Traditional uses of family Asteraceae in Ethiopia: A review of ethnobotanical knowledge and therapeutic applications

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Ethnobotany Research and Applications 31:55 (2025) - http://dx.doi.org/10.32859/era.31.55.1-25
Manuscript received: 27/06/2025 - Revised manuscript received: 02/08/2025 - Published: 03/08/2025

Review

Abstract

Background: The Asteraceae family is one of the most widely used medicinal plant families in Ethiopia, playing a crucial role in traditional healthcare across diverse ethnic and ecological settings. Despite its importance, a comprehensive synthesis of ethnobotanical knowledge, phytochemical constituents, and therapeutic applications remains limited.

Methods: A systematic review was conducted by searching multiple electronic databases for studies reporting on the medicinal use of Asteraceae species in Ethiopia. After screening and eligibility assessment, 40 relevant studies (35 published and 5 unpublished) were included. Data on species diversity, plant habits, and parts used, preparation methods, modes of administration, phytochemical profiles, and antibacterial activities were extracted and analyzed.

Results: Fifty-six Asteraceae species from 34 genera were documented, predominantly herbs (73.2%), with *Vernonia amygdalina* Delile and *Artemisia abyssinica* Sch.Bip. ex Oliv. & Hiern being the most frequently cited. Leaves were the most commonly used plant parts (71.4%). Preparation methods mainly involved crushing fresh material (50%), and remedies were applied dermally, orally, and nasally. Phytochemical analyses identified flavonoids, alkaloids, tannins, and terpenoids, correlating with broad-spectrum antibacterial activity against pathogens such as *Staphylococcus aureus* and *Escherichia coli*. However, limited data on dosage, toxicity, and conservation challenges were noted.

Conclusions: Ethiopian Asteraceae plants represent a rich resource for traditional medicine and potential drug discovery. Future research should prioritize standardization of preparation, in vivo validation, toxicity studies, and sustainable harvesting practices. Strengthening interdisciplinary collaboration and community awareness is essential for preserving this invaluable ethnobotanical heritage.

Keywords: Asteraceae, Antibacterial activity, Ethiopia, ethnobotany, medicinal plants, phytochemicals, traditional medicine

Background

The Asteraceae family commonly known as the daisy or sunflower family is one of the largest and most ecologically diverse plant families worldwide, comprising over 1,600 genera and approximately 25,000 species (Funk *et al.* 2009; Tamokou *et al.* 2017; Rolnik & Olas 2021). Its members are widely distributed across varied ecological zones and are valued for their nutritional, ecological, and medicinal properties. In Ethiopia, Asteraceae species occur across a broad range of habitats, from lowland dry savannas and semi-arid regions to high-altitude afro-alpine and montane forests (Friis *et al.* 2011; Hedberg *et al.* 2004). This broad distribution reflects the family's high ecological adaptability and evolutionary success.

Species in this family typically exhibit traits such as drought tolerance, short life cycles, prolific seed production, and efficient wind dispersal, enabling them to thrive in diverse and often disturbed environments (Tadesse 2004). For instance, *Vernonia schimperi* and *Bidens pilosa* commonly colonize open or degraded lands, while *Helichrysum* species are adapted to the harsh conditions of Ethiopia's afro-alpine zones, such as those found in the Bale and Simien Mountains.

Ecologically, Asteraceae contribute to soil stabilization in erosion-prone landscapes, enhance pollinator biodiversity through their conspicuous inflorescences, and serve as forage in rangelands (Kelbessa & Demissew 2014). Their ecological success is often associated with competitive strategies such as allelopathy and chemical defense mechanisms (Gemedo-Dalle *et al.* 2005). Rich in bioactive secondary metabolites including sesquiterpene lactones, flavonoids, and polyacetylenes many Asteraceae species possess antimicrobial, anti-inflammatory, and insecticidal properties (Tadesse 2004; Okunji *et al.* 2005), which underpin their traditional medicinal uses.

In Ethiopia, a country recognized for its exceptional floristic diversity and strong traditions of plant-based healing, Asteraceae species are prominent in traditional medicine. *The Flora of Ethiopia and Eritrea (FEE)* Volume 4, Part 2 identifies 133 Asteraceae species, making the family the second largest in the national flora after Poaceae (156 species) (Hedberg *et al.* 2004; Kelbessa *et al.* 2014; Demissew *et al.* 2021). However, while Poaceae dominates in species number, Asteraceae holds greater ethnomedicinal importance due to its versatility and widespread application in treating ailments such as malaria, wounds, respiratory infections, and gastrointestinal disorders.

The FEE provides valuable morphological descriptions, taxonomic keys, and habitat data for the Asteraceae family. However, it lacks integration of ethnomedicinal information, particularly concerning species widely used in traditional healing practices. This narrow taxonomic focus limits the Flora's relevance for interdisciplinary research and its application in healthcare or conservation. Bridging this gap is crucial for aligning botanical documentation with the cultural and therapeutic significance of plant species.

This review enhances the ethnobotanical utility of the FEE by consolidating traditional knowledge on Asteraceae, identifying species of cultural and medicinal relevance, and analyzing patterns of use across ecological and sociocultural contexts. Unlike Poaceae, whose ethnomedicinal applications are relatively limited, Asteraceae species demonstrate broader therapeutic versatility. This distinction emphasizes the need to expand the FEE with ethnobotanical annotations, including local names, traditional preparation methods, and conservation status. Such integration would increase its relevance for researchers, practitioners, and policymakers working in areas of integrative medicine, public health, and biodiversity conservation.

Despite the prominence of Asteraceae in Ethiopian traditional medicine, existing documentation is fragmented. Ethnobotanical studies often focus on limited geographic areas primarily Oromia and the Southern Nations, Nationalities, and Peoples' Region (SNNPR) and tend to generalize uses at the family level, thereby overlooking species-specific knowledge. Pharmacological and toxicological validations are also scarce, limiting the translation of traditional knowledge into evidence-based healthcare and drug development.

Traditional healing practices continue to play a central role in Ethiopia's primary healthcare system, particularly in rural areas with limited access to biomedical services (Giday *et al.* 2009; Tassew 2019). Asteraceae species are integral to these systems not only for their therapeutic efficacy but also for their symbolic and cultural roles. Their accessibility across various ecological zones and association with protection and purification rituals further reinforce their significance (Teklehaymanot & Giday 2007; Birhane *et al.* 2011; Bulcha 2021). However, the intergenerational transmission of this knowledge is increasingly threatened by land-use change, environmental degradation, urbanization, and cultural shifts (Bekele & Reddy 2015; Alebie *et al.* 2017; Dubale *et al.* 2023).

To address these gaps, this review consolidates and critically evaluates ethnobotanical data on the Asteraceae family across Ethiopia. It aims to provide a methodologically rigorous and geographically inclusive synthesis that supports future pharmacological, ecological, and ethnobotanical investigations. By linking indigenous knowledge with scientific inquiry, the review contributes to the conservation of biocultural diversity and the development of sustainable healthcare strategies.

The objectives of this review are to (i) document the diversity of Asteraceae species used in traditional medicine, (ii) identify the ailments treated, plant parts used, and modes of preparation and administration, (iii) explore the cultural and ecological contexts of use, and (iv) highlight conservation concerns and prospects for pharmacological validation. Given the increasing threats to both biological and cultural diversity, this synthesis contributes to preserving indigenous knowledge systems and informs efforts in biodiversity conservation, integrative medicine, and sustainable resource management.

Taxonomic characteristics and importance of the Asteraceae

The Asteraceae (Compositae) family is the largest and one of the most diverse families of flowering plants, comprising over 1,600 genera and an estimated 25,000 to 35,000 species distributed across all continents (Funk *et al.* 2009; Nikolić & Stevović 2015; Rolnik & Olas 2021). This remarkable diversity is attributed to a combination of evolutionary innovations, ecological plasticity, and efficient reproductive strategies that have allowed its members to colonize a broad range of habitats from alpine meadows and arid deserts to tropical forests and temperate grasslands (Anderson 1995; Zhang *et al.* 2015).

A key feature underlying the global success of Asteraceae species is their high degree of phenotypic and ecological adaptability. Their morphological flexibility, particularly in root architecture from deep taproots to fibrous systems enhances resilience in nutrient-poor, drought-prone, and high-altitude environments (Zhang *et al.* 2015). Furthermore, many species form mutualistic relationships with mycorrhizal fungi, improving nutrient uptake and stress tolerance (van der Heijden *et al.* 1998).

Reproductive efficiency further contributes to the widespread distribution of Asteraceae. The family employs both sexual and asexual reproduction, with many species exhibiting self-compatibility, apomixis, or clonal propagation (Jeffrey 2007; Mandel *et al.* 2019). The characteristic capitulum or flower head, in which numerous small florets are tightly grouped and surrounded by involucral bracts, mimics a single large flower, thereby enhancing pollinator attraction and reproductive success (Funk *et al.* 2009; Panero & Crozier 2016). In addition, their high seed output and diverse dispersal mechanisms including wind-dispersed pappus-bearing seeds and animal-mediated transport facilitate effective colonization of both stable and disturbed ecosystems (Linder 2003).

Another critical element of the family's ecological dominance is the production of secondary metabolites. Compounds such as sesquiterpene lactones, flavonoids, alkaloids, terpenoids, and polyacetylenes serve multiple functions, including defense against herbivory and pathogens, allelopathic suppression of competitors, and resilience under environmental stress (Chadwick *et al.* 2013; Karadeniz *et al.* 2021). These bioactive compounds not only enhance ecological fitness but also contribute to the family's pharmacological relevance.

Structurally, Asteraceae species are predominantly herbaceous, although the family also includes shrubs, vines, and occasional tree forms (Jeffrey 2007; Funk *et al.* 2009). The unique floral morphology of the capitulum facilitates efficient pollination, while biochemical diversity underpins their wide-ranging uses in traditional and modern medicine. Species such as *Artemisia afra* are traditionally used to treat respiratory infections, while *Vernonia amygdalina* is employed for its antimalarial and antiparasitic properties (Ayalew *et al.* 2017; Muluye *et al.* 2020).

Ecologically, Asteraceae species play a vital role in ecosystem functioning. They contribute to soil stabilization, promote pollinator diversity, and act as pioneer species in degraded or disturbed habitats due to their rapid growth, short life cycles, and tolerance to poor soil conditions (Grime 2001). Their ecological versatility also makes them ideal candidates for landscape restoration and sustainable land management.

Economically, the Asteraceae family holds significant value. Many species are cultivated as food crops (*Lactuca sativa* - lettuce), herbal teas (*Chamomilla recutita* - chamomile), ornamentals, oil crops (*Helianthus annuus* - sunflower), and sources of raw materials for dyes, insecticides, and cosmetics (Karadeniz *et al.* 2021; Awoke *et al.* 2024; Dubale *et al.* 2023). Their ethnobotanical importance is especially pronounced in countries like Ethiopia, where numerous species are integrated into traditional medicinal practices for treating a variety of ailments, from fevers and gastrointestinal disorders to chronic inflammatory diseases (Dubale *et al.* 2023).

Given their extensive taxonomic diversity, ecological adaptability, and biochemical richness, Asteraceae species continue to attract multidisciplinary scientific interest. In biodiversity-rich countries with deep-rooted traditions of plant-based medicine, such as Ethiopia, this family plays a central role in primary healthcare and represents a promising frontier for ethnopharmacological research, drug discovery, and conservation efforts.

Materials and Methods

Ethiopia, located in the Horn of Africa, is bordered by Eritrea to the north, Djibouti and Somalia to the east, Sudan and South Sudan to the west, and Kenya to the south. The country is defined by a vast central highland massif the Ethiopian Highlands which rises between 1,290 and 3,000 meters above sea level. Within this highland system, more than 25 peaks exceed 4,000 meters, including Ras Dashen, the highest point at 4,543 meters.

Administratively, Ethiopia is divided into 11 regional states and two chartered cities, each encompassing diverse agroecological zones that contribute to the country's ecological and cultural heterogeneity. Ethiopia's environmental complexity is further enhanced by geological formations such as the Afar Depression an active continental rift system situated 125 meters below sea level recognized globally as a site where an oceanic rift is developing within a continental setting (Varet & Gardo 2020). Prominent mountain ranges such as Ras Dashen and Tulu Dimtu also contribute to this ecological mosaic.

The country is globally acknowledged for its rich biodiversity and cultural heritage, including UNESCO World Heritage Sites such as the rock-hewn churches of Lalibela and the ancient city of Axum. Its botanical richness is driven by a combination of varied topography, climate gradients, and diverse soil types (Moges 2019; Awulachew 2021).

Earlier estimates placed Ethiopia's vascular plant diversity between 6,500 and 7,000 species. However, following the completion of the *Flora of Ethiopia and Eritrea (FEE)* project, the number of documented higher plant species has been revised to 6,027, including 27 subspecies, with approximately 12% endemism (Kelbessa & Demissew 2014; Demissew *et al.* 2021). This revised estimate highlights Ethiopia as one of the richest centers of plant diversity in Africa, particularly notable for its endemic and medicinally important taxa.

Within this botanical wealth, the Asteraceae family holds a prominent position. With 133 documented species, it is the second largest plant family in Ethiopia after Poaceae (156 species) (Demissew *et al.* 2021). Beyond its taxonomic significance, Asteraceae is extensively represented in traditional medicine across Ethiopia's ethnolinguistic groups due to its ecological abundance, cultural familiarity, and pharmacological potential.

Biodiversity hotspots such as the Yayu, Sheka, Majang, and Kafa biosphere reserves—as well as the Sheko forest—are critical for the conservation of Ethiopia's native flora, including medicinal plants (Moges 2019; Kassa *et al.* 2020; Tadese *et al.* 2021). These areas are also central to ethnobotanical studies due to their high species richness and the continued reliance of local communities on plant-based healthcare systems.

This study draws upon published ethnobotanical literature, floristic inventories, and national biodiversity assessments to compile and analyze data on Asteraceae species used in Ethiopian traditional medicine. The approach emphasizes regional representation, species-level identification, medicinal use documentation, and conservation status, contributing to a comprehensive understanding of the family's ethnobotanical relevance within Ethiopia's unique biocultural landscape.

Data sources and search strategy

A comprehensive literature review was conducted between 16 December 2024 and 26 March 2025, drawing on multiple academic and institutional databases to identify relevant studies on the ethnobotanical and medicinal uses of Asteraceae species in Ethiopia. The primary databases consulted included PubMed, Google Scholar, Web of Science, Scopus, and ScienceDirect. Additionally, authoritative botanical references such as *Flora of Ethiopia and Eritrea (FEE)* Volume 4, Part 2, Global Plants (JSTOR), and Plants of the World Online (Royal Botanic Gardens, Kew) were extensively reviewed. Supplementary data were gathered from official websites of academic institutions, research organizations, and governmental agencies to include grey literature and unpublished reports. The search strategy aimed to capture both peer-reviewed publications and non-peer-reviewed sources published prior to 26 March 2025. A combination of keywords and Boolean operators was used to enhance the search efficiency. The search terms included: "Asteraceae family," "traditional medicinal plants," "herbal medicine," "folk remedies," "ethnomedicine," "ethnobotany," "ethnopharmacology," "home remedies," "diseases," and "Ethiopia." This systematic approach ensured the inclusion of a wide array of sources documenting the medicinal applications, cultural relevance, and ecological contexts of Asteraceae species within Ethiopian traditional healthcare systems.

Inclusion and exclusion criteria

Inclusion criteria

All studies conducted in Ethiopia were incorporated as they documented the utilization of herbal medicines from the Asteraceae family for the treatment of human ailments. Provided details on plant parts used, preparation methods, and therapeutic indications. Both published and unpublished articles that reported findings prior to 26 March 2025 were encompassed in the analysis.

Exclusion criteria

The review papers excluded studies that lacked complete ethnobotanical information, such as the list of medicinal plant species, plant parts used, methods of preparation, and routes of administration. Additionally, these papers did not include any information on the Asteraceae plants family. Any studies that were not provided or inaccessible in their full text were also excluded from this review paper.

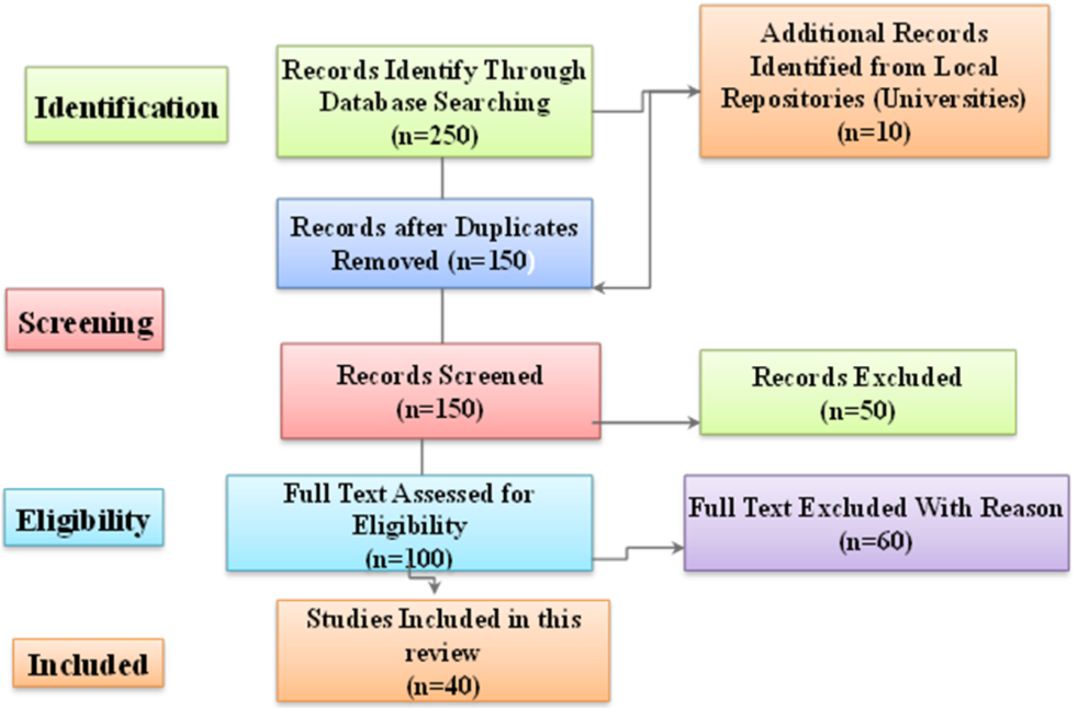

Figure 1 Flow diagram illustrating the process of literature identification, screening, eligibility assessment, and inclusion in the review.

Data extraction and analysis

Plant species names and vernacular names were verified using the *Flora of Ethiopia and Eritrea* (FEE) (Friis *et al.* 2011) to ensure taxonomic accuracy and consistency. Key ethnobotanical data were extracted from the selected literature, including the region of use, plant parts utilized, methods of preparation, routes of administration, ailments treated, and frequency of citation.

The extracted data were compiled and organized in Microsoft Excel for initial screening and categorization. Descriptive statistical analyses were performed using R software version 4.4.3 to identify patterns in medicinal plant use, regional distribution, and ethnobotanical relevance across the Asteraceae species reported.

Sampling methods, data validity, and potential biases in the reviewed literature

The reviewed ethnobotanical studies on the medicinal use of Asteraceae in Ethiopia employed a range of sampling methods, which directly influence the reliability and generalizability of their findings. Most studies utilized purposive sampling, targeting key informants such as traditional healers, elders, or knowledgeable community members. While this approach is valuable for capturing in-depth traditional knowledge, it may introduce selection bias by excluding broader community perspectives, particularly those of women, youth, or non-practicing individuals. Only a limited number of studies applied random or stratified sampling techniques, which are more effective in producing representative data across different social and ecological contexts.

Data validity across the literature varies depending on the rigor of data collection and verification procedures. Common methods included semi-structured interviews, focus group discussions, and participant observation, which provided detailed qualitative information on plant uses, preparation methods, and therapeutic applications. However, the reliability of findings was often compromised by the lack of cross-verification through multiple informants or triangulation with independent sources. While some studies authenticated plant species through voucher specimen collection and identification by botanists, others failed to follow standardized taxonomic protocols, limiting the reproducibility and scientific credibility of the reported data. Moreover, phytochemical or pharmacological validation was rarely included, leaving many therapeutic claims unverified.

Potential biases in the reviewed literature arise from several factors. Cultural and linguistic barriers especially when indigenous knowledge is translated into national or international languages may result in misinterpretation or oversimplification of nuanced ethnomedical concepts. In some cases, confirmation bias was evident, where researchers disproportionately focused on well-known or culturally prominent species, potentially overlooking lesser-known plants with significant therapeutic value. Publication bias is also a concern, as studies reporting novel or positive medicinal uses are more likely to be published, while negative or inconclusive findings remain underrepresented.

Recognizing these methodological limitations is critical for advancing ethnobotanical research in Ethiopia. Future studies should prioritize methodological rigor, including the use of representative sampling, voucher-based species verification, cross-informant validation, and quantitative indices (e.g., Use Value, Fidelity Level). Addressing these issues will enhance the reliability, inclusivity, and applied value of ethnobotanical research for healthcare, conservation, and drug discovery initiatives.

Results and Discussion

Article selection and scope

A comprehensive search across scientific databases yielded 260 relevant articles. After removing duplicates, 100 records were screened for eligibility, and 40 studies (35 published and 5 unpublished) met the inclusion criteria for this systematic review (Figure 1). These studies span floristic regions of Ethiopia and offer a broad overview of the ethnomedicinal applications of the Asteraceae family.

Diversity of Asteraceae medicinal plants in Ethiopia

This review synthesizes ethnobotanical data from multiple studies conducted across Ethiopia, revealing notable regional variation in the documentation and use of Asteraceae species. According to the *Flora of Ethiopia and Eritrea* (FEE), the Asteraceae family is the second most species-rich plant family in the country, following Poaceae, underscoring its significant botanical presence across Ethiopia's varied ecosystems (Friis *et al.* 2011). The ecological dominance of Asteraceae is largely attributed to their high adaptability to diverse environmental conditions, including wide altitudinal ranges, variable climatic zones, and disturbed habitats such as grasslands, shrublands, and semi-arid regions. Their success is further supported by effective reproductive strategies, including wind-dispersed seeds and vegetative propagation, which facilitate broad colonization and long-term persistence.

Unlike Poaceae, which is vital for agriculture and ecological stability but less prominent in ethnomedicine, Asteraceae species play a disproportionately significant role in traditional healthcare systems. This is primarily due to their rich phytochemical profiles. Many species produce a variety of secondary metabolites such as sesquiterpene lactones, flavonoids, and essential oils that exhibit documented antimicrobial, anti-inflammatory, antiparasitic, and wound-healing properties. These chemical attributes enhance their therapeutic potential and explain their widespread use in ethnomedicine. The dual prominence of Asteraceae in both floristic composition and traditional medicine reflects their ecological resilience and pharmacological relevance, positioning the family as a priority group for future ethnobotanical and pharmacological research in Ethiopia.

Geographically, the majority of ethnobotanical studies were concentrated in Oromia (35.7%) and Amhara (30.4%) regions. This trend may be linked to greater research infrastructure, accessibility, and academic presence in these areas. In contrast, regions such as Sidama, Southwest Ethiopia, Gambella, Afar, Somali, and Benishangul-Gumuz remain underrepresented in the literature, suggesting a need for expanded field surveys to capture undocumented species and traditional knowledge in these culturally and ecologically diverse regions The high species diversity recorded in Oromia may be attributed to its ecological richness, including fertile soils, dense vegetation, and high rainfall, which together support robust floristic diversity and medicinal plant use (Chemeda & Mosisa 2017; Bitew *et al.* 2019). Across the reviewed literature, 56 Asteraceae species were documented for ethnomedicinal use, spanning 34 genera. The most frequently cited species include: *Vernonia amygdalina* Delile (n = 12), *Artemisia abyssinica* Sch. Bip. ex A. Rich (n = 8), *Echinops kebericho* Mesfin (n = 8), *Acmella caulirhiza* Del. (n = 6), *Guizotia abyssinica* (L.f.) Cass. (n = 4), and *Ageratum conyzoides* L. (n = 4) Among these, *V. amygdalina* was the most widely used, particularly for the treatment of gastrointestinal disorders, febrile illnesses, and parasitic infections consistent with previous findings (Lulekal *et al.* 2013; Dubale *et al.* 2023). Similarly, *A. abyssinica*, *E. kebericho*, and *A. conyzoides* were frequently cited across different ecological and cultural settings, indicating their broad therapeutic relevance.

The ethnomedicinal value of these species is not limited to Ethiopia. For instance, *A. conyzoides* is a widely used medicinal plant in Nigeria, Uganda, and India, valued for its antimicrobial and wound-healing properties (Yadav *et al.* 2019; Kumar *et al.* 2021). *E. kebericho*, an Ethiopian endemic, has demonstrated antifungal and anti-leishmanial properties in pharmacological studies, further validating its cultural and therapeutic importance (Tadesse *et al.* 2023). Although 56 species were recorded in this review, this number likely underrepresents the true extent of Asteraceae's medicinal use in Ethiopia. Comparable studies in West Africa and South Asia have documented between 80 and 120 Asteraceae species with ethnomedicinal applications (Miya *et al.* 2020; D'Almeida *et al.* 2024), suggesting that Ethiopia's potential remains underexplored particularly in lesser-studied regions. Continued and geographically inclusive research is essential to fully document the country's rich Asteraceae heritage and to support efforts in traditional knowledge preservation, public health, and biodiversity conservation.

The dominance of a few widely used species may reflect their ecological abundance, strong cultural acceptance, or proven therapeutic efficacy. However, it also points to a possible neglect of lesser-known species that may possess unique bioactive compounds. This highlights the need for broader geographic and taxonomic coverage in future ethnobotanical research.
Taxonomic analysis revealed 56 Asteraceae species used in Ethiopian ethnomedicine, classified under 34 genera (Table 1). This level of diversity underscores the family's critical role in traditional healthcare and its potential as a reservoir of novel therapeutic agents. The finding is consistent with earlier studies that identified Asteraceae as one of the most frequently used plant families in Ethiopian ethnobotany (Lulekal *et al.* 2013; Dubale *et al.* 2023). This diversity surpasses that reported in other regions for example, only 30 species and 23 genera were documented in Eastern Azerbaijan Province (Joudi & Bibalani 2010). The variation in species count across studies may result from differences in ecological conditions, sampling intensity, cultural practices, and methodological approaches. Ethiopia's high reliance on traditional medicine, particularly in rural and resource-limited settings, is well-documented (Gedif & Hahn 2003; Agize *et al.* 2013; Getachew *et al.* 2022). This reliance is driven by multiple factors, including limited access to modern healthcare, high costs of pharmaceuticals, and long-standing cultural acceptance of herbal remedies (Kassa *et al.* 2020; Awoke *et al.* 2025). Certain genera such as *Vernonia*, *Artemisia*, *Echinops*, *Ageratum*, and *Guizotia* appear consistently across multiple studies, reflecting their widespread distribution and trusted therapeutic applications. *A. abyssinica* and *E. kebericho*, for instance, are among the most valued species, frequently cited for treating respiratory and febrile conditions due to their antimicrobial and anti-inflammatory properties (Muluye *et al.* 2020). This pattern of usage is reflected in other East African nations. In Kenya and Uganda, Asteraceae ranks among the top families used in traditional medicine (Kipkore *et al.* 2014; Walusansa et al., 2022). Similarly, Ghana and Nepal report over 90 and 120 medicinal Asteraceae species respectively, reinforcing the global ethnomedicinal relevance of the family (Osei-Tutu *et al.* 2020; Shrestha *et al.* 2021). Phytochemical studies confirm that many Asteraceae species contain bioactive compounds such as flavonoids, essential oils, and sesquiterpene lactones, which contribute to their therapeutic effects (Karadeniz *et al.* 2021). However, most of the species documented in this review have not yet been subjected to in-depth phytochemical or pharmacological evaluation, highlighting a critical gap between traditional knowledge and scientific validation.

The findings of this review highlight several critical implications for the future of ethnobotanical research and the sustainable use of Asteraceae medicinal plants in Ethiopia. First, there is a clear geographic imbalance in existing studies, with research predominantly concentrated in central regions such as Oromia and Amhara. This uneven distribution risks overlooking valuable traditional knowledge in peripheral and ecologically distinct areas. To address this, targeted ethnobotanical documentation in underrepresented regions is urgently needed to capture and preserve local medicinal plant knowledge before it is lost. Second, although many Asteraceae species are culturally and therapeutically significant, few have undergone rigorous phytochemical or pharmacological evaluation. This disconnects limits the scientific validation of traditional remedies and hinders their potential integration into modern healthcare. Bridging this gap through interdisciplinary research will be essential for verifying ethnomedical claims and identifying promising bioactive compounds. Third, Ethiopia's diverse Asteraceae flora represents a significant opportunity for sustainable bioprospecting. However, this potential must be balanced with the need for conservation and the implementation of fair benefit-sharing mechanisms. Ensuring that local communities retain ownership over their knowledge and resources is critical, especially as global interest in natural products continues to grow (Rajeswara et al., 2012). Finally, integrating traditional ethnomedicinal knowledge with national healthcare systems can enhance community health outcomes and provide culturally appropriate alternatives to modern pharmaceuticals. This requires cross-sector collaboration between ethnobotanists, healthcare practitioners, policy makers, and conservationists to support both the scientific validation and responsible use of Ethiopia's plant-based healing traditions.

Growth forms of medicinal plants

The analysis revealed that, Asteraceae species in Ethiopia reveals a strong predominance of herbaceous plants, which account for 73.2% of documented species. This is followed by shrubs (21.4%), climbers (5.5%), and trees (1.8%) (Table 1). The reliance on herbs reflects longstanding ethnobotanical practices, as also reported in earlier studies (Awas & Demissew 1999b; Giday *et al.* 2009; Lulekal *et al.* 2013; Dubale *et al.* 2023). Herbs are widely favored for their availability, ease of harvest, and fast regeneration, making them a practical and sustainable choice in traditional medicine. The abundance of herbaceous species across diverse agroecological zones especially in disturbed habitats, roadsides, and fallow lands further explains their frequent use (Teklehaymanot & Giday 2007). While seasonal accessibility can pose limitations, particularly for wild-collected herbs, their prevalence in communal landscapes ensures continued relevance in rural healthcare (Chemeda & Mosisa 2017; Asfaw *et al.* 2022). Shrubs, representing 21.4% of the documented species, also play a significant role. Species such as *Vernonia amygdalina* and *Echinops kebericho* are commonly used to treat chronic ailments like malaria, internal parasites, and respiratory conditions. Their semi-woody nature and perennial growth contribute to year-round availability (Tadesse *et al.* 2023). In contrast, trees and climbers are less utilized, likely due to slower growth, limited accessibility, and conservation concerns. This pattern is consistent with findings from other regions, including Uganda, India, and Nigeria, where herbaceous Asteraceae species dominate traditional pharmacopoeias (Walusansa et al., 2022; Okunade 2021; Suresh *et al.* 2022). From a pharmacological standpoint, herbs are particularly valued for their concentration of bioactive compounds in leaves and aerial parts, which are commonly used in traditional preparations (Karadeniz *et al.* 2021). Moreover, harvesting these parts tends to be less ecologically damaging compared to the extraction of roots or bark from woody species. These findings carry important implications. The dominance of herbs suggests their prioritization in pharmacological screening and ethnopharmacological research. At the same time, the underrepresentation of trees and climbers highlights the need for targeted conservation, especially amid ongoing threats such as deforestation and land-use change. Understanding growth habits also informs strategies for cultivation and domestication, ensuring both the preservation and sustainable use of medicinal plant resources. Thus, the medicinal use of Asteraceae in Ethiopia demonstrates a pronounced preference for herbaceous species, shaped by both cultural traditions and ecological conditions. Many members of the Asteraceae family are pioneer species, well adapted to colonize disturbed or degraded habitats. Their rapid growth rates, short life cycles, and resilience to poor soil conditions enable them to thrive in ecologically dynamic environments (Grime 2001). Additionally, certain species establish mutualistic relationships with soil microorganisms such as mycorrhizal fungi that enhance nutrient acquisition and increase tolerance to environmental stressors (van der Heijden *et al.* 1998). These ecological traits contribute to their availability and accessibility in rural settings, supporting their continued integration into traditional medical systems. However, this widespread use also underscores the importance of incorporating conservation strategies and sustainable harvesting practices into ethnomedicinal frameworks.

Table 1 Traditional medicinal uses of the Asteraceae in Ethiopia, compiled from various sources

Botanical name	Local Name	Hab	PU	Method of preparation	Disease Treated	RoA	Literature cited
Acmella caulirhiza Delile	**Yemider berbere(Am)**	H	Lf	Chewed and swallowed	Tonsillitis	Oral	(Tadesse 2004; Hedberg *et al.* 2004; Kefalew *et al.* 2015;Tuasha *et al.* 2018; Giday *et al.* 2010;Amsalu *et al.* 2018; Asfaw *et al.* 2022; Degu *et al.* 2022)
Adenostemma perrottetii DC.	**NA**	H	St	Boil leaves with water and dink half cup of coffee, the hot decoction every day until recovery.	Dysentery	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2010)
Ageratum conyzoides L.	**Qoricha michii(Or)**	H	Lf	Aqueous extract of the plant is applied externally to the body	Mitch/Fever	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Kassa *et al.* 2017;Degu *et al.* 2022)
Ageratum houstonianum Mill.	**Q/Merz(Or)**	H	Lf	Aqueous extract of the plant is applied externally to the body	Back bone pain	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2010;Kefalew *et al.* 2015)
Artemisia abyssinica Sch.Bip. ex Oliv. & Hiern	**Chiqugne(Am)**	H	Lf	Leaves are crushed with seeds of *Allium sativum* and leaves of *Ruta chalepensis*, powder soaked in water and inhaled; burned on fire and fumigated	Evil eye	Nasal	(Tadesse 2004; Hedberg *et al.* 2004;Chekole *et al.* 2015a;Birhan *et al.* 2017;Kassa *et al.* 2017;Amsalu *et al.* 2018;Asfaw 2021;Ayele 2022;Osman *et al.* 2020;Asfaw *et al.* 2022)
Artemisia rehan Chiov.	**Arity(Am)**	H	Lf	Boil leaves with water and dink half cup of coffee, the hot decoction every day	Diarrhea	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Getachew *et al.* 2022;Awoke *et al.* 2024)
Aspilia mossambicensis (Oliv.) Wild	**Kershu(Sh)**	H	Lf	The leaf is crushed and put on the affected part of the body.	Ear infection	Local (ear)	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2010)
Bidens macroptera (Sch.Bip. ex Chiov.) Mesfin	**Adey Abeba(Am)**	H	Lf	Leaf are used to remove pus from infected wounds	Wound	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Chekole *et al.* 2015a;Bitew *et al.* 2019)
Bidens pilosa L.	**Qoricha /marzii(Or)**	H	Lf	The leaf is crushed and put on the affected part of the body.	Poisoning	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Kassa *et al.* 2017;Giday *et al.* 2009a)

Bothriocline schimperi Oliv. & Hiern ex Benth.	**Qoricha /dhayichaa(Or)**	Sh	Lf	Aqueous extract of the plant is applied externally to the body and also internally through the nasal cavity	Mitch/Fever	Nasal	(Tadesse 2004; Hedberg *et al.* 2004;Kassa *et al.* 2017)
Carduus schimperi Sch.Bip.	**Kosheshila(Am)**	H	Rt	The root is pounded, squeezed, and drunk	Fibril illness	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Amsalu *et al.* 2018)
Carthamus tinctorius L.	**Habeshasuf(Am)**	H	Sd	The powder will be boiled, then drink the filtrate.	Constipation	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Ayele 2022)
Circium dender Friis	**Daji umbelo(Shk)**	H	Rt	Crush the root or boil the fresh root and then mix the extraction with honey and drink one glass for adults and one coffee cup for babies every morning	Liver	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Garedew & Abebe 2019)
Cirsium englerianum O.Hoffm.	**Koshashle(Am)**	H	Rt	The boiled steam taken through nostrils	Headache	Nasal	(Tadesse 2004; Hedberg *et al.* 2004;Chekole *et al.* 2015a; Ayele 2022)
Conyza bonariensis (L.) Cronquist	**Qilqilia(Mnt)**	H	Lf	Crush and give with water	Diarrhea(child)	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2009)
Coreopsis lanceolata L.	**Imbaboadey (Tg)**	H	Rt	Root powder is mixed with water and applied as an ointment	Wound	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Bitew *et al.* 2019)
Crepis rueppellii Scli.Bip.	**NA**	H	Rt	Crush and give with water	Anthrax	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Chekole *et al.* 2015a)
Dichrocephala integrifolia (L.f.) Kuntze	**Burbu'o (shk)**	H	Lf	Crushing and squeezing the leaf drop on the wound	Liver	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2009a;Garedew & Abebe 2019;Bitew *et al.* 2019)
Dichrocephala L'Hér. ex DC.	**NA**	H	Lf	Crushing and squeezing the leaf drop on the eye	Cataract	Local (eye)	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2009)
Echinops kebericho Mesfin	**Kebericho(Am)**	H	Rt	Bulbs are infused, inhaled, and smoked.	Cough	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Wondimu *et al.* 2007;Birhanu *et al.* 2010;Mesfin *et al.* 2014;Birhan *et al.* 2017;Dagne & Belachew, 2019 *et al.,* 2017;Banchiamlak & Young-dongKim, 2019;Asfaw, 2021;Asfaw *et al.,* 2022; Awoke *et al*., 2025)

Emilia herbacea Mesfin & Beentje	**Anbomora(Am)**	H	Lf	The powder will be boiled, then drink the filtrate.	Malaria	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2009;Dagne & Belachew 2019)
Emilia sonchifolia (L.) DC.	**Etse hayu este Yikestil(Am)**	H	Rt		Impotence	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Asfaw, 2021)
Galinsoga parviflora Cav.	**Midirberbere, (Amh)**	H	Lf	The leaf are grounded, mixed with water and the solution taken orally	Anemia	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Tolossa *et al.*, 2013;Tuasha *et al.*, 2018)
Galinsoga quadriradiata Ruiz & Pav.	**Zibute-kono(Mnt)**	H	Lf	Leaf are chewed and fluid swallowed	Snake bite	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.*, 2009)
Guizotia abyssinica (L.f.) Cass.	**Nug(Am)**	H	Sd	Seeds are grounded, mixed with water and the solution taken orally	Cough	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Birhan *et al.* 2017;Kassa *et al.* 2017;Osman *et al.* 2020;Alemneh 2021b)
Guizotia scabra (Vis.) Chiov.	**Mech(Am)**	H	Rt	Roots are chewed and fluid swallowed	Stomach ache	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Birhan *et al.* 2017;Bitew *et al.* 2019;Alemneh 2021b)
Guizotia schimperi Sch.Bip.	**Bihiwus(Am)**	H	Sd	Pound the mixture of *Allium sativum* and *Ruta chalepensis*, and consume it.	Stomach complaint	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Ayele 2022)
Helichrysum Mill.	**Shopo (Shk)**	H	Lf	Crush the leaf and drink the extract	Liver	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Garedew & Abebe 2019)
Helichrysum splendidum (Thunb.) Less.	**Gurjejit(Am)**	Sh	Lf	Crashed and washing with its decoction	Dandruf	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Mekuanent *et al.* 2015)
Inula confertiflora A.Rich	**Weynagif(Am)**	Sh	Lf	Juice of the leaf is applied to skin rash	Skin rash	Dermal	Tadesse 2004; Hedberg *et al.* 2004;Ayele 2022;Asfaw 2021)
Lactuca inermis Forssk.	**Ameessa(Sd)**	Cl	Lf	The leaf is chopped, boiled, and the filtrate is drunk	growth retardation)	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Tuasha *et al.* 2018)
Lactuca serriola L.	**Dememerarit (Am)**	H	Lat	Latex is creamed after removing the ticks.	Wound	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Bitew *et al.* 2019)
Laggera angustifolia Hayata	**Gimmie(Am)**	H	Lf	Leaf is inhaled for sometimes through the nose	Common cold	Nasal	(Tadesse 2004; Hedberg *et al.* 2004;Amsalu *et al.* 2018)

*Laggera crispata (*Vahl) Hepper & J.R.I.Wood	**Keskeso(Am)**	H	Lf	Leaves are crushed, mixed with water, filtered and taken orally for three days	Febrile illness	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Birhan *et al.* 2017;Amsalu *et al.* 2018)
Laggera decurrens (Vahl) Hepper & J.R.I.Wood	**Kes Bedeje(Am)**	H	Rt	Cooking	Gastritis	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Alemneh 2021b)
*Laggera tomentosa (*A.Rich.) Sch.Bip. ex Oliv. & Hiern	**Nech kese(Am)**	H	Lf	Hold fresh leaves tightly in to the nostrils	Common cold, insect	Nasal	(Tadesse 2004; Hedberg *et al.* 2004;Tolossa *et al.* 2013;Degu *et al.* 2020; Getachew *et al.* 2022)
Microglossa pyrifolia (Lam.) Kuntze	**Nibasho(Shk)**	Sh	Lf	Grind the fresh leaf and then mix the extraction with yogurt and drink the mixture four spoons per a day.	Amoeba	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2009a;Giday *et al.* 2009;Belachew & Dagne 2018)
Nuriaea engleriana (O.Hoffm.) Susanna, Calleja & Moreyra	**Kimer abeba (Am)**	T	Lf	Squeezing the leaves	Liver	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Garedew & Abebe 2019; Awoke *et al.* 2024)
Pentanema confertiflorum (A.Rich.) D.Gut.Larr., Santos-Vicente, Anderb., E.Rico & M.M.Mart.Ort.	**Wonagifit(Am)**	Sh	Lf	Grind the fresh leaf and then mix the extraction with yogurt and drink the mixture four spoons per a day.	Jaundice	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Asfaw *et al.* 2022)
Pulicaria schimperi DC.	**NA**	H	Lf	Pounded fresh leaf is pasted on the wounded part	Wound	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Bitew *et al.* 2019)
Solanecio angulatus (Vahl) C.Jeffrey	**Rafa(Am)**	H	Lf	Drying, grinding, making a powder	Evil eye	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Kindie *et al.* 2021, Awoke *et al.* 2024)
Solanecio gigas (Vatke) C.Jeffrey	**Shikoko gomen(Am)**	H	Lf	The leaf will be mixed with water then drunk	Rabies	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Ayele, 2022;Getachew *et al.* 2022)
Solanecio mannii (Hook.f.) C.Jeffrey	**Boz(Am)**	H	St	Stems are grounded, mixed with water and pasted on the swelling	Swelling	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Birhan *et al.* 2017)
Sonchus bipontini Asch.	**Meracho (Shk)**	H	Lf	Grind the leaf of Meracho and Nukesho and then mix the extraction with water. Drink the juice with a coffee cup measure depth of small finger of upper joint; Detoxified by eating two mouthful or spoons of honey or	Amoeba	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Belachew & Dagne 2018)

				cheese/ergo; no side effect; forbidden for pregnancy.			
Tagetes minuta L.	**Hada Barifidee (Or)**	H	Lf	Leaf chopped and ground and the drench the filtrate	Diarrhea and vomiting	Smoking	(Tadesse 2004; Hedberg *et al.* 2004;Tolossa *et al.* 2013;Giday *et al.* 2007)
Vernonia adoensis Sch.Bip. ex Walp.	**Etse Mossie(Am)**	Sh	Rt	Its root and *Chatha edulis* leaf are crashed and prepared as a decoction , then drink	Devil	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Mekuanent *et al.* 2015)
Vernonia amygdalina Delile	**Birmayda**	Sh	Rt	Root is chewed.	Stomach ache Headache Malaria	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Wondimu *et al.* 2007;Giday *et al.* 2009;Birhanu *et al.* 2010;Mesfin *et al.* 2014;Tuasha *et al.* 2018;Amsalu *et al.* 2018;Tassew 2019;Kindie *et al.* 2021;Asfaw, 2021; Abebe Ayele, 2022;Asfaw *et al.* 2022;Getachew *et al.* 2022)
Vernonia auriculifera Hiern	**Reejii(Or)**	Sh	Lf	Fresh leaf is crushed and applied	Dermatitis	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2009;Birhanu *et al.* 2010;Tuasha *et al.* 2018)
Vernonia bipontini Vatke	**Gobez tekes(Am)**	H	Lf	Squeeze leaves and drop one or two drops of the extract on the eye	Eye disease	Eye	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2007;Getachew *et al.* 2022)
Vernonia filigera Oliv. & Hiern	**Rejicho (Sd)**	Sh	Lf	Grinding	Leg pain	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Banchiamlak & Young-dongKim 2019)
Vernonia galamensis (Cass.) Less.	**Busnta (Kaf)**	Sh	Lf	Fresh leaf is crushed and applied	Wound	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Bitew *et al.* 2019)
Vernonia lancifolia Merr.	**Umel-iruq, aba-musa(Agw)**	H	Rt	The root will be mixed with water then drunk	Gastro-intestinal	Oral	(Tadesse 2004; Hedberg *et al.* 2004;Giday *et al.* 2007)
Vernonia leopoldi (Sch.Bip. ex Walp.) Vatke	**NA**	Sh	Lf	Fresh leaf is crushed and pounded, and then tied on the injured part	Wound	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Bitew *et al.* 2019;Tessema *et al.*2025)

Vernonia schimperi DC.	**Hecho (Sd)**	Sh	Lf	Grinding, powdering	Wound	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Banchiamlak & Young-dongKim 2019)
Xanthium spinosum L.	**Baandaa(Or)**	H	Lf	Leaves are crushed and mixed with butter and applied on the infected site	Fungal disease on skin	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Wondimu *et al.* 2007)
Xanthium strumarium L.	**Derkus(Am)**	H	Lf	Leaves are crushed and mixed with butter and applied on the infected site	Skin rush	Dermal	(Tadesse 2004; Hedberg *et al.* 2004;Getachew *et al.* 2022)

Key: Habit (T=tree, Sh=shrub, H=herb, Cl=climber), PU=Parts used ((Lf=leaf, Rt=root, Sd=seed, St=stem, La=Latex), **RoA=**Route of Administration**, NA=**Not Available**, Local Name: Oro=**Afan oromo, **Am=A**mharic**, Shk=**Sheka**, Kf=**Kaffa**, Mnt=**Meint**, Sd=**Sidama

Plant parts used remedies preparation

A review of ethnobotanical literature shows that traditional healers in Ethiopia predominantly utilize the leaves (71.4%) of Asteraceae species for medicinal purposes, followed by roots (21.4%), seeds (3.5%), stems (1.8%), and latex (1.8%) (Table 1). The preference for leaves reflects both practical and ecological factors: they are widely available, easy to prepare, and rich in bioactive compounds (Chekole 2017; Jima & Megersa 2018; Abebe & Teferi 2021). Similar patterns have been observed across various Ethiopian regions including Jimma, Sheka, and South Wollo (Lulekal *et al.* 2013; Yineger *et al.* 2008; Dubale *et al.* 2023), affirming the central role of leaves in traditional healthcare. Leaves are favored not only because of their accessibility but also because their harvesting is generally non-destructive, allowing the plant to continue growing (Giday *et al.* 2010; Abera 2003). However, in some species, leaf harvesting can interfere with flowering and seed production, potentially affecting regeneration (Abera 2014; Giday *et al.* 2009). In contrast, roots remain available year-round and are less affected by seasonal changes, making them a reliable resource during dry periods (Gebeyehu *et al.* 2014; Sharma *et al.* 2021). Yet, root harvesting is often lethal to the plant and, when combined with habitat loss and agricultural expansion, poses significant threats to species survival particularly for slow-growing or endemic taxa (Dubale *et al.* 2023; Tuasha *et al.* 2018). Globally, similar trends have been observed. Studies in Uganda, Nepal, and Nigeria also report leaves as the most commonly used plant part in traditional medicine, often accounting for more than 65% of usage (Walusansa et al., 2022; Miya *et al.* 2020; Yadav *et al.* 2019). This preference is often attributed to the perception of faster therapeutic effects, ease of preparation, and reduced ecological impact. Leaves are also known to concentrate high levels of pharmacologically active secondary metabolites such as flavonoids, terpenoids, and alkaloids (Karadeniz *et al.* 2021), reinforcing their therapeutic value and suitability for phytochemical research. Roots, while used less frequently, are often associated with potent medicinal effects (Awoke *et al.* 2024). However, their collection requires careful management to avoid population decline. Seeds, stems, and latex are rarely used together representing only 7.1% of reported applications. Their limited use may stem from lower accessibility or traditional knowledge favoring other parts. Still, species like *Guizotia abyssinica*, whose seeds contain antimicrobial essential oils, demonstrate that these parts can hold important pharmacological properties (Muluye *et al.* 2020). These patterns carry significant implications. First, the dominant use of leaves provides a sustainable focus for pharmacological research and bioprospecting, minimizing ecological disturbance. Second, conservation strategies must address the risks posed by root harvesting, advocating for community education and cultivation efforts to reduce wild extraction. Third, a balanced ethnopharmacological approach is needed one that respects traditional practices while supporting biodiversity conservation and responsible resource use. In conclusion, the parts of Asteraceae plants used in traditional Ethiopian medicine reveal a deep-rooted ethnomedical rationale shaped by ecology, accessibility, and effectiveness. Prioritizing the sustainable use of leaves while developing conservation frameworks for at-risk plant parts can help bridge traditional knowledge with modern scientific and conservation goals.

Method of preparation and mode of administration of medicinal plants

Ethnobotanical studies on the Asteraceae family in Ethiopia reveal a variety of traditional preparation methods and administration routes, reflecting the ingenuity and practicality of indigenous healing practices. Among these, crushing fresh plant materials is the most common method, reported in 50% of cases, followed by squeezing (33.9%) and powdering (16%) (Table 1). Less frequently, plant parts are heated or processed into oils for topical use, especially in wound care. These approaches rely on accessible, low-tech techniques that align with the resource-limited settings of many rural communities (Giday *et al.* 2009; Lulekal *et al.* 2013). The predominance of fresh plant use, particularly herbs, is also influenced by seasonal availability plants may be scarce during dry periods unless cultivated locally (Asfaw *et al.* 2022). Crushing remains the most frequently reported method across multiple studies, though regional variations exist. For instance, pounding was the dominant preparation method in some areas (Alemneh 2021), while other research has highlighted topical applications as the primary route for treating wounds and skin infections (Inngjerdingen *et al.* 2004; Vitale *et al.* 2022; Sharma *et al.* 2021). This pattern mirrors ethnomedicinal practices in other parts of sub-Saharan Africa and South Asia, including Uganda, India, and Nepal, where simple methods such as crushing, squeezing, and decoction are widely used (Walusansa et al., 2022; Shrestha *et al.* 2021; Kumar *et al.* 2021). The preference for fresh over dried materials likely stems from the belief that therapeutic potency diminishes with processing. Consistent with this, the most common routes of administration include topical, oral, and nasal applications, depending on the condition being treated practices also observed in global traditional medical systems (Okunade 2021). Despite their cultural efficacy and accessibility, these methods present several limitations. A key concern is the lack of standardization in dosage and treatment duration. Most studies do not specify precise quantities or frequency of administration, leading to variability in therapeutic outcomes and potential safety risks. This gap has been highlighted in prior literature as a persistent challenge in traditional medicine (Yineger *et al.* 2008; Hamilton 2004), and is particularly significant for bioactive-rich families like Asteraceae, where improper use can lead to toxicity. Moreover, the widespread use of topical and nasal administration routes especially for treating infections and respiratory conditions warrants targeted pharmacological evaluation. For example, *Echinops kebericho* and *Artemisia abyssinica* have demonstrated antimicrobial and anti-inflammatory activity when applied dermally or inhaled (Tadesse *et al.* 2023). However, traditional claims remain under-validated in clinical settings. These findings have several implications. First, ethnopharmacological research should prioritize detailed documentation of preparation methods and administration routes to bridge traditional knowledge with scientific inquiry. Second, public health and policy interventions should promote awareness and guidelines for safe, standardized use of herbal remedies. Third, common techniques like crushing or squeezing may influence the chemical stability of active compounds, underscoring the need for biochemical and shelf-life studies to enhance the reliability of these practices in integrative medicine. In summary, the preparation and administration of Asteraceae-based remedies in Ethiopia exemplify the adaptability of traditional medicine to local conditions. While these practices are practical and culturally embedded, enhanced attention to standardization, safety, and scientific validation is essential to unlock their full therapeutic potential and ensure their sustainable use.

Standardized dosages, toxicological risks, and clinical implications

A significant limitation in the ethnomedicinal application of Asteraceae species in Ethiopia is the lack of standardized dosage information. While numerous ethnobotanical studies report preparation methods and routes of administration, few specify precise dosages, treatment frequency, or duration (Awoke *et al.* 2025). This absence of standardization poses challenges for clinical application, increasing the risk of therapeutic inefficacy due to underdosing or adverse effects resulting from overdosing.

The situation is further complicated by the limited availability of toxicological data for many Asteraceae species. Although these plants are rich in bioactive compounds with demonstrated pharmacological potential, some constituents can be toxic at high concentrations or with prolonged use (Kassa *et al.* 2020). Traditional practices such as polyherbal formulations and unsupervised self-medication may exacerbate these risks, leading to unpredictable pharmacological interactions and potential toxicity (Tessema *et al.* 2025).

These gaps have critical clinical and public health implications. The lack of dosage guidelines and toxicity profiles hinders the safe integration of traditional remedies into Ethiopia's formal healthcare system. It also limits the ability of health professionals to provide evidence-based recommendations and complicates the development of standardized phytotherapeutics (Lulekal *et al.* 2013). Moreover, the absence of rigorous pharmacological and toxicological assessments constrains drug discovery efforts based on Asteraceae species.

To ensure the safe and effective use of these medicinal plants, future research must prioritize the establishment of dosage parameters, identification of toxic constituents, and development of standardized treatment protocols. Such efforts are essential for promoting patient safety, supporting public health, and realizing the therapeutic potential of Ethiopia's rich Asteraceae flora (Lulesa *et al.* 2025; Bekele *et al.* 2015).

Patterns of knowledge transmission

Ethnobotanical knowledge related to Asteraceae species in Ethiopia is transmitted through distinct generational, regional, and gender-based pathways. Traditionally, this knowledge is concentrated among elderly community member's particularly traditional healers and elders who serve as primary custodians of plant-based healing practices. Transmission typically occurs orally through informal apprenticeships, often within families, where parents or grandparents pass on their expertise to younger generations (Abera 2014). However, this mode of knowledge transfer faces growing challenges, especially in urban and peri-urban areas. The increasing influence of formal education, modern healthcare systems, and changing socio-cultural dynamics has led to a decline in youth engagement with traditional practices (Tamene *et al.* 2023). As a result, younger generations are becoming progressively disconnected from ancestral ethnomedicinal traditions.

Regionally, higher levels of knowledge retention are observed in rural and culturally diverse areas such as Oromia, Amhara, and the Southern Nations, Nationalities, and Peoples' Region (SNNPR). In these regions, limited access to biomedical healthcare reinforces reliance on traditional medicine, sustaining ethnobotanical practices as integral components of primary healthcare (Lulekal *et al.* 2013). In contrast, urbanized settings tend to exhibit a marked decline in both the depth and diversity of medicinal plant knowledge. Gender also plays a significant role in shaping knowledge distribution. Women often specialize in the use of Asteraceae species for treating childhood illnesses, gastrointestinal disorders, and dermatological conditions, while men tend to focus on applications related to livestock care and ritual or spiritual practices (Hunde *et al.* 2015). These gender-specific domains of expertise reflect the culturally embedded roles in traditional healthcare systems.

The erosion of oral knowledge transmission poses a serious threat to cultural heritage, biodiversity conservation, and the discovery of novel therapeutic agents. As elder knowledge holders age and pass away without formally transferring their knowledge, irreplaceable insights risk being lost. To mitigate this, ethnobotanists have recommended strategies such as systematic documentation, community-based knowledge preservation initiatives, and the incorporation of traditional medicinal knowledge into local school curricula (Agize *et al.* 2013). Such interventions are vital for sustaining Ethiopia's rich ethnomedicinal heritage and ensuring its continued relevance for future generations.

Phytochemical and antibacterial properties of Asteraceae plant species in Ethiopia

Ethiopian Asteraceae species have been the focus of extensive phytochemical and antibacterial investigations, underscoring their ethnomedicinal significance. Comparative studies across Africa in countries such as Kenya, Nigeria, and South Africa demonstrate both overlaps and regional variations in the ethnobotanical use of Asteraceae species (Omokhua *et al.* 2016). While several species are commonly cited for their anti-inflammatory and antimicrobial properties, differences in preparation techniques and cultural contexts reflect localized traditional knowledge systems (Odukoya *et al.* 2022). Globally, similar therapeutic trends are observed in ethnobotanical research on Asteraceae species from China and North America, emphasizing the family's broad medicinal relevance (Liu *et al.* 2023; Kachura *et al.* 2022). These cross-regional perspectives highlight the importance of situating Ethiopian ethnopharmacological knowledge within a wider framework to enhance drug discovery and conservation efforts.

Key Ethiopian Asteraceae species including *Vernonia amygdalina*, *Artemisia abyssinica*, *Echinops kebericho*, and *Ageratum conyzoides* have undergone qualitative and quantitative phytochemical screening, revealing abundant bioactive secondary metabolites such as flavonoids, tannins, alkaloids, saponins, terpenoids, and phenolic compounds (Dubale *et al.* 2023; Muluye *et al.* 2020). For example, leaf extracts of *Vernonia amygdalina* are rich in flavonoids and phenolics, compounds widely recognized for their antioxidant and antimicrobial activities (Hussen *et al.* 2023). Similarly, *Artemisia abyssinica* contains sesquiterpene lactones and essential oils with demonstrated antimicrobial potency (Mohammed *et al.* 2022), while *Echinops kebericho* exhibits significant alkaloid content correlating with notable antibacterial effects (Negasa *et al.* 2024).

Antibacterial efficacy in Ethiopia has been primarily evaluated using agar diffusion and minimum inhibitory concentration (MIC) assays against common pathogens such as *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Salmonella* spp. Crude extracts of *Vernonia amygdalina* and *Artemisia abyssinica* showed broad-spectrum antibacterial activity, with inhibition zones ranging from 12 to 22 mm and MIC values between 62.5 and 250 µg/mL (Tura *et al.* 2024; Tadesse *et al.* 2023). Notably, *Echinops kebericho* demonstrated potent activity against multidrug-resistant *S. aureus* strains, reinforcing its traditional application in wound healing (Negasa *et al.* 2024).

These findings align with international research reporting strong antimicrobial effects of Asteraceae species such as *Ageratum conyzoides* and *Vernonia amygdalina*. For instance, studies from Nigeria and India confirm flavonoid-rich extracts of *Ageratum conyzoides* inhibit both Gram-positive and Gram-negative bacteria, with MIC values comparable to Ethiopian data (Yadav *et al.* 2019; Suresh *et al.* 2022). Additionally, essential oils from *Artemisia* species are globally acknowledged for their antibacterial and antifungal properties (Karadeniz *et al.* 2021).

The consistent presence of diverse phytochemicals in Ethiopian Asteraceae supports their ethnobotanical uses. Flavonoids and phenolics disrupt bacterial cell walls and inhibit enzymes vital for microbial survival, explaining their broad antibacterial spectrum (Gebremedhin *et al.* 2021). Alkaloids and terpenoids contribute through mechanisms such as DNA intercalation and membrane disruption (Karadeniz *et al.* 2021). Importantly, the observed antibacterial activity against *S. aureus* and *E. coli* is clinically relevant amid rising antibiotic resistance. MIC values reported fall within effective ranges for crude extracts, indicating significant potential as sources of novel antimicrobials (Muluye *et al.* 2020).

Variations in antibacterial potency across studies may stem from differences in extraction techniques, plant parts used, and geographic influences on phytochemical composition (Dubale *et al.* 2023; Mekonnen *et al.* 2022). Ethiopian Asteraceae frequently demonstrate antibacterial properties that are comparable to or exceed those reported in other regions, a distinction likely attributable to Ethiopia's unique agroecological diversity, which promotes the production of diverse and potent phytochemical metabolites (Negasa *et al.* 2024; Kumar *et al.* 2021).While these results validate traditional claims and encourage further bioassay-guided fractionation to isolate active compounds, most research has focused on crude extracts. Consequently, more studies on toxicity profiling, mechanisms of action, and in vivo efficacy are critical for advancing pharmaceutical development. Sustainable harvesting and cultivation practices should also be emphasized to prevent overexploitation of these valuable medicinal resources.

The documented phytochemical richness and antibacterial efficacy of Ethiopian Asteraceae highlight their promise for future drug discovery. Scientific validation of traditional uses can facilitate the development of novel therapeutics while ensuring equitable benefits for local knowledge holders. Moreover, integrating traditional medicine with formal healthcare systems could enhance treatment accessibility and cultural relevance, particularly in underserved communities.

Conservation challenges and socio-economic pressures on Asteraceae species in Ethiopia

Ethiopia, recognized for its rich botanical and cultural diversity, hosts a significant variety of medicinal plants, with the Asteraceae family representing a dominant component. Comprising approximately 11.3% of medicinal species in areas such as Goba District, Asteraceae plants are central to traditional medicine and rural healthcare systems (Tegene 2018). Despite their importance, these species face complex conservation and socio-economic challenges shaped by Ethiopia's unique environmental and socio-political context.

Ecologically, Asteraceae species occupy diverse habitats across Ethiopia's agroecological zones—from moist highlands to arid lowlands where their distribution and regeneration depend heavily on rainfall patterns, temperature, and soil conditions (Shembo *et al.* 2024). However, climate variability, particularly recurrent droughts intensified by climate change, is altering species distributions and diminishing regeneration rates, especially for endemic and narrowly distributed taxa (Tafesse *et al.* 2023). Concurrent land degradation and shifting agroecological boundaries exacerbate habitat loss and fragmentation.

From a socio-economic perspective, reliance on Asteraceae-based traditional medicine remains high in rural and low-income communities with limited access to modern healthcare (Giday *et al.* 2010). This dependence often leads to unsustainable harvesting practices, particularly where cultivation alternatives and knowledge of sustainable use are lacking. Overexploitation of species such as *Echinops kebericho* has been documented in areas experiencing high demand and inadequate conservation oversight (Kassa *et al.* 2020; Awoke *et al.* 2024). Rapid population growth, agricultural expansion, and land-use changes further accelerate habitat fragmentation and loss of medicinal plant populations.

Moreover, indigenous knowledge transmission is under threat due to urban migration and shifting cultural values, risking the loss of critical ethnobotanical insights and traditional sustainable harvesting practices (Abdela 2018). The increasing commercialization of certain Asteraceae species intensifies pressure on wild populations, with unsustainable root and whole-plant harvesting contributing to local extinctions (Kassa *et al.* 2020). Additionally, poverty-driven land conversion for agriculture and fuelwood collection places further stress on habitats critical for medicinal plants (Feleke *et al.* 2025).

Ecologically, Asteraceae species are vulnerable to deforestation, overgrazing, and invasive species such as *Parthenium hysterophorus* and *Lantana camara*, which disrupt native plant communities and reduce biodiversity (Awoke *et al.* 2024; Asfaw *et al.* 2021). These pressures reduce regeneration capacity and threaten the ecological balance in montane and grassland ecosystems where many Asteraceae species thrive.

Addressing these challenges requires integrated conservation strategies combining in-situ and ex-situ approaches to preserve genetic diversity and ecological function. Promoting home-garden cultivation and agroforestry systems has proven effective in alleviating pressure on wild populations while offering economic benefits to local communities (Agize *et al.* 2022). Complementary educational programs and incorporation of ethnobotanical knowledge into school curricula can revitalize interest in traditional practices and encourage sustainable resource management. Systematic documentation through digital databases and herbarium collections is also critical for safeguarding fading indigenous knowledge (Nigussie *et al.* 2021). Thus, Asteraceae medicinal plants are indispensable to Ethiopia's healthcare and cultural heritage but face intertwined socio-economic and ecological threats. A coordinated, multidisciplinary approach involving community participation, policy support, habitat protection, and knowledge preservation is essential to ensure their sustainable use and long-term conservation.

Conclusion and recommendations

This systematic review underscores the considerable ethnobotanical, phytochemical, and antibacterial potential of Ethiopian medicinal plants within the Asteraceae family. With 56 species across 34 genera widely employed in traditional medicine, these plants constitute a vital bioresource, particularly for rural communities where access to modern healthcare remains limited. The predominance of herbaceous species such as *Vernonia amygdalina* and *Artemisia abyssinica* reflects both their ecological abundance and cultural preference for readily accessible plant materials. Phytochemical analyses reveal a rich diversity of secondary metabolites in Asteraceae species, including flavonoids, alkaloids, tannins, and terpenoids. These compounds collectively contribute to broad-spectrum antibacterial activities against common human pathogens, thereby scientifically validating traditional medicinal uses and highlighting their potential in developing novel plant-based antimicrobials to address rising antibiotic resistance. Despite these promising attributes, critical knowledge gaps persist. The absence of standardized dosage regimens and incomplete documentation of traditional preparation methods limit reproducibility and hinder clinical translation. Furthermore, the paucity of in vivo and toxicological studies constrains comprehensive safety evaluations and the integration of these plants into formal healthcare systems. Unsustainable harvesting, particularly root extraction, threatens biodiversity and jeopardizes the long-term availability of valuable medicinal species. The *Flora of Ethiopia and Eritrea*, Volume 4, Part 2, offers a foundational taxonomic treatment of Ethiopian Asteraceae, focusing mainly on morphological and anatomical characteristics, with limited chemical data. However, it lacks integration of comprehensive ethnobotanical information, including vernacular nomenclature across Ethiopia's diverse linguistic groups and up-to-date conservation assessments. Addressing these deficiencies requires incorporating ethnomedicinal knowledge, pharmacological validation, and standardized vernacular documentation in future Flora revisions. Significant research gaps in Asteraceae ethnobotany remain, notably limited phytochemical and toxicological studies, absence of standardized dosage protocols, and inconsistent reporting of preparation techniques and clinical outcomes. Future investigations should prioritize these areas alongside sustainable harvesting and conservation efforts to enhance the scientific rigor and practical application of traditional knowledge. Comparisons with global plant databases such as those maintained by the Royal Botanic Gardens, Kew, reveal the urgent need for an updated Ethiopian Flora aligned with current taxonomic standards and nomenclatural revisions. Linking this updated Flora with the National Herbarium's collections and global data platforms would improve accessibility, reliability, and utility for botanists, ethnobotanists, healthcare practitioners, and conservationists. Based on these findings, several recommendations are advanced. Ethnobotanical and pharmacological research should emphasize meticulous documentation of preparation methods, dosages, and treatment durations to facilitate reproducibility and clinical applicability. Comprehensive pharmacological and toxicological evaluations, including in vivo studies, are imperative to establish efficacy and safety profiles. Community-based conservation and cultivation programs must be promoted to protect vulnerable species and sustain ecological balance. Interdisciplinary collaboration among ethnobotanists, phytochemists, pharmacologists, and policymakers is essential to bridge traditional knowledge with scientific validation, fostering sustainable use and drug discovery. Public education and awareness initiatives should be strengthened to empower local communities in the sustainable utilization of medicinal plants and to mitigate risks associated with improper use. Collectively, these measures will contribute to the preservation of Ethiopia's rich ethnobotanical heritage, promote sustainable medicinal plant use, and support the development of novel therapeutics grounded in traditional knowledge.

Declarations

List of abbreviations: Not applicable

Ethics approval and consent to participate: Not applicable

Consent for publication: Not applicable

Availability of data and materials: All the information gathered for this review was examined, interpreted, and incorporated into this paper

Competing interests: Not applicable

Funding: Not applicable

Author contributions: AA was responsible for developing the review protocol, study design, literature review, data collection, data extraction, data analysis, and interpretation. MT drafted the manuscript, contributed to the data analysis and interpretation, as well as editing the manuscript.

Acknowledgements

The authors acknowledge the contributions of researchers whose ethnobotanical data provided the foundation for this review.

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