

Medicinal Plants Knowledge and Traditional Healing Practices of Mentawai Indigenous People in Indonesia: An Ethnomedicine Approach

Suharmiati Suharmiati¹, Zulfa Auliyati Agustina², Diyan Effendi¹

¹Researcher, National Institute of Health Research and Development, Ministry of Health of Indonesia, Jl. Percetakan Negara No. 29 Jakarta, Indonesia, ²Researcher, Functional Unit of Health Technology Innovation, Ministry of Health of Indonesia, Jl. Indrapura No. 17 Surabaya, Indonesia

Abstract

Background: Medicinal plants have an important role in traditional medicine. Mentawai ethnic in Mentawai islands is one of the indigenous tribes in Indonesia that have strong traditional practices. However, little information is known about the medicinal plants that they use. This study aims to analyze medicinal ingredients used by Mentawai people seen from ethnomedicine and modern pharmacology perspectives. **Methods:** Data was collected through observations and interviews with key informants in Madobag village, Mentawai Regency, Indonesia. **Results:** Most of the medicinal plants according to the informant (*Sikerei*) were used for treating swelling, new wounds, and lymphatic diseases. Based on modern pharmacology literature, some of the plants used by the Mentawai people have the properties of antimicrobial, anti-inflammation, and antioxidants. **Conclusion:** Traditional healer in Mentawai islands has knowledge of medicinal plants even though some of them do not correspond to the modern pharmaceutical science.

Keywords: Medicinal plant, indigenous, ethnomedicine, pharmaceutical, traditional healer

Introduction

One of the cultural characteristics of people in developing countries is that traditional elements are still dominant in daily life. This situation is supported by biodiversity whose use has undergone a long history as part of their culture. One of these activities is the use of medicinal plants by various ethnic groups or groups of people living in remote areas. The healing tradition of a community cannot be separated from the local culture. In most societies, the modern medical system coexists with the traditional healing system. The use of natural

and local products related to people's perspectives and life is generally used as the basis for traditional medical systems.¹ Perception of the concept of health and illness and the diversity of plant species used as traditional medicines are formed through social construction from generation to generation and are believed to be true. The relationship between humans and their environment is determined by local culture as the knowledge that is believed and becomes the source of the value system.^{2,3} The knowledge system possessed by the community is one part of the culture of indigenous tribes and rural farmers.^{2,4} Mentawai is one of the ethnic groups in Indonesia that inhabits remote Mentawai islands in West Sumatra Province. The health knowledge system related to the concept of health-sickness affects the health behavior of the Mentawai ethnic group. One of them is the belief in *Sikerei* to cure illnesses. *Sikerei* is a term for a traditional healer. Mentawai people believe that *Sikerei* has the knowledge, expertise, and skills in medicine and medicinal plants. People who can relate

Corresponding Author:

Diyan Effendi

Researcher, National Institute of Health Research and Development, Ministry of Health of Indonesia, Address: Jl. Percetakan Negara No. 29 Jakarta, Indonesia, Phone: +62-81234026863, ORCID: <https://orcid.org/0000-0002-3930-7021>
Email: diyaneffendi@outlook.com

to the spirits and souls of people in the real world and the supernatural. They have the capability to protect from magic and diseases by using certain mantras and rituals.^{5,6}

The special abilities of a *Sikerei* are not just obtained, there are many stages and tests that one must go through to become a *Sikerei*. He must go through a long process to gain knowledge about medicinal herbs, rituals or traditional ceremonies, chants (*urai sikerei*), and dances (*turuk*). All of that knowledge and skills are obtained by learning from senior *Sikerei*. The senior *Sikerei* acts as a teacher and mentor known as *sipaumat*. Although there is no prerequisite for gender to become a *Sikerei*, in general, and it can even be said that most *Sikerei* are male and together with the *rimata* (leader of a group of relatives/clans) he leads a ceremony.

The Mentawai people respect *Sikerei* because they are seen as people who have maturity and wisdom in carrying out traditions and customs. As well as service and ability to provide traditional medical treatment. Considering the vital position of *Sikerei* in providing medical treatment to Mentawai people, it is important to problematize the treatment and medicinal plants ingredient used by *Sikerei* from modern medical perspectives. This study is well-rooted in ethnomedicine conception that essential in revealing medicinal plants that prospective to be the new source of drugs. Besides, the ethnomedicine approach could be used to protect indigenous people from the misuse of medicinal plants.⁷ Ethnomedicine studies combine anthropological study and drug discovery research. Anthropological studies look at traditional medicine's cultural understanding and context. While the drug discovery study aims to develop vendible pharmacological outcome.⁸

In light of the above, this study aims to analyze the medicinal ingredients used by *Sikerei* to treat health problems, especially swelling problems. The discussion is based on cultural and pharmaceutical perspectives.

Methods

This study was qualitative research. This study was conducted in Madobag Village, South Siberut

District, Mentawai Regency, West Sumatra Province, Indonesia. Data were collected through participatory observation. Researchers made direct observations, taking videos, field notes, and conducted interviews with informants. All participants signed an informed consent indicating that they agreed to participate and agreed to be videotaped and photographed. The data collection was conducted in one month. During the data collection, the researchers lived with the local people. Establishing good communication relationships between researchers and informants is important to extract data from informants. Although there should be still a barrier between the two so that going native does not occur.⁹

Results and Discussion

Pabetei ritual

The Mentawai people who live in Madobag Village believe that the illness they suffered was caused by magic and evil spirits. To cure the illness suffered by the Mentawai people, they performed a healing ritual called *pabetei*. *Pabetei* was performed by *Sikerei* that aimed to expel evil spirits (*sanitu*) from the patient's body. In practice, *pabetei* also used several kinds of medicinal plants.

Diseases that are cured through *pabetei* are of various types such as high fever and skin diseases. The main role of a *Sikerei* is to treat diseases and lead traditional rituals. When the *pabetei* was about to be carried out, *Sikerei* asked the patient's family to provide pork (*saina* ') and chicken (*gougouk*) which were a prerequisite for the treatment. During the ritual, the two animals were slaughtered to be eaten by family and clan members. The *pabetei* ritual was attended by all relatives of the patient and was believed to be attended by the spirits of the ancestors. During *Pabetei* there were taboos that must be avoided, including eating certain types of animals and plants, prohibiting bathing and having sexual intercourse, and avoiding bad actions. The *pabetei* ritual was performed at the request of the patient or his family, including the time for performing the ritual.



Figure 1. Pabetei ritual by Sikerei.

Source: Researcher documentation

Cultural belief, substantially, influences the health behavior of the people. Customs, traditions, and rituals that are performed in the family and the community in general, become a part of the community's life and embedded into behavior and used as the community's identity.^{10,11} *Pabetei* rituals and the medicinal herbs used are one among many of ethnomedicines in Indonesia. In other ethnic groups, similar phenomena were also found. Research on *Tidung* community reveals the local wisdom of the community in traditional medicine efforts. *Tidung* community uses three approaches to overcome the health problems they experience, namely using the traditional medicinal approach, the supernatural approach, and the combination of both.¹²

Research on *Dole-dole* healing ritual in the Butonese community shows that the Buton people believe in traditional medicine more than modern medical care.¹³ Likewise, in Africa the people of Ghana rely on traditional medicine by seeking health treatment from groups of prayer rituals and taking herbal medicine.^{14,11} People

of Ghana choose to visit traditional healers because they think traditional medicine is more effective. This phenomenon is also caused by dissatisfaction to modern medical treatment outcomes besides its high cost.¹⁵

Medicinal plants used for swelling healing

One of the diseases that are treated through the *pabetei* ritual is swelling (*Oilu*). The swelling problem is believed by the Mentawai people to be caused by contact with dead pigs while in the fields. The treatment process was carried out by three *Sikereis*. The three *Sikereis* would first look for medicinal plants in the yard or forest (*atauleleu*). The plants used were *Simakainout* (1 flower and 1 leaf), *Allepet* (2 leaves), *Allelep Simabulau* (2 leaves), *Simuruh* (1 leaf and 1 flower), *JiaJiat* (1 stem), *Sibakat laggai* (2 leaves). All of these plants were shredded using grated sago leaves (*dudurut*). Furthermore, the grated results were squeezed out to drink. This potion was taken twice a day, for three days. The waste was smeared on the sore place and then tied with a cloth.

If after three days, the swelling had not healed, then the stage 2 treatment would be carried out. In stage 2, a dance (*turuk*) was performed as part of the

treatment process carried out by *Sikerei* in *uma*. *Uma* is a communal house where assets are stored and a place to hold tribal ceremonies.⁶



Figure 2. *Uma* of Madobag village (left); *Allepet* leaves (right)

Source: Researcher documentation

In the second stage of treatment, the family prepared one pig weighing 60 kg and three chickens. In this second stage, the medicinal plants needed were *mumunen* (1 flower), *surak* (2 leaves), *katcaila* (2 leaves), *botbolo* (2 leaves), *sogha buluk* (2 leaves), *sigigri* (2 leaves), *buluk duruk* (2 leaves), *katuicha* (2 leaves), *tebeleki* (2 leaves), *palakuruk bakkak* (2 leaves). The composition of these herbs is called *Sibakat laggai*. The next process, *Sikerei* melted tin-lead (*bulao*) to be molded using bamboo sticks with a length of 3-5 cm. After the tin cooled, it was put into bamboo with a length of 50 cm. This tin-filled bamboo symbolized evil spirits.

After the process was complete, *Sikerei* began to recite the incantation for about 30 minutes while ringing a small bell called *jejeneng* to bring forth a good spirit (*simagre*). Meanwhile, the patient's family slaughtered a chicken to take its liver. Chicken liver was handed over to *Sikerei* as a dish to summon good spirits. Furthermore, the *Sikerei* performed a dance (*turuk*) to ward off evil spirits. *Turuk* is a traditional Mentawai dance that mimics the movements of animals in their environments such

as eagles, monkeys, and chickens. The *turuk* movement also involves stomping the foot to the rhythm of the drum (*Gajeumak*). After exorcising evil spirits, *Sikerei* got guidance from the ancestral spirits about the medicine to be used. *Turuk* performed by *Sikerei* in the healing ritual is called *Turuk Puliaijat* (Treatment Ritual). In the middle of the ritual, *Sikerei* touched the patient's head with a plate filled with medicinal leaves. When touching the patient's head, a clot of blood appeared on the plate, as well as from the crown of the patient, a handful of fine shells emerged from the patient's head. Furthermore, *Sikerei* concocted the drugs to be given to the patient.

After the medicinal ingredients were ready, the dance was continued to the final stage by the three *Sikerei* holding a bamboo filled with lead. The goal of the final stage of this dance was to ask the patient for forgiveness from the evil spirit. After the dance finished, the ritual was continued by giving the patient the enchanted chicken liver to eat. This chicken liver symbolizes the good spirit (*simagre*). The next day, a pig and chicken slaughtering ceremony was held as a

symbol of the completion of the healing ritual.

Medicinal plants used by Mentawai people viewed from pharmaceutical lens

One of the reasons for the use of medicinal plants by *Sikerei* is because they are considered to have supernatural powers that can accelerate the healing of diseases. This is consistent with what Singer and Baer stated that the medical system is an integral part of a culture.¹⁶ Other factors that cause traditional medicine to be of great interest to the Mentawai community is the perception of the people that the disease they suffer is not serious and is not life-threatening so that they do not need to see a doctor.⁶ This is in accordance with what was stated by Spradly, that culture as knowledge, values are used to interpret experiences and generate social behavior.⁹ Apart from *Botbolo* leaves, there are several other plants such as *Simakainout* leaves (*Cyrtandra pendula*) which are used for swelling, *Allelep Simabulau* (*Cassia alata*) for skin problems, and others. The plant names below can be used for various diseases, such as skin diseases, wounds, sprains, ulcers, and so on.

Most of the plant parts used by the Mentawai tribe are leaves including *Cyrtandra pendula* Blume, *Ficus benyamina*, *Cassia alata*, *Alpinia malaccensis* (Burm.f.) Rosc, *Monochoria vaginalis*, *Garphthophyllum pictum*, *Blumea lanceolaria* (Roxb.) Druce, *Rhaphidophora celatocaulis*, *Codiaeum variegatum*, *Dracaena maingayi*, *Piper crocatum* Ruiz & Pav., *Piper umbellatum*, *Flemingia macrophylla*, and *Pseuduvariam acrophylla*. Other parts used are flowers such as *Solanum ferox*, *Monochoria vaginalis*, *Etlingera elatior* and *Homalomena singaporensis* Regel stems. The chemical content of medicinal plants used by the Mentawai ethnic group is Solanin (0.30%) and Alkaloid

(0.43%) in the *Solanum ferox* plant.¹⁷ Antibacterial rhine is a chemical ingredient in the leaves of *Cassia alata*, saponins, flavonoids and polyphenols in the *Ficus benyamina* plant.

The rhizome of *Alpinia malaccensis* (Burm.f.) Rosc contains methyl cinnamate essential oil.¹⁷ Meanwhile, the essential oil from the leaves ($\pm 0.16\%$) contains more terpenes than the rhizome. The essential oil in the leaves contains kaneelzuur-methyl ester and allokaneelzuur.¹⁸ The essential oils of *E. megalocheilo* are monoterpenes, sesquiterpenes, oxygenated sesquiterpenes, oxygenated terpenes and terpenes.¹⁹ *Graphthophyllum pictum* leaves contain phytol, n-nonacosane, and acetone hexahydrofarnesil.²⁰ The main compound of *Blumea lanceolaria* (Roxb) is methyl thymol (95%).²¹ The leaves of *Codiaeum variegatum* contain alkaloids, glycosides, saponins, tannins, cardenolides, steroids, and philat and contain very small amounts of flavonoids, phlobatnins, phenols, and anthraquinones.²²

Methanol extract from *Piper crocatum* Ruiz & Pav. indicates the IC₅₀ value 2.04; 1.34, 2.08 and 27.40 $\mu\text{g} / \text{mL}$ in n-hexane, ethyl acetate, butanol fraction solvent. *Piper umbellatum* leaves contain terpenes (especially in essential oils), alkaloids, flavonoids, sterols and secondary metabolites. *Flemingia macrophylla* stem extract contains a new Isoflavone, called flemiphyllin.²³ The leaves of *Pseuduvaria monticola* and *Pseuduvaria macrophylla* contain not only alkaloids but also benzopyran derivatives, aptolic phenolic acid, and phenyl propanoid. The medicinal plants used by *Sikerei* and their usage according to modern pharmaceutical science are summarized in table 1.

Table 1. Medicinal plants used by *Sikerei*

Local Name	Latin Name / Family	Contents	Traditional Use by Mentawai Ethnic	Modern Pharmaceutical Use
<i>Simakainout</i> (Leaf)	<i>Cyrtandra pendula</i> Blume / Gesneriaceae	<ul style="list-style-type: none"> • Solanine • Alkaloid 	<ul style="list-style-type: none"> • Swelling • Fever 	<ul style="list-style-type: none"> • Cancer • Heart problem • Antiviral.²⁴
<i>Simakainout</i> (Flower)	<i>Solanum ferox</i> / Solanaceae	<ul style="list-style-type: none"> • Solanine • Alkaloid 	<ul style="list-style-type: none"> • Swelling 	<ul style="list-style-type: none"> • Carminative • Astringent • Expectorant • Diaphoretic • Anthelmintic • Asthma • Dry cough • Dysuria • Intestinal worms • Colic • Flatulence • Vomiting • Asthma • Rheumatism.¹⁷
<i>Allepet</i> (Leaf)	<i>Ficus benyamina</i> / Moraceae	<ul style="list-style-type: none"> • Saponin • Flavonoid • Polyphenol 	<ul style="list-style-type: none"> • Skin disease • Swelling 	<ul style="list-style-type: none"> • Skin disease • Inflammation • Vomiting • Leprosy • Malaria • Nasal disease • Cancer • Antimicrobe • Antinociceptive • Antipyretic • Hypotension • Antidysentery.²⁵
<i>Allelep Simabulau</i> (Leaf)	<i>Cassia alata</i> / Caesalpiniaceae	<ul style="list-style-type: none"> • Rhein • Emodin • Aloe-emodin 	<ul style="list-style-type: none"> • Skin disease • Swelling 	<ul style="list-style-type: none"> • Antibacterial • Antifungal.^{17,26}
<i>Sibakat Laggai</i> (Leaf)	<i>Alpinia malaccensis</i> (Burm.f.)Rosc / Zingiberaceae	<ul style="list-style-type: none"> • Essential methyl cinnamate • Kaneelzuur-methyl ester • Allo kaneelzuur 	<ul style="list-style-type: none"> • New wounds 	<ul style="list-style-type: none"> • Heals wounds • Reduces nausea.¹⁷
<i>Simuruh</i> (Leaf and flower)	<i>Monochoria vaginalis</i> / Pontederiaceae	<ul style="list-style-type: none"> • Antioxidant 	<ul style="list-style-type: none"> • Swollen 	<ul style="list-style-type: none"> • Antioxidant • Antiinflammation.²⁷
<i>Mumunen</i> (Flower)	<i>Etilingera megalocheilo</i>	<ul style="list-style-type: none"> • Monoterpene • Sesquiterpene 	<ul style="list-style-type: none"> • Swelling 	<ul style="list-style-type: none"> • Antibacterial.¹⁹

Cont... Table 1. Medicinal plants used by *Sikerei*

	<i>Etilingera elatior</i> / Zingiberaceae	<ul style="list-style-type: none"> • Oxygenized sesquiterpene, • Oxygenized Diterpene • Diterpene 		
<i>Katcaila</i> (Leaf)	<i>Graphtophyllum pictum</i> / Acanthaceae	<ul style="list-style-type: none"> • Phytol, • N-nonacosane • Acetone • Heksahidrofarne sil 	<ul style="list-style-type: none"> • Swelling 	<ul style="list-style-type: none"> • Cytotoxic • Antioxidant • Treatment of bacterial infections.²⁰
<i>Botbolo</i> (Leaf)	<i>Blumea lanceolaria</i> (Roxb.) Druce / Compositae	<ul style="list-style-type: none"> • Methyl thymol 	<ul style="list-style-type: none"> • Swelling • Fever 	<ul style="list-style-type: none"> • Antiseptic.²¹
<i>Surak</i> (Leaf)	<i>Codiaeum variegatum</i> / Euphorbiaceae	<ul style="list-style-type: none"> • Alkaloid • Glycoside • Saponin • Tannin • Cardenolides • Steroid, • Philat • Flavonoid, • Phlobatannins • Phenol • Antrakuinon 	<ul style="list-style-type: none"> • Headache • Snakebite 	<ul style="list-style-type: none"> • Antifungal.²²
<i>Sisigri</i> (Leaf)	<i>Piper crocatum</i> Ruiz & Pav. / Piperaceae	<ul style="list-style-type: none"> • n-hexane, • Ethyl acetate, • Butanol fractions, • Methanolic extract 	<ul style="list-style-type: none"> • Swelling • Boils 	<ul style="list-style-type: none"> • Larvicide • Antitumor.²⁸
<i>Bulu Duruk</i> (Leaf)	<i>Piper umbellatum</i> / Piperaceae	<ul style="list-style-type: none"> • Terpene • Alkaloid • Flavonoid • Sterol • Metabolite 	<ul style="list-style-type: none"> • Headache • Cough 	<ul style="list-style-type: none"> • Antibacterial • Antiinflammation • Analgesic • Antioxidant • Cytotoxic • Antimalaria • Antileishmanial • Antitrypanosomally.²⁹
<i>Palakuruk Bakkak Pangesele</i> (Leaf)	<i>Pseuduvariama crophylla</i> / Annonaceae	<ul style="list-style-type: none"> • Alkaloid, • Phenolic Acid • Propanoic fenil 	<ul style="list-style-type: none"> • Fever 	<ul style="list-style-type: none"> • Antioxidant • Anticancer • Antidiabetic type 2.³⁰

Conclusion

From a cultural perspective, the use of medicinal plants by *Sikerei* is considered to have supernatural powers that can accelerate the healing of diseases. Besides, the Mentawai people consider the illness they suffer is not life-threatening, so they don't need to see a doctor. Most of the medicinal plants according to the informant (*Sikerei*) are useful for treating swelling, other uses are for treating new wounds and for lymph disease. From a pharmaceutical perspective, the plants used by *Sikerei* have antimicrobial, anti-inflammatory, and antioxidant properties. *Sikerei* has knowledge about the properties of medicinal plants although some do not correspond to modern pharmaceutical science. Hence, it is recommended that the local Health Office provide guidance to *Sikerei* as well as to the local community so that they know the benefits and correct use of medicinal plants in their area.

Acknowledgements: The researchers would like to thank the Director General of National Institute of Health Research and Development, Ministry of Health of Indonesia for funding this study.

Ethical Clearance: This study was approved by the Ethic Committee of National Institute of Health Research and Development, Ministry of Health of Indonesia (LB.02.01/5.2/KE.194).

Source of Funding: National Institute of Health Research and Development, Ministry of Health of Indonesia.

Conflict of Interest: The authors affirm that they have no conflict of interest.

References

- Toledo BA, Galetto L, Colantonio S. Ethnobotanical knowledge in rural communities of Cordoba (Argentina): The importance of cultural and biogeographical factors. *J Ethnobiol Ethnomed.* 2009;5(1):1–8.
- Alexiades MN, Sheldon JW. Selected guidelines for ethnobotanical research: a field manual. New York: New York Botanical Garden; 1996.
- Pfeiffer JM, Butz RJ. Assessing cultural and ecological variation in ethnobiological research: The importance of gender. *J Ethnobiol.* 2005;25(2):240–78.
- Long C, Li S, Long B, Shi Y, Liu B. Medicinal plants used by the Yi ethnic group: A case study in central Yunnan. *J Ethnobiol Ethnomed.* 2009;5(1):1–5.
- Sagugurat RP, Aditiawarman M. Semiology Analysis on Sikerei Tattoo in Taileleu Village, Southwest Siberut, Mentawai Island. *J Ilm Lang Parol.* 2019;2(2):47–55.
- Agung MG, Purwaningsih E, Zamzami L, Rahanto S. Turuk Sikerei. Tri Juni Angkasawati, editor. Jakarta: Lembaga Penerbitan Balitbangkes; 2014.
- Lee R, Balick MJ. Ethnomedicine: Ancient wisdom for contemporary healing. *Altern Ther Health Med.* 2001;7(3):28–30.
- Deepak A, Anshu S. Indigenous herbal medicines: Tribal formulations and traditional herbal practices. Vol. 440. Jaipur, India: Aavishkar Publishers; 2008.
- Spradley JP. Metode Etnograf. Yogyakarta: Tiara Wacana; 1997.
- Waterworth P, Pescud M, Braham R, Dimmock J, Rosenberg M. Factors influencing the health behaviour of indigenous Australians: Perspectives from support people. *PLoS One.* 2015;10(11):e0142323.
- Dwi Laksono A, Dwi Wulandari R, Khaqiqi Nantabah Z, Auliyati Agustina Z, Ummu Aimanah I, Rukmini R, et al. The Concept of Illness among Ethnic Groups in Indonesia: A Meta-Ethnographic Study. *Syst Rev Pharm.* 2020;11(9):584–91.
- Lesmana H, Alfianur A, Utami PA, Retnowati Y, Darni D. Pengobatan tradisional pada masyarakat tidung kota Tarakan: study kualitatif kearifan lokal bidang kesehatan. *MEDISAINS.* 2018;16(1):31–41.
- Asrina A, Palutturi S, Tenri A. Dole-Dole Tradition in Health Seeking Behavior of Buton Society, Southeast Sulawesi. *Indian J Public Heal Res Dev.* 2018;9(7):270–4.
- Anarfi JK, Badasu DM, Yawson A, Atobra D, Abuosi AA, Adzei FA. Religious affiliation and health-seeking behavior related to non-communicable diseases among children in Ghana. 2016;
- Aniah P. The contribution of indigenous health care providers to health care delivery in Rural Ghana: An exploratory study of Bongo District. *Sci J*

- Public Heal. 2015;3(1):20–8.
16. Singer M, Baer H. Critical medical anthropology. Critical Medical Anthropology. Massachusetts: CRC Press; 2018. 1–406 p.
 17. Khare CP. Indian Medicinal Plants. An Illustrated Dictionary. New York: Springer, New York; 2007.
 18. Muchtaridi M, Musfiroh I, Subarnas A, Rambia I, Suganda H, Enas Nasrudin M. Chemical composition and locomotors activity of essential oils from the rhizome, stem, and leaf of *alpinia malaccensis* (Burm f.) of indonesian spices. J Appl Pharm Sci. 2014;4(1):52–6.
 19. Vairappan CS, Nagappan T, Palaniveloo K. Essential oil composition, cytotoxic and antibacterial activities of five *Etlingera* species from Borneo. Nat Prod Commun. 2012 Feb;7(2):239–242.
 20. Jiangseubchatveera N, Liawruangrath B, Liawruangrath S. Journal of Essential Oil Bearing Plants The Chemical Constituents and the Cytotoxicity , Antioxidant and Antibacterial Activities of the Essential Oil of *Graptophyllum pictum* (L .) Griff . J Essent Oil Bear Plants. 2015;1(April):11–7.
 21. Duñg NX, Loi DT, Hùng DT. Chemical Composition of the Oil of *Blumea lanceolaria* (Roxb .) Druce from Vietnam. J Essent Oil Res. 2011;3(Jul/Aug):285–6.
 22. Ogunwenmo KO, Idowu OA, Innocent C, Esan EB, Oyelana OA. Cultivars of *Codiaeum variegatum* (L.) Blume (Euphorbiaceae) show variability in phytochemical and cytological characteristics. African J Biotechnol. 2007;6(20):2400–5.
 23. Rao KN, Srimannarayana G. Flemiphyllin, an isoflavone from stems of *Flemingia macrophylla*. Phytochemistry. 1984;23(4):927–9.
 24. Atkins H, Preston J, Cronk QCB. A molecular test of Huxley’s line: *Cyrtandra* (Gesneriaceae) in borneo and the Philippines. Biol J Linn Soc. 2001;72(1):143–59.
 25. Imran M, Rasool N, Rizwan K, Zubair M, Riaz M, Zia-ul-haq M, et al. Chemical composition and Biological studies of *Ficus benjamina*. Chem Cent J. 2014;8(12):1–10.
 26. Ibrahim D, Osman H. Antimicrobial activity of *Cassia alata* from Malaysia. J Ethnopharmacol. 1995;45(3):151–6.
 27. Chandran R, Thangaraj P, Shanmugam S, Thankarajan S, Karuppusamy A. Antioxidant And Anti-Inflammatory Potential Of *Monochoria vaginalis* (Burm. F.) C. Presl.: A Wild Edible Plant. J Food Biochem. 2011;
 28. Ruiz P. Cytotoxic Activities of Fractions and Two Isolated Compounds from *Sirih Merah* (Indonesian red betel),. Procedia Chem. 2014;13:79–84.
 29. Roersch CMFB. *Piper umbellatum* L.: A comparative cross-cultural analysis of its medicinal uses and an ethnopharmacological evaluation. J Ethnopharmacol. 2010;131(3):522–37.
 30. Taha H. Phytochemical and biological studies of the extracts of *Pseuduvaria Monticola* and *Pseuduvaria Macrophylla*. University of Malaya; 2016.