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A comparative study on medicinal plants used in Akha's traditional medicine in China and Thailand, cultural coherence or ecological divergence?

Angkhana Inta [a,*], Pei Shengji [b], Henrik Balslev [c], Prasit Wangpakapattanawong [a], Chusie Trisonthi [a]

[a] *Department of Biology, Faculty of Science, Chiang Mai University, Huaykaew Road, Chiang Mai 50200, Thailand*
[b] *Department of Ethnobotany, Kunming Institute of Botany, Chinese Academy of Sciences, Kunming 650204, China*
[c] *Department of Biological Sciences, University of Aarhus, Building 1540, Ny Munkegade, DK-8000 Aarhus C, Denmark*

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Abstract

Aim of the study: : The survey aims to study the effect of geographic separation of ethnic groups on local knowledge of medicinal plants used by Akha people in Thailand and China, who were separated 100–120 years ago, to see how different the two geographically distinct but culturally similar groups were in this respect.
Materials and methods: : Interviewing 10 villagers in each of five Akha villages, three in Thailand and two in China, about which plants they used and how they used them.
Results: : A total of 95 medicinal plants registered in the five villages only 16 were shared between China and Thailand. Otherwise the use patterns were quite similar with respect to which plant families and plant growth forms were used and also in terms of in which habitats the Akha found their medicinal plants.
Conclusions: : The moving to a different site has forced the Akha to find a new set of species, but that when using these new species they have maintained other traditions relating to medicinal plants.

Keywords: Aini; Hani; Hill tribe; Xishuangbanna; Chiang Rai

1. Introduction

We look into how splitting of ethnic groups followed by migrations affect their knowledge of natural resources. In particular we investigate how local knowledge of medicinal plants vary between five Akha villages in southern China and northern Thailand that were separated due to migrations that occurred 100–120 years ago. The forested mountains of Southeast Asia and southern China have for centuries been inhabited by ethnic groups that migrated into the area from other parts of Asia. These groups, though culturally diverse, share a number of socio-cultural characteristics. Their traditional subsistence economy is based on slash and burn agriculture, husbandry, hunting and gathering, and various forms of forestry. One of those groups, the Akha, spread over a territory that covers parts of present day Myanmar, Laos, Thailand, Vietnam and China, and currently the largest group of Akha, counting some 156,000 people, lives in the Yunnan province of China, whereas the Thai Akha population is less than half that size, or ca. 69,000 people (He et al., 2000; Henin, 1996; Janet, 2004; Toyota, 2003; Tribal Research Institute, 1995). Because of political problems, wars, economic instability, and other social pressures some Akha from Myanmar migrated to northern Thailand in 1887, and in the beginning of the twentieth century a group of Akha from Xishuangbanna in southwestern Yunnan, China, migrated to the same region, especially to Thailand's Chiang Rai province (Anderson, 1993; Hanks and Hanks, 1975; Henin, 1996; Trisonthi and Trisonthi, 1999).

The Akha live on steep mountain ridges and in deep valleys, mostly in villages established halfway or more up the mountain sides, and usually between 1000 and 1500 m above sea level (Anderson, 1993; Qibo, 2003; Rerkasem, 2003). They were formerly shifting cultivators and now they grow upland rice, a variety of fruits, and rubber trees on the mountain sides. The Akha continue to use plants from the forests for their subsistence, especially for food and medicine (Anderson, 1993; Shengji,

* Corresponding author. Tel.: +66 5394 3346/1234; fax: +66 5389 2259.
E-mail address: aungkanainta@hotmail.com (A. Inta).

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1985; Trisonthi and Trisonthi, 1999). Most Akha villagers maintain some traditional knowledge of medicinal plants that they use for first aid remedies, to treat cough, cold, fever, poisonous bites and some simple ailments but most of the traditional knowledge of medicinal plants rest with the healers. This traditional knowledge has been transmitted from one generation to the next by spoken words and lifestyle, even if elderly Akha with knowledge of plant medicine often complain that it is difficult to find younger people who want to apprentice themselves (Anderson, 1993). Akha's knowledge of traditional medicinal plants may therefore be decreasing, and this may be true for the Akhas in both China and in Thailand. Nevertheless, Akha from China who migrated to Thailand have practiced and still maintain substantial amounts of cultural and traditional knowledge (Anderson, 1993). The Akha in China and Thailand have lived under different community structures, and economic and political reforms and development opportunities have not been the same for Akhas living in the two places (Henin, 1996). Moreover, the natural resources they have access to are different. It is therefore interesting to compare the Akha traditional knowledge and their use of natural resources and whether any differences can be found between Akha communities in China and in Thailand in this respect. This relates to fundamental anthropological questions such as whether peoples' relationship and use of the natural resources that surrounds them is culturally bound or whether it is a reflection of the ecological conditions under which they live. If peoples' use of natural resources is culturally bound, one would expect little difference in plant uses between geographically separated but culturally identical groups of people—this would imply that traditional knowledge evolved and was maintained by cultural coherence. If – on the other hand – peoples' use of natural resources is determined by ecological factors one would expect larger differences between groups of the same culture living geographically separated and therefore presumably under different ecological conditions—this would imply that traditional knowledge evolved and was maintained by ecological divergence.

Here we document traditional botanical knowledge of medicinal plants in five Akha villages, two in Xishuangbanna, China and three in Chiang Rai, Thailand that have been separated by migrations over the past 100–120 years. We also compare growth form, habitat, plant family, route of administration and method of preparation of the medicinal plants to determine differences and similarities between the two medicinal plant traditions. We made a quantitative comparison of medicinal plant knowledge between Chinese and the Thai Akha communities to see how similar or different they were, and we discuss our observations in the light of cultural coherence versus ecological divergence of local knowledge.

2. Methodology

2.1. Study area

We studied two Akha communities in Xishuangbanna, southwestern Yunnan, China, which border Laos and Myanmar

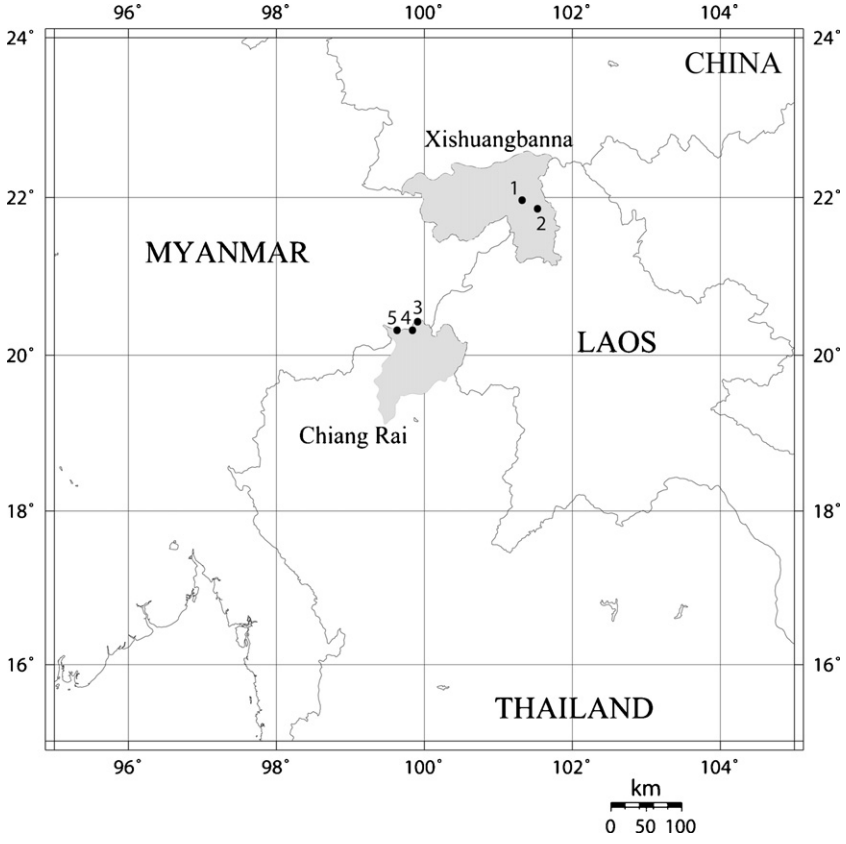

Fig. 1. Map of study areas (1, Hong Mou Shu; 2, Taka Lojek; 3, Phamee; 4, Phahee; 5, Lisa).

(21°09′–22°33′N, 99°58′–101°50′E) (Fig. 1). This area, famous for its diverse flora and fauna and beautiful landscape, is inhabited by a diversity of ethnic tribes, including 14 minorities, principally Dai, Hani or Akha, Jinuo, Han, Yi, and Bulang. Akha (sometimes called Aini) in Xishuangbanna share similar culture, religion and languages with Akha in Laos, Myanmar, Thailand, and Vietnam (Anderson, 1993; He et al., 2000; Henin, 1996; Janet, 2004; Qibo, 2003; Toyota, 2003; Zhang and Cao, 1995). The two Akha villages, Taka Lojek and Hong Mou Shu, are located in Meng Lun township of Mengla county, Xishuangbanna 540–980 and 1200 m above sea level and 12 and 75 km away from Meng Lun, respectively. These villages are surrounded by natural forests. There are 66 households 226 people in Taka Lojek and 41 households 142 people in Hong Mou Shu. Both villages have a primary school for children aged 7–11 years and a few children who continue their studies must do so in Meng Lun. Most of the villagers are farmers, and rice, especially non-glutinous, is their staple diet. Every family grows rice, which they supplement with maize, vegetables, and animal products for their diet. The villagers derive their main monetary income through the sales of tea, maize, rubber, and pork. In addition to the fields outside the villages, home gardens are commonly present in Hong Mou Shu and less so in Taka Lojek. The Akha are traditionally animists and show respect to their ancestors, especially during the Akha's New Year in December, but during the Cultural Revolution (1966–1976), many religious practices, cultural events, festivals, and ceremonies were abolished (Henin, 1996). As a result both villages lack the Akha sacred structures such as the gate and the swing and ancestor worship is rarely practiced but traditional healers maintain medicinal plant knowledge in both villages and Akha healers collect plants from the forests for medicine preparation. Most Akha villagers prefer to be treated by the local healers when they are sick.

For comparison we studied three Akha communities in Chiang Rai in northern Thailand (19°54′–20°30′N, 99°49′–100°45′E). Several natural walls of high mountains that surround and separate this region from Myanmar and Laos, neighbors to the northwest and the northeast, are extensions of the Himalayas and some mountain ranges in the Chinese region of Yunnan. The Chiang Rai province contains Thailand's northernmost point at Mae Sai which is well known for its crisp mountain scenery, and ethnic tribes (Akha, Lahu, Mien, Karen, Lisu and Hmong). The most populous tribe in Chiang Rai is Akha (Tribal Research Institute, 1995). Three Akha villages in Mae Sai and Mae Fha Laung districts were selected for this study. Phamee, Phahee and Lisa are situated at 700, 1080 and 1300 m above sea level and 5, 13 and 20 km away from Mae Sai, respectively. The villages are surrounded by natural forests. There are 115 households and 449 people in Phamee, 87 households and 365 people in Phahee, and 44 households and 196 people in Lisa. Most villagers farm non-glutinous rice as their staple food which they supplement with vegetables and food plants gathered from the forests around their villages. These three villages lie within the Doi Tung Development Project which was launched in 1982 on the initiative of the late Royal Highness the Princess Mother of Thailand (Mogg, 2006). This project has supported the villagers and provided them with alternatives to opium poppy growing and slash and burn agriculture since 1989. Arabica coffee, macadamia, litchi and orange trees were introduced to these Akha villages as economic crops and most families now derive their main income through the sales of these fruits. Most of their houses have home gardens. Like their Chinese tribesmen, they are animists and show the respect to their ancestors, and keep an ancestral altar in their homes, at which food is offered at important times of the year such as Akha's New Year and after rice harvest. These Thai Akha still practice and maintain their cultural events, festival, ceremonies and costumes and during our field work we observed many sacred structures such as the gates and swings and traditional healers still function in all three villages. Villagers prefer to be treated by their local healers. The Akha healers collect medicinal plants from the forests for preparing the medicine and for planting in their home gardens. Each village has a primary school for children aged 7–11 years and as in the Chinese Akha villages children who wish to continue their studies beyond that must travel to the nearest city.

2.2. Ethnobotanical field survey methods employed for data gathering, information and voucher collections

Field surveys were made on several visits between 2004 and 2006 during which ethnobotanical data were collected through interviews and discussions with ten villagers aged 25–75 years who had at least some traditional knowledge of plants in each of the five villages. In addition to the vernacular names questions were asked about each medicinal plant prescribed, such as which part of plant was used, which mode of preparation (*i.e.*, decoction, hot infusion, pounded, *etc.*) was used, and which medicinal conditions (*i.e.*, poultices, teas, bath, *etc.*) were treated. Each time a plant was mentioned as used was considered a single "use record" (Treyvaud Amiguet et al., 2005). For example, if plant A was used to treat fever, a single use record would be noted; however, if plant A was used to treat both fever and diarrhea, two use records would be noted, and so on. Mentions were then divided into use categories following Cook (1995). The used plants were identified (local name), photographed and samples were collected for preparation of herbarium specimens which were deposited the herbarium of Ethnobotanical Research Unit, Department of Biology, Faculty of Science, Chiang Mai University and Queen Sirikit Botanical Garden Herbarium (QBG), Chiang Mai, Thailand.

2.3. Herbarium botanical identification

The used plants were identified taxonomically using *The Flora of Thailand* and *The Flora of China*. The identifications were then confirmed in the herbarium of Queen Sirikit Botanical Garden Herbarium, Thailand and the herbarium of Xishuangbanna Tropical Botanical Garden (XTBG), China.

2.4. IAR method and a one-tail paired t-test to measure use value

We used Trotter and Logan's (1986) informant agreement ratio (IAR) which has been widely used in comparative ethnobotany (Collins et al., 2006; Heinrich et al., 1998; Leporatti and Ivancheva, 2003) to measure the agreement between informants concerning what plants are used for specific use categories:

$$\mathrm{IAR} = \frac{n_{\mathrm{ur}} - n_{\mathrm{t}}}{n_{\mathrm{ur}} - 1}$$

where n_{ur} is the number of mentions in each use category and n_{t} is the number of taxa used in each use category. IAR ranges from 0 to 1 and a value of 1 indicates that taxa are used by many informants, thus inferring a high degree of consensus and a well-defined medicinal plant tradition (Heinrich et al., 1998). For the purpose of this study, the taxon considered is species. IAR was calculated for each use category in each of the five studied Akha communities. It was assumed that the Akha medicinal plant traditions in the two communities would not have a different average IAR. A one-tailed paired *t*-test was used to determine if the average value of the IAR was significantly different between the Chinese Akha and Thai Akha communities.

2.5. Chi-square analysis

Number of growth forms, plant parts used, habitat, route of administration, and method of preparation mentioned were compared by using Chi-square analysis to determine whether these aspects of medicinal plant traditions varied between the communities studied.

3. Results and discussion

3.1. Numbers of species uses

In total, 95 medicinal plant species were recorded in the five Akha villages (Table 1), 60 in Xishuangbanna and 51 in Chiang Rai. Of the plants registered in Xishuangbanna, 53 were identified to species and 7 to genus, but all incompletely identified plants represented different species. Of the 51 plants registered in Chiang Rai all were identified to species.

3.2. Use records and use categories

A total of 224 and 164 use records were registered in Xishuangbanna and Chiang Rai, respectively (Table 2). We assumed that use categories with most use records were the most prevalent in the villages and also of greatest importance to the villagers. In the Chinese Akha communities the most important use category was Metabolic System Disorders, which accounted for slightly more than 19% of all use records, whereas Blood System Disorders (18%), Skin/Subcutaneous Cellular Tissue Disorders (15%), Digestive System Disorders (14%), and Injuries (13%) were also common. In the Thai Akha communities Injuries and Digestive System Disorders were the

Table 1
List of medicinal plants

Species (voucher no.)	Family	Akha name	Habit	Habitat	Parts used	Application	Method of preparation	Route of administration
Achyranthes aspera L. (INTA201)	Amaranthaceae	Mu nae	H	Fo	L	Wound	Po	Poultices
**Acorus calamus* L. (INTA007, 204)	Araceae	Cham poo	H	Hg	R	Colic	No	Oral
**Ageratum conyzoides* L (INTA013, 208)	Asteraceae	Mo na, La bue ya bae	H	Fo	L	Rashes, itching, coagulation	Po	Liniment
Alocasia esculenta L. (INTA008)	Araceae	Blue ma	H	Hg, Fi	Ex	Muscle relaxant	No	Liniment
Alocasia odora K. Koch (INTA009)	Araceae	Yueang na	H	Hg	L	Smallpox	Bu	Liniment
Aloe vera (L.) Burm.f. (INTA012)	Asphodelaceae	Wan	H	Hg	Ex	Boil, burn	No	Liniment
Amomum villosum Lour. (INTA257)	Zingiberaceae	Mae jae	H	Fi	R	Indigestion, carminative	De	Tea
Angiopteris caudatiformis Hier. (INTA203)	Marattiaceae	Ta ku	S	Fo	L	Wound	Po	Poultices
Angiopteris evecta (G.Forst.) Hoffm. (INTA231)	Marattiaceae	Ta pia ta la	S	Fo	L	Wound	Po	Poultices
Ardisia depressa C.B. Clarke (INTA234)	Myrsinaceae	-	T	Fo	L	Wound	Po	Poultices
Argyreia wallichii Choisy (INTA022)	Convolvulaceae	Ar ya ar choei	C	Fo	Un	Lactation stimulant	De	Tea
Arundina graminifolia (D.Don) Hochr. (INTA033)	Orchidaceae	Ti chue ti chue	H	Hg	R	Whooping cough	De	Tea
**Asclepias curassavica* L. (INTA011, 205)	Asclepiadaceae	Chae bu chae ta, Chae bu	S	Hg	L	Rashes, itching, temperature regulation	Po and Hf	Liniment and tea
Asparagus filicinus Buch.-Ham. ex D.Don (INTA226)	Labiatae	Tian tong	C	Fo	R	Tonic	De	Tea

Table 1 (*Continued*)

Species (voucher no.)	Family	Akha name	Habit	Habitat	Parts used	Application	Method of preparation	Route of administration
**Blumea balsamifera* DC. (INTA002, 209)	Asteraceae	Ping ping to, Hor sa la ma	S	Fo	L	Fever, urinary tract infection, ophthalmia, temperature regulation	Bu and Hf	Bath, liniment, tea and put over vagina
Caesalpinia sappan L. (INTA021)	Ceasalpiniaceae	Yae	T	Fo	L	Itching, internal breeding	Po	Liniment
Callicarpa giraldii Hesse ex Rehder (INTA027)	Labiatae	Ue jue nue ma	T	Hg	Un	Cancer	De	Tea
Canarium album Raeusch. (INTA213)	Burseraceae	Si mor	T	Fo	Infr	Temperature regulation	Po and Hf	Tea
Centella asiatica (L.) Urb. (INTA040)	Umbelliferae	Duck kung	H	Hg	Un	Rashes, fractures	Po	Liniment and poultices
**Chormolaena odoratum* (L.) R.M.King & H.Rob. (INTA014, 207)	Asteraceae	Mo to ka la, Mor kor mor na	S	Fo	L	Coagulation	Po	Poultices
Tetrastigma sp. (INTA256)	Vitaceae	Ya ko la ma	C	Fo	L	Rashes	Po	Liniment
Clausena excavata Burm.f. (INTA244)	Rutaceae	Ha kee mee chae	T	Fo	L	Temperature regulation	Hf	Tea
Clerodendrum colebrookianum Walp. (INTA255)	Verbenaceae	Yae pu	S	Fo	L	Fractures	Bu	Poultices
Clerodendrum serratum Moon (INTA042)	Verbenaceae	Lob yung	S	Fo	St	Cancer	De	Tea
Clerodendrum thomsoniae Balf. (INTA043)	Verbenaceae	Ya new	S	Hg	Un	Urethral stones	De	Tea
**Clerodendrum viscosum* Vent. (INTA044)	Verbenaceae	Kam dat si	S	Fo	L	Urinary tract infection	Bu	Put over vagina
Conyza canadensis (L.) Cronquist (INTA206)	Asteraceae	Hao chee	H	Fo	L	Coagulation, temperature regulation, cat bite	Po and Hf	Liniment and tea
Costus speciosus Sm. (INTA046)	Zingiberaceae	Me je kor ye	H	Fo	R	Colic	De	Tea
Crateva religiosa G.Forst. (INTA214)	Capparaceae	Pak ku lu	T	Hg	L	Fractures	Bu	Poultices
Curcuma caesia Roxb. (INTA258)	Zingiberaceae	Mae jae	H	Hg	R	Colic	No	Oral
Curcuma longa L. (INTA047)	Zingiberaceae	Ma jue chue	H	Hg	R	Carminative, indigestion	No	Oral
**Dendrophthoe pentandra* (L.) Miq. (INTA050, 227)	Loranthaceae	Ter rue, Ter rue a pae	P	Hg	L and Un	Fractures, rheumatoid arthritis	Po and De	Poultices and tea
Diospyros sp. (INTA260)	Ebenaceae	Blue mee	T	Fo	L	Colic	Hf	Tea
Drymaria diandra Blume (INTA020)	Caryophyllaceae	Ta kum yu	H	Fo	L	Fever	Po	Poultices
**Elephantopus scaber* L. (INTA015, 212)	Asteraceae	Poy ja, Are ker are nga ya mu	H	Fo	R	Cough, tonic	De	Tea
Elsholtzia winitiana Craib (INTA028)	Labiatae	Hgu shee	S	Hg	L	Cancer, food poisoning, dog bite	De and Po	Tea and poultices
Euodia lepta (Spreng.) Merr. (INTA245)	Rutaceae	Cha cha ye	S	Fo	L	Sore throat, alcohol intoxication, wound	Hf and Bu	Tea and poultices
Eupatorium adenophorum Spreng. (INTA211)	Asteraceae	Ba bu	H	Hg	L	Coagulation	Pd	Poultices
Euphorbia pulcherrima Willd. ex Klotzsch (INTA024)	Euphorbiaceae	A bun nee	S	Hg	Ex	Rashes, itching	No	Liniment
Pedilanthus tithymaloides (L.) Poit. (INTA216)	Euphorbiaceae	Pa ter	H	Hg	L	Wound	Po	Poultices
Eurya acuminata DC. (INTA261)	Theaceae	Blue su	S	Fo	L	Diarrhea	Hf	Tea
Gardenia jasminoides Ellis (INTA035)	Rubiaceae	Lo ma	S	Hg	R	Colic	De	Tea
Helianthus annuus L. (INTA016)	Asteraceae	Nue mun nue ngu	H	Fi	St	Cancer	De	Tea
**Hydrocotyle javanica* Thunb. (INTA041)	Umbelliferae	Duck kung	H	Hg	L	Rashes	Po	Liniment
Illicium verum Hook.f. (not collected)	Illiciaceae	Ba ko	T	Fo	Infr	Sore teeth	No	Cooked with chicken
Psychotria calocarpa Kurz (INTA239)	Rubiaceae	Che tu	S	Fo	L	Internal bleeding	Po	Poultices

Table 1 (*Continued*)

Species (voucher no.)	Family	Akha name	Habit	Habitat	Parts used	Application	Method of preparation	Route of administration
Impatiens balsamina L. (INTA018)	Balsaminaceae	Khue ki ka ne	H	Hg	Un	Birth	De	Tea
**Imperata cylindrica* P.Beauv. (INTA025, 220)	Graminae	Ou ji, Ou ja are um	H	Fo	L and R	Coagulation, colic	Po and De	Poultices and tea
Jasminum sootepense Craib (INTA032)	Oleaceae	A ji ji chue	C	Fo	St and R	Cancer	De	Tea
Jatropha curcas L. (INTA218)	Euphorbiaceae	Tong yo	S	Hg, Fi	L	Fractures	Bu	Poultices
Kaempferia galanga L. (INTA048)	Zingiberaceae	Mae kong	H	Hg	R	Weight loss	De	Tea
**Kalanchoe pinnata* (Lam.) Pers. (INTA023, 216)	Crassulaceae	Me ja lung, Pa ter	H	Hg	L	Burn, wound	Po	Liniment and poultices
Laggera pterodonta Sch. Bip.ex Oliver (INTA210)	Asteraceae	Kor sa pa meaw	H	Fo	L	Rashes, temperature regulation	Po and Hf	Liniment and tea
Leucas ciliate Benth. (INTA223)	Labiatae	Pia kor ya mu	H	Fo	Un	Rheumatoid arthritis	De	Tea
Lobelia nicotianaefolia Heyne (INTA019)	Campanulaceae	Do yo	S	Hg	L	Wound	Dr and Po	Poultices
Lycopodium cernuum L. (INTA228)	Lycopodiaceae	Ta piak	C	Fo	L	Migraines	Po	Poultices
Maesa indica Wall. (INTA235)	Myrsinaceae	Are mue kee sung	S	Fo	L	Colic, temperature regulation	Hf and No	Tea and oral
Manihot esculenta Crantz (not collected)	Euphorbiaceae	La pi	S	Fi	L	Fractures	Bu	Poultices
Melastoma polyanthum Blume (INTA232)	Melastomataceae	Bu bae la nga	S	Fo	L and R	Diarrhea	De and Hf	Tea
Mentha cordifolia Opiz ex Fresen. (INTA029)	Labiatae	Are jee po to	H	Hg	L	Stroke	Po	Smell
Mentha haplocalyx Briq. (INTA224)	Labiatae	Are jee jee daw daw sa	H	Fo	L	Colic	Po	Poultices
Mussaenda hossei Craib in Hosseus (INTA242)	Rubiaceae	Pee ya ni ti	S	Fo	L	Temperature regulation, rashes	Hf and Po	Tea and liniment
Mussaenda sanderiana Ridl. (INTA036)	Rubiaceae	Nue si ya	S	Fo	St	Sore throat	De	Tea
Nicotiana tabacum L. (INTA038)	Solanaceae	Ya kho	H	Hg, Fi	L	Sore teeth	No	Cooked with chicken
Oryza sativa L. (INTA221)	Graminae	Lor cha	H	Hg, Fi	L	Colic	Hf	Tea
**Paederia scandens* (Lour.) Merr. (INTA051, 243)	Rubiaceae	A kue chi nee, E khow pu tung	C	Fo	L	Sprains, wound	Bu and Po	Poultices
Pavetta sp. (INTA240)	Rubiaceae	Lung nae a mi pa pa	S	Fo	R	Fever	De	Tea
Perilla frutescens (L.) Britton (INTA225)	Labiatae	Jue chum	H	Hg, Fi	L	Temperature regulation	Hf	Tea
Peristrophe lanceolaria Nees (INTA001)	Acanthaceae	Me are ka	S	Hg	L	Smallpox, rashes, fever	Bu and Po	Liniment and poultices
Phyllanthus amarus Schumach. & Thonn. (INTA217)	Euphorbiaceae	Yu jae	H	Fo	Un	Rashes, itching	Po	Poultices
Phytolacca americana L. (INTA237)	Phytolaccaceae	Bu yaw	S	Fi	R	Anaemia	Cc	Oral
Plantago major L. (INTA034)	Plantaginaceae	Poi ja	H	Fo	L	Wound	Dr and Po	Poultices
Elsholtzia blanda Benth. (INTA222)	Labiatae	-	H	Fo	L	Sprains	Po	Poultices
Polygonum chinense L. (INTA238)	Polygonaceae	Nae chee jae	H	Hg	R	Cough	De	Tea
Pothos scandens L. (INTA010)	Araceae	-	E	Fo	Un	Cancer	De	Tea
Psidium guajava L. (INTA031)	Myrtaceae	Tem ma	T	Hg	L	Diarrhea	No	Oral
Rauvolfia serpentina Benth. ex Kurz (INTA005)	Apocynaceae	-	S	Hg	R	Fever	De	Tea
Rhus chinensis Mill. var.*chinensis* (Mill.) T.Yamaz. (INTA003)	Anacardiaceae	Si ma	T	Fo	Infr	Detergent for skin	Cf	Bath
Sambucus chinensis Lindl. (INTA246)	Caprifoliaceae	Akha ka wu	S	Fo	L	Rheumatoid arthritis	Po	Poultices

Table 1 (*Continued*)

Species (voucher no.)	Family	Akha name	Habit	Habitat	Parts used	Application	Method of preparation	Route of administration
Saurauia roxburghii Wall. (INTA200)	Actinidiaceae	A yum num bae	T	Fo	R	Indigestion	De	Tea
Schima wallichii Choisy (INTA039)	Theaceae	Si sa	T	Fo	B	Cancer	De	Tea
Sida acuta Burm.f. (INTA230)	Malvaceae	Ko pi ko tue	S	Fo	L	Rashes	Po	Liniment
Solanum nigrum L. (INTA248)	Solanaceae	Haw lui Haw lui pu ta	H	Hg, Fi	Infr	Sore throat	De	Tea
Solanum spirale Roxb. (INTA249)	Solanaceae	Ya kaw chi li	H	Hg, Fi	L	Temperature regulation	Hf	Tea
Solanum torvum Sw. (INTA037)	Solanaceae	Si kha la go	H	Hg, Fi	St and R	Intoxication due to drugs	De	Tea
Stemona tuberosa Lour. (INTA250)	Stemonaceae	Ta tian tom	C	Fo	R	Tonic, fracture	Cp and Po	Oral and poultices
Stephania glandulifera Miers (INTA030)	Menispermaceae	Khi ni lo bae	C	Hg	Un	Smallpox	De	Tea
**Sterculia laevis* Wall. (INTA052)	Sterculiaceae	Ko na ko chi	C	Fo	Un	Tonic	De	Tea
Tagetes erecta L. (INTA017)	Asteraceae	Rod do	H	Hg	L	Rashes, itching	Po	Liniment
**Thunbergia laurifolia* Lindl. (INTA251, 253)	Acanthaceae	Kue dong na nga, Are kue chi nee	C	Fo	L	Snake bites	Po	Poultices
Toddalia asiatica Lam. (INTA262)	Rutaceae	Lab phe lab song	C	Fo	L	Sore throat, temperature regulation	Hf	Tea
Torenia fournieri Linden ex Fourn. (INTA247)	Scrophulariaceae	La chon chon tu	H	Fo	Un	Fever	De	Tea
Urena lobata L. (INTA229)	Malvaceae	Jue ka jue to yu sa	S	Fo	L, R and Infl	Rashes, wound, food poisoning	Po and De	Liniment, poultices and tea
**Verbena officinalis* L. (INTA045, 253)	Verbenaceae	Ya mu mor kao, Are lu ta pia	H	Hg	L	Colic, cough, temperature regulation	De and Hf	Tea
**Zingiber montanum* Link ex A.Dietr. (INTA049, 259)	Zingiberaceae	Mae jae	H	Hg	R	Fractures	Bu	Poultices

Medicinal plants used in two Chines (Chinese) Akha villages in Xishuangbanna and three Thai Akha villages in Chiang Rai. For each species a voucher specimen is deposited the herbarium of Ethnobotanical Research Unit, Department of Biology, Faculty of Science, Chiang Mai University and Queen Sirikit Botanic Garden Herbarium, Chiang Mai, Thailand. Vouchers numbered 001–052 are from Chiang Rai, Thailand, and vouchers numbered 200–262 are from Xishuangbanna, China. Species recorded in both Xishuangbanna and Chiang Rai are marked with a *. Habit: T, tree; S, shrub; H, herb; C, climber; E, epiphyte; P, parasite. Habitat: Fo, forest; Hg, home garden; Fi, field. Parts used: L, leaf; R, root; Infl, inflorescence; Infr, infructescence; Ex, exudates; B, bark; St, stem; Uns, unspecific aerial parts. Way of preparation: Pd, pounded; Hf, hot infusion; Bu, burned; Cf, cold infusion; De, decoction; N, none; Cc, cooked with chicken; Cp, cooked with pig heart; Dr, dried.

most important use categories and each accounted for 22% of the use records whereas Skin/Subcutaneous Cellular Tissue Disorders (15%) and Infections/Infestations (9%) were also common. Through these use categories, the five ailments that were most commonly mentioned in the Chinese Akha communities were temperature regulation, coagulation, wound, rash and colic while in the Thai Akha communities the five most commonly mentioned ailments are wounds, sore teeth, coagulation, diarrhea, and fever. This shows that many Akha in all the studied communities mention medicinal plants for the treatment of common ailments, especially to induce coagulation and to treat wounds which is similar to what Anderson (1993) found in a study of the ethnobotany of the hill tribes of the Golden Triangle. However, medicinal plants mentioned as useful to temperature regulation were for preventing fevers and colds in the Akha communities of Xishuangbanna were also used for tea on a daily basis and drunk when the consumer did not have fevers and colds. The medicinal plants mentioned as useful to treat sore teeth in the Akha communities of Chiang Rai were also used for chewing on a daily basis, when they did not have tooth problems, and hence they were used as preventive medicine.

3.3. Medicinal plant families

Among the Chinese Akha, the most commonly used plant families were Asteraceae (23%), Euphorbiaceae (9%) and Rutaceae (6%) and in Thailand they were Asteraceae (17%), Solanaceae (7%) and Zingiberaceae (7%). We used contingency tables to determine differences or similarities in the importance of the plant families to which the medicinal plants belonged; however, almost all plant families had expected cell counts lower than four, which reduced the accuracy of computed p values from Chi-square analysis. A trend towards coincidence of the families used medicinally in the two regions is, nevertheless, apparent, not least exemplified by the Asteraceae which had the highest percentage of medicinal plant species in both regions.

Table 2
Number of species of medicinal plants recorded among two Akha communities in China and three in Thailand, separated per use category

Usage category	Chinese Akha	Thai Akha
(1) Blood System Disorders		
Anaemia	5	–
Coagulation	36	12
(2) Circulatory System Disorders		
Strokes	–	1
(3) Digestive System Disorders		
Carminative	5	2
Colic	17	2
Diarrhea	4	10
Indigestion	6	2
Sore teeth	–	20
(4) Genitourinary System Disorders		
Urethral stones	–	1
Urinary tract infection	3	4
(5) Inflammation		
Ophthalmia	1	–
Sore throat	11	1
(6) Infections/Infestations		
Fever	4	9
Food poisoning	–	1
Smallpox	–	3
Whooping cough	–	2
(7) Injuries		
Bites (non-venomous)	1	1
Burn	–	8
Internal breeding	3	1
Wound	26	26
(8) Metabolic System Disorders		
Temperature regulation	42	–
(9) Muscular–Skeletal System Disorders		
Fractures	9	2
Muscle relaxant	–	2
Rheumatoid arthritis	2	2
Sprains	2	5
(10) Neoplasms		
Cancers	–	6
(11) Nervous System Disorders		
Migraines	2	–
	(12) *Nutritional Disorders*	
Tonic	6	2
Weight loss	–	2
(13) Poisonings		
Alcohol intoxication	4	–
Intoxication due to drugs	–	1
Snake bites	1	1
(14) Pregnancy/Birth/Puerperium Disorders		
Birth	–	1
Lactation stimulant	–	6
(15) Respiratory System Disorders		
Cough	1	4
(16) Skin/Subcutaneous Cellular Tissue Disorders		
Boils	–	5
Detergent	–	6
Itching	12	6
Rash	21	7

Use categories follow Cook (1995).

3.4. Overlap in medicinal plant species between Chinese and Thai Akha

Only 16 of the 95 medicinal plant species recorded were used in the both the Chinese and the Thai Akha communities which is a clear indication of that, regardless of any other similarities in use patterns of medicinal plants, such uses are based on very different sets of plant species, supporting the ecological diversification hypothesis.

3.5. Preparation of medicinal plants

The way medicinal plants are prepared in the Chinese and Thai Akha communities are somewhat different. The most common ways of preparation in the Chinese Akha communities are pounded (36%), hot infusion (22%) and decoction (21%) whereas in the Thai Akha communities it is decoction (42%), pounded (31%) and no preparation (13%).

3.6. Plant parts used for medicine

Leaves are the most commonly used plant part in both study areas which accounted for 54%. However, Thai Akha had a more diverse use of plant parts which included infructescences, exudates, bark and stem, which were absent in the medical tradition registered among the Chinese Akha.

3.7. Intake of medicinal plants

The routes of applications are consistently similar among Chinese and Thai Akha with teas accounting for 44% and 41% and poultices accounting for 37% and 22%, respectively. Similarly Anderson (1993) found the main type of application to be as teas.

3.8. Life forms of medicinal plants

The percentages of medicinal plant life forms between the two areas are also very similar, the most common ones being herbs which accounted 38% and 48% and shrubs which accounted 36% and 25%, respectively.

3.9. Medicinal plant habitats

Chinese and Thai Akha collected their medicinal plants with different frequencies in different habitats. In China 39% of the

Table 3
Differences and similarities in medicinal plant tradition between Chinese and Thai Akha

Mention category	Degree of freedom	χ^2 test statistic	p value
Method of preparation	8	22.39	0.0043*
Medicinal applications	6	8.65	0.1939
Plant part used	7	23.67	0.0013*
Habitat	2	6.77	0.0339*
Habit	5	3.37	0.6429

* p value is significant.

Table 4
Comparison of medicinal plant use in Chinese and Thai Akha communities

Usage category	Number of taxa		Number of use-mentions		Informant agreement ratio (IAR)	
	Chinese Akha	Thai Akha	Chinese Akha	Thai Akha	IAR-Chinese	IAR-Thai
Blood System Disorders	6	3	41	12	0.875	0.818
Skin/Subcutaneous Cellular Tissue Disorders	8	14	33	24	0.781	0.435
Poisonings	2	2	5	2	0.750	0.000
Metabolic System Disorders	12	-	42	–	0.732	N/A[a]
Inflammation	4	1	12	1	0.727	UND[b]
Digestive System Disorders	11	9	32	36	0.677	0.771
Injuries	11	7	30	36	0.655	0.829
Genitourinary System Disorders	2	3	3	5	0.500	0.500
Nutritional Disorders	4	2	6	4	0.400	0.667
Infections/Infestations	3	9	4	15	0.333	0.429
Muscular–Skeletal System Disorders	11	5	13	11	0.167	0.600
Respiratory System Disorders	1	2	1	4	UND	0.667
Circulatory System Disorders	–	1	–	1	N/A	UND
Pregnancy/Birth/Puerperium Disorders	–	2	–	7	N/A	0.833
Neoplasms	–	6	–	6	N/A	0.000
Nervous System Disorders	2	–	2	–	0.000	N/A

[a] Not applicable.
[b] Undefined.

Table 5
Results of a paired *t*-test comparing informant consensus values between Chinese and Thai Akha

	Chinese Akha	Thai Akha
Mean	0.5709	0.5609
Variance	0.0551	0.0683
Hypothesized mean difference	0	
Degree of freedom	8	
t Stat	0.0858	
$p(T \leq t)$ one-tailed	0.4669	
t Critical one-tailed	1.8595	

medicinal plants were collected in forest and 19% in home gardens, whereas the Thai preferably gathered their medicinal plants in home gardens (29%) and less commonly in forest (20%). However, the medicinal plants in their home gardens were also collected from the forest and planted for the treatment of common ailments in their daily life.

3.10. Overall comparison

Using Chi-square analysis, we determined that the number of use records in each of the methods of preparation, plant part used, and habitat of the medicinal plants varied significantly among the communities and the routes of administration and plant habit did not vary significantly among the communities (Table 3). The use categories with the highest consensus and also high mention of Akha communities in China was Blood System Disorders while the use categories with the highest consensus of Akha communities in Thailand was Pregnancy/Birth/Puerperium Disorders (Table 4) although the mention of Pregnancy/Birth/Puerperium Disorders was very low. A one-tailed paired t-test was used to determine if the average "informant agreement ratio" for Akha communities in China was not significantly greater than that for Akha communities in Thailand (Table 5). Collins et al. (2006) used the same method for analyzing, several use categories with undefined "informant agreement ratio" were not included in the calculation of the *p* value for the paired *t*-test. This was done because it is not possible to use undefined values statistically. Our study chose not to use them in the *p* value calculation as it would significantly distort the findings. Furthermore, the use categories Metabolic System Disorders, Circulatory System Disorders, Pregnancy/Birth/Puerperium Disorders, Neoplasms, and Nervous System Disorders were not included as they were not applicable in the studied Akha communities in China and Thailand. The null hypothesis that the average IAR (informant agreement ratio) for China is not significantly greater than that for Thailand was accepted meaning that IAR is not different between the studied Akha communities in China and Thailand. Therefore, this finding indicates that the medicinal plant tradition is the same in the two areas.

4. Conclusion

Both Chinese and Thai Akha still use traditional plant medicines in their daily lives. Although they are under the different societal influences and live under somewhat different natural conditions, most of the traditional medicinal plant knowledge is similar between the two groups and in both places traditional plant medicine is used for treating basic ailments. There

are some differences. For instance, the Chinese Akha use plant medicines for hyperthermia and hypothermia regulation which is not the case among the Thai Akha; this may be an influence from the Chinese Akha foods which is similar to traditional Chinese foods concept, in which the function of food resembles Chinese medicine related to the negative (Yin) and the positive (Yang). According to this theory, foods have either positive or negative properties which must be combined to let the human body reach harmony of the positive and the negative such as hot and cold (Li et al., 2004; Sakatani, 2007). The plant species used were also quite different; of the 95 species recorded in the five villages only 16 were shared between Chinese and Thai Akha villages, and of those only 12 had similar uses between the Chinese and Thai Akha healers. This suggests a strong influence of the environment on the traditional Akha plant medicine. The Information Agreement Ratios (IARs) were similar in the Chinese and Thai Akha villages, suggesting the Akha must have brought with them a strong cultural tradition from China (cultural coherence), but they have had to apply their knowledge using a different set of species (ecological divergence).

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