Synergistic Herbal Ointment Formulations: Integrating Juglans regia and Lawsonia inermis for Wound Healing and Antimicrobial Therapy – A Comprehensive Review

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***Abstract*—Henna and Mehndi are common names for L. inermis. The flowering plant known as henna (Lawsonia inermis L.) has a wide range of cosmetic applications and strong in vitro pharmacological activity. It has been used as a dye for cosmetic purposes for more than 9000 years. Plant leaves are traditionally applied to hands, hairs, and feet in Asian nations like Pakistan and India. The internal organs of our body are protected from infections and pathogens by our skin. Wound healing is a dynamic and organic process. One treatment that helps wounds heal more quickly is antibacterial cream (or ointment). An antibiotic is a specific class of antimicrobial agent that combats bacteria. Conversely, antioxidants are chemicals that help protect the skin's surface from oxidative damage caused by free radicals and outside aggressors like pollution and UV light.**

Despite having significant therapeutic potential in traditional medicine, the walnut plant, scientifically known as Juglans regia, is regarded as a medicinal plant with a variety of qualities. Walnuts' chemical makeup and therapeutic benefits include liver protection, antidiabetic, hypolipidemic, antimicrobial, and antihypertensive properties.

***Index Terms*—Lawsonia inermis L, Juglans regia, antimicrobial, antioxidant, wound healing ointment.**

I. INTRODUCTION

Due to their widespread demand in various nations, herbal medicines have a wide range of biological and therapeutic properties. This review's goal is to compile the most recent data, including L. inermis diverse biological activities. This plant is widely used throughout the world. Henna's many pharmacological characteristics are of interest to researchers. The plant L. inermis is perennial.[1] The historical and cultural significance of the henna plant goes beyond its wellknown use as a natural hair and body art dye. Originating in parts of South Asia, the Middle East, and North Africa, this plant has been deeply ingrained in centuries-old customs. The historical and cultural significance of the henna plant goes beyond it well-known use as a natural hair and body art dye. Originating in parts of South Asia, the Middle East, and North Africa, this plant has been deeply ingrained in centuries-old customs.[2] The entire plant of henna and all of its components—roots, stems, flowers, bark, leaves, pods, and seeds—are quite beneficial. Lawsone is a primary natural dye that makes up 1% to 1.4% of leaves. (1). The foundation of herbal medicine is the idea that plants have natural compounds that have the potential to improve health and reduce illness. (3) Henna is sold commercially. Grown in Libya, Morocco, Pakistan, Afghanistan, India, Iran, Somalia, and Sudan Yemen as well. Currently, Rajasthan state's Pali district is the area in Henna cultivation is highest in India. In India, mehndi is typically applied to feet and hands. Fertility is represented by henna. In India, its use gained popularity. due to its cooling properties during India's scorching summers. [3]The earliest tree food that humans have ever eaten is walnuts.as early as 7000 B.C. The Romans called Juglans regia walnuts are known as "Jupiter's royal acorn." According to early history, English walnuts originated from ancient Persia, where they were kept for royalty. Consequently, the walnut is frequently referred to as the "Persian Walnut." Walnuts were exchanged along the Asia and the Middle East were connected by the Silk Road. Walnuts were transported by caravans to distant regions and eventually via maritime commerce, disseminating the walnut's global appeal.[4] [5]

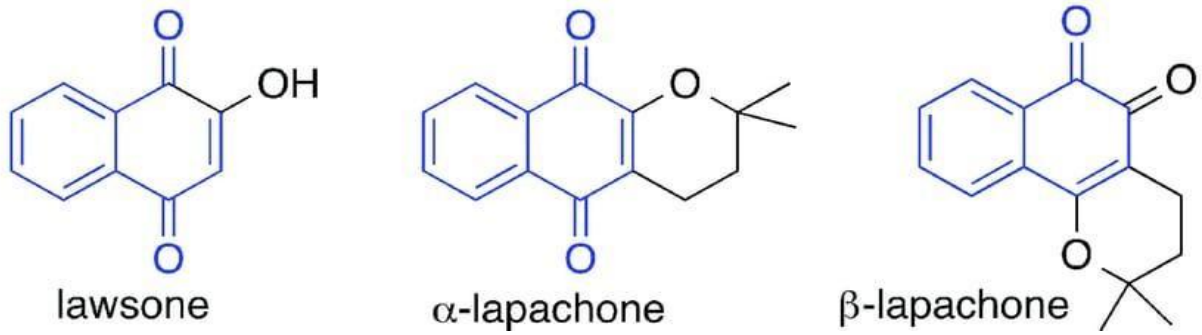
Scientific classification of L. inermis
Kingdom -Plantae
Division-Magnoliophyte
Class-Magnoliopsida
Order- Myrtales
Family-Lythraceae
Genus -Lawsonia
Species- inermis (5)

Description f the plant
Lawsonia inermis is a flowering plant that is frequently referred to as henna has cultural, cosmetic, and therapeutic value. It's a tiny shrub or tree, usually growing to a height of 1.8 to 7.6 meters (6 to 25 feet). The foliage are elliptical, simple, and opposite; they have a smooth surface and a light green hue. They have a distinct, slightly wavy margin and range in length from 2 to 4 cm. The henna plant's greyish-brown bark peels off with age. Flowers: Fragrant, tiny, white, pink, or yellowish flowers are produced by henna. They Are usually clustered at the terminal ends of the branches and have four lobes. Fruits: The plant produces tiny, brown capsules that are packed with seeds. [6] [7]
Lawasonia inermis: Synonyms: Lawsonia alba, Lawsonia , Alcanna spinosa[8]

Biological source: Henna is the dried leaves of the plant Lawsonia inermis. Family : Lythraceae

Fig:1. Lawasonia powder [9]

Chemical components: Lawsone is the primary coloring ingredient in henna (2-hydroxy-1:4 naphthoquinone) that is extracted from the leaves. The Other substances found in the leavesinclude:1,4dihydroxynaphthalene. 1,4-naphthoquinone, 1,2-dihydroxy- 2-hydroxy-1,4glucoyloxynaphthalene and diglucosyloxy naphthalene (7). The most common tree nut in the world is the walnut (Juglans regia L.).



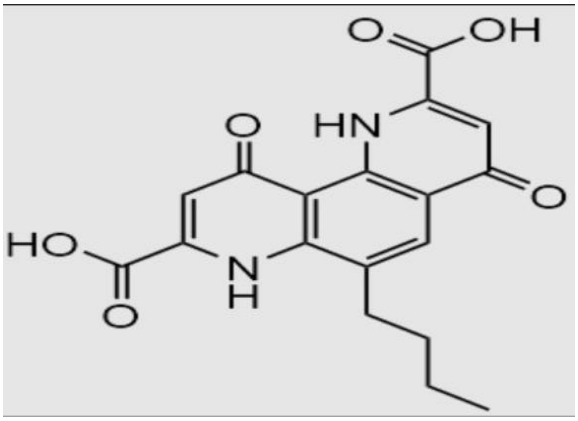
The tree is Often referred to as the English walnut, Persian walnut, white walnut, or common walnut (8). The walnut (Juglans regia L.) contains significant amounts of phenolic substances. It is well known that the stronger the phenol content, the activity of antioxidants. Walnut leaves have been utilized in cosmetic and pharmaceutical sectors.[10] [11]

Fig:2.Lawasonia inermis fruits

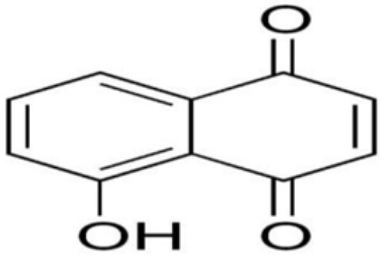
J. regia, also referred to as Aksoda or Aksota in Ayurvedic medicine, was utilized by Charaka and Sushruta, along with Abhisuka (pista),Vatama (almond), and other fruits that are dry. Ayurvedic literature J. regia is applied to wounds and phthisis. and nervous system disorders (medical applications based on writings from 1000 BC) up until the sixteenth century). The edible nut kernel was utilized by Charaka and Sushruta (1000 BC) in prescriptions for debility, senility, phthisis, anemia, and as a vitalizing tonic. Sushruta administered the seed oil as a digestive remedy.[12] Taxonomical classification- kingdom - Plantae [13]

Phylum - Tracheophyte
Subkingdom -Tracheobionta
Super division - Spermatophyta
Division -Magnoliophyte
Class - Magnoliopsida
Subclass - Hamamelididae
Order - Juglandales
Family - Juglandaceae
Genus - Juglans
Species -J. regia(9)
Juglance regia :
Synonyms: English walnut, Persian walnut, European walnut, Circassian walnut, and royal walnut
Biological source: Juglans regia powder is the walnut tree, specifically the plant material from Juglans regia L.
Family - Juglandaceae

Chemical Constituent:
J. regia L. is a rich source of various types of chemical compounds. It plays a great role in the ayurvedic and homeopathic system of medicine. It contains different biologically active substances like Polyphenols, Flavonoids, Steroids, Phospholipids, Triterpenes, Quinines, Fatty acids, Tannins like Gallic Acid and Ellagic Acid. Ellagic acid is responsible for anticancer property and immunization. The active constituent of J. regia L. is Juglone (quinone)J. regia L. bark contain higher polyphenolic compounds which are responsible for antioxidant and antibacterial activities[14]



Juglanin



Juglone

The principal Walnut oil contains triacylglycerols (980g/kg oil), wherein monounsaturated fatty acids (FAs) and polyunsaturated FAs, primarily oleic acid There are linoleic and α-linolenic acids (PUFAs).in significant quantities across all genotypes (Table 1). Oil According to [6], the contents
(78.83 to 82.4%) were greater than those that other researchers have reported.[15]


Fig.3. Juglance regia

Fig.4. Male catkin of juglance regia

Antidiabetic activities: Rats treated with streptozotocin were given 200 and 400 mg/kg body weight of J. regia leaf extract for 28 days, and it improved hyperglycemia by raising insulin and lowering glycosylated hemoglobin[16]

Immunomodulatory effect: proliferative responses of T cells were enhanced by a 1 mg/ml concentration's immunostimulant effect of methanol extract from henna leaves. Using the assay for lymphocyte transformation (LTA) to direct the fractionation of the total methanolic extract from henna leaves,[17] seven compounds were found. Naphthoquinone in the leaves of L.inermis fraction demonstrated a potent immunomodulatory effect.[18]

Lipid-lowering activity: Studies have shown that dose-dependent When Persian walnut oil extract is consumed, the amount of LDL-C cholesterol, triglycerides, and cholesterol in rats without diabetes with elevated cholesterol. The outcomes of giving walnut alcoholic extract leaves on the serum cholesterol and triglyceride levels show that the Somehow, the active component in walnut leaves has been able to lower the level of total serum cholesterol and triglycerides and raise the amount of HDL [19]

Anticancer activity: The antioxidant qualities of flavonoids are involved in immune function regulation and an increase in anticancer activity of the body Juglone in walnut leaves on rats' colon cancer cells demonstrated its anticancer function in preventing the development of benign or intestinal tumors that are malignant[20]

Antibacterial activity: Crude extracts in water, methanol, and chloroform of L. inermis leaves demonstrated in vitro antimicrobial activity to prevent the growth of four different types of bacteria and human pathogenic fungi in dose- dependent in a way. Recent research has shown that methanol extracts from five Punica granatum,[21] Eucalyptus globulus, Lawsonia inermis, Centratherumanthermin ticum, and Rubia cordifolia were among the plants that affected S. oxacillin-resistant strains of the bacteria obtained from clinical settings. It has been demonstrated the antibacterial qualities of these extracts. The IC50 range for the methanol extracts of S. aureus range from 0.250 to 4.30 mg/ml.[22]

Activity of Hypotriglyceridemic: Oral delivery of an extract high in polyphenols (WP) in highfat walnuts (100 and 200 mg/kg) Mice fed a diet dramatically decreased their liver weight and serum triglycerides (TG), whereas hepatic β-Cytosolic oxidation, including peroxisome oxidation, was improved by WP (50–200 mg/kg). A polyphenol Rich extract was discovered to have hypotriglyceridemic action through improvement of the liver's peroxisomal fatty acid β-oxidation. [23]These findings imply that tellimagrandin is participating in the mechanism of hypotriglyceridemia [24]

Brain Health Activities
Walnuts are rich in omega-3s (ALA) and antioxidants, which protect the brain from oxidative stress, improve memory, and support overall cognitive function. Their antioxidants and antiinflammatory compounds help combat oxidative damage, potentially protecting against certain cancers and reducing chronic inflammation. [25]

Immunostimulant Activity:
In 2015, Ruijun Wang screened J's immature fruits. mandchurica for the function of immune regulation. According to the study's findings, the extract from J. mandchurica's young fruits enhanced phagocytic and lymphocyte proliferation macrophage activity [26] [27]

II. CONCLUSION

The majority of the information was attempted to be mentioned in the current review. Available in literature, including explanations of Juglans regia's

chemical components and medicinal qualities.`11```numerous pharmacological characteristics that can be utilized to range of illnesses Numerous investigations have shown that Juglans Alkaloids, flavonoids, terpenoids, monoterpenes, coumarin, flavonoids, tannins, saponins, and other substances are found in regia .The investigation into the Lawsonia inermis extract showed its phytochemical characteristics, but the ointment made from it showed powerful antibacterial and antioxidant qualities. The first phytochemical An evaluation of this species revealed that the Lawsonia inermis extract includes reducing sugar, glycosides, tannins, alkaloids, and flavonoids. The The extract's antibacterial properties were especially potent against bacteria. such as Klebsiella, E. Coli, Enterococcus, and Streptococcus, particularly in the therapy for wound infections.

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