Research paper

Ethnobotany and diversity of medicinal plants used by the Buyi in eastern Yunnan, China

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Abstract

The Buyi are a socio-linguistic group in Yunnan Province of southwest China that have a long history of using medicinal plants as part of their indigenous medical system. Given the limited written documentation of the Buyi indigenous medical system, the objective of this paper is to document the medicinal plants of the Buyi and associated traditional knowledge and transmission. Field research was conducted in four villages in Lubuge Township of Luoping County in Yunnan Province using ethnobotanical methodologies including participatory observation, semi-structured interviews, key informant interviews, and focus group discussions to elicit information on medicinal plants. In total, 120 informants (including 15 key informants who are healers) were interviewed. This study found that a total of 121 medicinal plant species belonging to 64 families are used by the Buyi including by local healers to treat different diseases. Among the medicinal plants recorded in this study, 56 species (46%) have not previously been documented in the scientific literature as having medicinal value, highlighting the pressing need for ethnobotanical documentation in indigenous communities. The most frequently used medicinal part was the leaf (24.9% of documented plants), and the most common preparation method was decoction (62.8% of medicinal). Medicinal plants were mainly used to treat rheumatism (12.4% of plants), trauma and injuries (9.6%). The documented plants are also used for other non-medicinal purposes including food, fodder, fencing, and ornamental. In addition, 35 of the medicinal plants are considered poisonous and are used by local Buyi healers for medicine. The traditional Buyi beliefs and practices associated with the documented medicinal plants likely contributes to their conservation in the environments and around Buyi communities. This study further highlights that ethnomedicinal knowledge of the Buyi is at risk of disappearing due to increased introduction and use of modern medicine in Buyi communities, livelihood changes, rapid modernization, and urbanization. Research, policy, and community programs are urgently needed to conserve the biocultural diversity associated with the Buyi medical system including ethnobotanical knowledge towards supporting both environmental and human wellbeing.

1. Introduction

Plant resources are integral to human societies and have been used by different cultural groups for thousands of years for supporting wellbeing. Numerous cultural groups around the world continue to rely on plants as their primary means of healing and have developed their own medical systems based on unique theories, beliefs, and experiences (WHO, 2012). Indigenous and traditional medical systems are particularly widespread in...
The Buyi are indigenous inhabitants of southwestern China that have long relied on medicinal plants for disease prevention and treatment as well as overall wellbeing. The Buyi are one of the 55 recognized minority socio-linguistic groups in China and are the 11th most populous with a population of approximately 2.87 million (Population Census Office of Ministry of Population of China, 2010). The ancestors of the Buyi traditionally lived around the regions of the Nanpan, Beipan, and Hongshui Rivers. The association of the Buyi with rivers and mountainous areas has shaped their current living habits. For instance, the typical Buyi village is usually located in a mountainous area with a river nearby (Yu and Guo, 2018). The typical architectural style of the Buyi, called “gan lan” (stilt style), is designed with double floors with only the top floor for living for the purpose of avoiding moisture from nearby rivers, dangerous animals, and poisonous insects. The Buyi have had to overcome many natural challenges in order to survive in their traditionally small villages and high-altitude mountain and hilly river valleys. Over time, the Buyi have accumulated a large amount of indigenous knowledge of medicinal plants in their surroundings, which has helped to ensure their survival and the thriving of their communities. The Buyi ethnomedicinal system is comprised of unique theories and diagnostic methods, which are distinct from traditional Chinese medicine, Western medicine, and other ethnomedicinal systems (Liu and Xue, 2012).

The Buyi speak their own indigenous language, which belongs to the branch of Zhuang language family (Zhou, 2009). Their current written language was created in the 1950s as a combination of Latin and Pinyin systems (Zhou, 2009). The Buyi originated from one of the branches of the “bai yue” group, referred to as “lue yue” in China. The earliest literature regarding the Buyi dates back to the Han Dynasty (206BC–220AD). Since then, their name has been changed several times across different dynasties, including “pu yue”, “liao”, and “fan man”. The word “bu yi” was recorded in Chinese phonetically with “Bu” meaning ‘people’ or ‘linguistic group’. The Buyi people address themselves as “Yi” in a manner of respect (Editorial Committee of the Brief History of the Buyi People, 2008). The Buyi are mainly distributed in southwest China, including in Guizhou, Yunnan, and Sichuan provinces. More than 98% of the total population of Buyi people reside in Qinnan and Qianxinan prefectures of Guizhou Province. The remaining Buyi population is scattered in Luoping and Maguan counties of Yunnan, and in Ningnan County of Sichuan (Wang and Shang, 2009).

Several records about the medicinal plants used by the Buyi people have been compiled including the Checklist of Medicinal Herbs of Guizhou (Guizhou Institute of Traditional Chinese Medicine, 1988), Flora of China (Editorial Committee of Flora Reipublicae Popularis Sinicae, 2004), Buyi Medicine, and the Utilization of Buyi Medicinal Herbs of the Buyi People Inhabited Letters (Jia and Li, 2005). Furthermore, research has been carried out in several Buyi communities in Guizhou Province on the use of medicinal resources and documented 252 plants, 26 animals, and 11 minerals used for medicinal purposes (Pan et al., 2003). However, there remains limited documentation of the ethnomedicine of Buyi medicinal plants in Yunnan and Sichuan Provinces. As Buyi healers have traditionally collected medicinal plants from their surrounding fields, it is hypothesized that the medicinal plants and composition of medicinal plant prescriptions used by the Buyi in Yunnan and Sichuan Provinces differ significantly from those used in Guizhou Province due to variation in geography and certain cultural attributes.

The Buyi population in Luoping County of Yunnan Province is mainly concentrated in the Lubuge Buyi and Miao Autonomous Townships in a remote mountainous area with limited transportation, a distinct language, and extreme topographic variation. Consequently, the vegetation in and around Buyi communities in Yunnan is well preserved with high species diversity and a well forest coverage. The indigenous cultural practices of the Buyi are also well preserved in the remote communities in Luoping County.

Multicultural activities with other groups living around Buyi communities including the Miao, Yi, Bai, Hui, and Zhuang (Ju et al., 2013) are hypothesized to results in unique medical theories and medicinal plant uses by the Buyi communities living in Yunnan Province compared to those living in different geographic areas. Our previous ethnobotany studies indicate that the medicinal systems of the various indigenous people of Yunnan are vanishing due to habitat loss, influence from mainstream Chinese culture, development, and unsustainable resource utilization (Muthu et al., 2006; Li et al., 2006). Ethnobotanical research is urgently needed to investigate and document the medicinal system of Buyi communities in Yunnan Province in order to inform conservation efforts of biocultural diversity towards supporting both environmental and human wellbeing.

2. Material and methods

2.1. Buyi traditional culture

In general, one should be highly respected by the local people before becoming a healer in a Buyi community. For many local Buyi healers, healers do not ask for much money or goods from patients when they diagnose their patients’ diseases. The local Buyi healers do not buy medicinal materials from markets or pharmacy stores. Instead, they will go to the natural habitats to collect any medicinal materials they require for their practice. They prescribe medicinal recipes to patients as a gift, and they continue taking care of patients until they recover. If the patients’ health conditions continue getting worse, the healers will change their medicinal recipes (Cui and Tang, 2007).

The Buyi local healers believe in the “Jing, Qi and Xue”, three elements in Buyi ethnomedicine, which are a basic conceptual framework of the human body. When malfunction happens in these three elements, a patient’s body will get an illness. Additionally, they also believe that a human’s life is determined by the surrounding environmental conditions. If the environment has been damaged, one’s life will also been negatively impacted. The above-mentioned theories have been used as basic framework for treatment disease and medicinal prescribing.

During the long process of human—nature interactions, the Buyi people not only accumulated abundant traditional knowledge for the utilization and protection of the natural environment and its resources, but also they have established an environmentally friendly network, which is closely connected with animals and plants, geographic conditions, and local climates. These traditional cultural beliefs are rooted in their religious beliefs, routine practices, ritual rules, and social regulations.

Simultaneously, the local ecological environment has also been influenced directly or indirectly by the Buyi people’s traditional lifestyle, religious belief, and taboo. Here are two aspects:

(1) The richness and diversity of plants and animals might be broadly utilized in the traditional manufacturing process, such as textile, batik, brocade, embroidery, bamboo weaving, and carving.
(2) Buyi traditional customs and taboos call for more people to understand local biological resources and protect natural resources, so as to ultimately protect the composition, structure, and function of the ecosystem, stabilize the energy flow and material circulation, and improve the overall ecological function in terms of religious belief and worship.

The living condition of Buyi village is characterized by the surrounded mountains and rivers. Also, the Buyi village is also surrounded by towering ancient trees. Where there is a sacred tree, there is a mountain god. The Buyi people believe that the sacred tree cannot be cut down or destroyed at any time, otherwise disaster will occur. Therefore, the tree will survive and thrive for a long time.

2.2. Study area

Luoping County is located in Qujing Prefecture of Eastern Yunnan province in China at 103°57’-104°43’ E and 24°31’-25°25’ N, at the junction of Guizhou, Guangxi, and Yunnan provinces (Fig. 1). Altitudes in Luoping County range from 772 to 2468 m above sea level. Luoping is characterized by year-round precipitation, being located within one of the highest rainfall areas in Yunnan Province. Its climate is mainly dominated by plateau monsoon, with a mean annual temperature of 15.1 °C, mean annual rainfall 1743.9 mm, and annual average relative humidity 85%. There are several rivers in this region, including the Duoyi, Kuaize, Huangni and Nanpan Rivers. Two townships (Lubuge and Changdi) in this county are dominated by the Buyi people (Editorial Committee of Luoping County Annals, Luoping County Annals Assembly, 2014).

Based on our prior studies and field investigations, Lubuge Township is an cultural hotspot of Buyi people in Yunnan Province due to its well-preserved traditional practices and beliefs. For example, the Buyi people of this region still wear clothing linked to their cultural identity. Previous studies of the Buyi in Yunnan have mainly focused on the morals, ethics, culture, religion, literature, arts and economic development of this region (Zhu and Wang, 2008; Gao, 2001). However, there is a lack of detailed information concerning the use of medicinal plants by the Buyi of Yunnan. The objective of this study is to document medicinal plants used to prevent and treat diseases by Buyi communities in Luoping County as well as traditional methods of preparation based on the Buyi medicinal system.

2.3. Methods

Ethnobotanical research was conducted in four Buyi rural communities (Duoyi, Muna, Bantai and Badahe) in Lubuge Township of Yunnan Province between 2015 and 2017. We carried our semi-structured interviews with Buyi households and Buyi healers who served as key informants. In addition, we carried out community walks and plant collections. The interviews asked informants about their use of medicinal plants and consisted of the following questions adapted from previous ethnobotanical studies in the regions (Liu et al., 2014; Wang, 2014): (1) What plants in your community have been traditionally used for medicines? (2) Who in your household and community uses medicinal plants? (3) What season/time of the year do you collect medicinal plants? (4) How are each of these medicinal plants collected? (5) Where do medicinal plants grow in your community and surroundings? (6) How are medicinal plants processed and prepared for treating human and animal ailments? and (7) How do the Buyi people preserve medical technologies and associated cultural practices and traditional knowledge?

Fifteen healers from four villages were chosen as key informants. Another 105 informants were interviewed to gather information about local herbal medicinal knowledge, including experienced villagers, local healers, and herbal vendors. Information was recorded regarding the local names, medicinal parts, preparations, functional attributed, perceived toxicity levels, and other uses by Buyi informants. Voucher specimens of all documented plants through interviews were collected through community walks with Buyi healers and were examined to determine the species and botanical family using the Flora of China and the Subject Database of China Plant and Medicinal Plants of Yunnan Province (Jin, 2012; http://www.plant.csdb.cn; Wan, 2016). The voucher specimens were then deposited in the Herbarium at Kunming Institute of Botany of the Chinese Academy of Sciences. Findings were analyzed to tabulate the total number of medicinal plants belonging to different botanical families as well as the number of plants used to treat and prevent specific health conditions.

2.4. Data analysis

The data collected of medicinal plants in study area were collated into an inventory listing all the medicinal plants and related information. The use-value (UV) of each medicinal plant was calculated to evaluate the relative importance of each plant based on the number of times cited and the number of informants. The formula for UV is

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UV = \frac{S}{N} \times 100
\]

Where, \(S\) is the number of times cited by each informant for a certain medicinal plant, while N is the total number of informants (Sujarwo and Caneva, 2016).

3. Results

3.1. Buyi medicinal plants

A total of 121 botanical species were reported for medicinal purposes by the Buyi informants belonging to 64 families (Table 1). The first written documentation of the medicinal uses of these plants; specifically, 56 species were recorded for the first time in this study as medicinal plants (labeled with an asterisk in Table 1). The majority of documented medicinal plants have distinct local names in the Buyi language (labeled with a triangle mark in Table 1) while some are identified by their Mandarin names.

Among the 64 botanical families documented in this study, the Compositae was the most prevalent family with 10 species followed by the Polygonaceae, Araliaceae, Rubiaceae, Verbenaceae, Labiatae and Liliaceae (with 4 species each). Families with 3 species include Rosaceae, Apocynaceae, Smilacaceae, and Orchidaceae. Families with 2 species include Berberidaceae, Menispermaceae, Urticaceae, Umbelliferae, Asclepiadaceae, Solanaceae, Acanthaceae, and Araceae.

The most commonly reported medicinal plants include the following: Sargentodoxa cuneata (Lardizabalaceae), Uncaria scandens (Rubiaceae), Paederia scandens (Rubiaceae), Sinomenium acutium (Menispermaceae), Stephania delavayi (Menispermaceae), Hedera nepalensis (Araliaceae), Schefflera venulosa (Araliaceae), Munronia pinnata (Menispermaceae), Munronia henryi (Menispermaceae), Schisandra propinquia (Schisandraceae), Uncaria macrophylla (Rubiaceae), Zanthoxylum nitidum (Rubiaceae), Ardisia mamilata (Primulaceae), Alsophila spinulosa (Cycadaceae), Sinilax sp (Smilacaceae), Liquidambar formosana (Altingiaceae), Clerodendrum yunnanense (Lamiaceae), Tetragastris sichouense (Vitaceae),
Boehmeria nivea (Urticaceae), Solanum indicum (Solanaceae), Pinus yunnanensis (Pinaceae).

3.2. Plant parts and types of preparation

The plant parts used for medicinal purposes of the documented medicinal plants of the Buyi medical system are listed in Table 2. Leaves (23.72%) and whole plants (23.72%) were the most frequently used parts, followed by stems (17.95%) and roots (11.54%). Other parts that are less prevalent include the vine (6.41%), rhizome (4.49%) and fruit (5.11%).

The most common method of preparing the medicinal plants is using the decoction method (62.8%), followed by crushing the plant material for making a poultice (23.1%), broth (4.1%), soaking in alcohol (2.5%). Some species were used with other natural materials, such as the preparation of tonics made of medicinal plants combined with brown sugar, grains, chicken, pork and other materials.

3.3. Medicinal plant uses

The documented plants in this study are used for a wide range of health conditions (Table 3) by Buyi communities. A total of 40 health conditions were reported for the documented medicinal plants used by the Buyi. The most prevalent uses of the medicinal plants were for rheumatism (12.4%), trauma and injuries (9.6%), detoxification (5.7%), inflammation (5.1%), gynecological diseases (4.0%), tonics for overall health (2.8%), and pediatric diseases (1.7%).

The most prevalent plants reported for treatment of rheumatism were *A. spinulosa* (Cyatheaceae), *A. mamillata* (Primulaceae), Angiopteris sp (Marattiaceae), Asplenium antiquum (Aspleniaceae), *B. nivea* (Urticaceae), Chloranthus holostegius (Chloranthaceae), *C. yunnanense* (Lamiaceae), *Euonymus yunnanensis* (Celastraceae),...
| Voucher number | Scientific name | Family name | Local name | Part used | Preparation | UV | Medicinal uses | Poisonous tissue | Additional local uses |
|----------------|-----------------|-------------|------------|-----------|-------------|----|----------------|-------------------|-----------------------|
| LBG097a        | Achyranthes longifolia M. | Amaranthaceae | Hong niu xi | Whole plant | Decoction | 0.43 | Anaemia |               |                       |
| LBG018c        | Acmella calva (DC.) R.K.Jansen | Compositae | Jin niu kou | Flower | Soak in alcohol | 0.37 | Toothache, dental caries |               |                       |
| LBG0031        | Aceros calamus L. | Acoraceae | Guo cang pu | Whole plant | Crush and poultice | 0.44 | Inflammation of lymph | Root | Ornamental plant at dragon boat festival |
| LBG092a        | Justicia adhatoda L. | Acanthaceae | Guo zuan | Stem, leaf, flower | Decoction | 0.12 | Inflammation |                   |                       |
| LBG047         | Arima decumbens Thunb. | Labiatae | Nia zi mu gui | Whole plant | Crush and poultice | 0.23 | Injuries from falls |                   |                       |
| LBG011a        | Alocasia cucullata (Lour.) G.Don | Araceae | Bi shi lin | Rhizome, stem, leaf | Decoction | 0.30 | Gastroenteropathy, stomachache | Whole | Ornamental plant |
| LBG010a        | Alsophila spinulosa (Wall. ex Hook.) R. | Cyatheaceae | Long gu feng | Stem, leaf | Decoction | 0.45 | Injuries from falls, rheumatism, epilepsy | Whole | Landscape plan |
| LBG032a        | Alstonia scholaris (L.) R. Br. | Apocynaceae | Ba zhuo jin long | Stem, leaf | Decoction | 0.14 | Hemostasis, acesodyne | Leaf and bark | Latex for the raw materials of chewing gum |
| LBG015         | Alstonia yunnanensis Diels. | Apocynaceae | San bai bang | Leaf | Crush and poultice | 0.41 | Fracture, ostealgia, injuries from falls | Leaf |                       |
| LBG014a        | Angiopteris sp. | Angiopteridaceae | Gu li wai | Rhizone, whole plant | Decoction | 0.24 | Rheumatism, epilepsy |                   |                       |
| LBG056a        | Ardisia mamillata Hance. | Myrsinaceae | Mao qing gang | Whole plant | Decoction | 0.45 | Rheumatism, ostealgia, injuries from falls |                   |                       |
| LBG002         | Armenia carvifolia Buch.-Ham. ex R. | Compositae | Ya ai | Leaf | Decoction, fume | 0.45 | Inflammation |                   |                       |
| LBG112         | Artemisia argyi H.Lév. & Vaniot | Compositae | Bai hao | Stem, leaf | Crush and poultice | 0.44 | Nose bleeding, traumatic injury, wound |                   | Ornamental plant at dragon boat festival |
| LBG012a        | Asplenium antiquum Makino | Aspleniaceae | Ming rong ruo | Leaf | Crush and poultice | 0.23 | Rheumatism |                   |                       |
| LBG079a        | Basella rubra L. | Basellaceae | Teng qi | Vine, leaf | Decoction, broth | 0.35 | Anaemia |                   |                       |
| LBG108         | Boehmeria nivea (L.) Gaudich. | Urticaceae | Da huo ma | Stem, leaf | Crush and poultice, soak in alcohol | 0.49 | Rheumatism |                   |                       |
| LBG003         | Boehmeria siamensis Craib. | Urticaceae | Ge ju lw | Bark, leaf | Crush and poultice | 0.27 | Fracture, ostealgia, injuries from falls |                   |                       |
| LBG004         | Bougainvillea glabra Choisy | Nyctaginaceae | Luo lin | Root | Crush and poultice | 0.25 | Detumescence, hemostasis |                   | Ornamental plant |
| LBG004a        | Broomallia pinnatum (Lam.) Oken ex Benth. | Compositae | Luo li sheng gen | Stem, leaf | Decoction | 0.17 | Detumescence, burn |                   | Ornamental plant |
| LBG029a        | Buddleja officinalis Maxim. | Loganiaceae | Lu ya | Stem, leaf, flower | Decoction | 0.26 | Icteric hepatitis | Root, leaf | Yellow dyestuffs |
| LBG090         | Bulbophyllum odoratissimum (Sm.) Lindl. ex Wall. | Orchidaceae | Guo sang ye | Whole plant | Decoction, crush and poultice | 0.16 | Pneumonia, pulmonary tuberculosis, fracture |                   | Ornamental plant |
| LBG078         | Callicarpa arborea Roxb. | Verbenaceae | Mang zhi | Stem, leaf | Crush and poultice | 0.28 | Inflammation, hemostasis |                   | Landscape plant |
| LBG087a        | Callicarpa bodinieri H.Lév. | Verbenaceae | Jie gu dan | Whole plant | Crush and poultice | 0.25 | Fracture |                   | Landscape plant |
| LBG101a        | Campylandra wattii C.B.Clarke. | Orchidaceae | Wan nian zhu | Stem | Crush and poultice, soak in alcohol | 0.32 | Hemorrhoids |                   | Ornamental plant |
| LBG008         | Canna indica L. | Cannaceae | Ya yi | Root | Crush and decocction | 0.21 | Gynecologic diseases |                   | Ornamental plant |
| LBG074         | Carthamus tinctorius L. | Compositae | Hong hua | Flower | Crush and decocction | 0.40 | Overwork, hemostasis | Edible oil |                       |
| LBG065         | Centella asiatica (L.) Urb. | Umbelliferae | Gai liang | Whole plant | Decoction | 0.38 | Jaundice, hepatitis |                   |                       |
| Voucher number | Scientific name | Family name | Local name | Part used | Preparation | UV | Medicinal uses | Poisonous tissue | Additional local uses |
|----------------|----------------|-------------|------------|-----------|-------------|----|----------------|------------------|---------------------|
| LBG058        | Chloranthus holostegius (Hand.-Mazz.) C.Pei & San | Chloranthaceae | Si kuai wa* | Whole plant | Decoction | 0.42 | Injuries from falls, overwork, rheumatism, pediatric fever | Whole |
| LBG021        | Chonomorpha megacalyx Pierre ex Spire | Apocynaceae | Yin si du zhong | Bark | Decoction, broth | 0.15 | Nephropathy | Hairs |
| LBG006        | Cinnamomum glanduliferum (Wall.) Messia. | Lauraceae | Mai shang | Fruit | Crush and decoction | 0.41 | Fever | Camphor Repellent |
| LBG007        | Cirsium japonicum (Thunb.) Fisch. ex DC. | Compositae | Guo ai | Root | Crush | 0.19 | Injuries from falls | |
| LBG052        | Clerodendrum yunnanense Hu. | Verbenaceae | Chou mu dan | Root, leaf | Decoction | 0.47 | Rheumatism, sore on waist and leg | |
| LBG008        | Crotalaria sessiliflora L. | Liliaceae | Na jio | Whole plant | Decoction | 0.22 | Pediatric diseases | Seed |
| LBG009        | Cycas revoluta Thunb. | Cycadaceae | Bi sang | Whole plant | Decoction | 0.15 | Gastritis, gastrorrhagia, large intestine bleeding | Seed Edible starch of stems and landscape plant |
| LBG062        | Cynanchum auriculatum Royle ex Wright | Asclepiadaceae | Ge shan xiao | Earthnut | | 0.43 | Gastrosis | Root |
| LBG104        | Dendrobium loddigesii Rolfe. | Orchidaceae | Huang cao | Whole plant | Decoction | 0.14 | Legs paralysis, bedridden | Ornamental plant |
| LBG009        | Dichrocephala integrifolia (L.f.) Kuntze | Compositae | N/A | Whole plant | Decoction | 0.21 | Pulmonary tuberculosis | Whole |
| LBG006        | Dichrocephala integrifolia (L.F.) Kuntze | Compositae | Han lian cao | Stem, leaf, flower | Decoction | 0.15 | Hepatitis | |
| LBG010        | Eclipta prostrata (L.) L. | Compositae | Han lian cao | Stem, leaf, flower | Decoction | 0.15 | Hepatitis | |
| LBG044        | Eucommia ulmoides Oliv. (Thunb.) Landl. | Eucommiaceae | Gao wang ma | Stem | Decoction | 0.35 | Nephritis | |
| LBG026        | Euonymus yunnanensis Franch. | Celastraceae | Jin si du zhong | Stem | Decoction | 0.21 | Injuries from falls, rheumatism, wound | Whole |
| LUGB011       | Euphorbia helioscopia L. | Euphorbiaceae | Guo ya | Whole plant | Decoction | 0.14 | Stomach, intestine disease | |
| LBG024        | Euphorbia helioscopia L. | Euphorbiaceae | Guo bu a | Root | Crush and poultice | 0.31 | Traumatic injury | |
| LBG012        | Foeniculum vulgare Mill. | Umbelliferae | Ya wan | Whole plant | Decoction | 0.44 | Stomach, intestine disease | Vegetables and seasoning |
| LBG069        | Geraniocarpus jasminoides J.Ellis. | Rubiaceae | Zhi zhi | Fruit | Decoction | 0.25 | Icteric hepatitis | Ornamental plant and dyestuffs |
| LBG072        | Gentiana rigescens Franch. ex Hemsl. | Gentianaceae | Long dan | Whole plant | Decoction | 0.37 | Inflammation, liver trouble, stomatitis | |
| LBG096        | Glaphyra longituba (Nakai) Kuprian. | Labiatae | Ba ge nu nang | Stem, leaf | Decoction | 0.41 | Pediatric fever, overwork, strain, fracture | |
| LBG055        | Hedera helix L. | Araliaceae | San gu feng | Vine, leaf | Medicine bath | 0.14 | Skin disinfection | Berry Landscape plant |
| Voucher number | Scientific name | Family name | Part used | Preparation | UV | Medicinal uses | Poisonous tissue | Additional local uses |
|----------------|----------------|-------------|-----------|-------------|----|----------------|------------------|----------------------|
| LBG111         | Hedera nepalensis | Arealiaceae | San gu feng lin | Decoction | 0.57 | Furuncle on foot, eliminating naevi | | Landscape plant |
| LBG081         | Hibiscus syriacus L. | Malvaceae | Guo mu jin | Flower | Decoction | 0.39 | Stomach, intestine disease | | Landscape plant |
| LBG053         | Houttuynia cordata Thunb. | Saururaceae | Bie lan | Root | Decoction | 0.44 | Dyes | | Vegetables and seasonings |
| LBG073         | Hypericum japonicum | Hypericaceae | Tian ji huang* | Stem | Decoction | 0.23 | Hepatitis | | |
| LBG080         | Hypericum tectorum | Iridaceae | Ya yan hua | Rhizome | Decoction | 0.41 | Injuries from falls, rheumatism, wound | | Stem and root |
| LBG079         | Iris tectorum | Iridaceae | Guo tang | Stem | Decoction | 0.30 | Urethral problems | | |
| LBG054         | Juncus effusus | Juncaceae | Guo tang | Whole plant | Decoction | 0.51 | Gynaecopathia | Seed |
| LBG048         | Juncus effusus | Juncaceae | Guo tang | Whole plant | Decoction | 0.51 | Gynaecopathia | Seed |
| LBG051         | Ligularia hodgsonii Hook. | Compositae | Gao dou sha | Root | Decoction | 0.27 | Lung heat, phthisis, pulmonary tuberculosis, antineoplastic | | Vegetable |
| LBG059         | Ligularia japonica | Compositae | Gao ma la gang mu | Vell | Decoction | 0.39 | Hepatitis, nasosinusitis | | Vegetable |
| LBG091         | Ligularia pinnata (Wall.) W.Theob. | Compositae | Mai sang | Fruit, leaf | Whole plant | Decoction | 0.35 | Common cold, Overwork, rheumatism | | Fruit |
| LBG075         | Ligularia scortendens (Roxb.) Moon | Compositae | Bai hua cao | Whole plant | Decoction | 0.51 | Overwork, rheumatism | | Whole |
| LBG110         | Macarea domestic | Orchidaceae | Mou lang | Whole plant | Decoction | 0.41 | Traumatic injury, bleeding, fracture, gonorrhea | | Vegetable |
| LBG059         | Oenanthe javanica (Blume) DC. | Umbelliferae | Bai hua cao | Whole plant | Decoction | 0.36 | Rheumatism, gynaecopathia | | Vegetable |
| LBG045         | Oxalidaceae | Umbelliferae | Niu jin teng | Whole plant | Decoction | 0.52 | Rheumatism | | Vegetable |
| LBG070         | Peristeria japonica (Thunb.) Bremer. | Rubiaceae | San qi* | Rhizome | Decoction | 0.43 | Blood circulation, injuries from falls | | Vegetable |
| LBG023         | Peristeria japonica (Thunb.) Bremer. | Acanthaceae | Guo yue | Stem, leaf | Decoction | 0.13 | Inflammation, hemostasis, Gynecologic diseases | | Vegetable |

(continued on next page)
| Voucher number | Scientific name                  | Family name | Local name | Part used | Preparation | UV | Medicinal uses                                      | Poisonous tissue | Additional local uses     |
|---------------|----------------------------------|-------------|------------|-----------|-------------|----|----------------------------------------------------|-----------------|---------------------------|
| LBG038        | Pinus yunnanensis                 | Pinaceae    | Da jie     | Stem      | Decoction   | 0.44 | Rheumatism, injuries from falls                    |                  | Construction              |
| LBG013        | Plantago major                    | Plantaginaceae | Guo po sheng | Whole plant  | Decoction   | 0.43 | Nasosinusitis, pulmonary tuberculosis, nephritis   |                  |                           |
| LBG018        | Phalacrocorax carbo               | Charadriidae | Jie geng | Root      | Decoction   | 0.42 | Lung disease                                      |                  |                           |
| LBG049        | Polilla miranda                   | Poliidae    | N/A        | Stem, leaf | Decoction   | 0.18 | Inflammation                                      |                  |                           |
| LBG019        | Polygonatum kingianum             | Collet & Hemsl. | Guo dao ji | Rhizome   | Decoction, broth | 0.41 | Swirl, dizzy                                       |                  |                           |
| LBG061        | Polygonum capitatum               | Polygonaceae | Ba gu yan  | Whole plant | Decoction   | 0.24 | Analgesic                                         |                  |                           |
| LBG121        | Fagopyrum esculenthus             | Polygonaceae | He shou wu | Earthnut  | Decoction   | 0.42 | Hepatitis, anaemia                                |                  |                           |
| LBG080        | Portulaca oleracea                | Portulacaceae | Gao mao du | Stem, leaf | Decoction   | 0.38 | Malnutrition, indigestion syndrome                 |                  | Vegetable                 |
| LBG005        | Potentilla lineata                | Rosaceae    | Fan bai ye | Whole plant | Decoction   | 0.28 | Gastroenteritis, gastrorrhagia, bloody flux, dysentery |                  |                           |
| LBG063        | Lobelia angulata                  | Campanulaceae | Bi ye ya mu | Whole plant | Decoction   | 0.25 | Rheumatism, traumatic injury                      |                  |                           |
| LBG022        | Prunella vulgaris                 | Labiatae    | Xia ku cao | Whole plant, leaf | Burn into ash | 0.39 | Nasosinusitis                                      |                  |                           |
| LBG003        | Pteris multifida                  | Pteridaceae | Feng wei cao | Stem, leaf | Decoction   | 0.22 | Cholecystitis                                     |                  |                           |
| LBG020        | Reineckea carnea                  | Liliaceae   | Fen mei wai fing | Leaf | Crush and poultice, soak in alcohol | 0.42 | Fracture, rheumatism, injuries from falls |                  | Ornamental plant           |
| LBG021        | Reynoutria japonica              | Polygonaceae | Guo xie ling | Stem, leaf | Crush and poultice | 0.26 | Fracture, rheumatism, injuries from falls |                  |                           |
| LBG048        | Phlomis decursiva                | Araceae     | Guo shan long | Vine, leaf | Decoction   | 0.32 | Gastritis, gastrorrhagia, large intestine bleeding |                  |                           |
| LBG001        | Polygonum aubertii               | Polygonaceae | Da huang   | Whole plant | Decoction   | 0.17 | Inflammation, detumescence, diminish sore          |                  |                           |
| LBG104        | Sabia parviflora                 | Saliaceae   | Ya xiliang | Whole plant | Decoction   | 0.43 | Hepatitis, icteric hepatitis                       |                  | Tea                       |
| LBG035        | Sargentodoxa cuneata             | Sargentodoxaceae | Gao lu (gao zai) | Root, stem, leaf | Decoction   | 0.58 | Rheumatism, injuries from falls |                  |                           |
| LBG064        | Schieriana vernulosa              | Araliaceae  | Mai dang du | Stem, leaf | Decoction   | 0.53 | Hemostasis, acesodyne, fracture, rheumatism       |                  |                           |
| LBG039        | Schisandra propinquia            | Schisandraceae | Gao yi nou | Vine      | Decoction, soak in alcohol, broth | 0.61 | Tonic                                              |                  |                           |
| LBG082        | Senecio scardens                  | Compositae  | Xioo gan yao | Whole plant | Decoction   | 0.41 | Gastric diseases                                  |                  | Whole                    |
| LBG054        | Sinomenium acutum                | Menispermacae | Ge bou    | Vine      | Decoction   | 0.55 | Rheumatism                                         |                  | Stem and root             |
| LBG083        | Smilax chinensis                 | Smilacaeae  | Jin gang ci | Rhizome   | Decoction | 0.21 | Nephropathy, overwork                             |                  | Edible starch from root, fence and vines. |
| LBG085        | Smilax glabra                     | Smilacaeae  | Tu fu ling | Rhizome   | Decoction; soak in alcohol | 0.19 | Injuries, nephropathy, overwork, smallpox         |                  |                           |
Table 1 (continued)

| Voucher number | Scientific name | Family name | Local name | Part used | Preparation | UV | Medicinal uses | Poisonous tissue | Additional local uses |
|----------------|-----------------|-------------|------------|-----------|-------------|----|----------------|-------------------|-----------------------|
| LBG116         | Smilax sp.      | Smilacaceae | Jin gang teng | Rhizome | Decoction | 0.48 | Eczema, Rheumatism, detoxifying, detumescence | Whole | Young leaves for vegetable, mature fruit edible. |
| LBG089         | Solanum indicum L. | Solanaceae | Huang la guo | Ma ding | Fruit | Decoction, fume | 0.53 | Rheumatism, dental caries | None | |
| LBG007         | Smilax nigrum L. | Smilacaceae | | | Fruit | Crush and poultice | 0.42 | Furuncle on foot, eliminating naevi | Immature fruit | |
| LBG017         | Stephania delavayi Diels. | Menispermaceae | Ri mu dui | Earthnut | Crushed and poultice, decoction | 0.54 | Rheumatism, stomachache, gastrodudenal ulcer | None | |
| LBG016         | Taccaceae André | Taccaceae | Wang le xiang | Stem | | 0.14 | Skin infection, detumescence | Whole | |
| LGB019         | Taraxacum mongolicum Hand.-Mazz. | Compositae | Luo ai | Whole plant | Decoction | 0.41 | Inflammation, inflammation of lymph | Vegetable | |
| LBG036         | Vitaceae sicochea C.L. Li. | Vitaceae | Na gao le | Root | | 0.45 | Rheumatism, gastropy | Whole | |
| LBG020         | Toricetia tiliifolia DC. | Cornaceae | Gao qiang ling | Leaf | Crush and poultice | 0.43 | Fracture | Whole | |
| LBG041         | Uncaria morphophylla Wall. | Rubiaceae | Gou wou nou | Vine | Decoction | 0.51 | Hepatitis, acute icteric hepatitis | Whole | |
| LBG040         | Uncaria scandens (Sm.) Hutch. | Rubiaceae | Wou nou | Vine | Decoction | 0.13 | Rheumatism, injuries from falls | Whole | |
| LBG109         | Urtica fissa E. Pritz. | Urticaceae | Huo ma | Shoot | Decoction | 0.62 | Rheumatism, digestive disease | Whole | |
| LBG009         | Verbena officinalis L. | Verbenaceae | Nia muen | Whole plant | Decoction | 0.42 | Cholecystitis, icteric hepatitis, hepatitis, priurus | Whole | |
| LBG027         | Woodwardia japonica (L. f.) Sm. | Blechnaceae | Guan zhong | Root | Decoction | 0.25 | SARS, cephalomeningitis | Whole | |
| LBG046         | Xanthium strumarium L. | Compositae | Wa gou ma | Fruit | | 0.43 | Hepatitis, nasosinusitis | Whole | |
| LBG037         | Zanthoxylum nitidum (Roxb.) DC. | Rutaceae | Liang mian zhen | Root | Decoction | 0.48 | Chronic enteritis | Whole | |

Notes: * Names were pronounced the same as Mandarin Chinese.
* 56 species had medicinal values for the first time recorded from this study.

Table 2

| Plant part | Species number of uses | Percent (%) |
|------------|------------------------|-------------|
| Leaf       | 37                     | 23.72%      |
| Whole plant| 37                     | 23.72%      |
| Stem       | 28                     | 17.95%      |
| Root       | 18                     | 11.54%      |
| Vine       | 10                     | 6.41%       |
| Rhizome    | 7                      | 4.49%       |
| Flower     | 4                      | 2.56%       |
| Fruit      | 8                      | 5.13%       |
| Earthnut   | 3                      | 1.92%       |
| Bark       | 2                      | 1.28%       |
| Seed       | 1                      | 0.64%       |
| Shoot      | 1                      | 0.64%       |
| Total      | 156                    | 100%        |

Iris tectorum (Iridaceae), L. formosana (Altingiaceae), M. henryi (Meliacae), Dendanthe javanica (Apicaeae), P. scandens (Rubiaeae), P. yunnanensis (Pinaceae), Reineckea carnea (Asparagaceae), Reynoutria japonica (Polygonaceae), S. cuneata (Lardizabalaceae), S. venulosa (Araliaceae), Sinomenium acutum (Menispermaceae), Smilax glabra (Smilacaceae), S. indicum (Solaneaeae), S. delavayi (Menispermaceae), T. sichouensae (Angiospermae), and U. scandens (Rubiaeae).

Another important medicinal plant category for the Buyi is trauma and injuries. The surveyed Buyi communities have notable knowledge about the use of medicinal plants for physical trauma and injuries given the nature of farming activities that may cause body injuries and sores. The prevalent medicinal plants reported for used for physical trauma and injuries were C. holostegius (Chloranthaceae), S. glabra (Smilacaceae), R. carnea (Asparagaceae), Glechoma longituba (Lamiaceae), Oxlis corniculata (O. corniculata), S. cuneata (Lardizabalaceae), Alstonia yunnanensis (Apocynaceae), Oneronia myosurus (Orchidaceae), Bulbophyllum odoratismum (Orchidaceae), Callicarpa bodinieri (Lamiaceae), U. scandens (Rubiaeae), P. yunnanensis (Pinaceae), A. spinulosa (Cytaceaeae), Evonymus yunnanensis (Polyporaceae), S. venulosa (Araliaceae), Panax notoginseng (Araliaceae), S. propinqua (Schisandraceae), Z. nitidum (Rutaceae) and A. mammilata (Primulaceae).

The interviews revealed that medicinal plants used for detoxification and inflammation have extensive definitions and usages. Plants used for detoxification and treating inflammation are primarily for reducing inflammation in the liver, gallbladder, lung, kidney, head and nose. Medicinal plants that were reported for treating inflammation linked to liver ailments were Momordica charantia (Cucurbitaceae), Hypericum japonicum (Cucurbitaceae),
Xanthium sibiricum (Asteraceae), Eclipta prostrate (Asteraceae), B. odoratissimum (Orchidaceae), Polygonum multiflorum (Polygonaceae), Polygonum cuspidatum (Polygonaceae), Verbena officinalis (Verbenaceae), U. macrophylla (Rubiaceae), Gardenia jasminoides (Rubiaceae), Agrimonia pilosa (Rubiaceae), Sabia parviflora (Sabia- ceae), Cudrania tricuspidata (Moraceae), and Oroxylum indicum (Bignoniaceae).

Other prevalent medicinal plant uses noted were the fruits of Tetradium ruticarpum to treat stomachache, leaf of Solanum spirale to treat skin diseases, and the root of Begonia grandis subsp. sinensis to treat burns. Although only a few species were reported for treatment of gynecological diseases, the informants highlighted that these species are considered very important for women. Four of these important plants used for are gynecological conditions are Diuranthea major (Asparagaceae), Leonurus japonicas (Lamiaceae), O. javanica (Apiaceae), and Marsdenia tenacissima (Apocynaceae).

Several medicinal plants used for overall health tonics were cooked with meats, including pork and chicken, which were viewed as improving the medicinal effect. These plants were Polygonatum kingianum (Asparagaceae), Basella rubra (Basellaceae), Urtica fissa (Urticaceae), and Achyranthes longifolia (Amaranthaceae).

Plants for treatment pediatric diseases had a low proportion among the total medicinal plants; however, while only several plants are used by the Buyi for medicinal purposes, they were reported as being very important. Pediatric malnutrition and indigestion are treated in Buyi communities by G. longituba (Lamiaceae), Senecio scandens (Asteraceae), Metaplexis japonica (Apocynaceae), Portulaca oleracea (Portulacaceae). Hedera helix (Araliaceae) is used for skin-detoxification for newly born infants.

3.4. Poisonous species

As displayed in Table 1, almost one third (28%) of the reported medicinal plants (35/121) are perceived to be toxic. The most common poisonous plant part reported by informants was the whole plant (41.46%), followed by root (12.20%) and seed (12.20%). Other less poisonous plant parts that were reported are the leaf (9.76%), stem (7.32%) and bark (4.88%) (Table 4). Many of medicinal plants used by Buyi were reported to have side effects, highlighting the importance of ethnomedical knowledge of medicinal plant utilization in order to prevent serious harm to the human body.

3.5. Other uses of medicinal plants

In addition to medical uses, 41% of the reported medicinal plants (50) have other uses (Tables 1 and 5). The most prevalent uses of the documented plants other than medicine included ornamental (32%) and edible (30%) purposes, followed by landscape design (16%) and dyeing (10%). The remaining usages include for construction (4%), fencing (2%), and herbal teas (2%).

3.6. Diverse diagnostic methods

The Buyi medicinal system consists of unique diagnostic and treatment methods, particularly for the treatment of fractures, trauma and injuries, rheumatism, gynecological diseases and snakebites. There are some traditional Buyi medicinal prescriptions that have been shown to be effective in modern pharmacological experiments and clinical trials, and some pharmaceutical

### Table 3

| Diseases | Number of citation | Percentage (%) |
|----------|--------------------|----------------|
| Rheumatism | 22 | 12.4 |
| Trauma and injuries | 17 | 9.6 |
| Liver diseases | 15 | 8.4 |
| Intoxication | 10 | 5.7 |
| Inflammation | 9 | 5.1 |
| Analgesic | 8 | 4.5 |
| Fracture | 7 | 4 |
| Gastric diseases | 7 | 4 |
| Overwork | 6 | 3.3 |
| Nose ailments | 6 | 3.3 |
| Renal ailments | 5 | 2.8 |
| Skin diseases | 5 | 2.8 |
| Intestinal diseases | 5 | 2.8 |
| Respiratory system | 5 | 2.8 |
| Tonic | 5 | 2.8 |
| Hemostatic | 5 | 2.8 |
| Gynecologic diseases | 4 | 2.3 |
| Pediatric diseases | 4 | 2.3 |
| Cholelithic diseases | 3 | 1.7 |
| Parasitic diseases | 2 | 1.1 |
| Mental diseases | 2 | 1.1 |
| Invigoration | 2 | 1.1 |
| Anemia | 2 | 1.1 |
| Snakebite | 2 | 1.1 |
| Tooth ailments | 2 | 1.1 |
| Foot diseases | 2 | 1.1 |
| Freckle ailments | 2 | 1.1 |
| Calculous diseases | 1 | 0.6 |
| Diabetes | 1 | 0.6 |
| Cephalomenigitis | 1 | 0.6 |
| Urethral ailments | 1 | 0.6 |
| Physical weakness | 1 | 0.6 |
| Common cold | 1 | 0.6 |
| Burn | 1 | 0.6 |
| Neoplasm | 1 | 0.6 |
| Dizzy problems | 1 | 0.6 |
| Haemorrhoids | 1 | 0.6 |
| Infertile ailments | 1 | 0.6 |
| Smallpox | 1 | 0.6 |
| Gonorrhea | 1 | 0.6 |
| Total | 177 | 100 |

### Table 4

| Poisonous tissue | Number | Percentage (%) |
|------------------|--------|----------------|
| Whole plant | 17 | 41.46 |
| Root | 5 | 12.20 |
| Seed | 5 | 12.20 |
| Leaf | 4 | 9.76 |
| Stem | 3 | 7.32 |
| Bark | 2 | 4.88 |
| Camphor | 1 | 2.44 |
| Berry | 1 | 2.44 |
| Fruit | 1 | 2.44 |
| Unripe fruit | 1 | 2.44 |
| Seeding | 1 | 2.44 |
| Total | 41 | 100.00 |

### Table 5

| Kind of usage | Number of species | Percentage |
|---------------|-------------------|------------|
| Ornamental | 16 | 32.00 |
| Edible | 15 | 30.00 |
| Landscaped | 8 | 16.00 |
| Dyestuffs | 5 | 10.00 |
| Construction | 2 | 4.00 |
| Cane substitute | 1 | 2.00 |
| Tea | 1 | 2.00 |
| Repellent | 1 | 2.00 |
| Fence | 1 | 2.00 |
| Total | 50 | 100.00 |
companies have developed these into new drugs or healthcare products, such as “Qing Feng Hu Gan Cha” and “Yi Si Chun Ru Ji”.

The Buyi healers often used fresh and raw plants for their medicines, and they typically do not use complex methods to process the remedies. For example, the fresh leaves of Toricellia tiliifolia are usually used to treat fractures. Methods of pounding, pounding, and powdering were most widely used to prepare these remedies in the study area.

This study found that 121 medicinal plant species belonging to 64 families are used by the Buyi to cure seven health conditions considered the most important for treatment (rheumatism, trauma and injuries, detoxifying and inflammation, gynecological disease, weakness, pediatric disease). The disease spectrum found in this study is similar to the Buyi medical culture in Guizhou Province, which can be explained by the following two reasons:

1) The Buyi people usually live in mountainous and high humidity areas. Such geographic and climate factors could cause these ailments to become common and to develop into regional diseases.

2) The Buyi often have to do onerous labor work including farming to support their livelihoods, which might make them more likely to suffer from injuries. Therefore, the medicinal knowledge for treating diseases such as trauma and injuries could have been gradually accumulated across the generations. For example, C. holostegius was commonly recognized by local people for its specific medicinal effect on injuries from falls and fractures.

3.7. Buyi medicinal resources and their multipurposes

The local healers have extensive knowledge on medicinal plants resources. Among the 121 identified species, most of them were collected from the wild habitats. Different plant parts are used to treat various diseases (Table 2).

Only a few medicinal plants were brought from neighboring regions. For example, Eucommia ulmoides was purchased from Qianxinan Prefecture in Guizhou Province. We ascribe this situation to the following factors:

1) Like the natural conditions of many other Buyi villages, the Buyi villages in Luoping County are located in an area with a well-preserved natural habitat, good ecological environment, and rich biodiversity, which may provide a favorable foundation for medicinal plant resources for the local folk doctors.

2) The Buyi are one of the indigenous groups in southwest China. They gradually formed their epistemologies, such as the value of harmonious relationship with nature during a long process of production and practice. In the belief-system of Buyi people, they usually have pantheistical adaptations, such as habitats (e.g. sacred mountains), plants (e.g. divine arbors, bamboo) animals or mythological creatures (e.g. fish, dragon), and natural elements (e.g. fire). All of these ideas played a positive role in environmental protection and sustained the Buyi ethnic culture over time.

Most local names of medicinal plants are in local Buyi pronunciation. But the pronunciation of 13 species is the same as mandarin Chinese, including Acorus calamus (Changpu), Carthamus tinctorius (Honghua), Chloranthus holostegius (Sikuaiwa), Dendrobi um loddeissii (Huangcao), Eriobotrya japonica (Pipa), Gentiana rigescens (Longdan), H. japonicum (Tianjihuang), Lonicer a japonica (Jinyinhu), O. corniculata (Suanjiangcao), P. notoginseng (Sanqi), Plantago major (Cheqian), Prunella vulgaris (Xiaokua) and Z. nitidum (Liang mian zhen). In fact, these 13 medicinal species are normally used as traditional Chinese medicine and widely used in many prescriptions. Since Buyi people are living alongside other linguistic groups, some local healers' traditional medicinal technologies might be influenced by traditional Chinese medicine and by other ethnic groups. Therefore, local Buyi pronunciation of some medicines are same as mandarin Chinese.

Multipurpose plants play an important role in the diversity of plant utilization and can be used as an indicator of regional biocultural diversity. Two-use plants were most common among multipurpose plants, with ornamental-medicinal plants being the most popular among two-use plants. Some plants have three uses, such as Cucurbita maxima, G. jasminoides and Foeniculum vulgare. The multipurpose value of a plant is essentially determined by the plant itself. Trees tend to have more uses than herbaceous plants. Multipurpose plants studies contribute to the standard recording of regional or ethnic traditional ecological knowledge, the identification of plant uses with their potential applications, and the promotion of regional natural cultural diversity protection.

4. Discussion

4.1. The characteristics of Buyi medicinal plants in eastern Yunnan

Among the 64 botanical families documented in this study, the Compositae was the most prevalent family with 10 species. Medicinal plants in the Compositae have previously been shown to be commonly used by Buyi communities as well as easily obtained in their rural surroundings (Wu et al., 2017). As one of the largest families of seed plants over the world, the Compositae plants are easily available in local communities. The biomass and population sizes of Compositae plants are usually very large.

Specific edible uses of medicinal plants were as a vegetable, fruit, seasoning and starch (Sui et al., 2011). The local people used Smilax china as a fence, and they hung A. calamus and Artemisia argyi on the door for cultural purposes and traditional way during Dragon Boat Festival (Shu et al., 2018). Houttuynia cordata and P. oleraceae have been used both as vegetable and medicine by local people for a long time (Ye et al., 2015). Finally, medicinal dietary ferns were frequently used by Buyi people, such as they used ferns to treat influenza (Teng et al., 2016; Ye et al., 2016).

Previous research has highlighted how Buyi healers use multiple traditional methods to treat diseases including pocket (Doudu) therapy, moxibustion (Jiukao) therapy, curettage (Guazhi) therapy, light therapy (Dadenghuo) therapy, and egg rolling (Gundan) therapy (Pan et al., 2003; Xiong and Long, 2018) (Table 6). The abundant medicinal plants in Buyi region provide resources for healer's multiple traditional methods to treat diseases.

4.2. Conservation issues

Some medicinal plants used by the local people had not been found in our field surveys in Luoping County. Furthermore, the new medicinal plants and remedies we have documented imply the medicinal knowledge in Buyi marginal regions in Yunnan Province may serve to supplement the whole Buyi medicinal system, which should be protected and maintained.

Nevertheless, our investigation indicated that the traditional medicinal knowledge and methods in Luoping County are facing a danger of extinction. After extensive interviews with the local healers, we summarized the following main reasons for this situation:

Firstly, the young generation has little interest or is not willing to work hard to study traditional medicinal knowledge. Most of them have left their hometowns to earn money in big cities such as
Beijing, Guangzhou, and Kunming. For instance, an experienced herbal doctor who passed away in 2004 once asked his children to study their traditional medicinal knowledge. However, his children refused because they thought there is no value in studying this knowledge. Consequently, his precious medicinal experiences and knowledge have, unfortunately, faded way.

What makes a medicinal culture endangered is not just the number of users, but also how old the users are. If it is used by teens it is relatively safe. The critically endangered cultural systems are those that are only used by the elderly. Why do people reject the traditional medicine.

A growing interest in cultural identity may prevent the direst predications from coming true. The ethnic groups have not lost pride in their traditional remedies, but they have to adapt to higher standards of modern medical care often has advantages of fast recovery periods, precise curative effects, and other conveniences, so it has become a first choice of the local people. Only when some diseases cannot be cured by modern medicinal treatments, the local people will turn to the traditional medicine.

Thirdly, the inheritance and further development of the local Buyi medicinal culture is limited by some traditional conceptions such as limiting knowledge only to the men in the family. Women are not allowed to study traditional medicinal knowledge, or to use medicinal plants.

The present study revealed the richness of medicinal plants and importance of traditional medicinal knowledge among the Buyi communities in Luoping County. We understand the urgency and difficulties to save the endangered traditional knowledge. Further surveys are necessary to identify priority of traditional knowledge for better conservation. Intensive studies including phytochemical and pharmacological investigations will help to confirm the functions and dynamics of important Buyi herbal medicines such as S. parviflora and its crude products (Sui et al., 2011). The results from these efforts together supporting from current positive policies will be able to attract interests from stakeholders including local healers and their potential successors, publics, investors, enthusiasts, and institutions. Thus the endangered traditional Buyi medicinal knowledge will possibly be conserved throughout documentation, inheritance and sustainable uses.

In all 121 plant species documented in this study, 2 species (C. revoluta and Tacca chantrieri) are listed in China Red Data Book while 3 orchids (D. loddigesii, Oberonia cavaleriei and B. odoratissimum) will be listed. These species were used in a small amount, but they should be informed through various approaches such as new media, in particular, the most popular social media in China named WeChat. The alternatives to these species may be recommended since a lot of medicinal plants occur in Luoping County.

We anticipate that the traditional medicinal knowledge of the Buyi people in the marginal regions such as Yunnan should be emphasized, since it is an indispensable part of the whole Buyi medicinal culture. The remaining Buyi communities should be intensively investigated in order to build a comprehensive perspective on the Buyi medicinal knowledge system. Furthermore, local government policy support would be essential to ensure that
the whole of Buyi medicinal culture is continuous development in a sustainable way (Yang et al., 2015).

5. Conclusion

Medicinal plants used by the Buyi people in Luoping are very diverse. One hundred and twenty-one species in 54 families were documented for treating various ailments based on our ethnobotanical surveys in only four villages, in which 56 species were recorded for the first time in this study. Leaves and whole plants were commonly used by the Buyi healers in the form of decoction. The Buyi communities have abundant medicinal resources and traditional knowledge. However along with the development of global economy, the specialized knowledge of Buyi medicine resources are threatened by human activities and natural causes, and associated traditional knowledge is eroding rapidly. So it is thus urgent and necessary to prevent the further loss of the specialized knowledge of ethnic group. This is the best accomplished by recording and documenting their unique practice and their relationship to medicinal plants.

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Authors’ contributions

CL conceived of and designed the study. YX and XS conducted data collection, integrated the inventory and its analysis, and wrote the manuscript. CL, ZW, YX and XS identified the plants. SA supported with preparation of the manuscript.

Ethics approval and consent to participate

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Consent for publication

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Declaration of competing interest

The authors declare that they have no competing interests.

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