International Journal of Unani & Traditional Medicine
Published by FHT • ISSN: 3048-9482
Volume:2 Issue:2
Review Article

Mom (Beeswax): A Comprehensive Review Integrating Unani and Contemporary Medicines

Abstract

Mom or Beeswax (Cera alba) is a natural secretion of honeybees (Apis mellifera, Apis cerana) that serves as both a pharmaceutical excipient and therapeutic agent in Unani and contemporary medicine. Classical Unani texts describe Mom (also called *Qairoos*) as *Harr 2 Yābis* and *Raṭb Mu'tadil*. It possesses diverse ethnomedicinal properties, including *Mulayyin* (emollient), *Muhallil* (resolvent of swellings), and *Mudammil* (wound-healing), properties. It is recommended to use it in topical preparations such as *Marham* and *Qairooti*. Modern analyses confirm beeswax's complex chemical composition, consisting mainly of esters, hydrocarbons, and free fatty acids and its notable physicochemical stability. Pharmacological investigations substantiate its anti-inflammatory, antioxidant, antimicrobial, gastroprotective, and wound-healing activities. Preclinical experiments using burn wounds and antimicrobial models validate its traditional applications. Clinical evidence includes randomised placebo-controlled trials of D-002 (Abexol), a purified beeswax-alcohol preparation, demonstrating symptomatic relief in osteoarthritis and gastroprotective effects. Pilot clinical studies confirming the safety and efficacy of honey, olive oil and beeswax mixtures in haemorrhoids and anal fissures. The convergence of Unani doctrine and modern biomedical evidence highlights beeswax's dual role as a therapeutic agent and formulation base, supporting its continued clinical and formulation research.

Keywords: *Apis mellifera,* Beeswax, *Cera alba*, *Mom,* pharmacological activities, Unani medicine.

Rahnuma Anjum[1#], Arshiya Sultana[2*#], Shahla Anjum[3], Zya Shireen[1], Farhat Quamar[1]

[1] PG Scholar, Department of Ilmul Qabalat wa Amraze Niswan (Gynaecology and Obstetrics), National Institute of Unani Medicine, Bengaluru, Karnataka, 560091 India; 10797rahnuma@gmail.com, shireenzya193@gmail.com, farhatquamar08@gmail.com

[2] Professor, Department of Ilmul Qabalat wa Amraze Niswan (Gynaecology and Obstetrics), National Institute of Unani Medicine, Bengaluru, Karnataka, 560091 India; drarshiya@yahoo.com

[3]Department of Maolajat (General Medicine, A&U Tibbia College and Hospital, Karolbagh, New Delhi); anjumshahla5@gmail.com

[*]Corresponding Author
Prof. (Dr.) Arshiya Sultana: drarshiya@yahoo.com
 # Equally contributed

ARTICLE HISTORY:
Received on: 13-11-2025
Accepted on: 16-03-2026
Published on: 14-05-2026

1. Introduction

Various insects produce wax, but the bees of the *Apoidea* family are particularly renowned for creating wax that humans highly value and use. Beeswax is a valuable natural product primarily produced by honeybees in the family Apidae, with *A. mellifera* and *A. cerana* being the main species used in commercial production. Of these, *A. mellifera* is the predominant source for large-scale beeswax harvesting.(Gupta and Anjali, 2023) Beeswax is secreted by young worker bees aged 12-18 days, after their nursing phase in the hive. These bees release wax from specialised abdominal glands, which initially appear as a liquid but soon solidify into thin flakes upon exposure to air. The worker bees then mould these flakes using their mandibles to construct hexagonal honeycomb cells, reinforced with pollen and propolis to enhance durability.(Fratini et al., 2016)

Freshly secreted beeswax is nearly white but gradually turns yellow when it comes into contact with honey and pollen. With continued use in the hive, it darkens over several years due to the accumulation of impurities such as cocoon residues. Chemically, beeswax is stable and resistant to acids and the digestive enzymes of bees. It is insoluble in water and cold alcohol, partially soluble in boiling alcohol, and completely soluble in chloroform, carbon disulfide, and hot turpentine.(Fratini et al.2016)

Because of its distinctive chemical constituents and physical properties, beeswax is extensively used in various natural and industrial applications.

Mom serves as both a pharmaceutical excipient and a therapeutic agent in Unani as well as contemporary medicine. It has diverse ethnomedicinal properties , including *Mulayyin* (emollient), *Muhallil,* and *Mudammil* properties.

It is recommended in topical formulations.(Khān MA, 2018) In modern pharmacology, beeswax is recognised for its complex chemical structure, comprising mainly esters, hydrocarbons, and free fatty acids and for its notable physicochemical stability, which supports its wide use as a natural excipient and bioactive ingredient. (Gupta and Anjali, 2023) Pharmacological and clinical investigations substantiate the traditional Unani uses of beeswax, demonstrating its anti-inflammatory (Puente et al., 2014; Fernandez-travieso, Rodriguez-perez and Ruenes-domech, 2020; Martinello, 2021), antimicrobial (Ghanem, 2011), gastroprotective (Fernandez-travieso, Rodriguez-perez and Ruenes-domech, 2020) and wound-healing activities.(Bayir et al., 2019) Because of its distinctive chemical constituents, biological activities, and stability, beeswax remains a valuable natural product extensively utilised in pharmaceutical, cosmetic, and industrial formulations.(Kurek-Górecka et al., 2020) The present manuscript aims to provide a comprehensive account of beeswax, highlighting its traditional Unani perspectives, pharmacognostic characteristics, chemical profile, pharmacological activities, and clinical applications. By integrating evidence from Unani classical texts with modern biomedical and pharmacological research, the paper seeks to elucidate the scientific basis underlying its traditional therapeutic claims and to highlight its role as both a bioactive natural substance and a pharmaceutical excipient.

Main Contribution of the manuscript: This manuscript contributes to the existing body of

body of knowledge by connecting traditional Unani wisdom with modern scientific validation of beeswax. It amalgamates classical descriptions of its temperament (*Mizāj*) and therapeutic properties with contemporary evidence on its physicochemical attributes, pharmacological actions, and clinical efficacy. The review emphasises the dual significance of beeswax as a therapeutic agent and formulation base, providing a rational basis for its continued utilisation in Unani and modern pharmaceutics. Furthermore, it identifies probable areas for future research, including mechanistic studies and clinical validation of beeswax-based preparations.

2. Methadology

This review consolidates data from classical Unani texts, (Ghanī N, 2001; Hakim MA, 2002; Kabīruddīn M., 2007; Tariq NA, 2010; Khān MA, 2018) and modern scientific studies retrieved from PubMed, Scopus, and Google Scholar. The pharmacognostic properties, physicochemical characteristics, and pharmacological activities of beeswax were compiled and analysed from primary and secondary sources. Studies focusing on wound healing, anti-inflammatory, antimicrobial, antifungal, and antihemorrhoidal effects were specifically reviewed to establish correlations between traditional Unani usage and modern biomedical evidence.

Standardised Purification Protocol for Beeswax

In Unani pharmaceutics, purification (*Tadbeer*) is a fundamental process undertaken to remove impurities, enhance physicochemical stability, and improve the safety and therapeutic efficacy of crude substances. Classical Unani texts describe specific purification methods for beeswax to obtain pharmaceutically acceptable quality. However, contemporary standardisation requires harmonisation of these traditional procedures with modern analytical and quality control frameworks.

This review synthesises documented Unani purification practices for beeswax and correlates them with modern Good Manufacturing Practices (GMP) and established analytical quality parameters. The reported purification steps-melting, filtration, washing, reheating, and solidification are critically analysed in light of their ability to eliminate physical impurities (debris, pollen, propolis residues), reduce chemical contaminants (pesticide residues and heavy metals), and minimise microbial load, while preserving the intrinsic chemical composition and therapeutic properties of beeswax. Emphasis is placed on aligning each traditional step with measurable physicochemical and microbiological quality attributes to support reproducibility and batch consistency as described in the literature.

The review further discusses quality control and safety evaluation criteria for purified beeswax as recommended in Unani Pharmacopoeial standards, WHO guidelines for herbal medicines (WHO guidelines on good herbal processing practices for herbal medicines.Annex 1, 2003), and AYUSH regulatory frameworks. Reported parameters include melting point, loss on drying, microbial limits, heavy metal content, and pesticide residues, which are commonly assessed using validated analytical techniques such as Atomic Absorption Spectroscopy (AAS) and Gas Chromatography–Mass Spectrometry (GC-MS/MS). Chromatographic profiling methods, including HPTLC and HPLC, are highlighted as tools for establishing chemical fingerprints and ensuring batch uniformity, as documented in previous studies.

1. **Raw Material Procurement and Authentication:**

Literature indicates that crude beeswax intended for pharmaceutical use should be sourced from authenticated suppliers in accordance with Pharmacopoeia of India (UPI) standards . Authentication procedures described include macroscopic and microscopic evaluation conducted in pharmacognosy laboratories, with deposition of voucher specimens in institutional herbaria for reference.

2. **Classical Purification Procedure**:

Classical Unani purification methods, as reported in pharmacopeial and textual sources, are reviewed and interpreted alongside modern standardisation principles to enhance quality assurance without altering traditional foundations.

3. **Storage and Stability:**

Purified beeswax is stored in amber glass jars at 25 ± 2 °C and relative humidity 60 ± 5%. Stability and physicochemical parameters were re-assessed every 3 months for 12 months.

4. **Documentation:**

The review underscores the importance of GMP-compliant documentation practices such as batch records, equipment calibration, and quality control certification as essential components of standardised processing in contemporary Unani pharmaceutical manufacturing.

Quality Parameters and Evaluation of Beeswax:

Beeswax is evaluated based on a combination of sensory, physical, and chemical properties to ensure its quality, authenticity, and safety. Parameters such as colour, odour, texture, melting point, density,(Winkler-Moser JK, Anderson J and Etal, 2019) and chemical composition are standardised, and specific tests are applied to detect impurities, contaminants, and adulteration. These criteria are essential to guarantee that beeswax meets the requirements for pharmaceutical, cosmetic, and industrial applications.(Bogdanov, 2004; Bogdanov and Science, 2016; Svečnjak et al., 2019; MS and IA, 2020) The table below summarises the key parameters, their standard values, and the methods used for their evaluation.(**Table 1**)

Table 1. Quality Criteria and Parameter Requirements

Category	Parameter	Requirement / Value Range	Method / Reference
Sensory Characteristics	*Color*	*Yellow to yellow-brown*	*Visual*
	Odour	*Honey-like*	*Sensory*
	Texture / Breakage	*Fine-granular, blunt, not crystalline*	*Physical observation*
	Consistency	*Workable, non-sticky to fingers*	*Manual test*
	Chewing property	*Should not stick to the teeth*	*Sensory*
Physical Properties	*Density*	*0.950-0.965*	-
	Melting point	*61-65°C*	*EP*
	Refractive index (at 75°C)	*1.4398-1.4451*	*EP / DGF-M-V-2**
Chemical Properties	*Water content*	*< 1%*	*DGF-M-V-2**
	Acid value/number	*17-23*	*EP*

Category	Parameter	Requirement / Value Range	Method / Reference
	Ester value/number	*70-90*	*EP*
	Ester/Acid ratio	*3.3-4.3*	-
	Saponification value/number	*87 -104*	*EP*
	Peroxide value	*≥ 8*	-
	Hydrocarbons	*max. 14.5%*	*DGF-M-V-6*
	Paraffins	*Absent*	-
Purity	*Mechanical impurities, additives*	*Absent*	*DGF-M-V-3*
	Glycerols, polyols, fatty acids, fats	*Absent*	*EP*
Authenticity	*Gas chromatography pattern*	*Typical for the sample*	-
Contamination	*Acaricide residues*	*Free / Absent*	-

DGV, V2,3,6 – Methods of Deutsche Gesellschaft für Fettwissenschaft, EP - European Pharmacopoeia 7 th - Edition, 2008

Beeswax Sampling, Processing, and Storage

1. Sampling of Beeswax

The method of collecting beeswax depends on the research purpose and the analytical approach used. Samples may be obtained directly from hives, from comb foundations, or from processed beeswax blocks available in the market. The aim is to ensure that samples are representative and free from external contaminants.*(Svečnjak et al., 2019)*

2 . Collection of Comb Wax

For the analysis of genuine beeswax, it is advisable to collect wild-built combs, newly constructed combs made by bees without any foundation sheets. During the wax-producing season, empty frames should be placed in the hive to allow natural comb formation. Colonies chosen for sampling must not have been exposed to veterinary drugs to prevent contamination. Visible impurities like propolis, pollen, or honey should be removed before analysis. Although old combs may also be used, they often contain residual substances such as cocoons and bee debris, which require purification through melting.

3. Collection of Comb Foundation

Comb foundations are typically obtained from local beekeepers or commercial beekeeping suppliers. As these foundations are usually refined and homogeneous, no additional purification is needed before examination.

4 . Collection of Beeswax Blocks

Beeswax blocks are produced by melting comb cappings or old honeycombs. These blocks may vary in texture, appearing either uniform or layered.

For **homogeneous blocks**, collect small portions from several areas and mix them.

For **layered blocks**, take samples from the top, middle, and bottom sections, and blend them to ensure uniformity.

Sampling instruments such as metal spatulas must be sterilised with ethanol between uses to prevent cross-contamination.

5. Washing of Beeswax

Before melting, the wax should be checked for any remaining impurities. Washing with distilled water helps remove traces of honey, pollen, and propolis, ensuring a cleaner sample for melting and analysis.(Svečnjak et al., 2019)

6 . Melting of Beeswax

Melting is the most common purification step used in beeswax processing. Two basic techniques are followed:

a. Melting with Water: Beeswax is placed in a stainless-steel or heat-resistant glass vessel and covered with distilled water. It is then heated gently between 70-90°C until fully melted. The molten mixture is filtered through fine cotton or gauze, cooled, and allowed to solidify. Once hardened, the wax is removed and dried at room temperature.

b. Melting without Water: Refined or commercial wax may be melted directly in an oven, heating plate, or water bath at 70–90°C, followed by natural cooling. Heating beyond 140°C should be avoided, as it alters wax composition and may degrade its physicochemical quality.(Bogdanov and Science, 2016; Svečnjak et al., 2019)

7. Refining and Purification

Further purification may involve additional filtration or settling. Laboratory methods sometimes use solvents such as gasoline or xylene for extraction, but these are suitable only for small-scale analyses because they dissolve both wax constituents and impurities, leading to inferior quality.(Bogdanov and Science, 2016)

8. Storage of Beeswax

Properly dried beeswax remains stable for long periods without preservatives. It should be stored in airtight containers made of plastic, glass, or stainless steel; reactive metals such as copper or iron should be avoided. Large wax sheets can be wrapped in paper or kept in envelopes.

Ideal storage conditions are dark, dry environments at 10–23°C. Samples containing brood or bee bread should be kept below 9°C to avoid wax moth infestation. Under suitable conditions, beeswax remains safe and stable for several years.(Svečnjak et al., 2019; AI et al., 2024)

9 . Manufacture of Beeswax

Industrial wax production began in the mid-19th century and continues to rely mainly on melting and chemical extraction methods.

Melting using boiling water, steam, electricity, or solar energy is the most common and effective method, yielding high-quality wax. Chemical extraction, involving solvents such as xylene or gasoline, is limited to laboratory use due to the risk of dissolving beneficial wax components.(Bogdanov and Science, 2016) Wax yield varies depending on the comb type and extraction method-typically around 50% from old combs, with higher recovery from new combs and cappings. Residual comb debris still contains about 30% wax, which may be recovered by solvents but is generally of lower quality.

Using soft water and stainless-steel vessels helps maintain colour and purity. Wax derived from comb cappings is considered the purest form, meeting high standards of quality and stability. (Bogdanov and Science, 2016; Svečnjak et al., 2019)

3. Results and Discussion

Unani and Conventional Perspectives of Mom

***Mahiyat* (Definition and Description)**: Beeswax, a popular product derived from beehives, is secreted as a waste product from the wax glands located near a bee's abdomen.(Ghanī N, 2001; Kabīruddīn M., 2007; Tariq NA, 2010) This yellowish, solid substance is produced as a byproduct and has a unique characteristic: it doesn't feel greasy. Beeswax melts between 144°F to 148°F and is soluble in terpentine oil when heated.(Tariq NA, 2010) The part used and studied is the wax.

It occurs in white or yellow colour, as mentioned in Bustan al-Mufradāt. In terms of organoleptic properties, it is tasteless, unpalatable, and oily, as described in Bustan al-Mufradāt and Taj al-Mufrādat. It possesses a slightly unpleasant odour, which is characteristic of its natural form

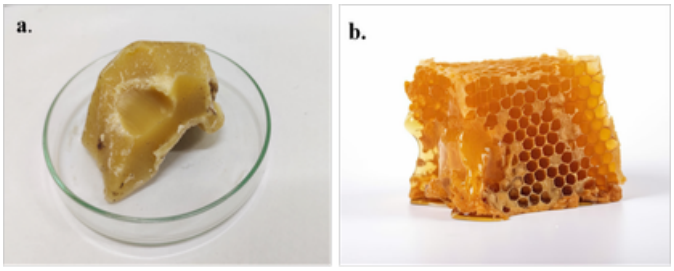

Figure 1. a) Beeswax; b) Honeycomb

I. Types of Beeswax: According to Muḥīṭ-i-Aʿẓam:

1. Honeycomb Wax: The first type involves honey collection by bees. This is the finest quality, reddish-yellow, soft, sticky, fragrant, and associated with the smell of honey. It is used medicinally and in formulations.

2. Structural Wax: Used by bees to form hive walls; of moderate quality and without honey.(Khān MA, 2018)

3. Propolis: A dark resinous substance, also called *bee glue* or *Russian penicillin,*(El-Seedi *et al.*, 2022) used by bees to coat and protect hives. It is the lowest grade of wax in terms of medicinal use. (Khān MA, 2018)

II. **Ideal Characteristics:** The ideal wax possesses the following characteristics: a yellowish-red hue, softness, shine, stickiness, purity, fragrance reminiscent of honey, and freedom from impurities. It should be malleable and resistant to breakage. According to Sheikh, pure wax comes from the cells where bees lay eggs and hatch young bees, without honey. The dark wax is the residue from these cells.(Khān MA, 2018)

III. **Taxonomy and Nomenclature:** Cera alba,(Shamim Khan, 2016) commonly known as beeswax, belongs to the family Apidae. It is known by various vernacular names across different languages and traditional systems of medicine. In **English**, it is called Wax; (Kabīruddīn M., 2007; Nadkarni KM, 2009; Tariq NA, 2010; Khān MA, 2018) in **Latin**, it is referred to as Cera;(Kabīruddīn M., 2007) in **Arabic**, it is known as *Shama;*(Hakim MA, 2002; Kabīruddīn M., 2007; Nadkarni KM, 2009; Khān MA, 2018) and in **Hindi**, it is called Mom(Hakim MA, 2002; Nadkarni KM, 2009) and Madan. (Khān MA, 2018) In **Ayurvedic** texts, it is referred to as Madhuchishtha.(Fratini et al., 2016) In **Persian**, it is known as *Mom,*(Hakim MA, 2002; Nadkarni KM, 2009; Khān MA, 2018) and *Qairoosa.*(Khān MA, 2018) In **Sanskrit**, it is identified as Sikhta and Madhujan.(Nadkarni KM, 2009) In **Bengali**, the terms Moti(Kabīruddīn M., 2007; Tariq NA, 2010) and Mom(Nadkarni KM, 2009) are used. Within the Unani system, it is called Mom,(Hakim MA, 2002) and Qairoos.(Khān MA, 2018) Additionally, in Syria, it is referred to as Qairoosa, while in Roman sources, it appears as Qaraarnoosh or Qairota.(Khān MA, 2018) In regional Indian languages, it is known as Mina, Min, or Mah in Gujarati; Mellugu in Tamil; Mainam in Telugu; and Lilin in Malayalam.(Nadkarni KM, 2009)

IV. **Method of Whitening Beeswax**

To refine and whiten beeswax, it should first be melted and thoroughly cleansed of dirt. The purified wax is then placed in a wide-mouthed earthen vessel with seawater and a small quantity of Armenian bole (a type of red clay). This mixture is boiled two or three times and then removed from the heat. A smaller earthen pot, moistened at the base with cold water, is used to collect the wax by rubbing it against the larger pot. The process is repeated until all the wax is gathered

The collected wax is then moulded into tablets, suspended by threads, and exposed to sunlight while being intermittently sprinkled with cold water. They are left overnight under the moonlight until the wax turns white. For further whitening, the boiling process may be repeated, sometimes by adding very hot water and Armenian bole, followed by pressing the wax through a silk cloth using a round-bottomed earthen pot.

This procedure is preferably carried out in spring, when the sun's heat is gentle and the air retains humidity, thereby preventing the wax from becoming brittle.(Ibn Baitar, 1999)

V. ***Mizāj* (Temperament):** According to classical Unani literature, the temperament of Cera alba (*Mom*/*Qairoos*) has been described with slight variations by different scholars. As per Taj al-Mufrādat, (Tariq NA, 2010) it is characterised as *Harr 2* Muʿtadil Yābis (hot in the second degree and moderately dry). Some sources, including Taj al-Mufrādat and Makhzan al-Mufrādat, describe it simply as *Muʿtadil* (moderate in temperament). Meanwhile, Jalinoos (Galen) classify its temperament as *Harr 1 Raṭb Muʿtadil* (slightly hot and moist with a moderate nature).(Khān MA, 2018) This indicates a moderately warm temperament with either dry or balanced moist qualities, supporting its use in conditions caused by excessive coldness or dryness.

VI. ***Afʿāl* (Therapeutic Actions in Unani Texts):** According to the Unani text,(Hakim MA, 2002; Kabīruddīn M., 2007; Tariq NA, 2010; Khān MA, 2018) beeswax demonstrates the following therapeutic actions (**Table 2**).

Table 2. Therapeutic Action of Mom in Unani Medicine

Action (Arabic)	English Translation
Muhallil wa Mulayyin -i-Awrām Sulba(Kabīruddīn M., 2007; Tariq NA, 2010)	*Resolvent of inflammatory swellings*
Muhallil-i-Awrām wa Riyah (Hakim MA, 2002)	*Resolver of swellings and disperser of gases*
Munḍij-i-Waram(Hakim MA, 2002)	*Maturative of abscesses*
Mudammil-i-Quruh(Khān MA,2018)	*Wound and ulcer healer*
Musakkin-i-Auja'a,(Hakim MA, 2002; Kabīruddīn M., 2007; Tariq NA, 2010)	*Analgesic: relieves pain*
Munbit-i-Lahm(Kabīruddīn M., 2007; Tariq NA, 2010)	*Promotes granulation and tissue regeneration*
Mulayyin-i-Aʿ Sab(Hakim MA, 2002)	*Nerve relaxant*

VII. Isti'mālāt (Therapeutic Uses)

External Uses

a) In Ointments and Poultices:

- Used as a base in *Marham* (ointments) and *Zamad* (plasters) for its emollient, healing, and anti-inflammatory effects.(Kabīruddīn M., 2007; Tariq NA, 2010) Mixed with *Banafsha* (*Viola odorata)* oil to treat chest and skin roughness, itching, and dryness. (Hakim MA, 2002; Khān MA, 2018)
- Combined with *Alsi* (linseed oil) to cleanse the face and relieve muscle stiffness.(Hakim MA, 2002)
- Heated with *Haldi* (turmeric) in sesame oil, applied to swollen areas to reduce inflammation and gas retention.(Hakim MA, 2002; Khān MA, 2018)
- When applied with *Roghan-e-Gul* (rose oil), it heals cracked skin, wounds, boils, and tumours.(Khān MA, 2018)
- As *Qairooti*, it provides pain relief and anti-swelling effects in musculoskeletal disorders.(Kabīruddīn M., 2007)

b) Fumigation:

- Burning beeswax emits smoke that induces sweating, protects against epidemic infections, and neutralises foul odours.(Hakim MA, 2002; Khān MA, 2018)
- Used during fevers and epidemic outbreaks to cleanse the air and prevent harmful vapours from entering the brain.(Hakim MA, 2002)

c**) Wound and Ulcer Care:**

- Heals even chronic, purulent wounds.
- When combined with zinc oxide, it prevents the formation of pus and accelerates epithelial regeneration.
- Gilani notes that the wax's inclusion in ointments enhances penetration and moisture absorption in ulcers, promoting faster healing.(Khān MA, 2018)

d) Neuromuscular Disorders:

- The oil derived from beeswax (*Roghan-e-Mom*) is useful in paralysis, facial palsy, and neuralgia by relaxing muscles and relieving stiffness.(Sīnā I, 1999; Tariq NA, 2010)

Internal Uses

a) Respiratory Disorders:

- Alleviates dry cough, hoarseness, and chest pain when taken in small granules or mixed with sesame oil.(Hakim MA, 2002)
- Clears the voice, soothes a sore throat, and relieves respiratory discomfort.(Kabīruddīn M., 2007)

b) Gastrointestinal Ailments:

- Acts as a mild laxative and astringent, beneficial in diarrhoea, flatulence, and post-vomiting cramps.(Hakim MA, 2002; Tariq NA, 2010)
- A classical formulation: burnt pearl (2 g) + wax (2 tolas) made into tablets and taken with milk prevents diarrhoea and flatulence.(Tariq NA, 2010)

c) Small tablets of beeswax are administered with certain medicines for intestinal ulcers(Ibn Baitar, 1999) ten such pills taken with millet or rice broth help soothe and heal the intestinal lining.(Sīnā I, 1999)

d) Fever Management:

Beeswax fumigation induces sweating in febrile patients and alleviates body aches.(Khān MA, 2018)

e) Wound Healing

Internal use supports healing of internal wounds, ulcers, and tuberculosis-related tissue damage due to its demulcent and absorbent nature.(Hakim MA, 2002)

f) Antidote

Wax is believed to absorb poisons, and when applied as a coating to wounds, it helps neutralise the toxic effects of poisoned spear injuries.(Sīnā I, 1999)

VIII. ***Miqdār-e-Khurak* (Dosage):** The recommended dosage of *Mom* varies according to different Unani sources. As stated in Taj al-Mufrādat, the usual dose ranges from ½ to 1 gram. According to Bustan al-Mufradāt, the dose is between 1 to 1.75 *Masha,* and in Makhzan al-Mufrādat dose is ½ to 1 *Masha.* In certain compound formulations, the dose may be increased up to 10 masha, as mentioned in Khazā'in al-Adwiya and Muhit-i-A'zam.

IX. ***Muzir* (Adverse Effects):** Excessive use of *Mom* may lead to certain adverse effects. It is described as Muqallil-e-Ishtiha, causing loss of appetite,(Ghanī N, 2001; Hakim MA, 2002; Kabīruddīn M., 2007; Tariq NA, 2010; Khān MA, 2018) and may result in obstruction (*Sudda*)(Hakim MA, 2002; Kabīruddīn M., 2007; Khān MA, 2018) within the body. Overuse can also lead to *Zo'f-e-Mi'da (*weak digestion) and *Masdood-e-Masam* (blockage of skin pores), thereby affecting normal physiological functions.(Ghanī N, 2001; Khān MA, 2018)

X. ***Muṣliḥ* (Correctives)** To counter its adverse effects, several correctives are recommended, including *Roghan-e-Kunjad* (sesame oil),(Hakim MA, 2002; Kabīruddīn M., 2007; Tariq NA, 2010) *Roti* (bread),(Hakim MA, 2002) *Zangar* (rust of copper)(Ghanī N, 2001; Khān MA, 2018) and *Zeera* (cumin).(Khān MA, 2018) These substances help to neutralise or minimise the undesirable effects associated with the drug.

XI. ***Badal* (Substitutes)** In the absence of beeswax, suitable substitutes include *Aard Baqla* (broad bean flour),(Hakim MA, 2002; Kabīruddīn M., 2007; Tariq NA, 2010; Khān MA, 2018) *Roghan-e-Gul* (rose oil), *Roghan-e-Zaitoon* (olive oil), and *Mardarsang* (lapis calaminaris).(Ghanī N, 2001) These alternatives can be used to achieve similar therapeutic or functional effects when beeswax is unavailable.

XII. ***Murakkabāt* (Compound Formulations)** Beeswax serves as an essential base in various Unani formulations. It is a key ingredient in *Qairooti* (liniment) used for relieving pain and swelling, in *Zamaad* (topical paste) applied for inflammation, and in *Marham* (ointment) prepared for the treatment of wounds and ulcers.(Khān MA, 2018)

XIII. ***Muddat-e-Isti'māl* (Duration of Use)** It is considered safe and stable for use for up to three years when stored properly under suitable conditions.(Khān MA, 2018)

Therapeutic Significance of Beeswax in Unani Medicine: A Classical and Contemporary Perspective:

In Unani medicine, beeswax occupies a distinguished place owing to its multifaceted therapeutic actions and pharmacological significance. Traditionally described under categories such as *Muhallil wa Mulayyin Awrām*, *Mudammil-i-Quruh*, *Musakkin-i-Auja'a*, and *Mundij-i-Waram wa Munbit-i-Lahm*, it has been employed extensively in topical formulations, including *Zamaad*, *Qairooti*, and *Roghan*. These traditional uses are increasingly supported by modern pharmacological research, which highlights beeswax's anti-inflammatory, analgesic, wound-healing, and tissue-regenerative effects.(Cornara et al., 2017) Studies have demonstrated its role in modulating inflammatory mediators, enhancing fibroblast activity, promoting collagen deposition, and facilitating epithelial regeneration, reinforcing the scientific validity of its classical Unani indications (**Table 3**).

Table 3. Summary of Traditional Unani Applications and Correlating Modern Evidence

Unani Indication (Af'āl / Isti'māl)	Traditional Form / Route	Modern Correlate / Pharmacological Support	Supporting Studies / References
Muhallil wa Mulayyin Awrām (Resolves inflammation and softens swellings)	*External application as Zamaad or Qairooti (paste/ointment)*	*Yellow Anti-inflammatory and analgesic effects in burns, wounds, and arthritis to yellow-brown*	*Puente 2014 (Puente et al., 2014)*
Mudammil-i-Quruh (Heals ulcers and wounds)	*Topical with Roghan Banafsha or Linseed oil*	*Enhanced fibroblast activity, collagen regeneration*	*Moustafa 2015; (Moustafa and Atiba, 2015) Bayir Y 2019 (Bayir et al., 2019)*
Musakkin-i-Auja'a (Pain relief)	*Wax-based ointment with essential oils*	*Reduction in WOMAC/VAS pain in OA patients*	*Puente 2014 (Puente et al., 2014)*
Mundij-i-Waram & Munbit-i-Laḥm (Matures abscesses, promotes tissue growth)	*Warm compress with wax & turmeric oil*	*Promotes keratinisation and fibroblast proliferation*	*Bayir 2019 (Bayir et al., 2019)*

Chemical Constituents:

Beeswax is a naturally occurring substance composed of more than 300 individual compounds. Its primary constituents include hydrocarbons (approximately 12–16%), predominantly long-chain alkanes such as heptacosane, nonacosane, hentriacontane, pentacosane, and tricosane. Free fatty acids account for about 12–14% of the total composition and include 15-hydroxypalmitic acid, palmitic acid, and oleic acid. A major fraction of beeswax consists of esterified components, particularly linear wax monoesters and hydroxy monoesters (35–45%), along with more complex wax esters (15–27%) incorporating 15-hydroxypalmitic acid or diols. In addition, beeswax contains trace amounts of vitamins A, B_1, B_4, B_6, and P, as well as essential minerals such as calcium, copper, iron, potassium, manganese, sodium, phosphorus, and zinc. (Nainu et al., 2021) Compositional analyses of Apis mellifera comb wax further resolve these constituents into specific chemical classes, reporting approximately 14% hydrocarbons, 35% monoesters, 14% diesters, 3% triesters, 4% hydroxy monoesters, 8% hydroxy polyesters, 1% acid esters, 2% acid polyesters, 12% free acids, and 1% free alcohols, with around 6% of the components remaining unidentified. (Svečnjak et al., 2019)

Pharmacological and clinical studies on Beeswax:

Beeswax and its natural formulations (with olive oil, butter, or honey) exhibit diverse pharmacological activities supported by scientific evidence. It promotes wound healing by enhancing fibroblast proliferation, collagen synthesis, and angiogenesis via modulation of growth mediators such as TGF-β1 and VEGF-α. (Moustafa and Atiba, 2015; Bayir et al., 2019) Its anti-inflammatory effects alleviate pain and stiffness in osteoarthritis. (Puente et al., 2014) Rich in bioactive compounds including squalene, chrysin, 10-hydroxy-trans-2-decenoic acid, and β-carotene, beeswax supports skin regeneration, protects against microbial invasion, and slows collagen degradation. (Kurek-Górecka et al., 2020) It also shows antimicrobial and antifungal activity against Staphylococcus aureus, Escherichia coli, and Candida albicans. (Ghanem, 2011; Fratini et al., 2016) Combinations of beeswax, honey, and olive oil are effective in haemorrhoids and anal fissures by reducing pain, inflammation, and itching. (Al-Waili et al., 2006) Additionally, propolis constituents associated with beeswax demonstrate anticancer potential through inhibition of tumour growth, induction of apoptosis, and immune modulation. (Nainu et al., 2021) Collectively, these findings highlight beeswax as a multifunctional natural agent with healing, protective, and restorative potential in both traditional and modern medicine (Table 4).

Table 4. Summary of Pharmacological and Clinical Studies on Beeswax

Study (Author, Year)	Model/ Design	Sample Size	Intervention/ Dose/ Duration	Primary Outcome	Key Findings (Significance /p-value)	Reference
Bayir et al., 2019	*Preclinical (Rat model of 2nd-degree burns)*	*n = 24 rats*	*Beeswax-Olive oil-Butter (BOB) ointment, topical, daily × 21 days*	*Wound contraction, TGF-β1, VEGF-α expression*	*Accelerated wound healing, enhanced angiogenesis and fibroblast proliferation ($p < 0.05$ vs. control, SSD)*	*Bayir et al., BMC Complement Altern Med., 2019 (Bayir et al., 2019)*
Moustafa et al., 2015	*Preclinical (Dog model, randomised controlled)*	*5 dogs (each dog:3 wound groups)*	*Mixture of Honey + Beeswax + Olive oil (MHBO), topical vs. SSD 1%*	*% wound contraction, time to closure, inflammation score*	*Faster wound contraction ($p < 0.05$), reduced inflammation, closure at 21.9 ± 2.2 days vs. 24.7 ± 2.4 days (SSD)*	*Moustafa et al., Vet World,2015 (Moustafa and Atiba, 2015)*
Puente et al., 2014	*Clinical (Randomised, double-blind, placebo-controlled)*	*n = 60 OA patients*	*D-002 (Beeswax alcohols) 50–100 mg/day × 6 weeks*	*WOMAC, VAS pain, stiffness*	*Significant ↓ pain & stiffness ($p < 0.01$), improved physical function; safe and well-tolerated*	*Puente et al., Int J Clin Pharmacol Res., 2014 (Puente et al., 2014)*
Al-Waili et al., 2006	*Clinical (Pilot, prospective)*	*n = 12 haemorrhoid; n = 18 fissure patients*	*Topical Honey + Olive oil + Beeswax mixture × 4 weeks –100 mg/day × 6 weeks*	*Pain, bleeding, itching*	*Significant improvement in all symptoms ($p < 0.001$); no adverse events*	*Al-Waili et al., Scientific World Journal, 2006 (Al-Waili et al., 2006)*
Ghanem et al., 2011	*In vitro antimicrobial*	*-*	*Crude beeswax (ethanolic extract)*	*Zones of inhibition vs. bacterial/-fungi*	*Inhibited S. aureus (7 mm), B. subtilis (7 mm), C. albicans (20 mm); inactive vs.S. typhimurium*	*Ghanem et al., J Microbiol Res., 2011 (Ghanem, 2011)*
Kurek-Górecka et al., 2020	*Review + in vitro data*	*-*	*Beeswax-derived squalene, chrysin, 10-HDA*	*Antioxidant, antimicrobial assays*	*Beeswax compounds promote epithelial regeneration*	*Kurek-Górecka et al., Int J Mol Sci., 2020 (Kurek*

Study (Author, Year)	Model/ Design	Sample Size	Intervention/ Dose/ Duration	Primary Outcome	Key Findings (Significance /p-value)	Reference
					and inhibit skin pathogens.	*-Górecka et al., 2020)*
Fratini et al., 2016	*Review + ethnophar-macologica l survey*	-	*Beeswax + Honey + Olive oil*	*Antifungal (pityriasis versicolor, tinea, etc.)*	*Effective against dermatophyt es and yeasts (clinical case data)*	*Fratini et al., J Tradit Complement Med., 2016(Fratin i et al., 2016)*
Molina et al., 2015	*Clinical (RDBPC) – healthy adults with dyspeptic symptoms*	*60*	*D-002 (100 mg/day) for 8 weeks*	*Gastrointesti nal Symptom Rating Scale (GSRS)*	*Reduced overall GSRS and individual symptom scores vs. placebo*	*Molina et al., Indian J Pharm Sci., 2015(MOLI NA V, no date)*

Anticancer activity:

Propolis contains numerous bioactive compounds that target key cancer processes. It inhibits cancer cell growth, spread, and new blood vessel formation while promoting cancer cell death (apoptosis). Major active substances like caffeic acid phenethyl ester (CAPE) and chrysin drive these effects by regulating multiple cellular pathways. Propolis also modulates the immune system, reducing inflammation and enhancing anti-tumour immune responses. Additionally, it can sensitise resistant cancer cells to chemotherapy and reduce treatment side effects. Overall, propolis acts through antiproliferative, pro-apoptotic, anti-inflammatory, anti-metastatic, and immunomodulatory mechanisms to exert its anticancer effects.(Nainu et al., 2021)

4. Conclusion

Beeswax (Cera alba) is a natural substance of considerable ethnomedicinal and pharmacological significance, exhibiting anti-inflammatory, antioxidant, antimicrobial, gastroprotective, wound-healing, and dermatological properties. While its traditional uses in Unani and other medicinal systems are well supported by preclinical and emerging clinical evidence, further rigorous trials are required to establish standardised formulations, dosing, and long-term safety. Integrating traditional knowledge with modern scientific research highlights beeswax's potential as a versatile therapeutic agent and excipient in contemporary medicine.

Acknowledgement: Nil

Consent of Publication: Not applicable

Funding: None

Conflict of Interest: There are no conflicts of interest.

Ethics Statement: Ethical approval was not required since the study did not involve experiments on humans or animals.

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