ORIGINAL ARTICLE

The Unani Approach to Pediculosis: Understanding and Treating Lice Infestation

Abstract

Pediculosis, a parasitic condition caused by distinct lice species, remains a significant public health concern due to its widespread occurrence, particularly among children and adolescents, and in conditions of overcrowding and poor hygiene. This article examines pediculosis from both the Unani and Persian systems of medicine and contemporary medical perspectives, covering its history, life cycle, etiopathogenesis, risk factors, signs, symptoms, diagnosis, and treatment. This review aims to provide a comprehensive understanding of pediculosis, presenting insights from both Unani/Persian and modern scientific perspectives. It also proposes the potential for integrated or complementary treatment strategies. A comprehensive literature review was conducted, analyzing manuscripts of Unani/Persian medicine and contemporary scientific research to explore the historical context, biology, risk factors, and management strategies of pediculosis. A search was conducted on PubMed, Google Scholar, and Scopus until October 2023, using keywords such as lice, pediculicide, insect, and insecticide alongside the scientific name of each plant. The review highlights the divergence between traditional and modern medical explanations. While the Unani/Persian medicine explains lice infestation based on bodily secretions and environmental factors, contemporary medicine emphasizes lice feeding on blood and the ensuing inflammatory response. Both approaches emphasize the importance of hygiene and environmental conditions for lice infestation. Potential hybrid approaches may offer more comprehensive and effective strategies for managing pediculosis by integrating traditional and modern understandings. Unani/Persian medicine's emphasis on herbal remedies and lifestyle adjustments, combined with modern pharmacological treatments, presents a promising direction for future research and treatment paradigms.

Key words: Pediculosis, Lice infestations, Unani/Persian medicine, Essential oils, Herbal medicine

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Introduction

Pediculosis, commonly known as a lice infestation, is a parasitic condition that has plagued human populations for centuries. Three distinct types of lice cause this condition: head lice (Pediculus humanus capitis), body lice (Pediculus humanus corporis), and pubic lice (Pthirus pubis). Pediculosis infestation remains a significant public health concern due to its widespread occurrence, particularly among children and adolescents, and in conditions of overcrowding and poor hygiene. The prevalence of pediculosis varies across different geographical regions and socioeconomic strata. While it is often perceived as a mere nuisance, it can lead to considerable discomfort and secondary health issues, such as bacterial infections, skin irritations, and psychological distress. The social stigma associated with pediculosis can further exacerbate its impact, making it essential to address this condition comprehensively. The terms "*sepesh*," "*Qummal*," "*Dawaa al-Qamah*," "*Zu'al al-Ra'as*," "*ju'on*," or "*Seyban*" have been discussed in manuscripts of the Unani/Persian system of medicine as the synonym of pediculosis.

History

Descriptions of pediculosis and recommended treatments and preventive measures can be found in treatises such as Avicenna's "*The Canon of Medicine*" and other medical texts. Archaeological findings, including lice combs and nit remains, further corroborate the historical prevalence of lice infestation in these cultures. However, the historical significance of lice management in the U.S. extends beyond these artifacts. A Bone comb discovered at Crawford Fort in the 1930s, likely used for lice removal is shown in Figure 1.

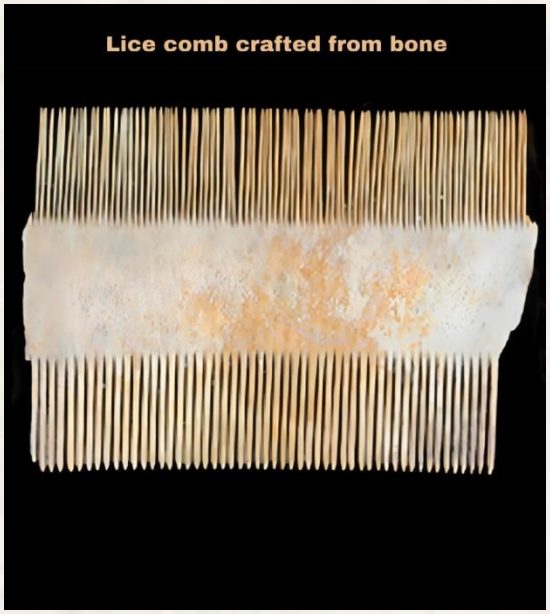


Figure 1. Antique Bone Lice Comb Discovered in the 1930s at Fort Crawford, Wisconsin, Currently on Display at the Wisconsin Historical Museum (*Lee, 2015*)

In the 1930s, archaeologists made a noteworthy discovery at the Fort Crawford site, unearthing what is believed to be the first lice comb ever found in the country. This discovery sheds light on a persistent nuisance that afflicted the soldiers stationed at Fort

Crawford: head lice (Lee, 2015).

The understanding and prevention of lice infestations in human history underwent a significant transformation, particularly after 1864. In that year, the renowned scientist Louis Pasteur made a groundbreaking contribution by reporting on the complete life cycle of head lice and various other insects. This marked a pivotal moment in the evolving battle against these pesky parasites. Interestingly, lice are not unique to humans. At some point in history, lice species also affected other primates like gorillas and chimpanzees. However, a fascinating evolutionary process occurred approximately 13 million years ago. Certain lice species began to adapt specifically to humans, setting the stage for the distinctive relationship between humans and lice that we observe today.

Around 42,000 to 72,000 years ago, human lice further diverged into two distinct types: head lice and body lice (Kittler, Kayser, and Stoneking, 2003; Boutellis, Abi-Rached, and Raoult, 2014). The discovery of genetic differences between head and body lice supports the theory that this period marked a significant shift in human behavior, with the adoption of clothing as a pivotal development. This transition from shared lice ancestors to specialized human louse species and the emergence of clothing are interconnected aspects of our evolutionary history, shedding light on the fascinating interplay between human culture, biology, and the pests that have plagued us throughout the ages.

Life Cycle

Egg Stage (Nit): It all begins with female lice laying eggs, known as nits. These tiny, oval-shaped eggs attach to individual hair strands or clothing seams. The incubation period varies; for head lice, it is approximately one week, while for body lice, it is around 8 to 10 days (Nutanson, Steen, and Schwartz, 2007).

Nymph Stage: After incubation, the first nymph hatches from the egg. Nymphs are immature lice and look similar to adult lice but smaller in size. They have a voracious appetite for blood, which they obtain through their bites. Chemical compounds in their saliva, including anticoagulants and vasodilators, help them feed more efficiently. Human lice are known to take blood meals at frequent intervals, approximately every 3 to 4 hours (Weems and Fasulo, 2015).

Molting: Over the course of their development, nymphs undergo three molts. These molts involve shedding their exoskeletons to accommodate their growing bodies. The entire nymph stage lasts about 9 to 12 days for head lice and over two weeks for body lice and pubic lice (Bohl, et al., 2015).

Adult Stage: Following the third molt, the nymphs reach adulthood. At this stage, they become fully mature and capable of reproducing. The lifespan of an adult louse while residing on a human host is roughly one month (Burgess, 1995; Ko and Elston, 2004).

The lice's life cycle begins with the female lice's attachment of eggs (nits) to hair strands or clothing seams. Incubation periods vary, with head lice taking approximately a week and body lice requiring 8-10 days. Nymphs, resembling smaller versions of adult lice, hatch after incubation and feed on blood every 3-4 hours. They undergo three molts to accommodate growth, with the nymph stage lasting 9-12 days for head lice and over two weeks for body and pubic lice. Following the final molt, nymphs mature into adults capable of reproduction, with a lifespan of about one month on a human host.

In the environment, lice face a much more challenging existence. Head lice can typically survive for just one or two days when they are not on a human host. Body lice, un-

der similar conditions, can persist slightly longer. Eggs removed from a host, commonly referred to as nits, have a limited lifespan outside the human body. They can survive up to 10 days, but their longevity is heavily influenced by environmental factors such as humidity and temperature. Nits have a better chance of survival in high humidity and temperatures above 28 degrees Celsius. The life cycle of lice is shown in Figure 2.

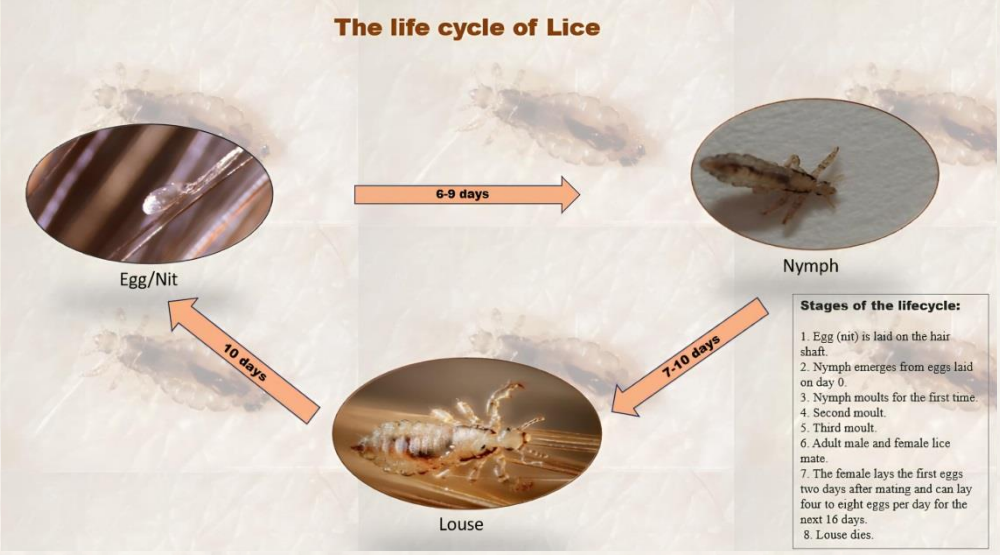


Figure 2. The life Cycle of a Lice Occurs in Three Stages: Egg, Nymph and Adult

Etiopathogenesis

According to Unani/Persian medicine, lice originate from undesirable secretions that lack the capacity to nourish the body. Tabiyat (Medicatrix Naturae) compels these secretions to move toward the skin's surface due to their proximity to the skin. This occurs because the impure secretions cannot be expelled through the pores; thus, they remain trapped deep within the body where they decompose, giving rise to these creatures. Lice can only emerge in such an environment created by this decomposition. These secretions migrate towards the outer skin and hair roots, serving as a receptacle for waste produced during the third and fourth stages of digestion, which lice feed on. It is worth noting that lice cannot develop from bile due to its firm and bitter nature, which is incompatible with lice's characteristics.

Similarly, lice cannot originate from black bile due to its unsuitable Mizaj (Temperament) for supporting life. Blood is also an unsuitable source since it is a valuable substance closely tied to Mizaj, and the body conserves it when expelling. The critical factor behind the birth of lice is an unnatural heat known as "*Hararat ghareeba*," which leads to the contamination and decomposition of existing moisture (RA, 2010). When this moisture, whether pure or contaminated, is influenced by this unnatural heat, it creates conditions conducive to the existence of lice (RA, 2010).

Contrary to the belief of Unani/Persian medicine, lice primarily inhabit areas close to the human scalp and feed on blood. According to contemporary science-based medicine, they engage in this behavior about six times a day (Khokhar, 2002). A small amount of saliva containing anticoagulants is introduced during each blood meal into the scalp skin. This process sensitizes the host to louse antigens and fecal matter, leading to an inflam-

matory response, itching, and potentially secondary impetiginization (Khokhar, 2002; Madke and Khopkar, 2012).

Risk Factors

While Modern and Unani/Persian medicine may approach the identification of risk factors for lice infestation from varying viewpoints, they do converge on certain shared concepts, as outlined in Table 1.

Table 1: Risk factors of pediculosis Common to Modern and Unani/Persian Medicine

Modern	Unani/Persian
Age: children (school-going) (Bartosik, Zając, and Kulisz, 2015)	Age: Being a child, adolescent, or elderly (Khan, 2011)
Common in females (Perotti, et al., 2004; Bartosik, Zając, and Kulisz, 2015)	-
Low economic social class (Bartosik, Zając, and Kulisz, 2015)	-
	Har- Ratab Mizaj (Hot and wet temperament) (Khan, 2011) Overproduction of *Dam* (Sanguine humor)
Poor hygiene (Gulgun, et al., 2013; Bartosik, Zając, and Kulisz, 2015)	Poor hygiene (Khan, 2011)
Overeating (Kartman, 1949)	Polyphagia
	The intake of certain categories of foods includes (AH, 2010; Al-Akhavaynī, 1965; Kabeeruddin, 2007; Khan, 2011) 1. Dense foods such as Halvah, Haleem, cabbage, and cow's milk. 2. Fresh and dried figs. 3. Radish and its seeds. 4. Foods with high moisture content that can lead to phlegm production, such as milk and fresh fish. 5. Salty foods. 6. Excessive consumption of both cow and wild animal meat. 7. Date syrup. 8. Slippery or "*Lazij*"(sticky) foods, such as pasta, pizza, and greasy dishes.
	-Chronic illness (Qamri, 2008) -Fatigue

In both Modern and Unani/Persian perspectives, age is recognized as a risk factor for pediculosis. This condition is commonly found in children and adolescents due to their naturally higher moisture levels. Nevertheless, in the elderly, an excess of abnormal moisture raises the risk of infection. According to the Unani/Persian system of medicine, any situation that fosters moisture and lower levels of Hararat Ghareeziya (Innate heat) contributes to lice infestation (AH, 2010). Both Unani/Persian and modern medicine emphasize the importance of maintaining proper personal hygiene as a fundamental measure to prevent lice infestations (Qamri, 2008). The spread of lice thrives in conditions characterized by poverty, inadequate hygiene, and overcrowding, with overcrowding being the predominant contributing factor (Ko and Elston, 2004; Burns, et al., 2008; El-Bahnasawy, Abdel, and Morsy, 2012).

Signs and Symptoms

The primary symptom of lice infestations is severe pruritus. An intense itching is believed to stem from an allergic or inflammatory response triggered by the saliva of the louse (Ko and Elston, 2004). Bite reactions can be categorized into four distinct phases, each with its clinical characteristics. In Phase I, there are no apparent clinical symptoms. Phase II is characterized by the development of papules accompanied by moderate itching. Phase III involves the immediate appearance of wheals following a bite, followed by delayed papules and intense itching. The presence of smaller papules and mild pruritus marks phase IV. These phases are believed to be associated with developing immune sensitivity and tolerance over time (Ko and Elston, 2004). Excoriations, cervical lymphadenopathy, and conjunctivitis are common manifestations (Burns, et al., 2008; Chandrashekar, 2018). Secondary bacterial infections, post-treatment dermatitis, and allergic reactions are potential complications of head lice infestations. Furthermore, head lice infestations can cause psychological stress and negatively impact school performance, raising concerns about outbreaks among schoolchildren (Gulgun, et al., 2013). Chronic infestation, particularly in children, can exacerbate pre-existing iron deficiency anemia or potentially trigger it (Chandrashekar, 2018). The Unani/Persian system of medicine believes that in addition to the symptoms mentioned above, these diseases may also manifest with signs such as pallor of the face, reduced appetite, body emaciation, and neck weakness (Qamri, 2008).

Diagnosis

The definitive method for confirming a head lice infestation involves discovering a live adult louse, a young louse (nymph) on the scalp, or a viable egg (nit) within the hair on the scalp (Di Stefani, Hofmann-Wellenhof, and Zalaudek, 2006).

Differential diagnosis

The broad spectrum of conditions to consider in the differential diagnosis of pediculosis encompasses inner root sheath remnants (hair casts), Black Piedra, White Piedra, Trichodystrophy (monilethrix and trichorrhexis nodosa), psoriasis, hair spray debris, seborrheic dermatitis, and psocids (book lice) (Lam, Crutchfield, and Lewis, 1997; Elston, 1999; Ko and Elston, 2004).

Treatment

The Unani/Persian medical approach to dealing with pediculosis adopts a holistic method, focusing on restoring bodily balance to address the condition. This traditional approach incorporates herbal remedies, hygiene practices, and lifestyle adjustments to manage and eliminate the infestation effectively. The goal of the Unani/Persian method is not only to eradicate lice but also to promote overall health and well-being for the affected individual. Humans have grappled with the issue of pediculosis for an extended period. At one point, the situation seemed manageable with the introduction of conventional insecticides like DDT (dichloro-diphenyl-trichloroethane).

Nevertheless, within a few years, clear indications of resistance emerged, not only to DDT but also to other control agents, with instances of cross-resistance documented (Yoon, et al., 2004). In contemporary times, treatments for pediculosis typically involve topical products, such as shampoos, lotions, perfumes, or repellents. The physical re-

moval of nits, nymphs, and adult lice often complements these treatments. In treating lice infestation, drugs operate through four primary activities: repellents, pediculicides, direct contact action, and fumigant activity. Repellents deter lice; pediculicides kill them, while direct contact activity involves substances that affect lice upon contact. Fumigant activity works by creating an environment inhospitable to lice. These varied drug activities provide a multifaceted approach to combating infestations. Topical anti-lice treatments employ various mechanisms to combat lice infestations (Clark, et al., 2013; Dagrosa, and Elston, 2017; Gupta and Gupta, 2022). These mechanisms include:

• Inducing Respiratory Paralysis in Lice: Certain chemicals, such as Pyrethrins and Permethrin, interact with sodium channels in lice and depolarize their cell membranes, leading to respiratory paralysis.

• Paralyzing Lice through Neural Hyperstimulation: Organochloride compounds like Lindane alter the transport of sodium and potassium in lice, resulting in neural hyperstimulation and lice paralysis.

• Inhibition of Cholinesterase in Lice: Organophosphate compounds like Malathion inhibit cholinesterase in lice, disrupting their nervous system and leading to paralysis.

• Asphyxiation of Lice: Some treatments, like Benzyl Alcohol and Dimethicone, work by asphyxiating lice, blocking their respiratory system.

• Physical Removal of Lice: Wet combing is a method that removes lice from the hair by combing them out.

The Unani/Persian system of medicine contains numerous drugs cited in its literature, utilized for their effectiveness in combating lice infestations, and exhibit potent anti-lice properties. This medicinal system offers a range of remedies that have efficiently addressed lice-related issues. The demand for alternative head lice treatments, especially safe and natural for children, has led scientists to seek plant-based products with strong anti-lice properties, minimal resistance, and high safety levels. Due to their lower toxicity and cost-effectiveness, natural extracts from medicinal plants remain the primary valuable resource for treating a wide array of human diseases and disorders, including pediculosis (Muniyandi, et al., 2013). While over 1000 plant species have been identified across various regions with chemical components in their seeds, stems, roots, leaves, and flowers known to combat insect pests, only a select few have been practically employed commercially for insect control in recent decades. The most effective method for eradicating head lice involves the efficient application of pesticides to eliminate both head lice and their eggs, followed by manual removal of the eggs (Al-Zanbagi and Al-Hashdi, 2014). During the literature survey, a total of 225 formulations were discovered in the manuscripts (Figue 3), specifically focusing on skin and hair disorders within the Unani/Persian system of medicine or in sections related to topical dosage forms. The search referenced five classical books using the keywords Qaml, Qamqam, and Shepesh (lice) to ensure thoroughness. Seyban and Reshk signifying nits were searched as indicated in the following pie chart.

The Unani/Persian system of medicine has provided several formulations or prescriptions that involve a combination of various single drugs (mufarad advia) to treat pediculosis. The utilization of herbal medicine in these prescriptions is noteworthy, as it proves to be effective and less harmful when compared to conventional medication. In Unani/Persian medicine, the fundamental approach to treating pediculosis involves a process known as "*Tanqiyya*," which is the systematic elimination of pathological substances

from the body (Arzani, 2005; Hubal, 2005, pp. 19–20; Razi, 2008). This comprehensive treatment method encompasses the administration of various medicinal categories, including musafiyat (Blood purifier), jaali advia (Cleansers), mushilat (Purgatives), and doing fasad (Venesection). The application of Musafiyat and Jaali advia extends to both internal and external routes, reflecting a holistic strategy for addressing pediculosis. The external application of these medications contributes to the eradication of lice and soothes any associated skin irritation or inflammation. Essentially, the focus is on cleansing and purifying the body to address the underlying causes of pediculosis. This approach aligns with the holistic principles of Unani/Persian medicine, which emphasizes restoring the body's natural balance for overall health and well-being. Several Unani/Persian scholars have noted the efficacy of "*fasad* or *venesection*" as a beneficial therapeutic intervention in the context of pediculosis (Arzani, 2005; Hubal, 2005, pp. 19–20; Razi, 2008). This procedure involves controlled bloodletting, which is believed to address the condition positively. The rationale behind this approach lies in the Unani/Persian concept that certain imbalances or impurities in the blood may contribute to pediculosis, and venesection is seen as a method to rectify these issues. Most formulations in Unani/Persian medicine designed for treating pediculosis are applied directly to the affected areas or used as washes for the head or body where lice infestation is evident. These topical applications are specifically designed to target and address the localized problem of lice, providing a targeted and effective means of treating the condition. By applying these formulations directly to the affected areas, Unani/Persian medicine aims to combat the infestation at its source, offering a practical and focused approach to managing and eliminating lice-related issues on the skin and hair. The formulations mentioned below have been proven beneficial in treating lice infestations, showcasing the potency of Unani/Persian remedies in managing this condition.

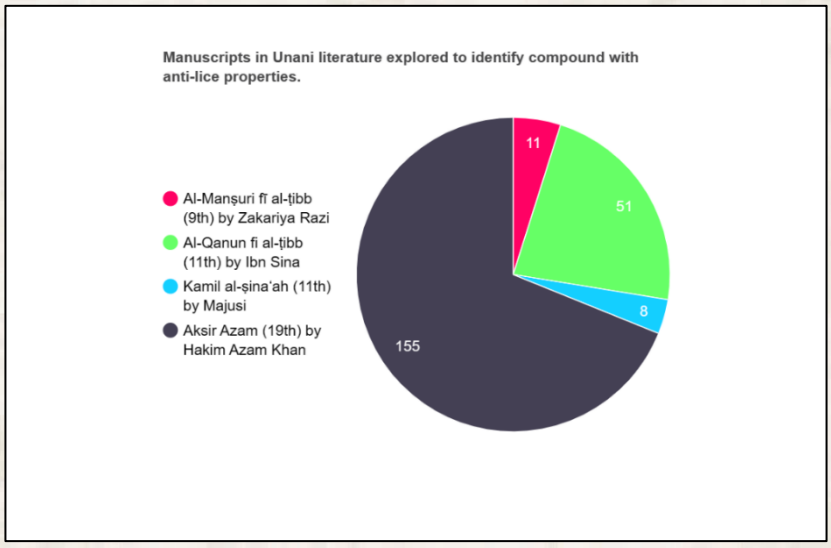


Figure 3. Five Unani/Persian Textbooks Showing 225 Formulations Having Anti-Lice Property

Table 2: Some Unani/Persian Formulations for Pediculosis (Arzani, 2005; Hubal, 2005, pp. 19–20; AMBZ, 2005; Qamri, 2008; Razi, 2008)

Formulation I	Local application of Elva (Aloe barbadensis) and Murmaki (Commiphora myrrha) should be followed by washing the affected area using water infused with the juices of Barg Murd/As (Myrtus communis) and Barg Sanober (Juniperus macropoda).
Formulation II	Apply a locally blended mixture comprising Siyah Kutki (Picorrhiza Kurroa), Borah Armani (Bole Armenian/aluminium silicate) in a 1:1 ratio, and Maveezaj (Delphinium Staphisagria) in a 1:3 ratio, mixed with Rogan Gul (oil of Rosa Damascena). After the application, wash the hair thoroughly.
Formulation III	Apply a combination of Elva (Aloe barbadensis), Mameesa (Thalictrum foliolosum), Murmaki (Commiphora myrrha), Hadtal (Arsenic Trisulphide), and Borah Surkh (Red Aluminium silicate) mixed with Rogan Gul (oil of Rosa Damascena). Subsequently, wash the treated area with a decoction prepared from the leaves of Aas (Myrtus communis), Gulab (Rosa rubiginosa), and Dirmana Turki (Artemesia Meritima).
Formulation IV	When dissolved in water, potash alum is employed for hair washing or bathing to eliminate lice infestation.
Formulation V	Prepare Joshanda Turmus, a decoction of Lupinus Albus Linn, by boiling the beans in water. Strain the resulting liquid and use it to wash the affected area.
Formulation VI	Roghan Qurtum: Heat clarified butter (ghee) and incorporate powdered Carthamus Tinctorius seed paste, stirring constantly until it thickens. After straining the mixture, apply it topically.
Formulation VII	Roghan Turb: Heat sesame oil and incorporate the powdered seeds of Raphanous Indicus, stirring until the mixture thickens. Strain the mixture and use it topically.

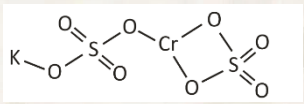
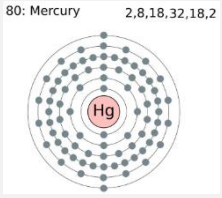
Table 3: List of 20 medicinal Plants that show anti-lice properties according to Unani/Persian medicine

Botanical name	Family	Common / Unani/Persian name	Parts used	Active constituent	References
Peganum harmala L.	Zygophyllaceae	Harmal	Root	Harmine, Harmaline, Harmol and Harmalol, Quinazoline derivatives	(Mazandarani, et al., 2012; Miraj, 2016)
Rhus coriaria L	Anacardiaceous	Sumaq	Berry	Tannins, phenolic acids, flavonoids, terpenoids, and essential oil (monoterpenes)	(Avicenna, 2010; Alzweiri, et al., 2011; Kamalinejad, et al., 2019)
Melaleuca alternifolia	Theaceae	Tea tree	Leaves	Terpinen-4-ol, α-terpeninol, linalool, etc	(Rossini, Castillo and González, 2008; Di Campli, et al., 2012; Kumari, et al., 2023)
Pongamia pinnata L.	Fabaceae	Karanj	Seed, Bark	Petroleum ether, chloroform, methanol, demethoxy-kanugin, gamatay, glabrin, glabrosaponin, kaempferol, kanjone, kanugin, karangin, neoglabrin, pinnatin, pongamol, pongapin, quercitin, saponin, b- sitosterol and tannin.	(Samuel, et al., 2009; Yadav, et al., 2011; Ghumare, et al., 2014; Raja and Sreenivasulu, 2016)
Annona squamosa	Annonaceae	Custard apple/ Sharifah	Seed, Leaves	Oleic acid, triglyceride, Linalool, Borneol, Eugenol, Farnesol, Geraniol and Flavonoids	(Intaranongpai, Chavasiri, and Gritsanapan, 2006; Khare, 2008; Patel, and Kumar, 2008; Khazain-ul-Advia and Delhi, 2011; Saha, 2011; Benitez, et al., 2015)

Lawsonia Inermis	Lythraceae	Henna /Mehndi	Leaves	Coumarins, flavonoids and naphthoquinones	(Marimuthu, et al., 2012; Al-Zayyadi, 2020; Malviya, et al., 2020)
Aristolochia longa	Aristolochiaceae	Zarawand Taveel	Root, Leaves	Polyphenols, flavonoids (flavonol, flavones, flavonoid glycoside), proanthocyanin, tannins, cheterosides, carbohydrates, and saponins	(Majusi, 1889; Avicenna, 2010; Sana, 2020)
Piper nigrum L	Piperaceae	Kali Mirch	Fruit	Piperine, Piperamide, Piperamine, Piperettine, Pipericide, Piperolein B, Sarmentine, Sarmentosine, Retrofractamide, Phenolics, flavonoids, alkaloids, amides and steroids, lignans, neolignans, terpenes, chalcones	(Majusi, 1889; Khan, 2011; Hossain, Mahmud and Rahmatullah, 2012; Kumar, et al., 2012)
Delphinium staphisagria L	Ranunculaceae	Mavizaj	Seed	Delphinine, delphinoidine, delphisine, Staphisagrine	(Kuder, 1947; Vicentini, Manfredini and Contini, 2018)
Artemisia vulgaris L	Asteraceae	Mugwort	Flower, leaves	Essential oils, flavonoids, sesquiterpene lactones, phenolic acids, coumarins	(Majusi, 1889; Khan, 2011; Candy, et al., 2020)
Mentha Piperita	Lamiacaea	Pudina/Mint	Leaves	Menthol, Menthone, limonene	(Veal, 1996; Sittichok, Wongnet, and Soonwera, 2018; Candy, et al., 2020; Salehi and Heshmat, 2017)
Eugenia caryophyllata	Myrtacaea	Loung/Clove	Bud, leaves	Acetyleugenol, β-caryophyllene, eugenol, α-humulene, and methyl salicylate, isoeugenol and Methyleugenol	(Yang, et al., 2003; Candy, et al., 2020)
Abrus Precatorius	Fabacaea	Gonkchi/ Crab eye	Seeds	Abrusogenin	(Upadhyay, Ghosh, and Singh, 2011; Salehi and Heshmat, 2017)
Citrus Aurantifolia	Rutacaea	Lemon	Fruit	citronellol	(El Akkad, et al., 2016; Kristinawati, Zaetun and Srigede, 2018; Susanty, et al., 2020; Izzah, et al., 2022)
Allium sativum	Amaryllidaceae	Garlic	Bulb	Allicin, flavonoids and saponins	(Shrivastava and Jain, 2010; Susanty, et al., 2020; Izzah, et al., 2022)

Aloe Barbadensis L	Liliaceae	Aloe vera/Ghekwar	Gel	Aloe-emodin, aloin, Aloesin, emodin, and Acemannan	(Ahmad, Ibrar, and Ali, 2011; Khazain-ul-Advia and Delhi, 2011)
Pinus sylvestris	Pinacaea	Qatran	Buds, bark	monoterpenes (α-terpineol, borneol, fenchol), sesquiterpenes (caryophyllene and δ-cadinene), saturated fatty acid (palmitic acid) and monounsaturated fatty acid (oleic acids)	(Aghili, Rahimi, and Shams-Ardekani, 2009; Khazain-ul-Advia and Delhi, 2011)
Datura metel L	Solanaceae	Datura/Thorn apple	Whole plant	flavonoids, tropane alkaloids, tannins, saponins, and withanolides	(Sharma, Shailajan, and Menon, 2009; Sreedhar, et al., 2020)
Azadirachta indica	Maliceae	Neem	Leaves	Azadirachtin,nimbolinin, nimbin, nimbidin, nimbidol, sodium nimbinate, gedunin, salannin, and quercetin	(Nadkarni, 1954; Majeed, et al., 2007; Khazain-ul-Advia and Delhi, 2011; Mehlhorn, et al., 2011; Abdel-Ghaffar, et al., 2012; Putriana, et al., 2019)
Myrtus communis L.	Myrtaceae	Aas	Leaves	Polyphenols, myrtucommulone (MC), semimyrtucommulone (S-MC), 1,8-cineole, α-pinene, myrtenyl acetate, limonene, linalool, and α-terpinolene	(Milhau, et al., 1997; Shirazi, 2007; Khani, and Basavand, 2012)

Table 4: Anti-lice activity of mineral origin drugs (local application) according to Unani/Persian medicine

Chemical name	Common Name	Chemical formula	Chemical or Atomic Structure	Form	Reference
Aluminous Sulphate	Alum, Phitkari, Shab-i-Yimani	$K_2SO_4.Al_2(SO_4)3.24H_2O$		Crystal	(Khazain-ul-Advia and Delhi, 2011; Roqaiya and Begum, 2015)
Mercury	Seemab	*Hg*		Liquid	(Delario, 1950; Fornaciari, et al., 2011; Arnold, 2017)

Essential oils

These are typically composed of a mixture of different compounds obtained from plants using methods like steam or hydro-distillation. These essential oils are most frequently extracted from plant species that are primarily found within the Myrtaceae, Lauraceae, Lamiaceae, and Asteraceae families. Typically, they contain a few major terpenes or terpenoid components with low molecular weights, often pivotal in defining the biological characteristics of the essential oils (Roqaiya and Begum, 2015). Previously, essential oils have demonstrated significant efficacy in treating pediculosis. However, the effectiveness of essential oils against lice varies significantly among different species. Table 5 presents the essential oils that have shown effectiveness against various species of lice.

Table 5: Essential Oils Showing Anti-Lice Activity

Family	Plant name	Major component	Action	Reference
Apiaceae	Pimpinella Anisum	*Trans-Anethole*	Inhibit Lice	(Candy, et al., 2020)
Lamiaceae	Thymus vulgaris	*Thymol, p-cymene, carvacrol*	Pediculicidal	(Gutiérrez, et al., 2016)
	Lavandula Augustifolia, Lavandula latifolia, Lavandula Intermedia	*linalool and linalyl acetate*	Pediculicidal	(Valnet, 1990; Lawless, 1992)
Lauraceae	Cinnamomum Cassia, Cinnamomum zeylanicum Cinnamomum porphyrum	*Cinnamaldehyde, benzaldehyde, Eugenol*	Pediculicidal, Repellant	(Yang, et al., 2005; Elumalai, et al., 2016; Yones, Bakir and Bayoumi, 2016)
Myrtaceae	Eugenia Caryophyllata	*Eugenol*	Repellant, Pediculicidal	(Yang, et al., 2004)
	Eucalyptus globulus	*1,8-cineole*	Pediculicidal	(Yang, et al., 2004; Toloza, et al., 2008; Choi, et al., 2010)
Verbenaceae	Aloysia Citriodora, Aloysia Polystachya	*Limonene, citronellal, α-curcumene*	Pediculicidal	(Toloza, et al., 2008)
	Lippia multiflora	*limonene, geraniol, and linalool*	Pediculicidal	(Oladimeji, et al., 2000)
Zingiberaceae	Hedychium spicatum	*1,8-cineole.*	Pediculicidal	(Jadhav, Kore and Kadam, 2007)
Meliaceae	Azadirachta indica	*azadirachtin, gedunin, nimbandiol, nimbin, nimbinene, nimbolide, nimbolinin, nimbidin, salannin and quercetin*	Pediculicidal,	(Su, and Mulla, 1999; Morsy, et al., 2000)

Discussion

The discussion offers an extensive overview of pediculosis, encompassing modern medical knowledge and insights from the Unani/Persian system of medicine. By merging historical, scientific, and alternative medical perspectives, it serves as a valuable resource for researchers and practitioners investigating the complexities of lice infestations and potential treatment approaches. This in-depth exploration holds the potential to advance knowledge, aiding the development of more varied and efficient methods for managing pediculosis.

The article meticulously examines the life cycle of lice, elucidating the stages from egg (nit) to adult louse and their survivability outside the human host. It highlights lice's adaptation to human-specific environments, especially in relation to the emergence of clothing, a significant milestone in human history.

Exploring etiopathogenesis, the article contrasts the viewpoints of Unani/Persian and modern scientific understanding. While the Unani/Persian system of medicine emphasizes lice origin from decomposed secretions due to heat and moisture, the scientific perspective focuses on blood-feeding behavior and allergic responses triggering inflammatory reactions. Signs, symptoms, diagnosis, and differential diagnosis are extensively detailed, underscoring the need for accurate identification to differentiate lice infestations from other scalp conditions or debris.

The article navigates through historical and contemporary treatments, tracing the evolution from conventional insecticides to modern topical products and the holistic, plant-based Unani/Persian approach.

Further research exploring herbal remedies, essential oils, and traditional treatments may help us understand their efficacy, safety, and integration into modern medical practices. This discussion sets a foundation for interdisciplinary research and collaborative efforts in addressing pediculosis, emphasizing a nuanced understanding from diverse medical and historical perspectives.

Future research should intensify the search for anti-lice products from plants, expanding studies on EOs and fixed extracts. The search should diversify target activities, focusing on more effective repellents, natural synergists, and products that soften the glue attaching nits to hair strands.

The study indicates that plant extracts with proven head lice repellency are primarily general insect repellents. However, there might be discrepancies between results in vitro and clinical trials. Essential oils (EOs) have substantial potential for controlling various insects, being relatively harmless to mammals and biodegradable. Their use in cosmetic formulations makes EOs promising candidates for managing sanitary issues, including medical, veterinary, and agricultural pests. For head lice treatment, EOs show promise as new control agents, although limited knowledge about their efficacy and mode of action hinders their widespread recommendation as treatment alternatives.

Conclusion

This comprehensive review of pediculosis merges modern medical insights with the Unani/Persian system of medicine, examining lice's life cycle and their adaptation to human environments. It highlights contrasting perspectives on the origins and management of lice, enriching the discourse. Emphasizing holistic, plant-based treatments like essential oils, the article underscores the need for future research to bridge traditional remedies with modern science, paving the way for safe, effective, and integrative lice management solutions.

Authors' Contribution

Sabba Saltanat and Nadeem Ahmad Shah collaboratively conceived the idea for the review. Sabba Saltanat conducted the initial literature review and drafted the manuscript. Nadeem Ahmad Shah provided critical revisions, added key insights, and contributed to the analysis and interpretation of the data. Both authors contributed equally to refining the manuscript and addressing reviewer feedback. Both authors read and approved the final version of the paper.

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