

MEDICINAL HERBS OF PASIR MAYANG, JAMBI: ETHNOPHARMACY AND TOXICITY SCREENING

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ABSTRACT

This article presents the results of an investigation concerning the use of herbal medicinal plants by the people of Pasir Mayang, sub-District (Municipality) of VII Koto, District of Tebo, Jambi Province, Sumatera. The data collection was based on interviews with the healers and other villagers of Pasir Mayang who possess knowledge of the different plants and their medicinal uses. The study recorded 57 species of medicinal plants used in Pasir Mayang. The detailed uses of the 57 medicinal plants are given. All plant species were subjected to phytochemical analysis and toxicity tests, and the outcome of the analysis on the presence of alkaloids, saponins, steroids/terpenoids, and the level of toxicity against brine shrimp (*Anemia salina*) are presented. A comparison with other studies reported in the literature seems to indicate that a high frequency of the use of leaves in therapy may be a part of a larger cultural phenomenon among the tropical forest tribes of Southeast Asia.

Keywords : Indonesia/Jarabi/Pasir Mayang/medicinal plants/ethuophannacy/toxicity screening

INTRODUCTION

Pasir Mayang is the name of an area in the District of Tebo in the province of Jambi. In the beginning, the name of Pasir Mayang was Dusun Tuo. However, since the establishment of PT Industries et Forest Asiatiques (IFA), it has used the name Pasir Mayang. In line with the increasing population and then later, with the influx of settlers from neighboring communities, Pasir Mayang developed to become several villages which were administratively included in the sub-district of VII Koto.

Pasir Mayang can be reached by road from the District of Muara Bungo, traversing about 20 km, then turning right at the Simpang Sawmill for about another 20 km on the way to the Transmigration Area of Rimbo Bujang to the village of Dusun Tuo. From there, the sub-district VII Koto can be reached by continuing 8 km more. The access to the village of Sungai Karang can be reached from Dusun Tuo through unpaved roads traversing 3 km to Batanghari River, then crossing the Batanghari River by boat and taking another 15 km more of unpaved roads to the village of Sungai Karang.

The sub-district VII Koto covers an area of 112,700 ha bordering the province of West Sumatera in the northern side. The southern part of the area is bounded by the sub-district of Tebo Ulu, and the western side by the District of Bungo. Meanwhile, the eastern side is bounded by the Province of Riau.

The population of the sub-district VII Koto, based on a census conducted by the office of sub-district VII Koto on April 2001, is composed of 19,249 individuals which consisted of 9,595 men, and 9,654 women, comprising over 11 villages.

Forest is no longer a source of income for the people of Pasir Mayang. The forest in the area has been used for collecting a wide range of forest fruits and medicinal plants, not to mention building materials and firewood. Occasionally, people collect rattan from the forest, but even this is hard to find, because lots of rattan had been collected for a long time for commercial purposes. While the people of Pasir Mayang are not "primitive" forest-dwellers, they have retained a relatively simple agricultural way of life. Therefore, agriculture is the main occupation of the people of Pasir Mayang. Traditional farming (*ladang*) usually takes place far away from the villages and this usually involves one-quarter to one-half hectare of forest which are cleared and burned and planted with a wide variety of crops. Most of their harvest, however, are adequate only to supply their own needs.

The cultivation of "pohon karet" or rubber tree (*Hevea brasiliensis*) is important in Pasir Mayang as one of the main sources of income in this otherwise moneyless society. Rubber is planted in the forest close to the villages. At certain ages of the rubber trees, farmers tap and collect the latex, and sell them to the collectors in the district of VII Koto or Tebo. They also plant coffee in the forest for their own use or sell to the market.

The health center, more widely known as *Puskesmas*, is located in the sub-district of VII Koto, headed by a medical doctor, assisted by another medical doctor, one dentist and eight paramedical personnel. Health services are provided free of charge for those who could provide proof that they are not able to pay. A *Bidan* (nurse) is available in each village. Nurses are trained to diagnose basic illnesses and diseases and can provide a number of common medicines. These common generic medicines which are subsidized by the government with generic names, are supplied every three months from the Health Center in the sub-district of VII Koto and are given free of charge. *Pembantu Puskesmas* (health sub-centers) exist in each village in the sub-District of VII Koto, headed by a nurse and some paramedical personnel.

The most prevalent illnesses are diarrhea, cholera and malaria. Meanwhile, other communicable diseases include leprosy, framboesia, tetanus neonatorum, diphtheria, whooping cough, and filariasis. No smallpox cases have been registered. Due to the proximity of the area, and also on account of scarcity of medicine, doctors could not conduct regular visits to villages, which are far from the sub-District of VII Koto. Only when an epidemic occurs or the situation becomes really threatening medical assistance will be sent. The distance between the district and the health centers, as well as the high expenses which travel incurs are the main obstacles preventing the population from making use of the health facilities provided by the government for them.

People generally accept the modern medicines that provide wide therapeutic measures for illnesses and diseases that people suffer from, except for mental illness.

For this group of diseases, people will then ask for help directly from the traditional healers. In much the same way, if health problems persist and cannot be solved by the health center, they will then turn to traditional healers who combine herbal remedies with mystical ceremonies which, according to those interviewed, counter the influence of what was generally believed to be "evil spirits" which are responsible for the illnesses, diseases, or even accidents the citizens experience.

Almost all cultures have a long history of folk or traditional medicine, which includes the use of medicinal plants or herbs prescribed by local folk or traditional doctors in the neighborhood. Even in ancient cultures, people methodically and systematically collected information on herbs and developed well-defined herbal pharmacopoeias. This must have also occurred to the ancient people of Pasir Mayang, for there are still quite a number of traditional healers who do their ritual practices in the communities.

This study provides an outline of the contemporary knowledge on the use of herbal medicinal plants by the community around Pasir Mayang with the purpose of preserving this aspect of traditional knowledge for the generations to come.

Specifically, this research aims to make an inventory of herbal medicinal plants available in Pasir Mayang and how these are used by the community residents. It further aims to describe the herbal plants used for medicinal treatment by the indigenous people paying particular attention to the methods of preparation prior to its use, identification of the specific illness or disease that can be treated by each plant, and the effect of the treatment. Phytochemical analysis and toxicity tests had also been conducted on the medicinal plants collected in the area, to determine the toxic level of the methanolic plant extracts against brine shrimp (*Artemia salina*) and to trace the presence of specific chemical substances such as alkaloids, steroids, saponins, and flavonoids.

METHODOLOGY

Data collection of Pasir Mayang medicinal plants

Information on the traditional medicinal plants and herbs in Pasir Mayang was collected by a team of four workers in a duration of two months in the year 2003, in April and October. Information was obtained for the series of one-hectare plots. In each case, one-strip transects (25 x 100m) were made within each plot marked out by coloured plastic ropes at both ends and in the centre. Inputs were collected in the presence of local healers or other villagers by walking along the centre line. The villagers were asked to identify the local names and uses of each plant occurring within the series of transects. For every plant with indication of traditional use(s), every information was recorded and herbarium specimens of each species were collected by pressing between newsprints, stacked and placed in heavy plastic bags, treated with denatured alcohol and packed, opened only upon arrival at the SEAMEO BIOTROP laboratory in Bogor. Small amounts of plant materials from

each plant were taken to the SEAMEO BIOTROP natural products laboratory for phytochemical analysis carried out at a later date.

Toxicity test (brine shrimp lethality bioassay)

Twenty grams of air-dried plant materials from each species were extracted with methanol at room temperature. The crude extracts were evaporated under reduced pressure until dried. Sea water was poured into a small tank and shrimp eggs were added to the tank provided with aerator. After two days the shrimp eggs hatched and mature as *naupili*. Each crude extract was weighed (20 mg) and dissolved with dichloromethane (2 ml). From this solution, 500, 50, 5 μ l were transferred to small petri dish corresponding to 1000, 100, 10 (J.g/ml (ppm), respectively (Meyer *et al.* 1982). The solvent was evaporated by standing overnight at ambient temperature. After two days, when the shrimp larvae were ready, sea water was added to each petri dish containing 10 shrimps per dish (30 shrimps per dilution), and adjusted the volume with sea water to 5 ml/dish. The number of shrimps that survived were counted and recorded after 24 hours. The data were analyzed with Finney computer program to determine LC₅₀ values at 95% confidence intervals (Hostettmann 1991). Each crude extract of the sample was tested in three replicates with one control each. The controls were treated in a similar manner without the presence of the crude extracts.

Phytochemical analysis

Alkaloid testing was conducted according to procedures described by Culvenor and Fitzgerald (1963) : two to four leaves, fruits and/or bark of each plant of the collected species were preserved in ethanol, after being dried in the laboratory, grounded with clean sands and added with 10 ml chloroform. Ammoniacal chloroform (10 ml, 0.05 M) was added, stirred and filtered, then shaken with aqueous sulphuric acid (10 drops, 2M). Then the aqueous layer was tested with Mayer's reagent. A dense, heavy precipitate was designated as 3+, strong precipitate as 2+ and weak precipitate as 1+.

Terpenoids/steroids and saponins were screened on the basis of Liebermann-Burchard and froth test, respectively, as generally described by Simes *et al.* (1959). An amount of 2-4 g dry leaves were cut into small pieces and boiled in ethanol (25 ml, 15 min.), filtered while still hot and evaporated to dryness. The extract was triturated with ether and the insoluble ether shaken with water (ca. 5 ml) in a Vi x 5-inch test tube. A foam more than 3 cm and lasting for more than 15 minutes was designated as 3+, between 2-3 cm was designated as 2+ and foam of 1-2 cm was designated as 1+. The ether soluble fraction was subjected to the Liebermann-Burchard test using acetic anhydride and sulphuric acid. The formation of a bright purple, red or pink coloration was considered 3+ while moderate and weak color-

tion were designated 2+ and 1+, respectively. In the case of doubtful coloration produced, the ethereal fraction was passed through a Pasteur pipette filled with active charcoal just enough to absorb chlorophyll and treated as above.

RESULTS AND DISCUSSION

A total of 57 herbs were collected and noted according to their uses for various purposes by the healers and villagers of Pasir Mayang. Of these, the medicinal uses which were presumed magical or superstitious in nature were considered of no interest for the present study and have been omitted for further discussions. Many of these comprise common weedy species and a few cultivated ones, all of which were easily available, in those areas where this study was conducted, as well as in most other villages in Pasir Mayang (Affandi *et al.* 1996). Many of the plants, however, were of forest origin, growing in the secondary and little-disturbed forests in the surrounding areas.

In the list, species were arranged alphabetically by family/followed by common name / plant part(s) used / and a description of their uses. These were summarized in Appendix 1.

Medicinal Uses

The process to cure common maladies and illnesses among the people of Pasir Mayang involves accessing both traditional and modern methods. Generally, the people of Pasir Mayang rely mostly on traditional medicines to treat minor ailments or are used as first aid towards a cure. They seek "modern" medicine only when the traditional methods have been exhausted.

The most frequently utilized plant part is the leaf (Table 1). This preference for leaves is apparently derived from the fact that therein, many species store high concentrations of bioactive compounds (Moore 1994). In addition to efficacy, other factors that may contribute to the preference for leaves as medicine include the ease with which they may be collected, stored, and transported and the ease with which bioactive compounds may be extracted.

The most frequently cited modes of preparation (Table 2) were: poultice (mashed, crushed, or chopped plant part), decoctions (boiling of plant parts), and used directly from the plants (none).

The most frequently encountered modes of administration are oral and topical (Table 3) which may be preferred because they are believed to be the most effective means for delivering bioactive compounds into the body.

Table 1. Parts of medicinal plants used by Pasir Mayang people

Part used	Total
Leaf	44
Fruit	3
Root	6
Flower	2
Bulb	1
Stem	4

Table 2. Mode of preparation frequently used for Pasir Mayang medicinal plants

Mode	Total
Poultice	34
Decoction	19
None	8

Table 3. Mode of administration of medicinal preparations by Pasir Mayang people

Mode	Total
Oral	34
Topical	23
Bath	4
Inhalation	-

Phytochemical Analysis and Toxicity Tests

The phytochemical analysis is a preliminary test to trace the presence of specific chemical substances such as alkaloids, steroids/triterpenes, and saponins without resulting to a biological screening. A total of 57 species from 30 families were phytochemically tested in the Laboratory of Natural Products at SEAMEO BIOTROP. The results of the tests are summarized in Table 4.

Table 4. Phytochemical Analysis and Toxicity Tests of Plant Extracts of the Medicinal Plants Collected from Pasir Mayang

No.	Species	Local Name	Part used	Alkaloid	Saponin	Steroid/ Tri terpenoid	Toxicity LC ₅₀ (i.c.95%)
Acanthaceae							
1	<i>Justicia gendarusa</i> Linn.	Setajam	L	-	1+	2+	> 1000
Amaranthaceae							
2	<i>Calosia argentea</i> Linn.	Bunga merah	L	-	2+	2+	645
Amaryllidaceae							
3	<i>Curculigo capitulata</i> O.K.	Ketari/Katorih bareh	L	-	-	1+	> 1000
4	<i>Curculigo latifolia</i> Dryand	Benit	L	-	1+	2+	> 1000
Asclepidirceae							
5	<i>Cryptolepis javanica</i> Bl.	Akar daun taun	L	-	1+	3+	> 1000
6	<i>Hoya</i> sp.	Daun setebal	L	-	1+	3+	875
Asteraceae							
7	<i>Blumea balsamifera</i> DC.	Celapo tai	L	-	2+	3+	> 1000
Burseraceae							
8	<i>Canarium littorale</i> Bl.	Ampelas licin	L	-	1+	2+	> 1000
Connaraceae							
9	<i>Roureopsis javanica</i> Planch.	Akar jaring tupai	L	-	-	2+	> 1000
Cyatheaceae							
10	<i>Hemitelia latebrosa</i> Mett.	Pakis longgok	L	-	2+	1+	> 1000
Dioscoreaceae							
11	<i>Dioscorea aculeata</i> Linn.	Kabenar	L	-	2+	1+	> 1000
Euphorbiaceae							
12	<i>Melanolepis multiglandulosa</i> Reich.ex Zoll.	Bunga sepanggih	L	-	1+	1+	> 1000
Gleicheniaceae							
13	<i>Gleichenia linearis</i> Clarke	Resam	L	-	1+	1+	143
Graminaceae							
14	<i>Centothea latifolia</i> Trin.	Rambut pulut- pulut	L	-	1+	2+	> 1000

Table 4. Continued

No	Species	Local Name	Part used	Alkaloid	Saponin	Steroid/ Tri terpenoid	Toxicity LC ₅₀ (i.c.95%)
15	<i>Driockloa djainkareh</i> Bush.	Buluh hitam	L		1+	1+	> 1000
16	<i>Gigantochloa hasskarliana</i> Becc.	Bambu nipis	L	-	1+	1+	> 1000
17	<i>Schizostachyum zollingeri</i> Kurz.	Buluh nipis	L	-	1+	2+	> 1000
Labiatae							
18	<i>Ocimum basilicum</i> L.	Selasih A	L	-	1+	2+	> 1000
Leguminosae							
19	<i>Cassia alata</i>	ketepeng	L	-	1+	2+	> 1000
20	<i>Milletia scicea</i> W.et	Akar semambu	L	-	1+	2+	> 1000
Liliaceae							
21	<i>Dianella montana</i> Bl.	Batang sia/ Akar sayak	L	-	1+	1+	> 1000
22	<i>Smilax leucophylla</i> Bl.	Akar gunung	L	-	1+	1+	> 1000
23	<i>Mucuna gigantea</i> DC	Akar katai	R	-	1+	2+	> 1000
Menispermaceae							
24	<i>Fibraurea</i> sp.	Akar kunyit	R	4+	1+	2+	608
25	<i>Percampylus glaucus</i> Merr.	Akar limpanang/ Akar manang/ Akar benang	L	-	1+	2+	> 1000
Monimiaceae							
26	<i>Kibara</i> sp.	Udu karo	L	-	1+	1+	> 1000
Piperaceae							
27	<i>Piper aduncum</i> Lind.	Kayu sirih	L	-	1+	3+	> 1000
28	<i>Piper betle</i> Linn.	Sirih	L	-	2+	2+	> 1000
29	<i>Piper</i> sp.	Akar sirih duduk	L	-	1+	2+	> 1000
30	<i>Piper</i> sp.	Sirih antu	L	-	1+	2+	295
Polypodiaceae							
31	<i>Aspidium ternatense</i> A.v.R.	Kelakap	L	-	1+	3+	> 1000

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Table 4. Continued

No	Species	Local Name	Part used	Alkaloid	Saponin	Steroid/ Tri terpenoid	Toxicity LC ₅₀ (i.c.95%)
32	<i>Dictyopteris irregularis</i> Pr.	Paku limat	L	1+	1+	-	2
33	<i>Dryopteris boryana</i> O.Chr.	Pakis longgoh	L	-	2+	1+	> 1000
34	<i>Lomariopsis spectabilis</i>	Pakis gajah	R	-	1+	1+	> 1000
35	<i>Nephrolepis hirsutula</i> Presl.	Pakis	L	-	1+	1+	> 1000
Rhamnaceae							
36	<i>Zizyphus</i> sp.	Akar kait	L	3+	1+	2+	> 1000
Rhyzoporaceae							
37	<i>Anisophyllea disticha</i> Baill.	Batang ibu/ Batang beribu	L	-	2+	2+	> 1000
Rubiaceae							
38	<i>Ixora javanica</i> DC.	Kayu telor	L	-	2+	1+	> 1000
39	<i>Uncaria</i> sp.	Akar kait	L	3+	1+	2+	654
40	<i>Uncaria</i> sp.	Akar kukualang	L	-	1+	2+	> 1000
Rutaceae							
41	<i>Clausena excavata</i> Burm.	Daun secere/ Cere-cere/ Kayu angit	L	1+	1+	1+	> 1000
Schizophyceaceae							
42	<i>Lygodium circinatum</i> Sw.	Akar kawel/ Akar sapoi/ Akar menang	L	-	-	2+	999
Selaginellaceae							
43	<i>Selaginella plana</i> Hieron	Sigagar tegak/Paku anai-anai/ Kuku bener/ Nganai duduk	L	-	3+	-	> 1000
Solanaceae							
44	<i>Solanum torvum</i> Sw.	Dubang	L	-	2+	3+	> 1000

Table 4. Continued

No	Species	Local Name	Part used	Alkaloid	Saponin	Steroid/ Tri terpenoid	Toxicity LC ₅₀ (i.c.95%)
Verbenaceae							
45	<i>Clerodendron inerma</i> Gaertn.	Bunga pekan	L	-	2+	2+	282
46	<i>Clerodendron squamatum</i> Vahl.	Bunga panggil	L	-	1+	1+	> 1000
47	<i>Lantana camara</i> Linn.	Sadancing	L	-	-	2+	50
Violaceae							
48	<i>Rinorea</i> sp.	Kayu pecat	L	-	1+	1+	> 1000
Vitaceae							
49	<i>Cissus</i> sp.	Akar kudang	L	-	1+	2+	> 1000
50	<i>Vitis</i> sp.	Daun katak	L	-	1+	2+	> 1000
Zingiberaceae							
51	<i>Achasma foetens</i> Val.	Puar angit	L	-	2+	3+	> 1000
52	<i>Costus rumphianus</i> Linn.	Setawal	L	--	1+	2+	> 1000
53	<i>Costus sericeus</i> Bl.	Lempung puar	L	--	1+	1+	> 1000
54	<i>Costus</i> sp.	Daun layang	L	--	1+	1+	> 1000
55	<i>Costus speciosus</i> Sm.	Setawau	L	1+	1+	3+	> 1000
56	<i>Globa maculata</i> Bl.	Puar emas	L	-	1+	2+	> 1000
57	<i>Riedelia carviflora</i> Oliv.	Puar angit	L	-	1+	2+	> 1000

*L: Leaves ; R: Root

Alkaloids

Of the 57 plant species, three species gave strong positive reaction (3+ - 4+) to alkaloid. Those species were *Fibraurea sp.*, *Zizyphus sp.*, and *Uncaria sp.* (Table 5).

Table 5. Plants giving strong positive reaction to Alkaloids

Family	Species
Menispermaceae	- <i>Fibraurea sp.</i>
Rhamnaceae	- <i>Zizyphus sp.</i>
Rubiaceae	- <i>Uncaria sp.</i>

Saponins

Of the 57 species tested for positive reaction to saponins, 12 species gave a strong positive reaction (3+ - 4+) (Table 6). Saponin is particularly prevalent in *Bridelia glauca*, *B. minutiflora*, *Macaranga triloba*, *Callophylum mucumense*, *Litsea aurea*, *Barringtonia racemosa*, *magnolia mackottii*, *Pternandra coerulescens*, *Ficus variegata*, *Eugenia sp.*, *Arenga pinnata*, *calamus sp.*, *Miletia sp.*, *Mucuna gigantea*, *Xanthophyllum sp.*, *Uncaria sp.*, *Euphoria malaiensis*, *Payena acuminata*, *Lygodium circinatum*, *Trema orientalis*, and *Lantana camara*.

Table 6. Plants giving strong positive reaction to Saponins

Family	Species
Amaranthaceae	<i>Calosia argentea</i> Linn
Asteraceae	<i>Blunea balsamifera</i> DC.
Cyatheaceae	<i>Hemitelia latebrosa</i>
Dioscoreaceae	<i>Dioscorea aculeata</i> Linn.
Piperaceae	<i>Piper betle</i> Linn.
Polypodiaceae	<i>Dryopteris boryana</i> O.Chr.
Rhyzoporaceae	<i>Anisophyllea disticha</i> Baill.
Rubiaceae	<i>Ixora javanica</i> DC.
Schizophyceaceae	<i>Selaginella plana</i> Hieron
Solanaceae	<i>Solanum torvum</i> Sw.
Verbenaceae	<i>Clerodendron inerma</i> Gaertn.
Zingiberaceae	<i>Achasma foetens</i> Val.

Steroids/triterpenes

Almost all plant species collected indicated positive response to steroids/ terpenes. Nine plant species showed strong reaction with 3+ or 4+ rating (Table 7). The compounds are particularly prevalent in *Mallotus paninlatus*; *Clochidion borescens*; *Litsea monopetala*; *Dictyopteris irregularis*; *Selaginella hieron*.

Table 7. Plants giving strong positive reaction to steroids/triterpenes

Family	Species
Asclepidirceae	<i>Cryptolepis javanica</i> Bl. <i>Hoya</i> sp.
Asteraceae	<i>Blumea balsamifera</i> DC.
Piperaceae	<i>Piper aduncum</i> Lind.
Polypodiaceae	<i>Aspodium ternatense</i> A.v.R.
Solanaceae	<i>Solanum torvum</i> Sw.
Zingiberaceae	<i>Achasma foetens</i> Val. <i>Costus speciosus</i> Sm.

Toxicity tests

Brine shrimp (*Artemia salina*) lethality test is a simple, fast and inexpensive assay in the search for bioactive compounds from plant extracts. The value of more than 1000 ppm is considered non-lethal and hence shown as negative (-ve). A total of more than 57 samples were tested and only ten showed toxicity against brine shrimps. Of the ten plant species tested, three species (*Dictyopteris irregularis* Pr., *Lantana camara* Linn, and *Gleichenia inermis* Clarke) indicated some potential toxicity which will require further investigation (Table 8).

Table 8. Lethal Concentration of Methanolic Extracts in the Brine Shrimp Larvae

Family	Species	Toxicity LC ₅₀ (i.e.95%)
Amaranthaceae	<i>Calosia argentea</i> Linn.	645
Asclepidirceae	<i>Hoya</i> sp.	875
Gleicheniaceae	<i>Gleichenia linearis</i> Clarke	143
Menispermaceae	<i>Fibraurea</i> sp.	608
Piperaceae	<i>Piper</i> sp.	295
Polypodiaceae	<i>Dictyopteris irregularis</i> Pr.	2
Rubiaceae	<i>Uncaria</i> sp.	654
Schizophyceaceae	<i>Lygodium circinatum</i> Sw.	999
Verberaceae	<i>Clerodendron inermis</i> Gaertn.	282
	<i>Lantana camara</i> Linn.	50

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Appendix 1. Traditional medicinal plants utilized by the population of Pasir Mayang village, sub-district of VII Koto, District of Tebo, Jambi Province, Sumatera, Indonesia

Species (Voucher specimen)	Local name	Part used	Uses
Acanthaceae			
<i>Justicia gendarusa</i> L. HA-259	setajam	Leaves	The leaves are crushed and rubbed on the affected parts of the body as a remedy for muscle pains and waist discomforts.
Amaranthaceae			
<i>Calosia argentea</i> Linn. HA-220	bunga merah	Flowers	The juice of the flower is pasted on the forehead as a remedy for fever or malaria.
Amaryllidaceae			
<i>Curculigo capitulata</i> O.K. HA-41	ketari; katorih bareh	Leaves	The leaves are mixed with the leaves of <i>Percamphylus glaucus</i> and boiled. The decoction is administered as a fever medication.
<i>Curculigo latifolia</i> Dryand. HA-228	benit	Leaves	The leaves are boiled and the decoction is administered as appetite stimulant (obat nafsu makan) for children.
Asclepidiaceae			
<i>Cryptolepis javanica</i> Bl. HA-55	akar daun taun	Leaves	The leaves are crushed, made into a paste and applied on the forehead to relieve headaches.
<i>Hoya</i> sp. HA-136	daun setebal	Leaves	The leaves are boiled and the decoction is administered as a remedy for stomach aches.
Asteraceae			
<i>Blumea balsamifera</i> DC HA-233	celapo tai	Leaves	The leaves are crushed, mixed with water, and filtered. The filtrate is administered to a recovering mother to strengthen and recondition her body.
Burseraceae			
<i>Canarium littorale</i> Bl. HA-157	ampelas licin	Roots	The root is squeezed and the liquid is administered as a headache and fever medication. Also used to relieve stomach aches.
Connaraceae			
<i>Roureopsis javanica</i> Planch. HA-222	akar jaring tupai	Leaves	The leaves are crushed, mixed with water, and rubbed on the stomach to cure stomach aches.

Appendix 1. Continued

Species (Voucher specimen)	Local name	Part used	Uses
Cyatheaceae <i>Hemitelia latebrosa</i> Mett. HA-58	pakis tonggak	Leaves	The leaves are crushed and mixed with turmeric and rice. The mixture is rubbed on the affected parts of the body to treat swelling. The mixture is also rubbed on the stomach as a stomach ache medication.
Dioscoreaceae <i>Dioscorea aculeata</i> L. HA-221	kabemar	Bulb	Below-ground bulbs are eaten as a remedy for mumps.
Euphorbiaceae <i>Melanolepis multiglandulosa</i> Reich.ex Zoll. HA-270	bunga sepanggih	Leaves	The leaves are crushed, boiled, and cooled down. The filtrate is used for babies to bathe in for health promotion.
Gleicheniaceae <i>Gleichenia linearis</i> Clarke HA-84	resam	Leaves	The leaves are boiled and the decoction is administered as a remedy for fever and ulcers.
Graminaceae <i>Centotheca latifolia</i> Trin. HA-255	rambut pulut- pulut	Fruit	The fruits are crushed and rubbed on the swollen parts as a remedy against abscess.
<i>Driockloa djainkareh</i> Busu	Buluh hitam	Leaves	The leaves are crushed and filtered. The filtrate is administered as appetite stimulant.
Labiatae <i>Ocimum basilicum</i> L.	selasih A	Leaves	The leaves are sun-dried. The dried leaves are crushed, mixed with coconut oil, and rubbed on the affected parts to reduce swelling.
Leguminosae <i>Cassia alata</i> L.	ketepeng	Leaves	Leaves are sun-dried. The dried leaves are crushed, mixed with water, and rubbed on the affected parts to cure skin diseases such as scabies.
<i>Milletia sricea</i> W.et	Akar semambu	Leaves	The leaves are crushed and filtered. The filtrate is administered as obat cacing perut or purgative.

Appendix I. Continued

Species (Voucher specimen)	Local name	Part used	Uses
<i>Mucuna gigantean</i> DC.	Akar katai	Root	The roots are crushed and rubbed on the stomach to cure stomach upset. (perut kembung).
Liliaceae <i>Dianella montana</i> BL HA-35	batang sia; akar sayak	Root; Fruit	The roots are sun-dried, boiled with water, and used for bathing a recovering mother to strengthen and recondition her body. The fruit is eaten to reduce a swollen part of the body or any other abscesses.
<i>Smilax leucophylla</i> Bl. HA-190	akar gunung	Leaves	The leaves are boiled and the decoction is administered to stimulate appetite.
Menispermaceae <i>Fibraurea</i> sp. HA-93	akar kunyit	Root	The chopped roots are mixed with water and applied externally to the eyes to cure conjunctivitis.
<i>Pericamphylus glaucus</i> Merr. HA-97	akar limpanang; akar manang; akar benang	Leaves; Root	The leaves of <i>Pericamphylus glaucus</i> and the bark of <i>Pometia pinnatas</i> are boiled and the decoction is administered as a fever medication. The root of <i>P. glaucus</i> , the bark of <i>P. pinnata</i> , and rice are crushed and filtered. The mixture is rubbed on the body also as a fever medication.
Monimiaceae <i>Kibara</i> sp. HA-103	udu kuro	Leaves	The leaves are heated on the fire to wither and rubbed on the stomach to treat intestinal worms.
Piperaceae <i>Piper aduncum</i> L. HA-15	kayu sirih	Leaves	The leaves are crushed and filtered. The filtrate is used as eye drops.
<i>Piper betle</i> L. HA-248	sirih	Leaves	The leaves are boiled and the decoction is administered as a cough medicine.
<i>Piper</i> sp. HA-30	akar sirih duduk	Leaves	The leaves are boiled and used to bathe a new born baby to prevent fever.
<i>Piper</i> sp. HA-242	sirih antu	Leaves	The leaves are roasted and rubbed on the affected parts to relieve pain.

Appendix 1. Continued

Species (Voucher specimen)	Local name	Part used	Uses
Polypodiaceae <i>Aspodium ternatense</i> A.vR.	kelakap	Leaves	The leaves are crushed and filtered. The filter is drunk as a cure for fever
<i>Dictyopteris irregularis</i> Pr. HA-12	paku lipan/ paku limat	Leaves	The leaves are crushed and rubbed on the stomach as a remedy for stomach aches
<i>Dryopteris boryana</i> O.Chr. HA-31	pakis tonggak; pakis longgoh	Leaves	The leaves, mixed with turmeric and hulled rice are crushed and mixed with water. The concoction is rubbed on the stomach as stomach ache medication
<i>Lomariopsis spectabilis</i> HA-56	pakis gajah	Root	Buttress roots are chopped, dried, and mixed with the crushed bark of <i>Millettia atropurpurea</i> and <i>Pometia pinnata</i> . The mixture is soaked in warm water and rubbed on the entire body to cure chicken pox
<i>Nephrolepis hirsutula</i> Presl. HA-135	pakis	Leaves	The crushed leaves are used to treat abscesses by rubbing on affected parts. Young leaves are used as a vegetable
Rhamnaceae <i>Zizyphus</i> sp. HA-249	akar kait	Stem	The stem is chopped and the exuded liquid is used as a gargle against oral ulceration.
Rhyzoporaaceae <i>Anisophyllea disticha</i> Baill. HA-33	batang beribu	Leaves	The leaves are boiled and the decoction is drunk as a fever medication
Rubiaceae <i>Ixora javanica</i> DC.	Kayu telur ikan	Leaves	The leaves are crushed and filtered. The filtrate is drunk as a fever medication
<i>Uncaria</i> sp. HA-45	akar kait	Leaves	The leaves are boiled and the liquid is administered as a fever medication
<i>Uncaria</i> sp. HA-	akar kuku alang	Leaves	The leaves are crushed and rubbed on the stomach to cure stomach ache

Appendix 1. Continued

Species (Voucher specimen)	Local name	Part used	Uses
Rutaceae <i>Clausena excavata</i> Burm HA-34	daun secere; cere-cere; kayu angit; puar anjali	Leaves	The leaves are crushed, mixed with water and table salt, and filtered. The filtrate is administered as a cure for stomach ache.
Schizophyceaceae <i>Lygodium circinatum</i> Sw. HA-20	akar kawé ; akar sapoi ; akar menang	Leaves	The leaves are crushed, mixed with water, and filtered. The residue is dried, cooked with water, and eaten as a fever medication.
Selaginellaceae <i>Selaginella plana</i> Hieron HA-139	sigagar tegak; paku anai-anai ; nganai duduk	Leaves	The leaves are boiled and the decoction is used to bathe three times a day to cure jaundice. The leaves are crushed and rubbed on the stomach as a remedy for diarrhea.
Solanaceae <i>Solanum torvum</i> Sw. HA-276	dubang	Fruit	The fruit is eaten as a vegetable. The fruits are boiled and the decoction is administered as a fever medication.
Verbenaceae <i>Clerodendron inerma</i> Gaertn. HA-274	bunga pekan	Flower	The flowers, mixed with the flower of <i>Calosia argentea</i> , are crushed and rubbed on a baby as a fever medication.
<i>Clerodendron squamatum</i> Vahl. HA-146	bunga panggil	Leaves	The leaves mixed with turmeric are crushed and filtered. The filtrate is used to bathe the babies in case of fever.
<i>Lantana camara</i> L. HA-1	sadancing	Stem	The twigs are chopped and boiled. The decoction is administered to cure stomach aches.
Violaceae <i>Rinorea</i> sp. HA-179	kayu pecat	Leaves	The leaves are boiled and the decoction is administered as a poison antidote.
Vitaceae <i>Cissus</i> sp. HA-134	akar kudang	Leaves	The leaves are boiled and the decoction is drunk to relieve headaches.
<i>Vitis</i> sp. HA-107	daun katak	Leaves	The leaves are crushed, mixed with water, and rubbed on the entire body to cause flatulence.

Appendix 1. Continued

Species (Voucher specimen)	Local name	Part used	Uses
Zingiberaceae <i>Achasma foetens</i> Val. HA-13	puar angit	Leaves	The leaves are chopped, soaked in water and the decoction is administered as a fever medication
<i>Costus rumphianus</i> L. HA-216	setawar	Leaves; Stem	The leaves are chopped, soaked in water, and rubbed on the waist and ribs to treat aches and pains. The stem is chopped, boiled with table salt, and drunk to treat whooping cough
<i>Costus sericeus</i> Bl. HA-11	limpung puar	Leaves	The leaves are crushed and applied on the fore-head to treat headaches
<i>Costus</i> sp. HA-38	daun layang	Leaves	The leaves are boiled, and the decoction is administered as a fever medication.
<i>Costus speciosus</i> Sm. HA-23	setawau	Stem	The stem is squeezed and the extract is administered as a cough medicine
<i>Globa maculata</i> Bl. HA-66	puar emas	Leaves	The leaves, mixed with the leaves of <i>Melastoma malabathricum</i> , are boiled and the decoction is administered as a fever medication