

# Ethnopharmacological Insights into Asteraceae: Traditional Medicine and Therapeutic Potential in the Gayo Highlands, Bener Meriah Regency

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Accepted : 1 February 2026  
Published: 26 April 2026

**Abstrak:** Masyarakat Dataran Tinggi Gayo memanfaatkan spesies dari famili Asteraceae sebagai obat tradisional untuk berbagai penyakit. Penelitian ini bertujuan untuk mendokumentasikan penggunaan etnofarmakologi Asteraceae serta menilai pengetahuan masyarakat terkait pemanfaatannya. Data dikumpulkan dari 48 responden di delapan kecamatan melalui purposive sampling dan kuesioner terstruktur. Hasil penelitian mengidentifikasi 10 spesies Asteraceae yang digunakan untuk mengobati 10 penyakit, termasuk diabetes melitus (DM), kanker, hipertensi, gangguan hati, hingga keluhan ringan seperti batuk dan demam. Daun merupakan bagian tanaman yang paling sering digunakan (95,96%) dan umumnya berasal dari tanaman liar di sekitar pekarangan atau lahan terlantar. Sebanyak 81,25% responden menggunakan Asteraceae untuk membantu pengelolaan DM, dengan metode pengolahan utama berupa perebusan dan penumbukan. *Erigeron sumatrensis* Retz. menjadi spesies yang paling dikenal dan paling banyak digunakan, terutama untuk DM dan kanker. Temuan ini menunjukkan potensi etnofarmakologi Asteraceae di Dataran Tinggi Gayo dan menjadi dasar untuk penelitian farmakologi lebih lanjut, khususnya pada *E. sumatrensis*.

**Kata kunci:** Asteraceae; obat tradisional; etnofarmakologi; Dataran Tinggi Gayo; *Erigeron sumatrensis*

**Abstract:** The Gayo Highlands communities use Asteraceae species in traditional medicine to treat various ailments. This study aimed to document the ethnopharmacological use of Asteraceae and assess community knowledge regarding their medicinal applications. Data were collected from 48 respondents across eight sub-districts using purposive sampling and structured questionnaires. The study identified 10 Asteraceae species used to treat 10 diseases, including diabetes mellitus (DM), cancer, hypertension, liver disorders, common cold, bloating, cough, fever, toothache, and skin itching. Leaves were the most frequently used plant organ (95.96%), mainly from wild plants growing near home yards or abandoned land. Approximately 81.25% of respondents reported using Asteraceae to manage DM. Standard

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preparation methods included boiling and pounding, with the leaves of *Erigeron sumatrensis* Retz being the most widely recognized and utilized for the treatment of DM and cancer. The community's preference for these plants is attributed to their availability, perceived safety, and efficacy. This study highlights the significant ethnopharmacological potential of Asteraceae in the Gayo Highlands and provides a basis for further pharmacological investigations, particularly on *E. sumatrensis*.

**Keyword:** Asteraceae; traditional medicine; ethnopharmacology; Gayo Highlands; *Erigeron sumatrensis*

## 1. Introduction

Gayo Highlands is a potential area for Asteraceae, as evidenced by the diversity of species found along provincial roads and around local residences. Asteraceae thrive in highland regions because environmental conditions meet their growth requirements [1][2][3]. Residents in highland areas commonly cultivate ornamental plants in their homes, with Asteraceae among the most frequently observed genera in household yards [4]. The widespread occurrence of these plants in both natural and human-modified environments increases direct interaction between local communities and plant resources, thereby enhancing opportunities for traditional utilization and knowledge transmission related to medicinal plant use.

Beyond their ornamental value, Asteraceae species are recognized as important sources of secondary metabolites with pharmacological potential [5]. Although wild-growing Asteraceae are often regarded as weeds due to their presence in unmanaged or vacant lands, numerous studies have demonstrated their significant medicinal value. Local communities utilize these plants as herbal remedies and biological agents, thereby contributing not only to traditional healthcare systems but also to local economic resources [6][7].

From an ethnopharmacological perspective, traditional plant use represents accumulated empirical knowledge connecting cultural practices, therapeutic applications, and biological activity, serving as a foundation for pharmacological discovery and validation. Previous studies have reported

diverse pharmacological activities in the Asteraceae family, particularly anticancer and antidiabetic effects. Several species, including *Artemisia vulgaris*, *Cosmos caudatus*, *Vernonia amygdalina*, *Bidens pilosa*, and *Galinsoga parviflora*, have shown promising bioactivity [8][9][10][11]. Additionally, *Gynura procumbens* has demonstrated potential in managing Type II Diabetes Mellitus through in vivo and in silico studies [12]. In contrast, luteolin compounds from *Tridax procumbens* may inhibit DNA replication in cancer cells [13]. These findings highlight the pharmacological importance of Asteraceae beyond their ornamental or weed status.

Based on an inventory of Asteraceae in the Gayo Highlands, Bener Meriah Regency, 13 non-cultivated (wild) species and 19 species utilized by the local community as ornamental plants were identified. Asteraceae, as a traditional herbal medicine, is common among local communities. Typically, traditional medicine practices are culturally transmitted through generations. The chemical composition of these plants contains medicinal potential that the community may not consciously recognize. They use the plants as alternative remedies for ailments without knowledge of the specific bioactive compounds present [14].

Documenting traditional knowledge is crucial for cultural preservation, scientific validation, and future drug discovery based on local medicinal practices. Ethnopharmacological studies in regions such as Bulgaria highlight the medicinal importance of the Asteraceae family [15][14][16][17][18][19]. Most existing studies focus on phytochemical analyses or regions outside Indonesia, and ethnopharmacological research on community-based medicinal use of Asteraceae in the Gayo Highlands is still lacking. Despite their high diversity, systematic documentation integrating species diversity, traditional knowledge, and medicinal applications has not been conducted. Therefore, this study aims to document Asteraceae diversity and traditional medicinal uses among local communities in the Gayo Highlands and evaluate their ethnopharmacological relevance.

## 2. Research Method

### a. Time and Location

Ethnopharmacological data were collected in Bener Meriah Regency across eight sub-districts: Timang Gajah (TG), Gajah Putih (GP), Pintu Rime Gayo (PRG), Bukit (BK), Wih Pesam (WH), Bandar (BN), Mesidah (MS), and Permata (PR). This study was carried out between July and December 2025. The study area map is presented in Figure 1.

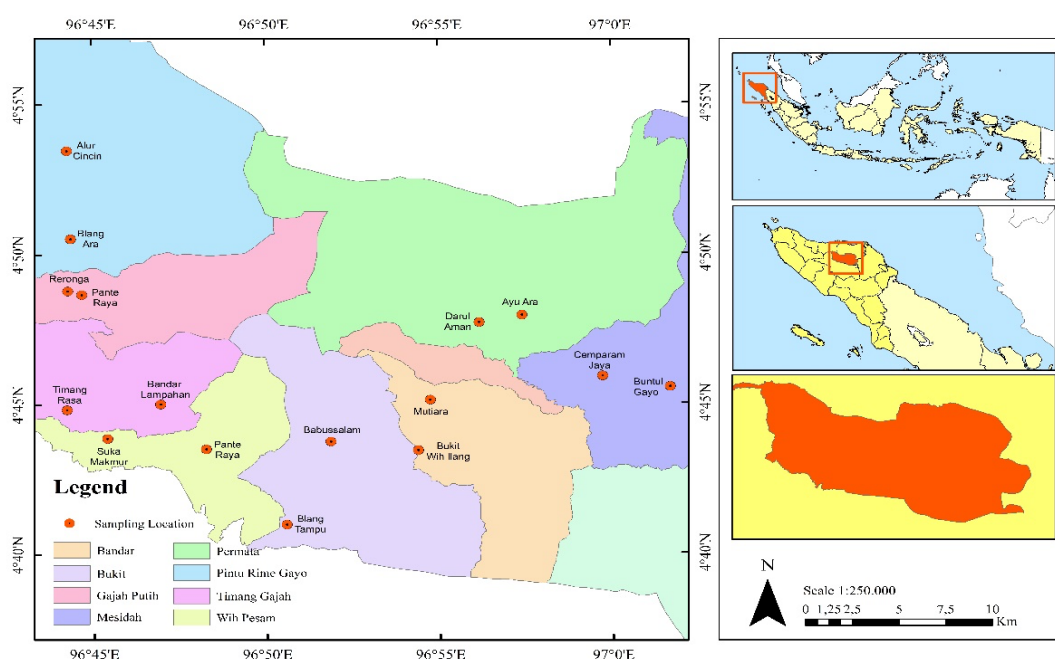


Figure 1. Study location

### b. Tools and Materials

The tools used in this study included a Canon digital camera (200D) and a smartphone with a 64 MP camera. The materials employed were writing instruments for data recording.

### c. Data Collection Techniques

Key respondents were selected using purposive sampling. Key informants included village heads, elders, and community members. Data were collected using structured questionnaires that included items assessing respondents' identities and knowledge of the use of Asteraceae as a traditional medicine. Six respondents were selected from each sub-district, yielding 48

respondents in the Gayo Highlands, representing the Gayo and Javanese ethnic groups.

#### **d. Data Analysis Techniques**

Data were analyzed descriptively to determine the plant parts used by the community for medicinal purposes and the preparation methods [20]. The frequency of Asteraceae species parts used was evaluated based on respondents' knowledge of plant parts, using the following formula:

$$F = S/N \times 100$$

Information:

F: Frequency

S: The number of respondents who provided information regarding the plant parts used

N: Number of respondents

The percentage of respondents who mention using a particular plant species to treat a specific ailment in a given area is referred to as the Fidelity Level (FL). FL is measured to determine the specific purpose for which respondents use certain plant organs. The data are subsequently analyzed using the following formula [21].

$$FL (\%) = n/N \times 100$$

Information:

FL: Fidelity Level

n: The number of respondents for a specific use

N: Number of respondents

### **3. Results and Discussion**

#### **a. Respondent Characteristics**

In total, 48 respondents provided information on the use of Asteraceae as medicinal plants. The distribution of respondents based on age, education, and occupation is presented in Table 1. According to the questionnaire analysis, knowledge of Asteraceae use was more prevalent among females than among males. Respondents aged 51–60 provided the most information on the use of Asteraceae as medicine. Informants with a Senior High School education level demonstrated greater knowledge of Asteraceae use than other groups. Respondents working as farmers exhibited greater knowledge than those in other occupations.

**Table 1.** Respondent characteristics

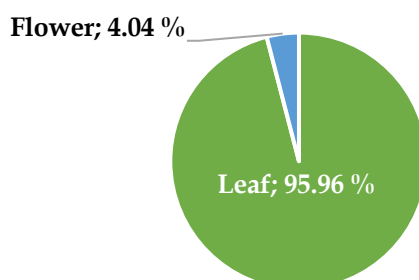
Variable	Category	Number of respondents	Percentage (%)
Gender	Woman	25	53.08
	Man	23	47.92
Age	40-50	17	35.42
	51-60	23	47.92
	61-70	5	10.42
	71-80	3	6.25
Education	Elementary School	6	12.50
	Junior High School	16	33.33
	Senior High School	26	54.17
Accupation	Farmer	40	83.33
	Civil servant	3	6.25
	House wife	5	10.42

### b. Plant Parts of Asteraceae Used as Medicine

The leaf is the plant organ most frequently utilized by the community, accounting for 95.96%, whereas the flower accounts for 4.04% (Figure 2). Analysis showed that the leaves of 10 Asteraceae species were the most commonly used as medicine. This is because leaves are readily accessible year-round, regardless of season. The community's use of Asteraceae as medicinal plants is primarily influenced by availability, with 91% of respondents reporting that the plants are easy to obtain. Other reasons include perceptions of safety and higher efficacy. The analysis further indicated that the Asteraceae used as medicine are primarily wild-growing species found around home yards and vacant land.

Flowers are used medicinally only in *Acmella uliginosa*. The community employs this species to treat diabetes mellitus (DM) and toothaches. It is known that all parts of the plant can be used to treat inflammation, act as antifungal agents, serve as antioxidants, and manage joint inflammation. At the same time, the flower exhibits potent anti-inflammatory and analgesic properties for tooth pain [22]. The main constituent of *A. uliginosa* extract is spilanthol, or (2E,6Z,8E)-isobutylamide-2,6,8-decatrienamide, which is characterized by a strong pungent taste, enabling it to produce a local

anesthetic effect. The bioactive compounds in this species are assumed to be responsible for their medicinal properties in treating various ailments.



**Figure 2.** Asteraceae Parts Used as Medicine

### c. Knowledge on the Use of Asteraceae as Medicine

The study revealed that 10 Asteraceae species are used as medicinal plants by the communities in the Gayo Highlands (Figure 3). These species are traditionally believed to treat 10 different ailments. The community utilizes Asteraceae to manage diabetes mellitus (DM), cancer, hypertension, liver disorders, common cold, bloating, cough, fever, toothache, and skin itching. The plants are used individually, meaning only a single species is employed without combining it with other species.

Table 2 presents the ailments believed to be treatable with Asteraceae species in the Gayo Highlands. The species most frequently used for medicinal purposes are employed in treating DM. The leaf of *E. sumatrensis* is the most commonly used, accounting for 17% of usage (Figure 4). This species is thought to originate from South America, but it has been naturalized in tropical and subtropical regions [23]

Respondent knowledge regarding the medicinal use of Asteraceae species is presented in Figure 5. The highest percentage of Asteraceae usage as medicine was reported for DM, at 81.25%. Species used for DM treatment include *E. sumatrensis*, *T. erecta*, *C. crepidioides*, *C. caudatus*, and *A. uliginosa*. Based on the data analysis, studies on *E. sumatrensis* remain limited, underscoring the species' potential for further investigation.

**Table 2.** Asteraceae Species Used as Medicine

Species	Local names	Uses part	Disease
<i>Erigeron sumatrensis</i> Retz.	Jelantir	Leaf	Diabetes mellitus (DM) and cancer
<i>Tagetes erecta</i> L.	Tahi kotok	Leaf	Common cold, hypertension, diabetes mellitus, cancer, bloating, and cough
<i>Tagetes patula</i>	Marigold	Leaf	Common cold and fever
<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	Sintrong	Leaf	Common cold, hypertension, diabetes mellitus, cancer, liver disorders, bloating, cough, and fever
<i>Cosmos caudatus</i> Kunth	Kenikir	Leaf	Common cold, hypertension, diabetes mellitus, cancer, bloating, and cough
<i>Acmella uliginosa</i> (Sw.) Cass.	Jotang kecil	Leaf and flower	Diabetes mellitus and toothache
<i>Dahlia pinnata</i> Cav.	Dahlia	Leaf	Common cold
<i>Bidens pilosa</i> L.	Ketulan	Leaf	Itching
<i>Ageratum conyzoides</i> L.	Bandotan	Leaf	Toothache
<i>Cosmos sulphureus</i> Cav.	Kenikir kuning	Leaf	Common cold

In addition to its use in DM, *E. sumatrensis* is also utilized by the community to manage cancer. Approximately 60.42% of respondents reported knowledge of Asteraceae as an anticancer remedy; however, the specific cancer types treated with these species remain unspecified. DM and cancer patients require antioxidants to neutralize free radicals [24], [25]. Notably, the aqueous leaf extract of *E. sumatrensis* exhibits an IC<sub>50</sub> value of 64.42 µg/mL in antioxidant assays, categorized as highly active or strong [26].

*E. sumatrensis*, locally known as “jelantir,” is abundant in the Gayo Highlands. This species has been reported to contain secondary metabolites, including phenolics, alkaloids, flavonoids, monoterpenes, sesquiterpenes, and quinones. Traditionally, its leaves are used to treat headaches, while its roots are used to relieve body aches and rheumatic pain. In Sleman, Yogyakarta, *E. sumatrensis* is also utilized in traditional medicine [27][28]. The chloroform fraction of *E. sumatrensis* leaf extract exhibits antiproliferative activity. NMR and MS analyses revealed the presence of Stigmast-5,22-dien-3-O-β-D-glucopyranoside(1) and 2,3-dihydroxypropyl hexacosanoate in the extract. These compounds demonstrated significant growth inhibition against human breast (MCF-7) and lung (NCI-H460) cancer cell lines. These compounds were isolated from the plant for the first time. They may serve as lead compounds

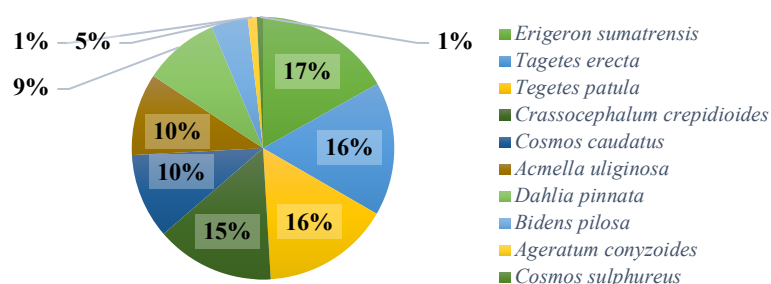
for further investigation as antiproliferative agents, providing a scientific basis for their ethnomedicinal use [36].



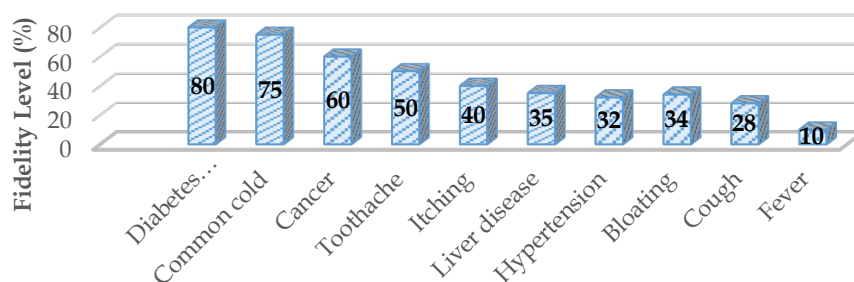
**Figure 3.** Asteraceae Species Used as Traditional Medicine. (a) *E. sumatrensis*, (b) *T. erecta*, (c) *T. patula*, (d) *C. crepidioides*, (e) *C. caudatus*, (f) *A. uliginosa*, (g) *D. pinnata*, (h) *B. pilosa*, (i) *A. conyzoides*, (j) *C. sulphureus*.

*Tagetes erecta*, locally known as “tahi kotok” or “tahi ayam,” has its leaves used by the community as medicine, accounting for 16% of usage. The leaves are traditionally employed to treat common cold, hypertension, DM, cancer, bloating, and cough. Methanol leaf extracts of *T. erecta* have been reported to contain secondary metabolites, including alkaloids, anthocyanins, betacyanins, cardiac glycosides, coumarins, flavonoids, glucosides, phenolics, quinones, saponins, steroids, terpenoids, and tannins. Antioxidant activity in *T. erecta* leaves has been analyzed using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay, showing an  $IC_{50}$  value of 145.79  $\mu\text{g}/\text{mL}$  (Abdiwijoyo et al., 2021). Other plant parts with medicinal potential include the flowers; methanolic flower extracts of *T. erecta* have been shown to contain more than 50 chemical compounds across several metabolite classes, including polyphenolic acids, flavonoids, amino acids, and tannins. Antioxidant assays of flower extracts confirmed their antioxidant activity [5]. These secondary metabolites and antioxidant activity are assumed to contribute to the species’ medicinal efficacy against various diseases.

*Tagetes patula* has long been utilized in traditional medicine in several countries, including Indonesia. The community in the Gayo Highlands uses its leaves to treat common colds and fevers. The ethnopharmacological aspects of *T. patula* have attracted attention due to its potential in developing novel and effective pharmaceuticals. Traditionally, *T. patula* has been employed to treat various ailments, including fever, headaches, and infections [29]. Recent studies have shown that *T. patula* contains bioactive compounds with anti-inflammatory, antioxidant, and antibacterial activities. These compounds can be used in drug development to treat various diseases, including chronic conditions such as diabetes and cancer. The chemical constituents include  $\alpha$ -terthienyl, saponins, flavonoids, polyphenols, essential oils, hydroxygenol, and coniferyl alcohol. These compounds exhibit diverse bioactivities, including plant-based pesticidal properties for nematode control, antibacterial effects, and anti-inflammatory activity [30][31][32].



**Figure 4.** Community Knowledge Level in the Gayo Highlands on the Use of Asteraceae Species as Traditional Medicine



**Figure 5.** Community Knowledge Level in the Gayo Highlands on the Use of Asteraceae for Treating Various Diseases.

#### d. Preparation Methods

Plant processing is carried out using several methods, including boiling, pounding, and chewing, and is applied individually rather than combined with other plant species (Table 3). Traditional medicines prepared individually without mixtures are believed to retain bioactive compounds that produce the desired pharmacological effects [33]. Community knowledge is highest regarding preparing *T. erecta*, which is boiled or pounded, and *C. sulphureus*, which is prepared by pounding. The lowest level of knowledge regarding preparation is associated with *A. conyzoides*, which is reportedly only pounded.

Most Asteraceae species used by the community are prepared by boiling, and the decoction is consumed. The decoction is primarily intended for treating internal organs, whereas the community prefers to pound the plant and apply it directly to the affected area for external ailments. The plant parts are typically chewed and placed on the affected teeth for toothaches. Decoctions are believed to act quickly when ingested, providing faster healing as the plant's bioactive compounds are directly absorbed into the body [34].

**Table 3.** Preparation Methods of Asteraceae Species as Medicine

Species	Preparation methods	Number of respondents	Fidelity Level (%)
<i>Tagetes erecta</i>	Boiled and pounded	43	89.58
<i>Tagetes patula</i>	Pounded	40	83.33
<i>Erigeron sumatrensis</i>	Boiled	39	81.25
<i>Crassocephalum crepidioides</i>	Boiled	39	81.25
<i>Dahlia pinnata</i>	Pounded	30	62.50
<i>Acmella uliginosa</i>	Boiled and chewed	27	56.25
<i>Cosmos caudatus</i>	Boiled and pounded	22	45.83
<i>Bidens pilosa</i>	Boiled	11	22.92
<i>Cosmos sulphureus</i>	Pounded	5	10.42
<i>Ageratum conyzoides</i>	Pounded	3	6.25

It is well known that the community acquires knowledge of medicinal uses of Asteraceae through experience passed down from parents and relatives; thus, precise dosages are not generally known. Traditional treatments are categorized into two types: external and internal therapies. External therapies involve treating conditions affecting the body's surface, including skin diseases, toothaches, eye conditions, and wounds. Internal

therapies involve consuming plant preparations, such as decoctions or other formulations, to treat fever, hypertension, diarrhea, DM, and stomach disorders [35].

#### 4. Conclusion

The communities of the Gayo Highlands utilize Asteraceae as traditional medicine. Based on the conducted study, it can be concluded that the Gayo Highland communities employ 10 Asteraceae species as traditional remedies for treating 10 different ailments. The community prefers these plants because they are readily available, considered safer, and effective. The leaf is the most frequently used plant organ, which is considered the easiest to harvest and is always available. Most Asteraceae are collected from areas near home yards or abandoned land where they grow wild. Approximately 81.25% of the Asteraceae are used by the community to treat diabetes mellitus (DM). The most common preparation methods are boiling and pounding. *Erigeron sumatrensis* Retz. Leaves are among the best-known and most widely used species for treating DM and cancer, underscoring the need for further research into their potential.

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