International Journal of Herbal Medicine
Available online at www.florajournal.com

E-ISSN: 2321-2187
P-ISSN: 2394-0514
www.florajournal.com
IJHM 2023; 11(6): 15-22
Received: 13-10-2023
Accepted: 19-11-2023

Saudah
Faculty of Teacher Training and Education, Universitas Serambi Mekkah Batoh, Banda Aceh, Indonesia

Ernilasari
Department of Education Biology, Faculty of Teacher Training and Education, Universitas Serambi Mekkah, Banda Aceh, Indonesia

Corresponding Author:
Saudah
Faculty of Teacher Training and Education, Universitas Serambi Mekkah Batoh, Banda Aceh, Indonesia

Ethnobotany of medicinal plants by the Suak Bugis community, Nagan Raya, Aceh, Indonesia

Saudah and Ernilasari

DOI: https://doi.org/10.22271/flora.2023.v11.i6a.909

Abstract
Sumber Bakti Village, Suka Makmur District, Nagan Raya, was the site of an ethnobotanical survey. Suak Bugis with a peat area is the name of this location. Plants are increasingly being used as medicine in traditional medicine treatment efforts. The use of therapeutic plants in the Suak Bugis area, however, has not been adequately documented or scientifically validated. As a result, this study was conducted to document the varieties of medicinal plants utilized by the community in Sumber Bakti, as well as traditional knowledge about the use of plants as medicine. To collect ethnographic data, the snowball sampling approach was used. The interview was detailed and candid. Semi-structured and in-depth interviews were done. The data was analyzed using the quantitative value of the ethnomedicinal index (UV). This study resulted in the identification of 31 plant species from 18 families that are employed in traditional medicine. The Zingiberaceae family is the most prevalent. The leaves are the most commonly used portion. Plants as medicines can be used to improve public health by serving as standards in traditional medications and conventional medicinal formulations.

Keywords: Back to nature, ethnobotany, social culture, traditional knowledge

Introduction
Indonesia is one of the richest biodiversity countries in the world after Brazil which has a lot of potential biological natural resources as a source of food and medicine. Around the 40,000 species of flora in the world, 30,000 species are found in Indonesia and 940 species are known to have medicinal properties which have been used for generations in traditional medicine by various ethnic groups in Indonesia [1]. Communities in various tribes in Indonesia have long used plants in various daily activities. The richness of biodiversity allows plants to grow throughout the year. The social culture of the people who are able to use medicinal plants is an excellent opportunity in the development of Indonesian medicinal plants [2].

Ethnobotany is a science related to the use of plants by people from generation to generation over a long period. Traditional community knowledge about medicinal properties can provide valuable information in selecting medicinal raw materials that can be commercialized [3]. The role and contribution of ethnobotany is very broad and varied, not only regarding the biological, and taxonomic appearance of plant groups but also in the form of attitudes, behavior, and knowledge of the community towards plant groups in maintaining and perpetuating their culture and ethnicity [4].

Treatment efforts using natural ingredients have grown rapidly along with the global issue of 'back to nature'. The people's desire to return to nature is a factor in the development of plants as alternative medicines for dealing with various health problems. This situation encourages efforts to seek, research, collect, extract, and traditional knowledge to obtain sources of medicinal raw materials that have commercial value.

The development of the potential and efficacy of natural medicines receives special attention in Indonesia [5], however, there is still a lot of plant biodiversity that has the potential to be used as medicine and has not been scientifically recorded. Over time and with advances in science, the use of plants as medicine has increased. One community group that still uses medicinal plants is the Sumber Bakti community, Darul Makmur sub-district, Nagan Raya Regency. So far, the use of medicinal plants by the Sumber Bakti community has not been well documented and the data has not been scientifically validated.

Materials and Methods

Study Area: The research was conducted in Suak Bugis, Nagan Raya district, Indonesia (Fig.1). Samples were collected from Sumber Bakti village, Darul Makmur subdistrict. Sumber Bakti Village is located at coordinates 96.49311"; 3.850495". This area is a peat swamp area, with residents coming from several tribes, including the Acehnese, Javanese, and also the Kluet tribe.

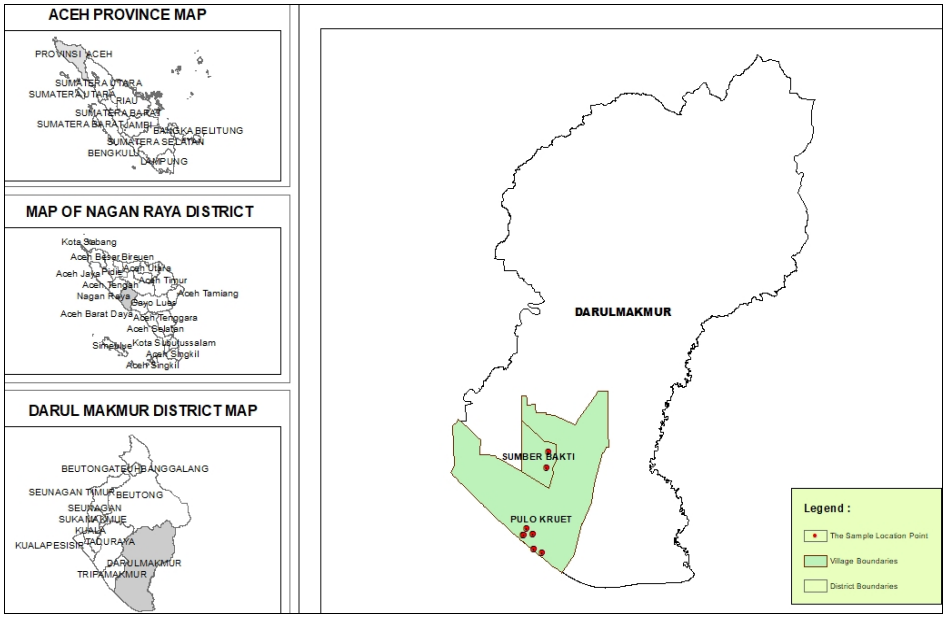

Fig 1: GIS-based map of the study area

Data Collection Method

The research was conducted using an ethnobotanical approach with interviews and participatory observation with 70 respondents. Data collection was carried out based on the ethnopharmacological research practice guidelines developed by Heinrich, *et al* [6]. Ethnobotanical data were collected by semi-structured interviews. Respondents were determined by purposive sampling. Specimen vouchers were made and kept at the Herbarium of Syiah Kuala University in Banda Aceh. Species identification was determined using Southeast Asian plant resources and online sources [7].

Data analysis

Descriptive statistical methods are used to calculate percentages and frequencies to analyze and summarize data on medicinal plants, their uses, and knowledge related to using MS Excel. Use value (UV) is used to measure the ethnobotanical index which is widely used to measure the relative importance of useful plants [8].

$$UV = \Sigma U/n$$

Where U is the number of utilization reports cited by each informant for a particular type of plant species, while n is the total number of informants interviewed for a particular plant.

Results and Discussion

Respondent demographics and traditional knowledge

A total of 70 respondents were interviewed about ethnomedicine in Darul Makmur village. Female respondents had a higher level of knowledge of 54.3% compared to male respondents (45.7%) (Table 1). This is due to women's involvement in maintaining family health and also their interest in traditions that have been passed down from their ancestors, thus depicting women as a good source of traditional knowledge. Bibi *et al*, [9] revealed that women have proficiency in botanical knowledge when compared to male respondents. This proves that women's involvement in agricultural activities and cultural practices provides space for understanding medicinal plants. The low level of ethnomedicine knowledge among male respondents is caused by outdoor activities and modern medical practices which result in loss of traditional knowledge [10]. Elderly respondents >50 have higher knowledge, when compared to respondents in the adult and young categories. Respondents with farming occupations had more ethnomedicine knowledge.

Table 1: Socio-Demographics of Respondents

Social Group	Variable	No. of Informant (n=70)	Percentage
Gender	Female	38	54.3
	Male	32	45.7
Age	Young (20-35)	12	17.1
	Adult (36-35)	19	27.1
	Older (>50)	39	55.7
Education	Illiterate	3	4.3
	Basic education	10	14.3
	Elementary (1–8)	32	45.7
	Secondary (9–12)	13	18.6
	Tertiary education (10+)	12	17.1

Table 2: Medicinal species used among the local community

Family	Species name	Local name	Part use	Method of preparation	Medicinal use	Sumber Perolehan	Use Value
Acoraceae	*Acorus calamus*	Jerango	Rhizome	Pounded	Sore foot, magical purpose, headache	Budidaya	0.89
Amaranthaceae	*Amaranthus spinosus*	Beyem	Leaves	Pounded	wound, swollen	Dari alam/liar	0.97
Asparagaceae	*Cordyline fruticosa*	Nongkal	Leaves	Decoction	Dysentery, magical purpose	Budidaya	0.21
Asphodelaceae	*Aloe vera*	Lidah Buaya	Leaves	Shredded	Wound infection, itchy	Budidaya	0.74
Asteraceae	*Blumea balsamifera*	Gelgung	Leaves	Pounded	Cold, headache	Dari alam/liar	0.06
Asteraceae	*Eclipta alba*	Urang-aring	Leaves	Decoction	Jaundice, heart attack	Dari alam/liar	0.23
Boraginaceae	*Cordia dishotoma*	Nunang	Cortex, Leaves	Pounded	Stomachache	Dari alam/liar	0.25
Crassulaceae	*Kalanchoe pinnata*	Dedingin	Leaves	Pounded	Feverish, cough, tonsils infection	Budidaya	0.66
Caricaceae	*Cacica papaya*	Pertik	Fruit	Shredded	Reduce high blood pressure, defecation launcher	Budidaya	0.45
Euphorbiaceae	*Bischofia javanica blume*	Tingkem	Cortex	Pounded	Stomachache	Dari alam/liar	0.23
Euphorbiaceae	*Jatropha curcas*	Geloah	Leaves	Pounded	wormy, fever	Dari alam/liar	0.34
Lamiaceae	*Ocimum tenuiflorum*	Reruku	Leaves	Pounded	Stomachache, wound	Budidaya	0.21
Liliaceae	*Allium cepa*	Bawang Ilang	Bulbus	Pounded	Fever, prevent diarrhea	Membeli dari pasar	0,34
Liliaceae	*Allium sativum*	Bawang Putih	Bulbus	Decoction	Prevent cancer, cholesterol	Membeli dari pasar	0,32
Melastomataceae	*Melastoma malabvathricum*	Bebeke	Leaves	Pounded	Stomachache, reduce pain	Dari alam/liar	0.09
Moraceae	*Morus rubra*	Kerto	Fruit	Pounded	Kidney stones	Dari alam/liar	0,09
Myristicaceae	*Myristica fragrans*	Pala	Seed	Pounded	Bruise, heart attack	Membeli dari pasar	0.32
Piperaceae	*Piper betle*	Belo	Leaves	Decoction	Clean dirty blood, healthy genitals.	Budidaya	0,67
Piperaceae	*Piper anduncum*	Belo Uten	Leaves	Bathed	Body ache, fever	Dari alam/liar	0,04
Rubiaceae	*Morinda citrifolia*	Lengkudu	Fruit	Decoction	Jaundice, heart attack	Budidaya	0,79
Rutaceae	*Citrus hystrix*	Mungkur	Fruit	Decoction	Magical purpose, cough, paralyzed, liver	Budidaya	0,31
Zingiberaceae	*Alpinia galanga*	Lengkues	Rimpang	Decoction	Gout arthritis, body endurance	Budidaya	0.68
Zingiberaceae	*Curcuma zanthorrhiza*	Temulawak	Rhizome	Decoction	Liver, diarrhea	Budidaya	0.63
Zingiberaceae	*Curcuma longa*	Kuning	Rhizome	Decoction	Stomachache, cold	Budidaya	0.99
Zingiberaceae	*Curcuma zedoaria*	Kuning Gajah	Rhizome	Decoction	Cold, heredity	Budidaya	0.34
Zingiberaceae	*Etlingera elatior*	Kecomberang	Stem	Roasted	Cough, gout arthritis	Budidaya	0.32
Zingiberaceae	*Kaempfria galanga*	Tekur	Rhizome	Decoction	Increase energy and appetite	Budidaya	0,37
Zingiberaceae	*Zingiber cassumunar*	Bungle	Rimpang	Decoction	Cold, fever	Budidaya	0.24
Zingiberaceae	*Zingiber officinale*	Baing	Rhizome	Decoction	Lose weight, increase endurance, fever, cough	Budidaya	0,14
Zingiberaceae	*Zingiber officinale Roscoe*	Baing Ilang	Rhizome	Decoction	Cough, cold, body endurance	Budidaya	0.18
Zingiberaceae	*Zingiber zerumbet*	Lempuyang	Rhizome	Decoction	Relieve joint pain, fever	Budidaya	0.07

Traditional medicine families utilized in Suka Makmur village: According to the findings of the study, 31 different plant species from 18 different families were employed in traditional medicine in Suka Makmur Village. Family Zingiberaceae has the largest percentage, followed by the family employed in traditional medicine by the Suka Makmur village population. The presentation of plants from the Zingiberaceae family is due to their ongoing use, both as medicine and as cooking spices. According to studies [11], people use plants in the Zingiberaceae family as food ingredients and spices in their daily lives. People in North Sumatra, Java, and Thailand use the Zingiberaceae family for food and medicinal [12-14]. Secondary metabolites are abundant in Zingiberaceae species, which are widely employed in the food, cosmetic, perfume, and pharmaceutical industries. Zingiberaceae plants' essential oils are utilized in aromatherapy and as a natural preservative in food [15-16]. The aromatic characteristics and high essential oil concentration of Zingiberaceae species make them the most commonly used in disease treatment [17]. Essential oils have antioxidant, antibacterial, antiviral, and depressive properties [18-19]. This has been demonstrated that the use of plants in the Zingiberaceae family has pharmacological impacts on human health.

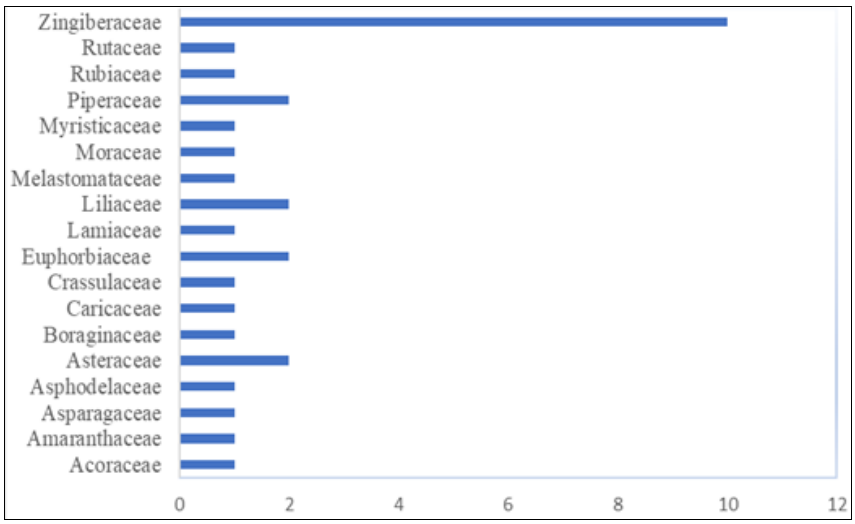

Fig 2: Family use as traditional medicine

Plant parts utilized in medicine

The most commonly used plant components in traditional medicine in Suka Makmur village are the leaves, rhizome, fruit, and bulb. The leaves are utilized the most in traditional medicine. When compared to other plant parts, leaves are abundant in nature, easy to find, and relatively simple to gather and process [20]. Leaves contain therapeutic characteristics and several advantages over other sections of the plant. The soft leaf structure, high water content, and location of photosynthate accumulation are thought to include disease-curing metabolic chemicals [21, 22]. Because of their potential and capacity to regenerate quickly, the leaves are widely used [23, 24]. Leaves have traditionally been used in traditional medicine to treat wounds [25]. The presence of secondary metabolite activities in leaves such as flavonoids, phenolics, tannins, terpenoids, and steroids has demonstrated the function of leaves in medicine [26, 27]. Furthermore, rhizomes have been widely employed in traditional medicine. In Sumatra, rhizome is utilized as the major element in herbal medicine for brewing, parem, and oukup [14]. The essential oil content of Zingiberaceae rhizomes can be used as a medical therapy [28, 30]. The rhizome's distinct aromatic composition has traditionally been employed as a stimulant, antipyretic, diuretic, carminative, and anti-expectorant [31]. The bark and seeds are the least used components because the preparation process takes a long time, and it is widely assumed that these sections have fewer bioactive characteristics than the roots and leaves.

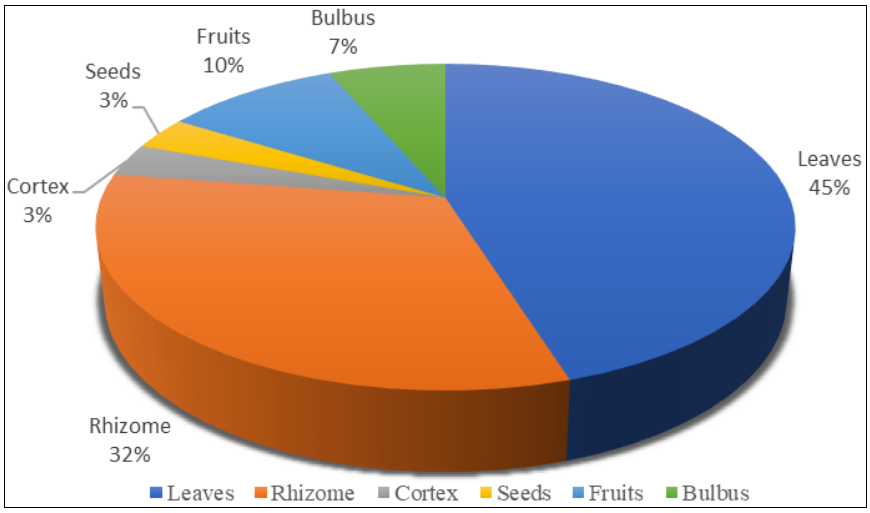

Fig 3: Parts of plants used in traditional medicine

Medicinal herb processing

Decoction, infusion, maceration, chewing, roasting, shredded, and crushed are all methods of processing. In producing medicinal potions, the decoction method has the highest proportion (Fig. 4). The Suak Bugis preferred method of preparation for mixtures is boiling. In the creation of concoctions, water is the primary solvent. The decoction is created by steeping plant ingredients in a small amount of water for 20-25 minutes before drinking. Infusions of therapeutic herbs are made by pouring boiling water into the plant material and leaving it to cool. Pounding, decoction, and shredding are all methods used to prepare potions. The Suak Bugis preferred technique of preparation for potions is boiling. This procedure is also used by Nugroho *et al*., [32], where the boiling process is used more frequently in the preparation of therapeutic mixtures. The Dayak people have also employed this strategy [33]. The boiling method is speedier and more effective, as boiling can accelerate the solubility of medicinal plant active components, allowing them to be ingested more quickly [34]. Boiling can be accomplished by either boiling water containing medicinal plant parts or soaking medicinal plant parts in hot water [35].

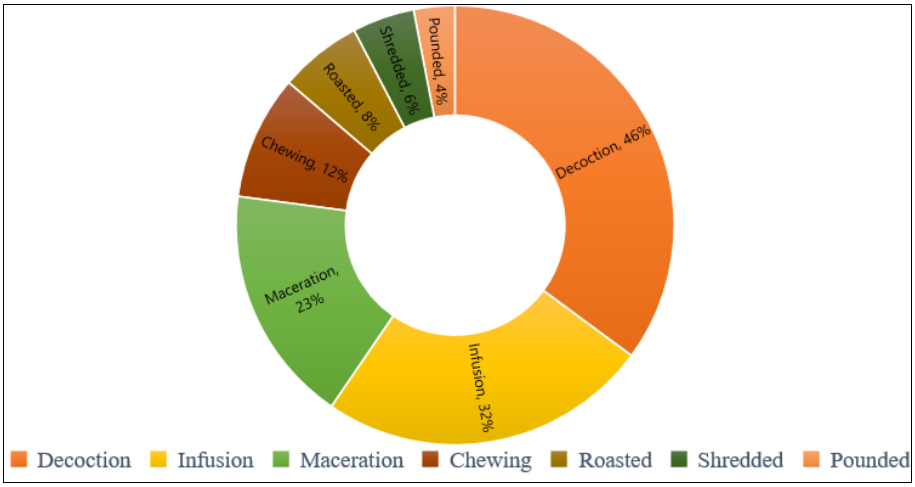

Fig 4: Medicinal herb processing

The use value of medicinal plants used by the community Suak Bugis

An index to evaluate the relative relevance of each medicinal plant prescribed by the community Suak Bugis to quantify the relative importance of plants. According to the research findings, the range of use values is 0.07-0.98 (Table. 2). *Curcuma longa* (0.99), *Amaranthus spinosus* (0.97), *Acorus calamus* (0.89), *Morinda citrifolia* (0.79), *Aloe vera* (0.74), *Alpinia galangal* (0.68), *Piper betle* (0.67), *Kalanchoe pinnata* (0.66), *Curcuma xanthorrhiza* (0.63), *Carica papaya* (0.45). *Curcuma longa* has been shown in tests to be effective as an antihypertensive, antifungal, neuroprotective, and antibacterial medication [36, 38]. The antioxidant action is provided by the presence of turmerone and curcuminoids as the major components [39]. Aside from that, tumeron, artumerone, and Zingeberine are the components that give turmeric its characteristic fragrance. This plant's essential oil has been utilized as food, drink, and medicine [40]. Turmeric has long been used as a therapeutic element in traditional medicine to boost energy, reduce bloating and worms, promote digestion, dissolve gallstones, treat arthritis, and facilitate menstruation [41]. *Curcuma longa* has antioxidant properties that can protect against free radicals and reduce lipid peroxidation. *Curcuma longa* has also been demonstrated to be capable of inhibiting mutagen-induced mutagenicity [42]. *Curcuma longa* application in traditional medicine may be an alternative in the future development of contemporary medicine. The Suak Bugis people utilize *Amaranthus spinosus* in traditional medicine to treat wounds, edema, fever, anemia, and diabetes [43]. Alkaloids, flavonoids, glycosides, phenolic acids, saponins, vitamins, and minerals make up the bioactive content [44]. This plant's antioxidant activity can ward off free radicals, which helps to protect against degenerative disorders. This plant exhibits anti-inflammatory, anticancer, hepatoprotective, gastroprotective, cardio protective, antimalarial, antimicrobial, and antidiabetic properties [45, 46]. Traditional medicine and supernatural medicine both employ *Acorus calamus* to treat sprained legs and migraines. This herb is used in traditional medicine to treat gout [11, 47]. This plant's bioactive constituents include phenylpropanoid chemicals, sterols, saponins, sesquiterpenes, and alkaloids. This plant has been shown to exhibit acetylcholinesterase inhibitory activity, anti-inflammatory, antidiarrheal, antibacterial, anthelmintic, insecticide, diuretic, antioxidant, cardiovascular, and mutagenic activity [48-49]. *In vitro* and *in vitro* preclinical studies, as well as clinical trials, show that this plant has anti-diabetic, immunomodulatory, anti-hypertensive, anti-oxidant, anti-convulsant, and protective activities [50, 52].

Conclusions

The usage of plants as medicine is a tradition passed down from ancestors to sustain social health. This is the first survey in the Suak Bugis area to document indigenous knowledge in the peat bog. The findings demonstrate the variety of therapeutic herbs employed. The many species mentioned, as well as how they are processed and the components used for treatment, demonstrate the community's valuable local knowledge. This study emphasizes the necessity of preserving local knowledge and cultural traditions for future generations of scientists and communities. The significance of collaborating with the pharmaceutical industry and indigenous populations to obtain new sources of medicine through traditional medicine. With this relationship, we may contribute to the advancement of scientific and traditional knowledge in the Suak Bugis area while also promoting conservation initiatives.

Acknowledgments

Acknowledgements are addressed to the parties who directly contributed to this research.

Funding

This research was funded by the Directorate of Research and Community Engagement (DRPM) Novice Lecturer Research in 2023.

References

1. Murdopo. O Bat Herbal Tradisional. Kementerian Perdagangan RI. 2014 Sept, 1-20.
2. BKPM. Peluang Investasi Sektor Industri Bahan Baku Obat di Indonesia. Direktorat Perencanaan Industri Manufaktur; c2016. p. 25.
3. Abbott R. Documenting Traditional Medical Knowledge. World Intellect Prop Organ [Internet]. 2014 Mar, 48. Available from: http://www.wipo.int/export/sites/www/tk/en/resources/pdf/medical_tk.pdf
4. Purwanto Y. Peran dan peluang etnobotani masa kini di Indonesia dalam menunjang upaya konservasi dan pengembangan keanekaragaman hayati. Pros Semin Hasil-Hasil Penelit Bid Ilmu Hayat Bogor, 16 Sept 1999; c1999.
5. Widayanti AW, Green JA, Heydon S, Norris P. Health-

Seeking Behavior of People in Indonesia: A Narrative Review. J Epidemiol Glob Health [Internet]. 2020;10(1):6. Available from: https://www.atlantis-press.com/article/125933140
6. Heinrich M, Lardos A, Leonti M, Weckerle C, Willcox M, Applequist W, *et al*. Best practice in research: Consensus Statement on Ethnopharmacological Field Studies - ConSEFS. J Ethnopharmacol [Internet]. 2018 Jan;211:329-39. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0378874117324030
7. POWO. Plants of the World Online [Internet]. Royal Botanic Gardens, Kew; c2023. Available from: http://www.plantsoftheworldonline.org
8. Assefa T, Nigussie N, Mullualem D, Sinshaw G, Adimasu Y. The Role of Medicinal Plants in Traditional Medicine in Adwa District, Tigray, Northern Ethiopia. Asian Plant Res J [Internet]. 2020 Feb 24;1-11. Available from: https://journalaprj.com/index.php/APRJ/article/view/57
9. Bibi F, Abbas Z, Harun N, Perveen B, Bussmann RW. Indigenous knowledge and quantitative ethnobotany of the Tanawal area, Lesser Western Himalayas, Pakistan. Ishtiaq M, editor. PLoS One [Internet]. 2022 Feb 22;17(2):e0263604. Available from: https://dx.plos.org/10.1371/journal.pone.0263604
10. Paniagua-Zambrana NY, Camara-Lerét R, Bussmann RW, Macía MJ. The influence of socioeconomic factors on traditional knowledge: A cross scale comparison of palm use in northwestern South America. Ecol Soc [Internet]. 2014;19(4):art9. Available from: http://www.ecologyandsociety.org/vol19/iss4/art9/
11. Saudah, Zumaidar, Darusman, Fitmawati, Roslim DI, Ernilasari, *et al*. Ethnobotanical knowledge of Etlingera elatior for medicinal and food uses among ethnic groups in Aceh Province, Indonesia. Biodiversitas [Internet]. 2022 Aug 24;23(8):4361-70. Available from: https://smujo.id/biodiv/article/view/11361
12. Inta A, Trisonthi C, Pongamornkul W, Panyadee P. Ethnobotany of Zingiberaceae in Mae Hong Son, Northern Thailand. Biodiversitas [Internet]. 2023 May 5;24(4):2114-24. Available from: https://smujo.id/biodiv/article/view/13726
13. Wahidah BF, Hayati N, Khusna UN, Ducha Rahmani TP, Khasanah R, Kamal I, *et al*. The ethnobotany of Zingibraceae as the traditional medicine ingredients utilized by Colo Muria mountain villagers, Central Java. IOP Conf Ser Earth Environ Sci [Internet]. 2021 Feb 1;1796(1):012113. Available from: https://iopscience.iop.org/article/10.1088/1742-6596/1796/1/012113
14. Silalahi M, Nisyawati, Purba EC, Abinawanto DW, Wahyuningtyas RS. Ethnobotanical Study of Zingiberaceae Rhizomes as Traditional Medicine Ingredients by Medicinal Plant Traders in the Pancur Batu Traditional Market, North Sumatera, Indonesia. J Trop Ethnobiol [Internet]. 2021 Jul 22;4(2):78-95. Available from: http://jte.pmei.or.id/index.php/jte/article/view/54
15. Ivanović M, Makoter K, Razboršek MI. Comparative study of chemical composition and antioxidant activity of essential oils and crude extracts of four characteristic zingiberaceae herbs. Plants [Internet]. 2021 Mar 8;10(3):1-20. Available from: https://www.mdpi.com/2223-7747/10/3/501
16. Jugreet BS, Suroowan S, Rengasamy RRK, Mahomoodally MF. Chemistry, bioactivities, mode of action and industrial applications of essential oils. Trends Food Sci Technol [Internet]. 2020 Jul;101:89-105. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0924224420304544
17. Ghorbani A, Langenberger G, Feng L, Sauerborn J. Ethnobotanical study of medicinal plants utilised by Hani ethnicity in Naban River Watershed National Nature Reserve, Yunnan, China. J Ethnopharmacol [Internet]. 2011 Apr;134(3):651-67. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0378874111000122
18. Zhang L, Pan C, Ou Z, Liang X, Shi Y, Chi L, *et al*. Chemical profiling and bioactivity of essential oils from *Alpinia officinarum* Hance from ten localities in China. Ind Crops Prod [Internet]. 2020 Oct;153:112583. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0926669020304994
19. Zubair MS, Khairunisa SQ, Widodo A, Nasronudin, Pitopang R. Antiviral screening on *Alpinia eremochlamys*, *Etlingera flexuosa*, and *Etlingera acanthoides* extracts against HIV-infected MT-4 cells. Heliyon [Internet]. 2021 Apr;7(4):e06710. Available from: https://linkinghub.elsevier.com/retrieve/pii/S2405844021008136
20. Zumaidar, Saudah, Rasnovi S, Harnelly E. Indigenous knowledge of postnatal mother care using plants by acehnese. In: IOP Conference Series: Earth and Environmental Science; c2019.
21. Elfrida, Tarigan NS, Suwardi AB. Ethnobotanical study of medicinal plants used by community in jambur labu village, East Aceh, Indonesia. Biodiversitas [Internet]. 2021 Jul 3;22(7):2893-900. Available from: https://smujo.id/biodiv/article/view/8776
22. Ratnani DAS, Junitha IK, Kriswiyanti E, Dhana IN. The ethnobotany of Ngusaba ceremonial plant utilization by Tenganan Pegringsingan community in Karangasem, Bali, Indonesia. Biodiversitas [Internet]. 2021 Apr 2;22(4):2078-87. Available from: https://smujo.id/biodiv/article/view/8221
23. Ahmad M, Sultana S, Fazl-i-Hadi S, Ben Hadda T, Rashid S, Zafar M, *et al*. An Ethnobotanical study of Medicinal Plants in high mountainous region of Chail valley (District Swat- Pakistan). J Ethnobiol Ethnomed [Internet]. 2014 Dec 16;10(1):36. Available from: https://ethnobiomed.biomedcentral.com/articles/10.1186/1746-4269-10-36
24. Gondokesumo ME, Aini SQ, Rahmadani S. Quantitative Analysist of Ethnomedicinal Practice and Used by the Banceuy Tribe in Subang Village of Indonesia. Pharmacogn J [Internet]. 2023 Aug 15;15(4):655-67. Available from: https://phcogj.com/article/2098
25. Samuelsen AB. The traditional uses, chemical constituents and biological activities of Plantago major L. A review. J Ethnopharmacol [Internet]. 2000 Jul;71(1-2):1-21. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0378874100002129
26. Yang Y, Luo X, Wei W, Fan Z, Huang T, Pan X, *et al*. Analysis of leaf morphology, secondary metabolites and proteins related to the resistance to Tetranychus

cinnabarinus in cassava *(Manihot esculenta* Crantz). Sci Rep [Internet]. 2020 Aug 26;10(1):14197. Available from: https://www.nature.com/articles/s41598-020-70509-w
27. Teoh ES. Secondary Metabolites of Plants. In: Medicinal Orchids of Asia [Internet]. Cham: Springer International Publishing; c2016. p. 59-73. Available from: http://link.springer.com/10.1007/978-3-319-24274-3_5
28. Musdja MY. Potential bangle (*Zingiber montanum* J. König) rhizome extract as a supplement to prevent and reduce symptoms of Covid-19. Saudi J Biol Sci [Internet]. 2021 Apr;28(4):2245-53. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1319562X21000152
29. Ren Y, Cui dan G, He Sha L, Yao H, Zi yan C, Gao Xiang Y, *et al*. Traditional Uses, Phytochemistry, Pharmacology and Toxicology of *Rhizoma phragmitis*: A Narrative Review. Chin J Integr Med [Internet]. 2022 Dec 23;28(12):1127–36. Available from: https://link.springer.com/10.1007/s11655-022-3572-1
30. Wakhidah AZ, Silalahi M, Yudiyanto. Ethnobotanical study of traditional steam bath bafufu in Lako Akediri Village, West Halmahera, Indonesia. Biodiversitas [Internet]. 2022 Feb 2;23(2):765-74. Available from: https://smujo.id/biodiv/article/view/9757
31. Khairullah AR, Solikhah TI, Ansori ANM, Hanisia RH, Puspitarani GA, Fadholly A, *et al*. Medicinal importance of *Kaempferia galanga* L. (Zingiberaceae): A comprehensive review. J HerbMed Pharmacol [Internet]. 2021 Jul 1;10(3):281-8. Available from: http://herbmedpharmacol.com/Article/jhp-37998
32. Nugroho Y, Soendjoto MA, Suyanto S, Matatula J, Alam S, Wirabuana PYAP, *et al*. Traditional medicinal plants and their utilization by local communities around Lambung Mangkurat Education Forests, South Kalimantan, Indonesia. Biodiversitas J Biol Divers [Internet]. 2022 Jan 5, 23(1). Available from: https://smujo.id/biodiv/article/view/9756
33. Az-zahra FR, Sari NLW, Saputry R, Nugroho GD, Pribadi T, Sunarto S, *et al*. Review: Traditional knowledge of the Dayak Tribes (Borneo) in the use of medicinal plants. Biodiversitas J Biol Divers [Internet]. 2021 Oct 6, 22(10). Available from: https://smujo.id/biodiv/article/view/9597
34. Zhang QW, Lin LG, Ye WC. Techniques for extraction and isolation of natural products: a comprehensive review. Chin Med [Internet]. 2018 Dec 17;13(1):20. Available from: https://cmjournal.biomedcentral.com/articles/10.1186/s13020-018-0177-x
35. Munir M, Sadia S, Khan A, Rahim BZ, Gagosh Nayyar B, Ahmad KS, *et al*. Ethnobotanical study of Mandi Ahmad Abad, District Okara, Pakistan. Ishtiaq M, editor. PLoS One [Internet]. 2022 Apr 7;17(4):e0265125. Available from: https://dx.plos.org/10.1371/journal.pone.0265125
36. Ayati Z, Ramezani M, Amiri MS, Moghadam AT, Rahimi H, Abdollahzade A, *et al*. Ethnobotany, Phytochemistry and Traditional Uses of Curcuma spp. and Pharmacological Profile of Two Important Species (C. longa and C. zedoaria): A Review. Curr Pharm Des [Internet]. 2019 Jun 19;25(8):871-935. Available from: http://www.eurekaselect.com/171225/article
37. Ernilasari E, Yuslinaini Y, Saudah S, Ahadi R. Etnopharmacology of Spices as Tradisional Medicine in Aceh Rural Communtities, Central Aceh. J Biot. 2022;10(2):151-61.
38. Meire de PSF, Dirlane A, Andressa BN, Larissa FF, Camila SB, Eacute lida HMM, *et al*. atilde es. Evaluation of new protocols to *Curcuma longa* micropropagation: A medicinal and ornamental specie. J Med Plants Res [Internet]. 2016 Jul 3;10(25):367-76. Available from: http://academicjournals.org/journal/JMPR/article-abstract/C4772DF59278
39. Mukherjee PK, Nema NK, Pandit S, Mukherjee K. Indian Medicinal Plants with Hypoglycemic Potential. In: Bioactive Food as Dietary Interventions for Diabetes [Internet]. Elsevier; c2013. p. 235-64. Available from: https://linkinghub.elsevier.com/retrieve/pii/B9780123971531000226
40. Sahdoe P, Aggarwal B. Chapter. Turmeric the Golden Spice: From Traditional Medicine to Modern Medicine. In: Herbal Medicine: Biomolecular and Clinical Aspects 2nd edition; c2011.
41. Saudah S, Ernilasari E, Suzanni MA, Irhamni I, Diana D. Inventarisasi Tumbuhan Obat Family Zingiberaceae di Masyarakat Keumala Kabupaten Pidie. Talent Conf Ser Trop Med. 2018;1(3):074-7.
42. Madhuri ML, Reddy MLN, Giridhar K, Kumari NR. Effect of mutagenic treatments on development of mutants in turmeric cv. Prathibha (*Curcuma longa* L.). Int J Agric Sci [Internet]. 2021 Jul 15;17(AAEBSSD):116-20. Available from: http://researchjournal.co.in/online/IJAS/IJAS-Conference-17-2021/17_116-120-C.pdf
43. Peter K, Gandhi P. Rediscovering the therapeutic potential of Amaranthus species : A review. Egypt J Basic Appl Sci [Internet]. 2017 Sep 8;4(3):196-205. Available from: https://www.tandfonline.com/doi/full/10.1016/j.ejbas.2017.05.001
44. Stintzing FC, Kammerer D, Schieber A, Adama H, Nacoulma OG, Carle R, *et al*. Betacyanins and Phenolic Compounds from *Amaranthus spinosus* L. and Boerhavia erecta L. Zeitschrift für Naturforsch C [Internet]. 2004 Feb 1;59(1-2):1-8. Available from: https://www.degruyter.com/document/doi/10.1515/znc-2004-1-201/html
45. Mishra SB, Verma A, Mukerjee A, Vijayakumar M. *Amaranthus spinosus* L. (Amaranthaceae) leaf extract attenuates streptozotocin-nicotinamide induced diabetes and oxidative stress in albino rats: A histopathological analysis. Asian Pac J Trop Biomed [Internet]. 2012 Jan;2(3):S1647-52. Available from: http://linkinghub.elsevier.com/retrieve/pii/S2221169112604705
46. Dikova B. Establishment of tobacco rattle virus (trv) in weeds and cuscuta. Biotechnol Biotechnol Equip [Internet]. 2006;20(3):42-8. Available from: https://www.scopus.com/inward/record.uri?eid=2-s2.0-33846277574&doi=10.1080%2F13102818.2006.10817379&partnerID=40&md5=faa1233cf1b88ec76641002a44ba9273
47. Saudah, Fitmawati, Roslim DI, Zumaidar, Darusman, Ernilasari, *et al*. Ethnobotany *Etlingera elatior* (Jack) R.M. Smith (Cikala) in Ethnic Gayo. Proc 3rd KOBI Congr Int. Natl Conf (KOBICINC 2020). 2021;14(2020):205-9.
48. Sukumaran S, Xiang W, Bean SR, Pedersen JF, Kresovich S, Tuinstra MR, *et al*. Association Mapping

for Grain Quality in a Diverse Sorghum Collection. Plant Genome. 2012;5(3):126-35.
49. Sharma V, Sharma R, Gautam D, Kuca K, Nepovimova E, Martins N, *et al*. Role of Vacha *Acorus calamus* Linn in Neurological and Metabolic Disorders: Evidence from Ethnopharmacology, Phytochemistry, Pharmacology and Clinical Study. J Clin Med [Internet]. 2020 Apr 19;9(4):1176. Available from: https://www.mdpi.com/2077-0383/9/4/1176
50. Kim H, Han TH, Lee SG. Anti-inflammatory activity of a water extract of *Acorus calamus* L. leaves on keratinocyte HaCaT cells. J Ethnopharmacol [Internet]. 2009 Feb;122(1):149-56. Available from: https://linkinghub.elsevier.com/retrieve/pii/S0378874108007034
51. Loying R, Gogoi R, Sarma N, Borah A, Munda S, Pandey SK, *et al*. Chemical Compositions, *In vitro* Antioxidant, Anti-microbial, Anti-inflammatory and Cytotoxic Activities of Essential Oil of *Acorus calamus* L. Rhizome from North-East India. J Essent Oil Bear Plants [Internet]. 2019 Sep 3;22(5):1299-312. Available from: https://www.tandfonline.com/doi/full/10.1080/0972060X.2019.1696236
52. Sharma V, Singh I, Chaudhary P. *Acorus calamus* L (The Healing Plant): a review on its medicinal potential, micropropagation and conservation. Nat Prod Res [Internet]. 2014 Sep 17;28(18):1454-66. Available from: http://www.tandfonline.com/doi/abs/10.1080/14786419.2014.915827