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RESEARCH ARTICLE

Highly localised traditional knowledge of Mien medicinal plants in Chiang Rai, Thailand

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Abstract

1. The Mien ethnic people have migrated from China to Thailand over centuries and traditionally settled in remote areas of northern Thailand. They relied extensively on the local ecosystem for construction, food, fodder, and medicine. There are only a few studies of Mien traditional knowledge in China and Nan, Thailand. This study examines the knowledge of medicinal plants used by Mien in Chiang Rai, Thailand.
2. We investigated traditional knowledge of medicinal plants in three Mien villages in Thailand, highlighting a crucial yet vulnerable cultural heritage. For this study, we interviewed five traditional healers to gather data about their specialist medicinal uses of plants and an additional 90 villagers, who did not have this specialist knowledge, about their ethnobotanical understanding. Each use report was categorised using the International Classification of Primary Health Care. The usefulness of the plant taxa was assessed with the use value index.
3. Our interviews revealed 352 use reports based on 77 plant species in 46 families, predominantly addressing women's health and digestive conditions. The most used plant families were Asteraceae, Rubiaceae, Fabaceae, Euphorbiaceae, Zingiberaceae, Plantaginaceae, Acanthaceae, Rhamnaceae, Amaranthaceae, Lamiaceae, and Vitaceae. The most frequently used species were *Clausena excavata*, *Ricinus communis*, *Blumea balsamifera*, *Chloranthus elatior*, *Monosis volkameriifolia*, *Plantago major*, *Plumbago zeylanica*, and *Zingiber montanum*, highlighting their critical roles in traditional medicinal practices.
4. The Mien people in Chiang Rai, Thailand, possess substantial traditional knowledge regarding medicinal plants, especially for women's healthcare. The identification of numerous species in this study based on traditional usage raises concerns about the effect of ongoing acculturation of ethnic minorities in the region and the potential erosion of traditional knowledge. Some of the identified knowledge is highly localised in the three villages, making the conservation of that knowledge particularly important. We strongly advocate further initiatives aimed at conserving traditional Mien knowledge, as well as more studies in Laos PDR and Vietnam to cover the Mien's migration line.

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KEYWORDS
ethnobotany, healthcare, hill-tribe, traditional knowledge, women

1 | INTRODUCTION

Four main necessities for humans are food, shelter, clothing, and medicines. The need for these essentials drives the cultivation of unique traditional knowledge related to the use of local natural resources. In turn, much of this traditional knowledge has been introduced into industry, yielding several products and services on a broader, sometimes global scale (Von Lewinski, 2008). Humans have used medicinal plants to combat diseases and symptoms for thousands of years (Gaur, 2024; Jaiswal & Williams, 2017). Despite numerous effective contemporary medicines and medical technologies available for specific conditions, many people living traditional lifestyles rely on wild or cultivated medicinal plants for health needs, particularly where contemporary medicine is economically out of reach. At the same time, people in high-income or high-resource regions search for medicinal plants as candidates for developing treatments (WHO, 2002). Indeed, many contemporary medicines have been derived from or built on chemical platforms pertaining to traditional medicinal plants (Domingo-Fernández et al., 2023; Fabricant & Farnsworth, 2001). One example is the discovery of artemisinin for treating malaria (Tu, 2011). During health crises, such as the COVID-19 pandemic, traditional medicinal plants proved useful for prevention or treatment when contemporary therapies proved ineffective or were unavailable (Adhikari et al., 2021). In Nepal, the use of medicinal plants increased during the pandemic (Khadka et al., 2021). In some countries, the efficacy of traditional medicines for symptoms was recognised, as with the use of *Andrographis paniculata* L. in Thailand for fever, cough, and sore throat. Crude powders and andrographolide extracts of this plant were added to Thailand's National List of Essential Herbal Medicines and recommended for the treatment of COVID-19 involving mild symptoms (National List of Essential Herbal Medicine, 2020). For these and other reasons, it is broadly valuable to study traditional local knowledge of medicinal plants and make efforts to conserve this knowledge.

Ethnic minorities, especially when living in remote areas, tend to maintain traditional knowledge about the use of medicinal plants. Thailand is one of the most culturally diverse countries in the world, home to people representing at least 60 ethnicities, each with distinct languages and dialects (Premsrirat, 2004). Some ethnic groups originated in Thailand, whereas others, such as the Karen, Hmong, Akha, and Mien peoples, migrated from other countries (Princess Maha Chakri Sirindhorn Anthropology Centre, 2024). Ethnic minorities living in northern Thailand, often referred to as 'hill-tribes', mostly migrated along a route traversing Tibet–China–Myanmar/Vietnam/Laos to northern Thailand. One specific example is the migration route of the Karen people into Thailand. The Karen originated in Tibet more than 2000 years ago, later migrating to Yunnan, China, before some of them continued on to settle in Myanmar more than 700 years ago. The Karen have continued to migrate from Myanmar in several waves to settle in various parts of northern and western Thailand as recently as 200–300 years ago (Princess Maha Chakri Sirindhorn Anthropology Centre, 2024).

In general, ethnic groups living in remote areas tend to rely on natural resources for their basic needs, including medicine. Because the composition of flora changes along migration routes, immigrants must modify and adapt their knowledge about surrounding resources, driving changes in traditional knowledge. A study of the traditional knowledge of Akha communities in China and Thailand that had been separated for centuries showed that despite the overall maintenance of the medicinal plant system, few similar plant species were used in both areas (Inta et al., 2008). A study on the composition of Tifey, a Haitian drink based on many species, found different species composition between the versions made in Cuba and in Haiti, where it originated (Volpato et al., 2009).

Ethnic communities often have a profound understanding of their surrounding flora and its medicinal properties that have been passed down through generations. Traditional medicinal knowledge can vary even within the same ethnic group, however, depending on the local availability of plant resources and environmental factors (Phumthum & Balslev, 2018). For this reason, each ethnic village in Thailand harbours distinct traditional knowledge concerning medicinal plants, reflecting this variability arising from geographical and ecological factors. As a consequence, migration to new surroundings drives the development of new ethnobotanical knowledge. Adaptation and modification of traditional knowledge in response to new environments after migration supports the uniqueness of traditional knowledge in each ethnic village.

The Mien people, also known as Iu Mien or Yao, are among the most prominent hill-tribes in Thailand (Princess Maha Chakri Sirindhorn Anthropology Centre, 2023). Currently, the global Mien population consists of more than 7 million people living in China, Vietnam, Laos, Thailand, France, and the United States (Long & Li, 2004). Of these, more than 2.7 million Mien people live in China, and more than 400,000 live in Vietnam, Thailand, and Laos (Cunningham, 2015). The Mien in Thailand migrated from the highlands in central China through Vietnam and Laos, settling in northern Thailand during the past 200 years (Princess Maha Chakri Sirindhorn Anthropology Centre, 2023). Most Thai Mien people live in Chiang Rai, Phayao, and Nan provinces, but a few Mien villages exist in Chiang Mai, Lampang, Sukhothai, and Kamphaeng Phet provinces (Perve, 2006; Princess Maha Chakri Sirindhorn Anthropology Centre, 2023) (Figure 1).

The Mien's ancestors lived in the highlands of central China. After migration to new areas, Mien communities were predominantly established in highland areas, near or within dense forests (Perve, 2006), which was an ideal setting for the development of their traditional knowledge about plants and their uses. However, few studies have described the Mien's botanical knowledge,

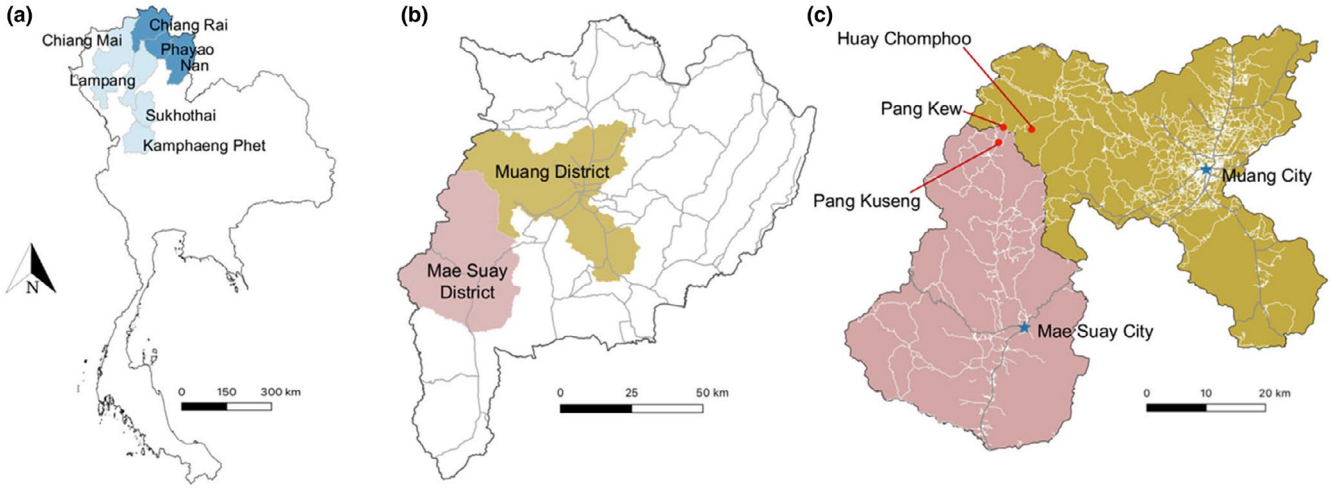


FIGURE 1 Distribution of Mien people in Thailand and studied sites. (a) Distribution of Mien people in Thailand. Dark blue indicates provinces with high concentrations of Mien villages, and light blue indicates the provinces with low numbers of Mien villages based on Perve (2006) and Princess Maha Chakri Sirindhorn Anthropology Centre (2023). (b) Chiang Rai province showing the location of the Muang and Mae Suay districts. Grey lines represent major roads. (c) Areas of Muang and Mae Suay districts, showing the location of the three studied villages (red dots), city centres (blue stars), and the road network including major (grey) and secondary (white) roads.

especially regarding medicinal plants, which is concerning considering that such traditional knowledge develops and evolves through generations and is rapidly disappearing (Srithi et al., 2009). In Myanmar, for example, the traditional knowledge of the Chin people about plant-based textile dyeing is eroding fast (Ling et al., 2022). Such rapid losses are driven in part by urbanisation and influenced by education and loss of languages (Cámara-Leret & Bascompte, 2021; Nguanchoo et al., 2022; Voeks & Leony, 2004), a main driver of knowledge decline (Cámara-Leret & Bascompte, 2021). The loss of traditional knowledge disproportionately affects younger generations of ethnic minorities, as they can more readily access contemporary medicine and public health centres and experience more influence from globalisation and urbanisation. Younger generations of ethnic minorities in Thailand, for example, prefer to leave their villages to find higher income jobs than to work in the villages, especially young men, who will often seek opportunities to work abroad (Tawong, 2014). These choices have negative effects that include a lack of people to take elders to public medical centres when they fall ill. Older generations, especially among ethnic people living in remote areas, still rely on and appreciate medicinal plants (Azrianingsih & Kusumahati, 2018), which remain crucial to them.

The Mien (Yao) represents one of the major ethnicities in Asia. In China, the Gongcheng Yao have used medicinal plants for treating sicknesses and symptoms related to the digestive, urinary, and nervous systems (Lu et al., 2022). Similarly, the Baiku Yao living in southern China most frequently use medicinal plants to treat health conditions related to the digestive system (Li et al., 2024). For the Red-Headed Yao in Yunnan, a variety of medicinal plant species are used to treat conditions related to women's health (Long & Li, 2004). One overview of ethnobotanical studies in Southeast Asia covered 312 publications published before 2015 but lacks detail about the studied ethnic groups, especially in Vietnam, Thailand, and Laos where the Mien villages are located (Hidayati et al., 2015). An analysis of studies in Thailand showed an ethnobotanical record of medicinal plant use for only seven Mien villages among the 223 villages in the country (Phumthum, 2020), suggesting that a greater number of Mien villages should be studied to see gradients of variation and diversity of traditional knowledge among the Mien people.

The majority of Mien ethnobotanical research related to the use of medicinal plants has been conducted in Nan province, with only limited studies in Chiang Rai province (Phumthum, 2020; Phumthum & Balslev, 2018), which is home to the largest Mien population in Thailand (Princess Maha Chakri Sirindhorn Anthropology Centre, 2023). Previous ethnobotanical studies of the Mien include the work of Panyaphu et al. (2011) and Srithi et al. (2012), which both focused on medicinal plants in Nan province and reported their use for treating conditions related to nutritional disorders, women's health, and injuries. In Suncharoen subdistrict, also in Nan province, over a quarter of medicinal species identified were used by the Mien to treat women's health-related symptoms, followed by digestive health problems (Panyaphu et al., 2011). These studies illustrate the variation in traditional knowledge around the use of medicinal plants by the Mien people, which varies between those living in Nan, Thailand, and those living in southern China, closer to where the Mien people originated.

Isolated ethnic communities often have a deep understanding of their surrounding flora and its medicinal properties, passing the related knowledge down through generations. Previous studies of the Thai Mien traditional knowledge emphasised that their knowledge is particularly abundant when it comes to medicinal plants for women's health (Srithi et al., 2012). However, traditional medicinal knowledge can vary even within the same ethnic group and be quite localised, depending on regional plant resources and

other environmental factors. Therefore, residents of each ethnic village in Thailand have a distinct traditional knowledge about medicinal plants that is reflected in the variability of relevant local geographical and ecological factors for each village. Chiang Rai is a large province which is the home for a large Thai Mien population but information about their traditional knowledge is lacking. The province bridges the Mien's migration route between Laos PDR and other provinces in Thailand (Princess Maha Chakri Sirindhorn Anthropology Centre, 2024). The documentation of medicinal plants used by the Mien not only aids in preserving their rich cultural heritage but also is crucial for biodiversity conservation, offering insights into sustainable resource use. Furthermore, understanding these practices is essential for integrating traditional knowledge into current health policies, which can enhance healthcare outcomes in rural and underserved areas. Understanding the Mien medicinal plant system aligns with global efforts to achieve sustainable development goals by promoting well-being and preserving knowledge for future generations.

Here we have focused on the traditional knowledge of medicinal plants used by the Mien in three villages (Huay Chomphoo, Pang Kew, and Pang Kuseng) in the Chiang Rai province of Thailand, situated at the border between the Muang and Mae Suay districts (Figure 1). To the best of our knowledge, no ethnobotanical study has been published covering these three villages and their shared natural resources. The general purpose of our study was to understand the degree of localised traditional knowledge in individual villages and the degree of more generalised ethnobotanical knowledge. Specifically, our aim was to document the traditional knowledge and medicinal plants used in the three villages. To achieve this aim, we sought to answer the following questions: (1) How many and which plant species do the Mien in the studied villages use? (2) Which plant taxa do they use most? (3) Which health conditions do they most commonly treat using traditional knowledge of medicinal plants? (4) How do the Mien in these three villages prepare medicine from the plants?

2 | MATERIALS AND METHODS

2.1 | Study area

Three Mien villages (Huay Chomphoo, Pang Kew, and Pang Kuseng) in Chiang Rai province, Thailand, were selected for this study (Figure 1). The selection criteria were that (1) the majority of villagers should be Mien people, (2) the villages should be located more than 50 km from the region's urban centres, (3) the selected villages should be located no more than 10 km from each other, and (4) the villages should have shared natural resources. Huay Chomphoo is located near the border of Muang and Mae Suay districts, around 90 km from Muang, the district capital. Pang Kew and Pang Kuseng are in Mae Suay district around 60 km from the district capital. The three villages are located 5–7 km from each other and share the natural resources of the same forest area (Figure 1).

2.2 | Ethnobotanical study

Our research was approved by the Faculty of Dentistry/Faculty of Pharmacy, Mahidol University Institutional Review Board (permit no. COA.No.MU-DT/PY-IRB 2021/037.0704). The three villages were visited in April 2022 for consultation with community leaders for local approval to conduct research. Community leaders were asked to identify and list well-respected traditional healers in each village. The criteria for identification were that the healer (1) must be living in the village and be Mien, (2) should be a respected and well-known traditional healer in the village, (3) should use medicinal plants to treat people and have been a traditional healer for at least 10 years, and (4) must remember medicinal plants and how to use them. Most ethnic informants could not write or read the official Thai language effectively. To avoid communication errors because of reading documents, this study performed oral consents. Our research team provided information in the consent form to the informants before interviews start. This process was stated in the ethics application to the IRB mentioned above.

In total, five key informants were selected for interviews during visits to their houses or any comfortable places they suggested and were introduced to the project to obtain oral consent, as required in the ethical approval. Unfortunately, all male traditional healers in the target villages have passed away so, all key informants from this study were women. The traditional healers were interviewed about their traditional knowledge. In general, traditional healers in each village knew each other very well. They even respected and praised other healers for their specific knowledge, such as about the treatment of bone and joints, as well as snake and venomous animal bites. The key informants were interviewed several times during different visits during the field trip period.

Ninety additional villagers (30 villagers from each village who together accounted for 10%–15% of the village population) also were selected for interviews. During walks in the villages, we asked for their consent for the interviews. Because ages and genders influence medicinal plant knowledge (de Albuquerque et al., 2011; Sousa et al., 2022), this study selected villagers in the age range of 18–80 years and ensured an equal gender balance among the 90 informants. Culturally, the Mien people in the selected villages tend to marry at around 18 years of age, and most villagers over the age of 80 years informed us that they could not remember the medicinal plants and how to use them.

We conducted semi-structured interviews with key informants, always asking for specifics such as the local name of the plant, its use and preparation, its route of administration, and whether it was used alone or in a mixture. Informants also were asked to identify and show living specimens of the medicinal plants during walks along forest trails or through farmlands and home gardens where they usually collected the plants. The different species grow, bloom, and produce fruits in different seasons, especially the rhizomatous plants that normally survive during the hot-dry season with their dormant underground parts. To ensure that we located all mentioned plants during the study, each key informant

was interviewed at least once each during the winter, hot-dry, and rainy seasons from May 2022 to April 2023. Plants were photographed and collected as voucher specimens for identification, which was performed using references such as the Flora of Thailand and other floras from neighbouring countries (i.e., Flora of China and Flora of Laos Vietnam and Cambodia). Some plant specimens were sent for identification by experts on Thai plant families. Plant names and families were updated following the Plants of the World Online (powo.science.kew.org). The vouchers were deposited in the Herbarium of Mahidol University (PBM) and Queen Sirikit Botanical Garden (QBG). Data relevant to each plant specimen and its uses were included on the labels attached to the herbarium sheet.

2.3 | Uses of plants

Any mention of a plant used for a particular purpose by an informant was counted as a single-use report. There are several standards to classify the uses of medicinal plants into categories (Cook, 1995; Staub et al., 2015). Of several options among standards for classifying uses of medicinal plants into categories (Gruca et al., 2014; Staub et al., 2015), we chose the International Classification of Primary Health Care (ICPC-2) standard (WHO, 2003) as the best fit for our purposes (Staub et al., 2015).

The importance of the individual plant taxa was compared with the use value (UV) (Phillips & Gentry, 1993), calculated as follows:

$$UV = \Sigma UR / n$$

where UR is the number of use reports for a plant taxon and n is the total number of interviewed informants. The higher UV a plant taxon has, the higher the average number of cited uses by the informants. We considered taxa with high UV as being used at a high frequency.

3 | RESULTS

3.1 | Used plant families and species

We gathered 352 use reports that covered 77 species from 46 plant families (Table S1). The highest number of use reports was recorded in the Huay Chompoo village (190 use reports), followed by Pang Kew (83 use reports) and Pang Kuseng (79 use reports).

The most frequently used plant families were Asteraceae (36 use reports), Rubiaceae (25), Fabaceae (19), Euphorbiaceae (15), Zingiberaceae (15), Plantaginaceae (14), Acanthaceae (12), Rhamnaceae (12), Amaranthaceae (11), Lamiaceae (11), and Vitaceae (11) (Figure 2).

Each plant family had different applications for treatments in different health categories. Asteraceae had many use reports across several categories but had a significantly higher number of use reports than expected only for the category of social problems. Amaranthaceae was significantly more frequently used for treatments related to pregnancy, childbearing, and fertility control, whereas Cucurbitaceae was significantly more frequently used for treatments in the cardiovascular category. Health conditions in many disorder categories were treated by several plant families, namely, general and unspecified (Acanthaceae, Amaryllidaceae, Commelinaceae, Primulaceae), digestive (Myrtaceae, Plantaginaceae, Zingiberaceae), musculoskeletal (Chloranthaceae, Crassulaceae, Menispermaceae, Rhamnaceae), respiratory (Amaryllidaceae, Lycopodiaceae, Poaceae), urological (Chloranthaceae, Rubiaceae), female genital (Fabaceae, Plumbaginaceae), and skin (Amaranthaceae, Vitaceae) (Figure 2; Table S1).

The most commonly used species were *Clausena excavata*, *Ricinus communis*, *Blumea balsamifera*, *Chloranthus elatior*, *Monosis volkameriifolia*, *Plantago major*, *Plumbago zeylanica*, and *Zingiber montanum*. Many plant species were used for multiple purposes, such as *B. balsamifera*, *Ricinus communis*, *Plantago major*, *Scoparia dulcis*, and *Clausena excavata*. For example, *Zingiber montanum* was used for abdominal pain, diarrhoea, and flatulence, *Cymbopogon nardus* for cold, cough, and fever, and *Plumbago zeylanica* as an abortifacient and for dysmenorrhoea, abnormal menstruation, and leukorrhoea. *Lycopodiella cernua* was used to treat cold, sore throat, and fever, *Kalanchoe pinnata* for muscle and bone-related symptoms, and *Chloranthus elatior* for anuria, urinary stones, bone fractures, muscle aches and pains, and knee pain (Table S1).

3.2 | Use reports and health categories

Plants used for the treatment of conditions relating to pregnancy, childbearing, and family planning had the highest number of use reports in all villages (62 use reports), followed by the category of plants used for general and unspecified purposes (59 use reports). The category related to digestive conditions had 47 use reports, whereas the category related to musculoskeletal conditions had 46 use reports. Categories, such as respiratory, urological, and female genital conditions had between 31 and 33 use reports. The category related to skin conditions had 16 use reports, and cardiovascular conditions had 12 use reports. Other categories had <10 use reports (Figure 2).

3.3 | Medicinal use categories

The healers in each village had expertise in different categories of traditional knowledge. Those in Huay Chompoo and Pang Kew had considerable knowledge of ICPC-2 categories related to male genital health, musculoskeletal health, pregnancy, childbearing, and family planning. Huay Chompoo and Pang Kuseng healers had considerable knowledge in the areas of digestive, respiratory, and urological health. Each village also had unique knowledge in some specific categories. Huay Chompoo experts excelled in knowledge related to endocrine metabolic and nutritional health, female genital health, general and unspecified health, and skin health. Pang Kuseng key informers showed expertise in the neurological category (Figure 2; Table S1).

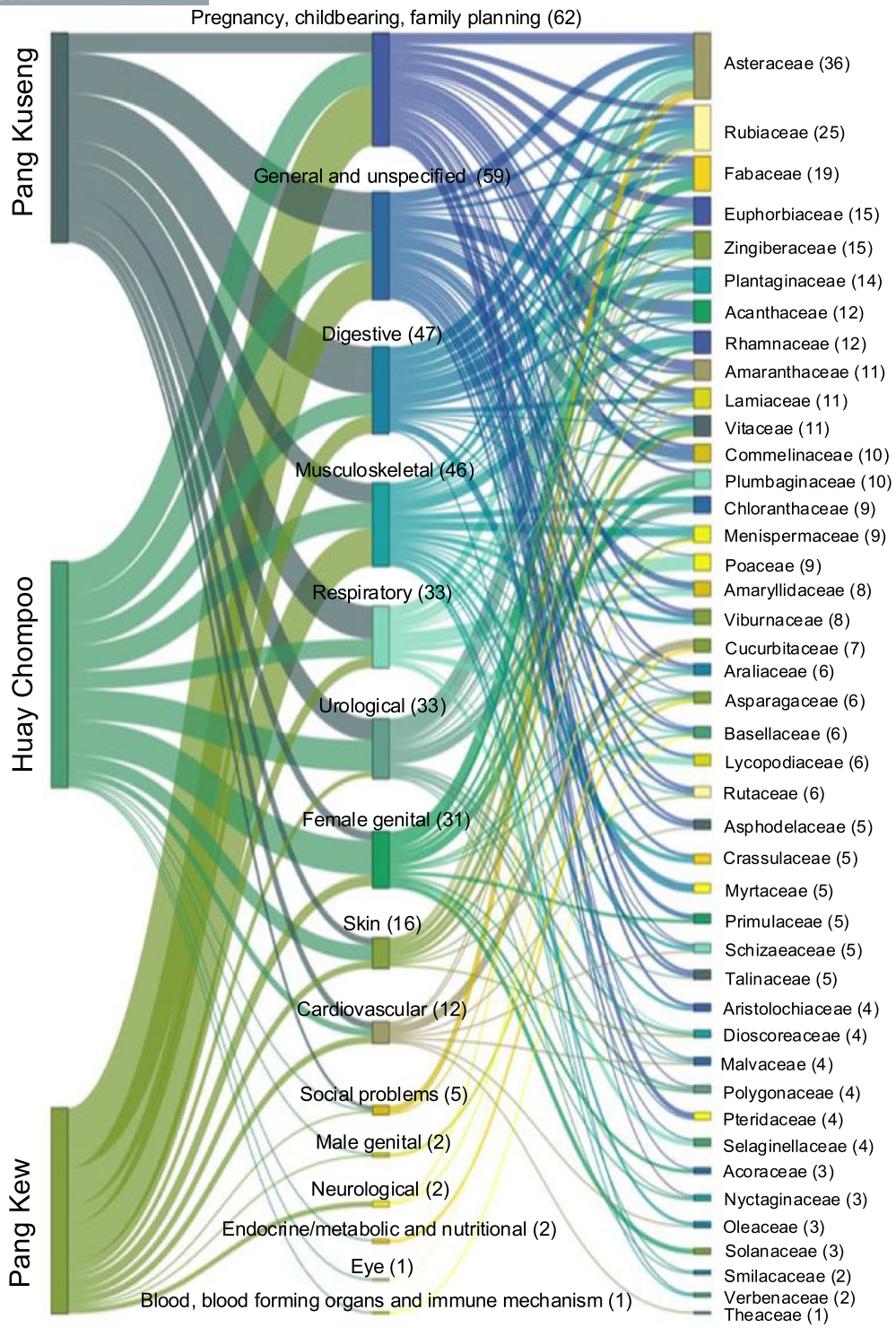


FIGURE 2 The numbers of use reports of traditional knowledge related to medicinal plants in three villages (left nodes). Nodes in the middle column represent the International Classification of Primary Health Care categories. Nodes in the right column represent plant families. Numbers in parentheses are the numbers of use reports, and the line thickness between nodes represents the number of use reports.

3.4 | Plant parts

The healers and villagers mentioned that using the whole plant was the most common choice, accounting for 28% of uses, but a few use reports focused on using only the aerial parts of the plant (9%). Stems were used in 23% of reports, followed by leaves (21%) and roots (19%). Few use reports involved mentions of using plant reproductive organs, whether flowers or fruits.

Pang Kuseng had a very high frequency of using the whole plant (42%), whereas in Huay Chompoo and Pang Kew, we recorded uses

of whole plants in only 25% and 21% of use reports, respectively. Huay Chompoo had almost a similar proportion of use reports based on roots, stems, and leaves/shoots, with each part of the plant accounting for around 21%. In Pang Kew, stems of medicinal plants dominated use reports at 29% (Figure 3).

3.5 | Preparation and administration

The most common preparation method was decoction, accounting for >70% of use reports. Mixing the plants as an ingredient with sweet fermented rice and chicken soup was the second most common preparation method cited in use reports, representing 10% of the cases, as did hot infusion. Several other less common methods for preparing the medicinal plants were recorded during the study, such as crushing, heating, macerating in alcohol, making herbal compresses, powdering, and soaking in water (Table S1).

The routes of administration were related to the preparation method. More than one-third of use reports described oral administration. Preparation methods for oral application included decoction, hot infusion, and cooking with chicken soup, and a few use reports mentioned boiling with sugar, cooking with steamed egg, heating, macerating in alcohol, or no preparation at all. The second most commonly described method was bathing the patient in a boiled medicinal plant solution, always using a decoction. Poulticing medicinal plant substances ranked third but was mentioned in only 26 use reports. The informants described various ways of preparing medicinal plants for poultices on injured organs, with the most common being to crush the raw/fresh plant parts, although a few informants described using heat or making an herbal compress (Table S1).

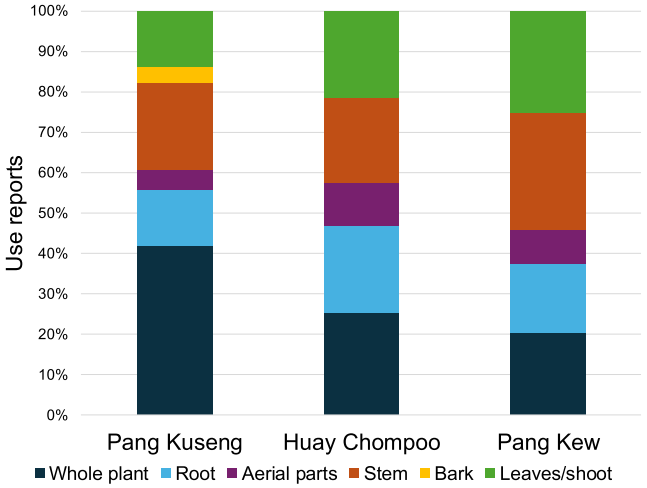


FIGURE 3 Uses of different parts of plants for preparation of traditional medicine in the three Mien villages in Thailand.

4 | DISCUSSION

4.1 | The number of recorded species

In this study, we encountered 77 medicinal plant species used in the three Mien villages, which is within the range of 44–146 species recorded in other previously studied Mien villages in Nan, Thailand (Panyaphu et al., 2011; Srithi, 2012; Tovaranonte, 1998). Similarly, a study of the Red-Headed Yao in Yunnan, China, yielded 66 species (Long & Li, 2004). Interestingly, a study among the Gongcheng Yao recorded a high number of 306 species of medicinal plants used by informants, but that study was based on interviews with 352 local healers, 40 of them key informants in 103 villages (Lu et al., 2022).

The Mien and Hmong are the most closely related ethnicities among hill-tribes in Thailand and the only two ethnic groups in Thailand classified in the Hmong-Mien language family (Premsrirat, 2004). Previous studies have reported that the number of medicinal plants used by the Hmong varied from 146 to 168 species (Nguanchoo et al., 2022; Srithi, 2012), more than the Mien seem to use. The relatively low number of medicinal species reported in this study could be the result of a transmission process from older to younger generations that has involved knowledge loss, personal accumulated experience by informants, developments in transportation systems, the impact of social media, the economy, and a lack of interest from the younger generations (de Albuquerque et al., 2011; Ling et al., 2022). Communities with low numbers of known medicinal plants are at risk of losing valuable traditional knowledge (Mattalia et al., 2020), and the current findings suggest that the survival of traditional knowledge of these three Mien villages could be under threat.

4.2 | Use reports and ICPC-2 standard categories

The three Mien villages varied in the use of plants for treatments in different health categories (Figure 2) and plant parts (Figure 3), despite their geographic proximity and similar vegetation types and forest resources for sampling (Figure 1). Each Mien village in Thailand has still developed its own traditional knowledge related to the use of medicinal plants, in keeping with a broader picture of highly localised traditional knowledge throughout Thailand (Phumthum & Balslev, 2018). A similar pattern of low overlap of medicinal plants among communities and highly localised traditional knowledge has been documented at the border between Turkey and Georgia in a region with shared natural resources, cultural backgrounds, and livelihood strategies (Kazancı et al., 2020). One possible explanation emerged in this study during interviews with the Mien healers, who reported that their traditional knowledge about medicinal plant use was secret and belonged to families or clans. The older generation of traditional healer in a family would choose the next generation, who would be taught secretly through oral knowledge transmission and personal training. In an earlier study, each key informant from specific Hmong and Mien villages was an expert in different treatments (Srithi, 2012), reflecting the knowledge, reputations, and expertise of each traditional healer's family. This tradition of knowledge

transmission is similar to what has been described for the Hutsuls people in Ukraine and Romania, emphasising the family as the main source of knowledge transmission (Mattalia et al., 2020).

Among ethnic groups and rural populations throughout Thailand, several categories of conditions are common, including 'general and unspecified', which encompasses pain, fever, chills, general malaise, and various infections (e.g., tuberculosis, measles, chickenpox, and malaria); symptoms associated with digestive conditions, such as abdominal pain, dyspepsia, flatulence, nausea, and vomiting; and those related to the oral cavity and gum issues. Recent studies conducted among the Karen and Hmong ethnic groups revealed that most medicinal plant use reports fell into the digestive and general and unspecified categories (Nguanchoo et al., 2019; Phumthum et al., 2020). The Akha ethnic communities residing in northern Thailand also have accumulated traditional knowledge about a substantial number of plants used for addressing conditions within these two categories (Srisanga et al., 2011). This pattern of ethnomedicinal use is consistent across Thailand, where a high diversity of plant species is employed for treating digestive system and genitourinary system disorders (Phumthum et al., 2018).

We also documented numerous uses of medicinal plants for the treatment of musculoskeletal disorders in all three villages. Most villagers in these areas are engaged in farming and endure rigorous daily labour, which frequently leads to muscle pain or bone and joint injuries (Kantasrila et al., 2020). A comprehensive meta-analysis of medicinal plant use in Thailand showed that rural residents and ethnic groups throughout the country commonly experience symptoms related to musculoskeletal system disorders (Phumthum et al., 2018).

Regarding the return migration route of the Thai Mien back to China, results from this study together with previous studies show that they maintain knowledge about using medicinal plants to treat a variety of health conditions, including many traditional uses in Thailand emphasising women's health (Li et al., 2024; Lu et al., 2022; Srithi, 2012). The villages in the current study did have similarities in terms of the top health condition categories treated, which were pregnancy, childbearing, family planning, general and unspecified, digestive, and musculoskeletal (Figure 2). Other studies of medicinal plants used by the Mien people also have mentioned the importance of medicinal plant species for conditions in these categories, especially for women's health (Panyaphu et al., 2011). This finding in the current study is also related to what we learned from villagers who were asked to identify key informants. All key informants were women, potentially leading to a bias towards women's uses of the plants. In some cases, the villagers mentioned that although the key informants could treat many health conditions, some of them were best known for treating specific problems, such as bone symptoms or conditions related to women's health.

Previous studies of the Mien in Thailand also have identified women's health-related conditions, such as menstrual problems, postpartum issues, and menopause, as the medicinal category with the most use records associated with medicinal plants (Panyaphu et al., 2011; Srithi, 2012). Knowledge about medicinal plants used to treat women's health problems is important for local people, especially for those who live in remote areas and who have limited access to city centres. For example, the Malay people in Indonesia are reported to have 34 important medicinal plant species used for various purposes from pregnancy, child delivery, postpartum recovery, and infant health care (Susandarini et al., 2021). The increasing availability and accessibility of contemporary medicine for younger generations have sometimes led to the abandonment of traditional knowledge (Quinlan & Quinlan, 2007). Women's health conditions accounted for only around 0.5% of all records each year based on information from the Thai government's public health centres (National Statistical Office, 2024), suggesting that people still may prefer using medicinal plants for women's health conditions or may simply ignore symptoms that do not seem serious or life-threatening.

The principle of using medicinal plants for women's health conditions is to balance women's gonadal hormones, especially during pregnancy and after childbirth. In traditional Thai culture, intrinsic body elements (hormone and circulatory systems) must be rebalanced after giving birth to prevent unpleasant symptoms during and after menopause, such as unusual chilling (Pitiporn, 2014). One study comparing the efficacy of medicinal plants for postpartum women found that Thai traditional postpartum medication significantly enhanced uterus recovery, reduced pain, and enhanced amniotic waste elimination better than placebo or contemporary medication alone (Makmanud et al., 2018). Older women are thought to avoid unpleasant symptoms because they used medicinal plant treatments after giving birth, whereas younger women using contemporary medications and no medicinal plants for postpartum are expected to experience unpleasant symptoms as they age. The ongoing difficulty of addressing age-related issues in women's health with contemporary medication is exacerbated by the loss of important local knowledge about the use of medicinal plants for treating these conditions. The result could be a negative impact on the health security of older women.

It is possible in the modern era to share traditional knowledge via online media that local people can access and to adapt that knowledge to the culture of their communities (Mattalia et al., 2020). Nevertheless, some shared information, especially accessed via online platforms, may not give sufficient detail about factors such as dose, ingredients, and risks and side effects. One study indicated that in the Kalat and Khuzdar regions in Pakistan, traditional herbalists would share their knowledge with community members but not share a specific prescription (Tareen et al., 2010). This situation could enhance the risk of using medicinal plants for women's health conditions, especially during pregnancy, when plants can lead to abortion when used over a threshold amount. The original knowledge may be better maintained through empirical exposure or personal training rather than through learning online.

4.3 | Used plant families and species

The general composition of plant species in Chiang Rai province has been influenced by Indo-Burmese floristic elements (van Welzen

et al., 2011), resulting in a similarity in plant diversity with neighbouring provinces. Many significant families and species with medicinal uses that are listed in this study have also been recognised as important medicinal taxa elsewhere in Thailand (Phumthum et al., 2019), and their extensive use by other ethnic groups has been documented in previous studies (Panyadee et al., 2019). Likewise, these taxa have been frequently reported in neighbouring countries that share a similar flora, such as Myanmar (Kyaw et al., 2021), Laos (de Boer et al., 2012), and Cambodia (Chassagne et al., 2016).

Cultural background influences the selection of plant families for medicinal use. A comparative study of plants used by the Akha people in China and Thailand found that despite a century of separation, these two Akha groups maintain shared traditions across borders related to the use of plants (Inta et al., 2008). In the case of the Mien ethnic group, the commonly used taxa identified here align with findings from studies conducted in Mien villages in Nan province (Panyaphu et al., 2011; Srithi, 2012). The Mien ethnic group is closely related to the Hmong in terms of their spoken languages, as both belong to the Hmong-Mien linguistic family (Mortensen, 2017), and many of the medicinal plant taxa listed here also overlap with those used by the Hmong people (Srithi et al., 2012).

The most frequently used families reported in this study, such as Asteraceae, Rubiaceae, Fabaceae, Euphorbiaceae, Zingiberaceae, Acanthaceae, and Lamiaceae, are large families with hundreds of species distributed worldwide (Kew, 2016), including in Thailand. Plant availability may not be the primary driver of the use of medicinal plants, however, and many studies have supported hypotheses of non-random selection of medicinal plant species in various regions across the world (Bennett & Husby, 2008). Plant families with a high number of uses in this study also have been identified as important medicinal plant families elsewhere in Thailand, especially Asteraceae, Rubiaceae, Fabaceae, Euphorbiaceae, Zingiberaceae, Acanthaceae, and Lamiaceae (Phumthum et al., 2019), and in Saudi Arabia (Amaranthaceae, Euphorbiaceae, Lamiaceae, Solanaceae; Rahman et al., 2004), Kenya (Fabaceae, Asteraceae, Rubiaceae, Euphorbiaceae, and Lamiaceae; Mutie et al., 2023), North America (Asteraceae and Lamiaceae; Moerman, 1996), Ecuador (Lamiaceae and Zingiberaceae; Bennett & Husby, 2008), and Italy (Lamiaceae; Weckerle et al., 2011). This non-random selection of similar plant species in these regions around the globe suggests that the choice of species is based on the medicinal efficacy of individual plants (Saslis-Lagoudakis et al., 2011).

Zingiberaceae is a good example of efficacy-based selection of traditionally used medicinal plants. Most traditional use reports for Zingiberaceae species have been classified under the digestive category, especially for the treatment of flatulence and diarrhoea (Phumthum & Balslev, 2020). Members of this family, such as turmeric (*Curcuma longa*), ginger (*Zingiber officinale*), and Proh Hom (*Kaempferia galanga*), have been included in the Thai National List of Essential Herbal Medicines for the treatment of digestive system conditions because of the properties of their volatile oils (National List of Essential Herbal Medicine, 2013). Species in Zingiberaceae accumulate various essential oils (Saowaluck & Yingyong, 2009) and exhibit antimicrobial activities against bacteria that cause diarrhoea (Devkota et al., 2021), in keeping with the uses identified in this study.

Conventional scientific evidence may be limited for the efficacy of some commonly used species listed in this study, even if these plants have been reported in traditional uses in many places. *Clausena excavata*, a species with multiple uses among the Mien, also is used for many reasons in other regions, possibly in part because it produces several secondary compounds and exhibits a broad range of biological activities (Arbab et al., 2011). Another species, *Ricinus communis*, was used for a wide range of conditions in this study (Table S1), including for diarrhoea (Pang Kuseng), dysmenorrhoea (Pang Kuseng), irregular menstruation (Huay Chomphoo), muscle aches and pains (Pang Kuseng), and unpleasant postpartum symptoms (Huay Chomphoo and Pang Kuseng), and as a postpartum tonic (Pang Kew and Huay Chompoo) and for rash (Huay Chompoo) (Figure 4). In Indonesia, the plant is reported to be used for various digestive symptoms, namely, constipation (Wahyuni & Afidah, 2022). A similar use was reported in Mexico for treating muscular pain (Andrade-Cetto, 2009), and *R. communis* appeared to be prominently used in women's healthcare by the Hmong (Srithi et al., 2012) and in other areas of Southeast Asia (de Boer & Cotingting, 2014). In Cameroon, *R. communis* was used to treat sterility in women (Jiofack et al., 2010).

As Figure 4 indicates, we found that *B. balsamifera* was applied for conditions across a wide range of symptoms in the categories of urological health (anuria in Huay Chomphoo and Pang Kuseng), digestive health (aphthous ulcer in Pang Kew and Huay Chomphoo and diarrhoea in Pang Kew), respiratory symptoms (cold and cough in Huay Chomphoo), and general and unspecified (fever in Huay Chomphoo) (Table S1; Figure 4). This plant was listed as the most used species among the Van Kieu people in Vietnam, where it was applied for everything from rheumatoid arthritis to fractures to irregular menstruation and other women's health-related conditions (Lee et al., 2019). In Borneo, Indonesia, the plant was ranked among the top seven medicinal plants and used for various ailments, including skin diseases, postpartum symptoms, and abdominal pain (Sundara Rajoo et al., 2023).

Plantago major in the current study (Table S1; Figure 4) was used to treat ailments in three ICPC-2 categories, mostly for digestive conditions (abdominal pain in Pang Kuseng, aphthous ulcer in Pang Kew and Huay Chomphoo, and diarrhoea in Huay Chomphoo), respiratory conditions (cough in Pang Kuseng and Pang Kew), and urological problems (anuria in Huay Chomphoo). The plant is widely distributed in many countries, resulting in a diversity of ethnomedicinal use records. For uses related to women's health conditions, the plant has been applied as an abortifacient in the United States and India, as a contraceptive in Afghanistan and by Hmong refugees in the United States, for symptoms related to menstruation in Afghanistan, the United States, and India, and for controlling pregnancy and childbirth in South Africa (Samuelsen, 2000).

Among other high-use plants, *Scoparia dulcis* was applied for cardiovascular conditions in Pang Kew, for muscle aches and pains in Huay Chomphoo, as an abortion preventive in Pang Kuseng,

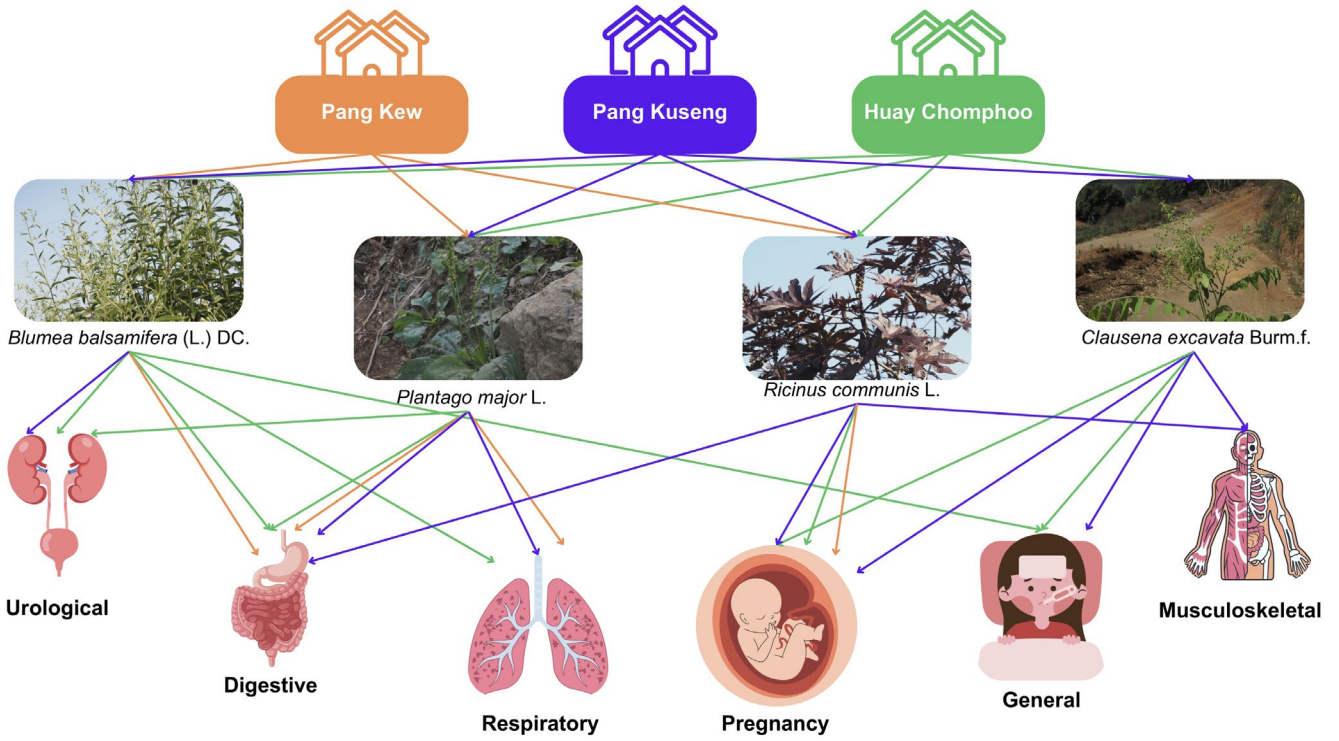


FIGURE 4 Example of uses of the most common medicinal plants (*Blumea balsamifera*, *Clausena excavata*, *Plantago major*, *Ricinus communis*, and *Scoparia dulcis*) in the three Mien villages. Orange arrows present the used by Pang Kew villages; purple arrows present the uses by Pang Kuseng village, and green arrows present the uses by Huay Chompoo village.

and for anuria in Huay Chomphoo (Figure 4; Table S1). In Nepal, *S. dulcis* has been used to treat cut-wounds and burning urination (Bhattarai, 2020).

As these findings and some consistencies across regions and cultures illustrate, exploring these traditionally used plants could uncover novel compounds that offer benefits beyond these current applications, potentially guiding future pharmacological research.

4.4 | Plant parts

The three villages reported different plant parts used for medicine. The Pang Kuseng informants commonly mentioned using the whole plant, whereas those in Huay Chompoo described using whole plants, root, stem, and leaves/shoots in similar proportions. Informants from Pang Kew emphasised the uses of stems and leaves rather than roots or the whole plant (Figure 3). This variation supports the concept of a uniqueness to traditional knowledge development in each community. The transmission process for traditional knowledge about medicinal uses or healing methods is much different from knowledge-sharing methods for other aspects, such as food, textile dying, toolmaking, cultivating crops, or other rituals. Such traditional knowledge would be transferred to younger generations through learning from community activities, peers, school activities, or daily activities (Turreira-García et al., 2015). However, traditional medical knowledge is more proprietary to a clan or family (Hsu, 1999), expected to be taught by a healing expert directly to a specifically chosen person. In most cases, the knowledge is kept as secret and is not to be shared among traditional healers, even if living in the same village (Hunde et al., 2006). A few key informants from this study shared that they were the chosen persons from their families to hold and be taught by elder healers while their siblings were not allowed to learn. In addition, the knowledge is varied from generation to generation because of environmental and resource changes (Saslis-Lagoudakis et al., 2014) or self-learning.

For some multiple-use species, different parts were used for different treatments. The aerial parts of *Heptapleurum leucanthum* were used to treat muscle aches and pains, its leaves were used to treat leucorrhoea, and its stems were used to treat bone pain and postpartum symptoms and as a tonic. Different parts of a plant species may bear different quantities and qualities of phytochemical compounds (Misra et al., 2011; Somkuwar & Kamble, 2013). We speculate that the selection of plant parts that the Mien use depends on variations in secondary metabolic contents in different parts of the plants, as the medicinal properties of plants mostly depend on these secondary metabolites. Plants produce secondary metabolites as protection against herbivores, and most plants store these compounds in roots, barks, and leaves. In contrast, during the development of their reproductive organs, such as flowers and fruits, plants produce compounds to attract pollinators and seed dispersers. One study of the andrographolide content in *Andrographis paniculata*, a prominent medicinal plant in Asia, showed high levels in leaves but low content in pods. The vegetative stage featured the highest andrographolide content, with declines after this stage of growth (Pholphana et al., 2013).

The reproductive organs of many plants may have limited medicinal properties that have led to their non-selection by the Mien, as all three villages used mostly non-reproductive plant parts for medicinal purposes. One reason may be that roots, stems, and leaves are available in all seasons. A similar preference for using non-reproductive plant parts because of all-year availability has been documented in Djibouti (Hassan-Abdallah et al., 2013). The Mobi people in Nigeria used plant parts from leaves, roots, bark, and whole plant to treat malaria (Mahmoud et al., 2020). In Ethiopia, several studies have reported a preference for the non-reproductive parts of plants for medicinal purposes (Teklay et al., 2013). In China, the Mulam people have been reported to believe that wild plants have more efficacy than cultivated plants, and their preferred plant parts for medicinal use are root, stem, and rhizome. They also are described as believing that different parts of the same plant can have different efficacy in the same treatment (Hu et al., 2020).

4.5 | Preparation methods

Decoction for oral ingestion is a common medicinal preparation method among Thai rural people and ethnic groups (Phumthum et al., 2018). The Mien villages in this study provided interesting information about a unique preparation method: making chicken soup. Many uses of this medicinal preparation method were related to women's healthcare, particularly after giving birth. The Hmong ethnic group also has incorporated various medicinal plants into their chicken soup (Nguanchoo et al., 2014). However, what set the Mien chicken soup apart in this study was the addition to the soup of yeast-fermented rice, known as Kao Mak. On a global scale, chicken soup is commonly used as a comfort food for people who are ill (Teeman, 2023).

5 | CONCLUSION

The Mien traditional knowledge of medicinal plants reported here represents a full system in terms of the diversity of plants used and the completeness of the medicinal categories of treatment. The findings also demonstrate an extensive knowledge about many methods for preparing plants and determining routes of administration. The Mien used all parts of plants but preferred entire plants as medicine. This study adds a piece to the jigsaw puzzle that bridges the transition of knowledge from China, where the Mien originated, to the latest settlement in Thailand. The medicinal categories most treated by the Thai Mien were related to women's health conditions. The Thai Mien tended to prepare medicine usually by simply boiling the plant material in hot water for oral ingestion. An interesting finding was that although decoction was the most common preparation technique, the Mien in this study usually put Kao Mak (sweet fermented rice) in medicinal recipes for treating symptoms related to women's health.

Although this study relied on standard ethnobotanical methods for the observations, the number of medicinal plant species documented was lower than has been reported in previous studies of other Mien communities and related ethnic groups in Thailand. This difference suggests that traditional knowledge in the study areas may be deteriorating. The development of a nearby urbanising subdistrict could be a main driver, but conditions that are beyond the scope of this study need to be investigated for confirmation to address concerns about the rapid erosion of traditional Mien knowledge in this region. This study also highlights the uniqueness of traditional knowledge about using medicinal plants among Mien communities that share natural resources. The findings about medicinal plant use in these three Mien villages highlight a highly localised knowledge tradition for each village despite a shared ethnic background and natural environment. The number of medicinal plants recorded in this study emphasised the decline of traditional knowledge on using medicinal plants, which is occurring in most parts of the world. Results from many other studies support the importance of traditional uses of medicinal plants for women's health conditions, particularly some complex symptoms affecting older women in ageing lives. Further studies are encouraged to be conducted in not only the Mien's populations along the migration route from China, Vietnam, Laos PDR to northern Thailand but also in various other parts of the world, especially where women find it unaffordable and difficult to access modern health services and products. Continuous projects on the application of scientific knowledge for sustainability and safety of traditional uses are strongly suggested. Overall, traditional knowledge of plant medicines plays a vital role in maintaining human–nature relations that connect local cultural practices to local ecosystems and their stewardship.

AUTHOR CONTRIBUTIONS

Methee Phumthum, Varangrat Nguanchoo, and Henrik Balslev conceived the idea. Methee Phumthum and Varangrat Nguanchoo collected data, analysed data, wrote the manuscript, and edited the manuscript. Henrik Balslev and Angkhana Inta wrote and edited the manuscript and supervised the study. Methee Phumthum and Henrik Balslev held research grants.

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CONFLICT OF INTEREST STATEMENT

The authors declare that there are no conflicts of interest.

DATA AVAILABILITY STATEMENT

This study does not include any data.

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SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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