



### Short Communication

## Dye Yielding Plants of the Garhwal Himalaya, India: A Case Study

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### Abstract

Indians have been considered as forerunners in the art of natural dyeing. Natural dyes find use in the coloring of textiles, drugs, cosmetics, etc. Owing to their nontoxic effects, they are also used for coloring various food products. Although indigenous knowledge system has been practiced over the years in the past, the use of natural dyes has diminished over generations due to lack of documentation. Also there is not much information available on databases of either dye-yielding plants or their products. The present paper is based on the extensive survey, collection of ethno-botanical information and review of relevant literature on the dye yielding resources of the Garhwal Himalaya. The study reports on 46 dye yielding plants belonging to 33 families, along with their vernacular names, habit, parts used, nature of dye and distribution. The aim of the present study has been to investigate the availability of natural dye-yielding plant species in the study area and gather information on traditional knowledge system associated with extraction and use of natural dyes by the villagers. Organic dyeing not only helps preserve the traditional art of weaving and design, but also provides employment and yields economic and ecological benefits. It also describes the preparation of dyeing stuffs, use of mordant and specific dye utilization to serve various purposes, including of new dye resources.

**Keywords:** Plant dyes, mordant, indigenous traditional knowledge.

### Introduction

Garhwal Himalaya occupies central part of the western Himalaya and lies in between the latitude and longitude of 30°-31°N and 78°-81°E respectively. The region comprises of six districts viz Tehri, Pauri, Uttarkashi, Rudrapur, Chamoli and Dehradun. Chamoli and Uttarkashi are border districts embracing with Tibet-China. This area is full of lush green valleys, natural lakes, rivers, waterfalls, alpine meadows and dense forests with rich biological diversity<sup>1-6</sup>. The study was carried out in one of the block of the district Tehri Garhwal is Narendra Nagar which sustains unique and diverse vegetation in wide range of habitats from Tarai- Bhabar tracts (275-1900 m. asl.) to the high range of lesser Himalaya. It lies in between 30° 10'-30° 17' N latitude and 78° 18'-78° 30'E longitude and covering in the area of 6, 8123 ha.

It stretches from Dhalwala to Than, Amsera, Jaikot, Gaja to Marora, Nigyer and Dhalwala to Kauriyala etc. Nomadic tribes are Gujjars and Bhotiyas, the former dwelling in the sub-montane zones during winters and moving towards high altitude during the summer seasons. Bhotiyas less often visit to the block. Several ethno-botanist have been work out the traditional uses of plants in the Garhwal Himalaya<sup>7-14</sup>. Dyes are one of the most important uses of the plant, as it relates with cultural practices, rituals, arts and craft, fabrics and to satisfy personal embodiment, however dye yielding have not significant intension.<sup>15-16</sup>

### Material and Methods

Extensive field surveys have been made during 2008-2011 to gather data on various aspects of dye yielding resources, along with their ethnobotanical studies. This information was also gathered from elderly women folk, priest and peoples associated with woolen fabrics living in different villages of Narendra Nagar block, Tehri Garhwal. They resided across various villages of Narendra Nagar block such as Than, Amsera, Khari, Jajal, Jaikot, Ghar-gaon, Kathur (Gaja), Marora, Nigyer, Dhalwala, Shivpuri, Byasi, Bachelikhal, Chaka, Pokhari etc. The methodology for collection of plant samples of dye yielding plants have been adopted as per recommended procedure<sup>17-18</sup>. All the collected plant specimens were identified with the help of recent and relevant floras and confirmed from the authentic specimens, housed in the Herbaria of Botanical Survey of India, Northern Circle (BSD), Dehradun, Forest Research Institute (DD), Dehradun and Garhwal University Herbarium (GUH), Srinagar Garhwal. All the collected plant specimens have been deposited in the Herbarium of H.N.B. Garhwal Central University, S.R.T. Campus Botany Department Badshahi Thaul, Tehri Garhwal and Botany Department Herbarium (GUH), Srinagar Garhwal.

In the following text, plant species were arranged alphabetically with their botanical names with citations, local names, family, habit dye yielding plant part used and nature of dye (table 1).

## Results and Discussion

The indigenous knowledge system particularly associated with extraction and processing of natural dyes from plants is ancient process. They have traditionally been engaged in extraction, processing and preparation of dyes using barks, leaves, fruits and roots of plant. 46 species belonging to 33 families have been recorded in the present work. Fabaceae is found to be most dominant six species followed by Acanthaceae with three species, Asteraceae, Euphorbiaceae, Lythraceae, Mimosaceae, Polygonaceae and Zingiberaceae with two species each. The remaining 24 families have one species each. Dye under utilization are produced from various parts of the plant, i.e. root, rhizome, stem, bark, leaf, flower, fruit, seed or whole plant, even in few cases resin or gum (*Acacia nilotica*, *Lannea coromandelica* and stem galls (*Terminalia chebula*) also yield dye. The important dyes extracted from roots or underground parts include *Curcuma domestica*, *Rubia cordifolia*, *Hedychium spicatum*, *Rumex hastatus*, *Urtica dioica*, *Berberis asiatica*. Etc. Stem or bark is the important dye source in *Acacia catechu*, *Lagerstroemia parviflora*, *Myrica esculenta*, *Pinus wallichiana*. Floral dyes include *Butea monosperma*, *Grevillia robusta*, *Punica granatum*, *Rhododendron arboretum*, *Tagetes erecta*, *Woodfordia fruticosa*. Fruit rind of *Acacia nilotica*, *Embilica officinalis* *Juglans regia*, *Mallotus philippensis* and *Punica granatum* are of common use. Sometimes pulp of fruit of *Embilica officinalis*, *Myrica esculenta*, *Princepia utilis* are also made into dyes. Whole plant used in dyes commonly includes *Peristrophe paniculata*. Generally chlorophyll, the source of green colour is easily extracted with the help of many solvents, therefore large numbers of plants are preferred to extract green dye i.e from the leaves of *Adhatoda zeylanica*, *Cupressus torulosa*, *Rumex hastatus*, etc. The actual nature of dye colour varies from plant to plant and their parts, including methods followed in dye preparations. Except for a few cases *Acacia catechu*, *Juglans regia*, *Mallotus philippensis*, *Princepia utilis*, *Punica granatum*, *Rubia cordifolia*, *Woodfordia fruticosa*, etc. most of the natural dyes are feeble in nature. Therefore, fastness or longevity of dyes depends on the use of mordants and experience of a person to bring refinement in particular dye or specific preparation. Techniques of extraction of dyes depend upon the specific part of the plant resource. To extract dye from underground root or rhizome, stem or bark, the material is cut into pieces, soaked in water for two to three days and made into paste. After squeezing and filtration, the whole extract is boiled and concentrated by repeating heating, subject to specific requirement. For fruits and fruit-rind, the material is squeezed into juice and added with required water. This solution is kept for 5-7 days in iron pots. In case of Kamala (*Mallotus philippensis*) the ripe fruits are collected and allowed to lie in heap. The powdered dye stuff of the fruit surface is separated through rubbing the fruits manually or sometimes fruits collected in a sac and externally pressed to isolate the dye powder. The floral parts and leaves, when used for dye, are crushed and dissolved in water for 24 hours, followed with gentle heating for the required concentration. Several of the

vegetable dyes are used as mordants and usage of mixture of dyestuff is a common practice. Light solution of organic manure, cow dung or urine, cream of tartar, curd water, ash of wood or bark, rock salt, lemon juice, lime water are common mordants used by the locales. Primitive methods of mordant utilization also include to keep the dye solution in iron, copper, or aluminium pots, and to add tanniferous materials like extract of tea, coffee, cinnamomum etc. With the advancement of knowledge, weak salts of iron, chromium, aluminium and tin have been used in the dye preparations. Now various chemical salts available in the market succeeded in the usage of mordants, a few are aluminium or potassium sulphate, potassium dichromate, ferrous sulphate, sodium carbonate, sodium bicarbonate, stannous chloride, etc. used by local experts to bring refinement in dyeing art. Most of the indigenous dye extraction processes, fresh, mature fruits, bark of *Terminalia chebula* and *Embilica officinalis* almost in equal parts by weight, are crushed and boiled in water for long periods in iron pots. The boiled mixture is then transferred to a pot having minute pores at the bottom through which only the thin liquid can percolate, leaving behind the residues in the pot. The pot with the mixture is placed over a tripod stand and another pot is placed below it, where the black thick liquid from the upper pot is collected in drops and allowed cool down. The thick liquid so collected in the lower pot is the dye (black) used for coloring clothes. The whole plant of *Achyranthes aspera* is dried, burnt to ashes and mixed with water. This is used as adhesive of various colour and making the colour brighter. A black dye is obtained from the bark of *Oroxylum indicum* which are soaked in water for 5-6 days or boiled. The dye is used for dyeing fishing nets.

In another process, the whole plant, leaves of *Rubia cordifolia*, shoots of *Ficus racemosa* separately or in mixture with parts (flowers, fruits, bark, leaves, etc.) of other natural dye-yielding plant species like *Juglans regia*, *Woodfordia fruticosa*, etc. are crushed and put in an iron pot, to which little water is added. The pot is kept undisturbed for 25 days during which period the contents of the pot get fermented. The fermented content is boiled to get a thick liquid and the extract is filtered through a piece of thin cloth to yield the natural dye. The colour of the dyes thus extracted and prepared through this process depends upon the plant species and parts used. In yet another process, hides of buffalo/ox/yak are burnt and about 50 g of the ash is mixed with gall bladder of locally available fish are crushed with leaves of *Solanum indicum*. The mixture is thoroughly mixed in about 1 liter of water and boiled till it becomes thick. The mixture is squeezed through a cloth to separate the liquid dye. To make the dye fast and non-washable, soot scraped out from cooking pots or burnt resin of *Pinus wallichiana* is added. However, addition of a few drops of bovine urine assigns quick drying property to the natural dyes. *Butea monosperma*, *Curcuma domestica*, *Geranium nepalense*, *Lannea coromandelica* *Lagerstroemia parviflora*, *Peristrophe paniculata*, *Toona hexandra* and several others are preferred for dyeing rough weaving and other textile fibre. *Juglans regia*,

*Lawsonia inermis*, *Embllica officinalis*, *Urtica dioica* are some of the plants used as hair-care dyes. A few decades back ink was prepared from the local resources. Commonly used plants yielding ink dye include *Acacia catechu*, *A. nilotica*, *Embllica officinalis*, *Hedychium spicatum*, *Juglans regia*, *Punica granatum* and *Terminalia chebula*. For ink preparation, dye yielding part is gently heated with water followed with filtration and solution is kept in pots, added with some mordants (alum, lac, tatri, etc.) or a little vegetable laxative gums (*Acacia catechu* and *Bombax ceiba*, *Acacia catechu*, *Aesculus indica*, *Juglans regia*, *Mallotus philippensis*, *Prinsepia utilis* *Toona hexandra*, etc. are used in wall and decorating wooden crafts.

## Conclusion

Wealth of traditional knowledge relating to dye yielding plants and their uses has been remained confined. The availability of cheap chemical dyes, the traditional practice of preparation of dye and their uses have been losing their popularity. Indigenous knowledge of extraction, processing and practice of using of natural dyes has done away to a great extent among the new generations of the ethnic groups and only a few of them still practice the process. Unfortunately, no such serious attempts have been made to document, preserve and take advantage of this immense treasure of traditional knowledge of natural dye preparation confined to the indigenous peoples. It is the high time to document these treasures of indigenous knowledge systems. Otherwise we bound to lose this vital information on the utilization of natural resources around us. Indigenous knowledge systems and methods of traditional utilizations of bio-resources of the ethnic groups of the state need to be documented to rescue them being lost forever. Commercialization of some of the natural dyes can be of successful venture to the rural population of the state through systematic and scientific approach with identification of resources, extraction, purifications, chemical structure and promotion of use of natural dyes, thereby enhancing their economy. As a whole, systematic approaches with scientific inputs would help in conserving the important plant resources, in addition to the indigenous knowledge base confined to the ethnic groups of Garhwal Himalaya

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**Table 1**  
**Dye yielding plants of Garhwal Himalaya**

Name of the Species	Vernacular Name	Family	Habit	Dye yielding plant parts (s)	Dye produced
<i>Abrus precatorius</i> L.	Ratti	Fabaceae	Climber	Seeds	Black
<i>Accacia catechu</i> (L.f) Willd.	Khair	Mimosaceae	Tree	Bark\ Wood	Dark- brown
<i>Accacia nilotica</i> L. (Willd) ex Del.	Babul	Mimosaceae	Tree	Fruit rind \ Gum	Black
<i>Achyranthes aspera</i> L.	Latjiri	Amaranthaceae	Herb	Whole plant	Black-Brown
<i>Adhatoda zeylanica</i> Medik.	Vasik	Acanthaceae	Shrub	Leaves	Yellow –green
<i>Artemisia japonica</i> Thunb.	Kunja	Asteraceae	Herb	Leaves	Brown
<i>Berberis aristata</i> DC	Kilmor	Berberidaceae	Shrub	Bark\ roots	Yellow
<i>Bixa orellena</i> L.	Sandoor	Bixaceae	Tree	Seed	Orange red
<i>Butea monosperma</i> (Lam.) Kuntze	Dhak	Fabaceae	Tree	Flowers	Yellow orange
<i>Cassia fistula</i> L.	Amaltas	Caesalpinaceae	Tree	Bark\fruits	Brown
<i>Cupressus torulosa</i> D. Don	Surai	Cupressaceae	Tree	Leaves	Green
<i>Curcuma domestica</i> Valetton	Haldi	Zingiberaceae	Herb	Rhizome	Yellow
<i>Desmodium multiflorum</i> DC.	Patioy	Fabaceae	Herb	Seed	Purple
<i>Emblica officinalis</i> Gaertn.syn	Anwala	Euphorbiaceae	Tree	Fruits\Bark	Dark Brown
<i>Erythrina suberosa</i> Roxb.	Madar	Fabaceae	Tree	Flower\Bark	Dark Brown
<i>Flemingia macrophylla</i> (Willd.) Prain.	Buor	Fabaceae	Shrub	Leaves and bark	Black
<i>Geranium wallichianum</i> D.Don ex Sweet	Syunli	Geraniaceae	Herb	Roots	Red- Brown
<i>Grevillea robusta</i> A. Cunnigh. Ex R. Br.	Silver-oak	Proteaceae	Tree	Flowers	Yellow
<i>Grewia optiva</i> Drumm. Ex Burr.	Bhimal	Tilaceae	Tree	Fruits	Yellow- orange
<i>Hedychium spicatum</i> Buch.-Ham. Ex Sm.	Bagaldu	Zingiberaceae	Herb	Rhizome	yellow
<i>Hypericum oblongifolium</i> Choisy	Basant	Hypericaceae	Herb	Flowers	Yellow
<i>Impatiens balsamina</i> L.	Gulmehndi	Balsaminaceae	Herb	Flowers	Red
<i>Indigofera tinctoria</i> Linn.	Sakina	Fabaceae	Shrub	Seed	Indigo
<i>Juglans regia</i> L.	Akrot	Juglandaceae	Tree	Bark\fruits	Camel\ Brown
<i>Lagerstroemia parviflora</i> Roxb.	Dhaura	Lythraceae	Shrub	Bark	Black
<i>Lannea coromandelica</i> (Houtt.) Merr.	Kalminia	Anacardiaceae	Tree	Bark\Resin	Yellow- Brown
<i>Mallotus philippensis</i> (Lam.) Muell.-Arg.	Ruina	Euphorbiaceae	Tree	Fruits	Red-Orange
<i>Mirabilis jalapa</i> L.	Gulabans	Nyctaginaceae	Herb	Flowers	Pink-red
<i>Myrica esculenta</i> Buch.-Ham. Ex D.Don	Kaphal	Myricaceae	Tree	Bark\Fruits	Red- yellow
<i>Oroxylum indicum</i> (L.) Vent.	Tantia	Bignoniaceae	Tree	Bark\Fruits	Black
<i>Peristrophe paniculata</i> (Forsk.) Burm.	Ban patrang	Acanthaceae	Tree	Whole plant	Greenish
<i>Phlogacanthus thyrsoformis</i> (Hardw.) Mabb.	Lalnya	Acanthaceae	Tree	Whole Plant	Greenish
<i>Pinus wallichiana</i> A.B. Jackson	Kail	Pinaceae	Tree	Bark	Black
<i>Prinsepia utilis</i> Royle	Bhainkal	Rosaceae	Shrub	Fruits	Blue
<i>Punicum granatum</i> L.	Darim	Punicaceae	Tree	Flower\Fruits	Yellow-red
<i>Rhododendron arboreum</i> Sm.	Burans	Ericaceae	Tree	Flowers	Red
<i>Rubia cordifolia</i> L.	Manjith	Rubiaceae	Herb	Whole plant	Red-brown
<i>Rumex hastatus</i> D.Don	Almorya	Polygonaceae	Herb	Roots	Yellow green
<i>Rumex nepalensis</i> Spreng.	Kathura	Polygonaceae	Herb	Roots	Yellow green
<i>Solanum nigrum</i> L.	Mikoi	Solanaceae	Herb	Seed	Black
<i>Tagetes erecta</i> L.	Genda	Asteraceae	Herb	Flowers	Yellow
<i>Tectona grandis</i> L.f.	Saigon	Verbenaceae	Tree	Leaves\ Bark	Reddish
<i>Terminalia chebula</i> (Gaertn.) Retz	Harad	Combrataceae	Tree	Root \bark	Dark blue
<i>Toona serrata</i> (Royle) M. Roem.	Toon	Meliaceae	Tree	Flowers\ seeds	Yellow-brown
<i>Urtica dioica</i> L.	Kandali	Urticaceae	Shrub	Roots	Brown- black
<i>Woodfordia fruticosa</i> (L.) Kurz	Dhaura	Lythraceae	Shrub	Flower\leaves	Red-yellow