

**FORMULATION AND EVALUATION OF HERBAL HAIR DYE  
CONTAINING HENNA, INDIAN BORAGE WITH NEEM EXTRACT**



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## **ABSTRACT**

Herbal based hair dyes are being preferred on large scale, due to vast number of advantages it exerts to overcome the ill effects of a chemical-based hair dye. We made an attempt to formulate an Herbal hair dye from plant-based ingredients such as Henna, Indian Borage, Indigo, Neem, Bhringaraj, Fenugreek, Tulsi, Amla, Curry Leaves, Hibiscus. The prepared formulations were evaluated for its organoleptic, phytoconstituents, physio – chemical, rheological aspects, patch test and stability testing for its efficacy and shelf life. The prepared herbal hair dye neither shows any side effects nor skin infections, act as a hair growth promoter, hair nourisher and anti-dandruff agent. In this attempt of formulation of herbal dye, formulation F3 has shown the better dyeing efficiency which produce darkest brown color as compared to other formulation and also stable at any place. The dye is effective, good in coloring effect, free from any obnoxious odor, totally biodegradable and very simple to use which was highly economical one, safe, consumer and eco- friendly.

**KEYWORDS:** Henna; Indian Borage; Tulsi; Herbal hair dye; Anti dandruff; Indigo; Neem; Hibiscus; Biodegradable; Eco-friendly.



## INTRODUCTION

From olden days itself, plants like Henna, Chamomile, Indigo etc are utilized to colour the white hair to get regular dark colour or red colour. Now days long-lasting dyes are available in the market but carries the issues of hypersensitivity in certain people. Some of the hair dyes contains 13% of phenylenediamine is an artificial colour and it mess the skin and garments during uses. The main advantage of herbal dye is the lack of hypersensitivity.

In comparison to natural hair dyes, synthetic hair dyes are reported to cause skin and other skin related diseases. The manufacturing process is hazardous to health of the people involved in the process and its applications leads to environmental pollution and also causes potential side effects to the consumers of the product. The fear of side effects from the synthetic dyes has limited its use by health-conscious customers throughout the world and has to overcome various regulatory barriers before it reaches its destination. A dye can generally be described as a coloured substance that has an affinity to the fibre, fur or hair. The dye is generally applied as aqueous solution, and may require a mordant to improve the fastness of the dye on the hair. Natural dyes also referred as mordant dyes. Different mordant will give different colour with the same dye. A mordant is thus an agent which allows a reaction to occur between the dye and the fibre, hair or fur. Hair dyes include dyes modifiers, antioxidants, alkalizers, soaps, ammonia, wetting agents, fragrance, and a variety of other chemicals used in small amounts that impart special qualities to hair such as softening the texture or give a desired action to the dye. The chemicals that are normally used in the dye are amino compounds (4-amino-2-hydroxytoluene and m-Aminophenol). Metal oxides, such as titanium dioxide and iron oxide, are also often used as colorants in the process. Colorants are classified as being temporary or permanent. In temporary colouring the colour can be washed from hair easily. Permanent colouring of hair involves addition of aromatic diamine or hydric phenols or poly-compounds such as para phenylenediamine in the formulation. Continuous usage of such compounds containing dye on natural hair causes so many side effects such as skin irritation, erythema, loss or damage of hair and skin cancer. Other chemicals used in hair dyes act as modifiers, which stabilize the dye pigments or otherwise act to modify the shade<sup>[1]</sup>



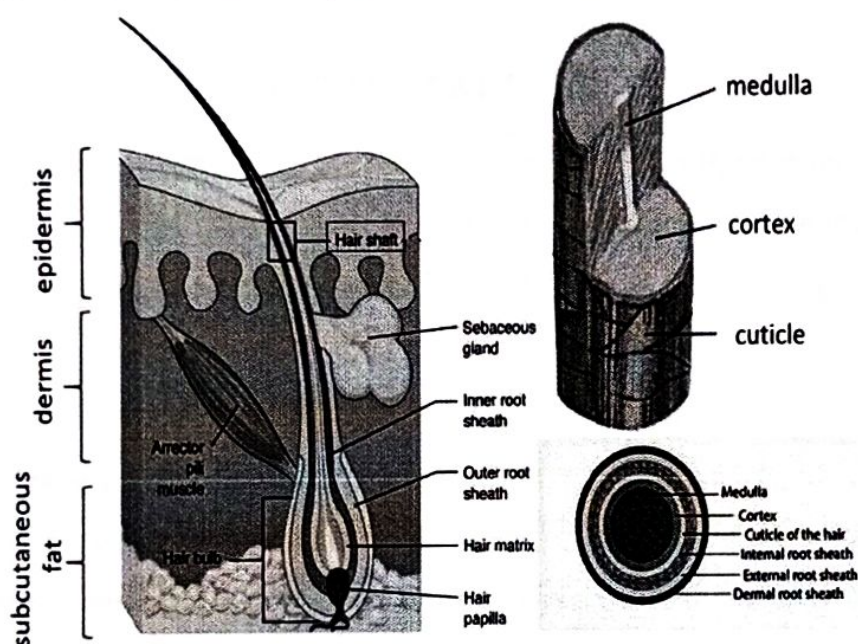
## **HAIR**

Hair, protective appendages on the body and structures of integument with sebaceous glands, sweat glands and nails are considered an important part of the body, derived from the skin ectoderm. They are also known as epidermal derivatives, since they originate from the epidermis during embryological development.

The hair is mainly constituted by 3 parts: the bulb, the root and the stem, and it is implanted in the pilo- sebaceous follicle in the dermis. The bulb is the deepest end of the hair and is also the portion that makes it grow. It is connected to the richly innervated and vascularized dermal papillae, which allow the contribution of nutrients necessary for hair growth. Keratin is the main component of the hair. It is a fibrous and resistant protein, whose amino-acidic chains are organized in an alpha helix and contains mainly tyrosine, glycine and cysteine. If on one hand, hair texture and shine are usually related to hair surface properties, on the other hand, the integrity of hair is due to the hair cortex. Hair products that improve the structural integrity of hair fibres and increase tensile strength, increase hair volume, reduce frizz, improve hair manageability, stimulate new hair growth are available along with products for treating diseases related to hair and scalp. Modern cosmetic products are formulated to clean hair from detritus, and to restore and improve hair physiology. Synthetic or Chemical hair dyes cause skin or other skin-related side effects. Therefore, herbal hair dye is preferred nowadays. Herbal drugs are used for healthy hair. Almost 70% of the population faces the problem of balding and greying of hair. The age at which greying starts is deeply influenced by heredity. But premature depigmentation in adults is mainly due to several other factors such as illness, some specific drugs, shock, etc. People have been using natural dyes since ancient times for many purposes including dyeing carpets, rugs, and clothing's with the help of roots, stems, barks, leaves, berries, and flowers of various dye yielding plants. The need for herbal-based natural products is increasing day by day due to their natural goodness and side effects free. The most widely used ayurvedic herbal drugs are Amla, Bhringraj, Henna, Mandara, Jatamansi, Reetha, Sariva, Curry leaves, and Methi seeds and are traditionally used as hair colorant and for hair growth. Indigo, known as an initial fabric dye, could be mixed with henna to make different light brown to black shades of hair dye. Use of these chemicals can result in unpleasant side effects, such as skin irritation, allergy, hair breakage, skin discoloration, unexpected hair

colour, etc. Continuous application of such compounds on natural hair causes multiple side effects such as skin irritation, allergy, hair fall, dry scalp, erythema, and also in some cases skin cancer. In India, henna has been used traditionally for colouring palms (Mehndi) and hairs. Henna

has wonderful benefits to offer your hair. Henna is amongst the most popular ingredients in the Middle Eastern countries for medicinal and dying purposes. It is used to dye fabric, skin, and hair. Henna is a plant extracted pigment; the leaves of the henna tree are dried and crushed to powder, from which henna hair dye is prepared. Henna powder benefits for scalp and hair are undeniable.



**Fig 1 : Structure of Hair<sup>[3]</sup>**

The leaves from the henna tree are rich in antioxidants and proteins that enhance your hair health.<sup>[2]</sup>

## **BENEFITS OF USING HENNA HAIR DYE**

### **• ACCELERATED HAIR GROWTH**

Natural henna hair colour strengthens the hair, prevents them from falling, breaking, or thinning, resulting in healthier-looking hair. Regular use of henna results in accelerated growth.

### **• NOURISHED SCALP**



Henna has natural properties of nourishment which helps in transforming dull and dry hair into luscious manageable locks. Its antimicrobial and antifungal characteristics help in cooling and soothing your scalp, which controls the scalp itchiness.

- **MULTIPLE SHADES OF HENNA**

Henna gives different shades depending upon the base colour of your hair. If your hair is Gray or white, henna hair dye will result in reddish-orange colour. If you already have black or dark brown hair, it will give a slightly different shade but won't make much difference.

- **REDUCED HAIR FALL**

Henna penetrates deep into the scalp and nourishes it, improving follicle health. It helps in controlling hair fall and also reduces hair thinning. Henna powder and mustard oil are a great mixture for controlling hair fall.

- **SMOOTH HAIR**

Henna conditions the hair when mixed with the right ingredients. Henna powder and eggs make a great natural conditioner for hair. Apply the mixture for a short period of time, one hour or less. You can feel a clear difference after one wash. Your hair will feel smooth and silky for days.

- **CONTROLLED DANDRUFF**

Henna helps in controlling dandruff and stops it from coming back. As henna hair dye removes extra dirt and grease from the scalp and nourishes it, its regular use reduces dandruff problems.

- **SPLIT ENDS PREVENTION**

Often dry hair tends to have split ends; simply trimming them off isn't enough. It would be best if you broke the never-ending cycle. Use the henna mixture to nourish your hair; healthy hair means no split ends.

- **NATURAL DYE**

Obviously, henna is a natural dye that helps nurture the hair and make it healthy. It is a cost-effective and healthier alternative to conventional chemical dyes.

- **BALANCED PH**

Henna helps in controlling extra sebum production in the scalp. It helps in sustaining the pH level of the scalp.

- **THICKER HAIR**

Henna makes your hair stronger, thicker, and restores natural shine.

- **RETAIN HAIR HEALTH**

Regular use of chemical-based hair dyes can result in hair breakage and loss, which ultimately leads to unhealthy hair. Luckily, we have natural dyes that do not damage your hair in any which way possible.

- **CONDITIONING OF HAIR**

The natural ingredients and essential nutrients in Natural Hair Dyes condition your hair. Shiny, strong, thick and healthy hair is guaranteed.

- **MINIMUM ENVIRONMENTAL IMPACT**

Formulated using natural ingredients, the dyes are not harmful for the environment. Being biodegradable, the dyes don't cause any pollution too.<sup>[4]</sup>

## **TYPES**

### **1. Earth Dye**

Natural hair dyes offer an alternative to harsher chemicals often present in hair dyes. Earth Dye claim that their hair dyes condition hair and restore its health, as well as colouring it.

### **Positives**

- are 100% hypoallergenic
- are plant-based and contain zero chemicals
- are easy to use
- work in 10–60 minutes
- work on eyebrows, goatees, and beards
- are safe to use during pregnancy or after chemotherapy

### Negatives

1. According to earth dye, their products can help hair grow faster.
2. As a result, the hair may need more frequent root touch-ups.
3. A person may also need to purchase specialty shampoo to help keep the colour intact.

### Ingredients

- indigo (*Indigofera tinctoria*)
- Shukokai (*Acacia concinna*)
- henna (*Lawsonia inermis*)
- brahmi (*Bacopa monnieri*)
- baheda (*Terminalia bellirica*)
- bhringraj (*Eclipta alba*)
- amla (*Emblica officinalis*)

## 2. Light Mountain

Light Mountain offers a variety of colors in their Natural and Colour the Gray! ranges.



## **Benefits**

- contain organic ingredients
- come in various shades, including reds, browns, chestnuts, and black
- are Leaping Bunny certified
- are gluten-free

## **Negatives**

- These products cannot lighten dark hair.
- Covering hair that is more than 10% white, Gray, or platinum blonde involves a two-step process.

## **Ingredients**

- henna
- indigo
- senna leaf powder
- amla fruit powder

## **3.The Henna Guys**

According to The Henna Guys, their dyes are safe for people with sensitive skin and scalps. Their dye comes from the leaves of a flowering plant, henna, which contain a red-orange pigment called lawsone. It is important to note that the colour is permanent.

### **Benefits**

- come from 100% natural henna
- are raw
- are cruelty-free

- are gluten-free
- are free from chemicals and metallic salts
- are safe to use on beards
- are ethically sourced

### **Negatives**

- With Gray and chemically dyed hair, it may take more than a single application for the henna to colour properly.
- The products cannot lighten dark hair.
- Some colours require a two-step process.
- The overall process may be complicated for first-time users.
- Certain colours require 8 – 10 hours of application time.
- The products are not suitable for use on eyebrows or eyelashes.

### **Ingredients**

- henna
- indigo powder
- amla (*Phyllanthus embolic*)
- neem (*Azedarach indica*)

## **4. Sante**

Sante's hair dyes contain ingredients such as organic henna, ground herbs, fruits, and wheat proteins.

### **Benefits**



- are certified by the International Natural and Organic Cosmetics Association, known as Nature
- are available as powders or ready-made creams
- comprise 14 colour options
- are suitable for grey hair

### Negatives

These hair dyes work best with ambient heat, such as from a towel around the head or a nearby heater, oven, or fireplace. The leave-on time is between 15 minutes to 2 hours depending on the natural colour of a person's hair and the chosen dye.

### Ingredients

- *Cassia auriculata* leaf powder, a form of senna
- rhubarb root powder (*Rheum undulate*)
- English walnut shell powder (*Juglans regia*)
- henna leaf powder
- *Coffea arabica* seed powder
- indigo leaf powder
- betaine
- algin<sup>[5]</sup>

### ADVANTAGES OF HERBAL HAIR DYE

- ❖ No mess or hair colour on your skin.
- ❖ Using herbal hair dye is one of the best quick fixes without any side effects.
- ❖ This hair dye will help you strengthen your hair and keep your hair protected

from chemicals throughout the procedure.

- ❖ If you want soft & silky coloured hair, this is the best option.
- ❖ Both men & women can use it.

## DISADVANTAGES OF HERBAL HAIR DYE

- ❖ Herbal drugs have slower effects as compare to allopathic dosage forms.
- ❖ It requires long term therapy.
- ❖ It is difficult to hide taste & odour.
- ❖ Manufacturing process are time consuming & complicated.
- ❖ No pharmacopoeia defines any specific procedure or ingredients to be used in any of the herbal cosmetics.<sup>[6]</sup>

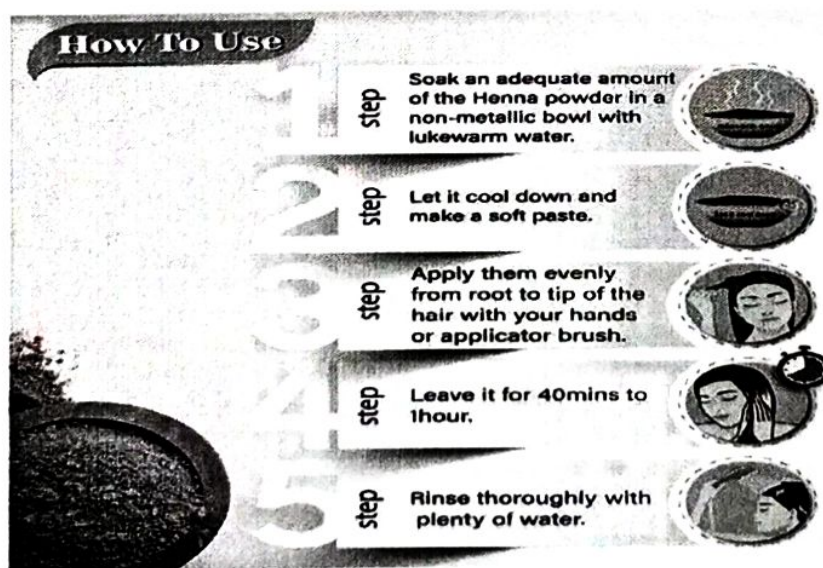


Fig 2 : How to use the Dye<sup>[7]</sup>



# ROLE OF INGREDIENTS

## 1.HENNA

Henna is widely used in the cosmetic industry as dyeing agent. It consists of fresh or dried leaves of the plant *Lawsonia inermis*. It has medicinal importance along with dyeing property. The active constituents of the leaf are lawsone is principally responsible for the colourant property of the henna leaves. Henna likewise lessens untimely turn grey of hair, since it is stacked with tannins, a plant compound found in a tea that adds to their rich shading. Henna contains vitamin E. which assists with mellowing hair. The natural leaves of the plant are rich in proteins and antioxidants that support hair health.<sup>[9][2]</sup>

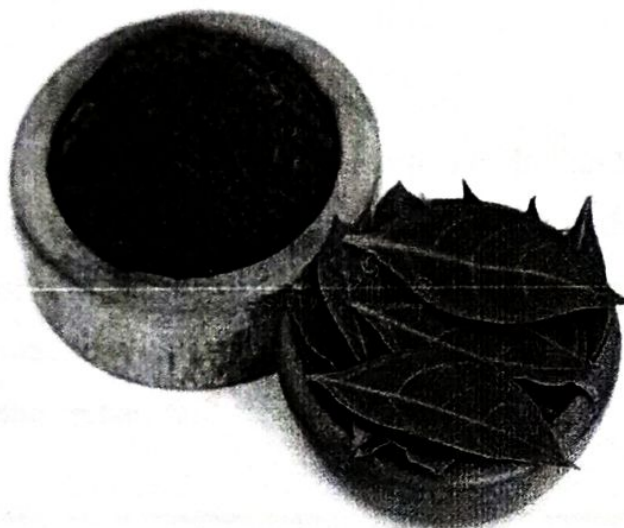
Kingdom: Plantae

Order: Myrtales

Family: Lythraceous

Genus: *Lawsonia*

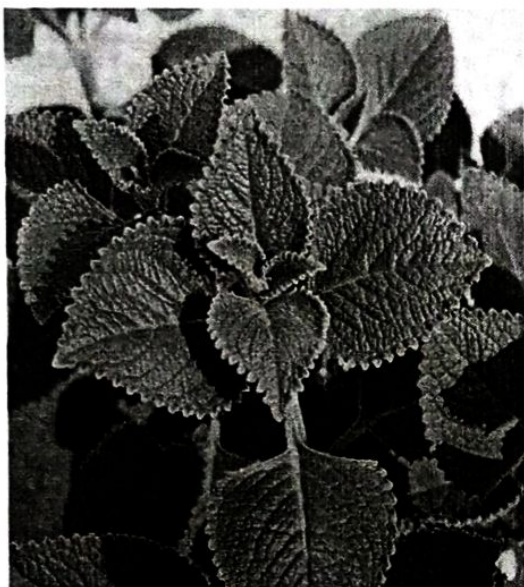
Species: *L. inermis*



**Fig 3 : Henna<sup>[8]</sup>**

## 2.INDIAN BORAGE

Indian Borage (*Coleus amboinicus Benth*) also known as country borage, is a medicinal plant used widely in Indian medicine. It is a succulent, aromatic, perennial herb belonging to the family Lamiaceae and decoction of its leaves is used for several medicinal purposes. Insect bites and stings, eczema & psoriasis can all benefit from the anti - inflammatory properties of Indian Borage, which can quickly reduce redness, swelling, itching & inflammation. Gamma – linoleic acid is present and helps to reduce inflammation, dermatitis, allergies and pain in the skin.<sup>[10]</sup>



Kingdom:	<u>Plantae</u>
Order:	<u>Lamiae's</u>
Family:	<u>Liliaceae</u>
Genus:	<u>Coleus</u>
Species:	<i>C. amboinicus</i>

**Fig 4 : Indian Borage<sup>[11]</sup>**

### 3.NEEM

*Azadirachta indica*, commonly known as margosa, neem, nimtree or Indian lilac, is a tree in the mahogany family Meliaceae. It is one of two species in the genus *Azadirachta*. Beneficial effects of different parts of neem are attributed to its biologically active principle "Azadirachtin". Benefits of neem leaves for hair includes treating dandruff & itchy scalp, reducing hair fall<sup>[12]</sup>

Kingdom:	Plantae
Order:	Sapindales
Family:	Meliaceae
Genus:	<i>Azadirachta</i>
Species:	<i>A. indica</i>



**Fig 5 : Neem<sup>[13]</sup>**

### 4.HIBISCUS

*Hibiscus rosa sinensis* is an evergreen shrub belonging to the cotton family Malvaceae. It is excellent for increase in hair growth activity. Hibiscus is naturally enriched with



calcium, phosphorus, iron, vitamin c, riboflavin, niacin which helps to promote thicker hair growth and decrease premature greying of hair. It controls dandruff & used to rejuvenate the hair by conditioning it. Hibiscus exhibit antioxidant properties by producing flavonoids such as anthocyanins & other phenolic compounds.<sup>[14][9]</sup>

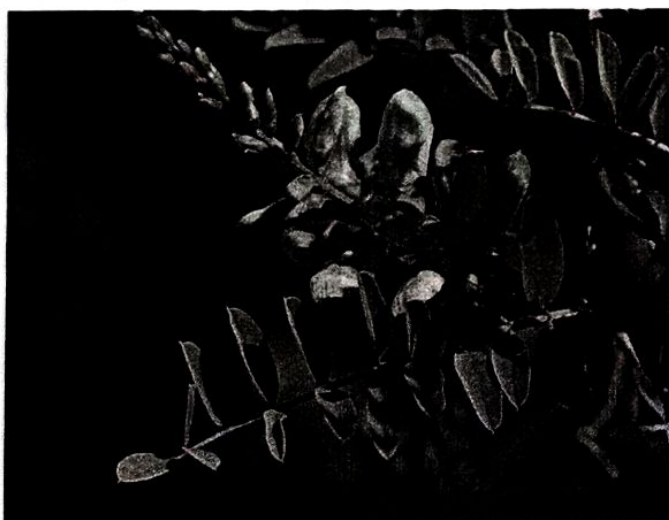


**Fig 6 : Hibiscus<sup>[15]</sup>**

Kingdom:	Plantae
Order:	Malvales
Family:	Malvaceae
Genus:	Hibisceae
Species:	Hibiscus

## 5.INDIGO

*Indigofera tinctoria* conditions & feeds the foundations of the hair and makes each strand of hair more grounded. Indigo powder forestalls scalp disease and utilising it with coconut oil advances the scalp with everyone of the supplements and makes hair more grounded and better. The compound responsible for the colouring action is called glycoside – a combination of glucose and indoxyl.<sup>[16]</sup>



**Fig 7 : Indigo<sup>[17]</sup>**

<u>Kingdom:</u>	<u>Plantae</u>
<u>Order:</u>	<u>Fabales</u>
<u>Family:</u>	<u>Fabaceae</u>
<u>Genus:</u>	<u>Indigofera</u>
<u>Species:</u>	<u>I.tintoria</u>

## 6.FENUGREEK

Fenugreek (*Trigonella gladiata*) is an annual plant belongs to the family Fabaceae. Fenugreek is rich in protein & nicotinic acid content, renowned for their capacity to fight hair fall & dandruff. It also treats dryness of hair, controls balding, & hair thinning.<sup>[18][9]</sup>

Kingdom:	<u>Plantae</u>
Order:	<u>Fabales</u>
Family:	<u>Fabaceae</u>
Genus:	<u>Trigonella</u>
Species:	<b><i>T.gladiata</i></b>



Fig 8 : Fenugreek<sup>[19]</sup>

## 7.CURRY LEAVES

*Bergera koenigii* are rich in antioxidants which help moisturise the scalp, and also remove dead hair follicles. curry leaves are beneficial to the hair since they are high in beta carotene & protein content, which are instrumental in preventing hair loss and thinning of hair. They retain the luster and shine of hair<sup>[20]</sup>

Kingdom:	Plantae
Order:	Sapindales
Family:	Rutaceae
Genus:	<i>Bergera</i>
Species:	<b><i>B. koenigii</i></b>



Fig 9 : Curry leaves<sup>[21]</sup>



## 8.AMLA

*Phyllanthus emblica* has anti - bacterial and cell reinforcement properties that can assist with advancing the development of solid and shiny hair. It contains vitamin c, tannins, amino acids, alkaloids, carbohydrates and reduces hair fall and condition your scalp [9][2]

Kingdom:	Plantae
Order:	Malpighiales
Family:	Phyllanthaceae
Genus:	<i>Phyllanthus</i>
Species:	<i>P. emblica</i>



Fig 10 : Amla<sup>[22]</sup>

## 9.BHRINGRAJ

It is also known as "false daisy". *Eclipta prostrata* act as a hair tonic. It works miraculously on hair problems such as hair fall, dandruff, premature greying, and also strengthen hair. Bhringraj plays a pivotal role in treating and preventing baldness. It effectively increases blood circulation in the scalp and hair follicles, which in turn enriches the roots by bringing in more nutrients through the blood supply & promote hair growth.<sup>[2][20]</sup>

Kingdom:	Plantae
Order:	Asterales
Family:	Asteraceae
Genus:	<i>Eclipta</i>
Species:	<i>E. prostrata</i>



Fig 11 : Bhringaraj<sup>[23]</sup>

## 10.TULSI

Tulsi (*Ocimum tenuiflorum*) not only reduce dandruff and scalp itchiness but also leave you with smooth, shiny tresses. Premature greying can occur due to lack of vitamin B 12 in the hair follicle. Tulsi promotes hair pigment production, reducing grey hair. Basil is packed with nutrients like vitamins A & C, iron, calcium that are essential for healthy hair growth.<sup>[24]</sup>

Kingdom:	Plantae
Order:	Lamiales
Family:	Lamiaceae
Genus:	<i>Ocimum</i>
Species:	<i>O. tenuiflorum</i>



Fig 12 : Tulsi<sup>[25]</sup>