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Medicinal Plants Diversity and Ethnobotany in Khok Hin Lad Forest of Maha Sarakham Province, Thailand

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Abstract

This research aimed to explore the diversity of medicinal plants in Khok Hin Lad Community Forest and to study the ethnobotany of medicinal plants in Khok Hin Lad Community Forest, Waeng Nang Sub-district, Mueang Maha Sarakham District, Maha Sarakham Province using four 20m. x 50m. plots through sample size justification. The main focus was to allow the area to represent the local community at its best through suggestions of local medical practitioners and experts and explore types of plants and herbs with a trunk diameter at 1.30 m. greater than or equal to 10 cm. Species diversity index (H), Diversity (D), and Evenness (J) analyzed using Shannon Wiener Index showed that (H) was at 3.312066269; (D) was at 27.44176899; and (J) was at 0.73072114. Species diversity (H) was low which indicated that there were small number of medicinal plant species. Evenness (J) was moderate. Data compilation and interviews with local medical practitioners and scholars regarding the use of medicinal plants in Khok Hin Lad Community Forest in Maha Sarakham Province showed that all 93 species of medicinal plants various were used, including 60 species that were prepared through decoction; 18 species that were consumed fresh or used for cooking; 4 species that were crushed and squeezed for consumption, and 11 species that were used for bathing, showering, rubbing, or wound dressing.

Introduction

Deciduous dipterocarp forest (DDF), commonly called “Daeng Forest” or “Khok Forest”, is mainly found on hillside plains and steep slopes at the altitude of approximately 500 meters above sea level. Main characteristics of the forest include arid and shallow soil, rocks and gravel, allowing water to flow through easily. Hillside plains may also consist of large sandstones in general. During the dry season, forest fires tend to spread through the forest floor. Deciduous plants, therefore, are drought-and-fire tolerant. Seedlings and saplings have fire-tolerant underground rhizomes, while large trees have thick bark that boasts similar characteristics. Distinctive features of the deciduous dipterocarp forest consist of predominant plants including rubber plants such as *Dipterocarpus obtusifolius*, *Dipterocarpus intricatus*, and *Dipterocarpus tuberculatus* Roxb., with *Shorea obtusa* Will. ex and *Shorea siamensis* Miq. being the most common species found along ridges and low hills. Small plants with a height of less than 10 meters, such as *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Pruniflorum* (Kurz). Gogelein, *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *formosum*, *Strychnaceae*, and *Morinda coreia* Buch.-Ham. Understorey plants include *Vietnamosasa pusilla* (A. Cheval. & A. Camus) Hguyen. (syn. A. Cheval. & A. Camus), which grows in dense clumps along with other shrubs and herbaceous plants. During the dry season, the understorey plants wither or discard all of their leaves, leaving behind a good source of dry fuel, especially *Arundinaria pusilla* [1].

Khok Hin Lad Community Forest is closely tied to the local village life. Villagers know how to utilize the forest throughout the year, whether for food or medicinal source. During the rainy season, villagers hunt for bullfrogs, mushrooms, and harvest wild vegetables and bamboo shoots. The forest is turned into a herding area from winter to summer. Food obtained from the forest such as red ant eggs, insects, wild vegetables, and various herbs are free from chemical contamination. Wild vegetables and medicinal plants harvested contain bioactive substances and medicinal properties and are used by local medical practitioners, scholars, and villagers. Treatments of diseases according to local wisdom include decoction and herbal compress balls. Academic data, records of medicinal plant diversity, however, have not been systematically compiled. No reports on the medicinal properties of local plants have been made for the community to emphasize the importance of local medicinal plants.

Objectives

- To explore the diversity of medicinal plants in Khok Hin Lad Community Forest
- To perform an ethnobotanical study of medicinal plants in Khok Hin Lad Community Forest
- To establish an online database accessible to the community, local institutions, and general public

Hypothesis

- Diversity of medicinal plant species is no less than 50 species
- Medicinal plants in Khok Hin Lad Community Forest are used in various ethnobotanical aspects.



Research Methodology

The study of medicinal plant diversity in Khok Hin Lad Community Forest in Maha Sarakham was conducted according to the following procedures:

- The study on the diversity of edible wild vegetables in the deciduous dipterocarp forest (2007) was used as a baseline in the classification of the medicinal plants.
- Study and survey the types of medicinal plants in the deciduous dipterocarp forest of Khok Hin Lad forest using plot sampling and sample size justification, allowing the area to represent the local community at its best through suggestions of local doctors and experts, using four 20m. x 50m. plots.
- Compile a list of plant species through surveillance and count the number of plants and herbs in the plots, including the total count of trees, and understory medicinal plants in the 1m. X 1m. plots at the 4 corners of the plots. Species seen will be recorded with the help from local medical practitioners, scholars, and experts, including Mr. Boonkong Saensuphan, Mr. Promma Chanthapang, Mr. Srichand Yuechan, and Mr. Winai Yothapakdi, the Community Forest Conservation Leadership Committee; along with experts who participated in the survey including Asst. Prof. Dr. Sombat Ammraka and Dr. Veera Thongnate from Walai Rukhavej Botanical Research Institute, Mahasarakham University.
- Collect and analyze the data by calculating the species diversity index: H; diversity: D; and evenness: J using the Shannon Wiener Index method [2].

Shannon-Weaver Index: H' (Shannon and Weaver, 1949) includes following equations:

$$H' = - \sum_{i=1}^s (p_i \ln p_i)$$

Whereas H' = species diversity index

P_i = ratio between the number of species i to all species

$\ln p_i$ = natural logarithm of p_i

S = number of species discovered

Species Diversity: D to find the number of species that could theoretically be found

$$D = e^{H'}$$

Whereas

D = diversity

$e = 2.71828$ (natural logarithm)

H' = species diversity index

Maximum species diversity index (H_{max})

$$H \ln S_{max}$$

Whereas

H_{max} = maximum species diversity index

S = number of species discovered

Evenness Index: J (Niwat Kachanan, 2005: referred to Hill, 1973)

$$J = H' / \ln S \text{ or } H / H_{max}$$

Whereas

H' = Shannon-Weaver Index

S = number of species discovered

- Study local usage of medicinal plants found in the plot and ethnobotany by collecting data from interviews with local scholars in the community near Khok Hin Lad Forest.
- Plant status analysis, plant species analysis based on natural characteristics, classification of plants by genus and family to distinguish between local and foreign species based "Eastern Forest Plants Species" of Botanical Affairs Division, Department of National Park, Wildlife and Plant Conservation (2018), and Plant Species in Mahasarakham University compiled by Chadaphon Senakhun, Surapon Saensuk et al.

[3]. Classification of plant status according to species diversity (D) for medicinal plants includes plants with low diversity (risk species: R_s) and plants with high diversity (common species: C).

- Important Value Index (IVI) analysis will determine dominant species in the ecosystem using density, frequency, and size of the canopy occupying the area:
 - Plant Density (Density: D) is the total number of plant species in the plots (plants/unit area). D (Area A) is the ratio of plants in Area A . Relative Density (RD) is the ratio between the density of a specific species and the overall density of all plants. $RD(A) = (\text{density of species } A / \text{overall density of all species}) \times 100$.
 - Frequency (Frequency: F) is the ratio between the number of plots in which species A exists and the total number of plots. $F(A) = (\text{number of plots where Plant } A \text{ is present} / \text{total number of plots}) \times 100$. Relative Frequency (RF) is the ratio between the frequency of a specific species and the overall species. $RF(A) = (\text{frequency of Plant } A / \text{total frequency of all plants}) \times 100$.
 - Basal area (BA) (sq.m.) = $\pi [\text{DBH (c.m.)}]^2 / 10,000$. Species Dominance (Do) is the ratio between the sum of the cross-sectional area of a specific species and the total area of the plot. $Do(A) = \text{cross-sectional area of Plant } A / \text{sample plot area}$. Relative dominance (RDo) is the ratio between the total cross-sectional area of a specific species and the total cross-sectional areas of all species. $RDo(A) = (\text{sum of cross-sectional areas of Plant } A / \text{sum of cross-sectional areas of all species}) \times 100$. Important Value Index (IVI) is the sum of the 3 relative values as follows:

$$IVI(A) = RD(A) + RF(A) + RDo(A)$$

- Questionnaires and interviews regarding the utilization of medicinal plants including organizing a meeting between local medical practitioners, local scholars, experts, and the research team.

Data Analysis

Statistics used in the analysis of species diversity of medicinal plants and risk species include:

- Descriptive statistics including percentage, density (D), relative density (RD), frequency (F), relative frequency (RF), dominance (Do), relative dominance (RDo), and important value index (IVI).
- Inferential statistics including diversity index (Shannon-Wiener Index: H'), species diversity (D), and evenness index (J).

Results

Study on medicinal plants in the deciduous dipterocarp forest of Khok Hin Lad Community Forest using plot sampling and sample size justification, allowing the area to represent the local community at its best through suggestions of local doctors and experts, using four 20m. x 50m. plots, found a total of 93 species, 83 genera, 47 families, with Rubiaceae being the most common (10 species), followed by Euphorbiaceae (6 species). Study on the diversity of plants in the survey plots with a trunk diameter at 1.30 m. greater than or equal to 10 cm., and those with a diameter less than 10 cm., found that the plant with the highest relative density was *Lannea coromandelica* (Houtt.) Merr., at 14.32, followed by *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Pruniflorum* (Kurz.) Gogelein, at 13.06, *Shorea siamensis* Miq. at 12.94, *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *formosum*, at 10.42, *Cratoxylum cochinchinense* (Lour.) Blume, at 6.53, *Lannea coromandelica* (Houtt.) Merr. at 4.93, *Dipterocarpus intricatus* Dyer, at 3.78, and *Shorea obtusa* Will. ex Blume, at 3.55, respectively.

For medicinal trees, the species with the highest relative frequency were *Xylocarpa xylocarpa* (Roxb.) Taub. var. *xylocarpa*, *Shorea siamensis* Miq., *Dipterocarpus intricatus* Dyer, *Catunaregam tomentosa* (Blume ex DC.) Tirveng., *Memecylon edule* Roxb., *Canarium subulatum* Guillaumin, *Lannea coromandelica* (Houtt.) Merr., and *Litsea glutinosa* (Lour.) C.B. Rob., all of which were equal to 4.49, followed by *Shorea obtusa* Will. ex Blume, *Casearia grewiaefolia* Vent., *Sindora siamensis* Teijsm. & Miq., *Mitragyna hisuta* Haval., *Diospyros ethetoides* Wall. Ex G. Don, and *Aganosma marginata* G. Don., all of which were equal to 3.37.



Medicinal trees with the highest relative dominance was *Shorea siamensis* Miq. at 29.63, followed by *Xylia xylocarpa* (Roxb.) Taub. var. *xylocarpa*, at 12.82, *Canarium subulatum* Guillaumin at 11.16, *Dipterocarpus intricatus* Dyer, at 8.47, and *Shorea obtusa* Will. ex Blume, at 5.90, respectively.

Medicinal trees with the highest Importance Value Index (IVI) was *Shorea siamensis* Miq. at 47.07, followed by *Xylia xylocarpa* (Roxb.) Taub. var. *xylocarpa*, at 31.64, *Canarium subulatum* Guillaumin, at 18.06, *Dipterocarpus intricatus* Dyer, at 16.74, *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Pruniflorum* (Kurz). Gogelein, at 16.47, *Shorea obtusa* Will. ex Blume, at 12.82, and *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Formosum*, at 12.68, respectively.

Study on the diversity of medicinal plants in the deciduous dipterocarp forest of Khok Hin Lad forest using plot sampling and sample size justification, allowing the area to represent the local community at its best through suggestions of local doctors and experts, using four 20m. x 50m. plots, and the survey on the species of plants in the plots with a trunk diameter at 1.30 m. greater than or equal to 10 cm., and those with a diameter less than 10 cm., as well as understorey species in the 4 plots, using species diversity index (H), diversity (D), and evenness (J) of Shannon Wiener Index, found that species diversity index (H) was at 3.312066269, diversity (D) was at 27.4176899, and the evenness (J) was at 0.73072114. The diversity index (H) was low, indicating that there were relatively few species of medicinal plants in the area. The evenness (J) was moderate, indicating that medicinal plants in Khok Hin Lad Community Forest were moderately distributed, whereas diversity (D) showed that there are 27 diverse species of medicinal plants in the area, including *Vietnamosasa pusilla* (Chevalier & A. Camus) Nguyen, *Trigonostemon reidioides* (Kurz) Craib, *Polyalthia debilis* (Pierre) Finet & Gagnep. *Polyalthia evecta* (Pierre) Finet & Gagnep. *Xylia xylocarpa* (Roxb.) Taub. var. *xylocarpa*, *Strophoblanchia fimbricalyx*, *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Pruniflorum* (Kurz). Gogelein, *Shorea siamensis* Miq., *Helicteres angustifolia* L., *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *formosum*, *Lannea coromandelica* (Houtt.) Merr., *Streptocaulon juvenas* (Lour.) Merr., *Aganonerion polymorphum* Pierre ex spire, *Croton crassifolius* Geiseler, *Cratoxylum cochinchinense* (Lour.) Blume, *Memecylon edule* Roxb., *Crinum* sp., *Micromelum minutum* (G. Forst.) Wight & Arn.), *Vitex pinnata* L., *Dipterocarpus intricatus* Dyer, *Canthium berberidifolium* Geddes, *Shorea obtusa* Will. ex Blume, *Ochna integerrima* (Lour.) Merr., *Leea thorelii* Gagnep., *Canarium subulatum* Guillaumin, and *Prismatomeris sessiliflora* Pierre. ex Pit., respectively. Data compilation and interviews with local medical practitioners and scholars regarding the use of medicinal plants in Khok Hin Lad Community Forest in Maha Sarakham Province showed that all 93 species of medicinal plants various were used, including 60 species that were prepared through decoction; 18 species that were consumed fresh or used for cooking; 4 species that were crushed and squeezed for consumption, and 11 species that were used for bathing, showering, rubbing, or wound dressing.

Discussion

Survey on species diversity and ethnobotanical study of medicinal plants in Khok Hin Lad Community Forest showed that the species with the highest relative density was *Lannea coromandelica* (Houtt.) Merr. Followed by *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Pruniflorum* (Kurz). Gogelein, and *Shorea siamensis* Miq., respectively. Medicinal trees with the highest relative frequency were *Xylia xylocarpa* (Roxb.) Taub. var. *xylocarpa*, *Shorea siamensis* Miq., *Dipterocarpus intricatus* Dyer, *Catunaregam tomentosa* (Blume ex DC.) Tirveng., *Memecylon edule* Roxb., *Canarium subulatum* Guillaumin, *Lannea coromandelica* (Houtt.) Merr., and *Litsea glutinosa* (Lour.) C.B. Rob. Medicinal trees with the highest relative dominance was *Shorea siamensis* Miq., followed by *Xylia xylocarpa* (Roxb.) Taub. var. *xylocarpa*. Medicinal trees with the highest importance value index (IVI) was *Shorea siamensis* Miq., followed by *Xylia xylocarpa* (Roxb.) Taub. var. *xylocarpa*, and *Canarium subulatum* Guillaumin, which corresponds with the research done by Tiamhatai Chupan, [4] that studied the diversity of plant species and ethnobotany of Khok Rai Forest, Don Ngern Sub-district, Chiang Yuen District, Maha Sarakham Province, and explored the diversity of plant species including trees, shrubs, and understorey plants, botanical characteristics of plants, and their usage in local communities using data query method. The research showed a total of 62 families, 151 species of plants, with *Shorea obtusa* Will. Ex Blume having the highest IVI at 0.4109, followed by *Xylia xylocarpa* (Roxb.) Taub. Var. *Kerri* (Craib & Hutch.) ICNielsen. Study on the diversity of trees, shrubs, and understorey plants showed that the species diversity index (H) was 3.2069, 2.7359, and 3.2033, respectively. The species diversity value (D) was 24.7031,

15.4240 and 24.6162, respectively. The evenness (J) was 0.7361, 0.6418 and 0.8684, respectively. The ethnobotanical study found that the usage of plants can be divided into 5 categories: 79 species for food, 97 species of medicinal purposes, 84 species for habitational purposes, 4 species for dying, and 6 species for local rituals and beliefs.

Study on medicinal plants in the deciduous dipterocarp forest of Khok Hin Lad Community Forest using plot sampling and sample size justification, allowing the area to represent the local community at its best through suggestions of local doctors and experts, using four 20m. x 50m. plots, found a total of 93 species, 83 genera, 47 families, with RUBIACEAE being the most common (10 species), followed by Euphorbiaceae (6 species), corresponds with Somchaya Sritham's [3] research on the diversity of trees and their usage in the local forest of Muang Surin District, Surin Province, by analyzing the density relative density, frequency, relative frequency, dominance, relative dominance, the important value index, the percentage of the important value, diversity index, and evenness index, and interviewing local scholars in Tenmey Sub-district, and Nok Muang Sub-District. The study found a total of 536 trees, 41 species from 24 families. The tree with the highest important index (IVI) was *Dipterocarpus obtusifolius* Teijsm. ex Miq., followed by *Melodorum fruticosum* Lour., *Shorea roxburghii* G. Don, *Shorea obtusa* Wall. ex Blume, *Parinari anamensis* Hance, *Canarium subulatum* Guillaumin, and *Aporosa villosa* (Wall. ex Lindl.) Baill., respectively, with a diversity index of 2.87, evenness index of 0.78. All species All species were locally used with most of them being used for medicinal purposes, followed by construction of shelters, food, home appliances, agricultural equipment, dyes, fuel, other usages, and ornamental plants, respectively found that species diversity index (H) was at 3.312066269, diversity (D) was at 27.4176899, and the evenness (J) was at 0.73072114. The diversity index (H) was low, indicating that there were relatively few species of medicinal plants in the area. The evenness (J) was moderate, indicating that medicinal plants in Khok Hin Lad Community Forest were moderately distributed, whereas diversity (D) showed that there are 27 diverse species of medicinal plants in the area, including *Vietnamosasa pusilla* (Chevalier & A. Camus) Nguyen, *Trigonostemon reidioides* (Kurz) Craib, *Polyalthia debilis* (Pierre) Finet & Gagnep., *Polyalthia evecta* (Pierre) Finet & Gagnep., *Xylia xylocarpa* (Roxb.) Taub. var. *xylocarpa*, *Strophoblanchia fimbricalyx*, *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Pruniflorum* (Kurz). Gogelein, *Shorea siamensis* Miq., *Helicteres angustifolia* L., *Cratoxylum formosum* (Jacq.) Benth. & Hook.f. ex Dyer subsp. *Pruniflorum*, *Lannea coromandelica* (Houtt.) Merr., *Streptocaulon juvenas* (Lour.) Merr., *Aganonerion polymorphum* Pierre ex spire, *Croton crassifolius* Geiseler, *Cratoxylum cochinchinense* (Lour.) Blume, *Memecylon edule* Roxb., *Crinum* sp., *Micromelum minutum* (G. Forst.) Wight & Arn.), *Vitex pinnata* L., *Dipterocarpus intricatus* Dyer, *Canthium berberidifolium* Geddes, *Shorea obtusa* Will. ex Blume, *Ochna integerrima* (Lour.) Merr., *Leea thorelii* Gagnep., *Canarium subulatum* Guillaumin, and *Prismatomeris sessiliflora* Pierre. ex Pit., respectively. Medicinal plants that researchers were interested in studying its bioactive substance was *Strophoblanchia fimbricalyx*, which corresponded with the research of Seephonkai P, Sangdee A, Bunchalee P, Pyne SG. [5] that focused on cytotoxic and antiparasmodial compounds found in the roots of *Strophoblanchia Fimbricalyx*. These compounds were the well-known phenanthrenone trigonostemone (1) along with the new phenantherone 9-O-demethyltrigonostemone (2) and two novel phenytophores, 3,6,9-trimethoxyphenanthropolone (3) and 4,6,9-trimethoxyphenanthropolone (4), which can be extracted from the roots of *Strophoblanchia fimbricalyx*. Compound 2 reacted toxically to NCI-H187, KB, and MCF7 cancer cells with IC50 values of 0.8, 0.8, and 2.9 microgram/mL, respectively, while Compound 3 and Compound 4 showed reduced cytotoxicity. Compound 3 also exhibited anti-cardiac activity in vitro (IC50 values of 2.7 and 3.2 mcg/mL, respectively) against *Plasmodium falciparum* (K1, resistant strain). These compounds also showed antioxidant properties against DPPH, but were only diagnosable in Compound 2. Seephonkai P, Pyne SG, Willis AC, Lie W. [6] also studied bioactive compounds from the roots of *Strophoblanchia fimbricalyx* and discovered 8 new compounds, namely *fimbricalyx*s BD (1-3), *fimbricalyx*anhydrides A and B (4, 5), and *fimbricalyx*lactones AC (6-8), along with three known compounds, trigonostemone (9), 3, 6,9-trimethoxyphenanthropolone (10) and *fimbricalyx* A (11). The structures of the new compounds were described on the basis of spectroscopic data and, in the case of compounds 2, 4, and 7, were confirmed by single-crystal X-ray diffraction. Compounds 1-4 and 8 were assessed for cytotoxicity (KB, MCF7, and NCI-H187) against cancer cells, and anti-cardiac activity (*Plasmodium falciparum*, K1 multidrug-resistant strain). *Fimbricalyx* B (1) also exhibited potential antiparasmodial activity with an IC50 value of 0.019 μ M, while Compound 4 was cytotoxic against NCI-H187 cancer cells. The X-ray structure of Compound and antiparasmodial activity in Compound 11 were also reported here for the first time.



Data compilation and interviews with local medical practitioners and scholars regarding the use of medicinal plants in Khok Hin Lad Community Forest in Maha Sarakham Province showed that all 93 species of medicinal plants various were used, including 60 species that were prepared through decoction; 18 species that were consumed fresh or used for cooking; 4 species that were crushed and squeezed for consumption, and 11 species that were used for bathing, showering, rubbing, or wound dressing. This corresponded with the research done by Patcharaporn Buranarak, (2008) that studied ethnobotany in Phu Hin Lad Cho Fa, compiling and categorizing medicinal plants into a database through interviews with local medical practitioners. The study found that villagers used medicinal plants to heal and nourish the body, with 4 species being used directly namely "Pang Pon Ngu Hao", *Chromolaena odorata*, "Ta Kwang Daeng", and "Ta Kwang Khao". Usage of medicinal plants can be classified based on 9 symptoms (24 species) including 1) fever treatment 2) infectious disease treatment 3) detoxification 4) detoxification of animal venoms 5) bruise treatment 6) indigestion treatment 7) body maintenance 8) gallstone treatment and 9) diabetes treatment. Survey and classification of medicinal plants found that there were 3 families, 3 genera, 3 species of ferns; 14 families, 20 genera, 21 species of flowering plants, corresponding with the research of Jing Wang, Barnabas C. Seyler, Tamara Ticktin, Yonggang Zeng & Kede Ayu. [7] that studied ethnobotany among Yi residents of Liangshan Province, Sichuan Province, China in 2016 and 2017. More than 396 residents of Level 1 County and six counties across Liang Chan were interviewed. The study found a total of 105 plant species belonging to 97 genera and 62 families were recorded, with ROSACEAE being the largest family (14 species), followed by herbs (58 species), fruits (34 species), roots (21 species), and shoots (20 species) which were mainly used for cooking. Six preparation and consumption methods were found including "primary food, famine food, snack, spice, culinary coagulant, and medicine, among a few other uses". These plants were harvested mostly from March to October, and rarely from November to February. There was a total of 35 species sold in local markets in Liangshan. Medicinal plants seemed to be sold at a higher price compared with fruit and other food. The research team had recorded a total of 49 species of medicinal plants in Liangshan, accounting for 44.7% of all wild edible plants. These plants were used in a treatment of 27 medical conditions including cough, diarrhea, injuries, and headache. *Berberis jamesiana*, *Pyracantha fortuneana* and *Artemisia capillaris* were among the most common plants used and were essential to the local people of Liangshan. Local knowledge regarding the use of wild plants reflected the culture of Yi people. Further research on the medical potential of these plants shall be supported, as well as the conservation of the declining species. Renchuan Hu, Chunrui Lin, Weibin Xu, Yan Liu & Chunlin Long., [8] also performed ethnobotanical among Mulam people in Guangxi Province of China, consisting of 12 villages and 5 communities in Luocheng area. Quantitative indices such as use categories, preference ranking exercises, the informant consensus factor (ICF), and the fidelity level (FL) were used to evaluate the importance of medicinal plant species. The study was carried out from January 2013 – April 2017. A total of 128 local people were interviewed during the study. Group discussions regarding the conservation of and threats to medicinal plants and traditional knowledge were also conducted. A total of 246 species of medicinal plants were recorded, including herbaceous (54%), followed by shrubs, with 76 species (17%), lianas, with 75 species (16%), and trees, with 59 species (13%). Oral administration was the most common form of administration (390 species, 62.70%). The most common method of preparation was decoction (316 species, 54.11%). The plants were used to treat 312 human diseases in 12 categories, and most of the categories had a high ICF value. The highest ICF value was recorded for gynecological ailments (0.92), followed by nervous and psychosomatic problems (0.90) and digestive system diseases (0.89). Local medicinal knowledge and medicinal plants were at risk due to "conservative inheritance processes and anthropogenic pressures."

It can be seen that Khok Hin Lad Community Forest of Maha Sarakham Province is an important natural resource for villagers in the community and nearby areas throughout the year. Medicinal plants in the forest should be conserved for a sustainable harvest. However, the researchers had encountered problems regarding the situation of the COVID-19 which hindered the collection of data from the villagers. Interviews with local medical practitioners and village scholars showed that there was a lack of knowledge transfer to younger generations, which put it at risk. Meanwhile, that fact that younger generations overlook this knowledge also jeopardize traditional medical practices. Villagers may unknowingly destroy medicinal plants, while illegally burning down the forest may cause some species of medicinal plants to be extinct. Data compilation and collection, therefore, are important as the knowledge can be systematically passed down to the younger generations, fostering awareness and encouraging the sustainable use of the plants, as well as serving as a biological platform for further studies on bioactive response in pharmaceutical production, as some plants may be essential for fighting against new health threats, including COVID-19 [9-18].

Suggestions

- The study on plant diversity should be more comprehensive, covering the forest area throughout Maha Sarakham Province.
- Cultivation and breeding of wild medicinal plants should be supported. Areas for the conservation and sustainable utilization of medicinal plants should be expanded.

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