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# An examination of medicinal ethnobotany and biomedicine use in two villages on the Phnom Kulen plateau

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5 May 2016

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## Abbreviations

KPHC: Khnom Phnom Health Center

NCTM: National Center for Traditional Medicine

PKNP: Phnom Kulen National Park

SFS: School for Field Studies

# Transliteration key

| **Vowels** | |
|---|---|
| a/ah | f**a**ther, **a**ha |
| ei | d**a**y, st**a**y |
| i | fl**ee** |
| ai | wh**y**, h**i**de |
| o | bel**ow**, r**oa**d |
| ö | g**oo**d |
| u | **oo**ze |
| ao | c**ow** |
| ə | g**u**t |
| ɔ | **o**dd, h**o**t |
| e | a sound between g**e**t and p**i**g |
| ia | tilap**ia** |
| oi | b**oy**, c**oi**n |
| ea | like the vowels in "h**ey uh**" |

The vowel key included above will aid in a simplified but approximate pronunciation of the Khmer vowel register. Other vowel combinations in the text, like in *thoa*, follow the sounds of their individual vowels. A y is used at the end of a long dipthong with an "ee" sound, such as kraoy (krao-eee). A glottal stop is represented by the use of an apostrophe, as in the term *pə'on*.

Two important consonant clusters:
Nh: ny
Ng: ng

Most of the Roman consonants used in the text are similar to the Khmer ones, although Khmer consonants frequently have an aspirated and an un-aspirated version, whereas in English we aspirate most of our consonants. Therefore, *th* is not pronounced like 'this' but rather as a aspirated 't', that is, a 't' with a breathed 'h' after it. Khmer words may also end with aspiration—an "s" at the end of a word is pronounced as an "h."

Dr. Lisa Arensen
April 2015

# Acknowledgements

This project would not have been possible without ADF, who graciously supported our team's research within the borders of Phnom Kulen National Park. We are indebted to Anlong Thom ADF staff, who opened their home to us and provided good cheer and great medicine. I'd also like to thank the villagers of Ta Penh and Sangkae Lak for the following: their willingness to share their knowledge with the *barang roam*, their palm sugar-flavored rice noodles, their snazzy dance moves, and allowing me to hold their infants during interviews. Thanks also to the Ministry of Environment for their ongoing work to protect and conserve biodiversity in PKNP. I could not have conducted my research without the dazzling brilliance and translational prowess of Dr. Lisa Arensen and Hang Chansophea; to them, I give my greatest thanks. To Maura Monagan, I owe my sanity and the legibility of this paper. I also thank Tim Barrows, my research partner, who kept the *kru* crew chill and the dancing hot.

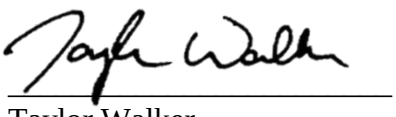
I would not be here in Cambodia if it weren't for my mentor, colleague and dear friend, Kayla Deur, whom I love very much. She helped me on every step of the way, from virtually packing my suitcase to laying ethnobotany research groundwork for me to follow. Here's to a post-grad life filled with peace and learning.

Finally, I wish to thank Dr. Ryan Huish, my botany professor, who is the reason I aspire to a future filled with green and growing things. He instilled in me a sense of wonder, joy and insatiable curiosity about the natural world—and as they say, I found within the midst of winter an invincible summer. Thank you, Dr. Huish.

# Declaration

I, Taylor Walker, acknowledge that the research embodied in this paper is entirely my own work, that where the ideas of others have been used, the sources have been acknowledged, and that no portion of this research has been previously submitted for grading at The School for Field Studies or Hollins University.

**Signed:**



Taylor Walker

5 May 2016
Date

# Abstract

Cambodians address symptomatic illness in two ways: they use traditional medicine, including medicinal plants, and biomedicine. Despite various attempts to quantify medicinal ethnobotany in Cambodia, no national ethnopharmacopoeia exists, and there is a gap in the literature regarding the mechanisms through which traditional medicines are prepared and used. This report presents an examination of the ethnopharmacopoeia of two villages within Phnom Kulen National Park, a study site chosen for its unique ecology and status as one of Cambodia's last remaining regions with lowland evergreen and semi-evergreen forest. The report also investigates the mechanisms through which villagers make decisions regarding illness treatment with traditional medicine or biomedicine. Semi-structured interviews conducted during April 2016 in Sangkae Lak and Ta Penh revealed 161 botanical species in current traditional medicine use, and 111 of these species were new to the School for Field Studies medicinal plant taxonomy. Regarding the decision-making process involved in medicating illness, respondents articulated that biomedicine and traditional medicine were effective for different purposes. Traditional medicine was considered successful in addressing chronic illness or long-term treatment, but biomedicine was considered better for acute illness. This report also reveals that the decision-making processes involved in medicating illness in these villages are multi-faceted and affected by government intervention. Furthermore, the disparate ways in which general community members, traditional medicine practitioners and government agents understand drug interactions is hugely impactful in community decisions to use traditional medicine or biomedicine. This research contributes to the knowledge of medicinal ethnobotany and community health decisions on Phnom Kulen.



**Keywords:** Cambodia, Khmer traditional medicine, medicinal ethnobotany, medicinal plants, biomedicine, drug interactions, public health, traditional healer, *kru khmer*

# Introduction

As decades of violent war and occupation came to an end in the 1990s, Cambodia was fraught with poverty and inadequate public infrastructure (Pilsczek 2001). Today, the healthcare sector is still underdeveloped, and reliable clinical care is largely inaccessible to rural communities (Laval et al. 2011). In fact, Cambodia has one of the lowest rates of use for government-provided healthcare in the world. In the absence of clinical treatment, Cambodians address symptomatic illness in two ways: they use traditional medicine,[1] including medicinal plants, and biomedicine[2] (Ashwell & Walston 2008).

Biomedicine, including life-saving antibiotics, antiparasitics and antifungals, is publically available without prescription in Cambodia (Khan et al. 2011). A large proportion of the biomedicine available to Cambodians is counterfeit; active ingredients may be present at sub-optimal levels or absent entirely (ibid). The low quality of biomedicine combined with the inaccessibility of formal clinical healthcare means that the primary healthcare strategy of many rural Cambodians is traditional medicine (Linddal & Mea 2004, Savajol et al. 2011). Though the Royal Government encourages the use of traditional medicine in conjunction with biomedicine (NCTM, n.d.), no real formal linkages have been made to the public healthcare sector (Ashwell & Walston 2008). As a result of these two modes of healthcare and treatment, Cambodians tend to use community-based traditional medicine and government-advocated biomedicine concurrently (Ashwell & Walston 2008). It is estimated that medicinal plants are used by 80% of the population in developing states because of the expense and reliability of biomedicine (Laval et al. 2011, Palombo 2006), and the Royal University of Phnom Penh believes there may be as many as 1000 medicinal plants in current use across Cambodia (Linddal & Mea 2004).

While research on the botanical biodiversity of Cambodia and the extent of plant use exists, much of this work has been conducted by government agencies and NGOs, and is neither peer-reviewed nor publically accessible (Hidayati 2015). Additionally, despite various attempts by government agencies and private enterprises to quantify ethnobotany in Cambodia,

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[1] Traditional medicine in Cambodia involves botanical treatments like pharmacologically-active plant materials (Peltzer et al. 2016), animal treatments like slow loris wine (Wallace 2012), metaphysical treatments like cupping (CPP 2010) and supernatural treatments like magical ceremonies (Eisenbruch 1992). For the scope of this paper, only the botanical aspect of traditional medicine will be examined.

[2] This is the terminology widely accepted in clinical literatures to refer to synthetic pharmaceuticals. While it is somewhat confusing to use 'biomedicine' in a report about biological medicine, it is preferable to its ubiquitous and politicized synonyms, e.g. 'western medicine', 'orthodox medicine', 'modern medicine' (Wiseman 2004).

no national ethnopharmacopoeia exists (WHO 2005). Much of the ethnobotanical research performed thus far has been restricted to biodiversity surveys without a medicinal focus (Hidayati 2015), or on medicinal plant use without a preparatory focus (Ashwell & Walston 2008; George c. 2005; Laval et al. 2011; Mea 2007; Richman et al. 2010). Thus, there is a gap in the literature with regards to preparatory methods of medicinal plants used in Cambodia.[3]

Because of its unique ecology, Phnom Kulen National Park (PKNP) in northwestern Cambodia is a key site for medicinal plant collection and thus a key site for research on medicinal ethnobotany (Ashwell & Walston 2008). The park, which was designated a government-protected area in 1993, is marked by lowland evergreen forest combined with sections of open grassland and secondary growth forests (Bonheur et al. 2008). Ashwell & Walston (2008) found that a large proportion of Cambodia's medicinal plants exhibit high levels of endemism and habitat specificity, and the landscape of PKNP is able to meet many disparate ecological needs at once given its forest biodiversity. Therefore, the medicinal resources of Phnom Kulen National Park are likely different than other regions of Cambodia that have already been examined in the literature (Ashwell & Walston 2008).

PKNP has 775 currently-identified botanical species, although much of the information we have about the park is either decades out of date, published in colonial-era French, or both (Hayes et al. 2013). Baseline biodiversity surveys have been conducted by Bonheur et al. (2008) and Hayes et al. (2013), and an economic survey on medicinal plants was conducted by Wallace (2012). Additionally, Dang (2014) and Deur (2015) conducted studies on the medicinal ethnobotany of four lowland villages[4] at the base of the plateau of PKNP. However, there is a gap in the literature on the medicinal ethnobotany of Phnom Kulen, as no published reports have examined medicinal ethnobotany on the plateau. The geographic distinction is an important one, as an individual from a medicinal plant species can have significant variation in physical appearance and bioactive constituents depending on the ecology of its habitat (Mea 2007).[5] In other words, given that the synthesis of bioactive secondary metabolites[6] is

[3] A notable exception to this trend is the work completed by the French NGO Nomad RSI, which works with communities in Mondulkiri Province regarding local medicinal treatments for fever and malaria (Linddal & Mea 2004). They are currently working on potential pharmacognostical extraction of artemisinin from antimalarial medicinal plants.

[4] The villages of Kamprum, Khum Ream, Sras Kvao and Phum Steng.

[5] For non-Cambodian examples, see Ormeño et al. (2007), Szakiel et al. (2011) and Woodhead (1981).

[6] Secondary metabolites are chemicals produced by a plant that are not required for existence, but aid in survival; for example, antifungal metabolites produced on the leaf surface which decrease incidence of fungal infection.

influenced by external ecology, it is important to examine the plants on Kulen, even if these species have been investigated previously, because differential medicinal use may suggest different bioactive constituents.

Furthermore, much of the existing research on medicinal plants in Cambodia is social or ecological rather than chemical in nature, and as such it does not record medicinal preparation. As a result, little information has been gathered about physiological efficacy. As Palombo (2006) notes, there is a need in Cambodian ethnobotany research to look at plant medicines holistically, in the ways that they are prepared by traditional medicine users, to understand their mechanism of action. Cambodian medicines are frequently prepared with several species in combination, using different extraction techniques (e.g. ethanol, boiling water, coconut water) (Linddal & Mea 2004). In those cases, the bioactive secondary metabolites of each plant may act synergistically together, leading to a biochemical efficacy which cannot be replicated through a single-compound focus in the laboratory (Palombo 2006). Validating use of medicinal plants through in-vitro antimicrobial assays is a common trajectory for many ethnobotanical studies today (ibid), but there is not yet enough available data regarding medicinal plants on Phnom Kulen to begin the process in the laboratory.

This report documents traditional medicine and biomedicine use in two villages on the plateau of Phnom Kulen. My objectives were as follows: to expand the preexisting School for Field Studies (SFS) taxonomy on Kulen medicinal plants, to record traditional medicine use and preparation, and to explore the decision-making processes involved in medicating illness. I investigated preparatory medicinal ethnobotany and additionally the ways that rural villagers balanced use of traditional medicine and biomedicine. By achieving these objectives, this research contributes to the knowledge of medicinal ethnobotany and community health decisions in Siem Reap Province.

# Methods

## Study site

The study was conducted in Sangkae Lak and Ta Penh,[7] two Svay Leu District villages on the plateau of Phnom Kulen National Park. PKNP is a 37,373 ha government-protected area covering several districts in Siem Reap Province, with a plateau dominated by evergreen and semi-evergreen forests and patches of deciduous diptocarp forest (Hayes et al. 2013). The average yearly rainfall of the site is 1500mm, affected by tropical monsoons (Bonheur et al. 2008). The botanical biodiversity survey conducted by Hayes et al. in 2013 found 775 distinct botanical species within the boundaries of the park, including nine IUCN-listed critically endangered species.[8] PKNP contains some of Cambodia's last remaining pristine evergreen forests, and as such is a key area for research regarding medicinal plant collection and use (Ashwell & Walston 2008). Maps of the study sites were designed using Google Earth version 7.1.5.1557 (*Figure 1*).


**Figure 1.** Study sites on the plateau of Phnom Kulen National Park, with the villages of Sangkae Lak and Ta Penh marked (Google Earth 2013).

[7] These villages have been established on Phnom Kulen since at least 1938; see Stern (1938).
[8] These species are: *Aglaia pleuropteris*, *Aquilaria crassna*, *Dipterocarpus baudii*, *D. turbinatus*, *Hopea helferi*, *H. latifolia*, *H. siamensis*, *Shorea hypochra*, and *S. thorelii* (Hayes et al. 2013).

## Data collection

Twenty-one semi-structured interviews were conducted during the dry season between 18 April 2016 and 28 April 2016 in two villages on the plateau of Phnom Kulen: Sangkae Lak and Ta Penh. I conducted these interviews as part of a research team with Tim Barrows; we collected two separate data sets simultaneously. Traditional medicine practitioners and community members were interviewed using convenience sampling methods. After receiving verbal consent, the interview questions that I posed in English were translated into Khmer by Hang Chansophea, a native speaker with specialized knowledge of plant taxonomy and terminology. Interview questions concerned demographics, medicinal ethnobotany use and practices, and the decision-making processes involved in use of traditional medicine and biomedicine (*Appendix 1*). If respondents claimed no knowledge of traditional medicine, I asked targeted questions to evoke a response (e.g. "What do you do when your children have a fever?"). Notes were taken by hand without the use of recording equipment. Medicinal plants were identified following each interview session using field texts (Dy Phon 2000; Kham 2009, 2010; NCTM 2006, 2008, 2010) and Sophea's translations to cross-link Khmer common name with Latin name.

## Data analysis and processing

Ethnobotany data was analyzed alongside data sets collected by Dang (2014) and Deur (2015) from villages at the base of Phnom Kulen. A medicinal plant taxonomy was produced with our combined data which links Latin names to Khmer names (*Appendix 2*).[9] All plant names were crosschecked with the Plant List (2013), making this the first time the SFS taxonomy has been published with verified authorship to the family, genus and species levels. I prepared an additional ethnopharmacopoeia of Phnom Kulen medical plants, including plant parts used, purpose and preparation (*Appendix 3*). To accompany the ethnopharmacopoeia, a glossary of plant uses was also prepared (*Appendix 4*). Microsoft Excel was used for descriptive statistics and chart design. The qualitative data software Atlas TI was used to analyze interview data (e.g. beliefs about the efficacy of biomedicine) using the grounded theory approach as described by El Hussein et al. (2014).

[9] *Appendix 2* is a modification of the document prepared by my research partner, Tim Barrows.

## Limitations

The short duration of the study period limited the possible number of respondents, meaning that the data collected does not reflect the full scope of medicinal plant use in these villages. Furthermore, because the interviews were conducted through a translator, some nuance in the descriptions of medicinal use may have been lost. The cross-linguistic nature of the study had another limitation, which was that local Khmer common names of plants could not always be found in the scientific literature, so some plants could not be assigned their binomial name. In addition, due to the protected status of PKNP and logistical limitations of the study, herbarium specimens could not be taken from the site to be preserved or chemically analyzed.

# Results and discussion

## Respondent demographics

### *Results*

Twenty-one semi-structured interviews were conducted in the villages of Sangkae Lak and Ta Penh. There were twenty-two respondents, eleven from each village, comprising equal numbers of general community members and traditional medicine practitioners (three midwives, six healers [*kru khmer*] and two snakebite specialists). Respondents ranged in age from 26 years to 85 years. The median age of general community members interviewed was 45, and for key informants was 65. Of the twenty-two respondents, seven were men and fifteen were women. Forty percent of the women interviewed were traditional medicine practitioners, compared to seventy percent of the men.

### *Discussion*

The designation of 'traditional medicine practitioner' was only applied if the respondents identified themselves as such. During some interviews, respondents would refuse to call themselves *kru*, even if they clearly had a working knowledge of traditional medicine, because they did not believe their skills to be worthy of the title. There appears to be no socially-codified mechanisms for establishing who is and who is not a *kru*.

Prior research in the lowlands of Phnom Kulen (Dang 2014, Deur 2015) had suggested it would be difficult to find enough traditional medicine practitioners to balance out the study; however, on the plateau we encountered the opposite. Frequently respondents would reveal mid-interview that they had had extensive training as a healer or midwife. The apparent density of traditional medicine practitioners may be connected to the status of the plateau as a key site for medicinal plant collection and practice (Ashwell & Walston 2008).

## Expansion of the SFS taxonomy on the medicinal plants of PKNP

### *Results*

Respondents were asked to first free-list which traditional plant medicines they use and then relay the botanical constituents that make them up, including the plant parts used and their preparation. The most elaborate preparation was a 19-plant medicine for postpartum care. The largest number of species free-listed by any respondent was 74, by a 63-year-old female healer. Over the ten-day data collection period, we recorded 335 components among 161 distinct botanical species for 102 medicinal preparations (see *Appendix 3*). Of the 161 species recorded

in the study, 111 were new to the SFS taxonomy prepared by Dang (2014) and Deur (2015). The SFS taxonomy now contains 238 species (see *Appendix 2*).

### *Discussion*

We found that asking respondents to free-list traditional medicines was the best method to collect data, since among our respondents, traditional medicines were almost always multi-plant preparations. Two respondents specifically explained to us that their medicines were effective because of the high number of constituent parts. One midwife explained, "The more ingredients there are, the healthier you are" (field interview with midwife, Sangkae Lak, 19 April 2016).

## Medicinal ethnobotany on the plateau

### *Results*

While all respondents had used traditional medicine at least once in their lives, some respondents were not able to identify the plants used. In some cases, traditional medicines were in current use within the household, but the respondent was not the person who collected ingredients or prepared treatments. In other instances, respondents who could not describe the constituents of the traditional medicine they used had either purchased prepackaged treatments from neighbors or markets, or had not used any traditional medicine since childhood.

Respondents with knowledge of traditional medicine described four basic preparatory methods: decoction, infusion, poultice/powder application and consumption not otherwise specified (Figure 2). A decoction involves boiling ingredients (whether fresh or dried) until the constituents steep into the solvent, which is almost always water. In infusions, ingredients are allowed to soak in a solvent without heating. Our respondents indicated that *Cocos nucifera* juice and rice wine were the most popular infusion solvents.

Of the 51 decoctions, 46 were to drink, 3 were for showers, 1 was for mouthwash and 1 was for steaming. Of the 30 infusions, 26 were to drink and 4 were for showers.[10] For topical applications, respondents reported 16 poultices and 1 powder. Consumption methods included eating raw, smoking and eating in the form of homemade tablets.

[10] Steaming involves deeply inhaling the vapors of a decoction; showers involve full-body washing with the decocted liquid.

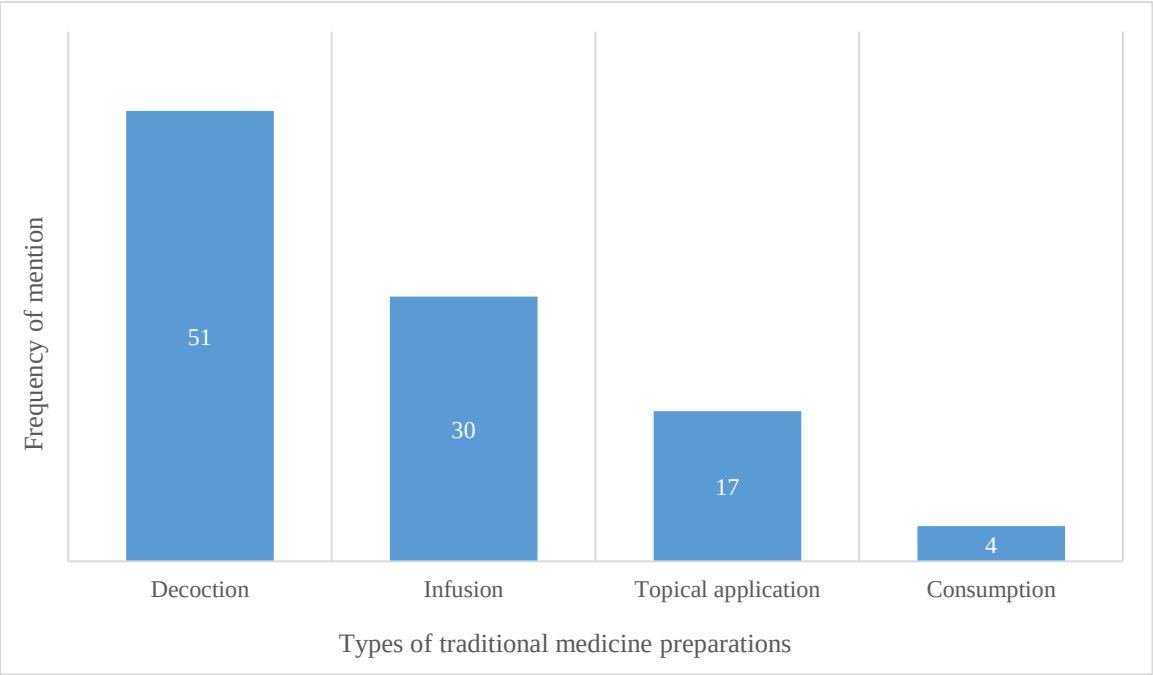


**Figure 2.** Frequency of traditional medicine preparations as described by twenty-two residents of the villages of Sangkae Lak and Ta Penh in April 2016.

Respondents described a large variety of uses for traditional medicine (see *Appendix 4*). These included: asthma, bites, cardiac problems, daily tonics, dental carries/gingivitis, diabetes, fever, gastrointestinal illness, headaches/migraines, hepatitis/liver disease, infectious disease not otherwise specified, medicine enhancement, nutrition, pregnancy care, sexually-transmitted disease, skin problems and swelling. The most species were listed for the following categories: pregnancy care (particularly the sub-topic postpartum care), infectious disease (particularly the sub-topic malaria), fever, and daily tonics. An ethnopharmacopoeia was prepared to frame these results into the context of prior ethnobotanical studies on Phnom Kulen conducted by student researchers with the School for Field Studies (see *Appendix 3*).

Of the 161 botanical species recorded during the study period, thirteen were reported at least five times and an additional three were reported more than ten times (*Figure 3*).

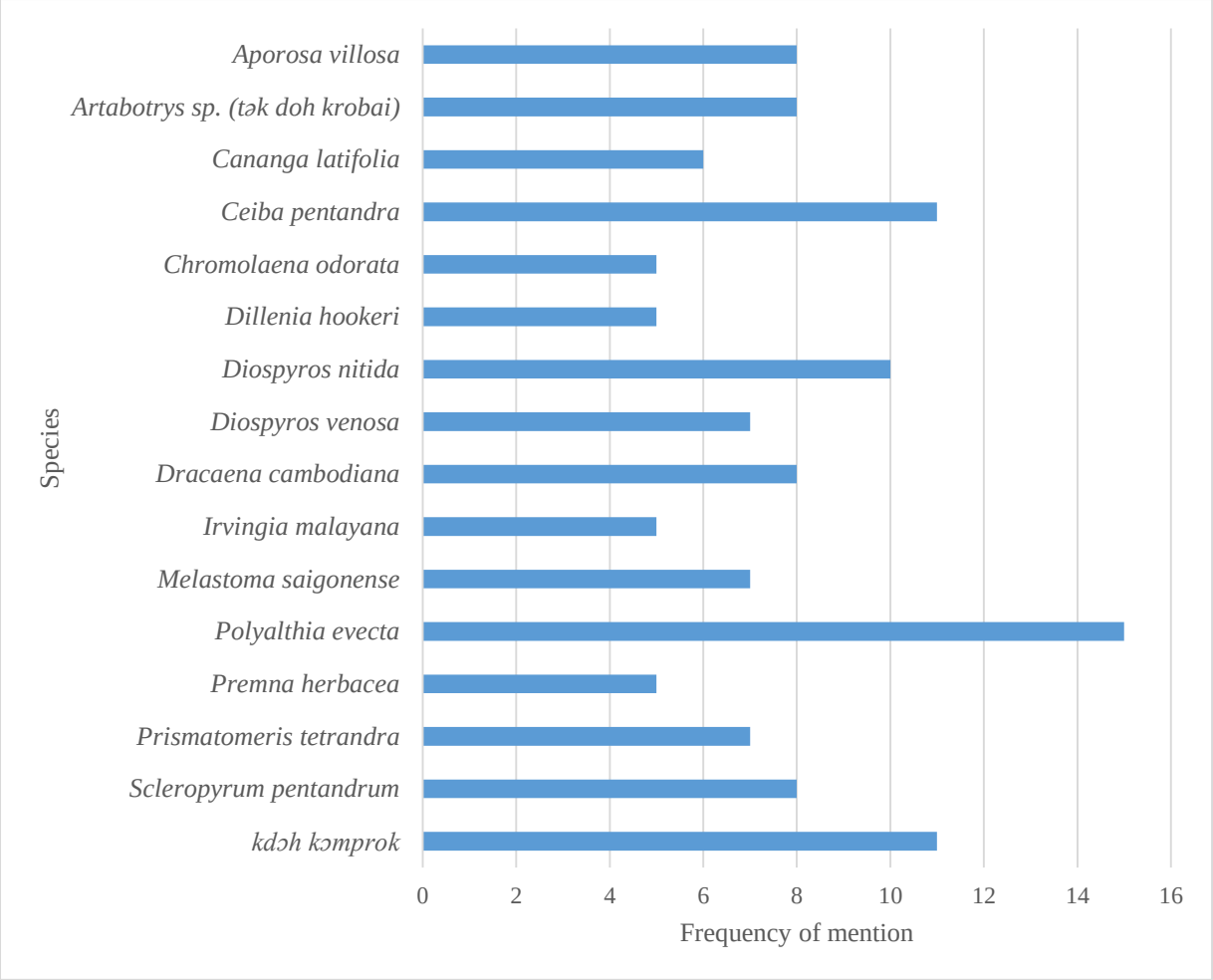


**Figure 3.** The sixteen medicinal plants most frequently mentioned by twenty-two residents of the villages of Sangkae Lak and Ta Penh in April 2016.

## *Discussion*

**Solvent choice** — The juice of *Cocos nucifera* is a sugar solution with dissolved proteins and mineral salts, and has shown significant antioxidant, antibacterial and antithrombotic activity in the laboratory (Prades et al. 2011). While respondents tended to report that this choice of solvent was to add a sweetness that would make childrens' medicines more palatable, Prades' study suggests the juice may also play an efficacious role in treatment pharmacology.

Rice wine, which is an alcoholic beverage made from fermented rice grains, is strongly ethanolic (i.e. slightly less polar than water) and therefore does not have the same extraction activity as water. The use of rice wine as a solvent affects the chemical constituents that are released from plant tissues, and thus the pharmacological activity of the medicine. There is also a cultural element that affects solvent choice. One healer we spoke with reported a daily strength tonic with three preparations: infusion into rice wine, decoction into water, or a tablet

made from the dried, crushed plants and honey. He explained that using rice wine for infusion is best, if available, because rice wine "makes the body hot, so the medicine works better" (field interview with snakebite specialist, Sangkae Lak, 20 April 2016). A common Khmer conceptualization of illness is that sickness is caused by an imbalance between hot and cold energies within the body; a 'cold' disease requires a warm medicine to treat it and rebalance the individual (Tea 2010). We found this ideation echoed in interviews, when this explanation was provided in order to support the practice of drinking decoctions while still warm for the best effectiveness.

**Limitations of methodology** — A limitation that we did not anticipate before entering the field was that often, respondents would be unable to recall medicines unless prompted with an illness (e.g. "What do you do when your daughter has a fever?"). Therefore, the data reported here may not accurately reflect the breadth of knowledge of our respondents, because our prompts failed to cover the full scope of locally-relevant disease. For example, not a single respondent indicated knowing or using a traditional medicine to treat tuberculosis, despite the fact that it is a major public health problem on Phnom Kulen (field interview with Knong Phnom Health Center director, 26 April 2016).

**Pharmacological efficacy in vitro** — Validating traditional use of Khmer medical plants is difficult because of how relatively few biochemical examinations of extract activity have been conducted, and particularly because many of these studies are seeking to identify metabolite structure instead of supporting traditional use. However, in PKNP, whether collected medical plants are physiologically active has significant public health implications. Of the sixteen most frequently referenced plants, five of these plants have been examined in non-regional literature; these findings provide pharmacological support for use on the Phnom Kulen plateau. An additional five plants, not among the top listed, also have literature supporting their use. These ten are described in alphabetical order below. The small size of this section relative to the number of medicinal plant species recorded by this report is indicative of the relative dearth of available peer-reviewed literature on these species.

In the present study, respondents indicated that the young leaves of *Azadirachtra indica* (Meliaceae) are used to treat venomous centipede bites. These bites are puncture wounds which are frequently accompanied by swelling and pain, and can become infected if not cared for properly. Chea et al. (2007) found that the methanolic extract of *A. indica* bark is bactericidal at a very low concentration, and is active against both *Staphylococcus aureus* and

*Mycobacterium smegmatis*, indicating that it likely aids in wound care by preventing bacterial infection.

*Cananga latifolia* (Annonaceae) was cited six times by respondents, and its wood is used to treat fever and abdominal pain. During the interviews, respondents did not indicate potential causes or associated comorbidities, but both fever and abdominal pain can be symptoms of bacterial infection. Methanolic extracts of *C. latifolia* bark exhibit inhibition against *Mycobacterium smegmatis*[11] (Chea et al. 2007). Genus *Mycobacterium* is broadly pathogenic and causes opportunistic infection in immunocompromised patients, such as those with tuberculosis; data suggests that a comorbid fever or gastroenteric episode could be addressed through *C. latifolia* treatment (ibid).

In a similar manner to *Cananga latifolia*, respondents use the bark of *Cheilocostus speciosus* (Costaceae) to treat unspecified fevers. Chea et al. (2007) reports that the methanolic extract of *C. speciosus* rhizome inhibits *Candida albicans*, the yeast responsible for candidiasis, which causes fever (Hidalgo & Vasquez 2015). If the fever were caused by *C. albicans*, laboratory research supports the efficacy of *C. speciosus* treatment. More research is needed to determine whether additional antipyretic compounds are present within the plant.

The plant *Chromolaena odorata* (Asteraceae) was listed five times by respondents for the treatment of malaria, fever, wound infection and healing. Extensive research has been performed on extracts of *C. odorata*. Phan et al. (1996) reported that aqueous extracts inhibit collagen lattice contraction, which mechanistically aids in wound closure and scar formation. Pandith et al. (2013) found that the extract increases both transcription and translation of heme oxygenase-1, one of the enzymes responsible for blood coagulation at wound sites. Multiple studies have described the antifungal, antibacterial and antiplasmodial[12] activity of the leaf extracts, and identified a number of key alkaloid and saponin constituents that may be responsible for the observed antimicrobial action (Chakraborty, Rambhade & Patil 2011; Kigigha & Zige 2013; Nwinuka, Nwiloh and Eresama 2009). Of particular interest is the study performed by Ezenyi et al. (2014); the study identified a flavonoid derivative present in an ether extract that is highly active against chloroquine-resistant *Plasmodium falciparum*, one of the protozoa responsible for malaria. Literature broadly supports traditional use. In addition,

[11] *M. smegmatis* is a nonpathogenic bacteria, but it was used in this assay because pathogenic *Mycobacterium* tend to be fastidious (i.e. difficult to culture in vitro).
[12] Malaria is caused by the protozoa genus *Plasmodium*.

compounds extracted or synthesized from *C. odorata* may well represent the future of malaria pharmaceuticals in a world increasingly devoid of efficacious antiplasmodials.

Respondents reported that the wood and resin of *Dracaena cambodiana* (Asparagaceae), cited eight times, are used to treat throat infections. The plant contains a variety of bioactive flavonoid derivatives which have antiviral (Dai et al. 2012) and antistaphylococcal (Luo et al. 2011) properties, supporting traditional use.

The woody vine of *Eurycoma longfolia* (Simaroubaceae) is used on the plateau as an energy tonic, a daily medicine to nonspecifically increase health and wellbeing. Rehman et al. (2016) found a variety of pharmacologically active constituents of *E. longifolia* and clinical evidence to support traditional use. Plant extracts contain water-soluble quassinoids which enhance testosterone and male fertility (ibid) as well as exhibiting antiplasmodial action[13] (Hout et al. 2006, Rehman et al. 2016). Extracts also have cytotoxic effects against human cancer cell lines, are antistaphyloccal and exhibit anxiolytic properties (Rehman et al. 2016). The in vitro assays performed on *E. longfolia* reveal that it broadly improves human stress hormone profiles, increases insulin sensitivity and acts to prevent oxidative osteoporotic bone loss, all data which lends high credence to the use of this plant as a daily tonic.

*Irvingia malayana* (Irvingaceae) was listed five times by respondents, four times in the context of postpartum care and once for the prevention of dental carries and gingivitis. Little research has been performed on the antimicrobial properties of *I. malayana*, although there is an existing body of research regarding its potential as antineoplastic or neuromodulating agents.[14] However, a report on ruminant physiology by Panyakaew et al. (2009) suggests antimicrobial action of fatty acids extracted from *I. malayana*. More research needs to be performed before traditional use can be fully validated in this case.

The entire plant *Phyllanthus urinaria* (Phyllanthaceae) is used in treatments for fever. Laboratory studies on pharmacologically active constituents, which exhibit antistaphylococcal and antiplasmodial activity, support traditional use (Chea et al. 2007, Hout et al. 2006).

Two respondents described using of the bark extract of *Premna herbacea* (Lamiaceae) for treatment of sexually-transmitted disease and intrauterine infection following delivery. Not many studies have been conducted on the efficacy of *P. herbacea* compounds for treating

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[13] These are: 10-hydroxycanthin-6-one, eurycomalactone, eurycomanone, eurycomanol, and 7-methoxy-β-carboline-1-propionic acid (Rehmann et al. 2016).
[14] See Nguyen-Pouplin et al. 2007 and Chung, Goh & Imiyabir 2005 respectively.

human infection, but Dhamija et al. (2014) suggest that the root extract is antimicrobially-active in vitro.

On the plateau of Phnom Kulen, the young leaves of *Psidium guajava* (Myrtaceae) are used in treatments for diarrhea, a regional ethnobotany that is echoed in many tropical parts of the world (Palombo 2006). Aqueous extracts of *P. guajava* have shown efficacy against pathogenic diarrheal illness, and it is believed that the secondary metabolite quercitrin is the active component (ibid).

The bark of *Stephania rotunda* (Menispermaceae) is used to treat malaria. An evaluation of *S. rotunda* samples from Siem Reap revealed that the plant's charismatic alkaloid, tetrahydropalmatine, has significant antiplasmodial activity (Bory et al. 2013). Additionally, the efficacy of the purified alkaloid is observable and active in aqueous extracts, which mirrors traditional preparation (Hout et al. 2006). This provides strong support for current use by villagers on the plateau.

While it is important to evaluate the available biochemical literature in order to validate traditional use, a literature review on Cambodian medicinal plants can be as misleading as it is helpful. To begin with, a lack of literature support for plant use does not necessarily indicate a lack of efficacy, as there is a great deal of pharmacology work to still be done on Cambodian medicinal plants. On the other hand, even the existence of biochemical literature which does not support traditional use may not be relevant to Phnom Kulen, because of the ecological factors requisite to secondary metabolite formation, as previously discussed (Mea 2007). Additionally, in vitro assays in sterile laboratories may not feature extraction methods that mirror traditional practice, leading to a misattribution of lack of efficacy where there is physiological activity in common use. Finally, it is very difficult to use in vitro methodology to validate certain traditional medicines, for instance treatments for postpartum care (*Polyalthia evecta, Melastoma saigonense, Scleropyrum pentandrum*, etc). As these are nonspecific daily tonics intended for months of consecutive use, it is possible that pharmacological efficacy observed in vivo cannot be adequately replicated with currently available analytical methods.

## Medicating illness on the plateau

### *Results*

On the plateau of Phnom Kulen, there are two readily available ways to medicate illness: traditional medicine and biomedicine. Respondents broadly reported decreased use of

traditional medicine in favor of biomedicine since the Knong Phnom Health Center (KPHC) became active in the nearby village of Anlong Thom.

Villagers reported accessing biomedicine through the following institutions: KPHC, Svay Leu District Health Center, any one of many Siem Reap Provincial Hospitals, pharmacies in Svay Leu Market, and through the state government (i.e. public school vaccinations[15]). Two respondents told our team that biomedicine at KPHC was weak, so they buy their biomedicine at pharmacies where they can get stronger medication.

A variety of responses were presented to the research team regarding the perceived efficacy and use value of biomedicine and traditional medicine, such as those below. The ways villagers decide to medicate illness varied based on their age, family status and personal history, and responses were far from monolithic.

**Table 1.** Selected quotes from villagers in Sangkae Lak and Ta Penh regarding perceived efficacy and use value of biomedicine and traditional medicine

| |
|---|
| "We're far from the clinic so we try our way first." – 40-year-old female villager, Ta Penh |
| "If traditional medicine doesn't win (*mɔn chnea*), go to the Health Center." – 71-year-old male snakebite specialist, Sangkae Lak[16] |
| "*Kru khmer* cannot see inside of you." – 54-year-old female healer-midwife on why x-rays and clinical care are important after vehicle accidents, Ta Penh |
| "The Health Center can't do anything for venom." – 71-year-old male snakebite specialist, Sangkae Lak |
| "Biomedicine is faster and better than traditional medicine." – 61-year-old female villager, Sangkae Lak |
| "I don't have time to collect from the forest or prepare." – 44-year-old female villager, Ta Penh |

Some respondents used traditional medicine instead of biomedicine because of perceived difficulty associated with accessing treatment; it was regarded as easier and less time consuming to collect plants at home than travel to a clinic. Other respondents argued that

[15] A midwife from Sangkae Lak told us that her children were routinely vaccinated, although she does not consider this to be biomedicine (field interview, 28 April 2016).
[16] The health center referred to in these quotes is KPHC.

biomedicine is not effective because of the nature of its formulation. Two healers independently relayed the following information: a strong treatment means the disease will not "come back." Traditional medicine does not work quickly, they conceded, but the length of the course of treatment means that disease is truly being eradicated from the body. The reason they do not trust biomedicine is because the short duration of treatment means that the disease will "come back" (field interviews with healer, Sangkae Lak, 19 April 2016; healer, Ta Penh, 26 April 2016).

On the other hand, many respondents reported that biomedicine is effective and convenient. An interesting trend was that those who had significant knowledge of traditional medicine—healers, midwives, snakebite specialists—tended to opt for biomedicine when they fell ill. As one Ta Penh healer explained, when he is sick, he does not have the time or energy to prepare the traditional treatment for himself. Several respondents argued that biomedicine was the *most* effective treatment option. Some of these responses can be attributed to a see-and-believe mentality; one woman believes in the power of biomedicine over traditional medicine because it was the only thing that could cure his chronic abdominal pain, and another mother told our team that she watched as biomedicine cured her daughter where traditional medicine failed.[17] A Ta Penh healer and midwife, whose name is reportedly known in every village on the mountain, told us laughingly that sometimes she does not want to prepare traditional medicine for people who visit her—they could get the same thing from the health center. For this woman, who was forced to serve as a midwife in a Khmer Rouge mobile labor unit, traditional medicine was a tool for surviving war, a tool that is no longer strictly necessary. She explains: "Why not go [to KPHC]? Everything is easy. It will go quickly," (field interview with healer-midwife, Ta Penh, 22 April 2016).

### *Discussion*

**Perceived efficacy of biomedicine** — A relevant factor in the discussion of biomedicine use on Phnom Kulen is the following of dosage instructions, considering the high level of functional illiteracy.[18] A male healer reported to the research team that he knows people who

[17] The director of KPHC said of tuberculosis patients who come to the clinic after traditional medicine fails: "When the flesh comes back, they believe," (field interview, Anlong Thom, 26 April 2016).

[18] Note that the director of KPHC is aware of this challenge and addresses it by having patients repeat their dosage instructions out loud, word for word, until they "get it right inside themselves" (field interview with director, Anlong Thom, 26 April 2016).

have been given biomedicine and not been cured. However, this could be explained by the Khmer conceptualization of illness, which does not include the concept of asymptomatic disease (CPP 2010). Following this model, it does not make intuitive sense to finish a prescription once symptoms are alleviated. An interview with a different household suggests this holds true with traditional medicine treatments as well. While his wife was describing their family's malaria cure, a man explained to us: "When you feel better, you stop. So bitter!" (field interview with villagers, Ta Penh, 23 April 2016).

**Decision-making factors in medication decisions** — Despite the apparent incongruencies expressed above, by far the most widely held belief was that there was a time and a place for both types of medicine. In other words, respondents articulated that biomedicine and traditional medicine were effective for different purposes. Traditional medicine was considered successful in addressing chronic illness or long-term treatment (e.g. months of postpartum care, daily tonics), but biomedicine was regarded as better for acute illness (e.g. fever, malaria). Whether respondents personally used traditional medicine as a first-line defense against illness appeared weakly inversely correlated to the age of the patient; parents and elders were more likely to attempt to treat their own illnesses with traditional medicine first, and the illnesses of their children with biomedicine and clinical care first. One villager explained this trend by telling us that both kinds of medicine are effective, but it depends on what kind of person you are—traditional medicine treatment could be effective at treating fever in adults and not children, particularly since, as another villager remarked, "children are bad at drinking hot things" like decoctions (field interview, Ta Penh, 21 April 2016; field interview, Ta Penh, 26 April 2016). A healer who specialized in broken bones explained that since the opening of KPHC, she recommends that people with broken bones seek clinical care to get an x-ray immediately—because, she says, "*kru khmer* cannot look inside you" (field interview with healer-midwife, Ta Penh, 22 April 2016). People should take the biomedicine they are given, she explained, and if they continue to need care, she would help them with traditional medicine upon completion of their prescription.

The one notable exception to the community trend of supporting biomedicine use is in postpartum care. As discussed by Deur (2015), traditional medicine is regarded as a critically important part in postpartum care, and a Ta Penh healer reported that strong postpartum care can give a woman good health for the rest of her life. Our interviews suggest that postpartum women take biomedicine from the clinic because the staff tells them to, but that they take traditional medicine at home so they can balance hot and cold energies.

**Differential understanding of health and risk** — The government-run KPHC visits each village on the mountain once a month to promote the clinic and teach villagers about disease prevention. At these visits, women are instructed against taking traditional medicine during or following pregnancy. One villager from Ta Penh said that KPHC staff told her traditional medicine would harm her unborn child, and another villager says fear of being blamed by the staff is why he has stopped using traditional medicine altogether. He explains that, in the past, he would try to treat illness with traditional medicine, and go to the health center if it did not get better. However, he was afraid to reveal this to center staff, fearing they would 'blame' him for his illness and say, "Why didn't you come in sooner?" (field interview with villager, Sangkae Lak, 20 April 2016). A separate interview with a villager in Ta Penh yielded an almost identical story.

A healer from Ta Penh shed some light on what was going on here. He has never been 'blamed' by KPHC staff, but he understands why they blame people who are not *kru*—who do not understand medicine as intimately as he does. He explained, "If you start with traditional medicine and come to the health center to use biomedicine, it will take a long time to help you because of the fighting," (field interview with healer, Ta Penh, 21 April 2016). By 'fighting', he means drug interactions. From his perspective, it's not that the staff believes traditional medicine is less effective than biomedicine—and in fact, when he visits, they ask him to prepare them his circulation tonics—but that they are very concerned about the interactions between traditional medicine and biomedicine. That is why they dislike when people come in having already taken something, he explains. They prefer that people come straight to them when they are very ill so that they can help effectively.

When I spoke with the director of KPHC, I found that the healer's explanation was representative of the director's view. The director is very concerned about chemical interactions between biomedicine and traditional medicine in his patients. For example, his staff prescribes mothers a variety of biomedicines during pregnancy and after delivery, and he advises these patients against concurrent traditional medicine to prevent overdose. He explained his professional perspective on traditional medicine: for healers to prepare traditional medicine that is as safe and effective as biomedicine, they must be trained and certified by the National Center for Traditional Medicine (NCTM) in Phnom Penh. The training is six months long and instructs healers on specific analytical preparations to ensure consistent dosage and constituent concentration. He explains that with professional training and consistent methodology, you can ensure that one kind of plant is not active over another—no 'fighting'.

Untrained healers, he asserts, have the potential to produce dangerous medicines because they have not been taught the proper methods; in other words, they know which plants to mix together, but not how much of each plant.

Clearly, the ways in which villagers and KPHC staff members understand drug interactions are incongruent. KPHC does not seek to blame villagers for cultural health practices—in the words of the director, the goal of KPHC is to make sure that "no one dies of disease on the mountain" (field interview with director, Anlong Thom, 26 April 2016). However, while the issue of drug interactions is a serious one and apparently not thoroughly understood by all respondents, Khmer healers do have a way of understanding this phenomenon. A healer from Ta Penh asserts that you cannot treat two kinds of illnesses at the same time, even with traditional medicine, because the plants will fight and it is dangerous to the patient. In fact, she has known people who have been hurt by taking two medicines together. When medicines fight, she explains, you become very hot inside—by which she means 'unbalanced'. Whether medicines fight depends on what they are made of. If the medication is prepared with the roots or bulbs, which she reports are the strongest part of the plant, they could fight with other biomedicine or other traditional medicines. If you just use leaves or wood, which are comparably weaker, there may not be fighting. Another Ta Penh healer echoed her sentiment; if multiple treatments are used at one time, she said, "the medicines will be fighting and it is dangerous" (field interview with healer, Ta Penh, 21 April 2016).

However, some villagers gave answers that contradict this understanding of medicinal safety and efficacy. A different healer from Ta Penh asserted that traditional medicine is better than biomedicine because plants do *not* fight each other. He did not think it was possible too overdose on traditional medicine. Along that vein, two healers asserted that the most effective medications contain the highest number of ingredients.

A further complication is that the definition of traditional medicine is seemingly variable among the population. Two young mothers were interviewed about their medicine use; they were both using traditional medicine and biomedicine at the same time, apparently without realizing it. One woman replied succinctly that she used no traditional medicine, despite the fact that she was visibly roasting[19] with *Diospyros nitida*. The other, a mother with chronic, painful knee inflammation, began using traditional medicine for pain when she started

[19] A type of postpartum care in which medicinal woods are slow-burned under the bed for warming and eradicating postpartum cold energy.

breastfeeding because KPHC would not give her biomedicine. She explained to our team that nothing bad would happen because it was a topical medicine; she wasn't drinking it, therefore it was not dangerous. As these examples reveal, decision-making practices about biomedicine and traditional medicine—and even what *constitutes* traditional medicine—vary widely from person to person.

**Role of government in modulating community health decisions and practice** — While other sources describe clinical care and prescription biomedicine as inaccessible and difficult to obtain for rural Cambodians, the villagers of Sangkae Lak and Ta Penh experience a high level of access and convenience because of the local KPHC (Linddal & Mea 2004, Savajol et al. 2011). However, despite the Royal Government's nominal support of traditional medicine use through the support of the NCTM, its local actors enact policies that undermine community enfranchisement through their marked implications on medicine use. In PKNP, the personal beliefs of the KPHC director impact the way that traditional medicine is valued and trusted in the villages of Sangkae Lak and Ta Penh, by respondents' own admissions. He distrusts healers who have not been trained by the government, but endemic illiteracy and monthly reminders of the dangers of traditional medicine serves to discourage even highly knowledgable healers from practicing traditional medicine. This is emblematic of a higher disconnect between the state and rural communities with regards to public health and medication decisions.

# Conclusion and recommendations

This report presents primary data of medicinal ethobotany and biomedicine use in Sangkae Lak and Ta Penh villages. As a result of this research, 111 new plants were added to the SFS taxonomy of the medicinal plants of PKNP, contributing to an ever-growing picture of the biodiversity and ethnobotany of Phnom Kulen. The ethnopharmacopoeia of traditional medicine use in these villages catalogues a 21st century example of rural communities relying on the local environment for their health and wellness. Additionally, the cataloguing of traditional medicine preparatory methods has established baseline data that may enable further biochemical examinations of bioactive plant constituents and their pharmacological efficacy.

In Sangkae Lak and Ta Penh, respondents stated that, with few exceptions, traditional medicine is obtained from community sources and biomedicine is obtained from state sources (e.g. school vaccinations, public clinics). The story of these villages is seemingly unique in the literature—other sources describe clinical care and prescription biomedicine as inaccessible and difficult to obtain in rural Cambodia (Linddal & Mea 2004, Savajol et al. 2011). This report reveals that the decision-making processes involved in medicating illness in these villages are multi-faceted and affected by government intervention. The impact of state rhetoric and policies with regards to medication safety and efficacy must not be overlooked in subsequent examinations of community public health and traditional medicine use, whether in rural Cambodia or abroad. Furthermore, the unique and disparate ways in which general community members, traditional medicine practitioners and government agents understand drug interactions is impactful in their decisions to use traditional medicine or biomedicine.

With regards to ethnobotany and biochemistry, I recommend further researchers examine the physiological interactions between biomedicine and traditional medicine in vivo. The issue of concurrent medication is highly relevant to these mountaintop communities and also to broader public health in Cambodia. Targeted laboratory and clinical investigations should be used to inform further healthcare policy for other rural settings, where communities are broadly bereft of easy-to-access clinical healthcare.

Regarding public health research, I recommend that additional studies focus on the specific ways that the personal medicating decisions of parents differ from the ways they supervise the medication of their children. That there is a difference at all is an interesting finding of this study, and it deserves targeted examination.

# References

Ashwell D & Walston N 2008, *An overview of the use and trade of plants and animals in traditional medicine systems in Cambodia*, TRAFFIC Southeast Asia, Hanoi, Vietnam.

Bonheur N, Hourt KE & Sophy T 2008, *Preliminary study of Kulen National Park for development of a botanical garden*, Ministry of Environment, Royal Government of Cambodia, Phnom Penh.

Bory S, Bun SS, Baghdikian B, Dumetre A, Hutler S, Mabrouki F, Bun H, Elias R, Azas N & Ollivier E 2013, 'HPLC analysis of *Stephania rotunda* extracts and correlation with antiplasmodial activity', *Phytotherapy Research* 27.2, pp. 278-284.

CPP (Community Partners Program) 2010, *Khmer culture and attitude towards health*, prepared by Cambodian-Australian Welfare Council, Bonnyrigg, Australia.

Chakraborty AK, Rambhade S & Patil UK 2011, '*Chromolaena odorata* (L.): an overview', *Journal of Pharmacy Research* 4.3, pp. 573

Chea A, Jonville M, Bun S, Laget M, Elias R, Dumenil G & Balansard G 2007, 'In vitro antimicrobial activity of plants used in Cambodian traditional medicine', *American Journal of Chinese Medicine* 35.5, pp. 867-873.

Chung LY, Goh SH & Imiyabir Z 2005, 'Central nervous system receptor activities of some Malaysian plant species', *Pharmaceutical Biology* 43.3, pp. 280-288.

Dai H, Wang H, Liu J, Wu J & Mei W 2012, 'Two new biflavonoids from the stem of *Dracaena cambodiana*', *Chemistry of Natural Compounds* 48.3, pp. 376-378.

Dang M 2014, *Exploring the range of usages and perceptions of biomedicine and traditional medicine in Kamprum village*, Center for Mekong Studies, The School for Field Studies, Siem Reap, Cambodia.

Deur K 2015, *Traditional medicine usage and the transmission of traditional ecological knowledge in three villages near Phnom Kulen National Park*, Center for Mekong Studies, The School for Field Studies, Siem Reap, Cambodia.

Dhamija I, Kumar N, Pai KSR, Setty MM, Kumar S & Jana AN 2014, 'Exploration of antioxidant and antimicrobial potential of methanolic extract of root stock of *Premna herbacea*', *Bangladesh Journal of Pharmacology* 9.4, pp. 663-664.

Dy Phon P 2000, *Dictionary of plants used in Cambodia*, Imprimerie Olympic, Phnom Penh, Cambodia.

Eisenbruch M 1992, 'The ritual space of patients and traditional healers in Cambodia', *Bulletin de l'Ecole française d'Extrême-Orient* 79.2, pp. 283-316.

Ezenyi IC, Salawu OA, Kulkarni R & Emeje M 2014, 'Antiplasmodial activity-aided isolation and identification of quercetin-4'-methyl ether in *Chromolaena odorata* leaf fraction with high activity against chloroquine-resistant *Plasmodium falciparum*', *Parasitology Research* 113.12, pp. 4415-4422.

El Hussein M, Hirst S, Salyers V & Osuji J 2014, 'Using grounded theory as a method of inquiry: advantages and disadvantages', *The Qualitative Report* 19.27, pp. 1-15

George CK c. 2005, *Project of the government of Cambodia: support to trade promotion and export development*, report to Spices and Medicinal Plants Sector, International Trade Center, Geneva, Switzerland.

Google Earth 2013, 13°37'14.83"N, 104°05'22.25"E, elevation 672m, *Google Earth* v.7.1.5.1557, accessed 24 April 2016.

Hayes B, Mould A, Khou EH, Hartmann T, Hoa K, Calame T, Boughey K & Yon T 2013, *A biodiversity assessment of Phnom Kulen National Park with recommendations for management*, report prepared to the Ministry of Environment, Phnom Penh, Cambodia.

Hidalgo JA, Vasquez JA 2015, *Candidiasis clinical presentation*, Medscape, viewed 1 May 2016, http://emedicine.medscape.com/article/213853-clinical

Hidayati S, Franco FM & Bussmann RW 2015, 'Ready for phase 5 – current status of ethnobiology in Southeast Asia', *Journal of Ethnobiology and Ethnomedicine* 11.17, doi:10.1186/s13002-015-0005-7

Hout S, Chea A, Bun S, Elias R, Gasquet M, Timon-David P, Balansard G & Azas N 2006, 'Screening of selected indigenous plants of Cambodia for antiplasmodial activity', *Journal of Ethnopharmacology* 107, pp. 12-18

Kham L (ed.) 2009, *Cambodia Medicinal Plants, vol. 3*, Ministry of Health, Phnom Penh, Cambodia.

Kham L (ed.) 2010, *Cambodia Medicinal Plants, vol. 4*, Ministry of Health, Phnom Penh, Cambodia.

Khan MH, Okumura J, Sovannarith T, Nivanna N, Nagai H, Taga M, Yoshida N, Akazawa M, Tanimoto T & Kimura K 2011, 'Counterfeit medicines in Cambodia—possible causes.' *Pharmaceutical Research* 28.3, pp. 484-489.

Kigigha LT & Zige DV 2013, 'Activity of chromolaena odorata on enteric and superficial etiologic bacterial agents', *American Journal of Research Communication* 1.11, pp. 266-276.

Laval P, Rakotoarison H, Savajol N & Vanny T 2011, 'The contribution of wild medicinal plants towards poverty alleviation and health improvements: a case study in two

villages in Mondulkiri Province, Cambodia', *Cambodian Journal of Natural History* 1, pp. 29-39.

Linddal M & Mea O 2004, *Medicinal plants in Cambodia: on the production, trade and potential for rural livelihood,* report to the Institute of Khmer Habitat, Phnom Penh, Cambodia.

Luo Y, Wang H, Zhao YX, Zeng YB, Shen HY, Dai HF & Mei WL 2011, 'Cytotoxic and antibacterial flavonoids from dragon's blood of Dracaena cambodiana', *Planta Medica* 77.18, pp. 2053-2056.

Mea O (ed.) 2007, *Cambodia knowledge on medicinal plants,* Institute of Khmer Habitat, Phnom Penh, Cambodia.

NCTM (National Center for Traditional Medicine) 2006, *Medicinal plants of Cambodia, vol. 1*, Ministry of Health, Phnom Penh, Cambodia.

NCTM 2008, *Medicinal plants of Cambodia, vol. 2,* Ministry of Health, Phnom Penh, Cambodia.

NCTM 2010, *Medicinal plants of Cambodia, vol. 3,* Ministry of Health, Phnom Penh, Cambodia.

NCTM n.d. *Traditional medicine in Kingdom of Cambodia,* Ministry of Environment, Phnom Penh, Cambodia.

Nguyen-Pouplin J, Tran H, Tran H, Phan TA, Dolecek C, Farrar J, Tran TH, Caron P, Bodo B & Grellier P 2007, 'Antimalarial and cytotoxic activites of ethnopharmacologically selected medicinal plants from South Vietnam', *Journal of Ethnopharmacology* 109.3, pp. 417-427.

Nwinuka N, Nwiloh B & Eresama J 2009, 'Nutritional and potential medicinal value of *Chromolaena odorata* leaves', *International Journal of Tropical Agriculture and Food Systems* 3.2, doi: 10.4314/ijotafs.v3i2.50044

Ormeño E, Fernandez C & Mévy J 2007, 'Plant coexistence alters terpene emission and content of Mediterranean species', *Phytochemistry* 68.6, pp. 840-852.

Palombo EA 2006, 'Phytochemicals from traditional medicinal plants used in the treatment of diarrhea: modes of action and effects on intestinal function', *Phytotherapy Research* 20, pp. 717-724.

Pandith H, Zhang X, Liggett J, Min K, Gritsanapan W & Baek SJ 2013, 'Hemostatic and wound healing properties of *Chromolaena odorata* leaf extract', *ISRN Dermatology* 168269, doi: 10.1155/2013/168269

Panyakaew P, Goel G, Lourenco M, Yuangklang C & Fievez V 2009, 'Effect of medium-chain fatty acids from coconut oil or krabok oil on in vitro rumen biohydrogenation', in Y Chilliard, F Glasser, Y Faulconnier, F Bocquier, I Veissier, M Doreau (eds.), *Ruminant Physiology: digestion, metabolism, and effects of nutrition on reproduction and welfare*, Wageningen Academic Publishers, Wageingen, Netherlands.

Peltzer K, Pengpid S, Puckpinyo A, Yi A & Anh LV 2016, 'The utilization of traditional, complementary and alternative medicine for non-communicable diseases and mental disorders in health care patients in Cambodia, Thailand and Vietnam', *BMC Complementary and Alternative Medicine* 16.92, doi:10.1186/s12906-016-1078-0

Phan TT, Hughes MA, Cherry GW, Le TT & Pham HM 1996, 'An aqueous extract of the leaves of *Chromolaena odorata* (formerly *Eupatorium odoratum*) (Eupolin) inhibits hydrated collagen lattice contraction by normal human dermal fibroblasts', *Journal of Alternative and Complementary Medicine* 2.3, pp. 335-343.

Pilsczek FH 2001, 'Hospital medicine in Cambodia: a visiting doctor's perspective', *Canadian Medical Association Journal* 165.1, pp. 37-41.

Plant List 2013, *Version 1.1*, accessed 2 May 2016, http://www.theplantlist.org

Prades A, Dornier M, Diop N & Pain J 2001 'Coconut water uses, composition and properties: a review', *Fruits* 67.2, pp. 87-107.

Rehman SU, Choe K & Yoo HH 2016, 'Review on a traditional herbal medicine, Eurycoma longifolia Jack (tongkat ali): its traditional uses, chemistry, evidence-based pharmacology and toxicology', *Molecules* 21, doi:10.3390/molecules21030331

Richman MJ, Nawabi S, Patty L & Ziment I 2010, 'Traditional Cambodian medicine', *Journal of Complementary and Integrative Medicine* 7.1, doi:10.2202/1553-3840.1194

Savajol N, Toun V & Sam J 2011, *Traditional therapeutic knowledge of the Bunong people in north-eastern Cambodia: healers, their practices and medicinal plants*, Nomad RSI, Phnom Penh, Cambodia.

Stern P 1938, 'III: Traveaux executes au Phnom Kulên (15 avril-20 mai 1936)', *Bulletin de l'Ecole française d'Extrême-Orient*, 38.1, pp. 151-174.

Szakiel A, Paczkowski C & Henry M 2011, 'Influence of environmental biotic factors on the content of saponins in plants', *Phytochemistry Reviews* 10.4, pp. 493-502.

Tea J 2010, *Cambodian perinatal culture-bound syndromes: providing care to Cambodian women with toas*, University of Washington, accessed 1 May 2016, https://ethnomed.org/clinical/pediatrics/cambodian-perinatal-culture-bound-syndromes-providing-care-to-cambodian-women-with-toas

Wallace PY 2012, 'Forest use, livelihoods and biodiversity: a case study from Phnom Kulen National Park, Cambodia', Master's thesis, Oxford Brookes University, Oxford, UK.

WHO 2005, *National policy on traditional medicine and regulation of herbal medicines*, World Health Organization, Geneva, Switzerland.

Woodhead S 1981, 'Environmental and biotic factors affecting the phenolic content of different cultivars of Sorghum bicolor', *Journal of Chemical Ecology* 7.6, pp. 1035-1047.

Wiseman N 2004, 'Designations of medicines', *Evidence Based Complementary and Alternative Medicine* 1.3, pp. 327-329.

# Appendix 1: Topic guide for semi-structured interviews

**Demographics**

1. How many people are living in your household?
2. What is your age?
3. How many years have you lived in the village?

**Ethnobotany**

4. Does your family use medicinal plants?
5. Can you tell me about your medicines? Let's do one plant at a time. (If no response, suggest an illness, e.g. "What do you use when you have a fever?")
    a. What does it treat or help with?
    b. What is one plant that you use?
    c. What part of that plant do you use?
    d. Where do you get this plant? Do you buy it, collect it or grow it?
        i. (if buy) Why do you buy it instead of growing or collecting it yourself?
    e. (Repeat a-d for other constituents)
    f. How do you prepare the treatment? What is the dosage?
    g. How long does it take to work?

**Biomedicine**

6. Is there a healer in or close to your village? Is there a midwife?
7. Do you go to the healer or midwife when someone in your family is sick?
8. Do you ever call the mobile clinic?
9. Do you ever leave the village to visit a doctor? Where?
10. What illnesses do you go to the doctor for?
11. Do you ever take biomedicine?
12. Where do you buy it?
13. For what illnesses?
14. How do you decide whether you will use plant medicines or biomedicine?
15. Which kind of medicine do you think is more effective? Why?
16. Do you ever use plant medicine and biomedicine at the same time? Why?
17. When you buy biomedicine from a pharmacist or doctor, do you tell them which plant medicines you are taking?

# Appendix 2: Medicinal plant taxonomy of PKNP[20]

This is the first time the SFS taxonomy has been published with verified authorship and family names (Plant List 2013).

*Dang 2014, Deur 2015, Walker 2016

| Latin name | Family | Khmer common name |
|---|---|---|
| *Acacia caesia* (L.) Willd. | Fabaceae | ដើមឆ្មារ tmia |
| *Acalypha wilkesiana* Müll. Arg | Euphorbiaceae | កប្បាស kbas |
| *Achyranthes aspera* L. | Amaranthaceae | អណ្តាតគោ andaht ko |
| *Aegle marmelos* (L.) Corrêa | Rutaceae | ញ្ចៅ pnao |
| *Allium sativum* L. | Amaryllidaceae | ខ្ទឹម kh'toum |
| *Alpinia nigra* (Gaertn.) Burtt | Zingiberaceae | រំដេង romdeng |
| *Alyxia reinwardtii* Blume[21] | Apocynaceae | វល្លិ៍ឆ្នូត ch'not |
| *Amaranthus spinosus* L. | Amaranthaceae | ផ្ទីបន្លា pti bənla |
| *Amomum xanthioides* Wall. ex Baker[22] | Zingiberaceae | ក្រកោព្រៃ krorka prai |
| *Anacardium occidentale* L. | Anacardiaceae | ចន្ទី jen ti |
| *Ancistrocladus tectorius* (Lour.) Merr. | Ancistrocladaceae | ខុនម៉ា khɔn mia |
| *Annona muricata* L. | Annonaceae | ទាប tiap |
| *Anthocephalus chinensis*[23] | Rubiaceae | ថ្កូរ t'kau |

[20] Khmer names were prepared by Hang Chansophea and Tim Barrows (2016).
[21] Dang (2014) first described this species as *Atherlepis pierrei* var. *glabra*. However, this plant is not recorded online or in any available record texts. With Hang Chanosophea's translation, the original Khmer name was used to redescribe the species.
[22] This name is in popular use in contemporary botany literature, but the Plant List (2013) describes its accepted name as *Amomum villosum* var. *xanthioides* (Wall. ex Baker) T.L. Wu & S.J. Chen.
[23] The authorship and ID of this plant is widely contested because of the contradictory work of early botanists. This species may refer to *Neonauclea purpurea* (Roxb.) Merr. or *Breonia chinensis* (Lam.) Capuron, but it is unclear how the entry should be corrected in this listing.

| Latin name | Family | Khmer common name |
|---|---|---|
| *Antidesma ghaesembilla* Gaertn. | Phyllanthaceae | ដង្កៀបក្តាម dɔngkiap k'dam |
| *Aporosa villosa* Lindl. Baill. | Phyllanthaceae | ក្រុង krong |
| *Areca catechu* L. | Arecaceae | ស្លា sla |
| *Artabotrys sp.* | Annonaceae | ទឹកដោះក្របី tək doh krɔbai |
| *Artocarpus altilis* (Parkinson ex F.A.Zorn) Fosberg[24] | Moraceae | ខ្នុរស្រុក knɔl srok |
| *Artocarpus heterophyllus* Lam. | Moraceae | ស្វ៊ីកខ្នុរធំ knao thom |
| *Artocarpus rigidus* Blume | Moraceae | ខ្នុរព្រៃ knɔl prei |
| *Azadirachtra indica* A. Juss | Meliaceae | ស្ដៅ sdao |
| *Baeckea frutescens* L. | Myrtaceae | ម្រែចទន្សាយ mərek tom sai |
| *Bambusa vulgaris* Schrad. | Poaceae | ឫស្សី rusai |
| *Barringtonia acutangula (L.) Gaertn.* | Lecythidaceae | រាំងភ្នំ riang phnom |
| *Bixa orellana* L. | Bixaceae | ជ្រៃយ jum pu |
| *Borassus flabellifer* L. | Arecaceae | ត្នោត tnaot |
| *Bridelia curtisii* Hook.f.[25] | Phyllanthaceae | ធ្មេញត្រី tmənh trei |
| *Calamus sp.* | Arecaceae | ផ្ដៅ pdao |
| *Cananga latifolia* (Hook.f. & Thomson) Finet & Gagnep. | Annonaceae | ង្កែស្រែង chkai sraing |
| *Carica papaya* L. | Caricaceae | ល្មុងញី ល្មុងឈ្មោល ləhong nyi/chhmol |
| *Cassia grandis* L.f. | Fabaceae | អូយមួយ oi moi |
| *Catunaregam spinosa* (Thunb.) Tirveng[26] | Rubiaceae | រមៀង roviang |

[24] Previously described as *Artocarpus communis.*
[25] Previously described as *Bridelia ovata var. curtisii.*
[26] Previously described as *Randia tomentosa.*

| Latin name | Family | Khmer common name |
|---|---|---|
| *Ceiba pentandra* (L.) Gaertn. | Malvaceae | គ ko |
| *Centella asiatica* (L.) Urb. | Apiaceae | ត្រចៀកក្រាញ់ trochiak tranh |
| *Cheilocostus speciosus* (J.Koenig) C.D.Specht[27] | Costaceae | ត្រចុក trɔ tok |
| *Chromolaena odorata* (L.) R.M.King & H.Rob[28] | Asteraceae | ទន្ទ្រានខេត្ត kɔntian ket |
| *Chrysophyllum cainito* L. | Sapotaceae | ទឹកដោះ tɔk doh |
| *Chrysopogon zizanioides* (L.) Roberty[29] | Poaceae | ស្បូវរុនដាស sbao röndas |
| *Chukrasia tabularis* A.Juss | Meliaceae | រល្មីយោង yiang |
| *Citrus histrix* DC.[30] | Rutaceae | ក្រូចម្នាំ kroach ma |
| *Citrus lucida* (Scheff.) Mabb.[31] | Rutaceae | ក្រសាំង krɔ sang |
| *Citrus spp.* | Rutaceae | ក្រូច kroach (any) |
| *Cocos nucifera* L. | Arecaceae | ដូង dong |
| *Colocasia esculenta* (L.) Schott[32] | Araceae | ត្រាវ trao |
| *Combretum quadrangulare* Kurz. | Combretaceae | ដើមសង្កែ songkai |
| *Croton persimilis* Müll. Arg.[33] | Euphorbiaceae | ទំពូង thom pung |
| *Curcubita maxima* Duchesne | Cucurbitaceae | ល្ពៅ lpao |
| *Curcuma longa* L. | Zingiberaceae | រមៀត romiat |
| *Curcuma zedoaria* (Christm.) Roscoe | Zingiberaceae | ប្រទាលស្បូន protial sbon |

[27] Previously described as *Costus speciosus.*
[28] Formerly known as *Eupatorium odoratum.*
[29] Previously describe as *Vetiveria zizanioides.*
[30] The author believes this to be the most likely species of lime used in this region of Cambodia, but the identification is not definitive.
[31] Previously described as *Feroniella lucida.*
[32] Previously described as *Colocasia esculenta* var. *esculenta*
[33] Previously described as *Croton oblongifolius*.

| Latin name | Family | Khmer common name |
|---|---|---|
| *Cyclea barbata* Miers | Menispermaceae | ព្រះក្រុង preah krong |
| *Cymbopogon nardus* (L.) Rendle[34] | Poaceae | ស្លឹកគ្រៃ slək grai |
| *Dalbergia nigrescens* Kurz[35] | Fabaceae | ស្នួល snual |
| *Dalbergia oliveri* Prain | Fabaceae | នាងនួន niang nuan |
| *Dasymaschalon lomentaceum* Finet & Gagnep. | Annonaceae | ជើងចាប chɔng chab |
| *Dendrocalamus giganteus* Munro | Poaceae | ឫស្សីព្រៃ rusai prei |
| *Dendrocalamus membranaceus* Munro | Poaceae | ឫស្សីស្រុក rusai srok |
| *Derris elliptica* (Wall.) Benth. | Fabaceae | វល្លិអន្ទង់ antong |
| *Derris scandens* (Roxb.) Benth. | Fabaceae | ប្រេងស breng sɔ |
| *Derris trifoliata* Lour. | Fabaceae | ប្រេងក្រហម breng krɔhom |
| *Dillenia hookeri* Pierre | Dilleniaceae | ភ្លូបាត plu bat |
| *Dillenia ovata* Wall. ex Hook.f. & Thomson | Dilleniaceae | ភ្លូធំ plu thom |
| *Dillenia sp.* | Dilleniaceae | ភ្លូ plu |
| *Diospyros nitida* Merr. | Ebenaceae | ឈើក្តឹង chö plɔng |
| *Diospyros venosa* Wall. ex A.DC. | Ebenaceae | អង្កត់ខ្មៅ angɔt kmao |
| *Dipterocarpus intricatus* Dyer | Dipterocarpaceae | ត្រាច traj |
| *Dracaena angustifolia* (Medik) | Asparagaceae | អង្រែដែក angrias daik |
| *Dracaena cambodiana* Pierre ex Gagnep. | Asparagaceae | ចន្ទក្រហម joan krahom |
| *Drepanostachyum falcatum* (Nees) Keng f.[36] | Poaceae | ឫស្សីពីងពង់ rusai ping pong |

[34] Identified to the genus level by Deur (2015).
[35] This name is in popular use in contemporary botany literature, but the Plant List (2013) describes its accepted name as accepted name as *Dalbergia lanceolaria* subsp. *paniculata* (Roxb.) Thoth.
[36] Previously described as *Arundinaria falcata.*

| Latin name | Family | Khmer common name |
|---|---|---|
| *Drynaria quercifolia* (L.) J.Sm. | Polypodiaceae | ប៉ប្រក bɔ brɔk |
| *Drynaria roosii* Nakaike[37] | Polypodiaceae | ប៉ប្រក bɔ brɔk |
| *Eclipta prostrata* L.[38] | Asteraceae | មុខឈ្នាង mok chniang |
| *Eichhornia crassipes* (Mart.) Solms | Pontederiaceae | កំប្លោក kɔmplaok |
| *Eleutherine bulbosa* (Mill). Urb. | Iridaceae | ប្រទាលមហាជម្ពរ protial mohas jɔmbɔk |
| *Entada phaseoloides* (L.) Merr. | Fabaceae | អង្គុញ angkönh |
| *Erythroxylum cambodianum* Pierre | Erythroxylaceae | ផ្តៃលមាស ចង្អេងសេក ptəl mias/jong eng sek |
| *Euonymus cochinchinensis* Pierre | Celastraceae | គោមួយ ko moiy |
| *Eurycoma longifolia* Jack | Simaroubaceae | អន្ទង់ស antom sɔr |
| *Ficus benjamina* L. | Moraceae | ជ្រៃក្រឹម jrei krəm |
| *Ficus pumila* L. | Moraceae | ក្របីត្រោស krobai trao |
| *Ficus sp.* | Moraceae | ល្វាទឹក lvia tək |
| *Ganoderma lucidum* (Curtis) P. Karst[39] | Ganodermataceae | ផ្សិតសុក្រំ psət sokrɔm |
| *Garcinia lanessanii* Pierre | Clusiaceae | អង្គោល angkaol |
| *Glycosmis pentaphylla* (Retz.) DC. | Rutaceae | ភ្លាំង pleang |
| *Gmelina philippensis* Cham. | Lamiaceae | អញ្ចាញ an chan |
| *Gnetum gnemon* L. | Gnetaceae | ឆ្លុក klot |
| *Gnetum latifolium* Blume | Gnetaceae | ខ្លែក klait |

[37] Previously described as *Draceaena fortunei*. This may be the same species as *D. quercifolia*.
[38] Previously described as *Eclipta alba.*
[39] *G. lucidum* is a fungus.

| Latin name | Family | Khmer common name |
|---|---|---|
| *Harrisonia perforata* (Blanco) Merr. | Rutaceae | ដើមខ្ទុំទេស klɔntia |
| *Heliotropium indicum* L. | Boraginaceae | ប្រមោយដំរី brɔmoi domrai |
| *Holarrhena pubescens* Wall. Ex G.Don | Apocynaceae | ទឹកដោះខ្លា tək doh kla |
| *Hopea sp.* | Dipterocarpaceae | គគី ko ki |
| *Hydnocarpus anthelmintica* Pierre ex Gagnep. | Achariaceae | ក្របៅ krɔk bao |
| *Hymenocardia punctata* Wall. ex Lindl. | Phyllanthaceae | ញៀង pniang |
| *Imperata cylindrica* (L.) Raeusch. | Poaceae | ស្បូវភ្លាំង sbao pliang |
| *Ipomoea aquatica* Forssk. | Convolvulaceae | ត្រកួនស tror kun sɔr |
| *Irvingia malayana* Oliv. ex A.W.Benn. | Irvingiaceae | ចំបក់ jɔm bɔk |
| *Kaempferia galanga* L. | Zingiberaceae | ប្រោះ prɔs |
| *Knema globularia* (Lam.) Warb. | Myristicaceae | ស្មាក្របី sma krobai |
| *Lagerstroemia calyculata* Kurz | Lythraceae | ស្រឡៅ srɔ lao |
| *Lagerstroemia floribunda* Jack | Lythraceae | ផ្កាត្របែកព្រៃ trobaik prei |
| *Licuala spinosa* Wurmb | Arecaceae | ផ្នោរ pə'ao (protial) |
| *Lygodium conforme* C. Chr. | Lygodiaceae | រំសៃ romsai |
| *Mangnifera duperreana* Pierre | Anacardiaceae | ស្វាយព្រៃ svai prei |
| *Melaleuca leucadendra* L. | Myrtaceae | ស្មាច់ smaj |
| *Melastoma saigonense* (Kuntze) Merr. | Melastomataceae | បាយញែញ bai nhenh |
| *Melastoma sp.* | Melastomataceae | បាយបែក bai baik |
| *Melientha suavis* Pierre | Opiliaceae | ព្រិច prich |
| *Melodorum fruticosum* Lour. | Annonaceae | រំដួល rɔmdual |
| *Micromelum falcatum* (Lour.) Tanaka | Rutaceae | រលាយស្នង romli'e smɔng |

| Latin name | Family | Khmer common name |
|---|---|---|
| *Millingtonia hortensis* L.f. | Bignoniaceae | អង្គាបុស្ស ɔngkia bos |
| *Mitragyna parvifolia* (Roxb.) Korth. | Rubiaceae | ខ្ទុំទឹក kh'toum tək |
| *Mitragyna sp.* | Rubiaceae | ខ្ទុំគោក kh'toum ko |
| *Musa sp. (jake kchai)* | Musaceae | ចេកខ្ចី jake kchai |
| *Musa sp. (jake krɔb)* | Musaceae | ចេកគ្រាប់ jake krɔb |
| *Musa sp. (jake nəmva)* | Musaceae | ចេកណាំវ៉ា jake nəmva |
| *Nelumbo sp.* | Nelumbonaceae | ផ្កាឈូក p'kas chuək |
| *Ocimum basilicum* L. | Lamiaceae | ជីនាងវង niang vong |
| *Oenanthe javanica* (Blume) DC. | Apiaceae | ស្ពៃកង្កែប plau kɔng kaip |
| *Parinari anamensis* Hance | Chrysobalanaceae | ធ្លក tlok |
| *Passiflora foetida* L. | Passifloraceae | សាម៉ាវព្រៃ sao mao (prei) |
| *Peliosanthes teta* Andrews[40] | Asparagaceae | តា្បល់ដែក tbal daik |
| *Phyllanthus amarus* Schumach. & Thonn. | Phyllanthaceae | ឥសីផ្សំស្រែច aisai psam sraj |
| *Phyllanthus urinaria* L. | Phyllanthaceae | អំពិលប្រក់ផ្លែ ampəl brak plai |
| *Phyllodium pulchellum* (L.) Desv.[41] | Fabaceae | ព្រហ្មបែរក្រោយ prom bai kraoy |
| *Physalis angulata* L. | Solanaceae | ប៉ែងពោះស្រោម peng poh sraom |
| *Plumbago indica* L. | Plumbaginaceae | ចិត្រមមួលភ្លើង p'chət romör plɔng |
| *Plumbago zeylanica* L. | Plumbaginaceae | ចិត្រមួលភ្លើង pjɔt romual plöng |
| *Plumeria alba* L.[42] | Apocynaceae | ចំបី jɔm pai |

[40] Previously described as *Dracaena elliptica* var. *gracilis.*
[41] Previously described as *Desmodium pulchellum.*
[42] Hang Chansophea believes this to be the most likely species, although there were others listed in our reference texts with extremely similar Khmer names.

| Latin name | Family | Khmer common name |
|---|---|---|
| *Polyalthia evecta* Finet & Gagnep | Annonaceae | បាតផ្ដៀល bat ptəl (f.) / jɔng sek (m.) |
| *Polyscias fruticosa* (L.) Harms | Araliaceae | ពោល្បុ po yöm |
| *Pouzolzia zeylanica* (L.) Benn. | Urticaceae | កណ្ដាប់ចង្អេរ kɔntap jɔng'e |
| *Premna herbacea* Roxb. | Lamiaceae | ថ្នាំចិន tnam jen |
| *Prismatomeris tetrandra* (Roxb.) K.Schum. | Rubiaceae | រំដេញមាស romdenh mias |
| *Psidium guajava* L. | Myrtaceae | ត្របែក trobaik |
| *Psydrax pergracilis* (Bourd.) Ridsdale[43] | Rubiaceae | មេកង mekong |
| *Rhodomyrtus sp.* | Myrtaceae | ពួចតូច puach toich |
| *Rhodomyrtus tomentosa* (Aiton) Hassk. | Myrtaceae | ពួចធំ puach thom |
| *Saccharum officinarum* L. | Poaceae | អំពៅ ampəu |
| *Saccharum officinarum* var. *violaceum* Pers.[44] | Poaceae | អំពៅខ្មៅ ampəu kmao |
| *Schumanniathus dichotomus* (Roxb.) Gagnep. | Marantaceae | រុន ron |
| *Scindapsus officinalis* (Roxb.) Schott | Araceae | អូរជំុ ou chum |
| *Scleropyrum pentandrum* (Dennst.) Mabb.[45] | Santalaceae | ក្លាបួស kla puəs/krala puəs |
| *Scoparia dulcis* L. | Plantaginaceae | ឬស្សីធ្យូស្រែច rusai psam srat |
| *Shorea roxburghii* G.Don | Dipterocarpaceae | ពពេល popəl |
| *Siphonodon celastrineus* Griff. | Celastraceae | បាក់ដោក bot daok |
| *Smilax ovalifolia* Roxb. Ex. D.Don | Smilaceae | ឬសប៉ប្រឹស boprah |
| *Spatholobus parviflorus* (DC.) Kuntze | Fabaceae | ដកទក់ dɔk tuak |

[43] Previously described as *Canthium didymum* var. *rostrata.*
[44] It is a matter of contention whether this variety, black sugarcane, is separate from *Saccharum officinarum*.
[45] Previously described as *Scleropyrum wallichianum.*

| Latin name | Family | Khmer common name |
|---|---|---|
| *Sphenodesme pentandra* Jack | Lamiaceae | រមៀតស romiat sɔ |
| *Spondias dulcis* Parkinson[46] | Anacardiaceae | ម្ក៉ាក់ m'kak |
| *Stephania erecta* Craib. | Menispermaceae | មើមកន្ទ្រាំង kəntrian |
| *Stephania pierrei* Diels | Menispermaceae | កន្ទ្រុម kən trom |
| *Stephania rotunda* Lour. | Menispermaceae | កុមារពេជ្រ ko'ma pech |
| *Strychnos nux-vomica* L. | Loganiaceae | ស្លែង slaing |
| *Suregada multiflora* (A.Juss) Baill. | Euphorbiaceae | ត្រមូងសេក trɔ mong sek |
| *Syzygium sp.* | Myrtaceae | ព្រីងធំ pring thom |
| *Tamarindus indica* L. | Fabaceae | អំពិល ampəl |
| *Tetracera loureiri* (Finet & Gagnep.) Pierre ex W. G. Craib | Dilleniaceae | ដកគុណ dɔk kɔn |
| *Tiliacora triandra* Diels | Menispermaceae | យ៉ៅរ yiu |
| *Tinospora crispa* (L.) Hook. f. & Thomson | Menispermaceae | បណ្តូលពេជ្រ bɔndol pech |
| *Urena lobata* L. | Malvaceae | កញ្ជ្រន់អាចម៏ជ្រូក konjoan aht chrouk |
| *Willughbeia edulis* Roxb. | Apocynaceae | គុយ kuy |
| *Xylia xylocarpa* (Roxb.) Taub. | Fabaceae | សុគ្រំ soh krɔm |
| *Zea mays* L. | Poaceae | ពោត pot |
| *Zingiber montanum* (J.Koenig) Link ex A.Dietr.[47] | Zingiberaceae | ពន្លៃ pönlai |
| *Ziziphus cambodianus* Pierre | Rhamnaceae | អង្គ្រង angkrong |
| *Ziziphus oenopolia* (L.) Mill. | Rhamnaceae | សង្គៅ songkao |

[46] Previously described as *Spondia cytherea*.
[47] Previously described as *Zingiber purpureum.*

| Latin name | Family | Khmer common name |
|---|---|---|
| unknown | Annonaceae | ទ្រលឹងក្រហម troling krɔhom |
| unknown | Annonaceae | ទ្រលឹងស troling sɔr |
| unknown | Annonaceae | ទ្រលឹង trolling |
| unknown | Bambuseae | ឫស្សីពក rusai pok |
| unknown | Euphorbiaceae | លាជផ្ទុះ liach p'tus |
| unknown | Euphorbiaceae | ខ្ញី knyai'i |
| unknown | Zingiberaceae | ប្រទាលខ្មៅរាល protial kmao rial |
| unknown | Zingiberaceae | ប្រទាលព្រះឈ្នះ protial preah chneas |
| unknown | Zingiberaceae | ប្រទាលឫសដូង protial rus dong |
| unknown | - | អន្ទង់ក្រហម antong krɔhom |
| unknown | - | បញ្ជើក្អែកដើមគរ banya k'ait/daom ko |
| unknown | - | បាត់គ្រាំគ្រា bat kroam kria |
| unknown | - | បំពង់ក្រូច bomprong krok |
| unknown | - | ឈើស្វយ chö sə'oi |
| unknown | - | អំពែង ɔmpaing |
| unknown | - | អំពែងយាង ɔmpong yiang |
| unknown | - | ដើមកំផ្លែង dam pleng |
| unknown | - | ដងដាវ dong dau |
| unknown | - | ជង្គង់ចិន jɔngkong jen |
| unknown | - | ចត់ព្រៃ jot prei |
| unknown | - | ជ្រោយ jroi |
| unknown | - | ដើមកំប៉ែត kam pait |

| Latin name | Family | Khmer common name |
|---|---|---|
| unknown | - | ក្អម k'ɔm |
| unknown | - | កំភ្លា kɔmplia |
| unknown | - | កណ្តៅបាត kɔndao-baht |
| unknown | - | ក្តឈូស kdaw chlu |
| unknown | - | ក្តកំប្រុក kdɔh kɔmprok |
| unknown | - | ខ្ចាស់ kjas |
| unknown | - | កំអើកអាទ្រាត komraok antriat |
| unknown | - | ក្រចាយព្រៃ krɔjai prei |
| unknown | - | ក្រឡាវ krɔlao |
| unknown | - | ក្របីជល់ដី krobai jöl dai |
| unknown | - | ក្របីឡើងក krobai laong kɔ |
| unknown | - | កន្ទ្រើយ kəntrao'i |
| unknown | - | ឡង់ដំ រី lɔng dɔmrai |
| unknown | - | ឡង់ lɔng |
| unknown | - | លិង្គឥសូរ löng aso |
| unknown | - | ម្ជុលមាស mjɔl mias |
| unknown | - | នាងម៉ៅ niang mao |
| unknown | - | ផ្នង p'ahng |
| unknown | - | ផ្នែញ p'lenh |
| unknown | - | ភ្លាង pliang |
| unknown | - | ផ្នែកកង្កែប pnek kɔng kaip |
| unknown | - | ប្រទេង prɔtenh |

| Latin name | Family | Khmer common name |
|---|---|---|
| unknown | - | ព្រះបង្គាប់ preah bɔng koap |
| unknown | - | ព្រះស្តេច preah sdach |
| unknown | - | ប្រទាលព្រះអង្គោល protial prei angkao |
| unknown | - | រុន roan |
| unknown | - | រមៀតក្រហម romiat krɔhom |
| unknown | - | រំពង់រាយ rompong vi'e |
| unknown | - | រុន run |
| unknown | - | សួតដំរី saot dɔmrai |
| unknown | - | សក់នាង sɔk niang |
| unknown | - | សម្បុរបាយ sɔmbo bai |
| unknown | - | សេះ ses |
| unknown | - | ស្មៅអាចម៏សេះ smao aht she |
| unknown | - | ស្មៅជើងក្រាស់ smao chöng kras |
| unknown | - | ស្មៅគុម្ពបីមុខ smao kombai mok |
| unknown | - | ស្នាយ snai |
| unknown | - | ស្រយ៉ង់ srɔ yɔng |
| unknown | - | សន្ទះខ្យង sɔntea kchɔng |
| unknown | - | ដើមតាអាន ta ahn |
| unknown | - | ឬសតាលាញ់ ta lanh |
| unknown | - | តាមែង ta meng |
| unknown | - | តាសៃ ta se |
| unknown | - | ក្តុំកំប្រុក tɔh kɔmprok |

| Latin name | Family | Khmer common name |
|---|---|---|
| unknown | - | ទំពាំង thom piang |
| unknown | - | ធ្នាញ tnianh |
| unknown | - | ត្រដឹក trɔdək |
| unknown | - | ត្រចៀកក្រាស់ trochiak kras |
| unknown | - | ត្រចៀកទន្សាយ trochiak tonsai |
| unknown | - | ទ្រលែងពាន trolaing piən |
| unknown | - | ទ្រលំពែ trolom pei |

# Appendix 3: Ethnopharmacopoeia of PKNP

*Dang 2014, Deur 2015, Walker 2016

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Acacia caesia* | bark | stomach ache | decoction with *Eclipta prostrata* and *Cananga latifolia*; see *Cananga latifolia*; see *Ficus sp.* (lvia tək), see *Dalbergia nigrescens* |
| *Acalypha wilkesiana* | root | malaria (adult) | see *Citrus hystrix* |
| *Achyranthes aspera* | resin | postpartum care | see kləntias |
| *Aegle marmelos* | bark | bone, nervous complications | tablets made from dried bark, *Stephania rotunda*, ta set, smao at seh, together with honey and formed into balls |
| | fruit | energy tonic | decoction to drink (keep warm in thermos) with: bulb of *Premna herbacea*, wood chips of *Cananga latifolia*, and vines of *Willughbeia edulis*, *Gnetum gnemon*, *Gnemun latifolium*, *Tetracera loureiri* |
| *Allium sativum* | bark, wood chips | postpartum care | decoction with bark of *Melodorum fruticosum*, *Irvingia malayana*, branch of *Diospyros nitida*, stem of ta meng, *Mitragyna parvifolia*, *Mitragyna sp.* (kh'toum ko), *Prismatomeris tetrandra*; see *Achyranthes aspera*; infusion into rice wine with leaves, bark of *Anthocephalus chinensis* |
| *Alpina nigra* | bark | postpartum care | see *Polyalthia evecta* |
| *Alyxia reinwardtii* | vine | muscle pain, nerve pain | see *Scoparia dulcis* |
| *Amaranthus spinosus* | flowering plant | pain, muscle ache, vitamin deficiency | macerate plant and mix with sugar |
| | entire plant | fever | see *Spondia dulcis* |
| *Amomum xanthioides* | bark, branch | postpartum care | decoction with *Antidesma ghaesembilla*, *Zizyphus oeniphlia*, pepper, onion to drink |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Anacardium occidentale* | bark | stomach ache, diarrhea | decoction to drink with roasted or boiled bark |
| *Ancistrocladus tectorius* | wood chips | postpartum care | see jroi |
| *Annona muricata* | bark | headaches, postpartum care; diarrhea | infusion into rice wine |
| *Anthocephalus chinensis* | bark | malaria; lactagogue | for malaria decoction with entire plant of smao chöng kras and termite mound soil; for lactagogue decoction with bark of *Derris elliptica*, onions, peppers; see *Cananga latifolia*; see *Ficus sp.* (lvia tək); see *Allium sativum*; see smao chöng kras |
| | bark | migraines | see romli'e smɔng |
| *Antidesma ghaesembilla* | bark, branch | postpartum care | see *Amomum xanthioides*; see *Cananga latifolia* |
| *Aporosa villosa* | wood chips | postpartum care | see *Polyalthia evecta*, see *Prismatoteris tetrandra*, see *Cananga latifolia*, see kdɔh kɔmprok, see jroi |
| | root | postpartum care | decoction to drink with kdɔh kɔmprok, *Diospyros nitida, Polyalthia evecta* |
| | root, wood chips | lactagogue | decoction to drink with: root/wood chips, root/woodchips of *Prismatomeris tetrandra*, wood chips of *Melastoma sp.* (bai baik), *Rhodomytrus sp.* (puach toich), *Rhodomyrtus tomentosa* |
| *Areca catechu* | root | blocked bowels, hemorrhoids | see *Borassus flabellifer* |
| *Artabotrys sp.* | roots | lactagogue | decoction |
| | vine | lactagogue | decoction; see *Scleropyrum pentandrum* |
| | roots, wood chips | lactagogue | decoction of wood/roots of: *Artabotrys sp.* (tək doh krobai), *Scleropyrum pentandrum, Catunaregram spinosa, Ceiba pentandra, Polyalthia evecta*, kdɔh kɔmprok |
| | wood chips | postpartum care | see *Scleropyrum pentandrum*, see kdɔh kɔmprok, see lɔng |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | wood chips | circulation | see dam pleng |
| *Artocarpus altilis* | pith | liver disease | see preah sdach |
| *Artocarpus heterophyllus* | leaves | postpartum care | decoction; decoction wrapped around an iron nail tied with black string |
| *Artocarpus rigidus* | pith | liver disease | see preah sdach |
| *Azadirachtra indica* | bark, leaves | malaria | see *Tiliacora triandra*; drink juice of macerated leaves |
| | young leaves | centipede bite | pound young leaves with tiger balm from market and apply to bite often |
| *Baeckea frutescens* | - | muscle pain, nerve pain | see *Scoparia dulcis* |
| *Bambusa vulgaris* | skin, leaves | infection | macerate skin and leaves of *Chromolaena odorata* |
| *Barringtonia acutangula* | flower | fetal health, delivery | decoction to drink, decoction with *Nelumbo* sp. (p'kas chuək) |
| | leaves | stomach ache | eat raw |
| *Bixa orellana* | bark | migraines | see romli'e smɔng |
| *Borassus flabellifer* | root | blocked bowels, hemorrhoids | decoction with root of *Areca catechu* and root of *Cocos nucifera* |
| | bulb (of young tree) | swelling | see *Calamus* sp. (pdao) |
| | sugar | sore throat | mix sugar with juice of *Citrus hystrix* and resin of *Dracaena cambodiana* to drink |
| | fruit | malaria (adult) | see *Citrus hystrix* |
| *Bridelia curtisii* | wood chips | circulation | see dam pleng |
| *Calamus sp.* | root | malaria | see *Licuala spinosa* |
| | root | swelling | decoction with root of *Lygodium conforme,* young bulb of *Borassus flabellifer,* bark of *Plumeria alba* |
| *Cananga latifolia* | inner bark | "cure all" | decoction with *Irvingia malayana,* ta meng, pepper, onion skin |
| | | | for stomach ache |
| | inner bark | stomach ache | decoction with vine of *Willughbeia edulis;* decoction with vine of *Eclipta prostrata* and bark of *Acacia* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | | | *caesia;* decoction with bark of *Antidesma ghaesembilla*, entire *Prismatomeris tetrandra;* decoction with *Eclipta prostrata* and entire trochiak tonsai; infusion to drink of bark and fruit of *Musa* sp. (jake nəmva) into *Cocos nucifera* juice |
| | inner bark | fever | decoction with bark of *Anthocephalus chinensis;* see *Cocos nucifera* |
| | wood chips | postpartum care | decoction to drink of wood chips with: *Melastoma sp. (bai baik), Melastoma saigonense, Dillenia hookeri, Polyalthia evecta, kdɔh kɔmprok, Diospyros nitida, Diospyros venosa, Aporosa villosa* |
| | wood chips | energy tonic | see *Aegle marmelos* |
| | wood chips | stomach ache | see *Dalbergia nigrescens* |
| | wood chips | fever | infusion to drink with *Cocos nucifera* juice |
| *Carica papaya* | root | sore throat | see *Polyscias fruticosa* |
| | root | fever | see *Spondia dulcis* |
| | seed | snakebite | grind seeds with seeds of *Citrus hystrix* and apply powder to bite |
| *Cassia grandis* | fruit | snakebite | infusion into rice wine with ground dried fruit, ground small unidentified seeds from the Battambang market, and ground peppercorns |
| *Catunaregram spinosa* | roots, wood chips | lactagogue | see *Artabotrys* sp. (tək doh krobai) |
| | wood chips | postpartum care | see lɔng, see jroi |
| *Ceiba pentandra* | young leaves | fever | macerate with water and apply to temple; macerate with vine of sɔk niang and apply to temples and cervical lymph nodes as poultice see *Passiflora foetida;* see *Cyclea barbata*; |
| | bark | stomach ache, diarrhea | decoction with grilled bark |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | inner bark | fever | decoction of roasted bark (adult fever); see *Schumanniathus dichotomus* (childhood fever); see *Chromolaena odorata*; see *Spondia dulcis* |
| | roots, wood chips | lactagogue | see *Artabotrys* sp. (tək doh krobai) |
| *Centella asiatica* | entire plant | fever | see *Spondia dulcis* |
| *Cheilocostus speciosus* | bark | fever | infusion of bark in water, use water to shower |
| *Chrysophyllum cainito* | roots, leaves | malaria | see *Musa* sp. (jake krɔb) |
| | leaves | lactagogue | drink decoction |
| | bark, leaves | stomach ache | drink decoction of leaves with bark of *Anacardium occidentale*; decoction of bark |
| *Chrysopogon zizanioides* | root | postpartum care | see kdɔh kɔmprok, see jroi |
| *Chromolaena odorata* | root | fever | decoction of root with inner bark of *Ceiba pentandra* |
| | root | malaria | decoction with soil of termite mound, large iron nail wrapped with black string; decoction of root with vine of *Tiliacora triandra;* decoction of root with root of *Tiliacora triandra* |
| | leaves | wounds | macerate leaves as poultice |
| | leaves | infection | see *Bambusa vulgaris* |
| *Chukrasia tabularis* | vine | fever (childhood) | see *Schumanniathus dichotomus* |
| | wood chips | intrauterine infection following delivery | see *Dipterocarpus intricatus* |
| *Citrus hystrix*[48] | seed | snakebite | *see Carica papaya* |
| | juice | sore throat | *see Borassus flabellifer* |

[48] The author believes this to be the most likely species of lime used in this region of Cambodia, but the identification is not definitive.w

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | root | malaria (adult) | decoction of chopped root with root of *Acalypha wilkesiana*, fruit of *Borassus flabellifer*, vine of *Curcubita maxima*, root of *tnianh*, and *Zea mays kernels* aged 1 year |
| | root | fever | see *Spondia dulcis* |
| *Citrus lucida* | bark | fever (childhood) | see *Schumanniathus dichotomus* |
| *Citrus spp.* | bark | migraines | see romli'e smɔng |
| *Cocos nucifera* | juice | solvent | see Appendix 4 |
| | root | vomiting | infusion to drink with: root, root of *Areca catechu*, bark of *Musa* sp. (jake nəmva) |
| | shell | muscle pain, nerve pain | see *Scoparia dulcis* |
| *Colocasia esculenta* | wood chips | STDs (female) | see *Dipterocarpus intricatus* |
| *Combretum quadrangulare* | wood chips | fever, appetite | decoction of dried materials with 3 unknown medicinal plants |
| *Croton persimilis* | stem, branch | stomach ache | decoction with dried pieces into "green tea" |
| | wood chips | postpartum care | see kdɔh kɔmprok |
| *Curcubita maxima* | vine | malaria (adult) | see *Citrus hystrix* |
| *Curcuma longa* | root | skin care (dry skin, itchy skin) | pound dried ingredients with water and apply to skin |
| *Curcuma zedoaria* | bulb | postpartum care (removes "blood inside") | decoction |
| *Cyclea barbata* | leaves | fever | macerate leaves with young leaves of *Ceiba pentandra* into a poultice and apply to forehead; macerate leaves alone |
| *Cymbopogon nardus* | grass (mature 1 year) | malaria | decoction with *Zea mays* kernels and termite soil, drink as often as possible |
| | grass (cooked in soup) | muscle aches and stiffness (e.g. from polio) | see kəntrao'i |
| | entire plant | colds, fevers | decoction as bath |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | root once 1+ years old | chicken pox | see roan |
| *Dalbergia nigrescens* | wood chips | stomach ache | decoction to drink, with: wood chips, bark of *Acacia caesia*, *Xylia xylocarpa*, wood chips of *Cananga latifolia*, vine of *Gnetum gnemon*, *Gentum latifolia*, *Willughbeia edulis* |
| *Dalbergia oliveri* | bark | strength tonic | see *Entada phaseoloides* |
| *Dasymaschalon lomentaceum* | root | "nerves balance" | see *Smilax ovalifolia* |
| *Dendrocalamus giganteus* | root | gingivitis, dental carries | see *Drepanostachyum falcatum* |
| *Dendrocalamus membranaceus* | root | sinus blockage | see bomprong krok |
| | root | gingivitis, dental carries | see *Drepanostachyum falcatum* |
| | leaves | headache | decoction for steaming with: leaves, leaves of *Phyllanthus amarus*, and rice (breathe in once daily) |
| *Derris elliptica* | bark | lactagogue | see *Anthocephalus chinensis*, see *Willughbeia edulis* |
| *Derris scandens* | vine | energy tonic, circulation | see *Gnetum gnemon* |
| *Derris trifoliata* | vine | energy tonic, circulation | see *Gnetum gnemon* |
| *Dillenia hookeri* | stem | postpartum care (reduce bad blood) | decoction to drink of stems of up to 9 ingredients, but at least 5: *Dillenia hookeri*, kdɔh kɔmprok, *Polyalthia evecta*, *Melastoma* sp. (bai baik), *Melastoma saigonense*, *Scleropyrum pentandrum*, *Prismatomeris tetrandra*, knyai'i, *Diospyros nitida* |
| | root | postpartum care | see Cananga latifolia; see kdɔh kɔmprok; see jroi |
| *Dillenia ovata* | wood chips | postpartum care | see lɔng |
| *Dillenia sp.* | bark | fetal health, delivery | decoction alone; decoction with bark of ko and sɔk niang |
| | young shoots | gingivitis, dental carries | see *Drepanostachyum falcatum* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Diospyros nitida* | entire plant | "cure all" | see trolom pei, see Tamarindus indica; decoction of dried parts with wood, roots of Prismatomeris tetrandra, wood of niang mao |
| | wood chips | postpartum care | see *Polyalthia evecta*, see *Dillenia hookeri*, see kdɔh kɔmprok, see jroi, see *Cananga latifolia* |
| | root | postpartum care | see *Aporosa villosa* |
| | root, wood chips | postpartum care | see *Prismatoteris tetrandra* |
| *Diospyros venosa* | root | postpartum care | decoction of fresh or dried roots of ta meng, *Parinari anamensis*, *Dillenia* sp. (plu); see *Melastoma* sp. (bai baik); see *Tamarindus indica*; see *Ziziphus oenopolia* |
| | root, wood chips | postpartum care | see *Prismatoteris tetrandra*, see *Cananga latifolia*, see *Polyalthia evecta* |
| | wood chips | postpartum care | decoction of wood chips, with: wood chips of kam pait, *Rhodomyrtus tomentosa*, *Prismatomeris tetrandra*, *Oenanthe javanica*, dong dau, *Saccharum officinarum*, root of ta lanh; see kdɔh kɔmprok |
| | wood chips | malaria | see jɔngkong jen |
| | wood chips | circulation | decoction to drink with: wood chips, wood chips of kdɔh kɔmprok, *Polyalthia evecta*, *Diospyros venosa* |
| | wood chips | STDs (female) | see kjas |
| *Dipterocarpus intricatus* | bark, branch | postpartum care | see trolom pei |
| | wood chips | STDs (female) | decoction of wood chips with ɔmpong yiang and *Colocasia esculenta* |
| | wood chips | intrauterine infection following delivery | decoction to drink of wood chips with: wood chips of *Chukrasia tabularis*, *Psydrax pergracilis*, fresh bark of *Premna herbacea*, sugarcane of *Saccharum officinarum* (cannot drink alcohol or have prahoc during treatment) |
| | charcoal | sore throat | see *Draecana cambodiana* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Dracaena angustifolia* | - | postpartum care | see *Ficus pumila*; decoction with *Irvingia malayana*, ta meng, *Melodorum fruticosum*, *Dracaena elliptica*, *Parinari anamensis*; infusion into rice wine |
| *Dracaena cambodiana* | stem, branch | sore throat | infusion of ground stem in water or *Cocos nucifera* juice; poultice for throat from grilled stem; infusion with woody mushroom |
| | pith | sore throat | infuse stone-ground ingredients with water or *Cocos nucifera* juice, plus: tree core of chö sə'oi, charcoal of Dipterocarpus intricatus, and an unknown kind of stone-dwelling fungi or lichen; that recipe without lichen |
| | stem | fever, sore throat | macerate stem with unidentified stone-dwelling fungi in *Cocos nucifera* juice |
| | resin | sore throat | see *Borassus flabellifer* |
| | root | sore throat | infusion to drink with *Cocos nucifera* juice 3x daily (can eat raw but is more palatable in juice) |
| | entire plant | energy tonic, circulation | see *Gnetum gnemon* |
| *Drepanostachyum falcatum* | root | gingivitis, dental carries | decoction for mouthwash of with root and: young shoots of *Irvinigia malayana*, *Dillenia* sp. (plu), bark of *Mangnifera duperreana*, snai, *Hopea* sp. (ko ki), roots of *Dendrocalamus membranaceus*, *Dendrocalamus giganteus* |
| *Drynaria roosii* | vine | malaria (childhood) | see *Passiflora foetida* |
| *Drynaria quercifolia* | bark | snakebite | decoction of bark wrapped inside tissue paper with red ants and a kind of soil-dwelling fly, apply water to bite. |
| *Eclipta prostrata* | entire plant | stomach ache, sore throat, respiratory illness | decoction with bark of *Cananga latifolia* and root of *Premna herbacea*; see *Cananga latifolia* |
| *Eichhornia crassipes* | stem | measles, scarlet fever | see *Schumanniathus dichotomus* |
| *Eleutherine bulbosa* | - | muscle pain, nerve pain | see *Scoparia dulcis* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Entada phaseoloides* | seed | strength tonic | pound seed with bark of *Dalbergia oliveri* in equal amounts into powder and mix with honey: in tablet form, infused into rice wine, or boiled in water |
| *Erythroxylum cambodianum* | wood chips | postpartum care | see lɔng |
| *Euonymus cochinchinensis* | bark | postpartum care | see *Ficus pumila* |
| | wood chips | postpartum care | see lɔng, see jroi |
| | wood chips | STDs (female) | see kjas |
| *Eurycoma longifolia* | vine | energy, aphrodisiac, neuralgia, rheumatism, sore muscles | mix oil from vine with oil of bulb of löng aso; see *Gnetum gnemon* |
| *Ficus benjamina* | leaves | fever, "pox" | infusion into bathwater |
| | leaves | measles, scarlet fever, fever (childhood) | see *Schumanniathus dichotomus* |
| *Ficus pumila* | - | postpartum care | infusion into rice wine; decoction with *Phyllanthus amarus, Euonymus cochinchinensis, Peliosanthes teta, Dracaena angustifolia* |
| | wood chips | circulation | see dam pleng |
| | vine | energy tonic, circulation | see *Gnetum gnemon* |
| *Ficus sp.* | wood chips | malaria, colds, fevers | decoction (apparently) of plant materials wrapped 7 times with string with a nail in the middle, with bark of *Anthocephalus chinensis* and bark of *Acacia caesia* |
| *Ganoderma lucidum* | fungi | rashes and infection | grind fungi with water into paste |
| | fungi | Pain | infusion into rice wine |
| *Garcinia lanessanii* | - | diarrhea, nausea | decoction of dried parts with dried kɔndao-baht and liach p'tus |
| *Glycosmis pentaphylla* | bark | migraines | see romli'e smɔng |
| *Gmelia philippensis* | entire plant | pregnancy health, delivery | decoction with root of *Barringtonia acutangula*, leaves of *Artocarpus heterophyllus* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Gnetum gnemon* | vine | stomach ache | see *Dalbergia nigrescens* |
| | vine | energy tonic, circulation | for energy, decoction to drink of vine with: vines of *Gentum latifolium, Willughbeia edulis, Sphenodesme pentandra,* romiat krɔhom, *Derris scandens, Derris trifolia,* troling sɔr, troling krɔhom, *Eurycoma longifolia*, antong krɔhom, *Ficus pumila,* krobai laong kɔ, krobai jöl dai, entire plant of *Peliosanthes teta, Draecana cambodiana,* bulb of löng aso, wood chips of komraok antriat; for circulation, replace löng aso and komraok antriat with bat kroam kria and *Premna herbacea*; see *Aegle marmelos* |
| *Gnetum latifolium* | vine | energy tonic, circulation | see *Aegle marmelos,* see *Gnetum gnemon* |
| | vine | stomach ache | see *Dalbergia nigrescens* |
| *Harrisonia perforata* | bark, branch, resin | postpartum care | see *Allium sativum*; drink mixture of resin, *Achyranthes apsera* resin, and *Cocos nucifera* juice |
| | root | malaria | decoction to drink (boil down 3 bowls water to 1 bowl) |
| *Heliotropium indicum* | entire plant, leaves and flower | fever | decoction with dried whole plant; poultice on temples from pounded leaves and flowers; decoction with *Physalis angulata* |
| *Holarrhena pubescens* | vine | dysentery, diarrhea, stomach ache | decoction of dried vine wrapped with string 7 times with central nail |
| | root | delivery | see *Lagerstroemia calyculata* |
| *Hopea sp.* | bark | gingivitis, dental carries | see *Drepanostachyum falcatum* |
| *Hydnocarpus anthelmintica* | bark | postpartum care | roasting with bark of *Melodorum fruticosum, Irvingia malayana*, ta meng, *Diospyros nitida, Parinari anamensis, Plumbago indica*, onion, pepper |
| *Hymenocardia punctata* | bark | postpartum care (blood replenishment) | mix with *Willughbeia edulis* in wine |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Imperata cylindrica* | root | STDs, urinary difficulty | dry roast mixed with sand and *Saccharum officinarum*, then remove sand and drink decoction of boiled plants |
| *Ipomoea aquatica* | entire plant | postpartum care, STDs | steaming for postpartum care, for STDs see *Siphonodon celastrineus* |
| *Irvingia malayana* | bark | postpartum care | see *Cananga latifolia*, see *Parinari anamensis*, *see Melastoma sp.* (bai baik), see kdɔh kɔmprok |
| | wood chips | postpartum care | see jroi |
| | wood chips | lactagogue | see *Scleropyrum pentandrum* |
| | young shoots | gingivitis, dental carries | see *Drepanostachyum falcatum* |
| *Kaempferia galanga* | leaves, roots | skin care (dry skin, itchy skin) | pound dried ingredients with water and apply to skin |
| | wood chips | circulation | see dam pleng |
| *Knema globularia* | wood chips | lactagogue | see *Scleropyrum pentandrum* |
| *Lagerstroemia calyculata* | bark | delivery | decoction to shower with bark, root of *Holarrhena pubescens*, fruit of *Areca catechu* |
| *Lagerstroemia floribunda* | flower | delivery | decoction with sɔk niang; drink mixture of bark of *Parinari anamensis*, skin of thom piang and egg shells; see *Prismatomeris tetrandra* |
| *Licuala spinosa* | root | malaria | decoction with pdao |
| | young leaves | centipede bite | pound young leaves with tiger balm from market and apply to bite often |
| | bulb | wounds | grind bulb as poultice |
| | root, wood chips | postpartum care | see kdɔh kɔmprok |
| *Lygodium conforme* | root | swelling | see *Calamus* sp. (pdao) |
| *Mangnifera duperreana* | bark | gingivitis, dental carries | see *Drepanostachyum falcatum* |
| *Melaleuca leucadendra* | wood chips | diabetes | see *Syzygium* sp. (pring thom) |
| *Melastoma saigonense* | roots | stomach ache, postpartum care | decoction with dried root of *Melastoma* sp. (bai baik) and root of *Imperata cylindrica*; decoction with root |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | | | of ta set, bark of *Cananga latifolia*, entire *Prismatomeris tetrandra*, entire *Eclipta prostrata*, root of both wild and cultivated *Dendrocalamus membranaceus*, see *Polyalthia evecta*, see *Cananga latifolia*, see kdɔh kɔmprok |
| | wood chips | postpartum care | see lɔng; see jroi; see *Dillenia hookeri* |
| *Melastoma sp.* | entire plant | postpartum care | decoction of dried bark of ta meng, *Irvingia malayana*, *Parinari anamensis*, roots/bark of *Diospyros venosa*, whole plant of ta set, *Prismatomeris tetrandra*, *Polyalthia evecta*, to drink. |
| | roots | postpartum care | see *Polyalthia evecta*, see *Cananga latifolia* |
| | wood chips | lactagogue, postpartum care | see *Dillenia hookeri*, see *Aporosa villosa* |
| *Meliantha suavis* | vine | fever | see *Tinospora crispa*; decoction |
| *Melodorum fruticosum* | bark | postpartum care | decoction with *Diospyros nitida*, *Prismatomeris tetrandra*, *Phyllanthus amarus*, ta meng |
| | stem | malaria | decoction with vine of *Willughbeia edulis*, bark of kɔmplia |
| *Micromelum falcatum* | bark | sinus blockage | see bomprong krok |
| *Millingtonia hortensis* | wood chips | fever | see *Spondia dulcis* |
| *Mitragyna parvifolia* | bark, branch | postpartum care | see *Allium sativum* |
| *Mitragyna sp.* | stem | postpartum care | see *Allium sativum* |
| *Musa sp. (jake kchai)* | peels (unripe) | stomach ache | mix into rice wine to drink |
| *Musa sp. (jake krɔb)* | bark | malaria | decoction with dried parts, bark of *Chrysophyllum cainito*, bark of *Spondia dulcis*, to drink |
| *Musa sp. (jake nəmva)* | fruit | "hot" abdominal pain | see *Cananga latifolia* |
| | bark | vomiting | see *Psidium guajava* |
| *Nelumbo sp.* | flower | delivery | see *Barringtonia acutangula* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Ocinum basilicum* | herbaceous stem, root | postpartum care, colds, headaches | decoction alone; decoction with onion and pepper (drink for headache, steaming for cold) |
| *Oenanthe javanica* | wood chips | postpartum care | see *Diospyros venosa* |
| *Parinari anamensis* | bark, small branch | postpartum care | decoction with dried parts, ta meng, *Irvingia malayana* to drink |
| | bark | migraines | see romli'e smɔng |
| *Passiflora foetida* | vine | stomach ache, daily health tonic | decoction of dried vine, decoction with dried *Willughbeia edulis* and *Musa* sp. (jek kchai) |
| | vine | malaria (childhood) | infusion of chopped vine with chopped *Drynaria roosii*, srɔ yɔng and ɔmpaing into water for a non-bitter medicine |
| | leaves | fever | macerate leaves and leaves of *Ceiba pentandra*, drink infusion of juice and apply leaf matter to temples |
| *Peliosanthes teta* | entire plant | energy tonic, circulation | see *Gnetum gnemon* |
| | - | postpartum care | see *Ficus pumila* |
| *Phyllanthus amarus* | - | postpartum care | see *Melodorum fruticosum* |
| | wood chips | postpartum care, circulation | decoction to drink with: wood chips, wood chips of kdɔh kɔmprok, *Polyalthia evecta, Diospyros venosa*; see lɔng |
| | root | postpartum care | see kdɔh kɔmprok |
| *Phyllanthus urinaria* | entire plant | fever (childhood) | infusion to drink with: entire plant and a stone-dwelling lichen into *Cocos nucifera* juice |
| *Phyllodium pulchellum* | entire plant | postpartum care | decoction with other unknown ingredients |
| *Physalis angulata* | entire plant | postpartum care | see thom piang |
| | leaves | liver inflammation | decoction of 3L to 1L until viscous; see *Heliotropium indicum* |
| *Plumbago indica* | stem, bark | postpartum care | see *Hydnocarpus anthelmintica* |
| *Plumbago zeylanica* | root | lactagogue, postpartum care | see *Scleropyrum pentandrum* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| *Plumeria alba* | bark | swelling | see *Calamus* sp. (pdao) |
| *Polyalthia evecta* | entire plant | postpartum care | see *Melastoma* sp. (bai baik) |
| | root | postpartum care | decoction of dried ingredients, with: tɔh kɔmprok, *Aporosa villosa, Scleropyrum pentandrum, Alpina nigra, Diospyros nitida, Melastoma sp.* (bai baik), *Melastoma saigonense;* see *Aporosa villosa*; see *Cananga latifolia*; see see kdɔh kɔmprok; see jroi; see lɔng |
| | wood chips | postpartum care | see *Dillenia hookeri*; see jroi; see *Prismatoteris tetrandra* |
| | wood chips | circulation | decoction to drink with: wood chips, wood chips of kdɔh kɔmprok, *Polyalthia evecta*, *Diospyros venosa* |
| | vine | postpartum care | decoction of vine with wood chips of kdɔh kɔmprok, *Aporosa villosa, Diospyros venosa* |
| | roots, wood chips | lactagogue | see Artabotrys sp. (tək doh krobai) |
| *Polyscias fruticosa* | root | sore throat | infusion into *Cocos nucifera* juice with *Carica papaya* |
| | leaves | skin care | poultice of pounded dried ingredients and water |
| *Pouzolzia zeylanica* | vine | postpartum care | see jroi |
| *Premna herbacea* | bulb | increases effectiveness of other medicines | see *Eclipta prostrata* |
| | bulb | energy tonic | see *Aegle marmelos* |
| | bulb | liver disease | see preah sdach |
| | bark (fresh) | STDs (female) | see kjas |
| | bark (fresh) | intrauterine infection following delivery | see *Dipterocarpus intricatus* |
| | wood chips | circulation | see *Gnetum gnemon* |
| *Prismatomeris tetrandra* | entire plant | postpartum care (sleep, nutrition, reduce bad blood); delivery | see *Melastoma* sp. (bai baik); see *Tetracera loureiri*; see *Diospyros nitida*; decoction to induce labor and |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | | | reduce labor pains with flower of *Lagerstroemia floribunda* |
| | wood chips | postpartum care (reduce bad blood) | see *Dillenia hookeri*, see *Diospyros venosa* |
| | root, wood chips | postpartum care | decoction with wood chips of: *Diospyros venosa, Diospyros nitida, Polyalthia evecta, Aporosa villosa* |
| | root, wood chips | lactagogue | see *Aporosa villosa* |
| | root | postpartum care | see kdɔh kɔmprok; see lɔng; see jroi |
| *Psidium guajava* | bark | diarrhea, stomach ache | decoction of grilled bark |
| | bark | diarrhea | infusion of roast bark to drink |
| | bark, young leaves | diarrhea | eat raw |
| *Psydrax pergracilis* | wood chips | intrauterine infection following delivery | see *Dipterocarpus intricatus* |
| *Rhodomyrtus sp.* | wood chips | lactagogue, postpartum care | see *Aporosa villosa* |
| *Rhodomyrtus tomentosa* | wood chips | lactagogue | decoction with *Rhodomytrus sp.* (puach toich); see *Aporosa villosa* |
| | wood chips | postpartum care | see *Diospyros venosa*, see lɔng |
| | wood chips, root | postpartum care | see jroi |
| *Saccharum officinarum* | sugarcane | STDs | see *Imperata cylindrica* |
| | sugarcane (fresh) | postpartum care | see *Diospyros venosa* |
| | sugarcane (fresh) | intrauterine infection following delivery | see *Dipterocarpus intricatus* |
| | sugarcane (fresh) | liver disease | see preah sdach |
| *Saccharum officinarum var. violaceum* | black sugarcane (fresh) | malaria | see jɔngkong jen |
| | black sugarcane (fresh) | postpartum care | see kdɔh kɔmprok, see jroi |
| | black sugarcane (fresh) | STDs (female) | see kjas |
| *Schumanniathus dichotomus* | root | measles, scarlet fever | infusion with *Eicchornia crassipes* stem, *Ficus benjamina* leaves and crab meat into water for shower |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | root | fever (childhood) | infusion as shower with: root, vine of *Chukrasia tabularis*, leaves of *Ficus benjamina*, bark of *Ceiba pentandra*, *Citrus lucida*, shower 7x daily |
| *Scindapsus officinalis* | vine | nutrition | decoction |
| *Scleropyrum pentandrum* | wood chips | postpartum care | see *Polyalthia evecta*, see *Dillenia hookeri;* see lɔng; see kdɔh kɔmprok |
| | wood chips | lactagogue | decoction of dried ingredients, with: *Artabotrys sp.* (tək doh krobai), *Irvingia malayana*, *Knema globularia;* decoction to drink with: wood chips of *Artabotrys sp.* (tək doh krobai), root of *Plumbago zeylanica* |
| | roots, wood chips | lactagogue | see *Artabotrys* sp. (tək doh krobai); decoction to drink with *Artabotrys sp.* (tək doh krobai) |
| *Scoparia dulcis* | - | muscle pain, nerve pain | poultice with extracted oils, combined with oils of marek tomseiy, portal preah angkao, *Cocos nucifera* shell, portal moha jomboul, voa ch'not |
| *Shorea roxburghii* | bark, branch | postpartum care | see trolom pei |
| *Siphonodon celastrineus* | bark | stds | decoction fresh or dried with *Ipomoea aquatica* to drink |
| *Smilax ovalifolia* | root | "nerves balance" | infusion into water or wine with roots of ta set, kdaw chlu, *Dasymaschalon lomentaceum, Diospyros venosa* |
| *Spatholobus parviflorus* | vine | delivery | decoction to drink with vine wrapped in black and white string |
| *Sphenodesme pentandra* | bark | vomiting | infusion of ground bark with charcoal to drink |
| | vine | energy tonic, circulation | see *Gnetum gnemon* |
| *Spondia dulcis* | bark, leaves | malaria; cardiac problems | see *Musa* sp. (jek krɔb); juice of macerated leaves to drink |
| | bark | fever | infusion of bark with woodchips of *Millingtonia hortensis* into *Cocos nucifera* juice; if have clean water, infuse chopped ingredients to drink (best |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | | | method): bark of *Spondia dulcis*, whole *Centella asiatica*, root of *Citrus hystrix*, root of *Carica papaya*, whole *Amaranthus spinosus*, bark of *Ceiba pentandra*; if have unclean water, infuse the same ingredients to shower. |
| *Stephania erecta* | bark | malaria | see jɔngkong jen |
| *Stephania pierrei* | root, wood chips | postpartum care (diarrhea) | decoction |
| *Stephania rotunda* | vine, root, bulb | beauty | infusion with dried parts into rice wine to drink; ground dried root mixed with honey to ingest |
| | vine, bulb | fever, malaria | infuse bulb and vine into rice wine |
| | bark | malaria | form tablets with honey, chopped dried bark, and the chopped dried vine of *Tinospora crispa* (6 tablets per day for a month, but will feel better after 1 week). |
| *Strychnos nux-vomica* | seeds | skin disease, strength, mosquito repellant | soak seeds in water to be cut (preparation note ends here) |
| | bark | migraines | see romli'e smɔng |
| *Suregada multiflora* | wood chips | postpartum care | see lɔng |
| *Syzygium sp.* | wood chips | diabetes | decoction with *Melaleuca leucadendra* and smeh [unlisted] |
| *Tamarindus indica* | bark | postpartum care | decoction with dried bark of *Diospyros nitida* and *Zingiber montanum*, entire *Diospyros venosa* and ta set; decoction with *Allium sativum* and onion |
| | bark | stomach ache, diarrhea | infusion of roast bark |
| *Tetracera loureiri* | bulb | postpartum care | decoction with *Prismatomeris tetrandra*; infuse into rice wine with *Prismatomeris tetrandra* |
| | vine | energy tonic | see *Aegle marmelos* |
| *Tiliacora triandra* | vine | malaria | decoction with bark of *Azadirachtra indica* |
| | vine, root | malaria | see *Chromolaena odorata* |
| *Tinospora crispa* | vine | fever | infusion into ricewine |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | vine | stomach ache, food poisoning | infusion with *Zingiber montanum* leaves to drink |
| | vine | post partum care | decoction of vine, the vine of *Melientha suavis*, and the bulb of *Zingiber montanum* |
| | vine | malaria | see *Stephania rotunda* |
| *Urena lobata* | entire plant | fetal health, delivery | see run |
| *Willughbeia edulis* | vine | malaria | see *Melodorum fruticosum* |
| | vine | energy tonic | see *Aegle marmelos;* see *Gnetum gnemon* |
| | vine | stomach ache | decoction with *Cananga latifolia* and ta ahn; see *Dalbergia nigrescens;* see *Cananga latifolia* |
| | vine | circulation | see *Gnetum gnemon;* decoction with *Derris elliptica* and troling |
| *Xylia xylocarpa* | bark | stomach ache | see *Dalbergia nigrescens* |
| *Zea mays* | kernels (dried 1 year) | malaria | see *Cymbopogon nardus;* see *Citrus hystrix* |
| *Zingiber montanum* | bark, bulb, leaves | postpartum care | infusion to drink with honey and wine; mix with weaver ants and salt for steaming |
| | bark | muscle aches and stiffness (e.g. from polio) | see kəntrao'i |
| | bark | postpartum care | infusion to drink with honey and rice wine |
| | bulb | wounds and scars | poultice with grilled bulb and kror sang [unlisted] |
| | leaves | cold | decoction as bath |
| | leaves | infection | macerate leaves and apply as poultice; see *Tinospora crispa* |
| *Ziziphus cambodianus* | wood chips | stomach ache, circulation, increase appetite | decoction with the vine of *Willughbeia edulis* and the wood chips of *Cananga latifolia* |
| | wood chips | stomach ache | decoction |
| | bark | pregnancy care | see trolaing piən |
| *Ziziphus oenopolia* | vine | postpartum care | see *Amomum xanthioides* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| unknown (Annonaceae / troling krɔhom) | root | stomach ache | see troling sɔr |
| | vine | energy tonic, circulation | see *Gnetum gnemon* |
| unknown (Annonaceae / troling sɔr) | vine | stomach ache | decoction with root of troling krɔhom and *Willughbeia edulis*; or mix all three with rice wine |
| | vine | energy tonic, circulation | see *Gnetum gnemon* |
| unknown (Annonaceae / troling) | - | circulation | see *Willughbeia edulis* |
| unknown (Bambuseae / rusai pok) | leaves | headache | see *Dendrocalamus membranaceus* |
| unknown (Euphorbiaceae / liach p'tus) | - | diarrhea, nausea | see *Garcinia lanessanii* |
| unknown (Zingiberaceae / knyai'i) | stem | postpartum care (reduce bad blood) | see *Dillenia hookeri* |
| unknown (Zingiberaceae, protial kmao rial) | bulb | irregular bowel movements | decoction with 2g each ingredient protial preah chneas, protial rus dong |
| unknown (Zingiberaceae, protial preah chneas) | bulb | irregular bowel movements | see protial kmao rial |
| unknown (Zingiberaceae, protial rus dong) | bulb | irregular bowel movements | see protial kmao rial |
| unknown (antong krɔhom) | vine | energy tonic, circulation | see *Gnetum gnemon* |
| unknown (banya k'ait, daom ko) | vine (growing on ko tree) | pregnancy health | decoction |
| unknown (bat kroam kria) | wood chips | circulation | see *Gnetum gnemon* |
| unknown (bomprong krok) | bark | sinus blockage | smoke shredded bark of popros, wild & cultivated *Dendrocalamus membranaceus*, *Micromelum falcatum*, fibers of *Cocos nucifera* |
| unknown (chö sə'oi) | core of tree | sore throat | see joan krahom |
| unknown (ɔmpaing | root | malaria (childhood) | see *Passiflora foetida* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | wood chips | circulation | see dam pleng |
| unknown (ɔmpong yiang) | wood chips | stds (female) | see Dipterocarpus intricatus |
| unknown (dam kam piet) | branch | postpartum care | decoction with fresh branch to drink |
| unknown (dam pleng) | wood chips | circulation | decoction with: wood chips of *Bridelia curtisii, Ficus pumila,* ɔm paing, *Kaempferia galanga, Artabotrys* sp. (tək dɔh krobai), with root of krɔjai prei |
| unknown (dong dau) | wood chips | postpartum care | see *Diospyros venosa* |
| unknown (jɔngkong jen) | roots | malaria | decoction of fresh roots with sugarcane *Saccharum officinarum* and shards of pottery collected around the village |
| | aerial root | malaria | decoction of dried ingredients to drink: aerial root of jɔngkong jen, bark of *Stephania erecta*, wood chips of *Diospyros venosa* |
| unknown (jot prei) | stem | fever | decoction, consume 3x daily until symptoms subside |
| unknown (jroi) | wood chips | postpartum care | see lɔng |
| | wood chips, bark | postpartum care | decoction to drink with: wood chips/bark, wood chips/root of *Polyalthia evecta,* root of female kdɔh kɔmprok, wood chips of male kdɔh kɔmprok, wood chips of *Aporosa villosa,* lɔng dɔmrai, *Irvinigia malayana, Rhodomytrus tomentosa* (and root), *Euonymus cochinchinensis, Catunaregram spinosa, Polyalthia evecta, Melastoma saigonense, Ancistrocladus tectorius, Diospyros nitida,* root of *Prismatomeris tetrandra, Dillenia hookeri, Chrysopogon zizanioides,* pnek kɔng kaip, vine of *Pouzolzia zeylanica,* fresh sugarcane of *Saccharum officinarum var. violaceum* |
| unknown (kam pait) | wood chips | postpartum care | see *Diospyros venosa* |
| unknown (k'ɔm) | vine | stomach ache | decoction with dried parts, vine of trɔdək |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| unknown (kɔmplia) | bark | malaria | see *Melodorum fruticosum* |
| unknown (kɔndao-baht) | - | diarrhea, nausea | see *Garcinia lanessanii* |
| unknown (kdaw chlu) | root | "nerves balance" | see *Smilax ovalifolia* |
| unknown (kdɔh kɔmprok) | wood chips | postpartum care | best method is decoction of wood of kdɔh kɔmprok, wood of *Polyathia evecta*, sugarcane of *Saccharum officinarum var. violaceum*, root of ta se, root of *Prismatomeris tetrandra*; otherwise can infuse ingredients into rice wine; see *Dillenia hookeri;* see *Polyalthia evecta* |
| | wood chips | postpartum care, circulation | decoction to drink with: wood chips, wood chips of kdɔh kɔmprok, *Polyalthia evecta, Diospyros venosa* |
| | root | postpartum care | decoction to drink with dried: root, root of *Polyalthia evecta, Melastoma saigonense, Dillenia hookeri, Chrysopogon zizanioides,* wood chips of *Diospyros nitida, Artabotrys* sp. (tək doh krobai), *Diospyros venosa,* bark of *Irvinigia malayana,* wood chips of *Scleropyrum pentandrum;* decoction to drink, with dried: root, root of *Dillenia hookeri, Polyalthia evecta, Melastoma saigonense,* wood chips of *Aporosa villosa, Diospyros nitida, Licuala spinosa, Irvingia malayana, Diospyros* venosa, *Croton persimilis, Phyllanthus amarus;* see *Aporosa villosa*; see *Cananga latifolia;* see lɔng |
| | roots, wood chips | lactagogue | see Artabotrys sp. (tək doh krobai) |
| | root (female tree), wood chips (male tree) | postpartum care | see jroi |
| unknown (kjas) | wood chips | stds (female) | decoction of wood chips with: wood chips of sɔmbo bai, krɔlao, *Diospyros venosa, Euonymus cochinchinensis*, bark of *Premna herbacea*, sugarcane of *Saccharum officinarum var. violaceum* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| unknown (komraok antriat) | wood chips | energy tonic | see *Gnetum gnemon* |
| unknown (krɔjai prei) | root | circulation | see dam pleng |
| unknown (krɔlao) | wood chips | stds (female) | see kjas |
| unknown (krobai jöl dai) | vine | energy tonic, circulation | see *Gnetum gnemon* |
| unknown (krobai laong kɔ) | vine | energy tonic, circulation | see *Gnetum gnemon* |
| unknown (kəntrao'i) | grass | inflammation, aching joints | see ses |
| | grass | muscle aches and stiffness (e.g. from polio) | decoction of ground ingredients (wrap in tissue, boil lightly and use to wash): grass of kəntrao'i, grass of ses, vine of preah bɔng koap, wood chips of prɔtenh, bark of *Zingiber montanum*, cooked herb of *Cymbopogon nardus*, and morning dew |
| unknown (lɔng dɔmrai) | wood chips | postpartum care | see jroi |
| unknown (lɔng) | root | postpartum care | decoction to drink with: root, wood of *Rhodomytrus tomentosa*, jroi, *Suregada multiflora*, *Erythroxylum cambodianum*, *Dillenia ovata*, *Melastoma saigonense*, *Artabotrys* sp. (tək doh krobai), *Scleropyrum pentandrum*, *Catunaregram spinosa*, *Phyllanthus amarus*, *Euonymus cochinchinensis*, root of *kdɔh kɔmprok*, *Polyalthia evecta*, *Prismatomeris tetrandra* |
| unknown (löng aso) | oil from bulb | aphrodisiac, neuralgia, rheumatism | see *Eurycoma longifolia* |
| | bulb | energy tonic | see *Gnetum gnemon* |
| unknown (mjɔl mias) | vine | fever during pregnancy | macerate vines of mjɔl mias and sɔk niang |
| unknown (niang mao) | wood | postpartum care | see *Diospyros nitida* |
| unknown (p'ahng) | bark | postpartum care | decoction with the bark of *Irvingia malayana*, *Parinari anamensis*, ta meng |
| unknown (p'lenh) | wood chips | postpartum care, circulation | infusion of wood chips into rice wine |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| unknown (pliang) | bark | malaria | decoction with bark of *Anacardium occidentale* to drink |
| unknown (pnek kɔng kaip) | root | postpartum care | see jroi |
| unknown (prɔtenh) | wood chips | muscle aches and stiffness (e.g. from polio) | see kəntrao'i |
| unknown (preah bɔng koap) | vine | muscle aches and stiffness (e.g. from polio) | see kəntrao'i |
| unknown (preah sdach) | wood chips | liver disease | decoction to drink of wood chips with: pith of *Artocarpus altilis*, *Artocarpus rigidus*, bulb of *Premna herbacea*, fresh sugarcane *Saccharum officinarum* |
| unknown (protial prei angkao) | - | muscle pain, nerve pain | see *Scoparia dulcis* |
| unknown (roan) | root | chicken pox | decoction with leaf of *Cymbopogon nardus*, to bathe |
| unknown (romiat krɔhom) | vine | energy tonic, circulation | see Gnetum gnemon |
| unknown (romli'e smɔng) | leaves | migraines | to smoke, take leaves and fill with chopped bark of: rompong vi'e, *Strychnos nux-vomica*, *Glycosmis pentaphylla*, *Anthocephalus chinensis*, *Bixa orellana*, *Citrus* spp. (kroach, any species), *Parinari anamensis* |
| unknown (rompong vi'e) | bark | migraines | see romli'e smɔng |
| unknown (run) | entire plant | fetal health, delivery | decoction with dried plant, dried *Urena lobata*; mix with rice wine |
| unknown (saot dɔmrai) | root | asthma | decoction |
| unknown (sɔk niang) | vine | delivery | decoction to drink 1 week before delivery; infuse in bathwater |
| | vine | fever | see *Ceiba pentandra* |
| | vine | fever during pregnancy | see mjɔl mias |
| unknown (sɔmbo bai) | wood chips | STDs (female) | see kjas |
| unknown (ses) | grass | inflammation, aching joints | macerate grass with kəntrao'i, wrap in tissue and heat over charcoal, apply warm to inflamed area |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| | grass | muscle aches and stiffness (e.g. from polio) | see kəntrao'i |
| unknown (smao aht seh) | - | bone, nervous complications (sor seiy) | see *Aegle marmelos* |
| unknown (smao chöng kras) | entire plant | malaria | see *Anthocephalus chinensis* |
| unknown (smao kombai mok) | grass | postpartum diarrhea | see trochiak kras |
| unknown (snai) | bark | gingivitis, dental carries | see *Drepanostachyum falcatum* |
| unknown (srɔ yɔng) | wood chips | malaria (childhood) | see *Passiflora foetida* |
| unknown (səntea kchɔng) | vine | fever | macerate vine, drink infusion of juice and apply vine matter to temples |
| unknown (ta ahn) | vine | stomach ache | see *Willughbeia edulis* |
| unknown (ta lanh) | root | fragrance (to make medicine palatable) | see *Diospyros venosa* |
| unknown (ta meng) | inner bark | postpartum care | see *Cananga latifolia*, *Parinari anamensis*, Melastoma sp. (bai baik) |
| unknown (ta se) | entire plant | postpartum care | see *Tamarindus indica*; see *Melastoma* sp. (bai baik); see *Melastoma saigonense*; see *Smilax ovalifolia*, see *Aegle marmelos* |
| | root | postpartum care | see kdəh kɔmprok |
| unknown (təh kɔmprok) | root | postpartum care | see Polyalthia evecta |
| unknown (thom piang) | skin of young shoots | postpartum care | decoction with chicken eggs, onion skin, pepper, spider web, and *Physalis angulata*, to drink |
| unknown (tnianh) | root | malaria (adult) | see *Citrus hystrix* |
| unknown (trɔdək) | vine | stomach ache | see k'ɔm |
| unknown (trochiak kras) | - | diarrhea after delivery | decoction with smao kombai mok |
| unknown (trochiak tonsai) | entire plant | stomach ache | see *Cananga latifolia* |

| Latin name | Plant part | Purpose | Preparation |
|---|---|---|---|
| unknown (trolaing piən) | vine | pregnancy care | decoction to drink with fresh: vine, bark of *Ziziphus cambodianus*, red weaver ant nest |
| unknown (trolom pei) | vine | "cure all" | decoction with root of *Hymenocardia punctata*, *Diospyros nitida*, *Willughbeia edulis* |
| | vine | postpartum care | decoction with *Hymenocardia punctata*, *Willughbeia edulis*, *Shorea roxburghii*, *Dipterocarpus intricatus*; see *Achyranthes aspera* |

# Appendix 4: Glossary of uses for medicinal plants in PKNP

*Dang 2014, Deur 2015, Walker 2016

**Asthma:** saot domrai

**Bone, nerve and muscle pain:** *Aegle marmelos, Alyxia reinwardtii, Amaranthus spinosus, Baeckea frutescens, Cocos nucifera, Cymbopogon nardus, Eleutherine bulbosa, Eurycoma longifolia, Eurycoma longifolia, Scoparia dulcis, Smilax ovalifolia, Zingiber montanum,* kəntrao'i, löng aso, prɔtenh, preah bɔng koap, protial prei angkao, ses, smao aht she

**Bites**

**Centipede:** *Azadirachtra indica, Licuala spinosa*

**Mosquito (repellant)***: Strychnos nux-vomica*

**Snake:** *Carica papaya, Cassia grandis, Citrus hystrix, Drynaria quercifolia*

**Cardiac problems:** *Spondia dulcis*

**Daily tonics (energy, circulation):** *Aegle marmelos, Artabotrys sp., Cananga latifolia, Dalbergia oliveri, Dasymaschalon lomentaceum, Derris scandens, Derris trifoliata, Diospyros nitida, Diospyros venosa, Dracaena cambodiana, Entada phaseoloides, Eurycoma longifolia, Eurycoma longifolia, Ficus pumila, Gnetum gnemon, Gnetum latifolium, Kaempferia galanga, Passiflora foetida, Peliosanthes teta, Premna herbacea, Sphenodesme pentandra, Tetracera loureiri, Willughbeia edulis, Ziziphus cambodiana,* troling krɔhom, troling sɔr, troling, antong krɔhom, bat kroam kria, ɔmpaing, dam pleng, kdaw chlu, kdɔh kɔmprok, komraok antriat, krɔjai prei, krobai jöl dai, krobai laong kɔ, löng aso, p'lenh, romiat krɔhom, trolom pei

**Dental carries, gingivitis:** *Dendrocalamus giganteus, Dendrocalamus membranaceus, Dillenia sp., Drepanostachyum falcatum, Hopea sp., Irvingia malayana, Mangnifera duperreana,* snai

**Diabetes:** *Melaleuca leucadendra, Syzygium sp.*

**Fever:** *Amaranthus spinosus, Cananga latifolia, Carica papaya, Ceiba pentandra, Centella asiatica, Citrus lucida, Cheilocostus speciosus, Chrysophyllum cainito, Chukrasia tabularis, Citrus hystrix, Combretum quadrangulare, Cyclea barbata, Cymbopogon nardus, Dracaena cambodiana, Chromolaena odorata, Chromolaena odorata, Ficus benjamina, Ficus sp., Heliotropium indicum, Melientha suavis, Millingtonia hortensis,*

*Passiflora foetida, Phyllanthus urinaria, Schumanniathus dichotomus, Spondia dulcis, Stephania rotunda, Tinospora crispa,* jot prei, sɔk niang, sɔntea kchɔng

**Gastrointestinal illness**

**Abdominal pain***: Acacia caesia, Anacardium occidentale, Barringtonia acutangula, Cananga latifolia, Ceiba pentandra, Chrysophyllum cainito, Cocos nucifera, Croton persimilis, Dalbergia nigrescens, Gnetum gnemon, Gnetum latifolium, Melastoma saigonense, Musa sp. (jake kchai), Musa sp. (jake nəmva), Psidium guajava, Tamarindus indica, Tinospora crispa, Willughbeia edulis, Xylia xylocarpa, Ziziphus cambodianus,* troling krəhom, troling sɔr, k'ɔm, ta ahn, trɔdək, trochiak tonsai

**Intestinal blockage, constipation***: Areca catechu, Borassus flabellifer, Eclipta prostrata,* protial kmao rial, protial preah chneas, protial rus dong

**Vomiting, diarrhea, gastroenteritis, dysentery***: Anacardium occidentale, Annona muricata, Annona muricata, Areca catechu, Ceiba pentandra, Cocos nucifera, Garcinia lanessanii, Holarrhena pubescens, Musa sp. (jake nəmva), Psidium guajava, Sphenodesme pentandra, Tamarindus indica, Tinospora crispa,* kɔndao-baht, liach p'tus

**Headaches, migraines:** *Annona muricata, Anthocephalus chinensis, Bixa orellana, Citrus spp., Dendrocalamus membranaceus, Glycosmis pentaphylla, Ocinum basilicum, Parinari anamensis, Strychnos nux-vomica,* rusai pok, romli'e smɔng, rompong vi'e

**Hepatitis, liver disease**: *Artocarpus altilis, Artocarpus rigidus, Physalis angulata, Premna herbacea, Saccharum officinarum,* preah sdach

**Infectious disease not otherwise specified**

**Colds, sinus blockage, upper respiratory infections***: Cymbopogon nardus, Dendrocalamus membranaceus, Eclipta prostrata, Ficus sp., Micromelum falcatum, Ocinum basilicum, Zingiber montanum,* bomprong krok

**Chicken pox***: Cymbopogon nardus, Ficus benjamina,* roan

**Malaria***: Acalypha wilkesiana, Anthocephalus chinensis, Azadirachtra indica, Borassus flabellifer, Calamus sp., Citrus hystrix, Curcubita maxima, Cymbopogon nardus, Diospyros venosa, Drynaria roosii, Chromolaena odorata, Chromolaena odorata, Ficus sp., Harrisonia perforata, Licuala spinosa, Melodorum fruticosum, Musa sp. (jake krɔb), Passiflora foetida, Saccharum officinarum var. violaceum, Spondia dulcis, Stephania erecta, Stephania rotunda, Tiliacora triandra, Tinospora crispa, Willughbeia edulis,*

*Zea mays*, jɔngkong jen, kɔmplia, ɔmpaing, pliang, smao chöng kras, srɔ yɔng, tnianh

**Measles, scarlet fever:** *Eichhornia crassipes, Ficus benjamina, Schumanniathus dichotomus*

**Throat infections:** *Borassus flabellifer, Carica papaya, Citrus hystrix, Dipterocarpus intricatus, Dracaena cambodiana, Eclipta prostrata, Polyscias fruticosa,* chö sə'oi

**Medicine enhancement**

**Sweetness:** *Cocos nucifera*

**Fragrance:** ta lanh

**Effectiveness:** *Premna herbacea*

**Nutrition:** *Scindapsus officinalis*

**Pregnancy**

**Appetite:** *Ziziphus cambodianus, Combretum quadrangulare*

**Delivery:** *Areca catechu, Barringtonia acutangula, Dillenia sp., Gmelia philippensis, Holarrhena pubescens, Lagerstroemia calyculata, Lagerstroemia floribunda, Nelumbo sp., Spatholobus parviflorus, Urena lobata,* run, sɔk niang

**Fetal and maternal health:** *Barringtonia acutangula, Dillenia sp., Gmelia philippensis, Urena lobata, Ziziphus cambodianus,* banya k'ait/daom ko, run, trolaing piən

**Fever during pregnancy:** mjɔl mias, sɔk niang

**Intrauterine infection following delivery:** *Chukrasia tabularis, Dipterocarpus intricatus, Premna herbacea, Psydrax pergracilis, Saccharum officinarum*

**Lactagogue:** *Anthocephalus chinensis, Aporosa villosa, Artabotrys sp., Catunaregram spinosa, Ceiba pentandra, Chrysophyllum cainito, Derris elliptica, Irvingia malayana, Knema globularia, Melastoma sp., Plumbago zeylanica, Polyalthia evecta, Prismatomeris tetrandra, Rhodomyrtus sp., Rhodomyrtus tomentosa, Scleropyrum pentandrum,* kdɔh kɔmprok

**Postpartum care:** *Achyranthes aspera, Allium sativum, Alpina nigra, Amomum xanthioides, Ancistrocladus tectorius, Annona muricata, Antidesma ghaesembilla, Aporosa villosa, Artabotrys sp., Artocarpus heterophyllus, Cananga latifolia, Catunaregram spinosa, Chrysopogon zizanioides, Croton persimilis, Curcuma zedoaria, Dillenia hookeri, Dillenia ovata, Diospyros nitida, Diospyros venosa, Dipterocarpus intricatus, Dracaena angustifolia,*

*Erythroxylum cambodianum, Euonymus cochinchinensis, Ficus pumila, Harrisonia perforata, Hydnocarpus anthelmintica, Hymenocardia punctata, Ipomoea aquatica, Irvingia malayana,* Licuala spinosa, *Melastoma saigonense, Melastoma sp., Melodorum fruticosum, Mitragyna parvifolia, Mitragyna sp., Ocinum basilicum,* Oenanthe javanica, *Parinari anamensis,* Peliosanthes teta, *Phyllanthus amarus, Phyllodium pulchellum, Physalis angulata, Plumbago indica,* Plumbago zeylanica, *Polyalthia evecta,* Pouzolzia zeylanica, *Prismatomeris tetrandra,* Rhodomyrtus sp., *Rhodomyrtus tomentosa,* Saccharum officinarum, Saccharum officinarum var. violaceum, Scleropyrum pentandrum, *Shorea roxburghii,* Suregada multiflora, *Tamarindus indica, Tetracera loureiri, Tinospora crispa, Zingiber montanum, Ziziphus oenopolia,* dam kam piet, dong dau, jroi, kam pait, kdɔh kɔmprok, lɔng, lɔng dɔmrai, niang mao, p'ahng, p'lenh, pnek kɔng kaip, ta meng, ta se, tɔh kɔmprok, thom piang, trolom pei, knyai'i

**Postpartum diarrhea:** *Stephania pierrei,* smao kombai mok, trochiak kras

**Sexually-transmitted diseases:** *Colocasia esculenta, Diospyros venosa, Dipterocarpus intricatus, Euonymus cochinchinensis, Imperata cylindrica, Ipomoea aquatica,* Premna herbacea, *Saccharum officinarum,* Saccharum officinarum var. violaceum, *Siphonodon celastrineus,* ɔmpaing yiang, kjas, krɔlao, sɔmbo bai

**Skin care and disease**

**Beauty:** *Stephania rotunda*

**Itchy, dry skin:** *Curcuma longa, Kaempferia galanga, Polyscias fruticosa*

**Infections, wound care:** *Bambusa vulgaris, Chromolaena odorata, Chromolaena odorata, Ganoderma lucidum,* Licuala spinosa, *Strychnos nux-vomica, Zingiber montanum*

**Swelling:** *Borassus flabellifer, Calamus sp., Lygodium conforme, Plumeria alba*