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Original Research Article

Ethnobotanical of the Lao Isan Ethnic Group in Pho Chai District, Roi Et Province, Northeastern Thailand

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ABSTRACT

Currently, there is urban expansion and development of transportation routes for commercial transportation, and it drives prosperity to rural communities resulting in the villages becoming more prosperous. This may alter the original way of living in harmony with nature, and over time, the knowledge of plant usage passed down through generations may be lost to future generations. Therefore, this study aims to investigate the ethnobotanical practices of the Lao Isan ethnic groups in the area of Na Ngam Village Pho Chai District, Roi Et Province, focusing on their specific uses. Data were collected by interviewing 37 individuals aged 20 years and older between July 2022 and July 2023. Results revealed that there were 317 plant species utilized, belonging to 243 genera and 89 families. These plants were further categorized into 12 groups based on their traditional uses. In the food and spice category, 201 species of plants were used the most, followed by 154 species for medicinal herbs. In terms of the Cultural Important Index, it was found that *Oryza sativa* had the highest CI value of 5.35. Meanwhile, constipation syndrome, with the highest Index of 0.93, was associated with *Zingiber officinale*, which is a medicinal plant with a reported accuracy level (%FL) that covers the most use in treating disease symptoms within this area. Therefore, this knowledge of local wisdom can be considered important and useful information for future generations and can be applied in other scientific fields for sustainable benefits in the future.

***Keywords*:** Ethnic Groups, Ethnobotanical, Lao Isan, Pho Chai District, Roi Et Province

Introduction

The interdependence of all living organisms, including both flora and fauna, on the planet Earth is critical. There are various life cycle variations. Particularly, the entities known as "Humans," which are distinct from other life forms on Earth, possess an exceptional ability to create to their utmost potential. Throughout history, human existence has depended on natural resources for essential needs such as sustenance, medicine, clothing, and shelter. Additionally, plants have been utilized in various ways, including rituals, superstitions, ornamental purposes, and cosmetics. When a greater number of individuals utilize a particular plant, it often becomes a profitable crop. Acquiring knowledge about the advantageous properties of plants is derived from practical experience in utilizing various plant species and reaping the benefits passed down over many generations. Eventually, this evolves into a cultural practice within each tribe. Possible modifications or paths regarding their utilization may exist for each generation.[1] Traditional or folk knowledge is typically transmitted through oral tradition, lacking written documentation.

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Consequently, certain aspects of this knowledge may evolve, influenced by modern lifestyles that heavily rely on technology and the adoption of foreign cultural practices. Hence, indigenous wisdom has been disregarded to the point of being at risk of extinction, particularly within the older generation.[2]

The diversity of ethnic groups, languages, and cultures varies throughout different regions in Thailand. The inclusion of biodiversity and the various methods of plant utilization are also distinct. Consequently, there is a greater emphasis on the value of plant diversity in the local environment, as well as an appreciation for the advantages of native species. People are employing inexpensive local flora more and more across diverse locations, according to several studies.[3,4-8,1,9-11] Furthermore, several academic papers have investigated the study of global plant biodiversity and ethnobotany.[12-19]

Roi Et is a province situated in the northeastern portion of Thailand, distinguished by a diverse landscape encompassing mountain, hills, and lowlands, with several notable rivers, including the Chi River, the Young River, the Moon River, and others. The predominant ethnic groups in Roi Et primarily include the Lao Isan ethnic group, which has ancestral ties to Laos. Their regional identity is intricately linked to the Lao language.[20]

Pho Chai District is a constituent of Roi Et Province, comprising one of its twenty districts. The Lao Isan ethnic group constitutes the bulk of the population in this district. The Pho Chai district is distinguished for its hilly terrain. The mountainous region is sparsely populated because of its secluded location and difficult transportation access. In the last three to four years, the Department of Highways has made significant alterations to Highway No. 12, resulting in evident enhancements to transportation routes and gradually impacting the development of the surrounding metropolitan area. This could potentially result in a departure from a lifestyle characterized by a harmonious coexistence with nature, leading to the progressive decline

of intergenerational knowledge regarding the exploitation of plants, which may ultimately be lost to future generations over time.
The present research investigated the ethnobotanical information of the Lao Isan ethnic group residing in Pho Chai District, Roi Et Province., located in Northeastern Thailand, to a valuable repository of traditional knowledge essential for the efficient utilization of plants in both traditional medicine practice and scientific research.

Materials and Methods

Study area
The research site is located in Na Ngam Village, Kham Phaung Sub-district, Pho Chai District, Roi Et Province, within the northeastern region of Thailand, precisely located at coordinates 16°26'56.2"N 103°52'55.0"E. Currently, no exhaustive investigation has been conducted of species diversity and ethnobotanical information among the ethnic groups in the study area. The Lao Isan ethnic group resides in northeastern Thailand, particularly along the border between Roi Et Province and Kalasin Province. The village is located within the Khao Phaeng Ma region, a part of the Dong Mae Phet National Reserved Forest. The mountain's approximate elevationis 360 meters, situated at an altitude of 150-200 meters above sea level. The village covers an area of approximately 376,000 m^2 (or 235 rai) and is inhabited by around 420 people. A significant portion of the population is involved in agricultural activities, mostly cultivating crops such as rice, corn, cassava, sugarcane, rubber trees, and locally grown vegetables. The current investigation was carried out between July 2022 and July 2023 (Figure 1)

Plant Materials and Diversity Study
The survey and collection of information on the diversity of plants utilized within Na Ngam Village, Kham Phaung Sub-district, Pho Chai District, Roi Et Province, was conducted between July 2022 and July 2023. The survey entails assessing the forest environment, comprising residential areas and other sectors within Na Ngam Village. Plant specimens were collected and documented using photographs and field notes. Additionally, spirit specimens were preserved in ethanol 70% (v/v). It also requires certifying accurate botanical data, such as the scientific names, native names, sources, and the potential advantages or dangers associated with the plants. Specimens of most of the documented plants were gathered, dehydrated, accurately identified, and stored as vouchers in the Herbarium of Mahasarakham University in Mahasarakham Province, Thailand. The scientific designation of plants primarily relies on botanical literature, such as the Flora of Thailand.

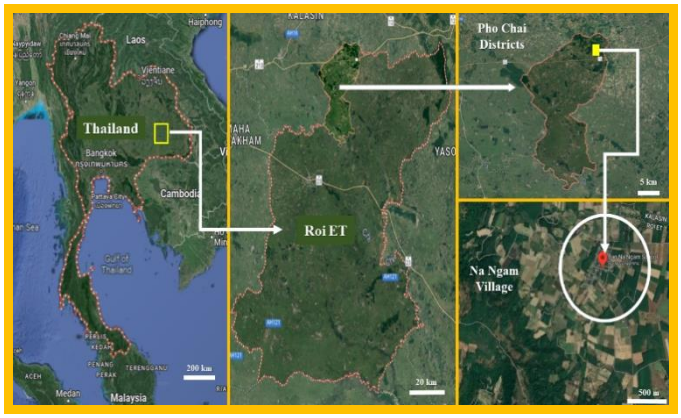

Figure 1: Map of Na Ngam Village, Kham Pha Ung Sub-district, Pho Chai District, Roi Et Province, Northeastern Thailand.(https://www.google.com/maps/place/Roi+Et/@16.0129717,103.1907692,9z/data=!4m6!3m5!1s0x3117e5d2164cb387:0x102b54113604a50!8m2!3d15.9032933!4d103.7289167!16zL20vMDFycGZr?authuser=1&entry=ttu

Table 1: Families, number of species and colors of groups by used species plant of local people in Na Ngam Sub-district, Pho ChaiDistrict, Roi Et Province, Northeastern Thailand.

Family	Number of species
Fabaceae	34
Zingiberaceae	15
Araceae, Poaceae	14
Cucurbitaceae	12
Arecaceae	11
Euphorbiaceae, Solanaceae	10
Asteraceae, Dipterocarpaceae	8
Lamiaceae	7
Apiaceae, Apocynaceae, Moraceae, Phyllanthaceae, Rubiaceae, Sapindaceae	6
Asparagaceae, Malvaceae, Myrtaceae, Piperaceae, Rutaceae	5
Acanthaceae, Annonaceae, Bignoniaceae, Combretaceae, Dioscoreaceae, Ebenaceae	4
Amaranthaceae, Amaryllidaceae, Anacardiaceae, Brassicaceae, Lythraceae, Musaceae	3
Bromeliaceae, Cactaceae, Cleomaceae, Convolvulaceae, Costaceae, Cyperaceae, Hypericaceae, Lecythidaceae, Meliaceae, Menispermaceae, Nyctaginaceae, Oxalidaceae, Passifloraceae, Rhamnaceae, Sapotaceae	2
Alismataceae, Asphodelaceae, Basellaceae, Boraginaceae, Cannabaceae, Cannaceae, Capparaceae, Caricaceae, Celastraceae, Chrysobalanaceae, Clusiaceae, Colchicaceae, Commelinaceae, Crassulaceae, Elaeocarpaceae, Irvingiaceae, Loganiaceae, Marsileaceae, Melastomataceae, Molluginaceae, Moringaceae, Muntingiaceae, Nelumbonaceae, Nymphaeaceae, Oleaceae, Opiliaceae, Orchidaceae, Pandanaceae, Pedaliaceae, Plantaginaceae, Polygonaceae, Pontederiaceae, Portulacaceae, Primulaceae, Rhizophoraceae, Rosaceae, Saururaceae, Stemonaceae, Verbenaceae, Vitaceae	1

The plant specimens were enclosed in a fabric wrapper and given a unique identification number. Professionals can do further investigation on these specimens or utilize them for subsequent research by employing plant identification keys, reference books, and botanical records such as Low *et al*. [21] The reports under investigation encompass several botanists.[7-72,87-88, 89, 90, 91]

Study Distribution
The information obtained was used to differentiate between species and classify them as wild, farmed, or aquatic plants. It is crucial to rely on trustworthy references that cite plant specimens stored in foreign herbaria (Table 1) when determining the distribution status of plants, whether they are native species or introduced plants. The distribution of species documented throughout study articles, both print and online, as well as pertinent literature, were examined, as well as data obtained from Kew Science's website Plants of the World Online.

Study Phenology
Data on the flowering and fruiting of plants were collected in research area at Na Ngam Village, in order to study plant diversity. Each month was assigned a numerical value ranging from 1 to 12, with each number corresponding to a certain month, starting from January and ending with December.

Vernacular Name Study
The common name of plants was obtained from residents in the survey region.

Ethnobotanical Data collection
A comprehensive survey to collect data on the plant diversity and their utilized by the Lao Isan ethnic group in Na Ngam Village was conducted. The survey was from July 2022 to July 2023. The plants included in the study were obtained through a semi-structured interview methodology. The participants were picked at random, using the methodology outlined by Saisor*et al*.[1], Numpulsuksan*et al*.[9], and Phatlamphu*et al*. [11] A total of 370 people aged 20 years and older were interviewed, representing 37 informants, which accounted for 10% of the population in the research area. The knowledge of plant use was recorded, including local plant names, utilization details, plant parts used, and procedures for plant preparation in many categories, such as food, clothing, shelter, medicine, and others.

Quantitative analysis
The ethnobotanical index was used for analyzing the quantitative data in order to calculate the Fidelity Level (%FL), Agreement Ratio (IAR), and Cultural Importance Index (CI), as shown below:

1) Cultural importance index (CI)
The Cultural Importance Index (CI) was employed to illustrate the significance of the plant to persons, using data gathered from surveys and interviews concerning species that were frequently employed in daily activities.[73] The index was established as follows:

$$CI = \sum_{(u=1)}^{NC} \sum_{(i=1)}^{N} UR_{Ui} / N$$

NC represents the overall count of use categories, UR represents the overall count of use reports, and N represents the overall count of informants. Hence, the CI index is calculated by adding up the percentage of informants who name each plant species for their respective use categories.

2) Informant agreement Ratio (IAR)
This indicator quantifies the level of acceptance among informants and the extent of plant consumption for each group of symptoms. The IAR ranges from 1 to 0. If the IAR is close to or equal to 1, the herb is considered acceptable by many informants. In addition to the IAR, it shows the consistency of the informant's knowledge of medicinal plant use with specific uses by calculating the IAR.[74,75] The calculation formula is as shown:

$$IAR = (Nur – Nt) / (Nur - 1)$$

The variable "Nur" represents the total number of reports of the specific usage of the plant species for each symptom of the disease derived from all data queries. The variable "Nt" represents the total number of plant species used for each syndrome.

3) Fidelity level (FL)
The fidelity level is employed to examine the most intriguing botanical species utilized for the treatment of diseases inside each ailment category.[76,1,9,11]

$$\%FL = (Np / N) \times 100$$

where N is the total number of plant species in that ailment and Np is the number of used reports of that plant species in that ailment.

Results and Discussion

The survey gathered data on the botanical diversity found in the study area. The diversity consisted of 89 families, 243 genera, and 317 species. The investigation identified the plant families that have the greatest variety of species utilized for plant purposes. The family Fabaceae holds the top position, consisting of 29 genera and 34 species. Zingiberaceae, consisting of 7 genera and 15 species, immediately follows it. Araceae and Poaceae rank third in terms of species diversity. Araceae consists of 12 genera and 14 species, while Poaceae consists of 7 genera and 14 species. The results are illustrated in Figure 2, Tables 1 and 2.
The findings of the plant diversity study conducted in the Ban Na Ngam region indicated that the Fabaceae family demonstrated the greatest number of documented plants uses. The family had 27 genera and 32 species. Out of all the genera mentioned, *Vigna* Savi showed the highest level of plant use, with four species: *Vigna mungo* (L.) Hepper, *V. radiata* (L.) R. Wilczek,*V. unguiculata* (L.) Walp., and *V. unguiculata* subsp. *sesquipedalis*(L.) Verdc. The distribution of these species within each genus of the Fabaceae family is visually depicted in Figure 2, with the bar graph colors indicating this information.
Pholhiamhan*et al*.[77] studied the variety of plant applications in the northeastern part of Thailand and showed data from 47 interviewees, members of the Phu Thai ethnic group residing in the Renu Nakhon area of Nakhon Phanom Province. The findings revealed that this community has utilized a total of 89 plat families and 329 species. The majority of most frequently utilized plants belong to the Fabaceae family, along with 42 species, which corresponds to 12.77% of the overall count. This was followed by the Zingiberaceae family, comprising 20 species, accounting for 6.07% of the overall count. The Poaceae family ranked third in terms of species diversity, with a total of 15 species, or 4.56% of the overall count. An investigation undertaken by Saisor*et al*.[1] on the utilization of Khok Nong Phok Forest, Maha Sarakham Province, with a particular reference to exploitation of the plant species, the researchers interviewed 30 indigenous philosophers and healers from six neighboring villages located in close proximity to the forest. The research identified an overall of 101 species from 52 families, which were classified into three groups based on traditional knowledge. Out of these, 50 species were used as food plants, 69 species had medicinal capabilities, and 42 species were utilized for housing, appliances, and fuel. These findings suggest that the research area has a rich abundance of valuable plant species. In another study by Numpulsuksan*et al*.[9], an ethnobotanical analysis was carried out to examine the utilization of medicinal species in Hua Kua village, located in the Kae Dam District of Maha Sarakham, Thailand. Data on ethnobotany were gathered from 19 indigenous specialists using a semi-structured questionnaire. The purpose was to capture the biographical details of the interviewees and explore the therapeutic applications of specific plants. A total of 38 therapeutic plants from 35 different genera in 23 families were gathered. The Zingiberaceae family, consisting of six species, was the most frequently represented. The study conducted by Phatlamphu*et al.*[78] on the ethnobotanical uses of edible plants in Muang District, Kalasin Province, Thailand, revealed a total of 140 species of edible plant. This research was categorized into 125 genera and 62 families. The Fabaceae family exhibited the greatest abundance, with a total of 14 edible plant species.

Table 2: Species diversity and Ethnobotanical of the Lao Isan ethnic group in Pho Chai District, Roi Et Province

Families	Scientific name	Lao Isan Name	Plant source	Habit	Phenology Month: Flowering Periods	Phenology Month: Fruiting Periods	Utilization	Used Parts	CI	Collector no.
Acanthaceae	*Andrographis paniculata* (Burm.f.) Wall. ex Nees	ฟ้าทะลายโจร	1	Ah	1-12	1-12	HM	LE	1.00	*NT001*
	Barleria lupulina Lindl.	เสลดพังพอนตัวผู้	2	S	1-12	1-12	HM	AS	0.05	*NT002*
	Clinacanthus nutans (Burm.f.) Lindau	เสลดพังพอนตัวเมีย	2	S	10-1	Not seen	HM	AS	0.05	*NT003*
	Thunbergia laurifolia Lindl.	รางจืด	2	C	1-3	2-4	HM	RO,AS, LE, WP	0.41	*NT004*
Alismataceae	*Limnocharis flava* (L.) Buchenau	ผักพาย	2,3	Su	9-11	11-12	FS,EC	LE,AP,FL	1.05	*NT187*
Amaranthaceae	*Amaranthus viridis* L.	ผักอม	1,2	Ah	11-1	Not seen	FS,HM	WP	1.35	*NT005*
	*Celosia argente*a L.	หงอนไก่	2	Ah	1-12	1-12	OS	WP	0.41	*NT006*
	Gomphrena globosa L.	สามปี	2	Ah	1-12	1-12	HM	WP	0.16	*NT007*
Amaryllidaceae	*Allium cepa* L.	หอมแดง	2	Ah	11-1	Not seen	FS,HM	BU,LE,FL	1.81	*NT008*
	A. sativum L.	กระเทียม	2	Ah	11-1	Not seen	FS,HM	BU,LE,FL	2.00	*NT009*
	A. tuberosum Rottler ex Spreng.	ผักแป้น	2	Ah	11-1	Not seen	FS,HM	BU,LE,FL	1.54	*NT010*
Anacardiaceae	*Mangifera indica* L.	หมากม่วงแก้ว	2	T	11-1	1-4	FS,HM,TO,DS,FU	BA,FR	2.95	*NT011*
	*M. pentandra*Hook.f.	หมากม่วงป่า	1	T	11-1	1-4	FS,HM,TO,DS,FU	BA,FR	2.57	*NT012*
	*Schinusterebinthifolia*Raddi	ตูมมาเล	2	T	1-12	1-12	FS	LE,AP	1.00	*NT013*
	Spondias pinnata (L. f.) Kurz	หมากกอก	2	T	4-6	7-11	FS,HM	RO,BA, LE, FR	1.30	*NT014*
Annonaceae	*Annona squamosa* L.	หมากเขียบ	2	T	3-5	5-9	FS,HM	LE,FR	1.27	*NT015*
	Uvaria dulcis Dunal	ผีผ่วน	1	C	3-5	5-7	FS,HM	FR	1.27	*NT016*
	U.siamensis (Scheff.) L.L.Zhou, Y.C.F.Su&R.M.K.Saunders	ล้าดวน	1,2	T	12-4	4-7	CF,OS	FL,WP	0.97	*NT017*
	Polyalthiaevecta (Pierre) Finet &Gagnep.	หมากต้องแล่ง	1	Ph	4-7	8-11	FS	FR	1.00	*NT018*
Apiaceae	*Anethum graveolens* L.	ซีลาว	2	Ah	1-12	1-12	FS,HM	RO,AS, LE,FL, WP	1.49	*NT019*
	Apium graveolens L.	ขึ้นฉ่าย	2	Bh	Not seen	Not seen	FS	RO,AS, LE,WP	1.00	*NT020*
	Centella asiatica (L.) Urb.	ผักหนอก	2	Ah	6-10	Not seen	FS,BE,HM	AS,LE,AP,FL	3.00	*NT021*
	Coriandrum sativum L.	ซีหอม	2	Ah	1-12	1-12	FS,HM	RO,AS, LE,WP	1.65	*NT022*
	Eryngium aquaticum var. aquaticum	แค่วเลือย	2	Ah	1-12	1-12	FS	AS,LE,FL	1.00	*NT023*
	Hydrocotyle umbellata L.	แว่นแก้ว	2	Ah	1-5	Not seen	FS	AS,LE	0.54	*NT024*
Apocynaceae	*Adenium obesum* (Forssk.) Roem. & Schult.	ชวนชม	2	S	1-12	1-2	OS	WP	0.41	*NT025*
	Allamanda cathartica L.	บานบุรี	2	S	1-12	Not seen	OS	WP	0.27	*NT027*
	Calotropis gigantea (L.) W.T.Aiton	ดอกรัก	1	S	1-12	Not seen	RB	FL	1.00	*NT028*

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Families	Scientific name	Lao Isan Name	Plant source	Habit	Phenology Month: Flowering Periods	Phenology Month: Fruiting Periods	Utilization	Used Parts	CI	Collector no.
	Carissa carandas L.	หมากม่วงหาวหมากนาวโห่	2	S	1-4	5-8	FS,HM	FR	2.00	*NT029*
	Catharanthus roseus (L.) G.Don	แพงพวย	2	Ah	1-12	Not seen	OS	WP	0.43	*NT030*
	Urceola polymorpha (Pierre ex Spire) D.J.Middleton&Livsh.	ส้มลม	1	C	3-7	7-8	FS,HM	LE	0.65	*NT026*
Araceae	*Aglaonema modestum* Schott ex Engl.	แก้วกาญจนา	2	Ph	1-12	Not seen	TO,OS	WP	0.11	*NT035*
	Alocasia cucullata (Lour.) G.Don	นางควัก	2	Ph	1-12	Not seen	RB,OS	WP	1.08	*NT036*
	Amorphophallus brevispathus Gagnep.	อีลอก	1	Ah	3-5	Not seen	FS, TO	TU,SH	2.00	*NT037*
	A.paeoniifolius (Dennst.) Nicolson	บุก	1	Ah	3-5	Not seen	FS,HM,TO	TU	2.22	*NT038*
	*A.saraburensis*Gagnep.	บุกรอ	2,3	Ph	5-6	6-8	FS,OS	CO	1.54	*NT039*
	Caladium bicolor (Aiton) Vent.	บอนสี	2	Ph	5-6	6-8	OS	WP	0.22	*NT041*
	Colocasia esculenta (L.) Schott	เผือก	2	Ph	5-6	6-8	FS,HM,TO	CO,LE, GU	2.41	*NT042*
	Dieffenbachia seguine (Jacq.) Schott	เศรษฐีวิลสัน	2	Ph	5-6	6-8	TO,OS	WP	0.16	*NT044*
	Epipremnum aureum (Linden & André) G.S.Bunting	พลูด่าง	1,2	C	Not seen	Not seen	OS	WP	0.54	*NT045*
	Homalomenarubescens (Roxb.) Kunth	เสน่ห์จันทร์แดง	2	Ph	1-12	Not seen	OS	WP	0.27	*NT046*
	Lasia spinosa (L.) Thwaites	ผักหนาม	2,3	Ph	5-6	6-8	FS	RO,LE, SH	1.00	*NT047*
	Leucocasia gigantea (Blume) Schott	ทูน	2,3	Ph	5-6	6-8	FS	AS	0.54	*NT041*
	Philodendron albisuccus Croat	เศรษฐีรวยทรัพย์	2	Ph	5-6	6-8	TO,OS	WP	0.22	*NT048*
	Zamioculcaszamiifolia (G.Lodd.) Engl.	กวักมรกต	2	Ph	5-6	6-8	OS	WP	0.14	*NT049*
Arecaceae	*Areca catechu* L.	บักหมาก	2	T	1-3	3-6	FS, HM,MA,RB, FU	AS,SW, LE,AP, FR,SE	2.57	*NT040*
	Adonidiamerrillii (Becc.) Becc.	หมากนวล	2	T	1-3	3-6	OS	WP	0.14	*NT034*
	Borassus flabellifer L.	ตาล	1,2	T	2-5	5-9	FS,BE,MA	SE	2.08	*NT050*
	Calamus viminalis Willd.	หวายดง	1	S	10-1	1-5	FS,HM,MA	AS,SH	1.68	*NT051*
	Chamaedorea seifrizii Burret	ปาล์มไผ่	2	S	Not seen	Not seen	OS	WP	0.14	*NT052*
	Cocos nucifera L.	หมากพร้าว	2	T	1-12	1-12	FS,BE,HM,DS,AA ,MA,RB	SW,LE, AP,SE	4.14	*NT053*
	ElaeisguineensisJacq.	ปาล์ม	2	T	1-12	1-12	EC	FR	0.27	*NT054*
	Phoenix dactylifera L.	อินทผลัม	2	T	6-7	7-8	FS,EC	FR	1.11	*NT055*
	Plumeria obtusa L.	ลั่นทม	2	S	1-12	1-12	OS	WP	0.41	*NT031*
	Streptocaulonjuventas (Lour.) Merr.	เคือสู้ด	1	C	8-10	11-3	MA	AS	0.81	*NT032*
	Tabernaemontana divaricata (L.) R.Br. ex Roem. & Schult.	ดอกคุด	2	S	1-12	Not seen	RB,OS	FL,WP	2.00	*NT033*
Asparagaceae	*Chlorophytum laxum*R.Br.	เศรษฐีเรือนทอง	2	Ph	Not seen	Not seen	TO,RB,OS	WP	0.65	*NT056*

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Families	Scientific name	Lao Isan Name	Plant source	Habit	Phenology Month		Utilization	Used Parts	CI	Collector no.
					Flowering Periods	Fruiting Periods				
	Dracaena braunii Engl.	กวนอิม	2	Ph	Not seen	Not seen	OS	WP	0.54	*NT057*
	D. fragrans (L.) Ker Gawl.	วาสนา	2	S	Not seen	Not seen	RB,OS	WP	1.08	*NT058*
	D. hyacinthoides (L.) Mabb.	ลิ้นมังกร	2	Ph	3-4	Not seen	OS	WP	0.46	*NT059*
	D. stuckyi(God.-Leb.) Byng & Christenh.	งาช้าง	2	Ph	Not seen	Not seen	OS	WP	0.38	*NT060*
Asphodelaceae	*Aloe vera* (L.) Burm.f.	ว่านหางจระเข้	2	Ph	Not seen	Not seen	HM	LE	1.00	*NT302*
Asteraceae	*Acmella oleracea* (L.) R.K.Jansen	ผักคราด	2	Ah	7-12	Not seen	FS	RO,AS, LE,AP,FL	1.00	*NT061*
	Blumea balsamifera (L.) DC.	หนาด	2	S	10-2	Not seen	HM,RB	RO,LE, FL,WP	0.68	*NT062*
	Chromolaena odorata (L.) R.M.King&H.Rob.	ใบฝรั่ง	1	Ph	11-1	11-1	HM,DS	RO,AS, LE,WP	0.78	*NT063*
	Elephantopusscaber L.	โดไม่รู้ล้ม	1	Ah	8-1	8-1	HM	LE,WP	0.35	*NT064*
	Helianthus annuus L.	ทานตะวัน	2	Ah	1-12	1-12	FS,OS	SE,WP	1.08	*NT065*
	Lactuca sativa L.	สลัด	2	Ah	Not seen	Not seen	FS	LE	1.00	*NT066*
	Tagetes erecta L.	ดาวเรือง	2	Ah	1-12	1-12	DS,RB,OS	FL,WP	1.41	*NT067*
	Zinnia elegans Jacq.	บานชื่น	2	Ah	1-12	1-12	OS	WP	0.22	*NT068*
Basellaceae	*Basella alba* L.	ผักปัง	2	S	1-12	1-12	FS,HM,DS	AS,LE, AP,SE	1.59	*NT069*
Bignoniaceae	*Dolichandroneserrulata*(Wall. ex DC.) Seem.	แคนา	1,2	T	3-6	6-8	FS,HM,DS	BA,FL,SE	1.46	*NT070*
	Millingtonia hortensis L.f.	แก่นของ	1	T	9-2	11-5	HM,DS	RO,AS, BA,LE,FL,FR	0.46	*NT071*
	Oroxylum indicum (L.) Kurz	ลิ้นฟ้า	1	T	3-7	8-10	FS,HM,DS	AS,BA, FL,FR	1.03	*NT072*
	Tecoma stans (L.) Juss. ex Kunth	ทองอุไร	2	S	1-12	Not seen	OS	WP	0.51	*NT073*
Boraginaceae	*Heliotropium indicum* L.	หญ้างวงช้าง	1	Ah	6-8	Not seen	HM	WP	0.16	*NT074*
Brassicaceae	*Brassica juncea* (L.) Czern.	ผักกาดเขียว	2	Ah	11-1	1-2	FS	LE	1.00	*NT075*
	B. oleracea L.	กะหล่ำปลี	2	Bh	Not seen	Not seen	FS	LE	0.54	*NT076*
	B. rapa L.	ผักกาดกวางตุ้ง	2	Ah	11-1	1-2	FS	AS,LE,FL	1.00	*NT077*
Bromeliaceae	*Ananas comosus* (L.) Merr.	หมากนัด	2	Ah	12-2	2-6	FS,BE,HM	FR	3.00	*NT078*
	Tillandsia usneoides (L.) L.	เคราฤาษี	2	Ah	Not seen	Not seen	OS	AR	0.68	*NT079*
Cactaceae	*Cereus hexagonus* (L.) Mill.	กระบองเพชร	2	T	Not seen	Not seen	OS	WP	0.54	*NT080*
	Selenicereusundatus (Haw.) D.R.Hunt	แก้วมังกร	2	C	4-10	11-4	FS	FR	1.00	*NT081*
Cannabaceae	*Cannabis sativa* L.	กัญชา	2	S	1-2	2-4	FS,HM	AS,LE,FL	1.27	*NT082*
Cannaceae	*Canna indica* L.	พุทธรักษา	2	Ph	1-12	1-12	OS	WP	0.41	*NT083*
Capparaceae	*Cratevaadansonii* DC.	ผักกุ่ม	2	T	2-7	7-10	FS,TO	LE,AP	1.08	*NT084*
Caricaceae	*Carica papaya* L.	หมากฮุง	2	T	1-12	1-12	FS,HM	FR,GU	2.00	*NT085*

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Celastraceae	*Celastrus paniculatus* Willd.	กระทงลาย	1	C	3-5	7-10	FS,FU	FR,SE, GU	1.08	*NT086*
Chrysobalanaceae	*Parinarianamensis* Hance	พอก	1	T	3-4	4-8	FU	AS,BA, HW	1.00	*NT087*
Cleomaceae	*Cleome gynandra* L.	ผักเสี้ยน	2	Ah	1-2	2-3	FS,FU	RO, AS, LE,AP,FL	1.14	*NT088*
	C. viscosa L.	เสี้ยนผี	1	Ah	1-2	2-3	HM	WP	0.14	*NT089*
Clusiaceae	*Garcinia cowa* Roxb. ex Choisy	ส้มโมง	1,2	T	2-4	4-6	FS	LE,AP	0.54	*NT090*
Colchicaceae	*Gloriosa simplex* L.	ดองดึง	1	Ph	8-10	10-1	HM	RO,TU	0.14	*NT091*
Combretaceae	*Combretum indicum* (L.) DeFilipps	เล็บมือนาง	2	C	1-12	1-12	OS	WP	0.14	*NT092*
	C. quadrangulare Kurz	สะแกนา	1	T	2-3	3-5	DS,FU	AS	1.08	*NT093*
	Terminalia chebula Retz.	ส้มมอ	2	T	4-6	9-12	FS,HM,DS	BA,FR	1.22	*NT094*
	T. elliptica Willd.	เซือก	1	T	5-7	7-11	MA,FU	AS,HW	1.62	*NT095*
Commelinaceae	*Tradescantia spathacea* Sw.	กาบหอยแครง	2	Ph	Not seen	Not seen	OS	WP	0.54	*NT096*
Convolvulaceae	*Ipomoea aquatica*Forssk.	ผักบุ้ง	2,3	Ph	1-12	Not seen	FS,HM	AS,LE,AP	1.54	*NT097*
	I. batatas (L.) Lam.	มันเทศ	2	Ah	8-12	11-2	FS	RO	1.00	*NT098*
Costaceae	*Costuswoodsonii* Maas	เอื้องหมายนาดอกแดง	2	Ph	5-10	Not seen	OS	WP	0.54	*NT099*
	Hellenia speciosa (J.Koenig) S.R.Dutta	เอื้องหมายนา	1	Ph	5-8	8-12	FS,HM,OS	RH,SH, WP	0.92	*NT100*
Crassulaceae	*Kalanchoe daigremontiana*Raym.-Hamet & H. Perrier	คว่ำตายหงายเป็น	2	Ph	12-1	Not seen	TO,RB,OS	WP	0.54	*NT101*
Cucurbitaceae	*Benincasa hispida* (Thunb.) Cogn.	หมากฟัก	2	Ah	1-12	1-12	FS	FR	1.00	*NT102*
	Citrullus lanatus (Thunb.) Matsum. & Nakai	หมากโม	2	Ah	1-12	1-12	FS,BE	FR	2.00	*NT103*
	Coccinia grandis (L.) Voigt	ตำนิน	1,2	C	1-12	1-12	FS,HM	RO,AS, LE,AP	1.41	*NT104*
	Cucumis melo L.	แตงจริง	2	Ah	1-12	1-12	FS	FR	1.00	*NT105*
	C. sativus L.	แตงกัว	2	Ah	1-12	1-12	FS	FR	1.00	*NT106*
	Cucurbita moschata Duchesne	หมากอึ่อ	2	Ah	1-12	1-12	FS,DS	AS,LE,AP,FL,FR	1.22	*NT107*
	Lagenaria siceraria (Molina) Standl.	หมากน้ำเต้า	2	Ah	1-12	1-12	FS	FR	1.00	*NT108*
	Luffa acutangula (L.) Roxb.	หมากบวบเหลี่ยม	2	Ah	1-12	1-12	FS,HM	AS,LE,AP,FL,FR	1.30	*NT109*
	Momordica charantia L.	หมากฮะซิ่นก	2	C	1-12	1-12	FS,HM	AS,LE,AP,FR	1.22	*NT111*
	M. cochinchinensis (Lour.) Spreng.	หมากฮะใหญ่	2	C	1-12	1-12	FS	AS,LE,AP,FR	0.27	*NT112*
	Sicyos edulis Jacq.	ฟักแม้ว	2	Ah	1-12	1-12	FS	AS,LE,AP,FL,FR	1.00	*NT110*
	Trichosanthes cucumerina L.	หมากโงเง้ียว	2	Ah	1-12	1-12	FS	FR	1.00	*NT113*
Cyperaceae	*Actinoscirpusgrossus* (L.f.) Goetgh. &D.A.Simpson	ผือ	1	Ah	6-8	Not seen	MA	AS	0.54	*NT114*
	Cyperus alternifolius L.	กกราซินี	2	Ah	6-8	Not seen	MA	AS	0.41	*NT115*

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Dioscoreaceae	*Dioscorea alata* L.	มันเล็บช้าง	2	Ph	6-8	8-11	FS,HM,TO	TU	2.24	*NT116*
	D. filiformis Blume	มันเทียน	2	Ph	6-8	8-11	FS	TU	1.00	*NT117*
	*D. hispida*Dennst.	กลอย	1	Ph	6-8	8-11	FS,HM,TO	TU	2.14	*NT118*
	Tacca leontopetaloides (L.)	อีปุก	1	Ph	7-8	8-10	FS,TO	TU	1.08	*NT119*
Dipterocarpaceae	*Anthoshorearoxburghii* (G.Don) P.S.Ashton&J.Heck.	กระยอม	1	T	12-2	1-3	DS, MA,FU	AS, HW	2.16	*NT127*
	Dipterocarpus alatus Roxb. ex G.Don	ยางนา	1	T	12-2	3-5	MA,FU	AS,HW, GU	1.08	*NT120*
	D. intricatus Dyer	สะแบง	1	T	1-2	2-5	DS,MA,FU	AS,HW, GU	2.08	*NT121*
	*D. obtusifolius*Teijsm. Ex Miq.	ซาด	1	T	12-2	3-5	DS,MA,FU	AS,HW, GU	2.16	*NT122*
	*D. tuberculatus*Roxb.	กรุง	1	T	12-2	3-5	MA,FU	AS,HW, LE	2.00	*NT123*
	*Hopea odorata*Roxb.	แคน	1	T	2-3	4-5	MA,FU	AS,HW	1.08	*NT124*
	Pentacmesiamensis (Miq.) Kurz	ฮัง	1	T	3-4	5-6	MA,FU	AS,HW	1.62	*NT125*
	*Shoreaobtusa*Wall. ex Blume	กิก	1	T	2-5	4-7	MA,FU	AS,HW	2.00	*NT126*
Ebenaceae	*Diospyros decandra*Lour.	จันทน์	2	T	6-9	6-9	FS,HM,MA,FU	AS,HW	2.11	*NT128*
	D. ebenum J.Koenig	ตะโก	1	T	3-4	4-6	FS,HM,FU	RO,AS, LE,FR	1.03	*NT129*
	D. filipendula Pierre ex Lecomte	คันจ้อง	1	T	1-3	3-5	HM,MA,FU	AS,HW	1.89	*NT130*
	D. mollis Griff.	หมากเกลือ	1	T	2-9	6-12	FS,HM,MA,FU	BA	1.95	*NT131*
Elaeocarpaceae	*Elaeocarpus hygrophilus* Kurz	หมากกอกน้ำ	2	T	4-6	7-10	FS	FR	1.00	*NT132*
Euphorbiaceae	*Acalypha indica* L.	ตำแยแมว	1	Ah	7-12	7-12	HM	WP	0.22	*NT133*
	Chrozophora tinctoria (L.) A.Juss.	เปล้าใหญ่	1,2	T	2-4	3-5	HM,RB	BA,LE, AP	0.41	*NT134*
	Cnidoscolusaconitifolius (Mill.) I.M.Johnst.	ผงชูรส	2	S	1-12	Not seen	FS	AS,LE,AP	0.54	*NT135*
	Euphorbia hirta L.	น้ำนมราชสีห์	1	Ah	1-12	Not seen	HM	WP	0.24	*NT136*
	E. milii Des Moul.	โป๊ยเซียน	2	Ph	1-12	Not seen	OS	WP	0.54	*NT137*
	E. tirucalli L.	สามพันกิ่ง	2	S	9-10	Not seen	HM	AS	0.11	*NT142*
	Hevea brasiliensis (Willd. ex A.Juss.) Müll.Arg.	ยางพารา	2	T	2-9	2-10	EC	AS,GU	0.49	*NT138*
	Jatropha curcas L.	หมากเยาเขียว	2	S	5-7	7-9	HM	GU	0.27	*NT139*
	J. gossypiifolia L.	หมายเยาแดง	2	S	5-7	7-9	HM	GU	0.27	*NT140*
	Manihot esculenta Crantz	มันสำปะหลัง	2	Ah	Not seen	Not seen	FS,TO,EC	RO	3.00	*NT141*
Fabaceae	*Acacia mangium* Willd.	กระถินเทพา	1	T	7-9	8-10	MA,FU	AS	1.05	*NT143*
	Adenantherapavonina L.	ผักหล่ำ	2	T	3-5	7-9	FS	LE,AP,SE	1.00	*NT203*
	Arachis hypogaea L.	ถั่วลิสง	2	Ah	1-12	1-12	FS, RB	SE	2.00	*NT145*

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	Butea monosperma (Lam.) Kuntze	จาน	1	T	1-3	3-5	AA	FL	0.49	*NT147*
	Caesalpinia pulcherrima (L.) Sw.	ฝางแดง	1	T	3-5	5-7	OS	WP	0.05	*NT148*
	Cassia fistula L.	คูน	2	T	2-5	6-12	HM,DS,RB,OS	AS,BA, FL,FR	1.49	*NT149*
	Clitoriaternatea L.	อัญชัน	1	Ah	1-12	1-12	FS,BE,HM,DS	FL	3.27	*NT150*
	Crotalaria juncea L.	ปอเทือง	2	Ah	1-12	1-12	MA,	WP	1.00	*NT151*
	Dalbergia cochinchinensis Pierre	ยูง	1	T	5-7	9-10	MA,FU,EC	AS,HW	2.03	*NT152*
	Dialium cochinchinense Pierre	เค็ง	1	T	6-9	9-12	FS	FR	1.00	*NT153*
	Glycine max (L.) Merr.	ถั่วเหลือง	2	Ah	1-12	1-12	FS,RB	SE	2.00	*NT154*
	Lablab purpureus (L.) Sweet	ถั่วแปบ	2	Ah	9-1	9-1	FS	FR,SE	1.00	*NT155*
	Leucaena leucocephala (Lam.) de Wit	กระเสดใหญ่	1,2	T	1-12	1-12	FS,FU	RO,BA, AP,SE	1.54	*NT156*
	L. leucocephala subsp. *glabrata* (Rose) Zárate	กระเสดน้อย	1,2	T	1-12	1-12	FS,FU	RO,BA, AP,SE	2.00	*NT157*
	Lysiphyllumstrychnifolium (Craib) A.Schmitz	ย่านางแดง	2	C	5-8	5-8	FS,HM	AS,LE	1.27	*NT146*
	Mimosa pigra L.	ไมยราบยักษ์	3	T	1-12	1-12	MA,FU	AS	0.65	*NT158*
	Mucuna pruriens (L.) DC.	หมามุ่ย	1	Ah	10-11	12-1	FS,HM,TO	RO,SE	1.62	*NT159*
	Neptunia oleracea Lour.	กระเสดน้ำ	2,3	F	1-12	1-12	FS	AS,LE,AP	1.00	*NT160*
	Peltophorumdasyrrhachis (Miq.) Kurz	อะลาง	1	T	1-4	5-7	DS,MA	AS	1.22	*NT161*
	Pithecellobium dulce (Roxb.) Benth.	หมากขามเทศ	2	T	10-12	12-4	FS,HM	AS,FR	1.54	*NT162*
	Psophocarpus tetragonolobus (L.) DC.	ถั่วพลู	2	Ah	10-11	11-12	FS	FR,SE	1.00	*NT163*
	Pterocarpus macrocarpus Kurz	ประดู่	1	T	3-5	6-8	HM,DS,MA,FU	AS,BA, HW	2.41	*NT164*
	Samanea saman (Jacq.) Merr.	ฉำฉา	1	T	8-9	10-12	MA	AS,HW	0.41	*NT144*
	Senegalia pennata (L.) Maslin	ผักขา	2	S	Not seen	Not seen	FS	LE,AP	1.00	*NT204*
	Senna alata (L.) Roxb.	หมากขี้กาก	2	S	10-12	12-2	HM	LE,FL	0.22	*NT165*
	S. siamea (Lam.) H.S.Irwin& Barneby	ขี้เหล็ก	1	T	1-3	3-5	FS,HM,MA,FU	AS,BA, HW	3.08	*NT166*
	Sesbania grandiflora (L.) Pers.	ดอกแคขาว	1	T	1-12	1-12	FS,HM	LE,AP,FL	1.27	*NT167*
	Sindora siamensis Teijsm. ex Miq.	หมากแต้	1	T	3-5	7-9	MA,FU	AS	1.08	*NT168*
	Tamarindus indica L.	หมากขาม	1,2	T	8-11	10-12	FS,HM,DS,MA,OS,FU	AS,BA, HW,LE, AP,FL,FR	3.95	*NT169*
	Vigna mungo (L.) Hepper	ถั่วดำ	2	Ah	1-12	1-12	FS,RB	SE	2.00	*NT170*
	V. radiata (L.) R.Wilczek	ถั่วเขียว	2	Ah	1-12	1-12	FS,RB	RO, SE	2.00	*NT171*
	V. unguiculata (L.) Walp.	ถั่วปี	2	Ah	1-12	1-12	FS	FR,SE	1.00	*NT172*
	V. unguiculata subsp. *sesquipedalis* (L.) Verdc.	ถั่วฝักยาว	2	Ah	1-12	1-12	FS	FR,SE	1.00	*NT173*

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	Xylia xylocarpa (Roxb.) W.Theob.	แดง	1	T	2-4	6-10	MA,FU	AS,BA, HW,FR	2.00	*NT174*
Hypericaceae	*Cratoxylum cochinchinense* (Lour.) Blume	ติ้วม่น	1	T	1-5	5-7	FS,HM	LE,AP	1.54	*NT175*
	C. formosum (Jacq.) Benth. &Hook.f. ex Dyer	ติ้วขาว	1	T	1-5	5-7	FS,HM	LE,AP,FL	1.03	*NT176*
Irvingiaceae	*Irvingia malayana* Oliv. ex A.W.Benn.	กระบก	1	T	1-3	2-4		AS,SE	2.00	*NT177*
Lamiaceae	*Coleus amboinicus*Lour.	หูเสือ	2	Ah	5-8	Not seen	HM	AS,LE,AP	0.16	*NT183*
	Melissa officinalis L.	สะระแหน่	2	Ah	7-9	Not seen	FS,HM	AS,LE,AP	1.81	*NT178*
	Ocimum × *africanum*Lour.	ผักอีตู่	2	Ah	1-12	1-12	FS,HM	AS,LE,AP,FL	1.30	*NT179*
	O. basilicum L.	โหระพา	2	Ah	1-12	1-12	FS,HM	AS,LE,AP,FL	1.30	*NT180*
	O. tenuiflorum L.	กระเพา	2	Ah	1-12	1-12	FS,HM	AS,LE,AP,FL	1.30	*NT181*
	Orthosiphon aristatus (Blume) Miq.	หญ้าหนวดแมว	1	Ah	1-12	1-12	HM	WP	0.16	*NT182*
	Tectona grandis L.f.	สักทอง	2	T	6-8	8-10	MA,FU,EC	AS,HW	2.03	*NT184*
Lecythidaceae	*Barringtonia acutangula* (L.) Gaertn.	กระโดนน้ำ	1,2	T	1-4	2-6	FS,HM,DS	RO,AS, LE,AP	1.38	*NT185*
	*Careya arborea*Roxb.	กระโดนบก	1,2	T	11-1	4-7	FS,HM,DS	RO,AS, LE,AP	1.38	*NT186*
Loganiaceae	*Strychnos nux-blanda* A.W. Hill	หมากตูม	1	T	3-5	5-8	FS,BE,HM	LE,FR	2.41	*NT188*
Lythraceae	*Lagerstroemia calyculata* Kurz	ตะแบก	1	T	7-9	10-1	MA,FU	CO	0.81	*NT189*
	L. speciosa (L.) Pers.	อินทนินบก	1	T	3-5	5-8	OS	WP	0.22	*NT190*
	Punica granatum L.	ทับทิม	2	T	1-12	1-12	FS,BE	LE,SE	1.59	*NT191*
Malvaceae	*Abelmoschus esculentus* (L.) Moench	กระเจี๊ยบมอญ	2	Ah	5-6	7-10	FS	FR	1.00	*NT192*
	Ceiba pentandra (L.) Gaertn.	หมากนุน	2	T	2-3	2-5	FS,AA,MA,RB	FR,FI	3.14	*NT193*
	Durio zibethinus L.	ทุเรียนหมอนทอง	2	T	11-1	1-6	FS,EC	FR	1.05	*NT194*
	Gossypium herbaceum L.	ฝ้าย	2	Ah	7-9	9-11	AA	FR,FI	0.76	*NT195*
	Hibiscus sabdariffa L.	กระเจี๊ยบแดง	2	Ah	9-11	9-11	BE,HM	FR	2.00	*NT196*
Marsileaceae	*Marsilea minuta* L.	ผักแว่น	3	Ph	2-6	6-10	FS	AS,LE,AP	0.54	*NT197*
Melastomataceae	*Memecylon aberrans*H.Perrier	เหมือดแอ่	1	T	3-9	3-9	MA,FU	AS	1.89	*NT198*
Meliaceae	*Azadirachta indica*A.Juss.	กะเดา	1	T	12-3	3-6	FS,HM,DS,FU	AS,BA, LE,AP, FL,FR	2.03	*NT199*
	Sandoricum koetjape (Burm.f.) Merr.	หมากต้อง	2	T	12-3	3-5	FS,HM,FU	BA,LE, FR	2.11	*NT200*
Menispermaceae	*Cissampelos pareira* L.	หมาน้อย	1	C	3-10	10-2	FS,HM	AS,LE,AP	1.24	*NT201*
	Tiliacoratriandra (Colebr.) Diels	ย่านาง	1,2	C	3-4	Not seen	FS,BE,HM,DS	RO,AS, LE	2.14	*NT202*
Molluginaceae	*Glinusoppositifolius* (L.) Aug.DC.	ผักแก่นขม	1	Ah	3-4	4-5	FS,HM	WP	1.27	*NT205*
Moraceae	*Artocarpus altilis* (Parkinson) Fosberg	สาเก	2	T	1-12	1-12	FS	FR	0.81	*NT206*

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Families	Scientific name	Lao Isan Name	Plant source	Habit	Phenology Month: Flowering Periods	Phenology Month: Fruiting Periods	Utilization	Used Parts	CI	Collector no.
	A. heterophyllus Lam.	หมากมี้	2	T	12-5	5-11	FS,DS,RB,OS	RO,AS, HW,LE, FR,SE, GU	2.41	*NT207*
	Ficus altissima Blume	ไทรยอดทอง	2	S	Not seen	Not seen	MA,OS	GU,WP	0.57	*NT208*
	F.populifolia Vahl	โพธิ์	2	T	1-12	1-12	MA,RB	GU,WP	1.30	*NT209*
	Morus alba L.	หม่อน	2	T	1-3	3-4	FS,BE,HM	LE,AP,FR	2.30	*NT210*
	Streblus asper Lour.	ข่อย	1	T	1-2	2-4	HM,MA	AS,LE	0.32	*NT211*
Moringaceae	*Moringa oleifera* Lam.	ผักอีฮุม	2	T	11-1	1-4	FS,HM	LE,AP,FR	2.00	*NT212*
Muntingiaceae	*Muntingiacalabura* L.	ตะขบ	2	T	8-9	8-9	FS, DS	FR	1.32	*NT279*
Musaceae	*Ensete glaucum* (Roxb.) Cheesman	กล้วยนวน	2	Ph	1-12	1-12	FS,HM	LE,FL,FR,GU	1.05	*NT213*
	Musa acuminata Colla	กล้วยหอม	2	Ph	1-12	1-12	FS,HM,DS,MA,RB	BA,LE,FL,FR,GU	2.08	*NT214*
	M. × paradisiaca L.	กล้วยอีออง	2	Ph	1-12	1-12	FS,HM,DS,RB	BA,LE,FL,FR,GU	2.59	*NT215*
Myrtaceae	*Eucalyptus globulus* Labill.	ยูคาลิปตัส	2	T	1-12	1-12	MA,FU,EC	AS,HW	2.05	*NT217*
	Psidium guajava L.	หมากสีดาขี่นก	2	T	2-5	5-8	FS,HM	LE,FR	1.19	*NT218*
	Syzygiumantisepticum (Blume) Merr. &L.M.Perry	ผักเม็ก	1,2	T	2-4	4-6	FS	LE,AP,FR	1.00	*NT219*
	S. cumini (L.) Skeels	หมากหวา	1	T	3-5	5-7	FS,HM,DS,FU	AS,BA, FR	2.54	*NT220*
	S. samarangense (Blume) Merr. & L.M.Perry	ชมพู่	2	T	2-4	4-6	FS	FR	1.00	*NT221*
Nelumbonaceae	*Nelumbo nucifera* Gaertn.	บัวหลวง	1,3	Im	1-12	1-12	FS,RB,EC	RH,AS, FL,SE	1.92	*NT222*
Nyctaginaceae	*Bougainvillea spectabilis* Willd.	เฟื่องฟ้า	2	S	1-12	Not seen	OS	WP	0.16	*NT223*
	Mirabilis jalapa L.	ดอกบานเย็น	2	Ah	1-12	1-12	RB,OS	AS,LE,AP,FL,WP	1.22	*NT224*
Nymphaeaceae	*Nymphaea pubescens* Willd.	บัวสาย	3	Im	1-12	Not seen	FS	FL	1.00	*NT225*
Oleaceae	*Jasminum sambac* (L.) Aiton	มะลิ	2	Sc	11-2	Not seen	RB,OS	AS,LE,FL,WP	1.54	*NT226*
Opiliaceae	*Melienthasuavis* Pierre	ผักหวาน	2	S	2-4	4-5	FS	LE	1.00	*NT227*
Orchidaceae	*Rhynchostylis* retusa (L.) Blume	กล้วยไม้หางกระรอก	2	Ep	11-4	2-7	OS	FL,AR	0.41	*NT228*
Oxalidaceae	*Averrhoa bilimbi* L	ตะลิงปิง	2	T	1-12	1-12	FS,HM	FR	1.62	*NT229*
	A. carambola L.	หมากเฟือง	2	T	11-2	2-4	FS,BE,HM	LE,AP,FR	2.62	*NT230*
Pandanaceae	*Pandanus amaryllifolius*Roxb. ex Lindl.	เตย	2	S	Not seen	Not seen	FS,BE,HM,DS,CF,RB	LE	3.08	*NT231*
Passifloraceae	*Passiflora edulis* Sims	กะทกรก	2	C	5-8	8-1	FS,BE,HM	SE	1.78	*NT232*
	P. foetida L.	ผักบ่วง	1	C	6-7	7-9	FS,HM	AS,LE,AP,SE	1.00	*NT233*
Pedaliaceae	*Sesamum indicum* L.	งา	2	Ah	4-5	5-7	FS,RB	SE	2.00	*NT234*
Phyllanthaceae	*Antidesma puncticulatum* Miq.	หมากเม่า	2	T	2-4	5-9	FS,HM	FR	1.14	*NT235*

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Families	Scientific name	Lao Isan Name	Plant source	Habit	Phenology Month: Flowering Periods	Phenology Month: Fruiting Periods	Utilization	Used Parts	CI	Collector no.
	Aporosa villosa (Lindl.) Baill.	เหมือดโลด	1	T	1-3	2-5	HM,MA,FU	AS	1.97	*NT236*
	Baccaurearamiflora Lour.	หมากไฟ	2	T	12-2	3-7	FS	FR	1.00	*NT237*
	Hymenocardia punctata Wall. ex Lindl.	หูลิง	1	S	Not seen	Not seen	MA	AS	0.05	*NT238*
	Phyllanthus acidus (L.) Skeels	หมากยม	2	T	4-5	5-7	FS,BE,HM,DS,RB,OS	LE,FR	3.65	*NT239*
	P. emblica L.	หมากขามป้อม	2	T	1-4	4-5	FS,HM,DS,FU	FR	1.95	*NT240*
Piperaceae	*Peperomia pellucida* (L.) Kunth	กระสัง	1	Ah	6-8	Not seen	HM	WP	0.16	*NT241*
	*Piper betl*e L.	พลู	2	C	3-4	Not seen	HM,RB	LE	1.03	*NT242*
	P. nigrum L.	พริกไทย	2	C	1-12	1-12	FS	SE	1.00	*NT243*
	P. retrofractum Vahl	ดีปลี	2	C	1-12	1-12	FS,HM	FR	0.95	*NT244*
	*P. sarmentosum*Roxb.	ผักอีเลิศ	2	Ph	8-12	Not seen	FS,HM	AS,LE,AP,FL	1.46	*NT245*
Plantaginaceae	*Limnophila aromatica* (Lam.) Merr.	ผักกะแยง	1,2	Ah	3-7	7-9	FS,HM	AS,LE,AP,FL	1.62	*NT246*
Poaceae	*Bambusabambos*(L.) Voss	ไผ่ป่า	1	Ph	Not seen	Not seen	FS,HM,TO,FU	AS,LE,SH	2.43	*NT247*
	B. beecheyana Munro	ไผ่กิมซุง	2	Ph	Not seen	Not seen	FS,HM,MA,RBFU, EC	AS,SW, LE,SH	2.81	*NT248*
	B. multiplex (Lour.) Raeusch. Ex Schult.	ไผ่เลี้ยง	2	Ph	Not seen	Not seen	FS,HM,TO,MA,RB,FU	AS,SW, LE,SH	3.70	*NT250*
	B. nutans Wall. ex Munro	ไผ่บ่ง	2	Ph	Not seen	Not seen	FS,HM,TO,MA,RB,FU	AS,SW, LE,SH	3.70	*NT251*
	*B. spinosa*Roxb.	ไผ่บ้าน	2	Ph	Not seen	Not seen	FS,HM,TO,MA,RB,FU	AS,SW, LE,SH	3.70	*NT249*
	B. vulgaris Schrad. ex J.C.Wendl.	ไผ่เหลือง	2	Ph	Not seen	Not seen	FS,HM,TO,MA,RB,FU	AS,SW, LE,SH	2.97	*NT252*
	Cymbopogon citratus (DC.) Stapf	หัวซิงไค	2	Ph	Not seen	Not seen	FS,BE,HM	RH,LE	2.54	*NT253*
	C. nardus (L.) Rendle	หัวซิงไคหอม	2	Ph	Not seen	Not seen	FS,HM	RH,LE	1.54	*NT254*
	Gigantochloaalbociliata (Munro) Kurz	ไผ่ไฮ	1,2	Ph	Not seen	Not seen	FS,HM,TO,MA,RB,FU	AS,SW, LE,SH	3.70	*NT255*
	Imperata cylindrica (L.) Raeusch.	หญ้าคา	1	Ph	4-5	Not seen	HM,MA	LE	1.14	*NT256*
	Oryza sativa L.	เข่า	2	Ah	8-9	9-12	FS,BE,HM,TO, MA, RB,FU,EC	LE,SE	5.35	*NT257*
	Saccharum officinarum L.	อ้อย	2	Ph	Not seen	Not seen	FS,BE,HM,TO,RB,EC	AS,AP	5.08	*NT258*
	*S. × sinense*Roxb.	อ้อยดำ	2	Ph	Not seen	Not seen	FS,BE,HM,RB	AS,AP	2.59	*NT259*
	Zea mays L.	เข่าโพด	2	Ah	1-12	1-12	FS	FR,SE	1.00	*NT260*
Polygonaceae	*Persicaria odorata* (Lour.) Soják	ผักแพว	2	Ph	10-11	Not seen	FS,HM	AS,LE,AP,FL	1.30	*NT261*
Pontederiaceae	*Pontederia crassipes* Mart.	ผักตบ	3	F	1-12	Not seen	FS	LE,FL	0.14	*NT262*
Portulacaceae	*Portulaca oleracea* L.	คุณนายตื่นสาย	2	Ph	1-12	Not seen	OS	WP	1.00	*NT263*

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Primulaceae	*Ardisia polycephala* Wall. ex A.DC.	ผักตีนจำ	1	T	1-4	2-6	FS	BA	0.14	*NT216*
Rhamnaceae	*Ziziphus mauritiana* Lam.	หมากทัน	2	S	4-6	6-9	FS	FR	1.00	*NT264*
	Z. oenopolia (L.) Mill.	เล็บแมว	1	S	3-5	5-8	FS	FR	1.00	*NT265*
Rhizophoraceae	*Carallia brachiata* (Lour.) Merr.	สมั่ง	1	T	11-2	2-5	FS,FU	LE	1.14	*NT266*
Rosaceae	*Rosa* × *damascena*Herrm.	กุหลาบ	2	S	1-12	Not seen	OS	AS,LE,FL,WP	0.08	*NT267*
Rubiaceae	*Ixora chinensis* Lam.	ดอกเข็ม	2	S	1-12	Not seen	RB,OS	WP	1.22	*NT268*
	Mitragyna speciosa Korth.	กระท่อมก้านแดง	2	T	Not seen	Not seen	HM	LE	0.30	*NT269*
	Morindacitrifolia L.	ยอบ้าน	2	T	1-12	1-12	FS,HM,DS,RB,OS	RO,HW, LE,FR	1.97	*NT270*
	M. coreia Buch.-Ham.	ยอป่า	1	T	4-7	5-8	FS,HM,DS,RB	RO,HW, LE	1.00	*NT271*
	*Oxyceroshorridus*Lour.	หมากโคยเสียก	1	Sc	12-2	2-5	FS,HM	LE	0.68	*NT272*
	Paederia linearis Hook.f.	เคียตดหมา	1	C	1-5	4-5	FS,HM	RO,AS, LE	1.41	*NT273*
Rutaceae	*Citrus* × *aurantiifolia*(Christm.) Swingle	หมากนาวแป้น	2	T	1-12	1-12	FS,BE,HM	FR	3.00	*NT274*
	C. hystrix DC.	หมากกรูด	2	T	7-8	8-10	FS,BE,HM,CF	LE,FR	3.14	*NT275*
	C. maxima (Burm.) Merr.	ส้มโอ	2	T	4-7	7-8	FS,BE	FR	1.41	*NT276*
	C. medica L.	หมากเวอ	2	T	7-8	8-10	FS,HM	LE,FR	1.54	*NT277*
	C. reticulata Blanco	ส้มเขียวหวาน	2	T	7-8	8-10	FS,HM,MA	FR	2.68	*NT278*
Sapindaceae	*Dimocarpus longan* Lour.	ลำใย	2	T	1-4	3-7	FS,BE	FR	2.00	*NT280*
	Lepisanthesrubiginosa (Roxb.) Leenh.	หมากหวดข่า	2	T	2-3	3-5	FS,HM	FR	1.30	*NT281*
	Litchi chinensis Sonn.	ลิ้นจี่	2	T	12-2	1-4	FS,BE	FR	2.00	*NT282*
	Nephelium hypoleucum Kurz	หมากแงว	1	T	12-2	1-4	FS,HM	FR	2.00	*NT283*
	N. lappaceum L.	เงาะโรงเรียน	2	T	1-2	3-5	FS,MA	FR	2.00	*NT284*
	Schleicheraoleosa (Lour.) Oken	หมากคร้อ	2	T	3-4	4-7	FS,HM	FR	1.54	*NT285*
Sapotaceae	*Manilkara zapota* (L.) P.Royen	ละมุด	2	T	1-12	1-12	FS	FR	1.00	*NT286*
	*Lucuma campechiana*Kunth	หมากห้อ	2	T	1-12	1-12	FS	FR	1.00	*NT287*
Saururaceae	*Houttuynia cordata*Thunb.	พลูคาว	2	Ph	6-7	7-8	FS,HM	LE	0.92	*NT288*
Solanaceae	*Capsicum annuum* L.	พริก	2	Ph	1-12	1-12	FS,HM	LE,AP,FR,SE	1.14	*NT289*
	Nicotiana tabacum L.	ยาจืด	2	Ah	1-2	2-3	HM,RB	LE	0.89	*NT291*
	Solanum aculeatissimum Jacq.	หมากเขียขื่น	2	Ph	1-12	1-12	FS,RB	FR,SE	1.54	*NT292*
	S. lycopersicum L.	หมากเขียเทศ	2	Ah	1-12	1-12	FS,HM	FR,SE	2.00	*NT297*
	S. melongena L.	หมากเขียยาว	2	Ph	1-12	1-12	FS,RB	FR,SE	1.54	*NT294*
	S. melongena subsp. *cumingii* (Dunal) J.Samuel	มะเขือเครือ	2	Ah	1-12	1-12	FS,RB	FR,SE	1.54	*NT290*
	S. stramoniifolium Jacq.	หมากอึก	2	Ph	3-4	4-7	FS,HM	FR,SE	1.81	*NT295*
	S. torvum Sw.	หมากแข้ง	2	Ph	1-12	1-12	FS,HM,TO,RB	FR,SE	2.35	*NT296*

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	*S.violaceum*Ortega	หมากแข้งขม	2	Ph	1-12	1-12	FS,HM,TO,RB	FR,SE	2.62	*NT293*
	S. virginianum L.	หมากเขียเปราะ	2	Ph	1-12	1-12	FS,RB	FR,SE	1.54	*NT298*
Stemonaceae	*Stemona tuberosa* Lour.	หนอนตายหยาก	1	Ph	1-4	4-9	HM	LE	0.14	*NT299*
Verbenaceae	*Durantaerecta* L.	เทียนทอง	2	S	1-12	1-12	OS	WP	0.27	*NT300*
Vitaceae	*Cissus quadrangularis* L.	เพชรสังฆาต	2	C	6-8	6-8	OS	WP	0.14	*NT301*
Zingiberaceae	*Alpinia galanga* (L.) Willd.	ข่าบ้าน	2	Ph	4–9	7–10	FS,HM	RH,AS, SH,FL	2.00	*NT303*
	A. malaccensis (Burm.f.) Roscoe	ข่าโคม	1	Ph	4–9	4–9	FS,HM	RH,AS, SH,FL	1.11	*NT304*
	Boesenbergia rotunda (L.) Mansf.	กระชายขาว	2	Ph	6-9	Not seen	FS,BE,HM	RH,LE, SH	2.54	*NT305*
	Curcuma longa L.	ขมิ้น	2	Ph	6–9	8–10	FS,BE,HM,DS,CF ,RB,OS	RH,AS, SH	4.22	*NT306*
	C. sessilis Gage	กระเจียว	1	Ph	6-8	Not seen	FS,HM	FL	1.54	*NT307*
	*C. zanthorrhiza*Roxb.	ว่านชักมดลูก	2	Ph	Not seen	Not seen	HM	RH	0.22	*NT308*
	Elettaria cardamomum (L.) Maton	กระวาน	2	Ph	5-7	7-8	HM	FR	0.27	*NT309*
	Etlingera elatior (Jack) R.M.Sm.	ดาหลา	2	Ph	1–12	8–12	FS,HM	RH,SH, FL	1.54	*NT310*
	Hedychium coronarium J.Koenig	สเลเต	2	Ph	6–12	Not seen	HM,OS	RH,LE, SH,FL	1.08	*NT311*
	Kaempferia parviflora Wall. ex Baker	กระชายดำ	2	Ph	6–9	Not seen	HM	RH,WP	0.54	*NT312*
	K. rotunda L.	ตูบหมูบ	1	Ph	3–5	Not seen	FS,HM	RH,LE, AP,FL	0.73	*NT313*
	Zingiber officinale Roscoe	ขิง	2	Ph	7-10	Not seen	FS,BE,HM	RH,AS, SH,FL	3.00	*NT314*
	Z. ottensii Valeton	ไพลดำ	2	Ph	7-10	Not seen	FS,HM	RH,LE, SH,FL	2.00	*NT315*
	Z. purpureum Roscoe	ไพล	2	Ph	7-10	Not seen	FS,HM	RH,LE, SH,FL	1.54	*NT316*
	Z. zerumbet (L.) Roscoe ex Sm.	อีหือ	2	Ph	6-10	Not seen	FS,HM	RH,SH, FL	1.54	*NT317*

Plant source: 1= Only in the wild; 2= Only in Cultivation; 3= Only in from water sources or wetlands.
Phenology: 1=January; 2=February; 3=March; 4=April; 5=May; 6=June; 7=July; 8=August; 9=September; 10=October; 11=November; 12=December.
Habit & Habitats: Ah=Annuals herb; Bh=Biennials herb; C=Climber; Ep=Epiphytic; F=Floating; Im=Immersed; Ph=Perennials Herb; S=Shrub; Sc=Scandent; Su=Submersed and T=Tree.
Utilization: FS=Food and spices; BE=Beverage; HM= Medicinal herbs; TO=Toxic plants to blame; DS=Dyed side; CF=Cosmetics and fragrances; AA=Apparel and accessories; MA= Materials and construction; RB=Rituals and beliefs; OS=Ornamental side; FU=Fuel; EC=Economic crops.
Used Parts: RO=Root; RH=Rhizome; TU=Tuber; BU=Bulb; CO=Corm; AS=Aerial stem; BA=-Barks; HW=Hard wood; SW= Soft wood; LE= AP=Apical; FL=Flower; FR=Fruit; SE=Seeds; AR=Aerial part; GU=Gum; FI=Fiber and WP=Whole parts

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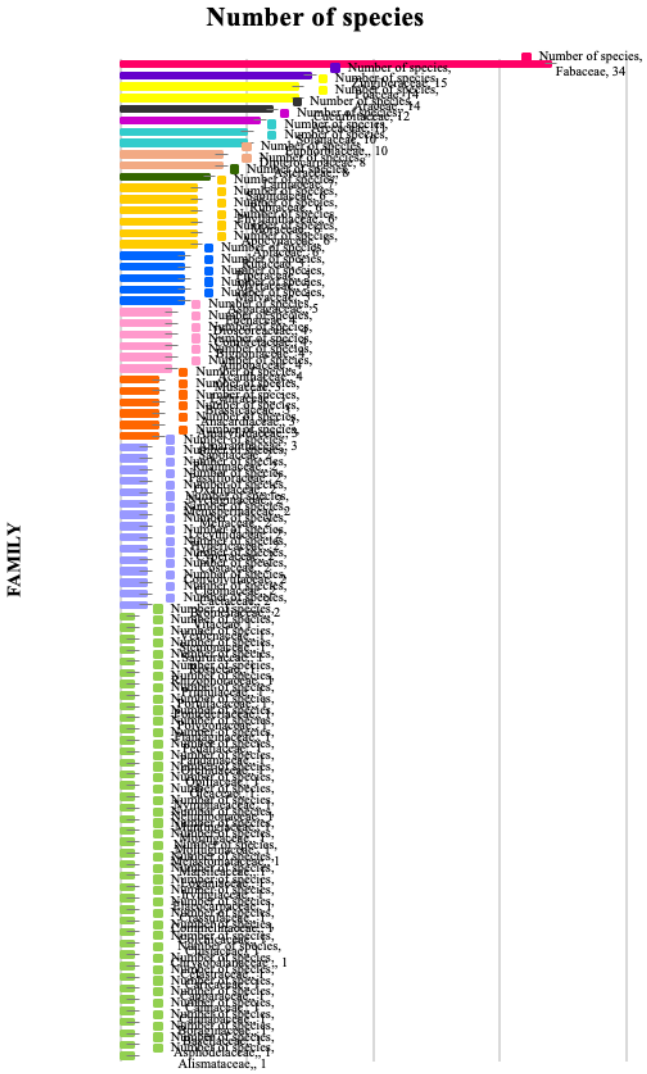

Figure 2: Diversity of family plants used by Lao Isan ethnic group in Na Ngam Village, Kham Phaung Sub-district, Pho Chai District, Roi Et Province,Northeastern Thailand

Subsequently, the Lamiaceae and Zingiberaceae families, including seven species each, were observed, along with the Apiaceae family, which consisted of six species.

In Roi Et Province, Junsongduang*et al.*[5] did a study on the ethnomedicinal knowledge of traditional healers, which yielded comparable reports. A total of 162 medicinal plant species were identified, belonging to 141 genera and 63 families. The Fabaceae family had the highest number of medicinal plant species, totaling 15. In a subsequent study, Junsongduang*et al.*[5] investigated the application of medicinal plants by Tai Lao healers in Roi Et. The study documented 146 species of medicinal plants belonging to 127 genera and 60 plant families, which were employed for therapeutic purposes by the 14 traditional healers who were surveyed. The Fabaceae family has the highest number of medicinal plants, with 12 species accounting for 8% of the total, followed by the Poaceae family, with 9 species (6%), and the Zigiberaceae family, with 8 species (5%).

The plants used by the villagers in the study can be divided into 6 groups:

(A) Plants that can be discovered in the wild
(B) Plants that are grown under culture
(C) Only in aquatic plants
(D) Plants discovered A and B
(E) Plants discovered both A and C
(F) Plants discovered both B and C.

In this study, a comprehensive survey carried out in research area, revealed a total of 82 species in the wild plant category, 207 species in the cultivated plant category, and 4 species in the aquatic plant category. Additionally, 17 species were found in both category A and category B, 1 species was discovered in both category A and category C and finally, 4 species were obtained in both category B and category C. The classification is also presented for each category, along with a thorough overview of the region in Figure 4 and Table 2. While this study shared similarities with the study investigated by Pholhiamhan*et al.*[77], which reported the percentage of plants obtained by the Phu Thai ethnic group in Nakhon Phanom Province, it found that the majority of plants were acquired through cultivation (53.15%), while the remainder were sourced from the forest (46.85%).

Under typical conditions, the majority of women dedicate a significant portion of their time to domestic chores, including cooking, childcare, and tending to a garden that includes both edible and ornamental plants. Consequently, they have a profound understanding of cultivated plants and their uses, such as *Ocimumafricanum*Lour. and *Coriandrum sativum* L. Estrada. However, Junsongduang*et al.*[6] conducted a study on medicinal herbs utilized by Tai Lao healers in Roi Et Province despite the existence of previous studies on similar findings.

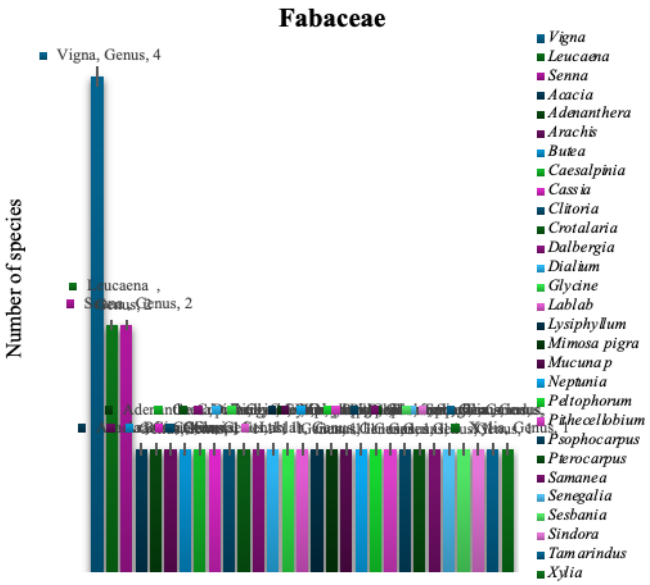

Figure 3: The Species diversity of Fabaceae plants that are most used in Na Ngam Village, Kham Phaung, Sub-district, Pho Chai District, Roi Et Province, Northeastern Thailand

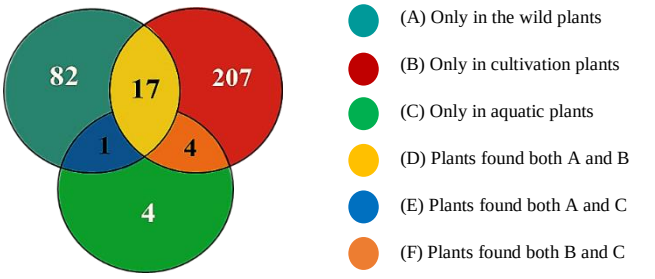

Figure 4: Illustrated chart shows the number of species encountered in the wild, in cultivation and in water sources or aquatic plants.

The research revealed that healers predominantly obtained their medicinal plants from their gardens (60 species, 41%), with the community forest being the second most common source (53 species, 36%). Other sources included the vicinity of their villages (24 species, 16%) and rice fields (10 species, 6%). Obtaining therapeutic plants from nearby villages was an uncommon practice, used only for three specific species, which made up a tiny 2% of the total. Thailand's collection of medicinal plants consisted mainly of native species, with a mere 3% being non-native grasses and 1% being shrubs.

Furthermore, our survey on plant utilization practices of the Lao Isan ethnic group in Na Ngam village, Roi Et Province, revealed the identification of a total of 317 plant species. According to the survey, trees (T) were the predominant plants among 109 species (34.4%), which comprised *Mangifera indica* L. and *Borassus flabellifer* L. Subsequently, a total of 73 species (23%) were identified to have both annual herb (Ah) and perennial herb (Ph), including *Cleome gynandra* L. and *Tradescantia spathacea* Sw., respectively. The Shrub (S) category has 31 species, accounting for 9.8% of the total. Some examples of these species are *Euphorbia tirucalli* L., *Jatropha curcas* L., and *Cannabis sativa* L.Figure 5 and Table 2 provide specific information on the proportions of plants displaying certain behaviors.

This study has a similarity to the work carried out by Pholhiamhan *et al.*[77], which examined plant behaviors of the Phu Thai ethnic group from Nakhon Phanom and documented their proportions. However, this study uncovered that trees (T) were the most dominant species behavior (26.53%), encompassing species such as *Mangifera indica* L. and *Tamarindus indica* L. Among the plant habits, herbs (H) constituted 22.92% of the total, including species such as *Eryngium foetidum* L. and *Blumeanapifolia* DC. Finally, climbers accounted for 9.21% of the plant behaviors, including species such as *Lablab purpureus* (L.) Sweet and *Tiliacoratriandra* (Colebr.) Diels. The Phu Thai community greatly benefits from and extensively utilizes trees.

Junsongduang*et al.*[5] reported comparable occurrences of plant species in Roi Et Province. Their investigation centered on the ethnomedicinal expertise of indigenous healers in the area. The researchers found that these healers used five distinct categories of medicinal plants, with trees being the most common, accounting for 56 species (34%). Shrubs followed with 47 species (29%), climbers with 38 species (23%), and herbs with 21 species (12%). Also, Junsongduang*et al.*[6] investigated the utilization of medicinal plants by Tai Lao healers in Roi Et Province. The results indicated that 14 healers employed therapeutic plants belonging to five different life forms. Out of all the species observed, the most common ones were trees, specifically a palm tree and a climbing plant, which made up 64 species, or 44% of the total. Among the species seen, 28% utilized trees, including exotic types, while 14% utilized shrubs, including some exotic varieties. Additionally, 9% of the species employed vines, and 5% utilized grass, including a few exotic forms.

Based on the Phenology study, that is, on the timing of blooming and fruiting of plants utilized by the Lao Isan ethnic community, all of the vegetation were classified into categories according to their respective seasons:

(A) Summer season (during February-May)
(B) Rainy season (during June-September)
(C) Winter season (during October-January)
(D) Found both A and B
(E) Found both B and C
(F) Found both C and A
(G) Found throughout the year.

The survey findings indicated that the category of plants that bloom consistently throughout the year (G) had the largest species count, amounting to a total of 93 species. Some examples of these species are *Andrographis paniculata* (Burm.f.) Nees, *Tecoma stans* (L.) Juss. ex Kunth, and *Carica papaya* L. In contrast, the group of plants that bloom in both winter and summer seasons (F) consisted of a total of 58 species. Some examples of these species are *Limnocharis flava* (L.) Buchenau, *Hibiscus sabdariffa* L., and *Zingiber officinale* Roscoe. The third category, which thrives during both summer and rainy seasons (D), has 37 species, such as*Spondias pinnata* (L. f.) Kurz, *Limnophilaaromatica* (Lam.) Merr., and *Ziziphus jujuba* Mill. The investigation conducted in this study discovered that the majority of plants displayed year-round fruiting (G), with a total of 73 species observed, including *Cocos nucifera* L., *Cucurbita moschata* Duchesne, *Musa* × *paradisiaca* L. Additionally, 43 species were identified as having flowers during both summer and rainy seasons (D), such as *Areca catechu* L., *Baccaurearamiflora*Lour., *Schleicheraoleosa* (Lour.) Merr. Finally, the third category, which consists of 36 species, exhibits flowering during rainy and winter seasons (E). Some examples of plants in this category include *Cassia fistula* L., *Citrus medica* L., and *Etlingera elatior* (Jack) R.M.Sm. The data presented in Figure 6 and Table 2 gave information on the periods of flowering and fruiting.

According to Boonma*et al.*[54], the Zingiberaceae plants in Nakhon Nayok Province had the most abundant flowering season from June to September. Across all three tribes, it was reliably observed that the plants bloomed in conjunction with the development of their pseudostems. A different botanical collection was found to bloom between February and May. These plants frequently generate flowers prior to the appearance of their pseudostems. For instance, within the Zingibereae tribe, specific species generate side inflorescences directly from the rhizome before new branches develop following their period of dormancy.

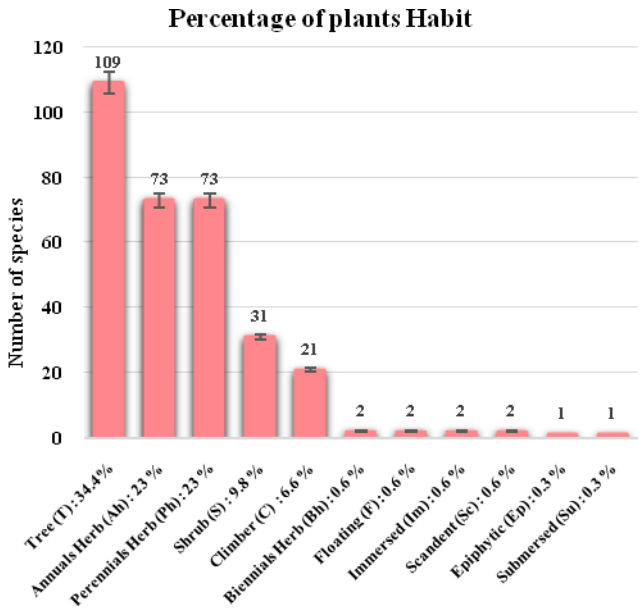

Figure 5: Percentage of plants habit used by the Lao Isan ethnic group in Na Ngam village, Kham Phaung Sub-district, Pho Chai District, Roi Et Province.

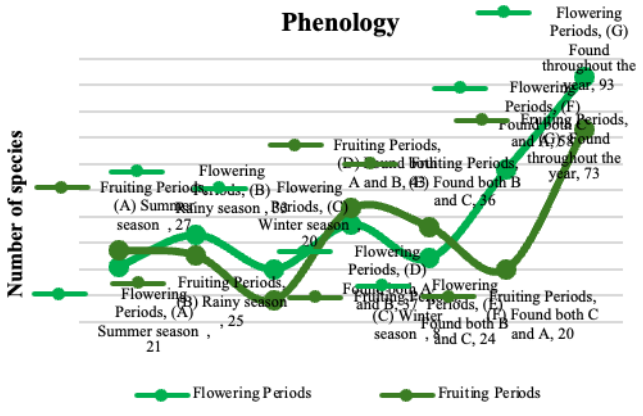

Figure 6: Phenology range of plants used by the Lao Isan ethnic group in Na Ngam village, Kham Phaung Sub-district, Pho Chai District, Roi Et Province.

Table 3: The 10 highest cultural importance index (CI) values in the area of Na Ngam Village, Kham Phaung Subdistrict, Pho Chai District, Roi Et Province.

No.	Scientific name	Plant uses												
		Food and Spices	Beverage	Herbs and Medicines	Toxic plants to blame	Dyed side	Cosmetics and Fragrances	Apparel and Accessories	Materials, Tools, and Housing	Rituals and Beliefs	Ornamental side	Fuel	Economic crops	Cultural Importance index (CI)
1	*Oryza sativa* L.)เข่า* (	✓	✓	✓	✓	-	-	-	✓	✓	-	✓	✓	5.35
2	*Saccharum officinarum* L.)อ้อย*(	✓	✓	✓	✓	-	-	-	-	✓	-	-	✓	5.08
3	*Curcuma longa* L.)ขมิ้น* (	✓	✓	✓	-	✓	✓	-	-	✓	✓	-	-	4.22
4	*Cocos nucifera* L.)หมากพร้าว* (	✓	✓	✓	-	✓	-	✓	✓	✓	-	-	-	4.14
5	*Tamarindus indica* L.)หมากขาม* (	✓	-	✓	-	✓	-	-	✓	-	✓	✓	-	3.95
6	*Bambusa nutans* Wall. ex Munro)ไผ่บง* (	✓	-	✓	✓	-	-	-	✓	✓	-	✓	-	3.70
	Bambusa blumeana Schult.f.)ไผ่บ้าน* (	✓	-	✓	✓	-	-	-	✓	✓	-	✓	-	3.70
	*Bambusa multiplex (*Lour.) Raeusch. ex Schult.)ไผ่เลี้ยง* (	✓	-	✓	✓	-	-	-	✓	✓	-	✓	-	3.70
7	*Phyllanthus acidus* (L.) Skeels)หมากยม* (	✓	✓	✓	-	✓	-	-	-	✓	✓	-	-	3.65
8	*Clitoriaternatea* L.)อัญชัน* (	✓	✓	✓	-	✓	-	-	-	-	-	-	-	3.27
9	*Ceiba pentandra* (L.) Gaertn.)หมากนุ่น* (	✓	-	-	-	-	-	✓	✓	✓	-	-	-	3.14
	Citrus hystrix DC.)หมากกรูด* (	✓	✓	✓	-	-	✓	-	-	-	-	-	-	3.14
10	*Pandanus amaryllifolius* Roxb.)เตย* (	✓	✓	✓	-	✓	✓	-	-	✓	-	-	-	3.08
	Senna siamea (Lam.) H.S.Irwin & Barneby)ขี้เหล็ก* (	✓	-	✓	-	-	-	-	✓	-	-	✓	-	3.08

* = Lao Isan Name

Several species that fall within this category are *Curcuma achrae*Saensouk&Boonma, *C. aeruginosa* Roxb., *C. mangga* Valeton & Zijp, *C. rubescens*Roxb., and *Kaempferia rotunda* L. In addition, some species could produce inflorescences and bloom continuously throughout the year, such as *Alpinia purpurata* (Vieill.) K. Schum. and *Etlingera elatior* (Jack) R.M. Sm. The study revealed that only 34 plants from the Zingiberaceae family in Nakhon Nayok Province were seen to bear fruits. The majority of these plants exhibited fructification between August and October.

The parts of specimens frequently used are shown in Figure 7. The data showed that leaves were the most commonly utilized plant parts among 119 species, followed by aerial stems in 103 species, and fruit in 91 species. Leaves were the most commonly used plant portion by the Lao Isan ethnic group for therapeutic purposes. The prevalence of leaf usage is consistent with findings from other studies conducted in different regions of Thailand, as shown by Srithi*et al*.[79], Tangjitman*et al*.[80], and Pholhiamhan*et al*.[77] The availability of leaves within their community is the main reason for this, as leaves serve as the primary photosynthetic organ in plants and play a vital part in the natural creation of many active chemicals.[81] Collecting leaves can be promoted as a sustainable practice as it usually leaves many on the parent plant, allowing the plants to survive their essential life processes.[82]

Based on extensive interviews, it was established that Na Ngam village harbors a total of 201 plant species that are specifically exploited for culinary and seasoning purposes. The dominant plant species in the area is *Oryza sativa*, which has a dominance index (CI value) of 5.53, followed by *Saccharum officinarum*, with a CI value of 5.08, and *Curcuma longa*, with a CI value of 4.22. *Oryza sativa* grains are subjected to the process of steaming or boiling to make them suitable for ingestion. These grains serve as a fundamental food source for both the Thai population and the Lao Isan ethnic group. Moreover, the apical buds of *S. officinarum* are employed for gastronomic reasons, particularly in the creation of curry through the process of boiling. Meanwhile, the rhizomes of *C. longa* are ground into a fine paste and incorporated into a transparent curry for culinary applications.[85]

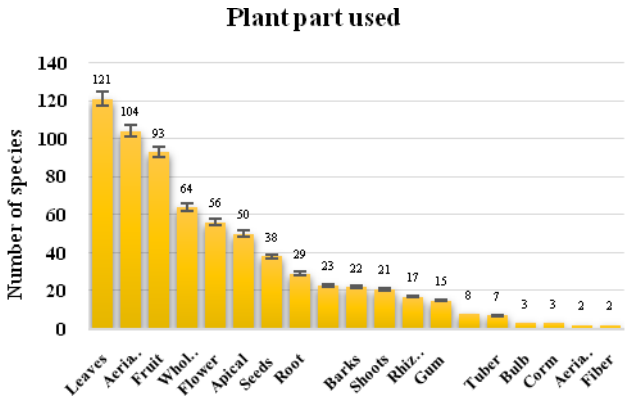

Figure 7: Number of plant part used in Na Ngam village, Kham Phaung Sub-district, Pho Chai District, Roi Et Province.

Also, a total of 154 species of medicinal plants were found in this region. *Oryza sativa* is the most common plant, with a CI value of 5.53. Subsequently, *Saccharum officinarum*, with a CI value of 5.08, and *Curcuma longa*, with a CI value of 4.22, were observed. The medical uses of *O. sativa* are characterized by its ingredients. A common recipe for rice beverages is as follows: Take a small amount of immature rice ears, ensure they are completely cleaned, then crush and chop them into small segments of about one inch. Cook rice stalks by boiling them in water and then simmering them on low heat for approximately 10 minutes. Gradually, honey is incorporated and boiled for an additional minute. Subsequently, transfer the rice milk into a pitcher. This beverage is consumed throughout the entire day. Alternatively, blend rice milk with conventional cow's milk and serve as a tonic. With respect to *S. officinarum*, its stems are fragmented, boiled, and ingested twice a day prior to meals due to its diuretic characteristics. Meanwhile, *C. longa* has several applications. Its rhizome is ground into a fine powder and mixed with hot water to be applied topically on regions affected by bug bite rashes. Moreover, ingesting 2 teaspoons of pulverized rhizomes, diluted in water, 3-4 times a day helps alleviate stomach ulcers, diarrhea, or colic.[84]

Out of the 55 species, the ornamental plant *Curcuma longa* has the highest CI value of 4.22. *Tamarindus indica* has a CI value of 3.95, whereas *Phyllanthus acidus* has a CI value of 3.65. Ornamental plants are grown with the purpose of augmenting the aesthetic appeal of residences. The region consists of towering trees, thick shrubs, and low-lying herbaceous species.

Also, a total of 51 species of plants were employed for the construction of dwellings and as raw materials. Of these species, *Cocos nucifera* exhibited the highest CI value of 4.14, whereas *Tamarindus indica* had a CI value of 3.95. In ranking, three species were identical duplicates: *Bambusa nutans*, *B. blumeana*, and *B. multiplex*, each having a CI value of 3.70. The process of utilizing *C. nucifera* entails removing the leaf blades from the midrib and then fashioning a broom using the midrib, usually referred to as "Mai-Kuad-Thang-Bak-Prao" in the Lao Isan dialect. Furthermore, a section of the tree trunk is segmented into fragments, each measuring approximately 60-70 cm, in order to fashion chairs for seating. *T. indica* is employed in the production of cutting boards and animal-shooting equipment that resembles the letter "Y". This entails affixing elastic bands to the upper extremities of the apparatus on both sides in conjunction with fastening animal hide sheets to the opposite end of the elastic band in order to function as a protective barrier for projectiles. The term "Nang-Satik" is used in the Lao Isan dialect to refer to this device. The stems of the three species within the Bambusa genus are employed for various uses, including the construction of buildings. It can be adapted as a tool for trapping animals or used as a container for holding different objects.

A total number of 48 botanical species were employed as fuel. *Oryza sativa* exhibited the greatest CI value of 5.35, whereas *Tamarindus indica* had a CI value of 3.95. In ranking third, three species were identical duplicates: *Bambusa nutans*, *B. blumeana*, and *B. multiplex*, each with a CI value of 3.70. The purpose of these plants is to utilize the desiccated whole of *O. sativa* as a source of combustible material for cooking. Moreover, *T. indica* and three species belonging to the *Bambus*a genus are utilized as firewood or incinerated to produce charcoal, which functions as a source of fuel. In the area, there is a notable plant known as *Dipterocarpus alatus*, which is utilized as a source of fuel in the form of oil, based on local expertise. The latex of this plant is obtained through incisions made in the trunk with a knife or axe, resulting in the formation of a hollow cavity. Once the latex oil derived from the tree has been left undisturbed for 2-3 days, it can be effectively used as a fire igniter. According to cultural traditions, latex is mixed with fragmented disintegrated wood and then wrapped in "Ton-Sad" leaves (*Dipterocarpus obtusifolius*), creating a stick that is around 50 cm long. The specific designation employed by the Isan ethnic group residing in the northeastern region of Laos is "Kra-Bong."

Based on in-depth interviews, it was found that 48 plant species were employed in rituals and beliefs. *Oryza sativa* has the highest CI value among plants, measuring 5.53. *Saccharum officinarum* has a CI value of 5.08, while *Curcuma longa* has a CI value of 4.22. *Oryza sativa*, commonly known as rice, exhibits a multitude of usage features. For instance, consider taking roughly two handfuls of desiccated stems and foliage. Fasten the upper and lower sections securely. Subsequently, acquire a bamboo tube measuring around 20 cm in length, specifically sourced from the *B. blumeana* species. Place this tube into the core of the rice bundles that have been created. Next, place a hard-boiled egg, soil from an anthill, a lit candle, and five sets of flowers within a bamboo tube. The rites involve the worship of "Pra-Mae-Po-Sop," the deity associated with the ancestral lineage of farmers. *Saccharum officinarum* is occasionally employed in wedding rituals for divination. Should the sugarcane plant release a delightful aroma, it will be likened to a residence that emanates warmth and fondness. You possess a residence teeming with offspring and grandchildren while simultaneously relishing a flourishing and gratifying societal standing. Nevertheless, in the event that the sugarcane has a deficiency in taste and possesses a bitter flavor, it can disturb the equilibrium of familial existence. Moreover, as part of their rituals and beliefs, Thai people traditionally use the juice obtained from specific parts of the rhizomes of *C. longa*, sometimes known as turmeric, to sprinkle water on Buddha statues during the Songkran celebration.

There were precisely 36 unique species of plants that are suitable for dyeing. Within all species, *Curcuma longa* exhibited the greatest CI value of 4.22. The CI value of *Cocos nucifera* is 4.14, while *Tamarindus indica* has a CI value of 3.95. The rhizomes of *C. longa* are coarsely ground into a powder and then mixed with water to extract a vivid yellow pigment. For the usage of *C. nucifera*, the old bark is boiled in water for at least thirty minutes. Rust, an iron oxide, is used as a pigment to give a brown color. In addition, *T. indica* seeds are subjected to a roasting procedure using sand for around 30 minutes or until the husks of the tamarind seeds become dark brown or black and provide a pleasant scent. Allow to cool. The seeds are fragmented, and only the outer layers are removed. Apply heat to cleansed water until it reaches its boiling point. Whisk the mixture at 15-minute intervals for about one hour. Once the required period has elapsed, proceed to chill the mixture and filter it through a cheesecloth. The seed coat will generate a solution of water that is stained with a dark brown color.

A total of 27 plant species were employed for beverage consumption. *Oryza sativa* had the highest CI value among the plants, with a value of 5.53. The CI value of *Saccharum officinarum* was 5.08, which was the second highest. *Curcuma longa* had a CI value of 4.22. Rice is often cooked by heating the grains, encasing them in cheesecloth, and storing them in an opaque container along with yeast. The combination is subsequently left undisturbed for roughly one month. Afterward, the liquid obtained from the fermented rice is squeezed and employed as an alcoholic beverage. In the Lao Isan dialect, the phrase used for it is "Luo-Tho". With respect to *S. officinarum*, the outer layer of the sugar cane stem is eliminated. Then, it is processed through a sugarcane juice press to extract the liquid for consumption. Additionally, the finely pulverized substance obtained from grinding the rhizomes of *C. longa* is steeped in hot water to produce a refreshing drink that relieves thirst.

There were approximately 26 species of dangerous plants in the study area that are used for various purposes, including gastronomy, herbal treatments, ceremonies, and cultural beliefs. Most of these drugs will affect the user, leading to symptoms such as a skin rash, itching, irritation, or the development of blisters. *Oryza sativa* was the plant most commonly associated with damage to consumers, as shown by a CI value of 5.35. *Saccharum officinarum* has a CI value of 5.08. Three species had duplicates: *Bambusa nutans*, *B. blumeana*, and *B. multiplex*, each with a CI value of 3.70, respectively.

The economic crop has a total of 13 plant species. Among these, *Oryza sativa* has the highest CI value of 5.35, followed by *Saccharum officinarum* with a CI of 5.08, and *Manihot esculenta* with a CI of 3.00. The natives raise these plants in significant quantities for wholesale distribution during each harvest, typically covering an area of roughly 8-10 rai per home. *O. sativa* can be acquired for a minimum price of 8,000-15,000 baht per ton. Furthermore, the acquisition cost of *S. officinarum* begins at 1,200-1,500 baht per ton. Simultaneously, the initial purchasing fee for *M. esculenta* is 2,500-3,500 baht per ton.[83]

Four species, specifically *Curcuma longa*, *Citrus hystrix*, *Phyllanthus acidus*, and *Melodorumfruticosum*, are used as cosmetics and fragrances. *Curcuma longa* has the greatest CI (comparative index) value of 4.22, followed by *Phyllanthus acidus* with a CI value of 3.65,

Citrus hystrix with a CI value of 3.14, and *Melodorumfruticosum* with a CI value of 0.97. The customary ritual of the Lao Isan ethnic community is extracting aromatic compounds from the rhizome of the *C. longa* plant. The rhizome is pulverized, combined with water, and subsequently strained using cheesecloth. The resultant fragrance can be utilized for bathing or preserved in a container for aerosol application. Concerning *P. acidus*, its fresh leaves are intricately coiled and folded into flower formations, acting as aromatic embellishments in bedrooms or baths. The fruit of *C. hystrix* can be utilized to produce hair wash when it is cut in half. Upon using this shampoo, the hair will acquire a delightful scent and a velvety texture. This technique fills the atmosphere with a calming fragrance, encouraging a feeling of tranquility. The last plant is *M. fruticosum*, whose flower components are used as aromatic compounds in the bedroom to improve the room's fragrance and promote a state of relaxation.

The plant species used in apparel and accessories are *Cocos nucifera*, *Ceiba pentandra*, *Gossypium herbaceum*, and *Butea monosperma* (Lam.) Kuntze. Among these, *Cocos nucifera* has the highest CI value of 4.14, followed by *Ceiba pentandra* with a CI value of 3.14, *Gossypium herbaceum* with a CI value of 0.76, and *Butea monosperma* (Lam.) Kuntze with a CI value of 0.49. The seeds of *C. nifera* are transformed into pendants that are worn as jewelry around the neck. The designer can achieve this by molding the seeds' shells into a variety of shapes. On the other hand, the dried fruit of *C. pentandra* is peeled, and the flesh is extracted and sun-dried for 2 days, after which it is utilized as stuffing for blankets, beds, pillows, and other similar items. *G. herbaceum* is known as "Ton-Dok-Fai" in the Lao Isan dialect. The fruit of this plant is peeled, and the flesh is transformed into fiber, which may be utilized for clothing production. The final botanical species is *B. monosperma*, in which the floral components are utilized for crafting garlands to embellish the human physique.

The results of the investigation of the 12 different aspects of plant uses and presented in Tables 2, Tables3 and Figure 8. Culturally Important Index (CI) values were largely the same as those reported by Pholhiamhan*et al*.[77] According to our findings, there were 199 species of plants used for food, 176 species for medicine, 79 species for culture, and 56 species for other purposes. The plant with the highest culturally important index (CI) was *Oryza sativa* (CI value = 2.74), followed by *Saccharum officinarum* (CI value = 2.74) and *Cocos nucifera* (CI value = 2.57). For the Thai people, especially the Phu Thai ethnic group, *O. sativa* is the primary diet. Furthermore, rice is employed in religious and funerary rites as well as other ethnic rituals and beliefs. Particularly, the Phu Thai uses rice to manufacture Chinese yeast cake for glutinous fermented liquors; the water required to soak the rice is used for shampoo. For each category of plant utility, *S. officinarum*, *C. nucifera*, *Musa paradisiacal* L., and *Musa balbisiana* Colla were utilized. These plants are vital to the Phu Thai people and are used in many tribal ceremonies, including the annual ceremonial that lasts for a full year, the Bai Si ceremony, weddings, Yao ceremonies, and funerals. More research is necessary to determine whether plants with high CI values contain any intriguing nutritional constituents. Furthermore, a plant with a low CI value might be significant to a small number of individuals.

The study conducted by Numpulsuksant*et al*.[9] found and classified a total of thirty-eight medicinal plants, which were distributed among 35 genera and 23 families. The plant *Antiaristoxicaria* (J.F.Gmel.) Lesch., native to the Ban Hua Kua hamlet, has the highest use value of 0.68 among all other species. The plants with the greatest CI value were *Dialiumcochinchinense*Pierre (CI = 0.21), *Anisomeles indica* (L.) Kuntze(CI = 0.21), *Vitex glabrata* R.Br.(CI = 0.21), *Aegle marmelos* (L.) Corrêa (CI = 0.21), *Phyllanthus emblica*L.(CI = 0.21), and *Naringicrenulata*(Roxb.) Nicolson (CI = 0.21). Furthermore, *Diospyros mollis*, *D.cochinchinense*, *A. indica*, *Vitex glabrata*, *P. emblica*, *A. marmelos*, and *N. crenulata*were also acknowledged. In their study, Phatlamphu*et al*.[78] reported a total of 140 edible plant species. The distribution of these species encompassed 125 distinct genera and 62 families. According to its CI value of 2.65, the *Tamarindus indica* species had the highest level of importance among edible plants. The CI value of *Bambusabambos* (L.) Vosswas 2.00, whereas the CI value of *Citrus hystrix*DC. was 1.90.

The result of the informant agreement ratio (IAR) shows that out of the 170 species, 154 were utilized for many ailments, while the remaining 16 species were just employed for treating a single condition, such as *Andrographis paniculata* (Burm.f.). The leaves and blossoms are boiled and ingested as a remedy for fever and headaches. A total of 57 plant species were utilized for the treatment of dyspepsia, with *Melissa officinalis* L. being consumed in its raw form for this purpose. Additionally, 43 plant species were employed for the management of respiratory disorders, including *Citrusaurantiifolia* (Christm.). Swingle consumes fresh fruit as a remedy for sore throats and phlegm. Additionally, Swingle uses some plants, such as *Cratoxylumcochinchinense* (Lour.) Blume to alleviate constipation and enhance overall bodily power. The highest Index of Agreement among informants' knowledge of medicinal plants used to treat ailments was recorded for constipation (IAR = 0.93), indicating a high degree of agreement. In contrast, neutralize had the lowest index of agreement (IAR = 0.70) (Table 4), which means that people did not agree on how to use a certain plant to treat a certain type of illness.

Studies conducted in the northeastern region of Thailand, specifically by Saisor*et al*.[1], have reported on the informant agreement ratio (IAR) regarding the use of plants. The analysis of the IAR index revealed that the dizziness syndrome group (or vertigo syndrome) had an IAR (0.958), indicating widespread acceptance of medicinal plants for treating the syndrome among informants. This level of adherence demonstrates a significant level of approval. The muscle related syndromes group (musculoskeletal system) had an IAR value (0.692), indicating that the medicinal plants used to treat this syndrome were not well accepted by all informants. This phenomenon may be attributed to the limited utilization of plants in this syndrome and the utilization of distinct plants for each participant. In line with Numpulsuksant et al.9 findings, which focused on the diversity and ethnobotanical study of medicinal plants in Ban Hua Kua, Kae Dam District, Thailand, it was observed that the climber part of the plant had the highest utilization rate (IAR value of 0.97), followed by the rhizome (IAR value of 0.86) and fruit (IAR value of 0.86) as the second highest. On the other hand, the root had the lowest utilization rate, ranking at IAR value of 0.43. The abundance of IAR signifies that the species has garnered widespread recognition; namely, the majority of villagers in the study area employ climbers and rhizomes for therapeutic purposes in their daily lives. Simultaneously, there are additional reports authored by Junsongduang*et al*.[5] The category with the highest number of use reports is the one related to plants used for treating jaundice, with an IAR value of 0.5. This category has seven use reports and includes four different species, indicating a high level of consensus. Next, the detoxicant category had an IAR value (0.37), based on nine use reports and six species. The insect bite/head lice category had an IAR (0.33), based on four use reports and three species. The gastritis category had an IAR (0.30), based on 14 use-reports and 10 species. Lastly, the tonic category had an IAR (0.26), based on 39 used plant reports and 29 species.

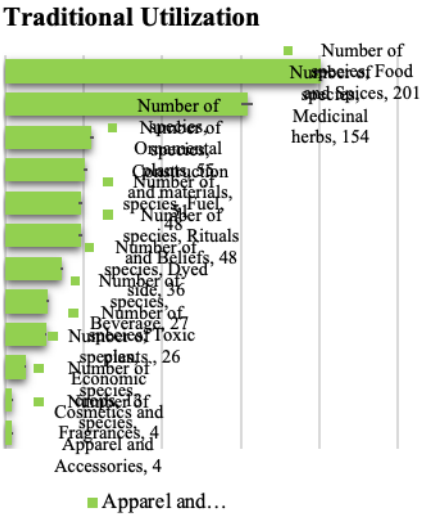

Figure 8: Number of plant species in each category

Table 4: Informant agreement Ratio (IAR) of used categories

No.	Syndrome category	Treated ailments	Number of use-report (Nur)	Number of species (Nt)	IAR
A	Constipation	Laxatives treat constipation	547	41	0.93
B	Eye care	Helps nourish eyesight	78	7	0.92
C	Dyspepsia	Treats colic, bloating, flatulence	596	57	0.91
D	Injuries	Treat wounds, bruises	292	30	0.90
E	Dizziness	Treats dizziness, nausea, vomiting	144	16	0.90
F	Malignant tumor, Cancer	Supportive treatment	61	7	0.90
G	Skin disorders	Treat skin diseases, rashes, ringworm, nourish the skin	298	38	0.88
H	Respiratory diseases	Treat symptoms of colds, stuffy nose, cough, sore throat, phlegm	366	43	0.88
I	Diuretic disorders	Helps to urinate	150	20	0.87
J	Element tonic, body strength	Helps relieve fatigue, nourishes strength	319	41	0.87
K	Postpartum tonic	Helps nourish after giving birth, expels milk	64	9	0.87
L	Diarrhea	Treat abdominal pain, diarrhea	304	43	0.86
M	Scabies, Pediculosis	Helps treat scabies, lice	43	7	0.86
N	Diabetes	Helps treat diabetes symptoms	91	14	0.86
O	Fever and Headache	Treat fever, reduce heat, headache	227	36	0.85
P	Oral disease	Treat oral ulcers, bleeding gums, swollen gums, prevent tooth decay	93	15	0.85
Q	Nourish heart	Helps nourish heart symptoms	70	12	0.84
R	Muscle disorders	Treat muscle pain in the body	146	24	0.84
S	Nourish hair	Helps nourish the scalp, nourishes the hair	55	11	0.81
T	Blood tonic	Treats fat in the arteries, anemia, reduces blood sugar	67	14	0.80
U	Hemorrhoids	Hemorrhoids treatment	21	5	0.80
V	Menstruation	Helps drive menstruation, relieves symptoms of blood remaining in the body.	42	9	0.80
W	Insomnia	Helps you sleep easily, relax	21	6	0.75
X	Parasite disease	Helps expel parasites from the body	42	12	0.73
Y	Neutralize	Helps treat boredom and intoxication, snake venom, insect, and animal venom	38	12	0.70

The fidelity level is determined by assessing the medicinal plants that are most noteworthy in the therapy of each disease condition. This is because, in each syndrome, different plant species can be treated by examining the proportion of reported plant intake within that particular set of symptoms compared to the total reported number of plant use across all symptom clusters. It was demonstrated that a plant with a high percentage of FL indicated that the plant was employed consistently in the same manner or that each informant utilized the same plant to cure the illness. The maximum value recorded was 100 (Table 6), but the percentage of plant FL was quite low. Table 7 demonstrates that a plant was utilized for several purposes or multiple symptoms.

When comparing the findings of Junsongduang*et al.*[6], who investigated the same ethnic group and region, there were noticeable differences in the characteristics of the study area. This study centered on the Isan Lao ethnic group living in Ban Na Ngam, Kham Phaung Subdistrict, Pho Chai District, Roi Et Province. The study conducted byJunsongduang*et al.*[6] aimed to investigate traditional Thai Lao medicine practitioners. The flora in Roi Et Province exhibits significant variation as a result of the various environmental conditions in each location, resulting in distinct utilization of these species.

This research revealed that Na Ngam Village serves as a significant reservoir of medicinal plants for the local people, with a total of 154 plant species identified and utilized for medical purposes. The results of the study showed that most used medicinal plants (16 species) of the Lao Isan ethnic group are used in the same direction, or each informant uses the same type of plant to treat specific diseases, which has the highest value equal to 100%.Forinstance, theleaves of *Andrographis paniculata* are boiled and drunk to treat fever and reduce heat and headache. Parts of the leaves and fruit of *Moringa oleifera*, are boiled and eaten to help as laxatives to treat constipation (Table 6).

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Table 6: Mostly used medicinal plant species for medical categories based on 17 highest fidelity level of the Lao Isan ethnic group.

No.	Scientific name	Np	N	%FL	Used Parts	Instruction	Syndrome category	Treated ailments
1	*Andrographis paniculata* (Burm.f.) Wall. ex Nees (ฟ้าทะลายโจร)*	37	37	100	Leaves	Boil and drink	Fever and Headache	Treat fever, reduce heat, headache
2	*Ipomoea aquatica*Forssk. (ผักบุ้ง)*	37	37	100	Aerial stem, Leaves, Apical	Boiled or eaten fresh	Eye care	Helps nourish eyesight
3	*Moringa oleifera* (ผักอีฮุม)*	37	37	100	Leaves, Fruit	Boil and eat	Constipation	Laxatives treat constipation
4	*Phyllanthus emblica* L. (หมากขามป้อม) *	20	20	100	Fruit	Eaten fresh	Respiratory diseases	Treat symptoms of cough, sore throat, phlegm
5	*Solanum violaceum*Ortega (หมากแข้งขม)*	20	20	100	Fruit, Seeds	Boiled or eaten fresh	Respiratory diseases	Treat symptoms of cough, sore throat, phlegm
6	*Solanum lycopersicum* L. (หมากเขียเครือ)*	20	20	100	Fruit, Seeds	Boiled or eaten fresh	Skin disorders	Treat skin diseases, rashes, ringworm, nourish the skin
7	*Kaempferia parviflora* Wall. ex Baker (กระชายดำ)*	20	20	100	Roots	Boil and eat	Dyspepsia	Treats colic, bloating, flatulence
8	*Pithecellobium dulce* (Roxb.) Benth. (หมากขามเทศ)*	17	17	100	Leaves	Boil and bath	Skin disorders	Treat skin diseases and rashes
9	*Alpinia malaccensis*(Burm.f.) Roscoe (ข่าโคม)*	16	16	100	Rhizome	Boil and eat	Dyspepsia	Treats colic, bloating, flatulence
10	*Senna siamea* (ขี้เหล็ก)*	15	0.41	100	Shoots, Leaves	Boil and eat	Constipation	Laxatives treat constipation
11	*Dioscorea alata*L. (มันเล็บช้าง)*	13	13	100	Tuber	Boil and eat	Dyspepsia	Treats colic, bloating, flatulence
12	*Jatropha gossypiifolia* L. (หมากเยาแดง)*	10	10	100	Gum	Apply to the wound	Injuries	Treat wounds, bruises
13	*Euphorbia hirta* L. (น้ำนมราชสีห์)*	9	9	100	Whole parts	Boil and drink	Postpartum tonic	Helps nourish after giving birth, expels milk

No.	Scientific name	Np	N	%FL	Used Parts	Instruction	Syndrome category	Treated ailments
14	*Streblus asper* Lour. (ข่อย)*	7	7	100	Barks,	Grind finely and mix with salt to rinse your mouth for 1 minute.	Oral disease	Treat oral ulcers, bleeding gums, swollen gums, prevent tooth decay
					Leaves	Chew for about 1 minute and then spit it out.		
15	*Piper betle* L. (พลู)*	7	7	100	Leaves	Chew the leaves	Oral disease	Treat oral ulcers, bleeding gums, swollen gums, prevent tooth decay
16	*Blumea balsamifera* (L.) DC. (หนาด)*	5	5	100	Leaves	Boil and bath	Skin disorders	Treat skin diseases and rashes
17	*Aporosa villosa* (เหมือดโลด)*	3	3	100	Aerial stem	Boil and drink	Diarrhea	Treat abdominal pain, diarrhea

*: Lao Isan Name
Np: Number of reported utilizations of the plant for that syndrome
N: Number of reports of utilization of that plant in all syndromes
%FL: Fidelity level

Table 7: The top 10 medicinal plants that have the most useful reports and fidelity level that have a variety of uses in the treatment of various diseases of the Lao Isan ethnic group.

No.	Scientific name	SU	Np	N	%FL	Used Parts	Instruction	Syndrome category	Treated ailments
1	*Zingiber officinale* Roscoe (ขิง)*	11	127	30	24%	Rhizome	Boiled or eaten fresh	Dyspepsia	Treats colic, bloating, flatulence
			127	20	16%	Rhizome	Grind and apply on the body	Skin disorders	Treat skin diseases, rashes, ringworm, nourish the skin
			127	20	16%	Rhizome	Boiled or eaten fresh	Constipation	Laxatives treat constipation
			127	16	13%	Rhizome	Boiled or eaten fresh	Diarrhea	Treat abdominal pain, diarrhea
			127	9	7%	Rhizome	Boiled or eaten fresh	Nourish heart	Helps nourish heart symptoms
			127	8	6%	Rhizome	Boiled or eaten fresh	Respiratory diseases	Treat symptoms of colds, stuffy nose, cough, sore throat, phlegm
			127	6	5%	Rhizome	Grind and separate the water to massage on the body.	Muscle disorders	Treat muscle pain in the body
			127	5	4%	Rhizome	Boiled or eaten fresh	Postpartum tonic	Helps nourish after giving birth, expels milk
			127	5	4%	Rhizome	Boiled or eaten fresh	Diabetes	Helps treat diabetes symptoms

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No.	Scientific name	SU	Np	N	%FL	Used Parts	Instruction	Syndrome category	Treated ailments
			127	4	3%	Rhizome	Boiled or eaten fresh	Element tonic, body strength	Helps relieve fatigue, nourishes strength
			127	4	3%	Rhizome	Boiled or eaten fresh	Dizziness	Treats dizziness, nausea, vomiting
2	*Curcuma longa* L. (ขมิ้น)*	9	82	37	45%	Rhizome	Grind and apply on the body	Skin disorders	Treat skin diseases, rashes, ringworm, nourish the skin
			82	15	18%	Rhizome	Boil and drink	Constipation	Laxatives treat constipation
			82	15	18%	Rhizome	Boiled or eaten fresh	Diarrhea	Treat abdominal pain, diarrhea
			82	3	4%	Rhizome	Grind and apply to the wound	Injuries	Treat wounds, bruises
			82	3	4%	Rhizome	Boiled or eaten fresh	Respiratory diseases	Treat symptoms of colds, stuffy nose, cough, sore throat, phlegm
			82	3	4%	Rhizome	Boil and drink	Muscle disorders	Treat muscle pain in the body
			82	2	2%	Rhizome	Boiled or eaten fresh	Nourish heart	Helps nourish heart symptoms
			82	2	2%	Rhizome	Boiled or eaten fresh	Dyspepsia	Treats colic, bloating, flatulence
			82	2	2%	Rhizome	Boil and drink	Fever and Headache	Treat fever, reduce heat, headache
3	*Musa*. × *paradisiaca* L. (กล้วยอีออง)*	8	101	30	30%	Fruit	Eat as fresh fruit	Dyspepsia	Treats colic, bloating, flatulence
			101	20	20%	Gum	Apply to wounds	Injuries	Treat wounds, bruises
			101	18	18%	Fruit	Eat as fresh fruit	Diarrhea	Treat abdominal pain, diarrhea
			101	15	15%	Fruit	Eat as fresh fruit	Muscle disorders	Treat muscle pain in the body
			101	6	6%	Fruit	Eat as fresh fruit	Element tonic, body strength	Helps relieve fatigue, nourishes strength
			101	5	5%	Fruit	Eat as fresh fruit	Nourish heart	Helps nourish heart symptoms
			101	5	5%	Fruit	Eat as fresh fruit	Diabetes	Helps treat diabetes symptoms
			101	2	2%	Fruit	Eat as fresh fruit	Blood tonic	Treats fat in the arteries, anemia, reduces blood sugar
4	*Alpinia galanga* (L.) Willd. (ข่าบ้าน)*	8	98	33	34%	Rhizome	Grind and apply on the body	Skin disorders	Treat skin diseases, rashes, ringworm, nourish the skin
			98	20	20%	Rhizome	Boiled or eaten fresh	Constipation	Laxatives treat constipation
			98	20	20%	Rhizome	Boiled or eaten fresh	Dyspepsia	Treats colic, bloating, flatulence

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No.	Scientific name	SU	Np	N	%FL	Used Parts	Instruction	Syndrome category	Treated ailments
			98	10	10%	Rhizome	Boiled or eaten fresh	Diuretic disorders	Helps to urinate
			98	8	8%	Rhizome	Boiled or eaten fresh	Respiratory diseases	Treat symptoms of colds, stuffy nose, cough, sore throat, phlegm
			98	3	3%	Rhizome	Boiled or eaten fresh	Dizziness	Treats dizziness, nausea, vomiting
			98	2	2%	Rhizome	Boiled or eaten fresh	Diarrhea	Treat abdominal pain, diarrhea
			98	2	2%	Rhizome	Boiled or eaten fresh	Diabetes	Helps treat diabetes symptoms
5	*Ocimumtenuiflorum* L. (กระเพา)*	7	39	10	26%	Leaves, Flower	Boil and drink	Postpartum tonic	Helps nourish after giving birth, expels milk
			39	8	21%	Leaves, Flower	Boil and drink	Blood tonic	Treats fat in the arteries, anemia, reduces blood sugar
			39	6	15%	Leaves, Flower	Stir fry or boil curry to eat	Dyspepsia	Treats colic, bloating, flatulence
			39	5	13%	Leaves, Flower	Boil and drink	Dizziness	Treats dizziness, nausea, vomiting
			39	4	10%	Leaves, Flower	Boil and drink	Respiratory diseases	Treat symptoms of colds, stuffy nose, cough, sore throat, phlegm
			39	3	8%	Leaves	Grind and apply on the body	Skin disorders	Treat skin diseases, rashes, ringworm, nourish the skin
			39	3	8%	Leaves, Flower	Boil and drink	Diarrhea	Treat abdominal pain, diarrhea
6	*Ocimumbasilicum* L. (โหระพา)*	7	33	6	18%	Leaves, Flower	Stir fry or boil curry to eat	Postpartum tonic	Helps nourish after giving birth, expels milk
			33	6	18%	Leaves, Flower	Boil and drink	Menstruation	Helps drive menstruation, relieves symptoms of blood remaining in the body.
			33	5	15%	Leaves, Flower	Stir fry or boil curry to eat	Dyspepsia	Treats colic, bloating, flatulence
			33	5	15%	Leaves, Flower	Boiled or eaten fresh	Diarrhea	Treat abdominal pain, diarrhea
			33	4	12%	Leaves, Flower	Boiled or eaten fresh	Constipation	Laxatives treat constipation
			33	4	12%	Leaves, Flower	Boiled or eaten fresh	Diuretic disorders	Helps to urinate
			33	3	9%	Leaves, Flower	Boiled or eaten fresh	Malignant tumor, Cancer	Supportive treatment
7	*Morus alba* L.	7	32	8	25%	Leaves, Fruit	Boiled or eaten fresh	Diabetes	Helps treat diabetes symptoms

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No.	Scientific name	SU	Np	N	%FL	Used Parts	Instruction	Syndrome category	Treated ailments
	(หม่อน)*		32	5	16%	Leaves, Fruit	Boiled or eaten fresh	Nourish heart	Helps nourish heart symptoms
			32	5	16%	Leaves, Fruit	Boiled or eaten fresh	Dyspepsia	Treats colic, bloating, flatulence
			32	5	16%	Leaves, Fruit	Grind thoroughly and use to wash your hair	Nourish hair	Helps nourish the scalp, nourishes the hair
			32	4	13%	Leaves, Fruit	Boiled or eaten fresh	Respiratory diseases	Treat symptoms of colds, stuffy nose, cough, sore throat, phlegm
			32	3	9%	Leaves, Fruit	Boiled or eaten fresh	Eye care	Helps nourish eyesight
			32	2	6%	Leaves, Fruit	Boiled or eaten fresh	Fever and Headache	Treat fever, reduce heat, headache
8	*Mangifera indica* L. (หมากม่วงแก้ว)*	7	29	2	7%	Fruit	Eat as fresh fruit	Fever and Headache	Treat fever, reduce heat, headache
			29	2	7%	Fruit	Eat as fresh fruit	Insomnia	Helps you sleep easily, relax
			29	3	10%	Fruit	Eat as fresh fruit	Oral disease	Treat oral ulcers, bleeding gums, swollen gums, prevent tooth decay
			29	5	17%	Fruit	Eat as fresh fruit	Diuretic disorders	Helps to urinate
			29	5	17%	Fruit	Eat as fresh fruit	Dyspepsia	Treats colic, bloating, flatulence
			29	5	17%	Fruit	Eat as fresh fruit	Diarrhea	Treat abdominal pain, diarrhea
			29	7	24%	Fruit	Eat as fresh fruit	Element tonic, body strength	Helps relieve fatigue, nourishes strength
9	*Cassia fistula* L. (คูน)*	7	26	7	27%	Fruit	Boil and eat	Constipation	Laxatives treat constipation
			26	6	23%	Stem	Chop into small pieces and bake in your mouth for about 30 minutes.	Oral disease	Treat oral ulcers, bleeding gums, swollen gums, prevent tooth decay
			26	4	15%	Fruit	Boil and eat	Diarrhea	Treat abdominal pain, diarrhea
			26	3	12%	Barks	Boil and eat	Blood tonic	Treats fat in the arteries, anemia, reduces blood sugar
			26	2	8%	Leaves	Boil and eat	Parasite disease	Helps expel parasites from the body
			26	2	8%	Young fruit	Eat fresh	Respiratory diseases	Treat symptoms of colds, stuffy nose, cough, sore throat, phlegm
			26	2	8%	Root	Boil and eat	Fever and Headache	Treat fever, reduce heat, headache
10	*Amaranthus viridis* L.	7	22	8	36%	Whole parts	Boil and eat	Element tonic, body strength	Helps relieve fatigue, nourishes strength

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No.	Scientific name	SU	Np	N	%FL	Used Parts	Instruction	Syndrome category	Treated ailments
	(ผักฮม)*								
			22	3	14%	Whole parts	Boil and eat	Blood tonic	Treats fat in the arteries, anemia, reduces blood sugar
			22	3	14%	Leaves	Grind and apply on the body	Injuries	Treat wounds, bruises
			22	2	9%	Leaves	Grind and apply on the body	Skin disorders	Treat skin diseases, rashes, ringworm, nourish the skin
			22	2	9%	Whole parts	Boil and eat	Constipation	Laxatives treat constipation
			22	2	9%	Leaves	Grind and apply on the body	Neutralize	Helps treat boredom and intoxication, snake venom, insect and animal venom
			22	2	9%	Whole parts	Boil and eat	Menstruation	Helps drive menstruation, relieves symptoms of blood remaining in the body.

*: Lao Isan Name
SU: Total number of symptoms used per species.
Np: Number of reported utilizations of the plant for that syndrome
N:Number of reports of utilization of that plant in all syndromes
%FL:Fidelity level

The medicinal plant that has the most useful reports and fidelity level that has a variety of uses in the treatment of various diseases of the Lao Isan ethnic group is *Zingiber officinale*. The rhizomes are boiled or eaten fresh or grind and applied on the body, helping to treat a variety of disease symptoms, including constipation, skin disorders, dyspepsia, diarrhea, respiratory diseases, muscle disorders, postpartum tonic, diabetes, element tonic, body strength, dizziness and to nourish heart. The second widely used plant is *Curcuma longa*, whose rhizomes are ground and applied on the body and on a wound to help treat skin disorders, boiled and drunk, eaten fresh for dyspepsia, diarrhea, injuries, and menstruation. The third is *Musa paradisiaca*, in which the fruit is boiled or eaten raw to treat injuries, diarrhea, muscle disorders, as an elemental blood tonic, to boost strength, nourish the heart, and others[86], as shown in Table 7.

The number of medicinal plant species from this study is smaller compared to that reported in "Ethnobotany of Phu Thai Ethnic Group in Nakhon Phanom Province, Thailand," conducted by Pholhiamhan*et al*.[77] In that study, a total of 179 botanical species were identified. The six components of plants commonly utilized for medicinal purposes include rhizomes and tubers, stems (including shoot, vine, bark, and pith), leaves, shoot tip, flowers, and fruits (Including seeds) as reported. In the same study, it was discovered that *Crinum asiaticum* L. leaves were used for various medicinal purposes. The leaves of *C. asiaticum* var. *asiaticum* were discovered to include six saturated straight-chain hydrocarbons, two sterols, and thirteen fatty acids, all of which were successfully identified and separated. This species of plant has been identified as traditionally used for medicinal purposes in different regions of Asia and the South Pacific islands. It is commonly employed to treat skin diseases, gastrointestinal disorders, fever, earache, urinary troubles, boils, tonsillitis, rheumatism, hernia, mumps, antidote to poison, edema, and as bone fractures. It is necessary to conduct investigations on all areas of medicinal plant species in order to assess their effectiveness and safety for the stated indigenous medical purposes. These research efforts should involve the use of phytochemical and pharmacological testing, along with bioactivity assays and toxicity investigations. The plants demonstrate a robust capacity for healing. Herbs that are utilized repeatedly are presumed to have a higher likelihood of being physiologically active.

However, our findings on the number of medicinal plant species was higher than those reported by Junsongduang*et al*.[6], which identified 146 species from 127 genera and 60 plant families used for medicinal purposes by 14 traditional Tai Lao healers in Roi Et province. The Fabaceae family had the highest number of medicinal plants (12 species, 8%), followed by Poaceae (9 species, 6%) and Zingiberaceae (8 species, 5%). The sedge *Cyperus rotundus* (UV=0.71) was the most significant and extensively utilized medicinal herb. The healers employed the roots and stems of *C. rotundus* to treat gastrointestinal ailments such as gallstones and flatulence. In addition, these herbs were utilized for treating illnesses of the genitourinary system, such as diuretic effects and venereal diseases. In the research mentioned above, plants were utilized for therapeutic purposes in each respective area. The selection of species for treatment varies based on their suitability and compatibility with the specific area.

Conclusion

The results of this ethnobotanical study indicate that a total of 317 plant species were utilized according to traditional knowledge in Pho Chai Districts, Roi Et Province, Northeastern Thailand. These species were classified into 89 families and 243 genera. They were further categorized into 12 groups based on their distinct use as per traditional understanding. The groups consist of 201 species utilized for food and spices, 154 species used for medicinal herbs, 55 species utilized as ornamental plants, 51 species serving as materials for construction, 48 species used for fuel, 48 species employed in rituals and beliefs, 36 species utilized for dye production, 27 species utilized in beverage production, 26 species used for toxic purposes, 13 species serving as economic crops, 4 species used for cosmetics and fragrances, and 4 species utilized for apparel and accessories, respectively. The most frequently utilized plant parts are leaves (121 species), aerial stems (104 species), and fruits (93 species), respectively. Among the plants studied, *Oryza sativa* had the highest frequency of use, with a CI value of 5.35, followed by *Saccharum officinarum* (5.08) and *Curcuma longa* (4.22), respectively. Constipation had the highest IAR value of 0.93, while neutralize had the lowest IAR value of 0.70. This study systematically recorded and collected data as fundamental knowledge for the conservation of plants, ensuring their availability for future generations. This information will be used as a reference for preserving traditional knowledge and for integrating it into related fields of study. It is also important promotional information for the sustainable cultivation and distribution of medicinal plants.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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