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Research Article

Medicinal Plants in Tropical Rain Forest from Hua Khao Subdistrict, Singha Nakhon District, Songkhla Province, Thailand

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ABSTRACT

Phytogeographically, southern Thailand is covered by tropical rain forest which high plant diversity is existing. Nevertheless, scanty study of medicinal plant diversity has been performed. This study aimed to survey medicinal plants from tropical rain forest of Hua Khao Subdistrict, Singha Nakhon District, Songkhla Province. It was carried out during July 2012–December 2012. Semi-structure interviews were performed to 5 key informants. The main criteria for consulting were plant vernacular name, plant part used, preparation, route of administration and properties. Plant identification and voucher specimens were done. The data were analyzed by descriptive statistics and interpretation. Totally, eighty-two species belonging to 69 genera and 48 families were recorded. Rubiaceae was the family with most species used (6 species). The most frequently utilized plant part was underground part (32.73%). Medicinal plants found could be categorized into 31 groups according to their properties, among them antipyretic drugs were mostly found with species utilized (20.80%). Decoction and oral were mostly used as drug preparation method and administration route, respectively. Local properties of 19 medicinal plants were consistent to their report on pharmacological activities. This study is useful for compilation of local knowledge on medicinal plant use for further planning in drug development, sustainable use or conservation of medicinal plants.

Key words: Medicinal plant, rain forest, Hua Khao Subdistrict, Songkhla, Sating Phra Peninsula

INTRODUCTION

Thailand locates in the world tropical zone. The country is the collective center of rich biological diversity among three floristic regions: Indo-Burmese, Indo-Chinese, and Malesian. As a result, Thailand comprises different types of plant communities such as tropical rain forest, mixed deciduous forest, dry evergreen forests, hill evergreen forest, coniferous forest, swamp forest, mangrove forest and beach forest [40]. It is found that there are about 10,000 species of vascular plants in Thailand, of which less than 2% are known to use by Thai people [36]. Among them, they are mostly utilized as traditional drugs [19,47,28,39,7,1,3].

In Thailand, there are many forest areas which were surveyed for finding medicinal plants. The north, Chiang Mai and Nan province [42,31,24] were studied and found with 183 and 216 medicinal

species, respectively. The northeast, Umnatchareon and Maha Sarakham province were studied and found with 99 and 31 species, respectively [30,43]. The west, Kanchanaburi and Prachuap Khiri Khan province were studied and found with 32 and 51 species, respectively [11,28,3]. Aforementioned studies, the concerning areas are dominant by mixed deciduous forest, hill evergreen forest, dry evergreen forest and Dipterocarp forest. However, survey of medicinal plants from rain forest is still scanty.

Southern of Thailand, it is mostly covered by tropical rain forest [40]. However, only one study has been performed [25,45,38,17]. Consequently, there are many areas never been surveyed for medicinal plants. Hua Khao subdistrict, Singha Nakhon district, Songkhla province is an example of interesting area lacking for any studies.

Hua Khao subdistrict, Singha Nakhon district, Songkhla province is composed of 2 types of forest:

mangrove and rain forests. Previously, A survey of medicinal plants from mangrove forests has been already done [29,2,13,14], but rain forest still has not been investigated. Nowadays, this forest is usually employed by local healers for collecting drug materials. In addition, it is also accessed by lumbermen and then bared for rubber agriculture. This is one of causes for species losing from the area. Thereby, this study aimed to survey medicinal plants in rain forest from Hua Khao subdistrict, Singha Nakhon district, Songkhla province. The advantage of this study would be the knowledge collection of medicinal plants and their folk uses before losing forever. Moreover, it would be the basic information for further research in herbal drugs.

Materials and Methods

Study area and local healers:

Hua Khao subdistrict locates in Singha Nakhon district, a portion of Sating Phra Peninsula, Songkhla province. It is bordered to the north by Ching Kao subdistrict, to the south by Songkhla lake, to the east by Gulf of Thailand and Songkhla lake, and to the west by Sating Moh subdistrict (Fig. 1). The total area is approximately 18.6 square kilometers.

Geographically, the central area is lain on with mountainous range and flanked by plain. The plain is connected to Songkhla lake bank. Hua Khao subdistrict is inhabited by about 14,627 people. Most of them are Muslims. The main occupations are fishery and trading.

In this study, tropical rain forest in Hua khao subdistrict was selected. Its geographical area is a mountain range covering about 3.94 square kilometers. Two representative parts of the area were selected; Hua Khao Dang and Hua Khao Yai mountain. Hua Khao Dang mountain is the important area because it was the settle place of ancient town and the first central city of Songkhla province. There has been the old temples setting at the foothill of this mountain especially, Suwan Khiri temple. This temple was the ceremonial place for drinking an oath of allegiance of ancient political officials to pay respect to the Songkhla governor. Suwan Khiri temple has constructed herbal garden for local healers since the old days. In addition, the study area is a large rain forest on Sating Phra Peninsula. Therefore, it is the reason for being still a favorite forest for collecting medicinal plants from healers in Singha Nakhon districts and adjacent areas nowadays.

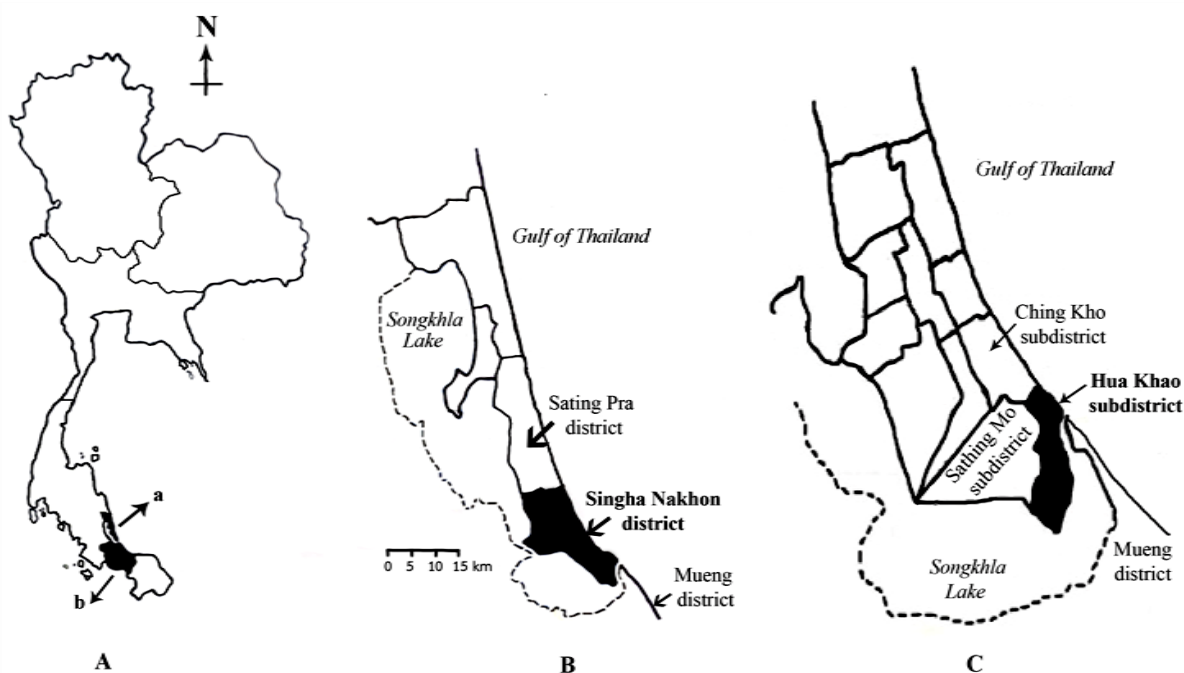


Fig. 1: Study area.

- A.** Thailand map represents Songkhla province (a+b), and (a) represents Sating Phra Peninsula part
B. Sating Phra Peninsula map represents Singha Nakhon district
C. Singha Nakhon district map represents Hua Khao subdistrict

Field study:

The field study was conducted during July 2012–December 2012, once a month. Five local healers were selected for studying. All of them were recognized by people and local public health officers

in the study area. Their folk knowledge in herbal utilization was extracted by interviewing. The semi-structured interviews were used for asking about local names of medicinal plants, plant parts used, drug preparations, using methods and their

properties. The folk healers were interviewed at their house and also during field surveying. Consistence of plant use was confirmed by at least 2 informants for reliable data.

Herbarium specimens:

All medicinal plants were photographed and then collected for making voucher specimens according to Chayamarit's method [10]. The voucher specimens were prepared for reference and deposited at Faculty of Traditional Thai Medicine Herbarium, Prince of Songkla University.

Medicinal plants identification:

The collected specimens were identified by corresponding author, a taxonomist at the faculty of Traditional Thai Medicine, with the aids of relevant literature e.g. Flora of Thailand, Flora Malesiana and Flora of China.

Data analysis:

The data were analyzed by descriptive statistics and interpretation.

Results:

Plant use:

Totally, 82 medicinal plant species belonging to 69 genera in 48 families were collected (Table 1). The three families most frequently used are Rubiaceae (6 species), Annonaceae (5 species) and Fabaceae (4 species), respectively.

Three groups of utilized plants including Dicots with 75 species (91.46%), monocots with 5 species (6.10%) and ferns with 2 species (2.44%) were categorized based on taxonomy.

According to plant habit, trees are most frequently used with 27 species (34.15%), followed by shrubs with 23 species (28.05%), climber with 21

species (25.61%), herbs with 6 species (7.32%) and epiphytic plants with 4 species (4.88%).

Disease/ symptom to treat:

Eighty-two medicinal plants were categorized into 31 groups according to disease or symptom treated (Table 2). Most plants are used for healing fever with 26 species (20.80%), joint and muscle pain with 11 species (8.80%), and dyspepsia with 9 species (20.70%), respectively.

Fever is common illness with high-body temperature and headaches [6]. Then, the medicinal plants for removing those symptoms are applied, for example, *Polyalthia suberosa* (Roxb.) Thwaites., *Fragraea fragrans* Roxb. and *Passiflora foetida* L.

For joint and muscle pain, it is sometimes indicated by inflammation [6]. Then, the medicinal plants to get rid of that symptoms are applied such as *Gloriosa superba* L., *Salacia verrucosa* Wight. and *Desmos cochinchinensis* Lour.

Dyspepsia is characterized by pain at stomach or small intestine [6]. The medicinal plants are used to cure this symptom such as *Alpinia malaccensis* (Brum.) Roscoe., *Morinda umbellata* L. and *Mesua nervosa* Planch. & Triana.

Interestingly, Most of the plants counted as 53 species are used for 1 disease, whereas only 29 species are used for more than 2 diseases. This is possible that most plants are not widely distributed and they have to grow in fertile area. Subsequently, they are not easily accessed by people, and then it is difficult to experience for various uses. For instance, *Garcinia hombroniana* Pierre which is not widely distributed is used only for constipation treating, while *Chromolaena odorata* (L.) R.M. King & H. Rob which is well grow in open and infertile area and categorized as weed, is used for both stop bleeding and fever. Moreover, Although a plant have various uses, some healers are confident to use 1 condition according to their familiar.

Table 1: Medicinal plants found from Hua Khao subdistrict, Singha Nakhon district, Songkhla province.

Family	Botanical name	Habit	Specimen	Local name	Part/ Preparation/ Administration/ Disease
Anacardiaceae	<i>Bouea oppositifolia</i> (Roxb.) Meisn.	tree	UH 054	Mapring	Fruits/ raw/ oral/ phlegm
					Roots/ decoction/ oral/ fever
Ancistrocladaceae	<i>Ancistrocladus tectorius</i> (Lour.) Merr.	climber	UH 046	Kon Tee Maa	Roots, stem/ decoction/ oral/ fever, abscesses, muscle pain
Annonaceae	<i>Desmos cochinchinensis</i> Lour.	climber	UH 023	Sa Lao	Stem/ decoction/ oral/ muscle pain
Arecaceae	<i>Caryota mitis</i> Lour.	tree	UH 020	Tao Rang	Roots/ decoction/ oral/ liver disease
Aristolochiaceae	<i>Polyalthia parviflora</i> Ridl.	shrub	UH 081	Sao Sadung	Stem/ decoction/ oral/ maintenance of testosterone, tonic
Asclepiadaceae	<i>Polyalthia suberosa</i> (Roxb.) Thwaites	shrub	UH 016	Num Nong	Roots/ decoction/ oral/ fever
	<i>Rauwenhoff stamensis</i> Scheff.	shrub	UH 006	Nom maew	Roots/ decoction/ oral/ pregnant
					Leaves/ decoction/ oral/ diarrhea
	<i>Uvaria rufa</i> Blume	shrub	UH 008	Nom Kwaai	Roots/ decoction/ oral/ pregnant
	<i>Aristolochia</i> sp.	climber	UH 039	Kraikreua	Roots/ decoction/ oral/ fever, tonic
Asclepiadaceae	<i>Hoya parasitica</i> (Roxb.) Wall. ex Traill	shrub	UH 057	Nom Tam Lia	Leaves/ decoction/ oral/ fever
Asteraceae	<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob	herb	UH 071	Sap Suea	Leaves/ poultice/ topical/ wound (bleeding)
	<i>Capparis montana</i> Jacobs	shrub	UH 026	Chingchee	Whole plant/ decoction/ oral/ fever
Capparaceae	<i>Capparis echinocarpa</i> Pierre ex Gagnep.	shrub	UH 082	Nam Pedart	Roots/ decoction/ oral/ diuretic
Celastraceae	<i>Salacia chinensis</i> L.	shrub	UH 019	Lum Nok	Stem/ decoction/ oral/ blood tonic, joint and muscle pain
					Stem/ decoction/ oral/ tonic, hemorrhoids
	<i>Salacia verrucosa</i> Wight	shrub	UH 043	Khobnang Noi	Stem/ decoction/ oral/ joint and muscle pain

Clusiaceae	<i>Gracinia cowa</i> Roxb.	tree	UH 031	Chamuang	Leaves/ raw/ oral/ phlegm, dyslipidemia, dyspepsia
	<i>Garcinia hombroniana</i> Pierre	tree	UH 070	Wa	Fruits/ raw/ oral/ phlegm
	<i>Mesua nervosa</i> Planch. & Triana	tree	UH 073	Nakbud	Fruits/ raw/ oral/ constipation
					Flowers/ decoction/ oral/ dizzy
Combretaceae	<i>Combretum quadrangulare</i> Kurz.	tree	UH 001	Sakae Na	Roots/ decoction/ oral/ dyspepsia
					Seed/ decoction/ oral/ parasites
					Roots/ decoction/ oral/ venereal disease
	<i>Combretum</i> sp.	tree	UH 079	Prakunchaisi	Leaves/ decoction/ oral/ fever
Connaraceae	<i>Connarus semidecandrus</i> Jack	shrub	UH 022	Torptaep Kreua	Leaves/ decoction/ oral/ constipation
Convolvulaceae	<i>Cuscuta reflexa</i> Roxb.	epiphyte	UH 053	Foi Tong	Stem/ decoction/ oral/ muscle pain
					Stem/ decoction/ topical/ toothache
					Stem/ poultice/ topical/ abscesses
Dilleniaceae	<i>Tetracera indica</i> Merr.	climber	UH 059	Pot Leun	Roots/ decoction/ oral/ liver disease
	<i>Tetracera loureiri</i> (Finet&Gagnep.) Pierre ex Craib	climber	UH 078	Tao Lin Seua	Roots/ decoction/ oral/ liver disease
Dioscoreaceae	<i>Dioscorea bulbifera</i> L.	climber	UH 048	Gling Glang	Fruits/ decoction/ oral/ maintenance of testosterone
				Dong	
	<i>Dioscorea hispida</i> Dennst.	climber	UH 007	Gloy	Rhizome/ decoction/ oral/ abscesses
					Rhizome/ poultice/ topical/ abscesses
Fabaceae	<i>Abrus precatorius</i> L.	climber	UH 060	Maklam Ta Nu	Roots/ decoction/ oral/ eye disease
					Leaves/ decoction/ oral/ parasites
	<i>Adenanthera pavonina</i> L.	tree	UH 061	Maklam Ta	Seed/ decoction/ oral/ inflammation
				chang	Roots/ decoction/ oral/ phlegm
	<i>Derris eriocarpa</i> F.C. How	climber	UH 041	Lohtin	Stem/ decoction/ oral/ menstrual disorder
	<i>Desmodium heterocarpon</i> (L.) DC.	climber	UH 050	Kontee Din	Whole plant/ decoction/ oral/ abscesses, inflammation
Flacourtiaceae	<i>Flacourtia indica</i> (Burm.f.) Merr	tree	UH 068	Takop Pa	Bark/ poultice/ topical/ scabies
					Seed/ poultice/ topical/ joint and muscle pain
Gentianaceae	<i>Fragraea fragrans</i> Roxb.	tree	UH 049	Gunrao	Wood, Bark / decoction/ oral/ fever
					Fruits/ decoction/ oral/ abscesses, inflammation
Gnetaceae	<i>Gnetum</i> sp. 1	climber	UH 028	Taomeuay	Stem/ decoction/ oral/ muscle pain
	<i>Gnetum</i> sp. 2	climber	UH 077	Maa Kra-teup	Stem/ decoction/ oral/ maintenance of testosterone, muscle pain
				Rong	
Labiatae	<i>Leucas zeylanica</i> (L.) R. Br	herb	UH 038	Brake	Leaves/ poultice/ topical/ wound (bleeding)
Lamiaceae	<i>Gmelina philippensis</i> Cham.	shrub	UH 040	Song Maew	Leaves/ decoction/ oral/ cancer
	<i>Tectona grandis</i> L.	tree	UH 012	Sak	Roots/ decoction/ oral/ diabetes mellitus
	<i>Vitex glabrata</i> R. Br.	shrub	UH 076	Kai Nao	Bark/ decoction/ oral/ diarrhea
Lauraceae	<i>Cassytha filiformis</i> L.	climber	UH 065	Sangwaan Prain	Whole plant/ decoction/ oral/ dysuria
Lecythidaceae	<i>Burrintonia racemosa</i> L.	tree	UH 042	Jik	Leaves/ decoction/ oral/ diarrhea
					Bark/ poultice/ topical/ heal a wound
Leeaceae	<i>Leea indica</i> (Burm) Merr.	shrub	UH 033	Gatang Bai	Roots/ decoction/ oral/ fever
Liliaceae	<i>Gloriosa superba</i> L.	climber	UH 010	Dongdeung	Rhizome/ poultice/ topical/ joint and muscle pain
Meliaceae	<i>Azadirachta excelsa</i> (Jack) Jacobs	tree	UH 051	Sadao	Leaves/ decoction/ oral/ dyspepsia
					Leaves/ decoction/ oral/ appetizing
					Heart wood/ decoction/ oral/ peptic ulcer
					Fruits/ raw/ oral/ phlegm
	<i>Azadirachta indica</i> A. Juss.	tree	UH 052	Sadao India	Whole plant/ decoction/ oral/ fever
Menispermaceae	<i>Cissampelos pareira</i> L.	climber	UH 015	Grung Khamao	Roots/ decoction/ oral/ fever, jaundice
	<i>Tiliacora triandra</i> Diels.	climber	UH 072	Ya Nang	Roots/ decoction/ oral/ fever
Moraceae	<i>Ficus hispida</i> L.	tree	UH 005	Madeua Plong	Bark/ decoction/ oral/ diarrhea
					Roots/ decoction/ oral/ fever
	<i>Ficus</i> sp.	climber	UH 032	Teen Tukgae	Whole plant/ decoction/ oral/ cancer
	<i>Streblus asper</i> Lour.	shrub	UH 004	Khoi	Bark/ decoction/ topical/ toothache
Myristicaceae	<i>Knema austrosiamensis</i> W.J. de Wilde	shrub	UH 064	Hun	Seed/ poultice/ topical/ scabies, ringworm, Tinea
					versicolor
	<i>Knema globularia</i> (Lam.) Warb.	tree	UH 080	Kun	Seed/ poultice/ topical/ scabies
Myrsinaceae	<i>Ardisia cerenata</i> Sims.	shrub	UH 074	Tapet Takai	Seed/ decoction/ oral/ muscle pain
	<i>Embelia ribes</i> Burm. f.	climber	UH 045	Somkung Khao	Stem/ decoction/ oral/ hemorrhoids
Oleaceae	<i>Jasminum prainii</i> H. LéV.	shrub	UH 058	Maliwan	Flowers/ decoction/ oral/ dizzy
Orchidaceae	<i>Cymbidium finlaysonianum</i> Wall. ex Lindl.	epiphyte	UH 013	Garegaron	Whole plant/ decoction/ oral/ dysuria
Oxalidaceae	<i>Averrhoa carambola</i> L.	tree	UH 017	Mafeuang	Leaves/ decoction/ oral/ fever
	<i>Biophytum sensitivum</i> L.	herb	UH 037	Grateup Yord	Whole plant/ decoction/ oral/ toxin in the body
					Leaves/ decoction/ oral/ fever
Passifloraceae	<i>Passiflora foetida</i> L.	climber	UH 056	Gatokrok	Whole plant/ decoction/ oral/ fever
Phyllanthaceae	<i>Antidesma ghaesembilla</i> Gaertn.	tree	UH 069	Mamao	Fruits/ poultice/ topical/ dandruff
	<i>Bridelia stipularis</i> (L) Blume.	shrub	UH 002	Maga Kreua	Stem/ decoction/ oral/ parasites
					Roots/ decoction/ oral/ tonic
Polypodiaceae	<i>Drynaria sparsisora</i> (Desv.) S. Moore	epiphyte	UH 047	Gratae Tai Mai	Rhizome/ decoction/ oral/ dysuria

	<i>Pyrosia piloselloides</i> (L.) M.G. Price	epiphyte	UH 075	Bia Laen	Whole plant/ decoction/ oral/ fever
Rubiaceae	<i>Morinda elliptica</i> (Hook. f.) Ridl.	tree	UH 003	Yor Pa	Heart wood/ decoction/ oral/ pregnant
	<i>Morinda umbellata</i> L.	climber	UH 062	Tor Yan	Leaves, Stem/ decoction/ oral/ dyspepsia
	<i>Prismatomeris tetrandra</i> (Roxb.) K. Schum.	shrub	UH 044	Gradook Kai	Roots/ decoction/ oral/ fever
	<i>Psychotria</i> sp.	shrub	UH 063	Sulong	Heart wood/ decoction/ oral/ muscle pain
	<i>Ixora javanica</i> (Blume) DC.	shrub	UH 027	Khem Pa	Whole plant/ decoction/ oral/ fever
	<i>Ixora</i> sp.	shrub	UH 036	Khem Khao	Roots/ decoction/ oral/ fever
Rutaceae	<i>Glycosmis pentaphylla</i> (Retz.) DC	tree	UH 011	Koie Tai	Roots/ poultice/ topical/ herpes simplex
	<i>Micromelum minutum</i> (G. Forst.)	tree	UH 055	Ram Pee Pai	Roots/ decoction/ oral/ fever Leaves/ decoction/ oral/ dyspepsia
	Wight & Arn.				
Sapindaceae	<i>Allophylus cobbe</i> L.	tree	UH 066	Tor Sai	Roots/ decoction/ oral/ dysuria, muscle pain
	<i>Lepisanthes fruticosa</i> Leenh.	shrub	UH 009	Chammaliang	Leaves/ poultice/ topical/ fever Roots/ decoction/ oral/ fever
	<i>Lepisanthes rubiginosa</i> (Roxb.) Leenh.	shrub	UH 014	Gamcham	Roots/ decoction/ oral/ tuberculosis
Schizaceae	<i>Lygodium circinatum</i> (Burm.f) Sw.	climber	UH 018	Lipao Haangkai	Whole plant/ decoction/ oral/ prostate cancer
Stemonaceae	<i>Stemona tuberosa</i> Lour.	climber	UH 025	Non Tai Yaak	Whole plant/ decoction/ oral/ skin cancer
Sterculiaceae	<i>Helicteres isora</i> L.	tree	UH 021	Por Bid	Fruits/ decoction/ oral/ constipation
Thymelaeaceae	<i>Linostoma pauciflorum</i> Griff.	shrub	UH 035	Phamee	Roots/ decoction/ oral/ rhinitis
Tiliaceae	<i>Microcos tomentosa</i> Sm.	tree	UH 034	Plabplaa	Leaves/ decoction/ oral/ toxin in the body
	<i>Trema orientalis</i> (L.) Blume	tree	UH 067	Pangrae	Leaves/ poultice/ topical/ dizzy Whole plant/ decoction/ oral/ fever
Ulmaceae	<i>Cissus hastata</i> Miq.	climber	UH 030	Somkung	Stem/ decoction/ oral/ phlegm
Vitaceae	<i>Alpinia malaccensis</i> (Burm.) Roscoe.	herb	UH 029	Kha	Leaves/ poultice/ topical/ ringworm, pityriasis versicolor
Zingiberaceae	<i>Zingiber zerumbet</i> L.	herb	UH 024	Gatue	Rhizome/ decoction/ oral/ dyspepsia Rhizome/ decoction/ oral/ dyspepsia Rhizome/ poultice/ topical/ inflammation

Table 2: Diseases or symptoms to be cured by medicinal plants.

Diseases/symptoms	Frequency	Percentage
Fever	26	20.97
Joint and muscle pain	11	8.87
Dyspepsia	9	7.26
Abscesses	7	5.65
Phlegm	6	4.84
Diarrhea	6	4.84
Skin diseases	6	4.84
Fatigue	6	4.84
Urinary system	5	4.03
Cancer	4	3.23
Midwifery	4	3.23
Wound	4	3.23
Liver diseases	3	2.42
Parasites	3	2.42
Maintenance of testosterone	3	2.42
Dizzy	3	2.42
Toxin in the body	2	1.61
Constipation	2	1.61
Hemorrhoids	2	1.61
Toothache	2	1.61
Peptic ulcer	1	0.81
Venereal disease	1	0.81
Menstrual disorder	1	0.81
Appetizing	1	0.81
Jaundice	1	0.81
Dyslipidemia	1	0.81
Rhinitis	1	0.81
Diabetes mellitus	1	0.81
Eye diseases	1	0.81
Tuberculosis	1	0.81

Plant parts used:

There are 9 plant parts used by local healers for treatment of diseases (Table 3). Underground parts namely, roots and rhizomes, are mostly used with 36 species (32.73%), followed by leaves with 20 species (18.18%) and stems with 15 species (13.64%), respectively.

Most of underground parts are used to treat fever, for example, roots of *Tiliacora triandra* Diels., *Bouea oppositifolia* (Roxb.) Meisn and *Polyalthia suberosa* (Roxb.) Thwaites.

Using of roots as the materia medica is found in other areas of Thailand such as Yasothon and Chiang Mai Province [42]. In addition, it is also preferred in abroad such as Bangladesh [16].

For Thai Traditional Medicine, it is believed that roots or rhizomes accumulate more substances than

other plant parts. Consequently, these parts are more widely preferred for using in folk medicine.

Noticeably, many parts of one species could be used for treating the same disease. For example, roots and stems of *Ancistrocladus tectorius* (Lour.) Merr. are used mixedly or separately to treat fever. On the other hand, different parts of one species could be used for treating different diseases. For example, leaves of *Burringtonia racemosa* L. are used to treat diarrhea, while its barks are used to treat wound. Traditionally, it is theorized that taste of drug is the essential for disease treating. If many plant parts can cure one ailment, it means that those parts have the same taste. On the contrary, if different parts are used to treat different ailment, it means that those parts have the different tastes.

Table 3: Plant part used.

Plant part	Frequency	Percentage
Root/rhizome	36	32.73
Leaf	20	18.18
Stem	15	13.64
Whole plant	13	11.82
Fruit	9	8.18
Seed	6	5.45
Bark	5	4.55
Heart wood	4	3.64
Flower	2	1.82

Herbal preparations:

There are 3 herbal preparation forms documented from this study. The three most frequently used preparation forms are decoction for 87 species (79.82%), followed by poultice for 16 species (14.68%) and raw for 5 species (4.59%).

It was found that some medicinal plants could be prepared with different preparation forms for treating different diseases. For example, *Zingiber zerumbet* L. is prepared as decoction for dyspepsia healing, whereas poultice is prepared for inflammation healing.

From this study, there are 2 methods for decoction preparation. The former, materials are washed and then added clean water with 3 times of required volume. After that, materials are boiled and simmered until the liquid decreased to be a third of original volume. This method is selected for healing disease directly or healing severe disease because it is believed that most active ingredients could be extracted well. For instance, *Fragraea fragrans* Roxb. is used to treat fever, and *Allophylus cobbe* L. is used to treat dysuria.

The latter, materials are washed and then added clean water with required volume. After that, materials are boiled until steam is obtained. The liquid is then drunk as tea. This method is selected when required for health care, and drug is taken as the supplements. In addition, this method is used for not severe diseases. For instance, *Micromelum minutum* (G.Forst.) Wight & Arn. is used to treat

dyspepsia, and *Mesua nervosa* Planch. & Triana is used to treat dizzy.

For poultice, drug materials are ground or pounded into small pieces. It is mostly prepared for skin diseases. With this method, crude drugs would be extracted with less quantity of active ingredients comparing to decoction. Therefore, some substances are mixed while processing for efficient extraction. These adding substances also promote skin to absorb active ingredients. For instance, *Gloriosa superba* L. is mixed with quicklime to treat joint and muscle pain, and *Knema austrosiamensis* W.J. de Wilde. is mixed with alcohol to treat ringworm.

In case of raw materials, plant parts are used without passing any processes. For instance, fresh fruits of *Bouea oppositifolia* (Roxb.) Meisn. and *Garcinia cowa* Roxb. are used to treat dissolve phlegm and constipation, respectively.

Route of administration:

Two routes of administration: oral and topical were revealed. Oral is the most preferred route of administration with 91 species (85.05%). It is usually concerned about drinking of decoction drug or eating raw materia medica. Generally, decoction is drunk before regular meals for healing diseases, and it is drunk as needed in case of drugs for supplements. Traditionally, it is believed that taking drug before meals is benefit for absorbing bioactive substance.

For topical, there are 16 species (14.95 %) involved. This route, most drug preparations as poultices are applied or covered on skin lesion.

Drugs are leaved on skin for about 2 hours before washing it. Two times daily are practiced until recovering.

Discussion:

Common diseases:

From this study, fever is the disease/ symptom including the most species for treating. In modern medicine, fever is a group of diseases that characterized by higher body temperature than normal stage. Meanwhile, in Thai Traditional Medicine, fever is the stage of imbalance of the four elements- soil, water, air, and fire- within the body which causing sickness. Malaria, dengue, and typhoid are examples of diseases categorized in to a group of fever according to Thai Traditional Medicine. In addition, malaria and typhoid are types of fever that local healers mostly have experienced.

In Thai Traditional Medicine, it is believed that drug used to treat fever must have bitter and cool taste. This study shows that herbal plants used for

fever healing consistent to that statement. For example, whole plant of *Azadirachta indica* A. Juss. has bitter, and root of *Leea indica* (Burm) Merr. has cool taste.

Comparison to related studies:

The folk wisdom of herbal utilization obtained from this study was compared to 2 related studies in adjacent areas. The former is a study of medicinal plants from Thale-noi wetland, Phatthalung province [47] which 8 same species were found. For example, *Chromolaena odorata* (L.) R.M. King & H. Rob. is used to treat wound, and *Glycosmis pentaphylla* (Retz.) DC is used to treat herpes. The latter is a study of medicinal plants from Sating Phra Peninsula, Songkhla Province [29] which 9 same species were found. For example, *Combretum quadrangulare* Kurz. is used to treat anthelmintic, and *Leucas zeylanica* (L.) R. Br. is used to treat wound (Table 4).

Table 4: The consistence of species and properties found in Hua Khao subdistrict and related studies.

Upho [47]	Neamsuvan et al. [29]
<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.	<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.
<i>Knema globularia</i> (Lam.) Warb.	<i>Combretum quadrangulare</i> Kurz.
<i>Glycosmis pentaphylla</i> (Retz.) DC	<i>Leucas zeylanica</i> (L.) R. Br.
<i>Linostoma pauciflorum</i> Griff.	<i>Tiliacora triandra</i> Diels.
<i>Azadirachta indica</i> A. Juss.	<i>Passiflora foetida</i> L.
<i>Tiliacora triandra</i> Diels.	<i>Pyrrosia piloselloides</i> (L.) M.G. Price
<i>Averrhoa carambola</i> L.	<i>Morinda elliptica</i> (Hook. f.) Ridl.
<i>Prismatomeris tetrandra</i> (Roxb.) K. Schum.	<i>Glycosmis pentaphylla</i> (Retz.) DC
	<i>Allophylus cobbe</i> L.

Comparison to herbs recorded in Textbook of Thai Traditional Medicine:

Textbook of Thai Traditional Medicine is the book recording all concepts of Thai Pharmacy (Bureau of Sanatorium and Art of Healing, n.d.). Many medicinal plants frequently used by traditional

Thai healers have been recorded. After comparison, local properties of 29 studied species are similar to those from Textbook of Thai Traditional Medicine. This may reflects that local healers have applied Thai Traditional Medicine knowledge into local wisdom for their use (Table 5).

Table 5: The consistence of species and properties found in Hua Khao subdistrict and textbook of Thai Traditional Medicine.

Fever	Joint and muscle pain	Diarrhea
<i>Bouea oppositifolia</i> (Roxb.) Meisn.	<i>Salacia chinensis</i> L.	<i>Bridelia stipularis</i> (L.) Blume.
<i>Fragraea fragrans</i> Roxb.	<i>Allophylus cobbe</i> L.	<i>Vitex yunnanensis</i> W.W.Sm.
<i>Leea indica</i> (Burm.f.) Merr.	Constipation	Liver diseases
<i>Azadirachta indica</i> A. Juss.	<i>Gracinia cowa</i> Roxb.	<i>Tetracera loureiri</i> (Finet & Gagnep.) Pierre ex Craib
<i>Cissampelos pareira</i> L.	<i>Connarus semidecandrus</i> Jack	<i>Caryota mitis</i> Lour.
<i>Tiliacora triandra</i> Diels.	<i>Dioscorea hispida</i> Dennst.	Eye diseases
<i>Averrhoa carambola</i> L.	Phlegm	<i>Abrus precatorius</i> L.
<i>Passiflora foetida</i> L.	<i>Gracinia cowa</i> Roxb.	Toothache
<i>Allophylus cobbe</i> L.	<i>Adenantha pavonina</i> L.	<i>Streblus asper</i> Lour.
Skin diseases	<i>Cissus hastata</i> Miq.	Blood tonic
<i>Flacourtia indica</i> (Burm.f.) Merr.	Dyspepsia	<i>Salacia chinensis</i> L.
<i>Glycosmis pentaphylla</i> (Retz.) DC	<i>Alpinia malaccensis</i> (Burm.) Roscoe	Parasites
<i>Stemona tuberosa</i> Lour.	<i>Zingiber zerumbet</i> L.	<i>Combretum quadrangulare</i> Kurz.
	Urinary system	
	<i>Allophylus cobbe</i> L.	

Comparison to PROSEA:

PROSEA (Plant Resources of South-East Asia) is an international database for documenting information on plant resources in South-East Asia [33]. Comparison to PROSEA stated that 10 species are consistently used to folk knowledge in this study.

For example, *Salacia chinensis* L. from Philippines is used to treat Amenorrhoea, and *Leucas zeylanica* (L.) R. Br. from Malaysia is used for wound treating. In addition, *Gloriosa superba* L. from India is used to treat inflammation (Table 6).

Table 6: The consistence of species and properties found in Hua Khao subdistrict and PROSEA.

Scientific name	disease	Country
<i>Salacia chinensis</i> L.	Amenorrhoea	Philippines
<i>Combretum quadrangulare</i> Kurz.	anthelmintic	Philippines
<i>Leucas zeylanica</i> (L.) R. Br	heal wounds	Malaysia
<i>Cassytha filiformis</i> L.	diuretic	India
<i>Gloriosa superba</i> L.	anti-arthritis	India
<i>Cissampelos pareira</i> L.	jaundice	South East Asian countries
<i>Biophytum sensitivum</i> L.	fever	Malaysia
<i>Micromelum minutum</i> (G.Forst.) Wight & Arn.	stomachache	Philippines
<i>Stemona tuberosa</i> Loureiro.	skin diseases	South East Asian countries
<i>Alpinia malaccensis</i> (Brum.) Roscoe.	cure wounds	Philippines

Comparison to biological activity:

From this study, 19 medicinal plants shows that their folk properties are consistent to their biological activities studied previously (Table 7). For example, leaf of *Biophytum sensitivum* L. is traditionally used as antipyretic, while its biological activity shows antibacterial activity of leaf extract [27]. Root of

Tiliacora triandra Diels is traditionally used as antimalarial, while its biological activity shows resisting *Plasmodium falciparum* infection which causes malarial fever [35]. In addition, rhizome of *Zingiber zerumbet* L. is traditionally used to treat inflammation, while its biological activity shows inflammation reduction in mice [44].

Table 7: Biological activities of some medicinal plants.

Scientific name	Traditional uses (plant part/ disease)	Pharmacological activities (References)
<i>Averrhoa carambola</i> L.	Leaf/ fever	Antirotavirus activity [15]
<i>Azadirachta indica</i> A. Juss.	Whole plant/ fever	Antiplasmodial activity [50]
<i>Biophytum sensitivum</i> L.	Leaf/ fever	Antibacterial activity [27]
<i>Cassytha filiformis</i> L.	Whole plant/ bleeding	Antiplatelet activity [49]
<i>Chromolaena odorata</i> (L.) R.M. King & H. Rob.	Leaf/ bleeding	Antiplatelet activity [22]
<i>Cissampelos pareira</i> L.	Root/ fever	Antiplasmodial activity [34]
<i>Cuscuta reflexa</i> Roxb.	Stem/ toothache	Analgesic activity [5]
<i>Desmos cochinchinensis</i> Lour.	Stem/ fever	Antimicrobial activity [20]
<i>Ficus hispida</i> L.	Root/ fever	Antiplasmodial activity [32]
<i>Gloriosa superba</i> L.	Rhizome/ inflammation	Analgesic and antiinflammatory activity [18]
<i>Gmelina philippensis</i> Cham.	Leaf/ cancer	Antioxidant activity [12]
<i>Morinda elliptica</i> (Hook. f.) Ridl.	Root/ fever	Antiviral and antimicrobial activities [4]
<i>Passiflora foetida</i> L.	Whole plant/ fever	Antibacterial activity [26]
<i>Polyalthia suberosa</i> (Roxb.) Thwaites	Root/ fever	Analgesic and anti-inflammatory activity [8]
<i>Stemona tuberosa</i> Lour.	Whole plant/ skin cancer	Antimigration of cancer cells [21]
<i>Streblus asper</i> Lour.	Leaf/ toothache	Antimicrobial activity [48]
<i>Tectona grandis</i> L.	Root/ Diabetes mellitus	Antidiabetic activity [37]
<i>Tiliacora triandra</i> Diels.	Root/ fever	Antiplasmodial activity [35]
<i>Zingiber zerumbet</i> L.	Rhizome/ inflammation	Anti-inflammatory activity [44]

Medicinal plants with new properties recorded:

From this study, new herb property is obtained from *Polyalthia suberosa* (Roxb.) Thwaites. Its root is added into a remedy named "Benchalokawichian" for antipyretic.

Generally, Benchalokawichian comprises roots of 5 plants, namely *Harrisonia perforata* Merr., *Capparis micracantha* DC., *Tiliacora triandra* Diels., *Tacca leontopetaloides* L. and *Ficus racemosa* L. It is traditionally used for fever relieving. After adding roots of *Polyalthia suberosa* (Roxb.) Thwaites, the remedy name is changed to be "Ya Hok Rak" meaning remedy constituting of 6 root materials.

As mentioned above, it presents that local healers would modify standard drug based on their experience and plant resource for healing any disease.

Interesting plants for promoting to cultivate near household:

Generally, any plants with various and frequent uses might be taken to cultivate near household. The species selected as domesticated plant must have not only drug properties but also foods and ornamental conditions should be considered.

Bouea oppositifolia (Roxb.) Meisn. or Mapring is herb for fever and phlegm. Its fruit is also a type of tropical fruit which is not widely consumed

nowadays. This may be caused by its sour taste and small size comparing to other closely related species. However, food products from this fruit such as jam or juice should be developed. In addition, the similar food products should be performed to *Lepisanthes fruticosa* Leenh. and *Lepisanthes rubiginosa* (Roxb.) Leenh. as well.

Mesua nervosa Planch. & Triana or Nakbud is herb for dyspepsia and dizzy. Its flower is about a diameter of 3 centimeters, white and very fragrant. This plant is suitable for growing as ornamental plant. Another species is *Prismatomeris tetrandra* (Roxb.) K. Schum. which should be promoted for this benefit. In contrast, people who like colorful flowers should not miss *Gloriosa superba* L. or Dongdueng which its flower is red and yellow and showy.

By the way, people who interested to primarily treat themselves when facing to health problem, are introduced to grow any medicinal plants for common diseases such as fever, skin diseases and dyspepsia.

Interesting place for Eco-tourism:

Geologically, tropical rain forest in Huakhao subdistrict is composed of many mountains and flanked by Sonhkhla lake. This beautiful geography included with beautiful ancient temples and rich diversity of medicinal plants, should be promoted for eco-tourism. If existence of forest offers income for inhabitants, it will be conserved appreciatingly by beneficiary for sustainable use.

Conclusion:

The studied area, Hua khao subdistrict, Singha Nakhon district, Songkhla province, presents one of high plant diversity area in Thailand. However, some parts of studied area were damaged by human activities for housing and cultivation, particularly para plantation. Consequently, nowadays, some medicinal plants are less abundant such as *Polyalthia parviflora* Ridl., *Prismatomeris tetrandra* (Roxb.) K. Schum. and *Mesua nervosa* Planch. & Triana. Terribly, key informants said that some plant species are lost from the area such as *Cinnamomum bejolghota* (Buch.-Ham.) Sweet and *Curculigo latifolia* Dryand. ex W.T. Aiton.

Therefore, this study is a compilation in folk knowledge on medicinal plant utilization as evidence database before losing forever. It is also a basis for further study in either sustainable conservation or drug development.

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