Wild food plants and wild edible fungi of Heihe valley (Qinling Mountains, Shaanxi, central China): herbophilia and indifference to fruits and mushrooms

Yongxiang Kang1, Łukasz Łuczaj2*, Sebastian Ye3, Shijiao Zhang1, Jin Kang1
1 College of Forestry, Northwest A&F University, Yangling 712100, China
2 Department of Botany and Biotechnology of Economic Plants, University of Rzeszów, Werynia 502, 36-100 Kolbuszowa, Poland
3 Skargi 11/70, 39-300 Mieler, Poland

Abstract

The aim of the study was to investigate knowledge and use of wild food plants and fungi in Han (i.e. Chinese) nationality villages in central China, including famine plants used in the respondents’ childhood. A valley adjacent to the extremely species-rich temperate forest vegetation of the Taibai Nature Reserve was chosen. Eighty-two people from 5 villages took part in the study. Altogether, 159 wild food plant species and 13 fungi folk taxa were mentioned by informants. The mean number of freelisted wild foods was very high (24.8; median – 21.5). An average respondent listed many species of wild vegetables (mean – 17, median – 14.5), a few wild fruits (mean – 5.9 and median – 6) and very few fungi (mean – 1.9, median – 1), which they had eaten.

Over 50% of respondents mentioned gathering the young shoots or leaves of Celastrus orbiculatus, Staphylea bumalda and S. holocapra, Caryopteris divaricata, Helwingia japonica, Pteridium aquilinum, Pimpinella sp., Amaranthus spp., Matteuccia struthiopteris, Allium spp., Cardamine macrophylla and Chenopodium album. Only one species of fruits (Schisandra sphenanthera) and none of the mushrooms were mentioned by over half of the respondents. Although very diverse, it can be noted that the use of wild vegetables has decreased compared to the second half of the 20th century, as informants listed several plants which they had stopped using (e.g. Abelia engleriana) due to the availability of cultivated vegetables and other foodstuffs. On the other hand, the collection of the most well-known wild vegetables is maintained by selling them to tourists visiting agritourist farms, and restaurants.

Keywords: ethnobotany, ethnomycology, wild edible plants, non-timber forest products, mycophobia, food security

Introduction

Wild food plant and fungi use in the world is very diverse. In many areas, mainly in urban centers or in the richest countries, few wild species are used, usually just a few wild fruits, mushrooms or green vegetables. However, in less developed countries wild food is still a significant component of nutrition. The use of wild greens and fungi shows a particularly interesting pattern as in some areas of the world these components of the diet are either avoided or little used (herbophobia and mycophobia, respectively), whereas in other areas they constitute an everyday part of nutrition [1]. For example in Amazonia and Eastern Europe wild greens are little used, in contrast to East Asia, India and parts of Africa [2]. Wild mushrooms are widely gathered in Italy, France, Catalonia, Slavic countries, Turkey, Mexico and parts of Africa, but traditionally little used in England [3].

The country the most renowned for its wide contemporary use of wild components in the human diet is China. This stems from a few factors [4,5]:

(i) China frequently suffered severe food crises up until the 1960s, so the use of any natural resources was important to the inhabitants,

(ii) wild plants and animals are believed to contain more “qi” (“life energy”), so they are regarded as more nutritious and healthy,

(iii) Chinese culinary art likes indulging in a large number of, often strange, ingredients.

Although the research on potentially edible wild plants has been well developed in China (e.g. [5–10]), studies focused on documenting local traditions of wild plant and fungi use using the methodology of modern ethnobotany are relatively few, and the publications in international papers solely concern ethnic minorities, i.e. Mongolians [11,12], Shaxi in Sichuan [13,14], Miao in Hunan [15] and a variety of ethnic groups in Yunnan [9,10,16–18]. Two papers (in Chinese) concerning wild food resources in the Qinling Mountains were published, but from a different part of these mountains [19,20]. The relatively short list of species given in them [19,20] suggests that only the most
commonly used species were included. The ethnomyecology of edible mushrooms in China is also under-developed (in spite of the extensive literature on the economic use of mushrooms in China), and particularly lacking are studies simultaneously oriented towards wild vegetables, mushrooms and fruits.

Paradoxically, little is known about wild food plant use patterns in north-central, central and eastern China where the dominant Han (i.e. "Chinese") population lives. The aim of our study was to fill this gap and to record wild food species in one little-developed, mountainous, rural area in the province of Shaanxi. For our study we chose probably the best-preserved forest complex in central China – the vicinity of the Taibai Nature Reserve, where the local population has a particularly rich choice of wild food plants and mushrooms.

The working hypothesis was that in an area of high biodiversity, in a country famous for the use of many species of wild foods, the farmers use a large number of wild vegetables, fruits and mushrooms in their nutrition, and this knowledge is widespread in the community. An additional aim was to elicit answers on the differences between present day use and use during the last widespread famine (1958–1960).

Study area
The study was located in the Heihe National Forest Park, on the southern edge of the Taibai Nature Reserve, with the highest peak of northern China in the center of the reserve (Mt Taibai 3767 m a.s.l.). The nature reserve protects a highly diverse flora – from warm temperate (with subtropical elements) to alpine at the top. The National Forest Park (a less strict protection regime) is the southern extension of it, and mainly protects species-rich forests. The area is completely covered by forest complex in central China – the vicinity of the Taibai Nature Reserve, where the local population has a particularly rich choice of wild food plants and mushrooms.

The majority of the local population are subsistence farmers who grow maize, potatoes, wheat and beans [21,22]. Sources of cash income are the orchards of zaopi (Cornus officinalis), walnuts (Juglans regia) and northern Sechuan pepper (Zanthoxylum bungeanum). Digging out medicinal roots and collecting medicinal herbs for wholesale buyers is also a very popular activity [21,22].

Methods
The field research was conducted in June and July 2011, as well as in August 2012, using transect walks and semi-structured interviews with key informants, individual and group freelisting interviews (36 freelists were created), and cross-checking of the gathered herbarium specimens with key informants. Altogether, 82 people from five settlements (Houzhenzi, Diaoyutai, Huaerping, Jiangjiaping, Sanhe) took part in the study. The mean age of participants was 50 (from 16 to 83). The data were supplemented by participant observations by one of the authors (S. Y.) who had frequently visited the area, in 2007–2010, during all seasons of the year. During freelisting we separately asked, which species of wild vegetables (including underground organs), wild fruits and wild mushrooms were used. Making the three separate freelists enabled the comparison of the use of these categories and helped elicit answers from the respondents [23,24]. Freelists were made orally and written down on the spot by our team, including the Chinese-script version of the plant/fungi names.

The nine restaurants selling wild vegetables in Houzhenzi were also visited and menus were photographed in order to record the taxa sold and their price.

The study started from a few informants found using the snowball technique, but most interviewees were found by systematic walks through the village, visiting houses and asking the inhabitants if they wanted to take part in the study. We aimed at interviewing only one person from each household, only occasionally were two people from the same house interviewed, if there were signs that their knowledge differed (e.g. one of the spouses comes from another village, etc.). We also displayed some of our collections (mushrooms and some wild vegetables) in the main street of Houzhenzi, to observe the reactions and comments of people to the edible taxa shown.

Voucher specimens were collected from the specimens gathered during transect walks or supplied by informants, and are stored in the Department of Forestry, Northwest A&F University in Yangling.

Results

General figures
Altogether, 159 plant species from 59 families (classified as 139 folk taxa) and 13 fungi taxa were mentioned by the informants as eaten at least once, but only 128 plant species
and 12 fungi species were confirmed as eaten by more than one person \( (\text{Tab. 1, Tab. 2, Tab. 3}) \). The leaves and green parts of 104 species have been used, roots/rhizomes/tubers/bulbs of 18 species, flowers of 4 species and fruits of 36 species. Respondents mentioned wild vegetables most eagerly, and generally had problems listing wild fruits and fungi, stating that they are unimportant and are collected rarely. The gathering of young shoots of \textit{Celastrus orbiculatus} and \textit{Staphylea} spp. (mainly \textit{Staphylea bumalda}, also \textit{S. holocarpa}) was mentioned by nearly every respondent. Over 50% of respondents also mentioned gathering the young shoots or leaves of \textit{Caryopteris divaricata}, \textit{Helwingia japonica}, \textit{Pteridium aquilinum}, \textit{Pimpinella} spp., \textit{Amaranthus} spp., \textit{Matteuccia struthiopteris}, \textit{Allium} spp., \textit{Cardamine macrophylla} and \textit{Chenopodium album} (\textit{Fig. 2, Fig. 3}). Six wild vegetables are served in most local restaurants (\textit{Tab. 3}). Only one species of fruits (\textit{Schisandra sphenanthera}) and none of the mushrooms were mentioned by over half of the respondents.

The mean number of freelisted wild foods was 24.8 (median – 21.5). An average respondent listed many species of wild vegetables (mean – 17, median – 14.5), a few wild fruits (mean – 5.9 and median – 6) and very few fungi (mean – 1.9, median – 1) as eaten.

The domination of wild vegetables in foraging activities is also confirmed by the fact that they are the only category of wild food stored for winter. Drying is a very common preserving technique (\textit{Fig. 4}). Households dry between 1–5 species each year, usually a few kg of dry shoots and leaves, but some households who host tourists [so called “nong jia le” (农家乐)] can even dry a few dozen kg of dry “ye cai” (wild vegetables). Particularly large amounts of \textit{Chenopodium album} are dried, as they are often used as winter fodder for pigs as well. Other commonly dried foods include \textit{Staphylea} spp., \textit{Helwingia japonica}, \textit{Celastrus orbiculatus}, \textit{Toona sinensis} and \textit{Cardamine macrophylla}. Also, plants which are usually not treated as “ye cai”, but as pig food (e.g. \textit{Artemisia subdigitata}), are dried for the animals. In 2011 and 2012 dried \textit{Staphylea} shoots were sold at the local food shop in Houzhenzi at 40 ¥/kg. Dried \textit{Chenopodium} was, in 2011, sold to tourists a few km before entering the village, along with dried \textit{Auricularia} and \textit{Lentinula} mushrooms. Most families dry 1–5 species of wild vegetables outside on the concrete, on mats or inside the house on newspapers. Formerly wild vegetables were lacto-fermented, but now this is done very rarely.

Forest species, species of grasslands and forest edges as well as ruderal species are well represented in the list of collected taxa (however typical forest species dominate with 44% taxa, only 15% taxa are ruderal species, the rest are ubiquitous species or species of intermediate successional stages). The ruderal species are collected near homesteads. Their growth is often promoted. For instance when a farmer sprays their \textit{Cornus officinalis} plantation with glyphosate, they leave a clump of wild vegetables unsprayed. One of the most protected species is \textit{Chenopodium album}, which is harvested and dried at the turn of May and June. Some forest species are harvested up to 5 km from the villages, up to the altitude of 1800 m a.s.l. At even higher altitudes, wild plants are only harvested while collecting medicinal herbs, which grow even higher.

All the older informants were asked about plants eaten during the severe food shortages that plagued China until the last case of famine in 1958–1960. The usual response was that they ate the same species but in larger quantities. They said that they were lucky having so many wild vegetables around, as some people from other, more populated areas had to take refuge in their mountains to avoid starvation. However, asking questions about the last time the particular species was used revealed that there is a group of taxa which could clearly be called famine plants – species, which were used in this area until the mid-20th century and are not used any more. These include: the leaves of \textit{Abelia engleriana}, the rhizomes of \textit{Pueraria lobata},

\begin{table}[h]
\centering
\caption{Most commonly freelisted species in the study.}
\begin{tabular}{ll}
\hline
Species & Category & N = 36 \\
\hline
\textit{Celastrus orbiculatus} & v & 35 \\
\textit{Staphylea} spp. & & 33 \\
\textit{Caryopteris divaricata} & & 27 \\
\textit{Helwingia japonica} & & 27 \\
\textit{Pteridium aquilinum} & v & 26 \\
\textit{Pimpinella} spp. & & 24 \\
\textit{Amaranthus} spp. & & 24 \\
\textit{Matteuccia struthiopteris} & & 23 \\
\textit{Cardamine macrophylla} & f & 22 \\
\textit{Schisandra sphenanthera} & f & 22 \\
\textit{Chenopodium album} & & 22 \\
\textit{Allium} spp. & v & 20 \\
\textit{Toona sinensis} & v & 18 \\
\textit{Akebia trifoliata} & f & 18 \\
\textit{Rubus} spp. & f & 17 \\
\textit{Prunus salicina} & f & 15 \\
\textit{Chrysopogon biondianum} & v & 15 \\
\textit{Sausarea dolichopoda} & v & 14 \\
\textit{Decaisnea fargesii} & f & 14 \\
\textit{Adenophora} spp. & v & 13 \\
\textit{Cantharellus cibarius} & m & 13 \\
\textit{Allium paepalanthoides} & v & 12 \\
\textit{Sedum amplexicaulatum} & v & 11 \\
\textit{Eleagnus umbellata} & f & 11 \\
\textit{Tricyrtis macrophylla} & v & 11 \\
\hline
\end{tabular}
\end{table}

\begin{table}[h]
\centering
\caption{Wild food plants sold in the restaurants in Houzhenzi.}
\begin{tabular}{ll}
\hline
Species & N \\
\hline
\textit{Staphylea} spp. (mainly \textit{S. bumalda}) & 9 \\
\textit{Toona sinensis} & 8 \\
\textit{Chenopodium album} & 7 \\
\textit{Matteuccia struthiopteris} & 6 \\
\textit{Pteridium aquilinum} & 6 \\
\textit{Celastrus orbiculatus} & 6 \\
\textit{Helwingia japonica} & 2 \\
\textit{Medicago sativa} & 1 \\
\textit{Cardamine macrophylla} & 1 \\
\textit{Caryopteris divaricata} & 1 \\
\textit{Pimpinella} sp. & 1 \\
\textit{Lychnis senno} & 1 \\
\hline
\end{tabular}
\end{table}

\( \text{N} \) – No. of restaurants selling wild food plants (total = 9).
### Tab. 3 The list of wild edible plants and fungi confirmed by at least two respondents.

| Scientific name | Family (according to APG III [31]) | Part used | Frequency | Local name in pinyin | Local name in Chinese |
|-----------------|-------------------------------------|-----------|-----------|----------------------|-----------------------|
| **Vascular plants** | | | | | |
| Abelia engleri Rehder | Linneaceae (formerly in Caprifoliaceae) | aerial parts | *** | shen xian dou fu | 神仙豆腐 |
| Achyranthes bidentata Blume | Amaranthaceae | aerial parts | * | niu xi | 牛膝 |
| Actinidia chinensis Planch. | Actinidiaceae | fruit | *** | ye mi hou tao | 野猕猴桃 |
| Adenophora spp. (A. capillaris Hemsl., A. polyantha Nakai) | Campanulaceae | whole plant | *** | nai ji an cai | 奶浆莱 |
| Akebia trifoliate (Thunb.) Koidz. | Lardizabalaceae | fruit | **** | ba yue gua, ba yue zha ge jiu, ye ji | 傻荚菜, 八月炸著圭, 野圭 |
| Allium ovalifolium Hand.-Mazz., A. cf. victoriaulis L. | Amaryllidaceae (formerly in Liliaceae) | whole plant | ** | han cai | 汉菜 |
| Allium paepalanthoides Airy Shaw | Amaryllidaceae (formerly in Liliaceae) | whole plant | *** | tian suan | 天蒜 |
| Allium spp. (A. cf. senescens L., A. macrostemon Bunge) | Amaryllidaceae (formerly in Liliaceae) | aerial parts | **** | ai jiu cai, ai suan, ye suan, yong bao tou, lao er jiu, zhong bao tou, ye jiu cai | 崖菜, 崖蒜, 野蒜, 罗儿韭, 棒包头, 野韭菜 |
| Akebia trifoliate (Thunb.) Koidz. | Lardizabalaceae | fruit | **** | ba yue gua, ba yue zha ge jiu, ye ji | 傻荚菜, 八月炸著圭, 野圭 |
| Anaphalis aureopunctata Lingelsh et Borza | Asteraceae | aerial parts | * | shi qu cao | 黄鹌草 |
| Anaphalis margaritacea Benth. & Hook. f. | Asteraceae | aerial parts | * | qing ming cao | 清明草 |
| Aralia chinensis L. | Araliaceae | tender buds | ** | ci long pao | 侧龙胆 |
| Arctium lappa L. | Asteraceae | leaf stalks, underground parts | * | niu bang zi | 牛蒡子 |
| Asarum himalaicum Hook. f. & Thomson ex Klotzsch | Aristolochiaceae | whole plant (as spice) | * | mao xin | 苦辛 |
| Asarum sieboldii Miq. | Aristolochiaceae | whole plant (as spice) | * | xi xin | 老辛 |
| Begonia sinensis A. DC. | Begoniaceae | aerial parts | * | yi kou xie | 一口血 |
| Berchemia ricinoides Schneid. | Rhamnaceae | fruit | * | ya gu teng, gou er cha | 喂根条, 喂儿茶 |
| Boehmeria gracilis C. H. Wright | Urticaceae | aerial parts | * | hong he ma | 红鹤麻 |
| Boehmeria tricuspid Makino | Urticaceae | aerial parts | * | he ma | 红麻 |
| Broussonetia papyrifera (L.) Vent. | Moraceae | leaves | * | gou shu guo, gou ye xiong er duo | 枯枝果, 枯叶木耳 |
| Capsella bursa-pastoris (Willd.) Medic. | Brassicaceae | aerial parts | *** | di ci cai | 地芥菜 |
| Cardamine macrophylla W. D. Wight. | Brassicaceae | aerial parts | *** | shi jia cai | 石芥菜 |
| Cardamine spp. (other smaller species e.g. C. flexuosa Wth., C. hirsuta L.) | Brassicaceae | aerial parts | * | xiao shi jia cai | 小石芥菜 |
| Caryopteris divaricata Maxim. | Lamiaceae (formerly in Verbenaceae) | aerial parts | **** | hui hui cai | 一味膏 |
| Castanea mollissima Blume | Fagaceae | fruit | * | ye mao li, ye ban li bai wan ye | 野毛栗, 野板栗白板叶 |
| Celastrus orbiculatus Thunb. | Celastraceae | aerial parts | **** | bai gai guo, bi zi shu, shui bai, sun guo hui hui cai | 白果, 碧子, 水柏松果灰灰菜 |
| Cephalotaxus sinensis (Rehder & E. H. Wilson) H. L. Li | Cephalotaxaceae | pseudo-fruit | * | | |
| Chenopodium album L., also C. giganteum D. Don | Chenopodiaceae | aerial parts | ** | chou lao han, lao han xiang | 臭老汉/老汉香 |
| Chrysosplenium boidianum Engl. | Saxifragaceae | aerial parts | *** | hong jin cai | 红金菜 |
| Cirsium arvense var. setosus (Willd.) C. A. Mey | Asteraceae | aerial parts | ** | hong hua miao, ci ji xiaoji | 红花苗, 水泡泡小菊 |
| Cirsium spp. eg Cirsium setosum Petrak ex Hand.-Mzt. | Asteraceae | aerial parts | * | | |
| Clethra triphylla Thunb. | Lamiaceae | aerial parts | * | | |
| Commelina benghalensis L. | Commelinaceae | aerial parts | * | | |
| Cornus kousa Bürger ex Miq. | Cornaceae | fruit | *** | shi zao | 雪小 |
| Scientific name | Family (according to APGIII [31]) | Part used | Frequency | Local name in pinyin | Local name in Chinese |
|-----------------|-----------------------------------|-----------|-----------|---------------------|-----------------------|
| Corylus heterophylla Fisch. ex Besser | Corylaceae | fruit   | * | zhen zi, mao li, mao li zi shu, xiao xiang zi shu |
| Crataegus huepehensis Sarg. | Rosaceae | fruit   | * | ye shan zha 野山楂 |
| Cryptospora japonica Hassk. | Apiaceae | aero parts | * | ya jiao ban 鸦脚板 |
| Cynanchum giralii Schlr. | Asclepiadaceae | underground parts | * | ge shan xiao 隔山消 |
| Decaisnea fargesii Franch. | Lardizabalaceae | fruit | *** | mao shi gua, ye xiang jiao 猫屎瓜、野香焦 |
| Descurainia sophia (L.) Webb ex Prantl (?) | Brassicaceae | aero parts | ** | yin chen, mi hao 因陈、米蒿 |
| Dioscorea batatas Decne. | Dioscoreaceae | underground parts | * | shan yao 山药 |
| Eleagnus umbellata Thunb. | Elaeagnaceae | fruit | *** | yang nai zi, niu nai zi 羊奶子、牛奶子 |
| Fragaria spp. (F. corymbosa Losinsk., F. pentaphylla Losinsk.) | Rosaceae | fruit | *** | cao mei, di pao, di di pao xiang pao 草莓、地泡、地泡泡 |
| Helwingia japonica (Thunb.) F. Dietr. | Helwingiaceae | leaves | **** | ye shang hua 叶上花 |
| Hemerocallis spp. (H. dumortierii C. Morren, H. fulva L.) | Xanthorrhoeaceae | flowers | ** | ye huang hua 野黄花 |
| Hieracium sp. | Asteraceae | aero parts | *? | ku mai cai 苦荬菜 |
| Impatiens nootapha Maxim. | Balsaminaceae | aero parts | * | dao laon nen 老娘伞 |
| Ixeris sonchifolia Hance | Asteraceae | aero parts | *** | ku mai cai 苦荬菜 |
| Juglans cathayensis Dode | Juglandaceae | fruit | *** | ye he tao 野核桃 |
| Kalimeris pinnatifida (Maxim.) Kitam. | Asteraeaceae | aero parts | * | ma lan tou 马兰头 |
| Kochia scoparia (L.) Schrad. | Amaranthaceae | aero parts | * | tie sao ba 铁扫把 |
| Lactuca serriola L. | Asteraceae | aero parts | ** | xiao bai jiang, xiao ku ma cai, ku ma cai 小白菜、苦荬菜 |
| Leontopodium japonicum Miq. | Asteraceae | aero parts | * | shi qu cao 石蕨草 |
| Ligusticum sinense (formerly Liliaceae) | Oli., Chuanhsiung | aero parts | ** | chuan xiong 川芎 |
| Lilium giganteum Wall. | Liliaceae | underground parts | ** | shui bai he 水百合 |
| Lilium spp. (L. leichtlinii Hook. f., L. tigrinum Ker Gawl.) | Liliaceae | underground parts | ** | ye bai he 水百合 |
| Lonicera standishii Carr. | Caprifoliaceae | fruit | * | huang hua cai 黄花菜 |
| Lysichthys senno Siebold & Zucc. | Caryophyllaceae | whole plant | * | ye bai cai, ze lan 鸡头菜 |
| Lycopodium lucidum Turcz. ex Benth. | Lamiaceae | aero parts | * | mu xi cai 木香菜 |
| Mattucia struthiopteris (L.) Tod. | Orl. Chuanhsiung | tender shoots | **** | ji tou cai 见头草 |
| Medicago sativa L. | Fabaceae | aero parts | * | suan pao, sang shu 酸菠、酸桑 |
| Morus australis Poir. | Moraceae | fruit | * | suan cao, suan cai, suan cao 酸菜 |
| Oxalis spp. (O. griffithii Edgew. & Hook. f., O. corniculata L.) | Oxalidaceae | aero parts | * | ku mai cai 苦荬菜 |
| Picris hieracioides L. | Asteraceae | aero parts | *? | dao lao nen 到老嫩 |
| Pilea mongolica Wedd. | Urticaceae | aero parts | *** | shui qin cai, sha qin cai 水芹菜、沙芹菜 |
| Pimpinella sp. (probably a new taxon related to Pimpinella arguta Diels and P. rhomboidea Diels) | Apiaceae | aero parts | **** | shui qin cai, sha qin cai 水芹菜、沙芹菜 |
| Plantago asiatica L. | Plantaginaceae | aero parts | * | kai men ye, che qian kao, che qian zi 开门叶、前草、前草子 |
| Polygonatum megaphyllum P. Y. Li and | Asparagaceae | underground parts | * | yu zhu, yu zhu shen 玉竹、玉竹参 |
| Polygonatum odoratum L. (formerly in Liliaceae) | Polygonaceae | underground parts | * | jiao mai tou 姜麦头 |
| Potentilla arbuscula D. Don var. veitchii (E. H. Wilson) Liu | Rosaceae | aero parts | * | guan yin cha 观音茶 |
| Prunus armeniaca L. | Rosaceae | fruit | ** | ye xing 野杏 |
| Prunus canescens Bois. | Rosaceae | fruit | ** | ye ying tao 野樱桃 |
| Prunus cf. polytricha Koehne | Rosaceae | fruit | * | chuan tao 川桃 |
| Prunus persica (L.) Batsch | Rosaceae | fruit | ** | ye tao zi 野桃子 |
| Prunus salicina Lindl. | Rosaceae | fruit | *** | ye li zi, ze mai li, huo li zi, huo li, ye mai li 野李子、火李、火李子、野李子 |
| Pteridium aquilinum (L.) Kuhn | Dennstaedtiaceae | tender shoots and underground parts | **** | jue cai, jue gen, long zhua 蕨菜、蕨根、龙爪菜 |
| Scientific name                  | Family (according to APGIII [31]) | Part used                  | Frequency | Local name in pinyin | Local name in Chinese |
|----------------------------------|------------------------------------|-----------------------------|-----------|----------------------|-----------------------|
| *Pueraria lobata* (Willd.) Ohwi  | Fabaceae                           | underground parts           | **        | ge gen               | 葛根                  |
| *Pyrola decandra* Andres         | Ericaceae                          | aerial parts (spice and infusion) | *        | hong ru, shou cha    | 红花、寿茶              |
| *Pyrola rotundifolia* L.         | Ericaceae                          | aerial parts (spice and infusion) | *        | bairu, shou cha      | 白花、寿茶              |
| *Pyrus seraphila* T. T. Yu       | Rosaceae                           | fruit                       | ***       | ye li, ma li, shan li | 野梨、麻梨、山梨      |
| *Rhizoma cichorii* Stokes        | Anacardiaceae                      | aerial parts                | *         | qi shu               | 槐树                  |
| *Rohania pseudococcacina* L.     | Fabaceae                           | flowers                     | *         | huai hua             | 角花                  |
| *Rorippa montana* Small          | Brassicaceae                       | aerial parts                | *         | man jing cai, la cai | 马芥菜、辣芥菜          |
| *Rosa sp.*                       | Rosaceae                           | young shoots                | *         | ci mei hua           | 刺玫花                 |
| *Rubus coreanus* Miq.            | Rosaceae                           | fruit                       | **        | ci pao, di pao, fu pen zi | 刺泡、地泡、复盆子   |
| *Rubus flosculosus* Focke         | Rosaceae                           | fruit                       | **        | cai zi pao           | 莓子泡                 |
| *Rubus flosculosus* Cambess.      | Rosaceae                           | fruit                       | **        | huang ci pao         | 黄刺泡                 |
| *Rubus flosculosus* Cambess.      | Rosaceae                           | fruit                       | ***       | duan yang pao, xuan gou zi |  cbdang yang pao, xuan gou zi |
| *Rubus flosculosus* Cambess.      | Rosaceae                           | fruit                       | ***       | niu she tou, ye da huang | 牛舌头                |
| *Sabia heresiensis* H. Y. Chen   | Sabiaceae                          | aerial parts                | *         | qing teng cai, teng er cai | 秦藤菜、藤儿菜          |
| *Saussurea dolichopoda* Diels     | Asteraceae                         | aerial parts                | ***       | kong tong cai, xin cai | 全枝菜、空心菜           |
| *Schisandra sphenanthera* Rehder & E. H. Wilson | Schisandraceae | fruit                       | ****      | wu wei zi            | 五味子                 |
| *Sedum aizoon* L., *S. sarmentosum* Bunge, *S. pampaninii* Raym.-Hamet, *S. lineare* Thunb. | Crassulaceae | aerial parts                | **        | gou ya ban, gou zai cai, machijie, da bu si, chui pen cao | 苦苣菜、打不死ancock菜、牛胁菜 |
| *Silene conoidea* L.             | Caryophyllaceae                    | aerial parts                | *         | mai pian cai         | 麦片菜                 |
| *Sinacalia tangutica* (Maxim.) B. Nord. | Asteraceae                 | underground parts            | *         | shui lu bo           | 水萝卜                 |
| *Smilacina japonica* A. Gray, *Smilacina henryi* (Baker) Hara | Asparagaceae | aerial parts                | *         | pian tou cai         | 魄头菜                 |
| *Sambucus chinensis*              | Lamiaceae                          | underground parts            | *         | di gu niu            | 地骨皮                 |
| *Staphylea holocarpa* Hems., *S. holocarpa* Hemsl. | Staphyleaceae | aerial parts, flowers       | ****      | shu hua cai          | 舒花菜                 |
| *Stellaria medica* (L.) Vill.     | Caryophyllaceae                    | aerial parts                | *         | e er chang           | 唇花菜                 |
| *Taraxacum mongolicum* Han.-Mzt  | Asteraceae                         | aerial parts                | **        | pu gong ying, ku mai cai, da ku cai | 鸡骨草、苦菜、大苦菜 |
| *Thalasi arvensis* L.             | Brassicaceae                       | aerial parts                | ***       | ji dan huang         | 鸡腺草                 |
| *Toona sinensis* (Juss.) M. Roem. | Meliaceae                         | tender leaf shoots          | ****      | xiang chun           | 香椿                   |
| *Tricytis macropoda* Miq.         | Liliaceae                          | aerial parts                | **        | xiang gua cai        | 黄瓜菜                 |
| *Ulmus pumila*                    | Ulmaceae                           | leaves, bark, immature fruit | **        | yu shu               | 楂树                   |
| *Urtica ardensis* E. Pritz. ex Diels | Urticaceae                 | aerial parts                | *         | bai he ma            | 白河菜                 |
| *Vicia cracca* L.                | Fabaceae                           | aerial parts                | *         | ye wan dou jian      | 野豌豆菜               |
| *Vitis chinas* Focke              | Vitaceae                           | fruit                       | ***       | ye pu tao            | 野葡萄                 |
| *Zanthoxylum bungeanum* Maxim.    | Rutaceae                           | fruits, aerial parts        | *         | ye hua jiao          | 野花椒                  |

**Fungi**

| Fungi                          | Family (according to APGIII [31]) | Part used                  | Frequency | Local name in pinyin | Local name in Chinese |
|--------------------------------|------------------------------------|-----------------------------|-----------|----------------------|-----------------------|
| *Boletus* spp.                  | Boletaceae                         | **                          |           | niu gan jin, da jiao gu | 牛肝菌、大脚菇          |
| *Cantharellus cibarius* Fr.     | Cantharellaceae                    | ***                         |           | huan si jin          | 牛肝菌                 |
| *Grifola umbellata* (Pers.) Pilat | Meripilaceae                       | ***                         |           | zhu ling jin         | 猪苓菌                 |
| *Hericium* sp.                  | Hericiaceae                        | **                          |           | hou tou jin          | 鹿角菌                 |
| *Laetiporus sulphureus* (Bull.) Murrill (??) | Polyporaceae | fruit                       | *         | ji guan jin           | 鸡油菌                 |
| *Lentinula edodes* (Berk.) Pegler (more often cultivated) | Marasmiaceae | fruit                       | *         | ye xiang gu          | 野香菇                 |
| *Morchella* sp.                 | Morchellaceae                      | **                          |           | yang que jin         | 莉莉菌                 |

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Pteridium aquilinum, Polygonatum spp., Sinacalia tangutica, the bulbs of Lilium giganteum and other Lilium species, and the bark of Ulmus spp. Nowadays the consumption of underground organs of plants has practically ceased and is restricted to the occasional use of Lilium spp. and Stachys affinis.

Wild vegetables are eaten in any of the daily three meals. The commonest preparation technique is boiling, then straining and sprinkling them with some oil in which Szechuan pepper, garlic, and sometimes ginger, was fried. Then they are served, warm or cold. This is a side dish, called “liang ban”, accompanied by home-made wheat bread (“bing”), rice or other stir-fried foods. Sometimes wild vegetables are also put into broad, home-made noodles served in spicy and sour soup. They are also, rarely, lacto-fermented. Dried vegetables are first soaked in water for a few minutes or hours and then used like fresh vegetables. Some respondents say that in the case of Staphylea shoots, drying even improves their taste and digestibility. Wild vegetables are also sold in all the local restaurants (Tab. 2), and every agritourist farm has them on their menu.

Fruits are and have always been less appreciated than wild greens. They are sometimes collected for fun by children or grown-ups going to the forest to collect wild greens, medicinal herbs or wood. They have never been stored for winter and are not used in any dishes by anyone, apart from dried Schisandra and Akebia fruits, used medicinally. In spite of this, most people easily mentioned a few species of wild fruits they had eaten.

Few fungi species are used, as most of them are generally feared. We found only one inhabitant of the valley, who had a hobby of collecting wild edible mushrooms, which he developed after gathering Boletus species for sale a few years ago. Others never go to the forest with the purpose of collecting mushrooms, apart from going to collect cultivated Auricularia and Lentinula edodes grown on piles of logs located in the woods. The only mushrooms relatively more widely known and accepted are Cantharellus cibarius, an unidentified Agaricales (called “banlijun”, i.e. “chestnut mushroom”), Ramaria spp. (and possibly Clavaria spp.) treated by locals as one folk taxon “shuabajun” (i.e. “brush mushroom”) and Grifola umbellata, whose sclerotia are collected for medicinal purposes, although fruiting bodies are occasionally eaten as well. However, only a third of the respondents have ever eaten the most commonly listed mushroom, Cantharellus cibarius. More than half of the respondents had never collected wild fungi in the forest. A few people who eat Boletus spp. species started doing so after taking part in commercial mushroom collecting a few years ago.

Discussion

The large number of used wild greens in this study is one of the highest recorded on such a small scale in the history of ethnobotanical studies. The only comparable study, by Zou [15], recorded the use of 335 taxa of wild vegetables, belonging to 87 scientific names.
families and 119 genera in 10 villages of Hunan, however the latter study concerned a larger and more heterogeneous area. Ghorbani [16] recorded the use of 173 wild food plants from 485 informants of four ethnic groups of Xishuanbanna valley, out of which only around a third were wild greens. However, his study concerned an area which was very heterogeneous in terms of elevation, inhabitants and vegetation. The average number of wild food plants listed by one informant was only around 10 species, whereas in this study we documented a much higher rate of use per person (mean – over 24 species), with probably the highest average number of wild green vegetables listed per person (mean – 17 species) using freelistning techniques in any ethnobotanical study to date.

Knowledge of wild vegetables in China is additionally encoded in the language. Most wild vegetables have the word “cai”, i.e. vegetable, so it is enough to know the name and to be able to recognize the plant to be able to presume its use, i.e. if it is a “cai” (vegetable) or “cao” / “yao” (medicinal plant).

The relatively high geographical diversity of the use of “ye cai” in China should be emphasized. For example none of the articles on wild vegetables of Qinling Mts mention the use of *Staphylea* sp. or *Pimpinella* sp. – locally important vegetables [19,20].

The widespread phenomenon of drying wild vegetables is worth attention. This ancient preservation technique is nowadays rarely used for wild vegetables across the globe. Storing a particular food for winter may mean that this is a culturally significant item.

Several taxa are semi-domesticated, and undergo varying degrees of active protection. Some are increasingly brought from the forest to be planted in gardens (*Toona sinensis, Staphylea bumalda, Asarum sieboldii*). The two species of mushrooms widely cultivated using tree logs left in the garden or in the forest, *Auricularia* sp. and *Lentinula edodes*, were mentioned by some respondents as wild vegetables as well. This shows that, similarly to other geographic areas, the distinction between the wild and the cultivated is not usually sharp [2,25,26].

The local population utilizes a large proportion of the local edible flora. However, strong cultural biases can be seen even in such a herbophilous community. Some edible wild vegetables, e.g. *Galinsoga* sp., *Reynoutria japonica*, most *Polygonum* species and *Lamium barbatum* are not used, the common *Stellaria media*, is also eaten rarely and only by a few individuals.

Over half wild vegetables come from the forest. This is in contrast with some studies showing that human populations, even in wooded areas, tend to over-utilize the ruderal flora [27,28]. Here, at least two explanations are possible:

(i) the fields’ area is relatively small, so in the past the volume of wild vegetables from ruderal sites may not have been sufficient,

(ii) many edible ruderal taxa are regarded here as pig food, and we observed some degree of separating wild vegetables for human consumption and pig food (the exception here is *Chenopodium*, eaten both by humans and pigs).

What is interesting is the large domination of wild greens over fruits and fungi. A typical answer of a respondent to the question about what wild veg they had eaten was: “ye cai hen duo” (there are many wild vegetables). On the other hand, the same question about fruits or fungi resulted in the opposite answer, e.g. “ye mogu/junzi hen shao” (there are very few wild fungi).

Wild vegetables are intentionally collected here, they are well known to everyone and dried for winter in most houses. Fruits are something unimportant, play objects, something one finds on a forest walk to collect herbs, something only eaten raw. They are never cooked or dried or added to any dishes. The only exceptions are the fruits of *Schisandra*, which are dried and sold as medicine. The lack of interest in mushrooms is puzzling, as China is usually regarded as a mycophilous part of the world [3,29,30].

**Conclusions**

The studied community displays one of the highest levels of herbophilia known in human cultures. On the other hand the community shows relative indifference to wild fruits and fungi, which are rarely collected, and only as an additional activity.

The results of this study show that further in-depth ethnobotanical research is needed to determine patterns in wild food plant and fungi use in different parts of China, as locally these patterns may be extremely variable.

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