Ethnobotanical study and utilization of plants in Khok Nhong Phok forest, Kosum Phisai District, Northeastern Thailand

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Abstract. Saisor N, Prathepha P, Saensouk S. 2021. Ethnobotanical study and utilization of plants in Khok Nhong Phok forest, Kosum Phisai District, Northeastern Thailand. Biodiversitas 22: 4336-4348. The present study was conducted in Khok Nhong Phok forest, Kosum Phisai District, Maha Sarakham Province, Northeastern Thailand. The forest was surrounded by communities where traditional knowledge has been inherited in the utilization of plants which may disappear over time due to the development of medicinal science and technology. The primary is to study the traditional knowledge in ethnobotanical, collect information about the utilization of plants, and provide the scientific name as the basis for future studies. Data were collected through open-ends interviewing with 30 villagers living in villages around the forest area about their local name, utilization of plants in all 3 aspects, including plants used as food, medicine, and plants used to build houses including parts of plants used. Plant materials and photographs were collected from January to December 2019. Altogether 101 plant species were recorded belonging to 52 families, divided into 3 groups of utilization according to traditional knowledge including 50 species of food plants, 69 species of medicinal plants, and 42 species used for housing, appliances, and fuel. In this study, some plants with more than one type of utilization showed that they were valuable to local people in terms of their uses, and such information can be used as a guideline for the conservation of plant resources in the area to show the importance of cherishing, and maintain valuable resources in the area to remain for future generations.

Keywords: Ethnobotanical, Maha Sarakham, Thailand, utilization

INTRODUCTION

From the past to the present, human life has relied on natural resources for survival, food, medicine, clothing, and housing. Learning to use plants for their benefits comes from real-world experience in using various plants and gaining benefits that inheritance for many generations until becoming a culture of each tribe. There may be some modifications or trajectories of each generation in response to their use. Currently, there is still ongoing exploitation of plants, especially in medicine (Pholhiamhan et al. 2018). Traditional or folk knowledge is often passed on from one generation to the next by verbal revelation and no written record, thus some things may differ from the old body of knowledge over time, because people in modern times have changed their lifestyle by relying on technology and imitating more foreign cultures. As a result, indigenous wisdom has been neglected until it tends to be lost along with the older generation (Anderson 1993).

In Thailand, the importance of plants in the community and the awareness of the value and benefits of local plants have been increasing attention due to people in different regions are increasingly making use of native plants from the naturally available. As reported in many studies, e.g. Chamratpan and Homchuen 2003, Inta et al. 2008, Panyadee et al. 2016, Saensouk et al. 2016, Pholhiamhan et al. 2018, Phumthum et al. 2018, Junsongduang et al. 2020, and Saensouk and Saensouk 2021.

In several studies from many parts of the world, i.e. Umair et al. 2017, Supiadi et al. 2019, Jadid et al. 2020, Rahman and Asha 2021, and Mutaqin et al. 2020.

Maha Sarakham is the province in Northeastern Thailand with the least forest area compared to the size of the province. "Khok Nhong Phok forest" is one of the deciduous dipterocarp forests located in Kosum Phisai District, the upper part of Maha Sarakham Province with a total area of about 1.792 km² (Isan people usually call the deciduous dipterocarp forest as Pa-Khok). Khok Nhong Phok forest is an important forest to the lives of the nearby villagers from the past to the present. It is a forest with an abundant diversity of plants, which is a source of food, herbs, and a place for livestock. In each season, villagers have gathered produce from the forest for use in food, herbs, firewood, etc. It is regarded as an important source of the utilization of plants for people in communities around the Khok Nong Phok forest until it becomes an inherited traditional knowledge from ancestors for a long time.

Due to the development of scientific technology, the new generation has reduced the utilization of plants less than in the past, especially the use of herbs which also results in the existing traditional wisdom may disappear over time along with the change from the rural society to urban society. Therefore, this study aims to study the traditional knowledge in ethnobotanical in Khok Nhong Phok forest, Kosum Phisai District, Maha Sarakham Province, northeastern Thailand, to collect information.
about the utilization of plants, provided the scientific name as the basis for future studies, and including a guideline for the conservation of plant resources in the area to show the importance of cherishing, and maintain valuable resources in the area to remain for future generations.

MATERIALS AND METHODS

Study area

This study was carried out in Khok Nhong Phok forest (Figure 1), the public area which is one of the deciduous dipterocarp forests located in Hua Kwang Sub-district, Kosum Phisai District, Maha Sarakham Province, Northeastern Thailand (Isan people usually call the deciduous dipterocarp forest as Pa-Khok). Khok Nhong Phok forest is situated at an altitude of about 166-185 meters above sea level. The total area of the study comprised 1.792 km² with six villages around the forest area. The number of inhabitants around about 3,500 people, mostly agriculture such as rice fields, cassava fields, rubber crops, and traditional vegetable fields, including livestock e.g., chickens, ducks, cows, and buffaloes, while in some of the adult's working in the nearby companies. Moreover, living nearby Khok Nhong Phok forest is also a chance to find natural products to sell as a supplementary income, use some plants as food and spice for family meals, including uses the area for animal husbandry. It can be considered that this forest is an important part of the livelihood of the villagers around and nearby this forest. Like other regions in Thailand, the Khok Nhong Phok forest has three seasons; summer spans the months of March to May, the rainy season spans June to October, whereas winter spans November to February. The present study was conducted from January to December 2019.

Data collections

Data were collected through open-ends interviewing with 30 villagers living in 6 villages around the forest area about their local name, utilization of plants in all three aspects, including plants used as food, medicine, and plants used to build houses including parts of plants used. Plant materials and photographs were collected from January to December 2019.

Plant collections

Plant specimens were collected from Khok Nhong Phok forest, Maha Sarakham Province, the complete samples containing leaves, flowers, and fruits, along with taking photographs and recording the details of the plant, such as botanical data, morphological such as the color of flowers and fruits, etc. Study plant morphology under a stereomicroscope to identify the scientific name by using the key to species and various botanical documents e.g., Phengklhai 1972; Chayamarit 1994; Middleton 2009; Inthachub et al. 2010; Chantaranothai 2011; Poopath et al. 2012; Boonma et al. 2020, 2021; Saensouk and Saensouk 2019; Saensouk et al. 2021a, 2021b. Dried specimens [Thailand, Maha Sarakham Province, Narin 1 to 101 (MSU)] were preserved at Mahasarakham University Herbarium.

Figure 1. Map of Khok Nhong Phok forest, Maha Sarakham Province, Northeastern Thailand. (https://www.google.com/maps/place/Maha+Sarakham/@15.9787937,103.3353341,189884m/data=!3m1!1e3!4m5!3m4!1s0x3122a6ecd410be59:0xbbad95e486cb239e8m2f3d16.013201544d103.1615169?hl=en)
Data analysis

Analysis of the data using basic statistics, frequency, percentage, the average of Use Value (UV), Agreement Ratio (IAR), and Fidelity Level (%FL) as shown below:

Use Value (UV)

\[ UV = \frac{\sum U_i}{N} \]

Where: \( U_i \) is the number of utilization reports for each species of plant, based on each interviewee, and \( N \) is the Number of interviewees.

Informant agreement Ratio (IAR)

\[ IAR = \frac{(N_{ur} - N_t)}{(N_{ur} - 1)} \]

Where: \( N_{ur} \) is the number of reports of the specific use of the plant species in each symptom of the disease obtained from all data inquiries, and \( N_t \) is the number of plant species used in each syndrome.

Fidelity Level (%FL)

\[ \%FL = \frac{N_p}{N} \times 100 \]

Where: \( N_p \) is the number of reported uses of that plant in that syndrome, and \( N \) is the total number of reported utilization of that plant in all syndromes.

RESULTS AND DISCUSSION

Utilization of Khok Nong Phok Forest (Public forest)

A study of the utilization of the Khok Nong Phok forest which is located in Hua Khwang Sub-district, Kosum Phisai District, Maha Sarakham Province by interview 30 local philosophers and healers in 6 communities living around the forest. The results show that the plant of the study area is rich in useful species, which includes a total of 101 species, classified in 52 families (Table 1).

Plant Utilization Index (Use Value, UV) in Khok Nong Phok Forest

When considering the utilization index (Use value, UV) as shown in Table 2, it was found that the plants that were most used in the Khok Nong Phok forest area were Azadirachta indica (Meliaceae), Senna siamea (Fabaceae-Caesalpinioideae), Phyllanthus emblica (Phyllanthaceae), Bambusa bambos (Poaceae), Amphineurion marginatum (Apocynaceae), Schleichera oleosa (Sapindaceae), Leucaena leucocephala (Fabaceae-Mimosoideae), Pterocarpus macrocarpus (Fabaceae-Papilionoideae), Cratoxylum formosum (Hypericaceae), and Canarium subulatum (Burseraceae). A higher Use Value (UV) number indicates that the plant is being utilized more than any other species. For example, Azadirachta indica (Meliaceae) has a UV number of 2.17. Based on utilization data, it is used as food, medicine, and fuel. Due to the high utilization, it's also causing the risk of extinction of such plants from the forest area studied. On the other hand, the low Use Value (UV) may indicate that people are less interested in that species of plants which makes it less at risk of extinction.

Classified by utilization

When considering the use of plants in the community. And herbal healers in the area found that each type has different uses, which can be divided according to the three groups of use as follows: (i) Used as food, (ii) Used as medicinal plants, (iii) Used to build housing or fuel.

Khok Nong Phok forest is an important source of food for the community. Fifty species of plants surveyed were used as food. The most commonly used family is the Fabaceae family, which has considerable species diversity and is common in the study area. There are six parts used for food: the rhizomes or tubers, the stems (pith, bark, vine, and shoot), leaves, young offshoots, flowers, and fruits (seeds). Most of the plants used for cooking or fresh vegetables use the young shoots and flowers, such as the young shoot of Smilax luzonensis, the young shoot, and the flower of Cratoxylum formosum, and the bamboo shoot. While fruit is the most eaten part, followed by the young leaves and shoots, seeds, sprouts, tubers, and heartwood respectively, they are mostly eaten fresh (Table 3).

Khok Nong Phok forest is also a collection of herbs which 69 species are used by the community. The seven parts used are tubers, roots, stems (all stems, piths, barks, and rhizomes), leaves, fruits, and latex. These herbs were used by local herbal healers who are like a small hospital in the community. When the villagers are sick, they may first come to the local herbal healers to inquire about symptoms. Each healer has a method for treating and administering medication according to specific symptoms and their expertise. Most of the medicinal formulas are used to treat the postpartum female gastrointestinal syndrome, to nourish the blood, to treat infantile group, tonic, and to treat fever. Methods for use include boiling and drinking, make it thoroughly by rubbing against a stone tool and pour into drinking, eating fresh, or make it thoroughly by rubbing against a stone tool and applied to the area to be treated depends on the type of plant and symptoms to be treated (Table 4).

Informant Agreement Ratio (IAR)

Physical abnormalities or diseases (Table 4) were categorized into 13 groups such as defined symptoms, injuries, respiratory system, endocrine system, genitourinary system, nutritional disorders, skin disorders, gastroenterology, poisonings, infection, pregnancy/birth/puerperium, muscular-skeletal system and other. 69 plants were used to treat ailments consists of Lannea coromandelica, Uvaria ferruginea var. cherreensis, Polyalthia debilis, Polyalthia evecta, Amphilennium marginitum, Streptocardon juventas, Urceola polymorpha, Urceola minuta/sflora, Asparagus racemosus, Chromolaena odorata, Elephantopus scaber, Millingtonia hortensis, Ehetia aspera, Canarium subulatum, Tremia orientale, Salacia chinensis, Ellipanthus tomentosus, Argylea...
breviscapa, Cyperus rotundus, Shorea obtusa, Diospyros oblonga, Diospyros mollis, Diospyros ehetroides, Erythroxylum cuneatum, Aporosa villosa., Croton persimilis, Trigonostemon reidoiodes, Croton crassifolius, Senna siamea, Bauhinia saccocaly, Xylla xylolcarpa, Pueraria candollei, Pierocarpus macrocarpus, Flacourtia indica, Nephelium hypoleucum, Hymenopyramis parvifolia, Vitex glabrata, Mesophaerum suaveolens, Litsea glutinosa, Careya arborea, Strychnos nux-blanda, Lagerstroemia calycata, Grewia abutilifolia, Helicteres angustifolia, Memecylon scutellatum, Azadirachta indica, Diplolisia glaucescens, Tinospora crispa, Artocarpus lacucha, Ocima integerrima, Phyllanthus emblica, Vietnamosasa pusilla, Ziziphus oenopolia, Ridsdalea wittii, Catunaregam tomentosa, Morinda coreia, Ixora finlaysoniana, Canthium berberidifolium, Discoporum parvifolium, Clausena wallichii, Micromelum minutum, Schleicheria oleosa, Syzyropus muricata, Xantolis cambodiana, Eurycoma longifolia, Stemona collinsiae, Cissus repanda, and Kaempferia marginalata.

Twenty eight (28) species are used to treat gastroenteropathy-related symptoms such as stomach ache, carminative, and flatulence, i.e. 1. *Uvaria ferruginea* var. *cherreensis*, 2. *Polyalthia debilis*, 3. *Amphineurion* tomentosa, 4. *Asparagus racemosus, 5. Trema orientale, 6. *Salacia chinensis*, 7. *Ellipanthus tomentosus*, 8. *Shorea obtusa*, 9. *Senna siamea*, 10. *Pierocarpus macrocarpus*, 11. *Flacourtia indica*, 12. *Hymenopyramis parvifolia*, 13. *Careya arborea*, 14. *Strychnos-nux-blanda*, 15. *Helicteres angustifolia*, 16. *Azadirachta indica*, 17. *Ochna integerrima*, 18. *Phyllanthus emblica*, 19. *Catunaregam tomentosa*, 20. *Morinda coreia*, 21. *Discoporum parvifolium*, 22. *Clausena wallichii*, 23. *Micromelum minutum*, 24. *Schleicheria oleosa*, 25. *Syzyropus muricata*, 26. *Eurycoma longifolia*, 27. *Cissus repanda*, and 28. *Kaempferia marginalata*.

| Family                  | Scientific name                                                                 | Thai name                                                                 | Coll. number |
|------------------------|--------------------------------------------------------------------------------|---------------------------------------------------------------------------|--------------|
| Anacardiaceae          | Buchanania cochinichensis (Lour.) M.R.Almeida                                  | มะขามหวานเริ่ม (Narin 1)                                                  |              |
| Anacardiaceae          | Mangifera caloneura Kurz                                                        | มะม่วง (Narin 2)                                                          |              |
| Anacardiaceae          | Lannea coromandelica (Houtt.) Merr.                                            | กaki (Narin 3)                                                            |              |
| Annonaceae             | Polyalthia debilis (Pierre) Finet & Gagnep.                                    | กล้วยเต่า (Narin 5)                                                       |              |
| Annonaceae             | Polyalthia evecta (Pierre) Finet & Gagnep.                                     | มะแยงสี (Narin 6)                                                       |              |
| Annonaceae             | Uvaria ferruginea var. *cherreensis* (Pierre ex Finet & Gagnep.) Mead & J. Parn.| มะขามหวาน (Narin 4)                                                     |              |
| Annonaceae             | Uvaria riga (Dunal) Blume                                                       | พักผักใน (Narin 7)                                                       |              |
| Apocynaceae            | Amphineurion marginatum (Roxb.) D.J. Middleton                                 | ได้บิน (Narin 8)                                                         |              |
| Apocynaceae            | Streptocaulon juventas (Lour.) Merr.                                           | เสริ่งเหลือง (Narin 9)                                                   |              |
| Apocynaceae            | Urceola polymorpha (Pierre ex Spire) D.J. Middleton & Livsh.                  | ศรีสิริบลรุน (Narin 10)                                                  |              |
| Apocynaceae            | Urceola minutiflora (Pierre) D.J. Middleton                                    | เกลือบแดง (Narin 11)                                                    |              |
| Aracaceae              | Anaphyllum brevispathus Gagnep.                                                 | ตับเต่าต้น (Narin 12)                                                   |              |
| Aracaceae              | Coccos nuifera L.                                                              | มะขามหวาน (Narin 13)                                                   |              |
| Asparagaceae           | Asparagus racemosus Willd.                                                      | ราชสามเสก (Narin 14)                                                   |              |
| Asteraceae             | Chromolaena odorata (L.) R.M.King & H.Rob.                                    | ใบทบ (Narin 15)                                                         |              |
| Asteraea               | Elephantopus scaber L.                                                          | โต้รู้รี่ (Narin 16)                                                      |              |
| Bignoniaceae           | Millingtonia hortensis L.f.                                                     | ปีป (Narin 17)                                                          |              |
| Boraginaceae           | Ehretia aspera Willd.                                                           | ตีน (Narin 18)                                                          |              |
| Burseraceae            | Canarium subalatum Guillaumin                                                   | มะกลิ้งบด (Narin 19)                                                   |              |
| Cannabaceae            | Trema orientale (L.) Blume                                                      | ฟ้าวย (Narin 20)                                                        |              |
| Celastraceae           | Salacia chinensis L.                                                            | ก้านพรรจีชื่น (Narin 21)                                                |              |
| Conneraceae            | Ellipanthus tomentosus Kurz                                                     | ตีนา ก (Narin 22)                                                       |              |
| Convolvulaceae         | Argyreia breviscapa (Kerr) Ooststr.                                            | เกี้ยวเงี้ยบ (Narin 23)                                                  |              |
| Cyperaceae             | Cyperus rotundus L.                                                             | ตันหมู (Narin 24)                                                       |              |
| Dilleniaceae           | Dillenia ovata Wall. ex Hook.f. & Thomson                                      | สำนัก (Narin 25)                                                        |              |
| Dioscoreaceae          | Dioscorea birmanica Prain & Burkill                                            | เสือผักแก้ว (Narin 26)                                                  |              |
| Dipterocarpaceae       | Shorea obtusa Wall. ex Blume                                                    | เสือ (Narin 27)                                                          |              |
| Dipterocarpaceae       | Dipterocarpus tuberculatus Roxb.                                                | ขุน (Narin 28)                                                          |              |
| Dipterocarpaceae       | Dipterocarpus obtusifoliusTejsm. ex Miq.                                      | ชุด (Narin 29)                                                          |              |
| Ebenaceae              | Diospyros oblonga Wall. ex G.Don                                                | ต้อทุกแห่าง (Narin 30)                                                  |              |
| Ebenaceae              | Diospyros mollis Griff.                                                         | มะม่วงสด (Narin 31)                                                    |              |
| Ebenaceae              | Diospyros ehetroides Wall. ex G. Don                                            | ต้อสั้น (Narin 32)                                                     |              |
| Erythroxylaceae        | Erythroxylum cuneatum (Miq.) Kurz                                              | ไทรทอง (Narin 33)                                                      |              |
| Euphorbiaceae          | Aporosa villosa (Lindl.) Baill.                                                 | เนื้อสั่ง (Narin 34)                                                    |              |
| Euphorbiaceae          | Croton persimilis Müll.Arg.                                                     | ป่าโกกญุ (Narin 35)                                                    |              |
| Euphorbiaceae          | Trigonostemon reidoiodes (Kurz) Craib                                          | ไทยหมื่นแปด (Narin 36)                                                 |              |
| Euphorbiaceae          | Croton crassiifolius Geiseler                                                   | ฟักเขียว (Narin 37)                                                    |              |
| Fabaceae-Caesalpinioideae | Senna siamea (Lam.) H.S.Irwin & Barneby                                      | ชิ้นเหล็ก (Narin 38)                                                   |              |
| Family                                         | Species                                                                 | Authors          |
|-----------------------------------------------|------------------------------------------------------------------------|------------------|
| Fabaceae-Caesalpinioideae                     | *Cassia fistula* L.                                                    | Narin39          |
| Fabaceae-Caesalpinioideae                     | *Baubinia saccocalyx* Pierre                                           | Narin40          |
| Fabaceae-Caesalpinioideae                     | *Erythrophleum succirubrum* Gagnep.                                     | Narin41          |
| Fabaceae-                                      | *Sindora siamensis* Miq.                                               | Narin42          |
| Caesalpinioideae                              |                                                                        |                  |
| Fabaceae-Mimosoideae                          | *Xylic yxolcarpa* (Roxb.) Taub.                                         | Narin43          |
| Fabaceae-Mimosoideae                          | *Leucaena leucocephala* (Lam.) de Wit                                    | Narin44          |
| Fabaceae-Papilionoideae                       | *Pueraria candollei* Wall. ex Benth.                                     | Narin45          |
| Fabaceae-Papilionoideae                       | *Pterocarpus macrocarpus* Kurz                                          | Narin46          |
| Fabaceae-Papilionoideae                       | *Dalbergia cochinchinensis* Pierre                                       | Narin47          |
| Fabaceae-Papilionoideae                       | *Dalbergia oliveri* Gamble ex Prain                                     | Narin48          |
| Hypericaceae                                  | *Cratoxylon formosum* (Jack) Benth. & Hook. f. ex Dyer                   | Narin49          |
| Irvingiaceae                                  | *Irvingia malayana* Oliv. ex A.W. Benn.                                 | Narin50          |
| Lamiaceae                                     | *Hymenopusias parvifolia* Moldenke                                      | Narin51          |
| Lamiaceae                                     | *Vitex glabrata* R.Br.                                                 | Narin52          |
| Lamiaceae                                     | *Mesophaerum suaveolens* (L.) Kuntze                                    | Narin53          |
| Lauraceae                                     | *Liraea glutinosa* (Lour.) C.B. Rob.                                    | Narin54          |
| Lecythidaceae                                 | *Careya arborea* Roxb.                                                 | Narin55          |
| Loganiaceae                                   | *Strychnos nux-blanda* A.W. Hill                                        | Narin56          |
| Lythraceae                                    | *Lagerstroemia calyculata* Kurz                                         | Narin57          |
| Malvaceae                                     | *Grewia eriocarpa* Juss.                                                | Narin58          |
| Malvaceae                                     | *Grewia abutilifolia* Vent. ex Juss.                                    | Narin59          |
| Malvaceae                                     | *Helicteres angustifolia* L.                                            | Narin60          |
| Malvaceae                                     | *Microcos tomentosa* Sm.                                                | Narin61          |
| Melastomataceae                               | *Memecylon scutellatum* (Lour.) Hook. & Arn.                            | Narin62          |
| Meliaceae                                     | *Walsura trichostemon* Miq.                                             | Narin63          |
| Meliaceae                                     | *Azadirachta indica* A.Juss.                                            | Narin64          |
| Menispermae                                   | *Tiliacora triandra* (Colebr.) Diels                                   | Narin65          |
| Menispermae                                   | *Diplolisia glaucescens* (Blume) Diels                                  | Narin66          |
| Menispermae                                   | *Tinospora crispa* (L.) Hook. & Thomson                                 | Narin67          |
| Moraceae                                      | *Artocarpus lacucha* Buch.-Ham.                                         | Narin68          |
| Myrtaceae                                     | *Syzygium antigeropticum* (Blume) Merr. & L.M. Perry                    | Narin69          |
| Myrtaceae                                     | *Syzygium cumini* (L.) Skeels                                          | Narin70          |
| Occhnaceae                                    | *Ochna integerrima* (Lour.) Merr.                                      | Narin71          |
| Ochnaceae                                     |                                                                        | Narin72          |
| Passifloraceae                                | *Adenia viridiflora* Craib                                              | Narin73          |
| Phyllanthaceae                                | *Phyllanthus emblica* L.                                                | Narin74          |
| Phyllanthaceae                                | *Antidesma acidum* Retz.                                                | Narin75          |
| Phyllanthaceae                                | *Hymenocardia punctata* Wall. ex Lindl.                                 | Narin76          |
| Poaceae                                       | *Vietnamosasa pasilla* (A. Chev. & A.Camus) T.Q.Nguyen                  | Narin77          |
| Poaceae                                       | *Bambusa bambos* (L.) Voss                                              | Narin78          |
| Primulaceae                                   | *Emelia ribes* Burm.f.                                                  | Narin79          |
| Rhamnaceae                                    | *Ziziphus oenopolia* (L.) Mill.                                         | Narin80          |
| Rubiaceae                                     | *Ridsdalea witti* (Craib) J.T. Pereira                                 | Narin81          |
| Rubiaceae                                     | *Catanaregam tomentosa* (Blume ex DC.) Tirveng.                         | Narin82          |
| Rubiaceae                                     | *Morinda corea* Buch.-Ham.                                              | Narin83          |
| Rubiaceae                                     | *Ixora finlaysoniana* Wall. ex G.Don                                    | Narin84          |
| Rubiaceae                                     | *Cantium barberidifolium* E.T. Gedde                                    | Narin85          |
| Rubiaceae                                     | *Disocpernum parvifolium* Kuntze                                       | Narin86          |
| Rubiaceae                                     | *Mitragnys diversifolia* (Wall. ex G.Don) Havi.                         | Narin87          |
| Rutaceae                                      | *Clusaena wallichii* Oliv.                                              | Narin88          |
| Rutaceae                                      |                                                                        | Narin89          |
| Rutaceae                                      | *Micromelum minutum* (G. Forst.) Wight & Arn.                           | Narin90          |
| Salicaceae                                    | *Flacourtia indica* (Burm.f.) Merr.                                     | Narin91          |
| Sapindaceae                                   | *Nepholium hypoleucum* Kurz                                             | Narin92          |
| Sapindaceae                                   | *Schlechter olesa* (Lour.) Oken                                       | Narin93          |
| Sapindaceae                                   | *Sisyrhopis varicata* (Pierre) Leenh.                                   | Narin94          |
| Sapindaceae                                   | *Lepisanthes rubiginosa* (Roxb.) Leenh.                                 | Narin95          |
| Sapindaceae                                   | *Xantolis cambodiana* (Pierre ex Dubard) P.Royen                       | Narin96          |
| Simaroubaceae                                 | *Eurycoma longifolia* Jack                                              | Narin97          |
| Similacaceae                                  | *Smilax luzonesis* C.Presl                                             | Narin98          |
| Stemonaceae                                   | *Stemonas collinsiae* Craib                                             | Narin99          |
| Thymelaeaceae                                 | *Enkeli malaccensis* Griff.                                             | Narin100         |
| Vitaceae                                      | *Cissus repanda* (Wight & Arn.) Vahl.                                   | Narin101         |
| Zingiberaceae                                 | *Kaempferia margarita* Carey ex Roscoe                                  | Narin39          |
| Zingiberaceae                                 | *Curcuma singularis* Gagnep.                                           | Narin40          |
| Scientific name            | Family                  | Use value (UV) | Utilization Index (Use Value, UV) of plants in Khok Nhong Phok Forest, Northeastern Thailand (sorted from highest to lowest) |
|---------------------------|-------------------------|----------------|----------------------------------------------------------------------------------------------------------------|
| Azadirachta indica        | Meliaceae               | 2.17           | Streptocalon juventas Apocynaceae 0.43                                                              |
| Senna siamea              | Fabaceae               | 2.13           | Buchanania cochinensis Anacardiaceae 0.40                                                           |
| Phyllanthus emblica       | Phyllanthaceae          | 2.07           | Diospyros mullis Ebenaceae 0.40                                                                      |
| Bambusa bambos            | Poaceae                | 2.00           | Croton persimilis Euphorbiaceae 0.40                                                                |
| Amphiopneuron marginatum  | Apocynaceae             | 1.47           | Tinospora crispa Menispermaceae 0.40                                                                |
| Schleicera oleosa         | Sapindaceae            | 1.40           | Catunaregam tomentosa Rubiaceae 0.40                                                               |
| Leucaena leucocephala     | Fabaceae-Mimosoideae   | 1.33           | Enklea malaccensis Thymelaeaceae 0.40                                                              |
| Pterocarpus macrocarpus   | Fabaceae-Papilionoideae| 1.30           | Nephelem hypoleucum Sapindaceae 0.37                                                               |
| Canarium sabalatum        | Burseraceae            | 1.20           | Lepisanthes rubiginosa Sapindaceae 0.37                                                             |
| Cassia fistula            | Fabaceae               | 1.20           | Eurycoma longifolia Simaroubaeae 0.37                                                              |
| Careya arborea            | Lecythidaceae          | 1.17           | Uvaria rufa Annonaceae 0.33                                                                        |
| Polyalthia debilis        | Anacardiaceae          | 1.10           | Micromelum minutum Rutaceae 0.30                                                                     |
| Xylia xylocarpa           | Fabaceae-Mimosoideae   | 1.07           | Lannea coromandelica Anacardiaceae 0.27                                                            |
| Cocos nucifera            | Areceae                | 1.00           | Urceola polymorpha Apocynaceae 0.27                                                                 |
| Dipterocarpus tuberculatus| Dipterocarpaceae       | 1.00           | Salacia chinensis Celastraceae 0.27                                                                 |
| Dipterocarpus obtusifolius| Dipterocarpaceae       | 1.00           | Syzygium antisepticum Myrtaceae 0.27                                                                |
| Tiliacora triandra        | Menispermaeae          | 1.00           | Ochna integerrima Ochnaceae 0.27                                                                    |
| Antidesma acidum          | Phyllanthaceae          | 1.00           | Morinda coreia Rubiaceae 0.27                                                                       |
| Irvingia malayana         | Irvingiaceae           | 0.97           | Dioscorea birmana Dioscoreaceae 0.23                                                                |
| Curcuma singularis        | Zingiberaceae          | 0.97           | Elephantopus scaber Asteraceae 0.20                                                                 |
| Dalbergia cochinensis     | Fabaceae-Papilionoideae| 0.90           | Ehretia aspera Boraginaceae 0.20                                                                    |
| Adenia viridiflora        | Passifloraceae         | 0.90           | Erythroxylum cuneatum Erythroxylaceae 0.20                                                          |
| Kaempferia marginata      | Zingiberaceae          | 0.90           | Trigonostemon reidioides Euphorbiaceae 0.20                                                         |
| Litsea glutinosa          | Lauraceae              | 0.87           | Dalbergia oliveri Fabaceae-Papilionoideae 0.20                                                       |
| Artocarpus lacucha        | Moraceae               | 0.87           | Helicteres angustifolia Malvaceae 0.20                                                               |
| Syzygium camini           | Myrtaceae              | 0.87           | Sisyropes maricata Sapindaceae 0.20                                                                  |
| Shorea obtusa             | Dipterocarpaceae       | 0.80           | Embelia ribes Primulaceae 0.17                                                                      |
| Sindora siamensis         | Fabaceae               | 0.77           | Millingtonia hortensis Bignoniaceae 0.13                                                              |
| Flacourtia indica         | Salicaceae             | 0.77           | Vitex glabata Lamiaceae 0.13                                                                       |
| Bauhinia saccocalyx       | Fabaceae               | 0.73           | Microcos tomentosa Malvaceae 0.13                                                                   |
| Ziziphus oenopolia        | Rhamnaceae             | 0.70           | Hymerocodonia punctata Phyllanthaceae 0.13                                                           |
| Mangifera caloaneura     | Anacardiaceae          | 0.67           | Isora finlaysoniana Rubiaceae 0.13                                                                  |
| Polyalthia exvta          | Anacardiaceae          | 0.67           | Xanthos cammodia Sapotaceae 0.13                                                                    |
| Diospyros oblonga         | Ebenaceae              | 0.67           | Stemona collina Stemonaceae 0.13                                                                    |
| Amorphophallus brevispathus| Araceae               | 0.63           | Diospyros ehrretoides Ebenaceae 0.10                                                                |
| Ristolaela witti          | Rubiaceae              | 0.63           | Pueraaria candele Fabaceae-Papilionoideae 0.10                                                       |
| Chromolaena odorata       | Asteraeae              | 0.60           | Canthium berheridifolium Rubiaceae 0.10                                                             |
| Ellipanthus tomentosus    | Connaraceae            | 0.60           | Lagerstroemia calycalata Lythraceae 0.07                                                           |
| Strychnos nux-blanda      | Loganiaceae            | 0.60           | Memecylon scutellatum Malastomataeae 0.07                                                            |
| Viennamosus saxilla       | Poaceae                | 0.60           | Urceola minutiflora Apocynaceae 0.03                                                                 |
| Clausena wallichii        | Rutaceae               | 0.60           | Trema orientale Cannabaceae 0.03                                                                    |
| Smilax lusonensis         | Smilaceae              | 0.60           | Argyreia breviscapa Convovulaceae 0.03                                                               |
| Aporosa villosa           | Euphorbiaceae          | 0.57           | Croton crassifolius Euphorbiaceae 0.03                                                               |
| Mitragyna diversifolia   | Rubiaceae              | 0.57           | Mesosphaerum suaveolens Lamiaceae 0.03                                                              |
| Hymenopryamis parvifolia  | Lamiaceae              | 0.53           | Diploclisia glaucens Menispermaceae 0.03                                                             |
| Asparagus racemosus       | Asparagaceae           | 0.50           | Discoperum parvifolium Rubiaceae 0.03                                                                |
| Erythrophleum succirubrum| Fabaceae               | 0.50           | Cissus repana Vitaceae 0.03                                                                        |
| Dilenia ovata             | Dileniaceae            | 0.47           |                                                                                                         |

Table 3. List of plants used as food in Khok Nhong Phok forest, Northeastern Thailand
| Family                  | Scientific name                  | Used part               | Instruction                                                                 |
|------------------------|----------------------------------|-------------------------|-----------------------------------------------------------------------------|
| Anacardiaceae          | Buchanania cochinchinensis       | Raw or ripe fruit       | Eaten fresh as fruit                                                        |
| Anacardiaceae          | Mangifera calomelura             | Raw or ripe fruit       | Eaten fresh as fruit                                                        |
| Annonaceae             | Uvaria ferruginea var. cherreventis | Ripe fruit              | Eaten fresh as fruit, sweet                                                |
| Annonaceae             | Polyalthia debilis               | Ripe fruit              | Eaten fresh as fruit, sweet                                                |
| Annonaceae             | Polyalthia evecta                | Ripe fruit              | Eaten fresh as fruit, sweet                                                |
| Annonaceae             | Uvaria rufa                      | Ripe fruit              | Eaten fresh as fruit, sweet and sour                                       |
| Apocynaceae            | Amphereon marginatum             | Young leaves and young shoots | Eat as fresh vegetables                                                    |
| Apocynaceae            | Urceola polymorpha               | Young leaves and young shoots | Eat as fresh vegetables, sour                                              |
| Araceae                | Amorphophallus brevispathus      | Stems                   | Boil and pour out the boiled water, then use the boiled stem to cook with Tiliacora triandra and tamarind juice |
| Areceae                | Cocos nucifera                   | Fruits                  | Dring coconut juice and eat coconut meat or used coconut meat to make coconut milk |
| Asparagaceae           | Asparagus racemosus              | Young shoots            | Blanched                                                                    |
| Boraginaceae           | Ehretia aspera                   | Raw fruit               | Eaten by pounding mix with weaver ant (Oecophylla smaragdina)              |
| Burseraceae            | Canarium subulatum               | Raw fruit               | Pickled, then cut and eat the white part of the fruit                      |
| Dioscoreaceae          | Dioscorea birmanica              | Tuber                   | Boil or make them into desserts                                            |
| Ebenaceae              | Diospyros oblonga                | Ripe fruit              | Eaten fresh as a fruit                                                     |
| Fabaceae-Caesalpiniae  | Senna siamea                     | Young shoots            | Boil and pour out the boiled water, then cook with Tiliacora triandra juice and curry paste |
| Fabaceae-Caesalpinioideae | Bauhinia saccocalyx             | Young shoots            | Put it in fish curry for a sour taste                                       |
| Fabaceae-Caesalpinioideae | Sindaora siamensis              | Seeds                   | Eaten young seeds                                                          |
| Fabaceae-Mimosoideae   | Xylica xylocarpa                 | Seeds                   | Eaten young seeds                                                          |
| Fabaceae-Mimosoideae   | Leucaena leucocephal             | Seeds                   | Eaten young seeds                                                          |
| Salicaceae             | Flacourtia indica                | Young leaves and young shoots | Eat as fresh vegetablesor add in fish curry                                |
| Hypericaceae           | Cratoxylum formosum              | Young shoots and flowers | Eaten as a blanched vegetable                                              |
| Irvingiaceae           | Irvingia malayana                | Seeds                   | Roasted and eaten as a snack                                                |
| Lecythidaceae          | Careya arborea                   | Young leaves and young shoots | Eat as fresh vegetables                                                    |
| Malvaceae              | Grewia eriocarpa                 | Young shoots            | Eaten fresh as fruit, sweet and sour                                       |
| Malvaceae              | Grewia abutilifolia              | Ripe fruit              | Eaten fresh as fruit, sweet and sour                                       |
| Malvaceae              | Microcos tomentosa               | Ripe fruit              | Eaten fresh as fruit, sweet and sour                                       |
| Malvaceae              | Walsara trichostemon            | Ripe fruit              | Eaten fresh as fruit                                                        |
| Malvaceae              | Acadrachta indica               | Young shoots and flowers | Eaten as a blanched vegetable                                              |
| Menispermaceae         | Tiliacora triandra               | Leaves                  | Crush to juice and used to cooking e.g. in bamboo shoot curry, Cassia curry |
| Moraceae               | Artocarpus lacuca                | Ripe fruit              | Eaten fresh as fruit, sweet and sour                                       |
| Myrtaceae              | Syzygium antisepticum            | Young leaves and young shoots | Eat as fresh vegetables or add in fish curry                                |
| Myrtaceae              | Syzygium cumini                  | Ripe fruit              | Eaten fresh as a fruit                                                     |
| Passifloraceae         | Adenia viridiflora               | Young shoots            | Eaten as a blanched vegetable                                              |
| Phyllanthaceae         | Phyllanthus emblica              | Fruit                   | Eaten fresh as a fruit                                                     |
| Phyllanthaceae         | Antidesma acudum                 | Fruit                   | Eaten fresh as a fruit                                                     |
| Phyllanthaceae         | Hymencocarpia punctata           | Young fruit             | Eaten fresh as a fruit                                                     |
| Pooaceae               | Vietnamosaas pusilia             | Young offshoots         | Eaten as a blanched vegetable                                              |
| Pooaceae               | Bambusa bambos                   | Young offshoots         | Eaten as a blanched vegetable or cooking curry with Tiliacora triandra juice |
| Primulaceae            | Embelia ribes                    | Young shoots            | Eat as fresh vegetables, sour                                              |
| Rhamnaceae             | Ziziphus oenopalia               | Ripe fruit              | Eaten fresh as a fruit                                                     |
| Rubiaceae              | Ridsdalea witti                  | Ripe fruit              | Eaten fresh as a fruit                                                     |
| Rutaceae               | Clausena wallichit              | Young leaves            | Eat as fresh vegetables                                                    |
| Sapindaceae            | Schleichera olesa                | Ripe fruit              | Eaten fresh as a fruit                                                     |
| Sapindaceae            | Sisyropeis muricata              | Ripe fruit              | Eaten fresh as a fruit                                                     |
| Sapindaceae            | Leptanthes rubiginosa            | Ripe fruit              | Eaten fresh as a fruit                                                     |
| Smilacaceae            | Smilax luzonensis                | Young leaves and young shoots | Eat as fresh vegetables or add in fish curry                                |
| Zingiberaceae          | Kaempferia marginata             | Young leaves            | Eaten as a blanched vegetable or cut into small pieces and stir-fry with chameleons |
| Zingiberaceae          | Curcuma singularis               | Young inflorescence     | Eaten as a blanched vegetable                                              |

**Table 4.** List of plants used as medicinal plants in Khok Nhong Phok forest, Northeastern Thailand
| Family                   | Plants name and scientific name                     | Used part                  | Instruction                                                                 |
|--------------------------|------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------|
| Anacardiaceae            | Lankea coromandelica                                 | Stems (barks)              | Bitter, boiled to treat diarrhea                                             |
| Anonaceae                | Uvaria ferrugine var. cherrevensis                   | Roots                      | Make it thoroughly by rubbing against a stone tool, to treat hemorrhoids, or boiled roots treat stomach pain or treat fever |
| Anonaceae                | Polyalthia debilis                                  | Roots                      | Make it thoroughly by rubbing against a stone tool, and put it in drinking water to treat fever, chickenpox, or boil and eat to treat stomachache |
| Anonaceae                | Polyalthia evecta                                   | Roots                      | Make it thoroughly by rubbing against a stone tool, and put it in drinking water to treat fever, or boil and eat to treat gallstones |
| Apocynaceae              | Amphoneurion marginatum                             | Roots, stems and leaves     | Make the roots thoroughly by rubbing against a stone tool, then put it in drinking water to nourish breast milk after giving birth; boiled stems and eat to treat hemorrhoids; crushed the leaves and applied to treat hemorrhoids |
| Apocynaceae              | Streptocaulon juvenalis                             | Latex                      | Use latex to treat stomatitis                                               |
| Apocynaceae              | Urceola polymorpha                                  | Leaves                     | Eat fresh to reduce dizziness                                               |
| Apocynaceae              | Urceola minutiflora                                 | All parts                  | Soak all parts of the plant in water and bath to treat belly disease        |
| Asparagaceae             | Asparagus racemosus                                 | Roots                      | Boil and drink to nourish the body, heal the uterus, or crush it and apply it to the abscess area |
| Asteraceae               | Chromolaena odorata                                 | Leaves                     | Crush and applied it to heal fresh wounds, help to stop bleeding            |
| Asteraceae               | Elephantopus scaber                                 | All parts                  | Boil and eat as a tonic                                                     |
| Bignioniaceae            | Millingtonia hortensis                              | Stems (barks)              | Helps relieve cough                                                         |
| Boraginaceae             | Ehetria aspera                                       | Fruits                     | Eat fresh to reduce dizziness                                               |
| Burseraceae              | Canarium subulatum                                  | Fruits and stems (barks and piths) | Pickle fruits, or crush the core of the stem with water, eat to treat children with croup, or soaked in water to treat conjunctivitis, wet eyes disease |
| Cannabaceae              | Trema orientale                                      | Roots                      | Boil and eat to treat stomach pain                                          |
| Celastraceae             | Salacia chinensis                                   | Roots and stems            | Boil to help cure gastritis. Used as a laxative, dried and then boiled or Make it thoroughly by rubbing against a stone tool and eat to detox the kidneys |
| Connaraceae              | Ellipanthus tomentosus                              | Stem (barks)               | Boiled barks and drink to treat gastritis, or boiled stems and bath to treat the rash |
| Convolvulaceae           | Argyrea breviscapa                                  | Roots                      | Boil and eat to cure cough                                                  |
| Cyperaceae               | Cyperus rotundus                                    | Roots                      | Boil and drink to cure gonorrhea, cure abscesses                           |
| Dipterocarpaceae         | Shorea obtusa                                       | Young leaves               | Boil and drink to cure stomachache                                         |
| Ebenaceae                | Diospyros oblonga                                   | Stem (barks)               | Boil and drink to help expel parasites                                      |
| Ebenaceae                | Diospyros mollis                                    | Stem (piths)               | Make it thoroughly by rubbing against a stone tool, and drink to help expel parasites |
| Ebenaceae                | Diospyros ehreitoides                               | Stems                      | Boil and eat to treat the cough and vaginal discharge                       |
| Erythroxylaceae          | Erythroxylum cuneatum                                | Roots                      | Boil and eat to nourish milk                                                |
| Euphorbiaceae            | Aporosa viliosa                                     | Stems                      | Boil and eat, or soak in bath water to treat croup                          |
| Euphorbiaceae            | Croton persimilis                                   | Leaves                     | Make it dried and wrapped in a thin white cloth, steamed it, and applied to the bruised or painful area |
| Euphorbiaceae            | Trigonostemon reidoides                             | Roots and leaves           | Make it thoroughly by rubbing against a stone tool, apply to cure abscesses, or mix with lemon juice to anti-snake venom. Boiled leaves and eat to relieve pain |
| Euphorbiaceae            | Croton crassifolius                                 | Roots                      | Boil and eat to nourish the blood                                           |
| Fabaceae-                | Senna siamea                                         | Leaves                     | Made it curry and eaten it as a laxative                                     |
| Caesalpinioideae         | Bauhinia saccocalyx                                 | Roots and young leaves     | Use the leaves or young shoots to chew thoroughly to treat mouth sores or mouth ulcers. The root is used to lozenge in the mouth or boil and eat to help heal mouth ulcers |
| Fabaceae-                | Xyla sylcarpa                                        | Stem (barks)               | Boil it with Irvingia malayana Oliv. ex A.W.Benn., and eat it for pain relief |
| Caesalpinioideae         | Pueraria candollei                                  | Roots                      | Apply or eat to help treat female internal symptoms, nourish the body       |
| Fabaceae-                | Pterocarpus macrocarpus                             | Stems                      | Boiled and eaten as an anthelmintic, can cure flatulence and indigestion   |
| Papilionoideae           | Flacourtia indica                                   | Roots                      | Boil and eat to cure flatulence, nourish the body                           |
| Fabaceae-                | Nepelium hypoelucum                                 | Stem (barks)               | Bring to boil and drink for women after giving birth to help heal wounds   |
| Salicaceae               | Hymenopyramis parvifolia                           | Stems                      | Boil to treat gastritis                                                     |

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| Family               | Species                          | Parts Used                  | Uses                                                                 |
|---------------------|---------------------------------|-----------------------------|----------------------------------------------------------------------|
| Lamiaceae           | Vitis glabrata                  | Stems and fruits            | Boil to cure diabetes                                               |
| Lauraceae           | Mesophaerum suaveolens          | Root                        | Boil with Ochna integerrima, and eat it to cure food poisoning      |
|                     | Litsea glutinosa                | Leaves and root             | The fermented leaves are used as a shampoo, and finely ground roots are applied to treat purulent abscesses |
| Lecythidaceae       | Careya arborea                  | Stem (barks)                | Boil to treat gastritis                                            |
| Loganiaceae         | Strynchnos nux-blanda           | Root and stems              | Chew bark and blow on snakebite wounds; boiled the piths and eat to cure stomach problems; roots soaked in water for cows or buffalo to eat it as a laxative |
| Rutaceae            | Lagerstroemia calycalata        | Stems                       | Boil and eat to treat muscle weakness                               |
| Malvaceae           | Grewia abutilifolia             | Roots                       | Boil and drink to cure urinary incontinence                         |
| Malvaceae           | Heliceros angustifolia          | Roots                       | Boil to cure flatulence                                            |
| Melastomataceae     | Memecylon scutellatum           | Roots and stem              | Make it thoroughly by rubbing against a stone tool, eat as herbal medicine by rubbing against a stone tool, eat as carminative and treat beriberi |
| Rubiaceae           | Azadirachta indica              | Leaves and stem (piths and barks) | Boiled leaves and eaten as an aphrodisiac to relieve flatulence; leaves or stem bark used for fermentation to kill insects; Boiled cores to treat diabetes |
| Menispermaceae      | Diplolcisia glaucescens         | Stems                       | Boiled and eaten help nourish milk, used as a herbal remedy for wound healing for women after giving birth |
| Menispermaceae      | Tinospora crispa                | Stems                       | Boil and drink to cure fever                                       |
| Moraceae            | Artocarpus lacucha              | Stems                       | Boil and eat as an anthelmintic drug or boil and bathe in rash fever |
| Ochnaceae           | Ochna integerrima               | Stems                       | The peel is applied to the face to make the face white. Boil and eat to help cure stomach problems |
| Phyllanthaceae      | Phyllanthus emblica             | Fruits and stems            | The core is boiled and eaten to cure cough; fruits are eaten fresh to moisten the throat and reduce coughing or eat fresh as a laxative |
| Poaceae             | Vietnomosasa pusilla            | Roots                       | Boil and eat to cure fever                                          |
| Rhamnaceae          | Ziziphus oenopolia              | Roots                       | Boil to treat purulent abscesses                                    |
| Rubiaceae           | Ridsdalea witti                 | Stems, roots, and fruits    | Boiled stems and eaten to treat tendon diseases or to be soaked in water to cure children's croup, boiled roots to relieve fever. Boiled fruit and eaten to nourish the body, or dried and boiled to treat diabetes |
| Rubiaceae           | Catunaregam tomentosa           | Stems and old fruits        | Boiled stems and eat to treat painkillers, diarrhea, and hemorrhoids; The mature fruit is used to beat with water and used as a shampoo |
| Rubiaceae           | Morinda coreia                  | Fruits                      | Eat fresh fruit as a laxative to cure flatulence and indigestion    |
| Rubiaceae           | Isora finlaysoniana             | Roots and stems             | Make it thoroughly by rubbing against a stone tool, eat to treat a suffer from food poisonous |
| Rubiaceae           | Canthium berberidifolium        | Stems                       | Make it thoroughly by rubbing against a stone tool, and applied to the pain area to reduce the pain |
| Rubiaceae           | Discospermum parvifolium        | Roots                       | Boil and eat to cure stomachache                                    |
| Rutaceae            | Clausena wallichii              | Roots or all stem           | Thoroughly the roots by rubbing against a stone tool, eat to treat the suffer from food poisonous for female after giving birth, the whole plant is eaten to carminative and treat beriberi |
| Rutaceae            | Micromelum minutum              | Leaves                      | Boil and eat as carminative and reduce flatulence and distension   |
| Sapindaceae         | Schleicheria oleosa             | Fruits                      | Eat it as a laxative, but should not take too much as it can cause diarrhea |
| Sapindaceae         | Sisyrolepis muricata            | Fruits                      | Eat it as a laxative, but should not take too much as it can cause diarrhea, or crushed into the water and eat to nourish the blood |
| Sapotaceae          | Xantolis cambodianna            | Stem (barks)                | Boil and drink to nourish the milk                                 |
| Simaroubaceae       | Eurycoma longifolia             | Roots                       | Make it thoroughly by rubbing against a stone tool, or boil and drink to cure hemorrhoids, or use fillings on tooth decay to relieve toothache; boiled and eat to treat food poisoning of women after childbirth |
| Steronaceae         | Stemona collinsiae              | Roots                       | Eat to cure skin diseases, rashes, lymphatic drainage. Or crush and apply to cure scorpion bites, snake bites |
| Vitaceae            | Cissus repanda                  | Leaves                      | Grind with Zingiber ootens; rhizomes and dry, eat to cure stomachache |
| Zingiberaceae       | Kaempferia marginata            | Rhizomes                    | Boil and eat as carminative                                        |
Five (15) species are used to treat infections related to infections such as fever, abscess, and pus, i.e. 1. Lamia coromandelica, 2. Uvaria ferruginea var. chevrevennei, 3. Polyalthea debilis, 4. Polyalthea evecta, 5. Salacia chinensis, 6. Ellipanthus tomentosus, 7. Cyperus rondulus, 8. Trigonostemon reidoioides, 9. Litsea glutinosa, 10. Tinospora crispa, 11. Artocarpus lacucha, 12. Vietnamosasa pusilla, 13. Ziziphus oenopolia, 14. Ridsdalea witti, and 15. Catunaregam tomentosa.

Fourteen (14) species are used to treat nutritional disorders such as antihistamines and tonics, i.e. 1. Polyalthea debilis, 2. Urceola minitiflora, 3. Asparagus racemosus, 4. Elephantopus scaber, 5. Canarium subalatum, 6. Aporosa villosa, 7. Croton crassifolius, 8. Flacourtia indica, 9. Mesosphaerum suaveolens, 10. Memecylon scutellatum, 11. Azadirachta indica, 12. Ridsdalea witti, 13. Isora finlaysoniana, 14. Sisyrolepis muricata.

Eleven (11) species are used for women during pregnancy, birth, or puerperium, i.e. 1. Amphiloenurion marginatum, 2. Asparagus racemosus, 3. Diospyros ehretoioides, 4. Erythroxylum cuneatum, 5. Pueraria candollei, 6. Nephelium hypoleucum, 7. Memecylon scutellatum, 8. Diplocasia glaucescens, 9. Clausena wallichii, 10. Xantolis cambodiabana, and 11. Eurycoma longifolia.

Nine (9) species are used to treat poisonings, i.e. 1. Diospyros oblonga, 2. Diospyros mollis, 3. Trigonostemon reidoioides, 4. Pierocarpus macrocarpus, 5. Strzychnos nux-blanda, 6. Azadirachta indica, 7. Artocarpus lacucha, 8. Canthium berberidifolium, and 9. Stemona collinsiae.

Five (5) species are used to treat the muscular-skeletal system, i.e. 1. Croton persimilis, 2. Trigonostemon reidoioides, 3. Xylia xylocarpa, 4. Lagerstroemia calycata, and 5. Catunaregam tomentosa.

Four (4) species are used to treat the respiratory system, i.e. 1. Millingtonia hortensis, 2. Argyreia brevescapa, 3. Diospyros ehretoioides, and 4. Phyllanthus emblica.

Three (3) species are used to treat the genitourinary system, i.e. 1. Polyalthea evecta, 2. Salacia chinensis, and 3. Grewia abutilifolia.

Three (3) species are used to treat the endocrine system, i.e. 1. Vitex glabrata, 2. Azadirachta indica, and 3. Ridsdalea witti.

Three (3) species are used to treat injuries, i.e. 1. Streptocaulon juventas, 2. Chromolaena odorata, and 3. Bauhinia saccocalyx.

Two (2) species are used for skin disorders, i.e. 1. Occhna integerrima, and 2. Stemona collinsiae.

Two (2) species are used to treat defined symptoms such as dizziness, i.e. 1. Urceola polymorpha, and 2. Ehetria aspera.

Two (2) species are used for other disorders treated, such as shampoo, i.e. 1. Litsea glutinosa, and 2. Catunaregam tomentosa.

The analysis of the IAR index (Table 5), the vertigo syndrome group has an ICF of 0.958 which indicates that medicinal plants for the treatment of the syndrome are accepted by many informants. This conformity shows a high degree of acceptance. While muscle-related syndromes group (Muscular-skeletal system) had an ICF of 0.692, indicating that medicinal plants used in the treatment of this syndrome were less acceptable by all informants. This may be due to the low use of plants in this syndrome and the use of different plants for each respondent.

Fidelity Level (%FL)

Fidelity Level by analyzing the plants which are the most interesting in the treatment of each syndrome. This is because, in each syndrome, multiple plant species may be treated using the ratio of the number of reported plant utilization in that symptom group to the total reported number of plant use of that plant across all symptom clusters. It was shown that if a plant had a high %FL, it meant that the plant was used in the same direction or that each informant was using the same plant to treat the syndrome. The highest value was 100, while the plant %FL was low. This indicates that the plant is used for multiple purposes or multiple syndromes (Table 6).

Comparing to the result of Sukrsri et al. (2005) which although we are studying in the same region in northeastern Thailand but differ in the characteristics area and provinces. Our study area, Khok Nhong Phok forest, is the deciduous dipterocarp forest located in Maha Sarakham Province, whereas the study of Sukrsri et al. studied in the Bung Khong Long area where is a wetland located in Bueng Kan Province. Due to the different conditions of the area, the vegetation found in the area is different and results in different utilization as well.

Khok Nhong Phok forest is an important source of food for the community; 50 plants surveyed are used as food. The proportion is less than the result of the study Ethnobotany of Phu Thai Ethnic Group in Nakhon Phanom Province, Thailand by Pholhimhan et al. (2018). While in this study, 101 plant species were found. Six utilization parts of plants used for food were rhizomes or tubers, the stems (pith, bark, vine, and shoot), leaves, young offshoots, flowers, and fruits (seeds). According to a study by Pholhimhan et al. (2018), most of the edible plants used young shoots and flowers, such as Senna siamea. The shoots and flowers of Cratoxylum formosum were used. Seasonal wild fruits such as Uvariaryia and Grewia abutilifolia. While the study of Cruz-Garcia & Price (2011) about wild plants used as food found 87 species belong to 47 families. 17 species of food plants, which found distributed in Kalasin province are also found in our study area and used as food too, i.e. 1. Mangifera caloneura, 2. Polyalthea debilis, 3. Polyalthea evecta, 4. Amorphophallus brevispathus, 5. Canarium subalatum, 6. Careya arborea, 7. Azadirachta indica, 8. Tilia corriatriandra, 9. Artocarpus lacucha, 10. Syzygium cumini, 11. Adenia viridiflora, 12. Bambusa bambos, 13. Ziziphus oenopolia, 14. Ridsdalea witti, 15. Schleichera oleosa, 16. Lepisanthe ssubiugina, and 17. Curcuma singularis. However, more than 70 percent are different.
Table 5. Disease symptom clusters and Informant Agreement Ratio (IAR) index of the therapeutic use of plants in Khok Nhong Phok forest, Northeastern Thailand

| Use-categories          | Disorders treated                                      | Number of use report | Number of taxa | IAR  |
|-------------------------|--------------------------------------------------------|----------------------|----------------|------|
| Defined symptoms        | Dizziness                                              | 25                   | 2              | 0.958|
| Injuries                | Wound, aphthous ulcers                                 | 36                   | 3              | 0.943|
| Respiratory system      | Cough                                                  | 49                   | 4              | 0.938|
| Endocrine system        | Diabetes                                               | 27                   | 3              | 0.923|
| Genitourinary system    | Diuretic, renal failure                                | 18                   | 3              | 0.882|
| Nutritional disorders   | Nutrients supplement                                   | 109                  | 14             | 0.880|
| Skin disorders          | Skin nourishment, rashes                              | 9                    | 2              | 0.875|
| Gastroenterology        | Hemorrhoid, stomachache, gastritis, constipation, carminative | 208                  | 28             | 0.870|
| Poisonings              | Sting, parasite, insect repellent                      | 51                   | 9              | 0.840|
| Infection               | Fever, diarrhea, abscess, gonorrhea                    | 85                   | 15             | 0.833|
| Other                   | Shampoo                                                | 7                    | 2              | 0.833|
| Pregnancy/ Birth/Puerperium | Lactation stimulant, recovery (female after giving birth) | 58                   | 11             | 0.825|
| Muscular-skeletal system | Muscle pain, sprain                                   | 14                   | 5              | 0.692|

Table 6. The %FL values of each plant from Khok Nhong Phok forest, Northeastern Thailand in the treatment of disease syndrome

| Family          | Plant name and scientific name | Medical category | Np | N  | % FL  |
|-----------------|--------------------------------|------------------|----|----|-------|
| Anacardiaceae   | Lannea coromandelica           | Infection        | 6  | 6  | 100.00|
| Annonaceae      | Uvaria ferruginea var. cherrevensis | Gastroenterology | 5  | 8  | 62.50 |
| Annonaceae      | Polyalthia debilis             | Infection        | 7  | 20 | 35.00 |
| Annonaceae      | Polyalthia evecta              | Genitourinary system | 2  | 3  | 66.67 |
| Apocynaceae     | Amphineuron                    | Gastroenterology | 7  | 12 | 58.33 |
| Apocynaceae     | Streptocaulon juventas         | Injuries         | 13 | 13 | 100.00|
| Apocynaceae     | Urceola polymorpha             | Defined symptoms | 14 | 14 | 100.00|
| Apocynaceae     | Urceola minutiflora            | Nutritional disorders | 23 | 23 | 100.00|
| Asparagaceae    | Asparagus racemosus            | Nutritional disorders | 1 | 10 | 10.00 |
| Asparagaceae    | Asparagus racemosus            | Gastroenterology | 2  | 10 | 20.00 |
| Asteraceae      | Chromolaena odorata            | Injuries         | 15 | 15 | 100.00|
| Asteraceae      | Elephantopus scaber            | Nutritional disorders | 20 | 20 | 100.00|
| Bignoniaceae    | Millingtonia hortensis         | Respiratory system | 14 | 14 | 100.00|
| Boraginaceae    | Ehretia aspera                 | Defined symptoms | 11 | 11 | 100.00|
| Burseraceae     | Canarium subulatum             | Nutritional disorders | 6  | 6  | 100.00|
| Cannabaceae     | Trema orientale                | Gastroenterology | 31 | 31 | 100.00|
| Celastraceae    | Salacia chinensis              | Gastroenterology | 6  | 18 | 33.33 |
| Connaraceae     | Ellipanthus tomentosus         | Genitourinary system | 5  | 18 | 27.78 |
| Convolvulaceae  | Argyreia breviscapa            | Gastroenterology | 5  | 14 | 35.71 |
| Cyperaceae      | Cyperus rotundus               | Respiratory system | 12 | 12 | 100.00|
| Dipterocarpaceae| Shorea obtusa                 | Gastroenterology | 8  | 8  | 100.00|
| Ebenaceae       | Diospyros oblonga              | Poisonings       | 2  | 2  | 100.00|
| Ebenaceae       | Diospyros mollis               | Poisonings       | 2  | 2  | 100.00|
| Ebenaceae       | Diospyros ehrhoides            | Respiratory system | 11 | 16 | 68.75 |
| Erythroxylaceae | Erythroxylum cuneatum          | Pregnancy/birth/puerperium | 5 | 16 | 31.25 |
| Euphorbiaceae   | Aporosa villosa                | Nutritional disorders | 7  | 7  | 100.00|
| Euphorbiaceae   | Croton persimilis              | Muscular-skeletal system | 3  | 3  | 100.00|
| Euphorbiaceae   | Trigonostemon reidioides       | Infection        | 12 | 21 | 57.14 |
|                  |                                | Poisonings       | 5  | 21 | 23.81 |
| Family                        | Species                                | Disorders and Systems                           | Uses                                    |
|-------------------------------|----------------------------------------|------------------------------------------------|------------------------------------------|
| Zingiberaceae                 | Croton crassifolius                     | Nutritional disorders                           | Gastroenterology                        |
| Fabaceae-Caesalpinioideae     | Senna siamea                           | Gastroenterology                               |                                         |
| Fabaceae-Caesalpinioideae     | Bauhinia saccocalyx                     | Injuries                                       |                                         |
| Fabaceae-Mimosoideae          | Xylocarpus malabarrosa                 | Muscular-skeletal system                        |                                         |
| Fabaceae-Papilionoideae       | Pueraria utilis                        | Pregnancy/birth/puerperium                      |                                         |
| Fabaceae-Papilionoideae       | Pterocarpus macrocarpus                | Poisonings                                     |                                         |
| Sapindaceae                   | Flacourtia indica                      | Gastroenterology                               |                                         |
| Sapindaceae                   | Nephelium hypoleucem                   | Pregnancy/birth/puerperium                      |                                         |
| Lamiaceae                     | Hymenopapysium parvifolia              | Gastroenterology                               |                                         |
| Lamiaceae                     | Vitex glabrata                         | Endocrine system                               |                                         |
| Lauraceae                     | Litsea glutinosa                       | Nutritional disorders                           |                                         |
| Lauraceae                     | Litsea glutinosa                       | Infection                                      |                                         |
| Lecythidaceae                 | Careya arborea                         | Gastroenterology                               |                                         |
| Loganiaceae                   | Stychnos nux-blanda                    | Poisonings                                     |                                         |
| Lythraceae                    | Lagerstroemia calyculata               | Muscular-skeletal system                        |                                         |
| Malvaceae                     | Grewia abutilifolia                    | Genitourinary system                           |                                         |
| Melastomataceae               | Memecylon scutellatum                  | Pregnancy/birth/puerperium                      |                                         |
| Meliaceae                     | Acadirachta indica                     | Nutritional disorders                           |                                         |
| Menispermaceae                | Diploclisia glaucescens                | Pregnancy/birth/puerperium                      |                                         |
| Menispermaceae                | Tinospora crispa                       | Infection                                      |                                         |
| Moraceae                      | Artocarpus lacucha                     | Infection                                      |                                         |
| Ochnaceae                     | Ochna integerrina                      | Skin disorders                                 |                                         |
| Phyllanthaceae                | Phyllanthus emblica                    | Gastroenterology                               |                                         |
| Poaceae                       | Vietnamosasa pusilla                   | Infection                                      |                                         |
| Rhamnaceae                    | Ziziphus oenopolia                     | Infection                                      |                                         |
| Rubiaceae                     | Ridsdalea witti                       | Nutritional disorders                           |                                         |
| Rubiaceae                     | Catunaregam tomentosa                  | Muscular-skeletal system                        |                                         |
| Rubiaceae                     | Morinda coreia                         | Gastroenterology                               |                                         |
| Rubiaceae                     | Ixora finlaysoniana                    | Nutritional disorders                           |                                         |
| Rubiaceae                     | Canthium berberidifolium               | Poisonings                                     |                                         |
| Rubiaceae                     | Discospermum parvifolium               | Gastroenterology                               |                                         |
| Rutaceae                      | Clausena wallichii                    | Pregnancy/birth/puerperium                      |                                         |
| Rutaceae                      | Micromelum minutum                     | Gastroenterology                               |                                         |
| Sapindaceae                   | Schleicheria oleosa                    | Gastroenterology                               |                                         |
| Sapindaceae                   | Sisyroplepis muceata                   | Gastroenterology                               |                                         |
| Sapotaceae                    | Xantolis cambodiana                    | Pregnancy/birth/puerperium                      |                                         |
| Simaroubaceae                 | Eurycoma longifolia                    | Gastroenterology                               |                                         |
| Stemonaceae                   | Stemona collinsiae                     | Skin disorders                                 |                                         |
| Vitaceae                      | Cissus repanda                         | Gastroenterology                               |                                         |
| Zingiberaceae                 | Kaempferia marginata                   | Gastroenterology                               |                                         |
This forest is a collection of plants of which 69 species have been used by the community for medicinal purposes. The majority of plants were used for the treatment of gastrointestinal diseases such as abdominal pain and gastritis, similar to the results of studies by Pholhiamhan et al. (2018) and Junsongduang et al. (2020), where most plants were used for medicinal purposes to treat the gastrointestinal.

In addition, plants in the Khok Nong Phok forest are used as building materials, appliances and fuel. Here, it is considered an important source of material in which 42 species of plants are used in this area, mainly stems and leaves, similar to the results of a study by Panyadee et al. (2016), who studied Woody Plant Diversity. in Urban Homesteads in Northern Thailand where plant stems are used to build homes, appliances, and fuel. But at present, it is found that the use of plants in this field has decreased due to the use of synthetic materials that can be substituted. And in the present, in the aforementioned areas, there is a resolution forbidding the use of trees in Khok Nong Phok forest for long-term forest conservation.

In summary, there are 101 species of plants that are used according to traditional knowledge, which classified in 52 families, categorized into three groups based on traditional used: 50 species of food plants, 69 species of medicinal plants, and 42 species used to build homes, appliances, and fuel. In this study, some plants with more than one type of utilization showed that they were valuable to local people in terms of various uses. Such information can be used as a guideline for the conservation of plant resources in the area to show the importance of cherishing and maintain valuable resources remain for future generations forward.

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