum carvi</i>	Seeds boiled with salt and taken orally is useful in fever, headache and as toothpaste.
<i>Nimbu</i>	<i>Citrus limon</i>	Fruit extract mixed with <i>Mentha</i> leaf extract and salt is taken to relieve from vomiting, acidity and gastric disorder.
<i>Doob</i>	<i>Cynodon dactylon</i>	Whole plant extract is taken orally in dysentery, nose bleeding and anemia.
<i>Gahath</i>	<i>Macrotyloma uniflorum</i>	Dried seed decoction is taken orally during kidney stone and intestinal problem.
<i>Banhaldi</i>	<i>Hedychium spicatum</i>	Rhizome extract is taken orally in asthma and bronchitis.
<i>Pudina</i>	<i>Mentha longifolia</i>	Leaf paste with extract of ginger and onion is taken during dehydration, vomiting and liver diseases.
<i>Tulsi</i>	<i>Ocimum sanctum</i>	Leaf paste is taken with black pepper to get relieve from cough, fever, cold and ear pain.
<i>Khatti buti</i>	<i>Oxalis corniculata</i>	Leaf extract is taken orally to remove open sores, in pimples and skin disease.
<i>Archu</i>	<i>Rheum emodi</i>	Root paste and turmeric powder mixed with refined fat is applied for skin problem; paste is taken orally to relieve muscular pain, abdominal pain and dysentery.
<i>Methi</i>	<i>Trigonella foenum-graecum</i>	Leaf extract is taken orally for curing obesity, indigestion and joints pain.
<i>Kandali</i>	<i>Urtica dioica</i>	Dry leaf extract is taken orally; also useful during joints and muscular pain.
<i>Timru</i>	<i>Zanthoxylum armatum</i>	Seed paste and twig/bark is used for teeth cleaning, toothache and pyorrhoea.
<i>Adrak</i>	<i>Zingiber officinale</i>	Mixture of rhizome extract and honey is used to get relieve from cough, cold and throat pain.

Source: Semwal *et al.*, 2010.

Table.3 Indigenous knowledge in religious purpose and rituals affecting biodiversity

Common Name	Botanical Name	Uses
Tulsi	<i>Ocimum sanctum</i>	Associated with Lord Vishnu. This sacred plant is worshiped daily due to a belief that it wards off the evil spirits from home.
Bilwa/Holy fruit tree	<i>Aegle marmelos</i>	Leaves offered to please god Shiva.
Palash	<i>Butea monosperma</i>	Used in Saraswati puja.
Devdar	<i>Cedrus deodara</i>	The fragrance of wood repels poisonous animals like snake and scorpion.
Haldi/Turmeric	<i>Curcuma longa</i>	Good antiseptic. Its paste applied on the face and body of bride and grooms to get blessings, as an auspicious ritual on the day of marriage.
Durba/Bermuda grass	<i>Cynodon dactylon</i>	It is used in all religious rituals to please lord Ganesh.
Peepal/Scarced fig tree	<i>Ficus religiosa</i>	Most sacred tree associated with planet Saturn and Jupiter and worshiped for blessings on almost all rituals. Oil mediated with its leaves used as ear drops.
Aam/Mango	<i>Mangifera indica</i>	Wood used in worship. Leaves also used in making string for doors on every auspicious occasion.
Kela/Banana	<i>Musa Paradisiaca</i>	Sacred plant mainly worshiped on Thursday. Stems used to make pavilion during various sacred rituals.
Dhan/Rice	<i>Oryza sativa</i>	The husked seeds are used in various sacred rituals and worship. It is also used for auspicious mark (tilak) on forehead with turmeric or sandal wood paste as blessings of fertility.
China rose	<i>Hibiscus rosa sinensis</i>	Used to make garlands in worship to god Kali.
Sandal wood	<i>Sanctalum album</i>	Used in auspicious mark (Tilak) on forehead as blessings.
Pan/Betel pepper	<i>Piper betle</i>	Leaves used in all religious ceremonies and regarded as a pleasure to Goddess Lakshmi.
Ganda/Marigold	<i>Tagetes erecta</i>	Flowers used to make garlands. Paste of flower used externally in eye diseases.
Kandali/Stinging Nettle	<i>Urtica dioica</i>	The twig is carried out with new born baby in travelling to ward off the spirits.

Source: Sharma and Jhosi, 2010.

Table.4 Indigenous knowledge for disease management of live stocks

Ailment	Management process
Wounds	<i>Devadar</i> tree oil
Loss of appetite	<i>Dhania</i> + onion+ <i>kalajeera</i> + curd
Fever	<i>Kalajeera</i> powder
De-worming	Forest leaves, stem peelings; Mustard oil, fermented mixture of butter milk and <i>neem</i> leaves
Bloat	<i>Kalajeera</i> + <i>dhania</i> mixed with feed; Asafoetida+ black salt+ tulsi seeds+ ginger powder mixed in water and given orally
Rumination	<i>Kalajeera</i> + <i>dhania</i> powder + jaggery + onion + curd
Treatment of minor injuries	' <i>Bans</i> ' (local grass) leaf paste
Treatment of 'Gal Ghotoo' in livestock	' <i>Bhang</i> ' and ' <i>Shivali</i> ' leaves are grinded together, put in cloth and while cloth is boiled. After cooling, cloth is applied on affected portion.
Foot and Mouth disease	Phenyl is applied on foot; in condition of sour mouth, wheat flour is given to animal, paste of peach applied on lesions.
For higher milk production	' <i>Pinda</i> ', a local feed prepared by mixing wheat flour in lukewarm water with ' <i>gur</i> ',butter, rice, <i>Jhingora</i> (<i>Echinochola frumentacea</i>); ' <i>Bhimal</i> ' leaves + black soybean+ wheat in combination with <i>Methi</i> seeds, <i>Dhalia</i> and jaggery.
Excessive bleeding during calving	' <i>Kala jeera</i> ' boiled in water and water is given to animals. Roasted <i>Jeera</i> powder is mixed in lukewarm milk and given to animal.
Mouth ulcers	Lemon + salt
Mastitis	Honey+ <i>Haldi</i>
Diarrohea	Powder of half ripe <i>Bael</i> fruit; powder of <i>Shisam</i> (<i>Dalbergia sissoo</i>) leaves

Source: Subrahmanyeswari and Chander, 2013

Storing of onion and garlic along with their leaves at ventilated places prevents rotting of food grains caused by fungal attack was also proved scientific by most of the experts.

Natural dye-yielding plants and indigenous knowledge on dye preparation in Arunachal Pradesh, northeast India

Arunachal Pradesh is one of the most important hotspots of biodiversity that encounter wide range of economically important plants. Some of these plant species have found to be used in the preparation of

natural dyes. Natural dyes have several applications in textiles, inks, cosmetics, etc.

Daphne papyracea, is one of the most important plant species being traditionally used by the Monpa tribe of West Kameng and Tawang districts for preparing dye as well as for making hand-made paper for painting and writing scripts in monasteries.

Plants species like *Rubia cordifolia*, *Rubia sikkimensis*, *Woodfordia fruticosa*, *Colquhounia coccinea*, etc. in combination with other plants have been traditionally used

by the local tribes for extraction and preparation of dyes utilising indigenous knowledge.

Indigenous knowledge and practice about biodiversity conservation by the Bankariya people of Nepal

Bankariya indigenous people use Scarecrow to chase away the cattle, wild animals and birds from the crop land.

Barriers are made of *Mainafal* (*Randia dumetorum* Lam.), *thakal* (*Argemone mexicana* Linn.), *saal* (*Shorea robusta*) and *bamboo* so that animals will not have access to destroy crops.

Ashes are applied to kill pests in vegetables and it also acts as fertilizer.

Bankariya people spread a mixture of resin of *Khirro* (*Holorrhena antidysenterica*), soap and kerosene to kill the pests of fruits.

In fracture of cattle's leg *hadchur* (*Viscum album*) is grinded and applied. It is applied to the human beings' fracture also.

Wild onion is grinded and applied to make cure the swollen problem of the cattle.

Use of compost fertilizer by the Bankariya people by mixing of medicinal power of *Saal* (*Shorea robusta*) along with animal dung is far better than the chemical fertilizer that ultimately reduces the productivity of the land day by day (Table 3).

Indigenous knowledge of the farmers in treatments of livestock's in Uttarakhand

Majority of the farmers preferred ayurvedic based traditional knowledge for the treatment of livestock. Especially, in hill areas the women who are the rice source of Indigenous

Technical Knowledge (ITK) related to animal husbandry, treat animals or live stocks in eco-friendly ways which also influences sustainable development (Table 4).

In conclusion, indigenous knowledge and biodiversity are inextricably linked. If biodiversities are lost, the survival of indigenous people is questioned. The diverse indigenous knowledge existing in our country is in the verge of extinction due to population explosion, globalization, industrialization and staggering of knowledge transfer to younger generations. Hence there is urgent need to preserve this unique indigenous knowledge to conserve the plant biodiversity. Thus it is utmost important to make the policies and effective implementation of them to conserve both indigenous knowledge and biodiversities to achieve sustainability for future generation.

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