Monpa, memory, and change: an ethnobotanical study of plant use in Mêdog County, South-east Tibet, China

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Abstract

Background: Due to their relative isolation, the previous studies of Monpa plant use were only conducted in north-east India. In October 2013, Mêdog County was no longer remote, thanks to completion of a highway into the county. This study of plant species used by the Monpa had three research objectives. These were (i) to identify and record local names and uses of plants in Mêdog County, (ii) to assess which of these were uses of endemic or near-endemic species within this part of the Indo-Burma biodiversity hotspot, and (iii) to assess how plant uses reflect socio-economic change in Mêdog County?

Methods: Field surveys were conducted in 12 villages of four townships in Mêdog County, Tibet, China. Two field visits were made. The first field trip was in November 2017 and the second field trip was in May 2018. We interviewed 64 key informants between 21 and 84 years old. Most of them were the village leaders and other local people who are knowledgeable about plants. After transect walks with knowledgeable local people, we used free listing, key informant interviews, and semi-structured interviews during the field work. Plants traditionally used by the Monpa were documented. Utilization frequency was used to assess the significance of each species, and the Cultural Importance index was used to estimate the cultural significance of the species in common. We also used the informant consensus factor (FIC) to determine the homogeneity of the informants’ knowledge of medicinal plants.

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Results: One hundred ninety-four plant species belonging to 82 families and 158 genera were recorded and collected. One hundred twenty-two species, primarily fruits, were food plants. Forty-five species were used as traditional medicines. This included highly valued species collected in alpine areas (Paris polyphylla) and brought to villages in Mêdog, which are at a lower altitude (between 728 and 1759 m a.s.l.). Seven edible plant species were also used as herbal medicines. We also recorded 39 species used for other purposes in Monpa daily life. These included nine species that were used to make agricultural tools, five species for dyes and mordants, four species for timber, three species for fuelwood, four species for religious ritual use, three species for washing, two species for incense, two species for thatching, two species for fiber (rope and paper), two “calendar plants” were used to indicate seasons for agricultural purposes, two fish poison plant species, and one species were used as a tobacco substitute. Based on taxonomic insights and from studies elsewhere, we suggested that fiber species were under-reported (c. 14 species were used vs. one species reported used). Even though these plant species are rich and diverse, the use of endemic or near-endemic species was rarely recorded in previous studies. These species included Arenga micrantha (used for starch), Homesteadia tibetica (fruits), Castanopsis clarkii (edible nuts) and Gnetum pendulum (edible nuts), Ophiiorrhiza medogensis (vegetables), Derris scabraulis (fish poison), Radermachera yunnanensis (agricultural tools), Litsea tibetana (seed oil), Dendrocalamus tibeticus (wine strainers and implements for administering medicine), Zanthoxylum motuoense (spices), Cinnamomum contractum (tobacco substitutes), Morus wittiorum (medicines), and Garcinia nuijiangensis (funeral rituals). Despite the absence of roads until 2013 and the impression of “isolation,” Monpa knowledge of plant use reflects three categories of change. Firstly, oral histories of plants used in Bhutan were also encountered by Monpa people after their migration from Bhutan to south-eastern Tibet. Secondly, a “slow change” through centuries of exchange of knowledge (for example of Chinese and Tibetan medical systems), seeds of introduced crops (finger millet (indigenous to Africa), maize (from Meso-America), and experimentation and use of introduced medicinal plants (such as Datura stramonium, which originates from North America). Thirdly, “fast change” over the past decade. This is reflected in changes in traditional architecture and in rising commercial trade in selected plant resources such as Dendrobium orchid stems and Paris polyphylla rhizomes which are in demand in China’s Traditional Chinese Medicine (TCM) markets.

Conclusions: Monpa people in the south-eastern Tibet have detailed knowledge of the diverse plant resources. But that traditional knowledge is now faced with a crisis because of the modern socio-economic change. In addition, Monpa knowledge of plants reflects slower changes in knowledge as well. For example, Monpa ethnomedicine has been influenced by traditional Tibetan and Chinese medicine over a longer period in time. Overall, this study provides a deeper understanding of the Monpa peoples’ knowledge on wild plants, including endemic and near-endemic species whose uses have not been previously recorded. Several of these narrowly distributed species, such as the fish poison Derris scabraulis, could be the focus of further studies. Some wild edible plants may also have interesting dietary constituents which need in-depth studies. These detailed studies could enable the Monpa people to benefit from the use of their traditional plant-derived culture and therefore support the biodiversity conservation.

Keywords: Indo-Burma biodiversity hotspot, endemic plants, Monpa, cultural change

Background

Introduction

This study was carried out in Mêdog County in the south-eastern Tibet, at the edge of two “biodiversity hotspots” which were the Himalayan and the Indo-Burma biodiversity hotspots. Due to its biogeography, topography, and altitudinal range (a difference of 7500 m over 40 km), south-east area of Tibet has high levels of biodiversity. South-eastern Tibet is also culturally diverse, with Tibetan, Hui, Monpa, Lhoba people developing cultural landscapes through farming, pastoralism, wild plant use, and management. The need to combine traditional ecological knowledge with management strategies to achieve biodiversity conservation in local beliefs and practices is well recognised [1]. In their review of conservation needs for the Indo-Burma biodiversity hotspot, for example, the CEPF (2012) stressed the need for “greatly improved information on status and distribution in Indo-Burma to highlight species for which available information is so limited that it precludes any form of meaningful conservation action”. This study is a contribution toward both conservation and development.

Although a few studies have been done on Monpa plant use in north-east India [2], this is the first study of Monpa ethnobotany in this formerly remote part of China. No longer remote, this area is undergoing rapid socio-economic change, which may lead to declining knowledge of local plant uses. In other parts of the
region, however, 68 medicinal plant species were recorded as used by Tibetans in Shangri-la, Yunnan, China [3]. Traditional knowledge of 168 wild edible plant species were recorded in Tibetans of Shangri-la region, Yunnan, China [4]. The uses of 81 species of vascular plants were recorded in Tibetans of Zhouqu county, Gansu, China [5]. The uses of 54 species of vascular plants and 22 mushrooms were recorded in Tibetan community of Zhagana in Tewo County, Gansu, China [6].

Study aims and research objectives

The aim of this study was to document the ethnobotanical knowledge of the Monpa people in Mêdog County, south-eastern Tibet. As no previous studies had been done on Monpa plant use in China, we had three research objectives. These were (i) to identify and record local names and uses of plants in Mêdog County, (ii) to assess which of these were uses of endemic or near-endemic species within this part of the Indo-Burma biodiversity hotspot, and (iii) to assess how current plant uses reflect socio-economic change in Mêdog County?

Methods

Location of the study sites

Mêdog County is the most remote county in the south-eastern Tibet, which covers a total area of approximately 31,395 km², located in the lower river valley of the Yarlung Tsangpo River. It is called “Pe-ma-ko” by the Tibetan Buddhists, meaning “hidden lotus.” The average annual temperature in Mêdog County ranges from 16 to 18 °C. The lowest temperature is 2 °C in January and the highest temperature is 33.8 °C in July. The annual average rainfall is 2350 mm, the frost-free period is about 330 days, and the average humidity is over 80%. In the horizontal distance of 40 km, Mêdog County has an altitudinal difference of more than 7500 m, with plant species ranging from alpine plant species to tropical plant species and complex vegetation structures [7, 8].

We had selected 12 villages belonging to four townships in the Mêdog County from different altitudes for investigation (Table 1). Monpa people accounted for 99.2% of the total population of the Beibeng Township. Dexing Township is the nearest township to the Mêdog County. It is located on the right bank of the Yarlung Tsangpo River, across the river from Mêdog County. Bangxin Township is situated in the northeast of Mêdog County and “Bangxin” which means “flat land” in Tibetan language. Jiaresa Township is located in the northern part of Mêdog County and is one of the three remote towns in the Mêdog County (Table 1).

The location of the 12 study villages in Mêdog County are shown in Fig. 1. The names and altitudes of the seven villages of Beibeng Township are Beibeng Village (839 m a.s.l), Jiangxin Village (893 m a.s.l), Xirang Village (823 m a.s.l), Gelin Village (1759 m a.s.l), De’ergong Village (1552 m a.s.l), Badeng Village (1316 m a.s.l), and Acang Village (1342 m a.s.l). The altitudes of the three villages in Dexing Township are Dexing Village (728 m a.s.l), Hezha Village (1051 m a.s.l), and Naerdong Village (1571 m a.s.l). We also studied one village in Bangxin Township: Bangxin Village (1162 m a.s.l) and one village in Jiaresa Township: Gengbang Village (1330 m a.s.l).

Cultural background: Monpa in Mêdog

The literal meaning of Monpa is “man of the lower country,” referring to several ethnically related peoples, which may not be related linguistically [9]. In the early to mid-eighteenth century, due to the hardships and heavy taxes in Bhutan at the time, the local Monpa people heard that there was a sacred place in the south-east of Tibet, called Pe-ma-ko (now Mêdog), where there was the chance for a better life, so they decided to flee from Bhutan to Tibet [10]. The oldest record of mentioning Monpa was the Tibetan epic of King Ling Gesar during the fourth century [11]. The language used by “Monpa” belongs to the Tibeto-Burman language group of the Sino-Tibetan language family [9]. However, the Monpa people do not have their own written characters. Consequently, the history of the Monpa people is known through oral histories and Tibetan literature [12]. In 1964, the Monpa group was officially recognized as an independent ethnic group by the People’s Republic of China [13] and approximately 25,000 Monpa currently reside in the low-altitude areas of Tsona, Nyingchi, and Mêdog in the Tibet Autonomous Region of China [14]. In China, the highest population of Monpa speakers lives in Mêdog County, a biologically and culturally diverse region that is 34,000 km² in extent.

Field survey

Ethnobotanical fieldwork took place over 45 days spreading between November 2017 and May 2018. We

### Table 1: Basical geographical information of the Townships

| Township | Beibeng | Dexing | Bangxin | Jiaresa |
|----------|---------|--------|---------|---------|
| Elevation | 400–5260 m | 850 m | 1240 m | 1120 m |
| Climate  | Low mountain tropical humid climate and Mountain subtropical semi-humid climate | Low mountain tropical humid climate and Mountain subtropical semi-humid climate | Mountain subtropical semi-humid climate | Mountain subtropical semi-humid climate |
| Population | 2371 | 1668 | 1370 | 581 |
interviewed 64 key informants. After transect walks with knowledgeable local people, information was collected through free listing, semi-structured, and key informant interviews, participatory approaches and group discussions. Most of key informants were the village leaders and the knowledgeable persons in the village. The age of key informants ranged between 21 and 84 years old. The interviews included the questions that were relevant to document detail information on all useful wild plants. The questions investigated included: What is your age? What is the local name of each plant? What are the most frequently used parts? What ailment does this plant treat? What is the cooking or preparation method of each plant? Do you know any other uses of the plants? We documented the ethnobotanical information for each plant, including scientific name, vernacular name, parts used, habitat and other specific purposes. Additional file 1 and Additional file 2 local writing system is derived from Tibetan language, so the local name is spelled by the writing system which is founded by Turrell Wylie (https://www.omniglot.com/writing/tibetan.htm) (Additional files 1 and 2). Scientific names of plants were confirmed by The Plant List (http://www.thepointlist.org). All the voucher specimens of listed species were collected and deposited at the herbarium of Kunming Institute of Botany.

Data analysis

Ethnobotanical quantitative indices including utilization frequency, informant consensus factor (FIC), and cultural importance index (CI) were adopted. The use frequency of certain species was estimated by utilization frequency:

\[ f = \frac{N_m}{N_i} \]

Where \( N_m \) was the number of certain species mentioned by informant, and \( N_i \) was the total number of informants. High \( f \) values indicated the plant used frequently [15].

FIC was determined using the following formula to evaluate the information of medicinal plants distributed between informants and to determine the homogeneity of informant’s knowledge on medicinal plants.

\[ \text{FIC} = \frac{N_{ur} - N_t}{N_{ur} - 1} \]

Where \( N_{ur} \) was the number of use reports from informants for each ailment category, and \( N_t \) was the total number of species used by all informants for this ailment category. Values of FIC ranging between 0 and 1. High FIC values (close to one) showed the agreement among the informants about this ailment category. On the contrary, low FIC values (close to zero) showed disagreement among the informants [16].

Each species mentioned by an informant within one use category was a use report (UR). Cultural importance index (CI) was used to indicate the spread of the use
(number of informants) of each species as well as to
determine diversity of uses.

\[ CI_i = \sum_{u=1}^{N_{\text{UR}_{ui}}} \sum_{i=1}^{NC} \frac{UR_{ui}}{N} \]

\( N \) was the total number of informants and \( NC \) was the
total number of use categories. \( CI \) was the sum of the
proportion of informants that mentioned each of the use
categories for a given species. The higher \( CI \) value
indicated the multiple uses of a species [17].

Results and discussion

Diversity and enumeration of Monpa plant use

This study has documented 194 plant species belonging
to 82 families and 158 genera used by Monpa people in
Mêdog County (Table 4 in Appendix). Of these plant
species, 84 were herbaceous (43.3%), 52 species were
trees (26.8%), 35 species were shrubs (18%), and 23
species were lianas or vines (11.9%). The survey results
reveal that there are 45 species of ethnomedicinal plants,
122 species of local edible plants, and 39 plant species
has been traditionally consumed as other purposes in
Monpa daily life, including agriculture tools (9), dyes (5),
incense (2), timber (4), fuelwood (3), religious ritual use
(4), washing (clothes and hair) (3), thatching (2), fish
poisons (2), fiber (2), seasonal indication (2), and a to-

bacco substitute (1) (Fig. 2).

In contrast to the staple diet of naked barley, yak meat,
mutton, buttered tea, and barley wine of traditional
Tibetan, they seldom eat vegetables or fruits, yet plant
resources in Mêdog County are more plentiful. Monpa
people have a wide variety of vegetables and beverages
in their traditional daily diet. The most frequently used
part is the fruit (58 species, 47.5%) in this study,
which is consistent with the situation in northeast
India, which has similar bio-climatic conditions [18].
This demonstrates the rich diversity of wild fruits
and vegetables in the region, providing local residents
with sustainable economic pillars and livelihood se-
curity by targeting wild edible fruits and vegetables
that can be developed commercially [18]. Out of 122
wild edible species, seven are also used as herbal
medicine. *Equisetum ramosissimum*, for example, the
root of this species is usually eaten directly as a fruit
and boiling the aerial part could be used for treating
rheumatism. Wild edible plants with high \( CI \) values
may have peculiar dietary constituent and require
further research. In addition, the alcoholic beverage
consumed by almost all Nepalese and Tibetans
(known as "jnard") which has the same ingredients as
this yellow “wine” in Mêdog County [19]. Seasonal
fishing and fishing by poison are also great economic
activities for many tribal people in the world. Studies
in Nepal recorded that four entirely different plant
species exploited as fish poison plants [20]. Tsering
et al.’s study was focused on higher altitude species
used by Monpa people, including the medicinal
plants *Aconitum heterophyllum*, *Neopicrorhiza scro-
phulariiflora*, *Paris polyphylla*, *Rhododendron hodgso-
nii*, *Swertia chirayita*, and *Taxus baccata* [2]. In our
study, one of these higher altitude species was re-
corded (*Paris polyphylla*).

Edible fruits and vegetables

Food categories include fruit, vegetable, starch, oil,
nut, beverage, condiment, and forage (Fig. 3). The
most widely used wild edible species are fruits (42
species), followed by vegetables (41 species). The Monpa depended on wild fruits with high CI values such as Saurauia punduana (0.78), Elaeocarpus bracleanus (0.5), Duchesnea indica (0.41), or Ficus semi-cordata (0.39) for vitamins and nutrients. The same as Lhoba people [21], Monpa depended on fruits from wild edible species which may be related to the low productivity of cultivated fruit trees of the Monpa group. Rubus ellipticus Sm. (0.33) is a renowned wild edible fruit to Monpa ethnic people in Mêdog County, whose ripe fruits can be taken orally and act as medicine for aperient and juice of the tender leaves cures oral ulcers in the district Udhampur, J&K, India [22]. Monpa people have been using stone casserole as cookware since ancient times [23]. Monpa people like to eat “hot-pot” dishes in the stone casserole including wild vegetables and meat which are a popular food combination in Mêdog County. Wild vegetables with high CI values included Crassocephalum crepidioides (0.78), Pimpinella diversifolia (0.56), Rorippa dubia (0.31), Solanum torvum (0.2), and Solanum hirta (0.08). Solanum hirta is a leafy vegetable that is also used as a functional food to provide energy for children and elders [24]. It is interesting that while it is used as a medicine in Bhutan [25], Entada rheedii is a popular addition to food by Monpa people. The cooking method for Entada rheedii is time-consuming due to the toxicity of the seeds. The seeds have to be detoxified by leaching and heating. The seeds are boiled with water, which is poured off each time to clear away the toxicity, then refilling the pot with water, repeating the process more than ten times. The Entada rheedii seeds are then cut into pieces and fried with rice.

Other categories were less frequent in use such as forage (13), starch (seven), beverage (seven), oil (six), spice source plant (five), and nuts (two). However, Monpa people have a rich tradition of extracting beverage, starch, and oil from specific plants in the region.

**Fermented beverages**

Traditional consumption of alcoholic beverages is an ancient tradition that is still an integral part of Monpa society. The Monpa people have the traditional custom of “three bowls of wine”, meaning that guests have to drink three bowls of yellow wine before they enter the door to show their friendship. Seven plant species were used to produce a yellow “wine.” The mainly ingredients were rice (Oryza sativa L.), maize (Zea mays L.), Eleusine coracana, and Fagopyrum esculentum. Buddleja asiatica is the most important plant species during the preparation of alcoholic beverage fermentation by Monpa people in Mêdog County. Based on the uses of Buddleja lindleyana and Buddleja officinalis in coloring rice yellow [26] and B. officinalis in indigo fermentation [27], we suggest that B. asiatica is a dual purposeful species, as both a wine colorant and a source of microorganisms that an aid to fermentation (Fig. 4).

**Starch sources**

Starch in Monpa people diets was supplemented by starch processed from wild species. Cultivated starch
sources were from both cereal crops and cultivated tubers (Table 4 in Appendix). The cultivated cereals were buckwheat (*Fagopyrum esculentum* and *Fagopyrum tataricum*), finger millet (*Eleusine coracana*), rice, and maize. Three taro (*Colocasia*) species and four yam (*Dioscorea*) species were cultivated as starch sources (Table 4 in Appendix). Of these, *Dioscorea alata* tubers have 80% starch in dry matter [28] and *Colocasia esculenta* have 70–80% starch in dry matter [29]. Wild species also provided supplementary starch sources (excluding the starch-rich seeds of *Entada rheedii* mentioned in the previous section). Two of these were palms (Table 4 in Appendix) in the genus *Arenga*. As Ellen points out [30], this is one of main starch-producing palm genera used for food in Asia, the other genera being *Borassus*, *Caryota*, *Corypha*, *Eugeissona*, and *Metroxylon*. Starch production from *Arenga micrantha* is poorly known as it is endemic to Mêdog County [8] and is documented in this study (Fig. 5). In contrast, *Arenga pinnata* is widely distributed in Asia, where it is most commonly served as palm sugar [31], but is also used as a starch source [30]. Other starch sources were *Alsophila articulata* and *Chenopodium album*. Today, the uses of *Arenga micrantha*, *Arenga pinnata*, and *Alsophila articulata* are almost abandoned. This decrease in consumption of these wild starch sources has increased the production of cultivated cereal crops in Mêdog County [32].

**Seed oils**

The Monpa in Mêdog County totally used six wild edibles as the source of oil and fats. One of these species, *Perilla frutescens*, was also widely used in various tribal groups of the northeast India [33]. Moreover, *Perilla frutescens* oil is rich in natural compounds that could be developed as nutraceuticals and/or phytomedicine [34].

**Medicinal plant use**

According to our survey results, 45 plant species are used as herbal medicines for treating 13 different categories of human ailments. Botanical and ethnobotanical information about these plant species include scientific name, family name, vernacular name, part(s) used, the method of preparation, the ailments treated, and voucher specimen number. Just over half medicinal plants were herbs (51.1%). This agrees with reports from the lower elevation of Bhutan that most of the ethnobotanical plants were herbs [25]. The common use of herbs as sources of medicine found in this study were also indicated by studies conducted elsewhere.

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**Fig. 4** The "yellow-wine" production process. a “Cakes” used to start rice “wine” fermentation drying on a bamboo rack. These are made from a mix of species based on a secret recipe. b Preparing the starch base for “yellow wine” from rice (*Oryza sativa*), maize (*Zea mays*), *Eleusine coracana*, and *Fagopyrum esculentum*. c Finger millet (*Eleusine coracana*). d Straining the wine using a strainer made from *Dendrocalamus tibeticus* culms. e Ready for a welcome drink of three cups of yellow wine: cultural and social values underpin the continued production of the yellow wine.
Leaves (40%) are the most predominantly used parts of these medicinal plants, followed by roots (22.2%), fruits (15.6%), seeds (11.1%), stems (6.7%), whole plant (6.7%), branches (6.7%), and buds (4.4%). The preference for leaf has also been recorded among the traditional Tibetan doctors of Mustang district of the north-central part of Nepal [35].

Uses for all illnesses for wild medicinal plants are locally classified into 13 categories (Table 2). These are skin and subcutaneous tissue diseases, circulatory system, immune system, genitourinary ailments, neurological diseases, inflammation, gastrointestinal ailments, endocrine and metabolism disorders, respiratory system disorders, leech bites, snake bites, abortion, musculoskeletal system disorders, and other diseases. FIC results for the 13 illness categories ranged from 0 to 0.75, with the highest for musculoskeletal system disorders (FIC = 0.75; two species, five use-reports), immune system diseases (FIC = 0.67; two species, four use-reports), and respiratory system disorders (FIC = 0.6; three species, six use-reports) (Table 2). One of the important livelihoods of the Monpa is hunting; the highest FIC for musculoskeletal system disorders is related to the damage caused by the accidents.

An empirical observation on the use of medicinal plants by the Monpa people of Mêdog County study area requires cross-validation with published literature on phytochemical and pharmacological properties of medicinal plants reported in this study to verify their effectiveness. Our literature review of 21 medicinal plant species shows that local uses are generally consistent with known pharmacological properties. And based on a literature review, 11 medicinal plant species had partial uses similar with reported pharmacological properties.
To date, no research studies are available on the phytochemical constituents or pharmacological properties of the *Cinnamomum contractum*, *Brassaiopsis hainla*, *Fraxinus floribunda*, or *Zanthoxylum motuoense*. Literature studies indicated that seven species, namely *Artemisia vestita*, *Coix lacryma-jobi*, *Equisetum ramosissimum*, *Oxalis corniculata*, *Persicaria capitata*, *Uncaria rhynchophylla*, and *Uncaria scandens*, were used in Tibetan medicine to treat the same ailments [37]. Four other species (*Curcuma aromatica*, *Dendrobium catenatum*, *Elaeocarpus braceanus*, *Sambucus williamsii*) were possibly the substitutes for *Curcuma longa* L., *Dendrobium nobile* Lindl., *Terminalia chebula* Retz., and *Sambucus williamsii* in Tibetan medicine. And only one species (*Paris polyphylla*) was used for different purpose by the Monpa than in Tibetan medicine.

Comparison of the information on traditional medicinal plant use of Monpa ethnic group with ethnomedical studies conducted in the lower elevation of Bhutan [25], shows that only one wild medicinal plant, *Datura stramonium*, is used in the same for toothache (Table 3).

### Natural dyes and mordants

*Strobilanthes cusia* (Yang-shar-pa), *Rubia wallichiana* (Lae-nyi), *Rubia membranacea* (Lae-nyi), *Eurya acuminata* (Zem-shing), and *Curcuma longa* (Dgrong) are the commonly used species in traditional dye processes. Fresh stems and leaves of *Strobilanthes cusia* are a well-known indigo source [78]. Boiling the stems of *Rubia membranacea* are used as a red dye. Mashed *Curcuma longa* tubers are used to dye threads yellow, while *Eurya acuminata* is used to dye threads green. In India, *Eurya acuminata* is used as a mordant together with *Rubia cordifolia* [79]. Whether *E. acuminata* is used in Mêdog as a mordant with *Rubia membranacea* or *Rubia wallichiana* is unknown at this stage, but is worth further investigation. This is because the genus *Eurya* (Pentaphylacaceae) is a known aluminium hyperaccumulator group [80] that are effective as mordants for red dye processes together with anthroquinone rich dye species, including *Rubia* [81].

### Paper making

The Monpa community in Linzhi city is famous for hand-made paper for religious scripts that is made from the stem bark of *Edgeworthia gardneri*. Peeling the stem bark and removing the outermost layer of the stem bark, the remaining parts are soaked in the water, then stir the solution into a viscous state, pour the solution into a wooden flat mold, and dry it into a paper. Linzhi paper is better than Tibetan paper produced elsewhere.

### Fibers for rope and string

Although *Edgeworthia gardneri* (Thymelaceae) can also be used for making rope and string, the value of this species for paper making may be a reason why this alternative use was not mentioned by local people.

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**Table 2** Informant consensus factor for traditional medicinal plant use categories

| Illness category                                                                 | Number of taxa (N_t) | Number of use-reports (N_u) | Informant consensus factor (FIC) |
|---------------------------------------------------------------------------------|----------------------|-----------------------------|---------------------------------|
| Circulatory system such as high blood pressure, altitude sickness                | 3                    | 4                           | 0.33                            |
| Endocrine and metabolism disorders such as diabetes                            | 1                    | 1                           | –                               |
| Gastrointestinal ailments such as diarrhea, stomach pain, cholecystitis,        | 6                    | 10                          | 0.44                            |
| Intestinal worms                                                                | 2                    | 2                           | 0                               |
| Genitourinary ailments such as menstrual problems                               | 2                    | 2                           | 0                               |
| Immune system such as rheumatism                                                | 2                    | 4                           | 0.67                            |
| Inflammation, suppuration, infective, toothache, sinusitis, clear heat and     | 8                    | 17                          | 0.56                            |
| Detoxification                                                                  |                      |                              |                                 |
| Malaria, mosquito and flea repellent, snake bite, leech bite                    | 5                    | 8                           | 0.43                            |
| Morning sickness, abortion                                                      | 2                    | 3                           | 0.5                             |
| Musculoskeletal system such as sprain, arthritis                                | 2                    | 5                           | 0.75                            |
| Neurology diseases such as epilepsy, acute alcoholic intoxication               | 4                    | 6                           | 0.4                             |
| Others (heat stroke, refreshing, killing insects, rice blast)                  | 4                    | 5                           | 0.25                            |
| Respiratory system disorders such as cold, sore throat and stuffy nose          | 3                    | 6                           | 0.6                             |
| Skin and subcutaneous tissue diseases such as wound, bruises, psoriasis,        | 16                   | 28                          | 0.44                            |
| Allergy, scar, leprosy, bleeding, bad skin odor                                 |                      |                              |                                 |

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| Scientific name                      | Reported phytochemical/pharmacological properties                                                                 | Indigenous use | Local use agreed with known properties |
|-------------------------------------|---------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|
| Alocasia longiloba Miq.             | Livestock wounds [37]                                                                                               | Anti-infective and treating burns | Yes                                    |
| Arintinga excelsa Noronha            | Antipyretic, aphrodisiac and carminative, expectorant, anti-inflammatory, and antitussive [39]                      | Refreshing      | Partial                                |
| Artemisia vestita Wall. ex Besser    | Clearing deficient heat, invigorating stomach, promoting diuresis, inducing the expulsion of gas from the stomach or intestines [40] | Stomach pain    | Yes                                    |
| Begonia acacetosa Craib              | Invigorate the circulation of blood [37]                                                                            | Leeches bite    | Yes                                    |
| Bidens pilosa L.                    | Anti-inflammatory, antiseptic, liver-protective, blood-pressure lowering, and hypoglycemic effects [41]            | Cold, sore throat, and stuffy nose | Yes                                    |
| Bassiaopsis hainla (Buch.-Ham.) Seem.| No relevant report found                                                                                           | Arthritis       |                                        |
| Cinnamomum contractum H. W. Li      | No relevant report found                                                                                           | Stomach pain    |                                        |
| Citrus medica L.                    | Antioxidative, anti-inflammatory, and analgesic [42]                                                                | Cold            | Yes                                    |
| Coix lacryma-jobi L.                | Inhibit obesity and reduce blood lipids [43]                                                                          | High blood pressure | Partial                                |
| Craibiodendron henryi W. W. Sm.     | Antioxidant activities and vasodilator effects [44]                                                                  | Rice blast      |                                        |
| Curcuma aromatica Salisb.           | Antioxidant, relieving pain and anti-inflammation, contributing flavor, and preventing cancer [45]                  | Heat stroke, irregular menstruation, and alcoholism | Partial                                |
| Datura stramonium L.                | Ulcers, wounds, anti-inflammation, rheumatism, bruises, fever and toothache [46]                                    | Toothache       | Yes                                    |
| Debregeasia longifolia (Bur.f.) Wedd.| Antitumor, rheumatism [47, 48]                                                                                     | Preventing miscarriage, and bruises | No                                     |
| Dendrobium catenatum Lindl.         | Enhancing immunity, resisting tumor, nourishing yin and clearing heat, benefiting stomach and promoting body fluid [49] | Cold            | Yes                                    |
| Dichor seafragifuga Lour.            | Anti-malarial activity [50]                                                                                         | Mosquito repellent | Partial                                |
| Duchesnea indica (Jack.s) Focke       | Anti-inflammatory, clearing heat, detumescence, and detoxification [51, 52]                                         | Detoxification and bruises | Yes                                    |
| Eboecarpus braceanus Watt ex C. B. Clarke | Anxiety, depression, nerve pain, epilepsy, and migraine [53]                                                      | Diarrhea        | No                                     |
| Equisetum ramosissimum Desf.         | high blood pressure and diabetes [54]                                                                               | Rheumatism      | No                                     |
| Fraxinus floribunda Wall.            | No relevant report found                                                                                           | Sprain and sunburn |                                        |
| Hovenia acerta Lindl.                | Alcoholism and vomiting [55]                                                                                       | Alcoholism      | Yes                                    |
| Impatients arguta Hookf. & Thomson  | Amenorrhoea, abdominal pain, and hemostasis [57]                                                                    | Stop bleeding   | Yes                                    |
| Isodon lophanthoides (Buch.-Ham. ex D.Don) H.Hara | Enteritis, jaundice, hepatitis, laryngopharyngitis, leptomatus leprosy, and ascariasis [38]              | Intestinal worms | Yes                                    |
| Leycesteria formosa Wall.            | Traumatic bleeding and fracture [37]                                                                               | Stop bleeding   | Yes                                    |
| Millettia pachycarpa Benth.          | Antimicrobic, a medication capable of causing the evacuation of parasitic intestinal worms [56]                  | Killing insects | Yes                                    |
| Morindora dioica Roxb. ex Willd.     | Diuretic, laxative, antihypertensive, anti-inflammatory, and analgesic properties [57]                            | Cholecystitis   | Partial                                |
| Mosla wittiorum Hand.-Mazz.          | Antioxidant activity and cytotoxicity [58]                                                                          | Leprosy         | Partial                                |
| Mosla diandera (Buch.-Ham. ex Roxb.) | Allergic disease is involved in many diseases such as asthma, sinusitis, and                                        | Allergies       | Yes                                    |

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| Scientific name                        | Reported phytochemical/pharmacological properties                                                                 | Indigenous use | Local use agreed with known properties |
|---------------------------------------|------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------|
| Maxim.                                | Rheumatoid arthritis [59]                                                                                               |                |                                        |
| Nicotiana tabacum L.                  | Antitumor, detoxification and anti-inflammatory [60]                                                                     | Sinusitis      | Partial                                |
| Oxalis comiculata L                   | Giddiness, cough, cold, fever, diarrhea, dysentery, antihelmintic [61]                                                   | Morning sickness | No                                     |
| Paris polyphilla ssp.                 | Anticancer, snake bite, parotitis, mastitis, chronic bronchitis, injuries from fractures, as well as to stop bleeding [62] | Diabetes       | No                                     |
| Persicaria capitata (Buch.-Ham. ex D.Don) H.Gross | Anti-inflammatory, antibacterial, analgesic, and diuretic [63]                                                           | Burns          | Yes                                    |
| Piper semiimmerum C. DC.              | Platelet aggregation induced by thrombin (IIa) or PAF in rabbit [64]                                                    | Altitude sickness and irregular menstruation | No                                     |
| Piper sylvaticum Roxb.                | Anthelmintic, antioxidant and hepatoprotective activities and treatment of bronchitis [65]                             | Anti-inflammatory | Yes                                    |
| Ricinus communis L                    | A laxative, an anti-infective, or an anti-inflammatory drug [66]                                                       | Bruises        | Partial                                |
| Sambucus williamsii Hance             | Anti-inflammatory, analgesic, fracture healing [67]                                                                    | Bruises        | Yes                                    |
| Sauromatum venosum (Dryand. ex Aiton) Kunth | Mitogenic and anti-proliferative activity [68]                                                                         | Suppuration     | No                                     |
| Solanum aculeatissimum Jacq.          | Constipation, back pain, snakebites, toothache, headache, skin infections, cough [69]                                  | Psoriasis       | Partial                                |
| Stephania abyssinica (Quart-Dill. & A.Rich.) Wulp. | Treat various stomach disorders, laxative, antidote, regulator of menstrual cycle [70]                             | Rheumatism and snake bite | Partial                                |
| Swertia angustifolia Buch-Ham. ex D. Don | Febrifuge and epilepsy [71]                                                                                           | Anti-malaria    | Yes                                    |
| Swertia nervosa (Wall. ex G. Don) C. B. Clarke | Clearing away heat and toxic material, invigorating blood circulation and regulating menstruation [72] | Diarrhea       | Yes                                    |
| Toddalia asiatica (L.) Lam.           | Relieve pain and stasis as well as for haemostatic, treat malaria, fever and to cure rheumatism [73, 74]             | Epilepsy       | No                                     |
| Uncaria rhynchophylla (Miq.) Miq. ex Havil. | Treatment of hypertension, headache, and stroke [75]                                                                    | High blood pressure | Yes                                    |
| Uncaria scandens (Sm.) Hutch.          | Treatment of nosotoxicosis, headache, dizziness, high fever in children, seizures, convulsions [76]                  | Epilepsy       | Yes                                    |
| Viburnum cylindricum Buch-Ham. ex D. Don | Cough, diarrhea, rheumatoid arthritis, and tumefaction [77]                                                            | Anti-inflammatory, scar and repelling flea | Partial                                |
| Zanthoxylum motoense C. C. Huang       | No relevant report found                                                                                               | Bad skin odor   |                                        |
during our fieldwork. What was mentioned as a source of rope was the aerial roots of *Poikilospermum lanceolatum* (Urticaceae). Based on taxonomic insights and from studies elsewhere, however, we suggested that fiber species were under-reported (c. 14 species in four families (Fabaceae, Moraceae, Urticaceae, and Thymeleaceae) were used compared to the use of just one species (*Poikilospermum lanceolatum*) reported used for rope making). For example, *Debregeasia longifolia* (Urticaceae) is known for the quality of its fibers from other parts of China and *Millettia pachycarpa* (Leguminosae) bark is also recorded used for rope in the Flora of China (www.efloras.org). It is also likely that the bark of Moraceae (*Ficus auriculata, Ficus cyrtophylla, Ficus oligodon, Ficus seminodata, Ficus subincisa, Morus alba, and Morus wittiorum*) are also used for rope or twine. As is the stem bark of several Urticaceae (*Elatostema cuneiforme, Elatostema nasutum, Gonostegia hirta, Pilea hilliana*).

**House construction, tools, and utensils**

*Morus wittiorum, Celastrus glaucophyllus, Terminalia myriocarpa,* and *Pinus wallichiana* are the main timber species that the Monpa used for building their houses, of which *Terminalia myriocarpa* is the best quality of all timber species but cannot be chopped now because of it is vulnerable species according to the China Red Data Book [82]. *Erythrina arborescens, Wendlandia tinctoria, Maesa rugosa, Radermachera yunnanensis, Abroma augusta, Macaranga denticulata,* and *Phrynium placentarium* are used to make agricultural tools or daily-life utensils. For example, *Wendlandia tinctoria* can be used to make hiltts for knives and *Erythrina arborescens* is used to make carvings for religious rituals.

*Imperata cylindrica* and *Themeda villosa* are used for thatching, of which the quality of *Imperata cylindrica* is better than *Themeda villosa*. *Themeda villosa* are covered on the roof, paved 5 cm thick, and changed once in 7 years, but *Imperata cylindrica* can be maintained 7 years.

In addition to use of bamboo (mainly *Bambusa teres* and *Dendrocalamus tibeticus*) for making household utensils, the rattan *Calamus acanthophathus* is used to make baskets (Fig. 6). This widespread species is found in China (Tibet, Yunnan) as well as in Bhutan, India, Laos, Myanmar, Nepal, Thailand, and Vietnam which is also used as a source of edible greens (from the young shoots).

**Ritual uses of plants**

The Monpa belief systems, derived from the pre-Buddhist Bon religion and from Tibetan Buddhism, also link to animistic beliefs, where even the new houses have soul [83]. *Laurocerasus undulata* seeds oil and liquor are blended together during religious rituals by Monpa people, and then poured near the house to drive away misfortune and malevolent spirits. Nowadays, Monpa culture has been deeply influenced by Tibetan culture and most of the Monpa people believe in Tibetan Buddhism. *Cinnamomum iners* and *Ekelohzita blanda* are used as incense sources, which play an important role in the religious rituals of the Monpa. *Luculia gratissima* locally called “nom-meng” is also used as an offering in religious rituals.

The Monpa in Mêdog County have a unique funeral culture owing to the special geographical environment, cultural background, and religious beliefs. The practice of re-burial occurs when after burial, the bones are dug out for cremation, and the ashes are scattered into the Yarlung Tsangpo River. This cremation is ignited by the leaves of *Altingia excelsa* locally called “Sang-shing,” which was used by the Monpa people to burn the body. In the meantime, yak butter and liquor are periodically added to the fire, along with offerings of rice, maize, and “Konpu” (*Eleusine coracana*). Secondly, put the leaves and stems of “Sra-gu” (*Arundo donax*) and the branches of “La-ga-dong-shing” (*Garcinia nujiangensis*) in turn. The leaves of “Sang-shing” are an essential ignition material for every funeral of the Monpa people.

**Fish poisons**

Seasonal fishing and hunting are great economic activities of Monpa ethnic community in addition to agriculture. Fishing by poison was well-known throughout the world in historical time [84]. *Derris scabraulis* and *Hydrocotyle javanica* are poisonous plants used by the Monpa people in Mêdog County for fishing. A proper amount of poisonous plants are soaked in the water, the fish will lose consciousness and float to the water within half an hour. However, if you could not catch the fish in time, the fish will wake up. No relevant reports about these two poisonous plants were found. However, the rotenones, saponins, and cyanide are the main active ingredients of these fish poison species [85].

**Calendar plants**

According to our investigation, *Mussaenda pubescens* and *Meliosma pinnata* are used for indicating the time of sowing maize by Monpa people. *Mussaenda pubescens* blossoms and the weather is fine, then you can sow the seeds in the field, but you cannot sow the seeds after the blooming period of *Meliosma*...
The flowering period of *Mussaenda pubescens* is during June to July. The blooming period of *Meliosma pinnata* is during May to June [86]. The flowering time of these two species is exactly the same as maize planting time.

**Uses of endemic and near-endemic plant species**

Uses of endemic and near-endemic species in 12 plant families reflect the plant diversity of this part of the Indo-Burman biodiversity “hot-spot.” Uses of these species have been rarely recorded in previous studies. In our field survey, we recorded the uses of narrowly distributed edible plants, for example, *Arenga micrantha* (used for starch), *Hornstedtia tibetica* (for fruits), *Castanopsis clarkei*, and *Gnetum pendulum* (for edible nuts) (Fig. 7a, d) and *Ophiorrhiza medogensis* (for vegetables). In contrast to the widespread use of the poisonous *Derris trifoliolata* (Leguminosae) containing rotenone, which occurs from East Africa to the Western Pacific, Monpa people use *Derris scabricaulis* which is endemic to Yunnan and Tibet. In terms of farming and equipment used by local households, agricultural tools are made from the high-density wood of *Radermachera yunnanensis* (Bignoniaceae) while wine strainers and implements for administering medicine are made from *Dendrocalamus tibeticus* (Poaceae). *Litsea tibetana* (Lauraceae) is a near endemic seed oil source, as are spices from the endemic

**Fig. 6** Rattan as a basketry resource. *a* Men returning to their village with bundles of *Calamus acanthospathus* stems. *b* Details of harvested *C. acanthospathus*. *c* Splitting *C. acanthospathus* in preparation for weaving. *d* A woven rattan strap for a carrying basket. *e* Completed winnowing basket. *f* Storage baskets.
Zanthoxylum motuoense (Rutaceae). Additional unusual records are the use of Cinnamomum contractum ( Lauraceae) as a tobacco substitute (a species only found in south-east Tibet and NW Yunnan, Morus wittiorum (Moraceae) fruits for medicine and the use of Garcinia nuijangensis (Clusiaceae), a species restricted to south-east Tibet, north-west, and west Yunnan for funeral rituals.

**How do plant uses reflect socio-economic change in Mêdog County?**

Until October 2013, there were no major roads in Mêdog County and Monpa people practised swidden agriculture, supplemented by hunting and gathering [87]. Despite the absence of roads, Monpa knowledge of plant uses reflect at least three categories of change.

Firstly, through oral history, knowledge of plants that Monpa ancestors would have encountered in Bhutan and Tibet prior to their migration to Mêdog. Secondly, a slow change in knowledge as introduced species were brought to Mêdog along the trade routes. These species include cereal crops from Africa (Eleusine coracana and Sorghum bicolor) and meso-America (Zea mays), cultivated fruits from north-west China (Prunus persica), medicinal plants from Africa (Ricinus communis) and North America (Datura stramonium), fuel from the Mediterranean Basin and the Middle East (Arundo donax), and three South American Solanceae that have come into “traditional” use (Nicotiana tabacum, Solanum americanum and Solanum aculeatissimum). Although oral histories do not indicate when these species were introduced, the fact that several introduced species are used ritually (maize, Eleusine coracana and Arundo donax) is one indication of early introductions. Another indication is the “traditional” medicinal use of introduced medicinal plants such as Datura stramonium (Fig. 8). Although D. stramonium seeds are known to be used for treating toothache elsewhere [88], but the method of preparation and administration used by Monpa people is innovative (Fig. 8a–d). Thirdly, in contrast to these “slow changes,” there is “fast
change” over the past decade that has speeded up rapidly since the highway was opened in October 2013. This is reflected in changes in traditional architecture and in trade in selected plant resources (such as *Dendrobium* and *Paris* to China’s TCM markets).

While Monpa people still have a wealth of ethno-botanical knowledge that has been passed down orally from generation to generation, the construction of a highway to Mêdog County has stimulated rapid change and possible loss of traditional knowledge. The influence of modernization, social and economic development, and the lack of interests shown by the young generation are seriously threatened to the ethnic culture of no written words [89]. Our research shows that the increasing publicity and availability of Tibetan and Chinese medicines has also affected the indigenous knowledge of the Monpa. There are no exclusive traditional doctors in the villages now and traditional medical knowledge is about to disappear.

**Conclusions**

Monpa traditional plant-based knowledge are practiced, accumulated, and passed down from generation to generation. The Monpa people in Mêdog County still preserve most of traditional plant-based knowledge. We documented 194 wild plant species belonging to 82 families 158 genera used for traditional medicines, food, dyeing, timber, religion, and other purposes during our ethnobotanical survey. Overall, this study provides a deeper understanding of the Monpa traditional knowledge on wild plants. The study suggests some wild medical plant species might have new active ingredients which are necessitated for further investigation. Since the development of modernization has changed the Monpa lifestyle and production structure, traditional knowledge and biocultural diversity can be essential components to ensure the sustainable development of Monpa community and may play a significant role in the sustainable use and development of Tibetan plant resources.

**Fig. 8** Experimentation and use of an introduced species in Monpa “traditional” medicine. a *Datura stramonium* fruits. The seeds are used to treat toothache. b, c Mixing *D. stramonium* seeds with pig fat. d Creating hot steam by placing a red hot iron in water, on which the *Datura* seed/fat mixture is placed. e *Dendrocalamus tibeticus* bamboo culm, sealed using rice around a protruding tube that is placed over the super-heated *Datura* and pig-fat infused steam to direct the ingredients to the sore tooth and remove the “insect” causing toothache.
## Appendix

### Table 4 Ethnobotanical inventory of Monpa in Mêdog County, Tibet, China

| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use | Voucher specimen number |
|-------------|-----------------|-----------------|-------|------------|-----------|------------------------|
| Acanthaceae | *Strobilanthes cusia* (Nees) Kuntze | Yang-shar-pa | Herb | Leaves | Dye plant | WangYH0009 |
| Actinidiaceae | *Saurauia punduana* Wall. | A-rong-ma | Tree | Flower buds and fruits | Food (a kind of fruit) | 18CS16811 |
| Adoxaceae | *Sambucus williamsii* Hance | Bha-mu-kling-shi | Shrub | Leaves | Leaves are baked on the fire with butter used for treating bruises | 18CS16839 |
| Adoxaceae | *Viburnum cylindricum* Buch.-Ham. ex D. Don | Uh-mu-ling-shing | Tree | Fruits and burgeons | Fruit oil soaked in alcohol for anti-inflammatory and soaked in honey for removing scar. Burgeons are boiled in water for repelling flea | 18CS16894 |
| Adoxaceae | *Viburnum enubesens* Wall. | Tseh-za-ku-lu-shing | Tree | Fruits | Food (a kind of fruit) | 18CS16949 |
| Altingiaceae | *Altingia excelsa* Noronha | Sang-shing | Tree | Branches, fruits and burgeons | Fuel. Fruits are burned for refreshing. Making tea | 18CS16869 |
| Amaranthaceae | * Chenopodium album* L. | Shar-ri-mu | Herb | Seeds | Food (extracting starch) | 18CS16857 |
| Anacardiaceae | *Choerospondias axillaris* (Roxb.) B. L. Burtt & A. W. Hill | Ju-ru-ra | Tree | Fruits | Food (a kind of fruit) | 18CS16940 |
| Apocynaceae | *Pimpinella diversifolia* DC. | Gya-ma-ga-da | Herb | Whole plant | Food (a kind of vegetable) | 18CS16816 |
| Apocynaceae | Apocynaceae sp. | Nu-ru | Vine | Roots and stems | Medicine used for treating allergy | 18CS16899 |
| Araceae | *Alocasia longiloba* Miq. | Bo-zong-gang-gyi-pa | Herb | Roots | Sliced roots used for anti-infective and treating burns | WangYH0069 |
| Araceae | *Colocasia affinis* Schott | Bu-dong | Herb | Rhizomes | Food (a kind of vegetable). Extracting starch | 18CS16922 |
| Araceae | *Colocasia antiquorum* Schott | Bu-pong | Herb | Whole plant | Food (a kind of vegetable). Extracting starch | 18CS16824 |
| Araceae | *Colocasia esculenta* (L.) Schott | Pon-song | Herb | Whole plant | Food (a kind of vegetable). Extracting starch | 18CS16814 |
| Araceae | *Remusatia pumila* (D. Don) H. Li & A. Hay | Pon-song | Herb | Whole plant | Food (a kind of vegetable, and boiled in the water) | 18CS16929 |
| Araceae | *Remusatia vivipara* (Roxb.) Schott | Ri-bo-song | Herb | Leaves | Food (a kind of vegetable, and boiled in the water) | WangYH0178 |
| Araliaceae | *Sauromatum venosum* (Dryand. ex Aiton) Kunth | Reh-drong-ma | Herb | Whole plant | Crushed plants are used for treating suppuration | 18CS16876 |
| Araliaceae | *Brassaiopsis hainila* (Buch.-Ham.) Seem. | Bhong-dong-shing | Tree | Barks | Boiled for treating arthritis | 18CS16883 |
| Araliaceae | *Hydrocotyle javanica* Thunb. | Sa-la-meng-ba-ren | Herb | Whole plant | Fish poison plant | 18CS16948 |
| Araliaceae | *Schefflera khasiana* (C. B. Clarke) R. Vig. | Pyu-shing | Tree | Stems | Musical instrument | 18CS16897 |
| Arecaeeae | *Arenga micrantha* C. F. Wei | Ta-shi | Tree | Stems | Food (extracting starch). Forage | 18CS16836 |
| Arecaeeae | *Arenga pinnata* | Ta-shing | Tree | Stems | Extracting starch | 18CS169132 |
| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use | f | CI | Voucher specimen number |
|-------------|----------------|----------------|-------|------------|-----------|---|----|------------------------|
| Arecaceae   | *Calamus acanthophalus* | B-nyu-mu/ Ba-ser | Vine  | Burgeons and fruits | Food (a kind of vegetable and fruit). Making agriculture tools | 0.43 | 0.43 | 18CS16864 |
| Areaceae    | *Caryota obtusa* | Chu-shing | Tree  | Stems | Making chopsticks | 0.09 | 0.09 | 18CS16819 |
| Asparagaceae| *Polygonatum oppositifolium* | Ren-gyi-tsong | Herb  | Burgeons | Food (a kind of vegetable) | 0.05 | 0.05 | WangYH0194 |
| Asparagaceae| *Rhodota nepalensis* | Ka-lu | Herb  | Tender stems | Food (a kind of vegetable) | 0.34 | 0.34 | 18CS16817 |
| Athyriaceae | *Diplazium esculentum* | Ta-wai | Fern  | Tender stems and leaves | Food (a kind of vegetable) | 0.33 | 0.33 | WangYH0050 |
| Balsaminaceae| *Impatiens arguta* | Gyang-tsong-hwen | Herb  | Leaves | Crushed leaves are used for stopping bleeding. Forage | 0.08 | 0.08 | 18CS16834 |
| Begoniaceae | *Begonia aborensis* | Gyu-bu | Herb  | Stems | Food (a kind of vegetable) | 0.13 | 0.13 | 18CS16818 |
| Begoniaceae | *Begonia acetosella* | Pa-pa-man | Herb  | Leaves | Mashed leaves are used for treating leeches bite | 0.27 | 0.27 | WangYH0038 |
| Berberidaceae| *Holboellia latifolia* | Chou-dang-lee-si | Vine  | Fruits | Food (a kind of fruit) | 0.05 | 0.05 | WangYH0037 |
| Bignoniaceae| *Radermachera yunnanensis* | Gya-srong-ni-shing | Tree  | Stems | Making agriculture tools | 0.08 | 0.08 | 18CS16944 |
| Boraginaceae | *Cordia dichotoma* | Pa-mi-shing | Tree  | Fruits | Extracting oil | 0.13 | 0.13 | 18CS16835 |
| Brassicaceae | *Cardamine macrophylla* | Shu | Herb  | Whole plant | Food (a kind of vegetable) | 0.2 | 0.2 | 18CS16989 |
| Caprifoliaceae | *Leycesteria formosa* | Pya-min-mon | Shrub  | Leaves | Medicine used for stopping bleeding | 0.13 | 0.13 | WangYH0170 |
| Celastraceae | *Celastrus glaucophyllus* | Ling-shing | Trunk  | Timber plant | 0.2 | 0.2 | WangYH0048 |
| Clusiaceae  | *Garcinia nujangensis* | La-ga-dong-shing | Tree  | Fruits and stems | Food (a kind of fruit). Fuel | 0.27 | 0.27 | WangYH0027 |
| Combretaceae | *Terminalia myricarpa* | Ba-lern-shing | Tree  | Trunks | Timber plant | 0.27 | 0.27 | WangYH0124 |
| Commelinaceae| *Streptolirion volubile* | Pa-ner-ju | Herb  | Whole plant | Forage | 0.13 | 0.13 | 18CS16885 |
| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use f | CL | Voucher specimen number |
|-------------|-----------------|----------------|-------|------------|-------------|----|------------------------|
| Compositae  | Acmella oleracea (L.) R. K. Jansen | Nyi-ri-ki | Herb | Burgeons | Food (a kind of vegetable) | 0.13 | WangYH0056 |
| Compositae  | Artemisia vestita Wall. ex Besser | Myer-rang-ma | Herb | Leaves | The powder of “xin zei” are wrapped in leaves and rolled up, and then placed on the navel as moxibustion, used for treating stomach pain | 18CS16868 |
| Compositae  | Bidens pilosa L. | Srong-treng-rong | Herb | Leaves | Boiled leaves used for treating cold, sore throat and stuffy nose | 0.05 | 18CS16872 |
| Compositae  | Crassocephalum crepidioides (Benth.) S. Moore | Gyal-pehn | Herb | Whole plant | Food (a kind of vegetable) | 0.78 | 18CS16809 |
| Compositae  | Gymnura procumbens (Lour.) Merr. | Wenv-gya-pa | Herb | Aerial parts | Forage | 0.06 | 18CS16872 |
| Compositae  | Helianthus tuberosus L. | Yang-gyal | Herb | Tubers | | 18CS16854 |
| Cornaceae   | Cornus capitata Wall. | Da-ming-der-shing | Tree | Fruits | Food (a kind of fruit) | 0.08 | 18CS16950 |
| Cucurbitaceae | Cucurbitaceae sp. | Doe-shung | Vine | Tubers | Washing hair and clothes | 0.19 | 18CS16823 |
| Cucurbitaceae | Momordica dioica Roxb. ex Willd. | Su-ba | Herb | Leaves | Food (a kind of vegetable), boiled leaves used for treating cholecystitis. Washing hair and clothes | 0.31 | 18CS16874 |
| Cucurbitaceae | Solena heterophylla Lour. | Gang-gu-long | Herb | Fruits | Food (a kind of fruit) | 0.25 | 18CS16873 |
| Cucurbitaceae | Thladiantha cordifolia (Blume) Cogn. | Su-pa | Vine | Tubers | Washing hair and clothes | 0.34 | 18CS16863 |
| Cucurbitaceae | Trichosanthes tricuspisata Lour. | A-pa-kas | Vine | Seeds | Food (a kind of vegetable) | 0.06 | 18CS16943 |
| Cucurbitaceae | Zehneria japonica (Thunb.) H.Y. Liu | Ka-gyi | Herb | Whole plant | Food (a kind of vegetable) | 0.19 | 18CS16826 |
| Cupressaceae | Platycladus orientalis (L.) Franco | Shug-pa | Tree | Stems | Religious ritual use | | WangYH0017 |
| Cyatheaceae  | Aiptophila articulata J. Sm. ex T. Moore & Houllston | A-gyi | Tree | Stems | Making alcohol beverages. Extracting starch | 0.16 | 18CS169108 |
| Cyperaceae  | Scirpus rathorum Diels | Gong-bu-ueh | Herb | Fruits | Food (a kind of fruit) | 0.06 | 18CS16946 |
| Dioscoreaceae | Dioscorea alata L. | Dgro-ton/Gyu-dang | Vine | Rhizomes | Food (a kind of vegetable), Extracting starch | 0.08 | 18CS169104 |
| Dioscoreaceae | Dioscorea melanophyrm Prain & Burkill | Bo-zon-za-ju | Vine | Leaves and rhizomes | Food (a kind of vegetable), Extracting starch, Forage | 0.06 | WangYH0059 |
| Dioscoreaceae | Dioscorea pentaphylla L. | Pan-dang | Vine | Roots | Extracting starch, Forage. Food (a kind of fruit) | 0.34 | 18CS16889 |
| Dioscoreaceae | Dioscorea sp. | Ju-dang | Vine | Rhizomes | Food (a kind of vegetable), Extracting starch | 0.36 | 18CS16877 |
| Ebenaceae   | Diospyros lotus L. | A-mu-dong-bashing | Tree | Fruits | Food (a kind of fruit) | 18CS16954 |
| Ebenaceae   | Diospyros variegata Kurz | Ang-dripa | Shrub | Fruits | Food (a kind of fruit) | | WangYH0104 |
| Elaeagnaceae | Elaeagnus conferta Roxb. | Trong-pa-lin | Shrub | Fruits | Food (a kind of fruit) | 18CS16952 |
| Elaeagnaceae | Elaeagnus | Dar-ma | Shrub | Fruits | Food (a kind of fruit) | 0.27 | 18CS16859 |
| Family name     | Scientific name                          | Vernacular name | Habit     | Parts used        | Local use                                                                 | f  | CI  | Voucher specimen number |
|-----------------|------------------------------------------|-----------------|-----------|-------------------|---------------------------------------------------------------------------|----|-----|-------------------------|
| Elaeocarpaceae  | Elaeocarpus bracteatus Watt ex C. B. Clarke | Gar-shar-dong-shing | Tree      | Seeds and fruits  | Boiled seeds used for treating diarrhea. Food (a kind of fruit)           | 0.5| 0.5| 18CS16858               |
| Euphorbiaceae   | Ostodes paniculata Blume                 | Ga-ren-de-shing | Tree      | Seeds             | Extracting oil                                                            | 0.06| 0.06| 18CS16840               |
| Euphorbiaceae   | Ricinus communis L. var.                 | Gyal-muna       | Herb      | Leaves            | Leaves are baked on the fire with butter used for treating bruises. Seed oils | 0.11| 0.11| 18CS16938               |
| Gentianaceae    | Swertia nervosa (Wall. ex G. Don) C. B. Clarke | Pa-bhu-ser-pu   | Herb      | Leaves and roots  | Leaves are boiled in the water used for treating diarrhea                   | 0.27| 0.27| 18CS16841               |
| Gnetaceae       | Gnetum pendulum C. Y. Cheng               | Gyong-ga-sa     | Vine      | Fruits            | Nut                                                                        | 0.22| 0.22| 18CS16959               |
| Hydrangeaceae   | Dichroa febrifuga Loure.                 | Yo-gor-shing    | Shrub     | Branches          | Branches are burned as mosquito repellent                                   | 0.30| 0.30| 18CS16901               |
| Hypericaceae    | Hypericum bellum H. L. Li                | Kor-mashiing    | Shrub     | Fruits            | Food (sweet taste)                                                         | 0.09| 0.09| 18CS16931               |
| Hyposidaceae    | Molinia capitulata (Lour.) Herb.         | Tsan-ngan       | Herb      | Fruits            | Food (a kind of fruit)                                                     | 0.11| 0.11| 18CS16938               |
| Lamiaceae       | Elsholtzia blanda (Benth.) Benth.         | Na-gang-shing   | Herb      | Aerial parts      | Incense plant                                                              | 0.27| 0.27| 18CS16829               |
| Lamiaceae       | Elsholtzia feddei H.Lév.                 | Pa-pi           | Herb      | Leaves            | Spice plant for making blood sausage                                        | 0.22| 0.22| 18CS16959               |
| Lamiaceae       | Isodon lophanthoides (Buch.-Ham. ex D.Don)H.Hara | Ra-khu-la-dang | Herb      | Whole plant       | Boiled liquid for treating intestinal parasites                              | 0.22| 0.22| 18CS16959               |
| Lamiaceae       | Mosla dianthera (Buch.-Ham. ex Roxb.) Maxim. | Shing-nang-gu-lu | Herb      | Whole plant       | Chewed leaves used for treating allergies                                   | 0.22| 0.22| 18CS16959               |
| Lamiaceae       | Penilla frutescens (L.) Britton          | Nang            | Herb      | Seeds             | Extracting oil                                                             | 0.08| 0.08| 18CS169199              |
| Lamiaceae       | Pogostemon brevicollus Y.Z.Sun            | Na-mu-sein      | Herb      | Whole plant       | Food (a kind of vegetable)                                                 | 0.22| 0.22| 18CS16959               |
| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use | f  | CI  | Voucher specimen number |
|-------------|-----------------|-----------------|-------|------------|-----------|----|-----|-------------------------|
| Lauraceae   | Cinnamomum contractum H. W. Li | Shing-tsa | Tree | Roots | Crushed roots are used for stomach pain. Tobacco substitutes | 0.28 | 0.28 | 18CS16892 |
| Lauraceae   | Cinnamomum iners Reinw. ex Blume | Lho-pa-sang-shing | Tree | Leaves | Incense plant | 0.06 | 0.06 | WangYH0030 |
| Lauraceae   | Litsea tibetana Yen C. Yang & P. H. Huang | Snying-shing | Shrub | Fruits | Extracting oil | 0.09 | 0.09 | 18CS16934 |
| Leguminosae | Amphicarpaea bracteata subsp. edgeworthii (Benth.) H.Ohashi | Shor-ru | Herb | Roots | Forage | WangYH0094 |
| Leguminosae | Deriss scabicaulis (Franch.) Gagnep. | Ang-du-ru | Liana | Roots | Fish poison plant | 0.16 | 0.16 | 18CS16821 |
| Leguminosae | Erythrina arboreascens Roxb. | Tsa-shing | Tree | Stems and leaves | Stems are used for carving materials. Making agriculture tools | 0.25 | 0.32 | 18CS16891 |
| Leguminosae | Entada rheedii Spreng. | Kor-lo-ba-ru | Vine | Fruits | Food (remove toxicity by boiling 10 times) | 0.22 | 0.22 | 18CS16846 |
| Leguminosae | Millettia pachycarpa Benth. | Ngra-ru | Liana | Seeds and roots | Crushed seeds and roots are used for killing insects | 0.09 | 0.09 | WangYH0061 |
| Loranthaceae | Tripodanthus acutifolius (Ruiz & Pav.) Tiegh. | Tsa-snying | Shrub parasitic | Fruits | Food (a kind of fruit) | 18CS16928 |
| Malvaceae   | Abroma augusta (L.) L.f. | Go-men-ta-dong-shing | Shrub | Whole plant | Making agriculture tools | 0.06 | 0.06 | WangYH0003 |
| Malvaceae   | Malacea sp. | Pu-lang-shing | Tree | Fruits | Food (a kind of fruit) | 0.06 | 0.06 | 18CS16827 |
| Malvaceae   | Sterculia lancefolia Roxb. | Bha-ba-ba-ru | Tree or shrub | Fruits | Food (a kind of fruit) | 0.23 | 0.23 | 18CS16910 |
| Malvaceae   | Urena lobata L. | Tsi-ming-uenh | Herb | Whole plant | Religious ritual use | 0.22 | 0.22 | 18CS16893 |
| Marantaceae | Stachyphrynium placentarium (Lour.) Clausager & Borchs. | La-gu-la-la | Herb | Leaves | Making agriculture tools | WangYH0196 |
| Malanthiaceae | Paris polyphylla ssp. | A-du-ba-du | Herb | Rhizomes | Boiled liquid for treating diabetes | 18CS16853 |
| Menispermaceae | Stephania abyssinica (Quart.-Dill. & A.Rich.) Walp. | Ru-dour | Woody vine | Roots | Boiled the dried roots used for treating rheumatism and snake bite | WangYH0177 |
| Menispermaceae | Stephania sp. | Yong-ju-pin | Woody vine | Fruits | Food (a kind of fruit) | 0.22 | 0.22 | 18CS16932 |
| Moraceae    | Ficus auriculata Loureiro | Ba-drong-ma-shing | Tree | Fruits and leaves | Food (a kind of fruit). Forage | 0.06 | 0.08 | 18CS16960 |
| Moraceae    | Ficus cyrtophylla (Wall. ex Miq.) Miq. | Pa-ju-ma | Tree or shrub | Fruits | Beverage | 18CS16915 |
| Moraceae    | Ficus oligodon Miq. | Ba-ler-drong-ma | Tree | Fruits | Food (a kind of fruit) | 0.09 | 0.09 | 18CS16918 |
| Moraceae    | Ficus semicordata Buch.-Ham. ex Sm. | Drong-ma | Tree | Fruits and leaves | Fruits are eaten directly. Leaves are used as sandpaper to burnish the bowl | 0.39 | 0.43 | 18CS16832 |
| Moraceae    | Ficus subincisa Buch.-Ham. ex Sm. | Rel-me-sgrong-ma | Tree | Fruits | Food (a kind of fruit) | 18CS16925 |
| Moraceae    | Morus alba L. | Sems-ling-shing | Tree | Fruits | Food (a kind of fruit) | 0.17 | 0.17 | 18CS16902 |
| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use | CI | Voucher specimen number |
|-------------|-----------------|-----------------|-------|------------|-----------|----|------------------------|
| Moraceae    | Morus wittiorum  | Sems-ling-shing  | Tree  | Stems      | Boiled liquid for treating leprosy. Timber plant | 0.25 | 18CS16947               |
| Musaceae    | Musa sanguinea   | A-nyi-lae-sih    | Herb  | Fruits     | Food (a kind of fruit) | 0.3  | WangYH0176              |
| Nephrolepidaceae | Nephrolepis cordifolia (L.) C. Presl | Ta-wai | Fern | Fruits | Food (a kind of fruit) | 0.33 | 18CS16896               |
| Oleaceae    | Fraxinus floribunda | Tra-per-shing    | Tree  | Barks      | Boiled liquid for treating sprain and sunburn | 0.33 | 18CS16912               |
| Omphalotaceae | Lentinus sjor-caju Fr. | Bren-ba-ba-mu   | Fungi | Mushroom | Food (a kind of vegetable) | 0.06  | 18CS16933               |
| Omphalotaceae | Lentinus sp.     | Tsier-gen-ba-mu  | Fungi | Mushroom | Food (a kind of vegetable) | 0.06  | 18CS16930               |
| Ophioglossaceae | Ophioglossum vulgatum L. | Gu-gu-meng    | Grass | Burgeons | Food (a kind of vegetable) | 0.06  | 18CS16844               |
| Orchidaceae | Dendrobium catenatum Lindl. | Shi-hu | Herb | Stems | Boiled liquid for treating cold | 0.06  | 18CS16856               |
| Oxalidaceae | Oxalis cunicular L. | Ju-bu-uenh     | Herb  | Leaves | Eaten directly, used for treating morning sickness | 0.06  | 18CS16867               |
| Pentaphylacaceae | Eurya acuminata DC. | Zem-shing    | Tree or shrub | Leaves | Dye plant and mordant | WangYH0067            |
| Phytolaccaceae | Phytolacca acinosa Roxb. | Mye-myegang-pum-mon | Herb | Leaves | Spice plant | 0.06  | 18CS16881               |
| Pinaceae    | Pinus wallichiana A.B. Jacks. | Shog-shing-nang | Tree  | Trunks | Timber plant | 0.2   | WangYH0128              |
| Piperaceae  | Piper semiimmersum C. DC. | Pi-pi-ling    | Climber | Leaves | Boiled the dried leaves used for treating altitude sickness and irregular menstruation | WangYH00097           |
| Piperaceae  | Piper sp.         | Sa-pa          | Shrub or climber | Leaves | Mashed leaves used for stopping bleeding | 18CS16822               |
| Piperaceae  | Piper sylvaticum Roxb. | Pang-ser | Climber | Leaves | Mashed leaves used for anti-inflammatory | WangYH0188               |
| Poaceae     | Arundo donax L.   | Sra-gu         | Bamboo | Leaves and stems | Fuel | WangYH00097              |
| Poaceae     | Bambusa teres Munro | Li-shing       | Bamboo | Culms | Making bow and arrow | 0.09  | WangYH00092              |
| Poaceae     | Coix lacyma-jobi L. | Phon-pa-lin   | Herb   | Seeds  | Boiled liquid for treating high blood pressure. Ornament plant | 0.27  | WangYH0179               |
| Poaceae     | Dendrocalamus tibeticus Hsueh & T. P. Yi | Ha-po | Bamboo | Culms and shoots. | Food (a kind of vegetable). Making agriculture tools | 0.1  | WangYH0160               |
| Poaceae     | Eleusine cocanaca (L.) Gaertn. | Kon-pu   | Herb   | Seeds  | Making alcohol beverages. Extracting starch | 0.47  | WangYH0001               |
| Poaceae     | Imperata cylindrica (L.) Raeusch. | Shing-pu | Herb | Leaves | Thatching | 0.06  | 18CS16843               |
| Poaceae     | Phyllostachys manni Gamble | Suo-nong | Bamboo | Burgeons | Food (a kind of vegetable) | 0.08  | 18CS16907               |
| Poaceae     | Sorghum bicolor (L.) Moench | Phim-nang | Herb | Stems and seeds | Stems are eaten directly. Seeds are used for preparing alcohol beverages | 0.05  | 18CS16814               |
| Poaceae     | Themeda villosa (Lam.) A.Camus | Pi-li   | Herb | Leaves | Thatching | 0.11  | 18CS16842               |
Table 4 Ethnobotanical inventory of Monpa in Mêdog County, Tibet, China (Continued)

| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use | f  | CI | Voucher specimen number |
|-------------|-----------------|-----------------|-------|------------|-----------|----|----|-------------------------|
| Polygonaceae | Fagopyrum acutatum (Lehm.) Mansf. ex K.Hammer | Pin-dae-mu | Herb | Leaves | Food (a kind of vegetable). Forage | 0.13 | 0.15 | 18CS16813 |
| Polygonaceae | Fagopyrum esculentum Moench | Ka-la | Herb | Fruits | Food (extracting starch) | 0.13 | 0.13 | 18CS16855 |
| Polygonaceae | Fagopyrum tataricum (L.) Gaertn. | Ka-la | Herb | Seeds | Making alcohol beverages. Extracting starch | 0.17 | 0.21 | WangYH0182 |
| Polygonaceae | Persicaria capitata (Buch.-Harm. ex D.Don) H.Gross | Long-pa-dang-mo-nang | Herb | Whole plant | Medicine used for burns | 0.05 | 0.05 | WangYH0155 |
| Polygonaceae | Persicaria nepalensis (Meisn.) Miyabe | Gong-sger-ming | Herb | Whole plant | Food (a kind of fruit). Forage | 0.06 | 0.08 | 18CS16919 |
| Polygonaceae | Polygonum chinense var. ovalifolium Meisner | Gu-ju-ma-shing | Herb | Tender stems and leaves | Food (a kind of vegetable) | 0.09 | 0.09 | 18CS16820 |
| Polygonaceae | Polygonus sp. | Shing-pa-mu | Fungi | Mushroom | Food (a kind of vegetable) | 0.09 | 0.09 | 18CS16917 |
| Primulaceae | Embelia floribunda Wall. | Ju-bu-ru | Vine | Fruits and roots | Food (a kind of fruit) | 0.09 | 0.09 | 18CS16927 |
| Primulaceae | Maesa marioniae Merr. | Ker-seh-ru | Shrub | Fruits | Food (a kind of fruit) | 0.06 | 0.06 | 18CS16953 |
| Primulaceae | Maesa rugosa C. B. Clarke | Lho-ku-mer-shing | Shrub | Leaves | Making agriculture tools | 0.09 | 0.09 | 18CS16957 |
| Ranunculaceae | Clematis napaulensis DC. | | Vine | Leaves | Forage | WangYH0058 |
| Rhamnaceae | Hovenia acerba Lindl. | Shi-pi | Tree | Fruits | Boiled or eaten directly, used for alcoholism | 18CS16884 |
| Rhamnaceae | Rhamnus napalensis (Wall.) M. A. Lawson | Da-gor-shing | Shrub | Fruits | Food (a kind of fruit) | 0.06 | 0.06 | 18CS16923 |
| Rosaceae | Chaenomeles cathayensis (Hems) C. K. Schneid. | Tong-ju-bha-bu | Tree | Fruits | Food (a kind of fruit) | 0.27 | 0.27 | 18CS16921 |
| Rosaceae | Duchesnea indica (Jacks.) Focke | Pu-tshu-la-gong | Herb | Fruits | Food (a kind of fruit), boiled the dried fruits used for detoxification and treating bruises | 0.41 | 0.41 | 18CS16875 |
| Rosaceae | Laurocerasus undulata (Buch.-Harm. ex D. Don) M. Roemer | Dan-bur | Tree or shrub | Seeds | Extracting oil. Religious ritual use | WangYH0068 |
| Rosaceae | Prunus persica (L.) Batsch | Lin-shing | Tree | Fruits | Food (a kind of fruit) | 0.33 | 0.33 | 18CS16956 |
| Rosaceae | Rubus ellipticus Sm. | Tser-gong | Shrub | Fruits | Food (a kind of fruit) | 0.33 | 0.33 | 18CS16850 |
| Rosaceae | Rubus niveus Thunb. | Tu-lu-tse-gong | Shrub | Fruits | Food (a kind of fruit) | 0.05 | 0.05 | 18CS16815 |
| Rubiaceae | Luculia gratissima (Wall) Sweet | Non-meng | Tree or shrub | Flowers | Religious ritual use | WangYH0051 |
| Rubiaceae | Mussaenda pubescens Dryand. | Meng-gya-bai-dong-shing | Shrub | Leaves | Seasonal indication | 0.06 | 0.06 | 18CS16941 |
| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use | f  | CI   | Voucher specimen number |
|-------------|-----------------|-----------------|-------|------------|-----------|----|------|-------------------------|
| Rubiaceae   | Ophiorrhiza medogensis H. Li | Ming-zim-ma-mu | Herb | Whole plant | Food (a kind of vegetable) | 0.11 | 0.11 | 18CS16862 |
| Rubiaceae   | Rubia membranacea Diels | Lae-nyi | Herb | Stems | Dye plant | WangYH0114 |
| Rubiaceae   | Rubia wallichiana Decne. | Lae-nyi | Herb | Stems | Dye plant | 0.3 | 0.3 | WangYH0127 |
| Rubiaceae   | Spiradiclis sp. | Mi-zu-ma | Herb | Whole plant | Food (a kind of vegetable) | 0.09 | 0.09 | 18CS16833 |
| Rubiaceae   | Uncaria rhynchophylla (Miq.) Miq. ex Havil. | Gou-du | Liana | Stems | Boiled liquid for treating high blood pressure | 18CS16962 |
| Rubiaceae   | Uncaria scandens (Sm.) Hutch. | Tsae-tsu | Liana | Leaves | Boiled liquid for treating epilepsy | 18CS16905 |
| Rubiaceae   | Wendiandia tinctoria (Roxb.) DC. | Mehi-neng-nang-shi | Tree or shrub | Stems | Making agriculture tools | 0.17 | 0.17 | 18CS16900 |
| Rutaceae    | Citrus medica L. | Hpo-rang-nying-pa | Tree or shrub | Stems | Medicine used for treating cold | 18CS16961 |
| Rutaceae    | Toddalia asiatica (L.) Lam. | Ae-pi-ka-ba | Shrub | Seeds | Seed oil with butter is used for treating epilepsy | 18CS16895 |
| Rutaceae    | Zanthoxylum motuoense C. C. Huang | Gei | Tree | Fruits | Crushed fruits are used for treating bad skin odour. Spice plant | 0.56 | 0.56 | 18CS16895 |
| Sabiaceae   | Meliosma pinnata (Roxb.) Maxim. | Beng-shar-shing | Tree | Flowers | Seasonal indication | 0.06 | 0.06 | 18CS16945 |
| Scrophulariaceae | Buddleja asiatica Lour. | Yang-ren | Shrub | Whole plant | Making alcohol beverages | 18CS16914 |
| Solanaceae  | Datura stramonium L. | Yun-ma-chu-dong | Herb or subshrub | Seeds | Medicine used for treating toothache | 0.06 | 0.06 | 18CS16837 |
| Solanaceae  | Nicotiana tabacum L. | Da-mu-ga | Herb | Leaves | Crushed leaves used for treating sinusitis | 18CS16906 |
| Solanaceae  | Solanum americanum Mill. | Gu-ju-shu | Herb | Burgeons | Food (a kind of vegetable) | 0.14 | 0.14 | 18CS16838 |
| Solanaceae  | Solanum aculeatissimum Jacq. | Kha-lang-gyi | Herb to subshrub | Roots | Crushed roots and the leaves of Luffa cylindrica are used for treating psoriasis | 18CS16866 |
| Solanaceae  | Solanum torvum Sw. | Kha-lang-gyi | Shrub | Fruits | Food (a kind of vegetable) | 0.2 | 0.2 | 18CS16812 |
| Taxaceae    | Torreya grandis var. yunnanensis (W.C.Cheng & LKFu) Silba | Gae-long-shing | Tree | Fruits | Food (a kind of fruit) | 18CS16880 |
| Thymelaeaceae | Edgeworthia gardneri (Wall.) Mein. | Sho-gu-shing/ Ju-pu-shing | Tree | Barks | Papermaking | 0.05 | 0.05 | WangYH0006 |
| Urticaceae  | Debregeasia longifolia (Burm.f.) Wedd. | Rang-shing | Shrub | Roots | Boiled liquid for preventing miscarriage and treating bruises | 18CS16870 |
| Urticaceae  | Elatostema cuneiforme W.T.Wang | Tsen-tsen-pa | Herb | Aerial parts | Forage | 0.08 | 0.08 | WangYH0091 |
| Urticaceae  | Elatostema nasutum Hookf. | Da-mi-ru | Herb | Leaves | Food (a kind of vegetable boiled in the water first) | 18CS16848 |
| Urticaceae  | Gonostegia hirta | Ro-gyi-ba | Herb | Whole | Food (a kind of vegetable) | 0.08 | 0.08 | 18CS16924 |
Table 4 Ethnobotanical inventory of Monpa in Mêdog County, Tibet, China (Continued)

| Family name | Scientific name | Vernacular name | Habit | Parts used | Local use | f | CI | Voucher specimen number |
|-------------|----------------|----------------|-------|------------|-----------|---|----|-------------------------|
| Urticaceae  | Pilea hilliana Hand.-Mazz. | Ru-gong-su-gang | Herb | Leaves | Food (a kind of vegetable) | 0.05 | 0.05 | WangYH0159 |
| Urticaceae  | Poikilospermum lanceolatum (Trécul) Merr. | Ba-mi-ru | Shrub | Leaves and aerial roots | Leaves are used for forage. Aerial roots are used for rope | 0.34 | 0.36 | 18CS16830 |
| Urticaceae  | Urtica maieri H. Lév. | Gang-dang-gyal-zu | Herb | Leaves | Food (a kind of vegetable) | | | WangYH0040 |
| Violaceae   | Viola sp. | Pian-mier | Herb | Whole plant | Boiled liquid for clearing heat and detoxification | | | WangYH0066 |
| Vitaceae    | Tetrastigma serratum (Roxb.) Planch. | Ju-bae-ru | Liana | Fruits | Food (a kind of fruit) | 0.28 | 0.28 | 18CS16828 |
| Xanthorrhoeaceae | Hemerocallis fulva (L.) L. | Chu-ta | Herb | Leaves and flowers | Food (a kind of vegetable) | 0.17 | 0.17 | 18CS16887 |
| Zingiberaceae | Alpinia bambusifolia C. F. Liang & D. Fang | Tar-gang | Herb | Flower buds | Food (sweet taste) | 0.2 | 0.2 | WangYH0101 |
| Zingiberaceae | Alpinia malaccensis (Burm.f.) Roscoe | Tar-gang | Herb | Flower buds | Food (sweet taste) | 0.2 | 0.2 | WangYH0103 |
| Zingiberaceae | Curcuma aromatica Salisb. | Dgrong | Herb | Roots and leaves | Boiled roots used for treating heat stroke, irregular menstruation and boiled leaves used for treating alcoholism | 18CS16879 |
| Zingiberaceae | Curcuma longa L. | Dgrong | Herb | Roots | Dye plant | 0.22 | 0.22 | WangYH0070 |
| Zingiberaceae | Hedychium coccineum Buch.-Ham. ex Sm. | Ma-mi-niu-mu | Herb | Burgeons | Food (a kind of vegetable) | 0.05 | 0.05 | 18CS16849 |
| Zingiberaceae | Hornstedtia tibetica T.L.Wu & S.J.Chen | Su-mi | Herb | Fruits | Food (a kind of fruit) | 0.08 | 0.08 | 18CS16847 |

Voucher specimen number with CS means collection section

Supplementary information
Supplementary information accompanies this paper at https://doi.org/10.1186/s13002-020-0355-7.

Additional file 1. The Tibetan alphabet (Consonants).
Additional file 2. The Tibetan alphabet (Vowels).

Acknowledgments
We are very thankful to the local people in Beibeng Village, Jiangxin Village, Xirang Village, Gelin Village, De’ergong Village, Badeng Village, Acang Village, Dexing Village, Hezhia Village, Naerdong Village, Bangshin Village, and Gengbang Village in Mêdog County, who have provided valuable information related to the useful plant resources. Extremely gratitude is expressed to the families of Rinchin lhamo for their kind hospitality, and to Padma Dorje for his genuine assistance.

Authors’ contributions
SL and YHW conceived and designed the research. SL, YZ, YJG, LXY, and YHW collected the data. YZ and YJG provided the botanical identification. SL analyzed the data and prepared the manuscript. LXY and SL took the photographs. YHW reviewed the manuscript. All authors read and approved the final manuscript.

Funding
This work was supported by the Strategic Priority Research Program of Chinese Academy of Sciences (No. XDA20050204, XDA19050301, and XDA19050303) and the 13th Five-year Informatization Plan of Chinese Academy of Sciences (No.XXH13506), and the National Public Scientific Data Center for Basic Sciences.

Availability of data and materials
All data generated or analysed during this study are included in this published article and its supplementary information files.

Ethics approval and consent to participate
The authors asked for permission from the local authorities and the people interviewed to carry out the study.

Consent for publication
The people interviewed were informed about the study’s objectives and the eventual publication of the information gathered, and they were assured that the informants’ identities would remain undisclosed.

Competing interests
The authors declare that they have no competing interests.
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Received: 11 September 2019 Accepted: 13 January 2020

Published online: 30 January 2020

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