

THE BOTANICAL JEWEL: A COMPREHENSIVE REVIEW OF LAWSONIA INERMIS AND ITS DIVERSE APPLICATIONS

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ABSTRACT

Medicinal plants are extensively utilized, either individually or in combination, within healthcare systems. *Lawsonia inermis* Linn. Commonly known as henna, holds significance in traditional medicine. It is a multi-branched shrub or small tree (2-6 m tall), primarily cultivated for its leaves, although other parts such as stem bark, roots, flowers, and seeds have also found applications in traditional medicine. Historically, it has been employed to alleviate various conditions including headaches, bronchitis, skin ailments, and urinary issues, among others. Moreover, it exhibits diverse pharmacological properties such as diuretic, antibacterial, anti-inflammatory, and analgesic effects. Despite its manifold therapeutic potentials, the widespread adoption of this plant remains limited. This review primarily focuses on exploring the traditional uses, phytochemistry, and pharmacological effects of *Lawsonia inermis* Linn.

Keywords: Medicinal plants, *Lawsonia inermis* Linn., Traditional medicine, multi-branched shrub, Pharmacological properties, Therapeutic potentials, Pharmacological effects.

1. INTRODUCTION

Many contemporary pharmaceuticals trace their roots back to traditional plant-based remedies. Traditional herbal medicine practitioners have long recognized the therapeutic potential of numerous indigenous plants for treating various diseases. Natural products remain a substantial reservoir for both synthetic and traditional herbal medicines and continue to form the cornerstone of primary healthcare systems globally. Traditional medicinal practices, particularly those involving the use of medicinal plants, remain integral in meeting basic health needs in developing nations. In recent years, there has been a remarkable surge of interest within the scientific community to investigate the pharmacological effects of herbs or validate claims found in ancient texts like Ayurveda. Henna (*Lawsonia inermis* Linn) is one such plant capturing attention from researchers worldwide due to its diverse pharmacological activities, spanning from anti-inflammatory to anticancer properties. *Lawsonia inermis* Linn (Family: Lythraceae) is a highly branched, smooth shrub or small tree (2-6 m tall), cultivated primarily for its leaves, although the stem bark, roots, flowers, and seeds have also been utilized in traditional medicine. This plant is globally renowned as a cosmetic agent used for dyeing hair, skin, and nails. Chemical constituents of henna include Lawsone, Esculetin, Fraxetin, Isoplumbagin, Scopoletin, Betulin, Betulinic acid, Hennadiol, Lupeol, Lacoumarin, Laxanthone, Flavone glycosides, and two pentacyclic triterpenes. It has been reported to possess various medicinal properties including analgesic, hypoglycemic, hepatoprotective, immunostimulant, anti-inflammatory, antibacterial, wound healing, antimicrobial, antifungal, antiviral, antiparasitic, antitrypanosomal, antidermatophytic, antioxidant, antifertility, tuberculostatic, and anticancer effects.

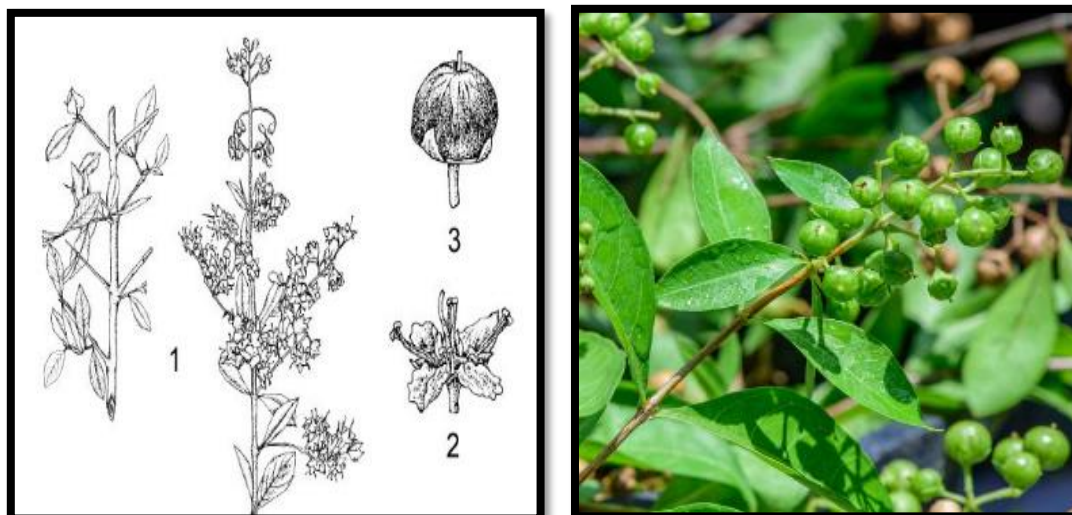


Fig. 1: Henna plant (*Lawsonia inermis*)

2. MORPHOLOGICAL CHARACTERISTICS OF LAWSONIA INERMIS LINN

1. **Growth Habit:** Lawsonia inermis Linn. Typically exhibits a bushy or tree-like growth habit. It is a much-branched shrub or small tree, often with multiple stems arising from the base.
2. **Size:** The size of Lawsonia inermis Linn. Can vary, but it generally ranges from 2 to 6 meters in height. However, under optimal growing conditions, it may reach heights beyond 6 meters.
3. **Leaves:** The leaves of Lawsonia inermis Linn. Are small, elongated, and lanceolate in shape, measuring about 1 to 2 inches in length. They are arranged alternately along the stems. The leaves are typically dark green in color and have a smooth texture.
4. **Stem:** The stems of Lawsonia inermis Linn. Are typically smooth (glabrous), slender, and often have a reddish-brown hue. With maturity, the stems may become woody, especially towards the base of the plant.
5. **Bark:** The stem bark of Lawsonia inermis Linn. May vary in texture and color. It can range from smooth to slightly rough and may exhibit shades of gray or brown. The bark is often utilized in traditional medicine for its medicinal properties.
6. **Flowers:** Lawsonia inermis Linn. Yields petite, aromatic flowers, typically in shades of white or pink. These blossoms form clusters at the tips of the branches, each boasting a tubular shape and comprising five delicate petals. Flowering predominantly takes place amid the warmer seasons annually.
7. **Roots:** less commonly used compared to the leaves, bark, and flowers, the roots also hold medicinal significance in some traditional medicinal practices.
8. **Seeds:** They are enclosed within a dry, papery capsule. While the seeds are less commonly utilized compared to other parts of the plant, they may also possess medicinal properties.

Lawsonia inermis Linn. Geographical distribution:

1. **Native Range:** Henna is believed to be native to regions of North Africa, including countries such as Egypt, Morocco, and Algeria. It is also native to regions of West Asia, including countries such as Iran, Iraq, and Saudi Arabia.
2. **Naturalized Regions:** Due to its popularity and cultivation, henna has become naturalized in various parts of the world with suitable climates. It is commonly found in countries across the Middle East, South Asia, and parts of North Africa. Additionally, henna has been introduced and cultivated in regions of Europe, the Americas, and Oceania.
3. **Cultivation:** Henna is widely cultivated in countries where it is not native, primarily for its leaves, which are used in traditional medicine, cosmetic applications, and as a natural dye. Cultivation occurs in regions with warm temperatures and well-drained soil.
4. **Habitat:** Lawsonia inermis Linn. Typically grows in arid or semi-arid environments. It thrives in regions with hot, dry climates and is often found growing in sandy or loamy soils. Henna plants are well-adapted to withstand periods of drought and can tolerate high temperatures.

Taxonomical classification of Lawsonia inermis Linn.

- Kingdom: Plantae (Plants)
- Clade: Tracheophytes (Vascular plants)
- Clade: Angiosperms (Flowering plants)
- Clade: Eudicots (Plants with two seed leaves)
- Clade: Rosids (Plants with flower parts in multiples of five)
- Order: Myrtales
- Family: Lythraceae (Loosestrife family)
- Genus: Lawsonia
- Species: Lawsonia inermis

Vernacular names

1. Arabic: حِنَّاء (Hinna)
2. Hindi: मेहंदी (Mehendi)
4. Urdu: حنا (Hina)
5. Spanish: Henna
6. French: Henné
7. German: Henna

8. Italian: Henné

Table 1: Chemical constituents in *Lawsonia inermis* Linn. With their uses.

| Sr. No. | Chemical constituents | Uses |
|---------|----------------------------|---|
| 1 | Lawsonone | Lawsonone is the principal pigment responsible for the red-orange colour of henna. It is widely used as a natural dye for hair, skin, and nails in cosmetic applications. |
| 2 | Esculetin | Esculetin is a coumarin derivative with antioxidant and anti-inflammatory properties. It may have potential applications in skincare formulations for its soothing effects. |
| 3 | Fraxetin | Fraxetin is another coumarin compound found in henna with potential antioxidant and anti-inflammatory properties. It may contribute to the plant's medicinal effects. |
| 4 | Isoplumbagin | Isoplumbagin is a naphthoquinone compound with reported antibacterial and antifungal properties. It may be utilized in traditional medicine for treating various microbial infections. |
| 5 | Scopoletin | Scopoletin is a coumarin derivative with diverse pharmacological activities, including anti-inflammatory, antioxidant, and antimicrobial properties. It may contribute to the therapeutic effects of henna. |
| 6 | Betulin and Betulinic acid | These triterpenoid compounds have been studied for their potential anticancer, anti-inflammatory, and antimicrobial properties. They may enhance the medicinal value of henna. |
| 7 | Lupeol | Lupeol is a triterpenoid compound with reported anti-inflammatory, antioxidant, and antitumor properties. It may contribute to the anti-inflammatory effects of henna. |
| 8 | Flavonoids | Henna contains various flavonoids, such as flavone glycosides, which have antioxidant properties. |
| 9 | Laxanthone | Laxanthone is a xanthone derivative found in henna with potential antioxidant and antimicrobial properties. It may contribute to the plant's overall medicinal effects. |
| 10 | Lacoumarin | Lacoumarin is a coumarin compound with reported anticoagulant properties. It may have potential applications in traditional medicine for treating clotting disorders. |

Traditional uses of *Lawsonia inermis* Linn

1. Cosmetic Applications:

- Hair Coloring: Henna has been traditionally used as a natural dye for coloring hair. It imparts a reddish-orange hue to the hair and is often preferred for its natural properties compared to synthetic hair dyes.
- Skin Decoration: Henna paste is applied to the skin in intricate patterns, known as mehndi or henna tattoos. These temporary tattoos are popular during celebrations, festivals, weddings, and religious ceremonies in various cultures, particularly in South Asia, the Middle East, and North Africa.
- Nail Staining: Henna is also used to stain nails, giving them a reddish-brown color.

2. Medicinal Uses:

- Skin Disorders: Henna has been traditionally used to treat various skin conditions, including eczema, psoriasis, rashes, and burns. Its anti-inflammatory and antimicrobial properties are believed to soothe and heal the skin.
- Headaches and Migraines: In some traditional medicinal practices, henna has been used as a remedy for headaches and migraines.
- Joint Pain: Henna paste is applied topically to joints to reduce inflammation and alleviate pain associated with conditions like arthritis.
- Hair Health: Henna is believed to strengthen hair, prevent dandruff, and promote hair growth. It is applied as a hair mask or mixed with other ingredients to make natural hair treatments.

3. Cooling Agent: In hot climates, henna paste is applied to the palms and soles of the feet to provide a cooling sensation and relieve discomfort.

4. Symbolic and Cultural Uses: Adornment: Henna has significant cultural and symbolic importance in many societies. It is often used to adorn the body during special occasions and celebrations, symbolizing beauty, auspiciousness, and protection from evil spirits.

Weddings and Ceremonies: Henna plays a prominent role in weddings and other ceremonies. It is applied to the hands and feet of brides as intricate designs, symbolizing blessings, fertility, and marital happiness.

5. Religious and Ritualistic Uses: Henna is used in various religious and ritualistic practices, such as childbirth rituals, coming-of-age ceremonies, and other significant life events. It is believed to have protective and purifying properties in some cultures.

Uses of *Lawsonia inermis* Linn. In skin conditions:

Henna (*Lawsonia inermis* Linn.) has been traditionally used in various cultures to treat a range of skin conditions due to its believed medicinal properties. However, it's essential to note that while henna may have anecdotal evidence supporting its use in treating skin diseases, scientific research on its efficacy is limited. Here are some skin conditions that henna has been traditionally used to treat:

- 1. Eczema:** Henna paste has been applied topically to relieve symptoms of eczema, including itching, inflammation, and dryness.
- 2. Psoriasis:** Some individuals have used henna to alleviate symptoms of psoriasis, such as scaling, redness, and irritation, when applied as a paste to affected areas.
- 3. Rashes:** Henna paste has been applied to the skin to soothe and heal various types of rashes, including those caused by allergic reactions or contact dermatitis.
- 4. Burns:** In traditional medicine, henna has been used topically to treat minor burns, providing a cooling sensation and promoting healing.
- 5. Wound Healing:** Henna has been applied to wounds to aid in healing and prevent infection. It is believed to have antimicrobial properties that may help protect against bacterial contamination.
- 6. Insect Bites and Stings:** Henna paste has been used to soothe itching and inflammation caused by insect bites and stings.
- 7. Skin Allergies:** Some individuals have used henna paste to alleviate symptoms of skin allergies, such as itching and redness, although caution should be exercised as henna itself may cause allergic reactions in some people.
- 8. Fungal Infections:** In traditional medicine, henna has been used to treat fungal infections of the skin, such as athlete's foot or ringworm, due to its believed antifungal properties.

While henna has been used traditionally to address these skin conditions, scientific evidence supporting its effectiveness is limited, and caution should be exercised when using henna for medicinal purposes. It's advisable to consult a healthcare professional before using henna or any other herbal remedy to treat skin diseases, especially if you have underlying health conditions or allergies.

Saponification properties of *Lawsonia inermis* Linn- Saponification is the chemical process of making soap from fats or oils and a strong alkali, such as sodium hydroxide (NaOH) or potassium hydroxide (KOH). While *Lawsonia inermis* Linn. (Henna) is not typically used for saponification to make soap, it's worth noting that some plant oils and fats, such as coconut oil or olive oil, are commonly used in soapmaking due to their fatty acid composition.

However, henna does contain certain properties that could potentially contribute to saponification or soapmaking processes, albeit to a lesser extent compared to traditional soapmaking oils. These properties include:

- **Fatty Acids:** While henna is not primarily composed of fats or oils like traditional soapmaking ingredients, it does contain some fatty acids. These fatty acids are usually present in small amounts and may contribute to the overall composition of the plant material.
- **Emulsifying Properties:** Henna paste, when mixed with water, has emulsifying properties due to its mucilage content. While this is not directly related to saponification, it indicates that henna may interact with water and other substances in a way that is characteristic of some soap ingredients.
- **Potential Alkaline Interactions:** Henna may interact with alkaline substances due to its chemical composition. While this may not directly lead to saponification, it suggests that henna could undergo chemical changes under alkaline conditions.

Overall, while *Lawsonia inermis* Linn. Does not have direct saponification properties like traditional soapmaking oils, its chemical composition and interactions with other substances suggest that it could potentially play a role in

soapmaking processes under certain conditions. However, it is not commonly used for this purpose, and traditional soapmaking oils are preferred for their well-established properties and suitability for saponification.

Toxic effects:

While henna (*Lawsonia inermis* Linn.) is generally considered safe for most people when used topically for temporary skin staining or hair coloring, there are potential toxic effects associated with its use, particularly in certain circumstances or when used improperly. Some of these toxic effects include:

1. **Allergic Reactions:** One of the most common adverse reactions to henna is allergic contact dermatitis, which can cause symptoms such as redness, itching, swelling, and blistering of the skin. Some individuals may develop severe allergic reactions known as "black henna" or para-phenylenediamine (PPD) allergies, which can lead to long-lasting skin damage and scarring.
2. **Sensitization:** Repeated or prolonged exposure to henna may lead to sensitization, making individuals more prone to allergic reactions upon subsequent exposure.
3. **Chemical Sensitivities:** Henna pastes sold commercially may contain additives or adulterants such as PPD, which can cause severe allergic reactions in some individuals, especially those with pre-existing chemical sensitivities.
4. **Skin Irritation:** Even in the absence of an allergic reaction, some individuals may experience skin irritation or discomfort when henna is applied topically, particularly if left on the skin for an extended period.
5. **Eye Irritation:** Henna paste should be kept away from the eyes, as it can cause irritation or damage to the delicate tissues surrounding the eyes if it comes into contact with them.
6. **Gastrointestinal Distress:** Ingestion of henna is not recommended, as it may cause nausea, vomiting, diarrhoea, and other gastrointestinal symptoms.
7. **Potential Toxicity in Children:** Henna should be kept out of reach of children, as ingestion or excessive handling may lead to toxicity, including nausea, vomiting, and abdominal pain.
8. **Adverse Reactions in Pregnancy:** While there is limited evidence on the safety of henna use during pregnancy, it is advisable for pregnant women to avoid using henna on their skin or hair to minimize the risk of potential adverse effects on the foetus.
9. It's essential to exercise caution when using henna and to perform a patch test on a small area of skin before applying it more extensively. Additionally, individuals with a history of allergies or chemical sensitivities should consult a healthcare professional before using henna or products containing henna.

3. CONCLUSION

This review highlights *Lawsonia inermis* Linn., or henna, showcasing its traditional uses, phytochemistry, and pharmacological actions. With recognized applications in traditional medicine for various ailments and a rich phytochemical profile including compounds like lawsone and lupeol, henna exhibits diverse therapeutic potentials. While generally safe for topical use, caution is warranted due to the risk of allergic reactions, particularly with adulterants like para-phenylenediamine (PPD). Despite challenges, henna remains culturally significant and holds promise as a source of novel therapeutic agents, urging further research to validate its efficacy, mechanisms of action, and safety for broader medical and cosmetic applications.

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