

Cosmeceutical Applications of Eclipta alba Oil in Herbal Hair Preparations

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Abstract—Herbal cosmetics have gained considerable attention due to their safety, effectiveness, and minimal adverse effects compared to synthetic products. Among various medicinal herbs, Eclipta alba, commonly known as Bhringraj, occupies a significant place in traditional systems of medicine for hair care and scalp treatment. Bhringraj oil is widely utilized in herbal hair preparations because of its nourishing, rejuvenating, antimicrobial, and hair growth-promoting properties. The oil contains several bioactive phytoconstituents such as wedelolactone, ecliptine, flavonoids, alkaloids, and triterpenoids that contribute to its therapeutic and cosmeceutical effects. The present review highlights the botanical profile, phytochemical constituents, pharmacological activities, mechanisms of action, and cosmeceutical applications of Bhringraj oil in herbal hair formulations. The review also discusses its role in controlling dandruff, premature graying, alopecia, scalp infections, and hair fall. Furthermore, different herbal hair preparations containing Bhringraj oil, including hair oils, shampoos, hair masks, conditioners, and serums, are summarized. The growing demand for natural and sustainable cosmetic products has enhanced the commercial importance of Bhringraj-based formulations in the cosmeceutical industry. This review provides comprehensive scientific information regarding the utilization of Bhringraj oil as an effective herbal ingredient for healthy hair management.

Index Terms—Bhringraj oil, Herbal cosmetics, Cosmeceuticals, Hair growth, Herbal hair preparations, Eclipta alba, Alopecia, Dandruff control

I. INTRODUCTION

Hair is considered an important component of physical appearance and psychological confidence in

both men and women. Healthy hair reflects overall wellness and has significant social and cosmetic importance. In recent decades, rapid urbanization, environmental pollution, stress, poor nutrition, hormonal imbalance, and excessive use of chemical-based cosmetic products have contributed to various hair disorders such as dandruff, alopecia, hair thinning, scalp irritation, split ends, and premature graying. These problems have increased the global demand for safe, effective, and natural hair care products.

Cosmeceuticals are products that combine cosmetic and pharmaceutical properties to improve appearance while providing therapeutic benefits. Herbal cosmeceuticals have gained remarkable popularity because they are perceived as safer and more compatible with the human body than synthetic products. Medicinal plants contain numerous bioactive compounds with antioxidant, antimicrobial, anti-inflammatory, and rejuvenating properties that support hair and scalp health. Herbal hair formulations are therefore widely used in shampoos, oils, conditioners, serums, gels, and hair masks.

Among the medicinal plants used in traditional hair care systems, Eclipta alba occupies a prominent position in Ayurveda and other traditional medicinal systems. The herb is commonly referred to as “Kesharaja” or “King of Hair” because of its exceptional benefits in promoting hair growth and maintaining scalp health. Traditionally, Bhringraj oil has been used to reduce hair fall, strengthen hair follicles, delay premature graying, improve hair texture, and treat scalp disorders. Ancient Ayurvedic

literature describes Bhringraj as a rejuvenating herb with cooling, nourishing, and restorative properties. Bhringraj oil is generally prepared by processing the fresh juice or extract of the plant in carrier oils such as coconut oil, sesame oil, or castor oil. The resulting medicated oil contains several biologically active phytoconstituents including wedelolactone, demethyl wedelolactone, ecliptine, flavonoids, alkaloids, triterpenoids, and polyacetylenes. These phytochemicals exhibit antioxidant, antimicrobial, hepatoprotective, anti-inflammatory, and hair growth-promoting activities. Scientific studies suggest that Bhringraj oil stimulates hair follicles, prolongs the anagen phase of the hair cycle, and improves blood circulation in the scalp region. The growing awareness regarding the adverse effects of synthetic hair cosmetics such as irritation, allergic reactions, hair shaft damage, and scalp dryness has encouraged consumers to shift toward plant-based formulations. Consequently, pharmaceutical and cosmetic industries are increasingly focusing on the development of herbal cosmeceutical products containing Bhringraj oil. The incorporation of Bhringraj into modern herbal formulations represents a promising approach for developing safer and more effective hair care products.

II. BOTANICAL PROFILE OF BHRINGRAJ

Eclipta alba belongs to the family Asteraceae and is widely distributed in tropical and subtropical regions of Asia, Africa, and South America. The plant commonly grows in moist areas, riverbanks, marshy lands, and agricultural fields. It is an annual herb with small white flowers and opposite leaves. The entire plant possesses medicinal value and is extensively used in Ayurvedic and traditional medicine for liver disorders, skin diseases, wound healing, and hair care applications.

Taxonomical Classification

| Category | Description |
|----------|--|
| Kingdom | Plantae |
| Division | Magnoliophyta |
| Class | Magnoliopsida |
| Order | Asterales |
| Family | Asteraceae |
| Genus | <i>Eclipta</i> |
| Species | <i>Eclipta alba</i> / <i>Eclipta prostrata</i> |

The plant generally reaches a height of 20–50 cm and possesses cylindrical stems with numerous branches. The leaves are sessile, lanceolate, and dark green in color. The flowers are small, white, and arranged in solitary heads. The fruits are compressed achenes containing black seeds. Bhringraj can grow under diverse environmental conditions and is commonly cultivated for medicinal purposes.

Traditionally, different parts of the plant including leaves, roots, stems, and whole plant extracts are used in medicinal preparations. However, leaves are considered the most therapeutically active part because they contain a higher concentration of bioactive constituents. Fresh leaf juice is often used for preparing medicated hair oils and herbal formulations. In Ayurveda, Bhringraj is classified as a “Rasayana” herb due to its rejuvenating and restorative effects.

The plant exhibits various pharmacological activities such as antioxidant, antimicrobial, anti-inflammatory, hepatoprotective, analgesic, immunomodulatory, and hair growth-promoting effects. These activities are primarily attributed to the presence of coumestans, flavonoids, and triterpenoid compounds. Due to its extensive therapeutic properties, Bhringraj has become one of the most commercially important medicinal plants in herbal cosmetic industries.

III. PHYTOCHEMICAL CONSTITUENTS OF BHRINGRAJ OIL

The therapeutic and cosmeceutical properties of Bhringraj oil are mainly attributed to its diverse phytochemical composition. Phytochemicals are naturally occurring bioactive compounds synthesized by plants for protection and survival. These compounds exhibit significant biological activities that contribute to hair nourishment, scalp protection, and follicular stimulation.

Extensive phytochemical investigations have revealed the presence of coumestans, flavonoids, alkaloids, glycosides, triterpenoids, phytosterols, thiophenes, and polyacetylenic compounds in Bhringraj extracts and oils. Among these compounds, wedelolactone and demethyl wedelolactone are considered major active principles responsible for many pharmacological activities. These constituents exhibit antioxidant and anti-inflammatory activities

that protect hair follicles from oxidative damage and inflammation-induced hair loss.

Major Phytoconstituents Present in Bhringraj Oil

| Phytochemical | Biological Role |
|------------------------|--|
| Wedelolactone | Hair growth promotion and antioxidant activity |
| Demethyl wedelolactone | Anti-inflammatory effect |
| Ecliptine | Follicular nourishment |
| Flavonoids | Free radical scavenging activity |
| Alkaloids | Antimicrobial activity |
| Triterpenoids | Scalp conditioning |
| Polyacetylenes | Antifungal effect |
| Sterols | Hair strengthening activity |

Flavonoids present in Bhringraj help neutralize free radicals generated by environmental pollutants and ultraviolet radiation. Oxidative stress is one of the major causes of premature aging of hair follicles and scalp damage. Therefore, the antioxidant activity of these compounds plays an important role in maintaining healthy hair growth.

The antimicrobial and antifungal properties of Bhringraj oil are beneficial in preventing dandruff and scalp infections. The presence of alkaloids and polyacetylenes contributes to inhibition of microbial growth on the scalp surface. Furthermore, triterpenoids and sterols help improve scalp hydration and hair texture by forming a protective layer over the hair shaft.

Recent studies have also reported that Bhringraj extracts contain minerals, vitamins, and essential nutrients important for hair follicle metabolism. These compounds support keratin synthesis and improve the strength and elasticity of hair fibers. The synergistic action of various phytoconstituents makes Bhringraj oil an effective ingredient in herbal hair preparations.

IV. MECHANISM OF ACTION OF BHRINGRAJ OIL IN HAIR CARE

Bhringraj oil exerts multiple beneficial effects on hair and scalp through various biological mechanisms. The combined action of antioxidant, anti-inflammatory, antimicrobial, and follicular

stimulating compounds contributes to its effectiveness as a herbal hair tonic.

4.1 Promotion of Hair Growth

One of the major therapeutic effects of Bhringraj oil is stimulation of hair growth. Research studies indicate that Bhringraj extract enhances the proliferation of dermal papilla cells and activates hair follicles. The oil improves blood circulation in the scalp region, thereby increasing oxygen and nutrient supply to hair roots. This process helps prolong the anagen or active growth phase of the hair cycle.

4.2 Reduction of Hair Fall

Hair fall occurs due to follicular damage, oxidative stress, hormonal imbalance, nutritional deficiency, and scalp inflammation. The antioxidant phytoconstituents present in Bhringraj oil reduce oxidative damage to hair follicles and strengthen hair roots. Regular application of the oil helps reduce breakage and improves follicular anchoring within the scalp.

4.3 Anti-Dandruff Activity

Dandruff is mainly caused by excessive growth of scalp microorganisms and increased shedding of dead skin cells. Bhringraj oil exhibits antifungal and antimicrobial activities against dandruff-associated fungi and bacteria. The oil also moisturizes the scalp and reduces dryness, itching, and irritation associated with dandruff conditions.

4.4 Prevention of Premature Graying

Premature graying is associated with oxidative stress and degeneration of melanocytes responsible for hair pigmentation. Bhringraj oil contains antioxidant compounds that protect melanocytes from oxidative damage and support melanin production. Continuous use may help maintain the natural color and shine of hair.

4.5 Scalp Nourishment and Conditioning

The emollient properties of Bhringraj oil help maintain scalp hydration and improve hair texture. The oil forms a protective layer around hair fibers, thereby reducing dryness, roughness, and split ends. Its cooling and soothing effect also helps relieve scalp stress and irritation.

V. COSMECEUTICAL APPLICATIONS OF BHRINGRAJ OIL

Bhringraj oil has become an important ingredient in herbal cosmeceutical formulations due to its multifunctional therapeutic properties. The increasing preference for natural and chemical-free cosmetics has significantly enhanced the commercial value of Bhringraj-based products in the cosmetic industry.

5.1 Herbal Hair Oils

Bhringraj oil is extensively utilized in medicated hair oils formulated for hair nourishment, strengthening, and scalp rejuvenation. These oils are commonly prepared using sesame oil, coconut oil, or castor oil as carrier bases. The addition of herbs such as *Phyllanthus emblica*, *Bacopa monnieri*, *Azadirachta indica*, and *Hibiscus rosa-sinensis* enhances therapeutic efficacy. These oils help improve scalp circulation, reduce hair fall, and increase hair density.

5.2 Herbal Shampoos

Bhringraj extract is incorporated into herbal shampoos because of its cleansing, antimicrobial, and conditioning properties. Herbal shampoos containing Bhringraj effectively remove dirt and excess oil without damaging the natural scalp barrier. They also help reduce dandruff, itching, and scalp irritation while promoting stronger hair roots. Unlike synthetic shampoos containing sulfates and parabens, herbal formulations are generally milder and safer for long-term use.

5.3 Hair Conditioners

Conditioners containing Bhringraj oil improve softness, manageability, and shine of hair. The oil smoothens the cuticle surface and minimizes frizz and split ends. Its moisturizing properties help restore hydration in dry and damaged hair. Herbal conditioners containing Bhringraj are particularly beneficial for chemically treated or heat-damaged hair.

5.4 Hair Serums

Modern herbal hair serums utilize Bhringraj oil for protection against environmental pollutants, ultraviolet radiation, and thermal damage caused by styling equipment. These serums provide a protective coating over hair shafts and improve elasticity and texture. The lightweight formulation allows easy

application without leaving excessive oiliness on the scalp.

5.5 Hair Masks and Hair Packs

Hair masks containing Bhringraj powder or oil provide intensive nourishment to the scalp and hair follicles. These preparations are generally used for repairing damaged hair, improving scalp hydration, and enhancing hair smoothness. Herbal hair packs containing Bhringraj are also utilized for detoxifying the scalp and promoting healthy hair growth.

VI. PHARMACOLOGICAL ACTIVITIES RELATED TO HAIR CARE

The effectiveness of Bhringraj oil in herbal hair preparations is strongly associated with its pharmacological activities. These activities contribute significantly to the prevention and management of various scalp and hair disorders.

6.1 Antioxidant Activity

Oxidative stress is one of the major causes of follicular degeneration and premature aging of hair. Bhringraj contains flavonoids and coumestans that neutralize free radicals and reduce oxidative damage to scalp tissues. Antioxidant activity helps maintain follicular integrity and supports healthy hair growth.

6.2 Anti-inflammatory Activity

Inflammation of the scalp may lead to itching, irritation, follicular damage, and hair loss. Bhringraj oil exhibits anti-inflammatory activity by inhibiting inflammatory mediators and reducing scalp redness and irritation. This property is beneficial in managing inflammatory scalp conditions.

6.3 Antimicrobial Activity

The antimicrobial constituents present in Bhringraj inhibit the growth of bacteria and fungi associated with scalp infections. This activity contributes to scalp hygiene and dandruff control. The use of herbal antimicrobial agents also reduces dependency on synthetic chemicals in cosmetic products.

6.4 Hair Growth-Promoting Activity

Experimental studies have demonstrated that Bhringraj extract stimulates hair follicle proliferation and promotes faster hair growth. The oil improves nutrient delivery to follicles and enhances keratin

synthesis, resulting in thicker and healthier hair strands.

6.5 Cooling and Relaxing Effect

In Ayurveda, Bhringraj is traditionally regarded as a cooling herb that relieves mental stress and scalp heat. Regular scalp massage with Bhringraj oil improves relaxation and may indirectly support healthy hair growth by reducing stress-induced hair loss.

6.6 Pharmacological Activities Related to Hair Care

| Activity | Role in Hair Care |
|----------------------------|--|
| Antioxidant activity | Protects follicles from oxidative stress |
| Anti-inflammatory activity | Reduces scalp irritation |
| Antimicrobial activity | Prevents scalp infections |
| Antifungal activity | Controls dandruff |
| Hair growth promotion | Stimulates follicular growth |
| Cooling effect | Relieves scalp stress |

VII. ADVANTAGES OF BHRINGRAJ OIL IN HERBAL COSMETICS

- Natural and safe for long-term use
- Minimal side effects
- Suitable for different hair types
- Eco-friendly and biodegradable
- Rich in bioactive phytoconstituents
- Multifunctional therapeutic benefits

VIII. LIMITATIONS AND CHALLENGES

Despite its benefits, certain limitations are associated with Bhringraj oil formulations:

- Strong herbal odor
- Variability in phytochemical composition
- Limited stability of herbal preparations
- Requirement for standardization
- Possibility of microbial contamination during storage

Proper formulation strategies and quality control measures are therefore essential.

IX. CONCLUSION

Bhringraj oil is an important herbal ingredient widely used in cosmeceutical hair preparations because of its significant therapeutic and cosmetic benefits. The presence of biologically active phytoconstituents contributes to its hair growth-promoting, antimicrobial, antioxidant, and scalp-protective properties. Bhringraj oil effectively helps manage dandruff, hair fall, premature graying, and scalp irritation while improving overall hair quality. Its incorporation into herbal oils, shampoos, conditioners, serums, and hair masks demonstrates its versatility in modern herbal cosmetics. The increasing popularity of plant-based formulations has enhanced the commercial importance of Bhringraj oil in the cosmetic industry. Further scientific research and clinical validation may strengthen its application as a promising natural cosmeceutical agent for healthy hair care.

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