



The ethnobotany of honey-based plant remedies: A systematic review of Plant–Honey–Human Therapeutic Interactions

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Review

Abstract

Background: Honey is widely used in traditional medicine, but often as a carrier and therapeutic matrix for medicinal plants rather than as a standalone agent. Despite the recurrence of these combinations in ethnobotanical literature, their diversity, indications, dosage forms, and level of scientific validation have not been synthesized systematically.

Methods: Following PRISMA 2020, we searched Scopus, Web of Science Core Collection, PubMed/MEDLINE, ScienceDirect, and Google Scholar from database inception to 31 December 2025 for peer-reviewed studies reporting traditional use or experimental/clinical evaluation of remedies combining honey with medicinal plants. Ethnobotanical, experimental, and clinical studies in English or French were eligible. Data were extracted on geography, taxa, plant parts, preparation forms, indications, and level of evidence. Because of heterogeneity, findings were synthesized narratively.

Results: Thirty-four studies met the inclusion criteria. They reported 79 plant species in 42 families, with strongest representation from North Africa and the Middle East and from South and Southeast Asia. Frequently cited taxa included *Nigella sativa*, *Zingiber officinale*, *Allium sativum*, *Thymus vulgaris*, *Curcuma longa*, and *Eucalyptus globulus*. Main dosage forms were powder-honey mixtures, syrups, macerations, and medicinal pastes. Respiratory disorders, gastrointestinal complaints, and wound or skin conditions were the dominant therapeutic categories. More than half of the included studies reported experimental or preclinical support, whereas clinical evidence remained limited.

Conclusions: Honey-based plant remedies may be interpreted as part of a broader biocultural therapeutic framework shaped by the interaction between plant metabolites, honey as a therapeutic matrix, and locally transmitted medical knowledge. Recurrent plant-honey combinations provide priority leads for phytochemical standardization, pharmacological testing, and future clinical evaluation.

Keywords: apitherapy; ethnobotany; ethnopharmacology; honey; medicinal plants; traditional medicine; honey-based plant remedies; systematic review

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Background

Honey has occupied a singular place in the history of medicine because it lies at the intersection of nutrition, therapy, and symbolic value. Produced through the transformation of floral nectar by *Apis mellifera*, honey is among the oldest natural remedies documented in human societies and has been used for inflammatory, digestive, respiratory, and cutaneous conditions across multiple medical traditions (Nikhat & Fazil 2022). This long therapeutic history has helped maintain honey as both a household remedy and a formal object of contemporary biomedical investigation.

Its medicinal relevance is supported by a chemically complex composition that includes simple sugars, organic acids, amino acids, enzymes, minerals, and a wide range of phenolic constituents. These features contribute to antioxidant, antimicrobial, anti-inflammatory, and wound-healing properties described in modern pharmacological studies (Ahmed *et al.* 2024, Rawwash *et al.* 2025). Importantly, the biological activity of honey is strongly shaped by floral source, which means that the therapeutic profile of a given honey partly reflects the surrounding plant biodiversity from which bees forage (Rawwash *et al.* 2025).

In traditional medicine, however, honey is rarely used in isolation. More often, it serves as a functional matrix in preparations that also contain medicinal plants, such as powders mixed with honey, syrups, macerates, plant pastes, or sweetened infusions. In this review, the term “honey-based plant remedies” is used as the preferred expression to describe traditional therapeutic preparations in which honey is combined with one or more medicinal plants. This term includes plant powders mixed with honey, honey-based syrups, macerations, medicinal pastes, and sweetened herbal preparations. The expression “plant–honey formulations” is used only as a descriptive synonym when referring to the physical preparation of these remedies, whereas “plant–honey–human therapeutic interactions” is reserved for the broader interpretive framework linking medicinal plants, honey, and human therapeutic knowledge.

In these formulations, honey may act simultaneously as a preservative, a palatability enhancer that improves adherence, a solvent or carrier for plant-derived metabolites, and a bioactive therapeutic component in its own right (Ahmed *et al.* 2024, Faqih & Taha 2022, Hanif *et al.* 2024).

Ethnobotanical field studies from Morocco, Ethiopia, Pakistan, Türkiye, Kosovo, and Argentina repeatedly document remedies in which crushed or powdered plant material is administered with honey for respiratory, digestive, infectious, inflammatory, and wound-related complaints (Achour *et al.* 2022, Awoke *et al.* 2024, Boubaker *et al.* 2014, Bourhia *et al.* 2019, Emre *et al.* 2024, Kujawska *et al.* 2012, Mekonnen *et al.* 2022, Megersa *et al.* 2023, Mustafa *et al.* 2015, Wali *et al.* 2022). These reports suggest that traditional plant-honey combinations are not random assemblages, but culturally stabilized formulations whose therapeutic logic is built on repeated empirical selection.

Despite growing interest in apitherapy and increasing attention to natural alternatives for infectious and inflammatory disorders, the scientific literature still tends to examine medicinal plants and honey as separate domains (Faqih & Taha 2022, Hanif *et al.* 2024, Nikhat & Fazil 2022). A systematic synthesis focused specifically on their traditional co-use is still needed to identify recurrent combinations, clarify therapeutic patterns, and prioritize promising associations for laboratory and clinical evaluation. The present review therefore aimed to map the medicinal plants most frequently combined with honey, describe the dominant traditional dosage forms, and assess the extent to which the literature provides ethnobotanical, experimental, or clinical support for these plant–honey–human therapeutic interactions.

Materials and Methods

Study design and reporting standard

This study was designed as a systematic review synthesizing ethnobotanical, ethnopharmacological, experimental, and clinical evidence related to remedies that explicitly combine honey with medicinal plants. Reporting was structured in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) statement to maximize transparency and reproducibility (Page *et al.* 2021). The review framework, eligibility criteria, and extraction variables were defined a priori before literature screening.

Review question and analytical framework

The review question was structured using an expanded PICO framework adapted to ethnobotanical evidence. The population/context comprised communities using traditional medicine in any region of the world. The intervention/exposure was any remedy that explicitly combined honey with one or more medicinal plants, including mixtures, macerations, syrups,

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medicinal pastes, powders, and sweetened herbal infusions. A formal comparator was not mandatory because most ethnobotanical studies do not include controlled comparison groups. Outcomes of interest were: (i) reported therapeutic uses, (ii) plant species and plant parts used, (iii) traditional preparation methods and dosage forms, (iv) therapeutic indication categories, and (v) any available in vitro, in vivo, quasi-clinical, or clinical evidence supporting the formulations.

Information sources and search strategy

A comprehensive search was conducted in Scopus, Web of Science Core Collection, PubMed/MEDLINE, ScienceDirect, and Google Scholar (supplementary search). Database coverage extended from inception to 31 December 2025. Search syntax was adapted to the functionality of each database, but the core search equation combined terms for honey, ethnobotanical or traditional medicine context, medicinal plants, and formulated preparations.

Core search equation: ("honey" OR "apitherapy" OR "bee products") AND ("ethnobotany" OR "ethnomedicine" OR "traditional medicine") AND ("medicinal plants" OR herbal OR phytotherapy) AND ("mixture" OR "honey-based remedy" OR maceration OR syrup OR paste).

Reference lists of eligible articles were also screened manually to identify additional studies not captured during the database search.

Eligibility criteria

Studies were included when they: (1) reported traditional or ethnobotanical uses of remedies explicitly combining honey and medicinal plants; (2) described a preparation method in which honey functioned as a therapeutic ingredient, vehicle, or carrier; (3) presented primary ethnobotanical field data, experimental pharmacological evaluation, or clinical/quasi-clinical observations relevant to a plant-honey formulation; (4) were published in peer-reviewed journals; and (5) were written in English or French.

Studies were excluded when they focused on honey alone without associated plant material, described medicinal plants without any mention of honey use, consisted solely of secondary review literature, or were editorials, conference abstracts without full text, or non-scientific reports.

Screening and study selection

All retrieved records were exported to reference management software, and duplicate records were removed before screening. Selection was performed in three sequential stages: title screening, abstract screening, and full-text eligibility assessment. Title and abstract screening was conducted independently by two reviewers. The same two reviewers then independently assessed the full texts of potentially eligible articles against the predefined inclusion and exclusion criteria. Disagreements at either stage were resolved through discussion and consensus. When necessary, unresolved disagreements were discussed with a third author before a final decision was made. The full selection process is summarized in a PRISMA flow diagram (Fig. 1). The full selection process is summarized in a PRISMA flow diagram (Fig. 1).

Data extraction and coding

A standardized extraction form was used for all included studies. Extracted variables comprised country and region, cultural or ethnic group, study design, scientific name and botanical family of each plant species, plant part used, type of honey when specified, preparation form, therapeutic indication, route of administration, and reported experimental or clinical outcomes. Botanical nomenclature was harmonized against World Flora Online to reduce synonym-related inconsistencies and to align with current accepted botanical names. Scientific binomials were consistently italicized throughout the manuscript, tables, figure legends, and supplementary material, whereas family names and higher taxonomic ranks were not italicized.

Quality appraisal and ethnobotanical indices

Given the diversity of study designs, methodological quality was appraised qualitatively according to study type rather than through a single pooled risk-of-bias instrument. For ethnobotanical studies, appraisal focused on the clarity of the sampling strategy, description of informants or study population, data collection methods, documentation of local names and scientific plant identification, description of plant parts used, preparation methods, route of administration, therapeutic indications, and whether dosage or duration of use was reported. For experimental pharmacological studies, appraisal focused on the clarity of the study design, description and authentication of plant material, characterization of honey when available, preparation of the plant-honey formulation, dose or concentration tested, presence of appropriate controls, outcome measures, reproducibility of the procedure, and completeness of result reporting. For clinical or quasi-clinical

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studies, appraisal considered participant characteristics, eligibility criteria, intervention description, comparator or control condition when available, outcome assessment, follow-up period, adverse-event or safety reporting, and clarity of conclusions. Because of the methodological heterogeneity of the included literature, this appraisal was used to guide interpretation of the evidence rather than as a basis for excluding studies.

When reported in the original studies, ethnobotanical indices were extracted to support descriptive comparison. Use Value (UV) was defined as $UV = \sum U/N$, where U is the number of use reports and N is the number of informants. Relative Frequency of Citation (RFC) was defined as $RFC = FC/N$, where FC is the number of informants mentioning the species. Fidelity Level (FL%) was defined as $FL = N_p/N \times 100$, where N_p is the number of informants citing a species for the same specific indication. Because these indices are context-dependent and influenced by study design and sample size, they were summarized descriptively and not pooled statistically across studies.

For frequency calculations, the unit of analysis was the extracted remedy entry. An extracted remedy entry was defined as a reported preparation in which one medicinal plant species was explicitly combined with honey for a therapeutic purpose. In Table 2, the frequency of citation refers to the number of extracted remedy entries in which each plant species appeared, not to the number of studies or individual informants. In Table 3, therapeutic categories were calculated based on therapeutic-use reports extracted from the included studies. A single study could therefore contribute more than one entry or therapeutic-use report when it described multiple plant–honey remedies or multiple indications.

Data synthesis

A quantitative meta-analysis was not considered appropriate because of substantial heterogeneity in cultural contexts, ethnobotanical methods, preparation forms, and outcome definitions. The evidence was therefore synthesized narratively and descriptively. The analysis focused on the frequency of plant species and botanical families, therapeutic categories, preparation patterns involving honey, and areas of convergence between traditional use and experimental or clinical evidence.

The interpretation of findings was guided by an integrative ethnobotanical framework in which honey-based plant remedies are understood as a plant–bee–human interaction system. Within this perspective, therapeutic outcomes emerge from the interaction between plant metabolites, bee-mediated transformation of nectar, and culturally transmitted medical knowledge (Nikhat & Fazil 2022).

Protocol and PRISMA reporting

This systematic review was conducted according to the PRISMA 2020 guidelines. A PRISMA checklist was completed and is provided as supplementary material. The review protocol was not registered in PROSPERO or any other registry; this is now explicitly acknowledged as a methodological limitation.

Information sources and search strategy

A comprehensive literature search was conducted in Scopus, Web of Science Core Collection, PubMed/MEDLINE, ScienceDirect, and Google Scholar. Database coverage extended from inception to 31 December 2025. The search strategy combined four main conceptual blocks: honey or bee products, ethnobotany or traditional medicine, medicinal plants or herbal medicine, and formulated preparations such as mixtures, syrups, macerations, pastes, or honey-based plant remedies. The core search equation was adapted to the search interface and indexing structure of each database in order to improve retrieval while maintaining conceptual consistency across sources.

In Scopus, the following search string was used: TITLE-ABS-KEY(("honey" OR "apitherapy" OR "bee products") AND ("ethnobotany" OR "ethnomedicine" OR "traditional medicine") AND ("medicinal plants" OR herbal OR phytotherapy) AND ("mixture" OR "honey-based remedy" OR maceration OR syrup OR paste)).

In Web of Science Core Collection, the search was performed using the Topic field as follows: TS=(("honey" OR "apitherapy" OR "bee products") AND ("ethnobotany" OR "ethnomedicine" OR "traditional medicine") AND ("medicinal plants" OR herbal OR phytotherapy) AND ("mixture" OR "honey-based remedy" OR maceration OR syrup OR paste)).

In PubMed/MEDLINE, the search was restricted to title and abstract fields using the following string: ("honey"[Title/Abstract] OR "apitherapy"[Title/Abstract] OR "bee products"[Title/Abstract]) AND ("ethnobotany"[Title/Abstract] OR "ethnomedicine"[Title/Abstract] OR "traditional medicine"[Title/Abstract]) AND

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("medicinal plants"[Title/Abstract] OR herbal[Title/Abstract] OR phytotherapy[Title/Abstract]) AND ("mixture"[Title/Abstract] OR "honey-based remedy"[Title/Abstract] OR maceration[Title/Abstract] OR syrup[Title/Abstract] OR paste[Title/Abstract])).

In ScienceDirect, the following search string was applied: ("honey" OR "apitherapy" OR "bee products") AND ("ethnobotany" OR "ethnomedicine" OR "traditional medicine") AND ("medicinal plants" OR herbal OR phytotherapy) AND ("mixture" OR "honey-based remedy" OR maceration OR syrup OR paste).

Google Scholar was used as a supplementary search source. It was searched on 31 December 2025 using simplified combinations of the main search terms because this platform has limited support for complex Boolean syntax. Results were sorted by relevance, which is the default ranking option in Google Scholar. The following combinations were used: "honey" "medicinal plants" "traditional medicine", "honey" "ethnobotany" "medicinal plants", "honey-based remedy" "medicinal plants", and "plant honey mixture" "traditional medicine". The first 200 records, corresponding to approximately 20 results pages, were screened. Screening was stopped after this point because the retrieved results became increasingly unrelated to the review question. Given the dynamic nature of Google Scholar indexing and ranking, Google Scholar was used to complement the structured database search rather than as a primary bibliographic database.

Reference lists of eligible articles were also screened manually to identify additional studies not captured during the database search. No date restriction was applied during the search process, but only peer-reviewed studies published in English or French and meeting the eligibility criteria were included in the final synthesis.

Results

Study Selection

The database search yielded 1,284 records across all sources. After removal of 312 duplicates, 972 records remained for title and abstract screening. A total of 86 full-text articles were then assessed for eligibility, and 34 studies met the inclusion criteria and were retained for qualitative synthesis (Fig. 1).

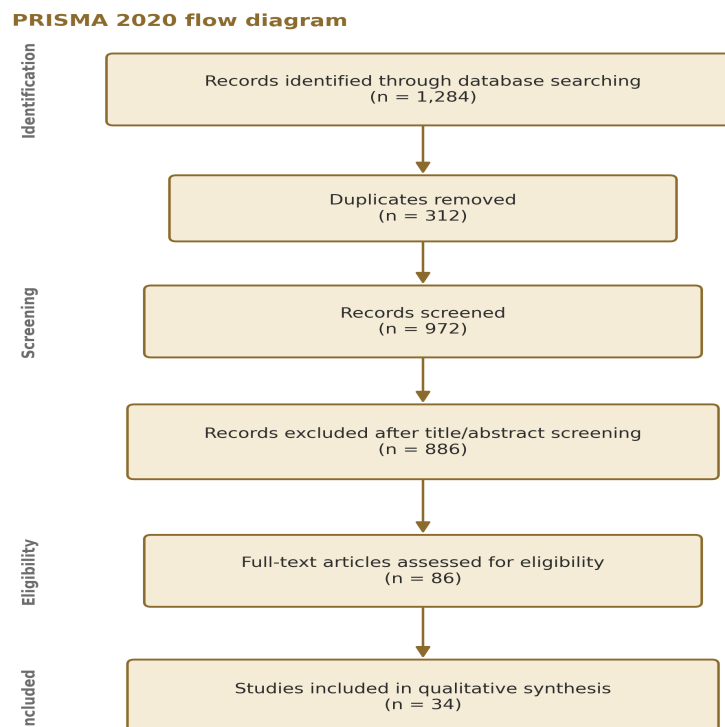


Figure 1. PRISMA 2020 flow diagram of study selection.

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Geographic distribution of included studies

The included literature showed a clear concentration in regions where traditional medical knowledge remains actively transmitted. North Africa and the Middle East accounted for 41% of the included studies ($n = 14$), followed by South and Southeast Asia (32%, $n = 11$), Sub-Saharan Africa (18%, $n = 6$), and Europe or other regions (9%, $n = 3$). This distribution indicates that honey-based plant remedies are especially visible in rural and semi-rural settings where medicinal plant use remains embedded in local healthcare practices.

Table 1. Geographic distribution of included studies.

Region	Number of studies	Percentage (%)
North Africa & Middle East	14	41
South/Southeast Asia	11	32
Sub-Saharan Africa	6	18
Europe & Others	3	9

Diversity of medicinal plants associated with honey

Across the 34 included studies, 79 plant species belonging to 42 botanical families were identified as constituents of honey-based plant remedies. The most represented families were Lamiaceae, Zingiberaceae, Apiaceae, Fabaceae, and Asteraceae. These families are widely recognized for aromatic, phenolic, and other bioactive secondary metabolites that are compatible with the major therapeutic domains identified in this review.

The most frequently cited individual species were *Nigella sativa*, *Zingiber officinale*, *Allium sativum*, *Thymus vulgaris*, *Curcuma longa*, and *Eucalyptus globulus*. Seeds, rhizomes, bulbs, aerial parts, and leaves were the plant parts most often combined with honey, indicating a preference for organs rich in volatile or phenolic constituents.

Table 2. Most frequently cited plant species in honey-based plant remedies.

Scientific name	Family	Plant part used	Main therapeutic indication	Frequency of citation
<i>Nigella sativa</i>	Ranunculaceae	Seeds	Respiratory; immune support	18
<i>Zingiber officinale</i>	Zingiberaceae	Rhizome	Digestive; anti-inflammatory	15
<i>Allium sativum</i>	Amaryllidaceae	Bulb	Antimicrobial	13
<i>Thymus vulgaris</i>	Lamiaceae	Aerial parts	Respiratory disorders	12
<i>Curcuma longa</i>	Zingiberaceae	Rhizome	Anti-inflammatory	10
<i>Eucalyptus globulus</i>	Myrtaceae	Leaves	Cough treatment	9

Note: Frequency of citation refers to the number of extracted remedy entries in which each plant species was reported in combination with honey. It does not represent the number of studies, informants, or independent clinical observations.

Traditional preparation forms

Four dominant preparation patterns emerged from the included studies: powdered plant material mixed directly with honey, herbal syrups, maceration of plant materials or extracts in honey, and medicinal pastes intended for oral or topical use. Powder-honey mixtures were the most frequent form, followed by syrups and macerations. Oral administration predominated, whereas topical application was mainly reported for wound healing and dermatological conditions.

These dosage forms suggest that honey fulfilled several technological and therapeutic roles at once. Besides its own biological activity, it acted as a viscous carrier, a natural preservative, and a taste-masking agent that likely improved acceptability, especially for children and for pungent or bitter plant materials.

Therapeutic categories

Respiratory disorders constituted the largest therapeutic category, accounting for 36% of reported uses, followed by gastrointestinal disorders (24%), dermatological conditions and wound healing (21%), immune support or general tonic uses (11%), and other indications (8%). Because a single study could report multiple remedies and uses, these frequencies reflect therapeutic-use reports rather than the number of included studies.

The predominance of respiratory applications was especially consistent with the frequent use of aromatic plants mixed with honey as soothing, expectorant, or antimicrobial preparations. Gastrointestinal remedies were often based on spice rhizomes, seeds, or leaves known for carminative and anti-inflammatory actions.

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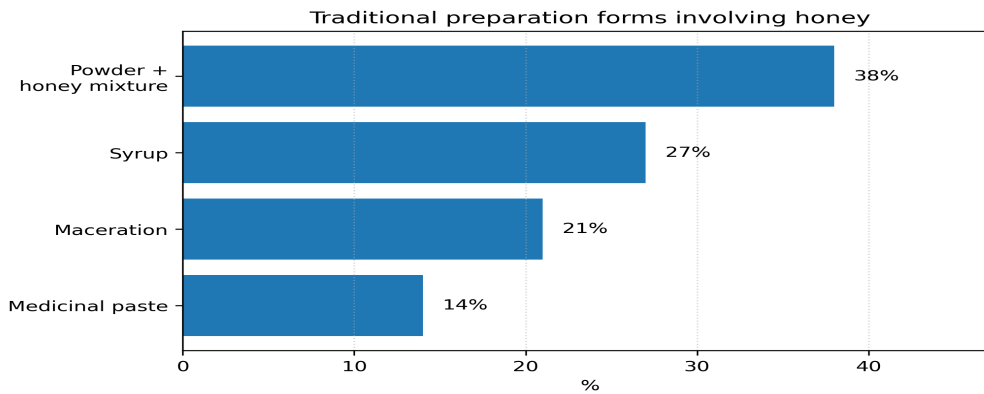


Figure 2. Distribution of traditional preparation forms involving honey.

Table 3. Therapeutic categories reported for honey-based plant remedies.

Therapeutic category	Reports	Percentage (%)
Respiratory disorders	49	36
Gastrointestinal disorders	33	24
Skin/wound healing	29	21
Immune support	15	11
Others	11	8

Note: Reports refer to therapeutic-use reports extracted from the included studies rather than to unique studies, individual informants, or clinical cases. A single study could contribute multiple reports when it described several plant-honey remedies or several therapeutic indications. Percentages were calculated using the total number of therapeutic-use reports as the denominator.

Level of scientific evidence

The included literature did not consist solely of descriptive ethnobotanical reports. Experimental or preclinical pharmacological support was reported in 53% of included studies, whereas 32% were ethnobotanical-use reports without further pharmacological evaluation, and 15% included clinical or quasi-clinical observations. These experimental studies most frequently provided preclinical evidence for antimicrobial activity, anti-inflammatory effects, or wound-healing properties of honey-based plant formulations.

Taken together, these results indicate that the evidentiary landscape remains uneven: the ethnobotanical record is broad, experimental support is emerging, and rigorous human evidence remains relatively limited.

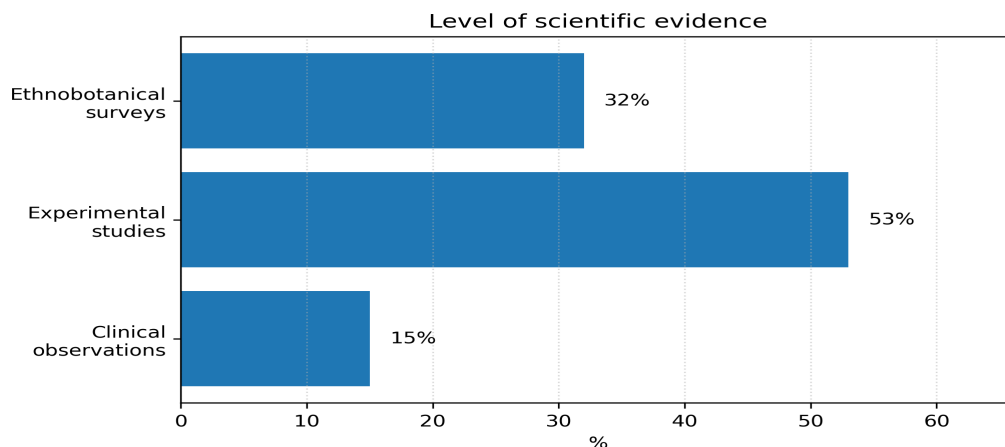


Figure 3. Level of scientific evidence reported among included studies.

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Reported ethnobotanical indices

Representative studies reporting UV, RFC, and FL values showed that species frequently combined with honey generally displayed moderate to high cultural salience. Reported UV values were all at or above 0.55, and most FL values exceeded 65%, suggesting substantial agreement among informants regarding the therapeutic relevance of these plants in specific symptom domains.

Aromatic species from Lamiaceae and metabolite-rich species from Zingiberaceae showed particularly high FL values in respiratory and gastrointestinal applications. These indices should nevertheless be interpreted descriptively because they were generated in different communities with distinct sample sizes, therapeutic repertoires, and survey methods.

Table 4. Reported ethnobotanical indices for representative plant species used in honey-based plant remedies.

Plant species	Study (country)	Main therapeutic use	UV	RFC	FL (%)
<i>Nigella sativa</i>	Achour <i>et al.</i> 2022 (Morocco)	Respiratory & immune disorders	0.82	0.61	78
<i>Allium sativum</i>	Mekonnen <i>et al.</i> 2022 (Ethiopia)	Antimicrobial; digestive	0.76	0.58	72
<i>Zingiber officinale</i>	Wali <i>et al.</i> 2022 (Pakistan)	Gastrointestinal disorders	0.69	0.54	70
<i>Thymus vulgaris</i>	Boubaker <i>et al.</i> 2014 (Morocco)	Respiratory infections	0.71	0.49	81
<i>Curcuma longa</i>	Emre <i>et al.</i> 2024 (Türkiye)	Anti-inflammatory	0.63	0.46	66
<i>Eucalyptus globulus</i>	Awoke <i>et al.</i> 2024 (Ethiopia)	Cough & bronchitis	0.58	0.42	74
<i>Foeniculum vulgare</i>	Kujawska <i>et al.</i> 2012 (Argentina)	Digestive disorders	0.55	0.39	68
<i>Mentha spicata</i>	Bourhia <i>et al.</i> 2019 (Morocco)	Digestive & tonic	0.60	0.44	64

Note: UV = Use Value; RFC = Relative Frequency of Citation; FL = Fidelity Level. Values are reproduced as reported in the original studies and are presented for descriptive comparison only.

Cross-cultural plant–bee–human interaction patterns

A recurrent therapeutic logic was apparent across regions. Aromatic plants rich in volatile constituents were commonly paired with honey for respiratory complaints; phenolic-rich spices and seeds were frequently used in digestive or anti-inflammatory remedies; and plants known locally for antimicrobial or vulnerary properties were often mixed with honey for wounds and skin disorders.

These convergent patterns suggest that traditional practitioners and households may have recognized, through long-term empirical observation, that combining plant metabolites with honey can enhance preservation, delivery, and perceived efficacy. In that sense, the remedy is better understood as a triadic formulation involving plant chemistry, bee-derived transformation, and human therapeutic knowledge.

Conceptual synthesis

Figure 4 summarizes the conceptual interpretation emerging from the review. In this model, plant secondary metabolites, bee-mediated transformation, and human cultural selection interact to shape remedy composition, modes of preparation, and perceived therapeutic performance across communities.

Conceptual model of plant–bee–human therapeutic interactions

Ecological transformation and culturally transmitted practice shape the therapeutic profile of honey-based remedies.

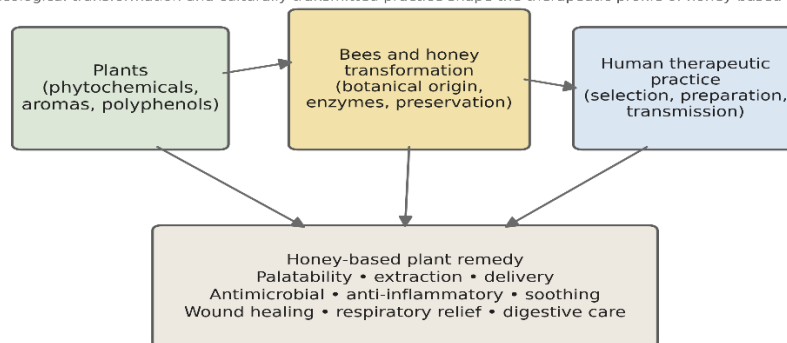


Figure 4. Conceptual framework of plant–honey–human therapeutic interactions in honey-based plant remedies.

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Discussion

However, this interpretation should be understood as a conceptual framework emerging from the synthesis rather than as a definitive conclusion. The included studies differ in geographic context, methodological design, remedy documentation, and level of pharmacological or clinical evidence. Therefore, the recurrence of honey-based plant remedies across regions supports the idea of cross-cultural convergence, but it does not by itself demonstrate the existence of a single, fully coherent therapeutic system.

This review suggests that honey-based plant remedies may be interpreted as a recurrent and culturally meaningful feature of traditional medicine rather than as merely incidental household preparations. The repeated appearance of combinations involving *Nigella sativa*, *Zingiber officinale*, *Allium sativum*, and *Thymus vulgaris* across geographically distant settings suggests a form of cross-cultural convergence. Such recurrence does not in itself prove efficacy, but in ethnopharmacology it is often considered a strong signal that certain taxa have been retained because they are both available and perceived as reliably useful over time.

The prominence of Lamiaceae and Zingiberaceae is particularly meaningful. These families contain species rich in essential oils, polyphenols, and pungent principles with well-recognized antimicrobial, secretolytic, digestive, and anti-inflammatory properties. Their repeated combination with honey therefore appears pharmacologically plausible as well as culturally stable.

The present synthesis also reinforces the idea that honey should not be treated as an inert excipient. In the reviewed remedies, honey performed multiple functions simultaneously: it increased palatability, provided viscosity and mucosal contact, reduced water activity, helped preserve preparations, and contributed its own antioxidant and antimicrobial activities (Ahmed *et al.* 2024, Faqih & Taha 2022, Hanif *et al.* 2024, Rawwash *et al.* 2025). This multifunctionality may explain why honey is repeatedly selected in traditional formulations for children, coughs, sore throats, digestive weakness, and wound care.

From a formulation perspective, the most common dosage forms identified in this review are also highly intelligible. Powder-honey mixtures are simple to prepare and dose in domestic settings; syrups are suitable for respiratory complaints; macerations allow prolonged contact between the plant material and the honey matrix; and pastes are practical for both oral and topical administration.

An important contribution of the included experimental studies is that they move the discussion beyond cultural description toward biological plausibility. Although several studies reported antimicrobial, anti-inflammatory, or wound-healing activities of honey-based plant formulations, these findings should be interpreted as experimental support or preclinical evidence rather than definitive validation. Most studies did not systematically compare honey alone, plant material alone, and the combined plant-honey formulation under standardized conditions. Therefore, the current evidence supports biological plausibility and potential additive effects, but it does not yet allow firm conclusions regarding pharmacological synergy or clinical effectiveness.

Future experimental work should therefore be designed to test synergy more explicitly by comparing isolated and combined treatments under standardized conditions, while also controlling for honey type, floral origin, extraction method, and dose ratio. Such designs would be essential for translating traditional observations into reproducible evidence.

The concept of a plant-bee-human therapeutic interaction system offers a broader interpretation of the findings. Honey is not merely a human-used substance derived from plants; it is the product of ecological mediation by bees, whose foraging behavior and enzymatic processing transform floral resources into a chemically distinct material. The medicinal value of honey-based plant remedies is therefore inseparable from the biodiversity of local floras and the ecological activity of pollinators.

This perspective has practical implications. Changes in floral diversity, land use, or pollinator abundance could alter the composition and perhaps the therapeutic performance of traditional honeys. Integrating pollinator ecology into ethnopharmacological research may therefore improve both the biological interpretation of remedies and the conservation framing around traditional healthcare resources.

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Several limitations should be considered when interpreting this review. First, primary ethnobotanical studies often reported preparation details incompletely, especially with respect to dose, ratio of plant material to honey, duration of use, and the specific botanical origin of the honey. Second, the studies were methodologically heterogeneous, which precluded quantitative meta-analysis. Third, clinical evidence remained sparse, and many claims of efficacy still rely on ethnobotanical reporting or preclinical experimentation rather than controlled human studies. Fourth, this review may be affected by publication bias, because remedies that are more frequently documented, pharmacologically promising, or scientifically investigated may be overrepresented in the published literature. Fifth, language bias may have influenced the findings, as only English- and French-language studies were included. This may have excluded relevant studies published in other languages, especially from regions with rich traditions of honey-based medicinal practices. Finally, unpublished knowledge, orally transmitted remedies, and locally restricted therapeutic practices are likely underrepresented because the review was limited to peer-reviewed scientific literature.

An additional methodological limitation concerns the absence of prospective protocol registration. Although this review was conducted and reported in accordance with PRISMA 2020 guidelines, and a completed PRISMA checklist was prepared as supplementary material, the protocol was not registered in PROSPERO or another systematic review registry. This may limit the external verifiability of the review process, particularly regarding the a priori definition of eligibility criteria, search strategy, and data extraction procedures. Nevertheless, the review framework, inclusion and exclusion criteria, and extraction variables were defined before screening, which helped maintain methodological consistency throughout the review process.

A further limitation is that ethnobotanical indices such as UV, RFC, and FL are locally meaningful but not directly comparable in a statistical sense across different surveys. They are still useful as descriptive indicators of cultural salience, but they should not be interpreted as pooled effect-size measures. These considerations underscore the need for better standardized reporting in future work.

The recurrent combinations identified in this review provide a rational starting point for translational research. Priority candidates include honey formulations containing *Nigella sativa*, *Zingiber officinale*, *Allium sativum*, *Thymus vulgaris*, *Curcuma longa*, and *Eucalyptus globulus*, particularly in respiratory, gastrointestinal, and wound-healing contexts. Future studies should integrate ethnobotanical documentation with phytochemical profiling of both the plant material and the honey, microbiological testing, and standardized formulation studies.

Well-designed clinical trials are especially needed for common and low-risk indications in which traditional use is frequent and mechanistic plausibility is relatively high, such as cough relief, sore throat, uncomplicated digestive complaints, and topical wound care. At the same time, conservation strategies should recognize pollinators as indirect contributors to traditional medicinal systems.

Conclusion

This systematic review suggests that honey-based plant remedies may be understood as a distinct, though still insufficiently documented, biocultural domain within traditional medicine. Across diverse cultural and geographic settings, communities repeatedly combine honey with medicinal plants characterized by aromatic, antimicrobial, digestive, or anti-inflammatory properties, most commonly in the form of powders mixed with honey, syrups, macerations, and medicinal pastes. The recurrence of these preparation patterns across distant regions suggests that such remedies are not incidental household mixtures, but rather structured therapeutic formulations embedded in local pharmacopoeias and maintained through intergenerational knowledge transmission. The evidence synthesized here further indicates that honey functions as more than a sweetener or preservative: it acts as a therapeutic carrier that may improve palatability, stability, extraction, and delivery of plant-derived bioactive compounds.

Conceptualizing these remedies as plant–honey–human therapeutic interactions provides a cautious interpretive framework for ethnobotanical research, focusing on the documented combination of medicinal plants, honey, and human therapeutic practices. It highlights that the medicinal value of honey-based plant remedies emerges from the convergence of plant chemistry, bee-mediated transformation of floral resources, and culturally shaped human practices of selection, preparation, and administration. In this sense, the therapeutic profile of these formulations reflects not only the properties of medicinal plants, but also the ecological contribution of bees and the social processes through which medicinal knowledge is transmitted and refined. This perspective expands ethnobotany beyond a strictly plant–human relationship and underscores the relevance of pollinator ecology to traditional healthcare systems.

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At the same time, this review identifies important limitations in the current evidence base. Although many studies report convergent traditional uses and some experimental work supports antimicrobial, anti-inflammatory, and wound-healing effects, the literature remains heterogeneous and often methodologically incomplete. Details regarding dosage, preparation ratios, honey type, botanical authentication, and duration of treatment are frequently underreported, while controlled clinical studies remain scarce. As a result, the therapeutic plausibility of many honey–plant combinations is supported more strongly than their clinical effectiveness, and caution is needed when translating ethnobotanical observations into biomedical claims.

Taken together, the most frequently cited combinations identified in this review offer a focused agenda for future research. Priority should be given to standardized ethnobotanical documentation, phytochemical characterization of both plant materials and botanical-origin honeys, and experimental and clinical evaluation of the most recurrent formulations, particularly for respiratory disorders, gastrointestinal conditions, and wound care. Equally important, the conservation of medicinal plant diversity, bee populations, and the cultural knowledge systems that sustain these remedies should be recognized as a shared scientific and heritage priority. Honey-based plant remedies should therefore be understood not only as remnants of traditional practice, but as living, adaptive therapeutic systems that may contribute valuable insights to ethnobotany, apitherapy, and evidence-informed integrative health research.

Declarations

List of abbreviations: FL, Fidelity Level; PICO, Population/Context–Intervention/Exposure–Comparator–Outcomes; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; RFC, Relative Frequency of Citation; SI, International System of Units; UV, Use Value.

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Consent for publication: Not applicable.

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Authors' contributions:

AO conceived and designed the study. AO and MY conducted the literature search and data extraction. KT and HA performed the data analysis and contributed to the interpretation of the results. KA supervised the research process and critically revised the manuscript. All authors contributed to writing the manuscript and approved the final version.

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Supplementary material

Table S1 presents representative included ethnobotanical field studies that explicitly described medicinal preparations combining honey with plant materials.

Table S1. Representative included studies explicitly reporting honey-plant preparations.

ID	Reference	Country/area	Study type	Reported indication(s)	Honey + plant preparation	DOI
1	Achour <i>et al.</i> , 2022	Morocco (Fez-Boulemane)	Ethnobotanical survey	Digestive disorders, rheumatism, others	Powdered plants mixed with honey; oral use	10.1155/2022/4104772
2	Bourhia <i>et al.</i> , 2019	Morocco (Greater Casablanca)	Ethnopharmacological survey	Cancer-related traditional uses (declarative)	Powder + honey as frequent oral vehicle	10.1155/2019/1613457
3	Kujawska and Hilgert, 2012	Argentina (Misiones)	Ethnobotany /ethnomedicine	Multiple uses depending on species	Several recipes including mixtures with honey	10.1155/2012/579350
4	Mekonnen <i>et al.</i> , 2022	Ethiopia (Sedie Muja)	Ethnobotanical survey	Malaria, colds, others	Examples include crushed garlic + honey	10.1155/2022/7328613
5	Megersa <i>et al.</i> , 2023	Ethiopia (Zuway Dugda)	Ethnobotanical survey	Wounds, fevers, others	Honey used as excipient/vehicle in multiple entries	10.1155/2023/5545294
6	Wali <i>et al.</i> , 2022	Pakistan (North)	Ethnobotanical survey	Gastrointestinal disorders	Several remedies involving mixtures with honey	10.1371/journal.pone.0269445
7	Awoke <i>et al.</i> , 2024	Ethiopia (Yeki)	Ethnobotanical survey	Human ailments (multi-system)	Several preparations with honey as adjuvant	10.1186/s13002-024-00748-y
8	Emre <i>et al.</i> , 2024	Türkiye (Kırşehir)	Ethnobotany	Bronchitis in children, others	Leaves or plant materials mixed with honey	10.3390/plants13202895
9	Mustafa <i>et al.</i> , 2015	Kosovo (South)	Comparative ethnobotany	Abdominal pain, others	Crushed leaves + honey; internal use	10.1186/s13002-015-0023-5
10	Boubaker <i>et al.</i> , 2014	Morocco (Agadir-Ida Ou Tanane)	Ethnobotany	Respiratory, digestive, urinary	Recipes mentioning mixtures with honey	10.4314/jab.v84i1.5