Postprint of an Ethnobotanical Study on Forage Plants of the White-trouser Yao in China

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Abstract

The Baiku Yao people have a strong tradition of raising and consuming local black pigs, and possess unique and extensive experience and knowledge regarding the collection and management of feed plants. This study aims to conduct an ethnobotanical inventory of feed plants and their related indigenous knowledge in the Baiku Yao region, providing data support for the preservation of their traditional knowledge and offering insights for the development of modern novel feed. From 2019 to 2021, we conducted multiple ethnobotanical surveys on feed plants in the Baiku Yao region through investigation methods such as key informant interviews, semi-structured interviews, and group discussions. Simultaneously, this study also screened feed plants with high comprehensive utilization value through scoring and ranking and statistical analysis of plant utilization frequency. The results showed that: (1) There are a total of 104 traditional feed plant species used by the Baiku Yao, belonging to 42 families and 85 genera; the family with the most cited species is Asteraceae (16 species, accounting for 15.38% of the total), followed by Urticaceae (13 species, accounting for 12.5% of the total). (2) Branches and leaves (56.73%), whole herbs (26.92%), and leaves (8.65%) are the main utilized parts of local feed plants; most feed plants are herbaceous plants (88.46%), and the majority can be collected year-round (accounting for 64.42% of the total), ensuring sufficient food sources for domestic pigs; chopping (crushing) followed by cooking is the primary processing method. (3) The species most frequently cited by local respondents are Zea mays, Broussonetia papyrifera, Ipomoea batatas, Morus alba, Fagopyrum dibotrys, and Oryza sativa. (4) According to comprehensive scoring and ranking, the feed plants receiving the highest comprehensive scores locally are Broussonetia papyrifera, Ipomoea batatas, Morus alba, Fagopyrum dibotrys, and Cucurbita moschata. The Baiku Yao possess rich traditional knowledge regarding the utilization and management of feed plants for pig farming, which is highly scientific and relatively well-preserved; the related feed plant resources are also worthy of further development and promotion.

Full Text

Preamble

Ethnobotanical Study on Forage Plants in Baiku Yao Communities of China

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Abstract

The Baiku Yao people have a strong tradition of raising and consuming local black pigs, and possess unique and extensive experience in collecting and managing forage plants. This study aims to document the forage plants and related indigenous knowledge in Baiku Yao areas through ethnobotanical inventory, providing data support for preserving their traditional knowledge and insights for developing modern feed alternatives. From 2019 to 2021, we conducted multiple ethnobotanical investigations on forage plants in Baiku Yao regions using key informant interviews, semi-structured interviews, and group discussions. Additionally, we screened forage plants with high comprehensive utilization value through scoring, ranking, and statistical analysis of plant usage frequency. The results show: (1) A total of 104 traditional forage plant species were recorded, belonging to 85 genera and 42 families. The family with the most cited species was Asteraceae (16 species, accounting for 15.38% of the total), followed by Urticaceae (13 species, accounting for 12.5%). (2) Branches and leaves (56.73%), whole plants (26.92%), and leaves (8.65%) were the main utilized parts of local forage plants. Most forage plants were herbaceous (88.46%), and the majority could be collected year-round (64.42% of the total), ensuring adequate food sources for domestic pigs. The primary processing method was chopping (or crushing) followed by cooking. (3) The most frequently cited species by respondents were *Zea mays*, *Broussonetia papyrifera*, *Ipomoea batatas*, *Morus alba*, *Fagopyrum dibotrys*, and *Oryza sativa*. (4) According to comprehensive scoring and ranking, the forage plants with the highest evaluation were *Broussonetia papyrifera*, *Ipomoea batatas*, *Morus alba*, *Fagopyrum dibotrys*, and *Cucurbita moschata*. The Baiku Yao possess rich traditional knowledge about the utilization and management of forage plants for pig farming that is highly scientific and well-preserved, and the related forage plant resources warrant further development and promotion.

Keywords: Yao, Baiku Yao, forage plant, ethnobotany, traditional knowledge, animal husbandry

Introduction

China is a mountainous country with large populations residing in mountain regions. Due to topographical constraints, mountain residents cannot engage in large-scale mechanized farming, and thus many areas maintain traditional animal farming and animal husbandry to meet daily needs (Long et al. 2007). Although technological advances have led to widespread use of commercial animal feed, many communities still retain the tradition of using wild plant resources to feed livestock (Long et al., 2007). While collecting wild forage plants requires time investment, they are often nutrient-rich, environmentally friendly, and free from pesticide residues, gradually attracting increasing attention from scientists (Yang et al., 2021).

Forage plants refer to plants that can be consumed by livestock, poultry, and wild animals (Kahasbagan & Pei, 2000). Indigenous (local) communities involved in animal husbandry possess rich traditional knowledge about forage plants, which often provides important theoretical support for developing modern feed alternatives (Sadat-Hosseini et al., 2017). Internationally, numerous ethnobotanical studies on wild forage plants have been reported, such as research cases from Brazil and Pakistan (Nunes et al., 2015; Shaheen et al., 2020). In China, although some regional studies on wild forage plants have been published, few have evaluated their relative importance to local communities (Kahasbagan & Pei, 2000; Ma et al., 2019; Yang et al., 2021). Among them, Ma et al. (2019) described changes in traditional knowledge during ecological resettlement through investigations of wild forage plants, while Yang et al. (2021) conducted a survey of wild forage plants in Zhuxi County, Shiyan City, Hubei Province, using citation frequency to reflect plant importance to the community, representing a typical ethnobotanical case study.

The Yao people are a typical mountain-dwelling ethnic group, among whom the Baiku Yao constitute one branch. The Baiku Yao call themselves "Duo Niu" and are named for the white trousers traditionally worn by men. They are primarily distributed in Lihu Township and Baxu Township in Nandan County, Guangxi, and Yaoshan Township in Libo County, Guizhou. They have been recognized by UNESCO as an ethnic group with exceptionally well-preserved culture and are acclaimed as a "living fossil of human civilization" (Qiu, 2008). The Baiku Yao are considered to have transitioned directly from primitive social formations to modern society, thus retaining unique customs regarding marriage, funerals, diet, as well as rich ethnic dances, competitions, traditional clothing, and traditional medicine (Qiu, 2008). Current research on Baiku Yao has focused primarily on humanities and social sciences, with few scientific reports from the perspective of plant resource utilization.

The daily livelihood of Baiku Yao includes animal husbandry, with nearly every household raising livestock to supplement family income. As an ethnic group with rich traditional culture, the Baiku Yao have accumulated considerable traditional knowledge about animal husbandry. Local pig farming primarily consists

of small-scale family operations to meet household meat consumption needs and generate supplementary income. The breed selection predominantly favors local traditional black pigs (Fig. 1). Among the households we surveyed, nearly 70% raised local black pigs. These pigs are small in stature, active, and produce delicious meat with a subtle fragrance, considered by the Baiku Yao as the finest among pigs. They have also observed that local black pigs have stronger disease resistance than common commercial white pigs. Based on our observations, local black pigs are mostly free-range, and we frequently encountered them running through village lanes during our surveys. Locals believe that allowing pigs sufficient exercise results in better-tasting meat and healthier animals. Additionally, most Baiku Yao insist on using traditional wild vegetables or planted coarse grains for feeding, avoiding commercial feed, which they believe generates excessive heat that pigs cannot digest, leading to illness.

Thus, the Baiku Yao possess unique understanding of black pig farming and excel at utilizing locally growing plant resources as feed. We therefore inferred that they have rich traditional knowledge about forage plants that could be applied to modern feed development. To (1) investigate and document traditional knowledge related to forage plants, and (2) evaluate and screen forage plants with good development potential, we conducted multiple ethnobotanical surveys in Baiku Yao areas between 2019 and 2021.

Fig. 1 Black pigs in Baiku Yao village

1.1 Study Sites

Based on preliminary literature review, combined with initial survey results and recommendations from Baiku Yao Ethnic Museum staff, we selected Huaili Village, Dongjia Village, and Yaoli Village in Lihu Yao Ethnic Township, Nandan County, Guangxi; Yaozhai Village, Lile Village, and Guanxi Village in Baxu Township, Nandan County; and Yaoshan Village in Yaoshan Township, Libo County, Guizhou as study sites (Fig. 2). These selected sites represent major Baiku Yao residential areas with well-preserved traditional culture, facilitating data collection. Between 2019 and 2021, we conducted six surveys in Baiku Yao villages across four different seasons.

Fig. 2 Study area

1.1.1 Literature Review and Analysis

We collected and compiled relevant materials on Baiku Yao research, including published academic papers, local chronicles, and folk manuscripts, to understand Baiku Yao cultural characteristics, customs, ethnic features, distribution, and traditional knowledge related to plant utilization, establishing a foundational knowledge framework for this study.

1.1.2 Selection of Survey Sites and Informants

To understand overall forage plant usage among Baiku Yao residents, we employed simple random sampling to survey villagers in the study sites (Luo et al., 2019). Simultaneously, we used purposive and snowball sampling to select key individuals within target villages, including elderly people with rich traditional knowledge, traditional veterinarians, and village officials, for further in-depth interviews (Yang et al., 2021).

1.1.3 Ethnobotanical Interviews

For general interviewees and key informants selected through sampling methods, we conducted interviews using a combination of semi-structured and informal conversational approaches (Martin, 2010). The interviews primarily covered local names, usage methods, utilized parts, usage frequency, collection sources, and collection seasons of forage plants used by Baiku Yao. This study interviewed a total of 185 informants, including 87 males and 98 females, among whom 43 were selected as key informants.

We also organized key informants for group discussions and applied the grading and ranking (GR) method (Chambers, 1994) to quantitatively score forage plants across four aspects: nutritional value, pig preference, collection difficulty, and processing difficulty. Each indicator was scored on a scale of 1 to 5 points. For example, for nutritional value: excellent = 5 points, good = 4 points, fair = 3 points, average = 2 points, poor = 1 point. The total score was used to evaluate forage plant quality. Plants with the highest scores indicated the best quality and high potential development value.

1.1.4 Data Analysis

The degree of utilization of different plants by local people is quantitatively important for exploring their adaptive strategies to the surrounding environment and their utilization of plant resources (Huai & Pei, 2003). For example, Ladio & Lozada (2001) used the concept of plant utilization frequency to study non-timber forest product use in two communities in northwestern Patagonia. In that case, plant utilization frequency was defined as f = Nm/Ni, where f is the utilization frequency of a particular plant, Nm is the number of informants who mentioned the plant, and Ni is the total number of informants. A higher f value indicates higher utilization frequency (Ladio & Lozada, 2001). Similarly, this study applied this indicator to evaluate Baiku Yao forage plants.

2.1 Statistical Analysis of Baiku Yao Forage Plants

This study recorded a total of 104 forage plant species used for domestic pigs in Baiku Yao communities (Table 1). Analysis of family composition (Table 2) revealed that Baiku Yao pig forage plants included 6 multiple-species families (containing 5 species), accounting for 14.29% of total families and 49.04% of

total species (51 species); 14 oligotypic families (containing 2–4 species), accounting for 33.33% of families and 29.81% of species (31 species); and 22 monotypic families (containing 1 species), accounting for 52.38% of families and 21.15% of species (22 species). Genus-level statistical analysis (Table 1) showed that Baiku Yao pig forage plants consisted only of oligotypic genera (14 genera, 33 species) and monotypic genera (71 genera, 71 species). Baiku Yao domestic pig forage plant species were concentrated at the family level in a few multiple-species families such as Asteraceae (16 species) and Urticaceae (13 species), while being dispersed among oligotypic and monotypic genera at the genus level (Table 2), demonstrating high taxonomic diversity.

In terms of plant life form, forage plants were predominantly herbaceous (88.46% of the total), followed by shrubs (9.62%) and trees (1.92%).

Statistical analysis revealed that Baiku Yao processing methods for these forage plants were relatively uniform, mainly consisting of two approaches (Table 1): chopping (or crushing) followed by cooking, or fresh feeding. Chopping or crushing forage plants facilitates consumption by black pigs and increases palatability. Some forage plants require cooking, which not only softens texture for better palatability and digestibility but also helps remove mild toxins and special odors.

The utilized parts of Baiku Yao forage plants were highly diverse, including branches and leaves, whole plants, leaves, seeds, husks, fruits, infructescences, stems, and flowers. Notably, roots were not utilized, ensuring plant survival and demonstrating sustainability (Fig. 3). Among these, branches and leaves (56.73%), whole plants (26.92%), and leaves (8.65%) were the main utilized parts, accounting for 92.3% of recorded plants. The utilized parts were typically young and tender, such as tender leaves and young branches, to enhance palatability. Locals also used rice and millet husks after threshing as feed to increase dietary fiber content. Additionally, multiple parts of some plants could be used as feed, demonstrating high utilization efficiency. For example, both leaves and infructescences of *Boehmeria nivea* and *Debregeasia longifolia*, as well as seeds and tender leaves of *Coix lacryma-jobi* and *Zea mays*, could all serve as feed.

Fig. 3 Used parts of Baiku Yao forage plants for swine

Wild plants used for feeding black pigs by Baiku Yao were generally available year-round, ensuring adequate feed supply, though some plants had seasonal collection patterns. Most forage plants could be collected throughout the year (64.42% of the total) (Fig. 4). The remaining forage plants were primarily collected in summer and autumn, accounting for 28.85% and 30.77% of the total, respectively, while spring and winter collections were minimal (3.85% each). During our surveys, we observed that locals also leveraged seasonal changes to optimize collection timing for improved palatability and utilization efficiency. For instance, they consistently collected forage plants according to plant growth cycles, typically gathering young, tender parts during peak growing seasons to

enhance palatability.

Fig. 4 Collection time of Baiku Yao forage plants for swine

Forage plants used for feeding black pigs in Baiku Yao areas typically included both wild and cultivated plants. According to our investigation, locals cultivated some easily grown and nutritionally valuable forage plants in home gardens or vacant spaces around houses for convenient pig feeding. Among the recorded forage plants, most were wild (77.88% of the total), while 20.19% were cultivated. Two species were both wild-collected and locally cultivated: *Asystasia chelonoides* and *Broussonetia papyrifera*. While no reports exist on *A. chelonoides* as feed or its nutritional composition, *B. papyrifera*, a deciduous tree widely distributed across China, contains 18–24% crude protein and has proven to be a highly promising unconventional feed resource (Tan et al., 2017).

2.2 Utilization Frequency and Grading/Ranking

Table 1 shows the utilization frequency (f) of 104 cited species, reflecting local familiarity with these plants. Baiku Yao forage plant f values ranged from 0.04 to 1.00, with 46 species having f values above 0.38 (the average f value) and 58 species below the average. The most frequently cited species were *Zea mays* (f = 1.00), *Broussonetia papyrifera* (f = 0.97), *Ipomoea batatas* (f = 0.97), *Morus alba* (f = 0.93), *Fagopyrum dibotrys* (f = 0.83), and *Oryza sativa* (f = 0.81). These forage plants are all common locally cultivated species that are easily accessible, convenient to use, and nutritionally valuable, thus exhibiting very high utilization frequency and indicating their important role in the local livestock system. As shown in Table 1, cultivated plants generally had relatively high utilization frequency.

We organized key informants for group discussions and grading/ranking of Baiku Yao forage plants, quantitatively scoring nutritional value, pig preference, collection difficulty, and processing difficulty, then ranking plants by total score (GR value). Baiku Yao forage plant GR values ranged from 6 to 20 points (maximum). The top five plants with highest GR values were *Broussonetia papyrifera* (GR = 20), *Ipomoea batatas* (GR = 19), *Morus alba* (GR = 19), *Fagopyrum dibotrys* (GR = 18), and *Cucurbita moschata* (GR = 18), indicating these five forage plants have high local utilization value. Additionally, the top-ranked plants with high GR values were all cultivated species. Among them, *Broussonetia papyrifera*, *Ipomoea batatas*, *Morus alba*, and *Fagopyrum dibotrys* simultaneously exhibited high comprehensive utilization value and high utilization frequency, demonstrating their excellent potential as local forage plants.

3.1 "Forest-Farmland-Garden" Sustainable Model

The Baiku Yao are a typical mountain-dwelling ethnic group with limited arable land, primarily cultivating corn, sweet potatoes, and rice (with rice mostly purchased). Corn and sweet potatoes are favored by Baiku Yao due to their drought

tolerance, high yield, strong adaptability, and high nutritional value, meeting both daily needs and providing nutritional supplements for livestock. Baiku Yao women have long maintained the tradition of sericulture, with silk being essential for traditional clothing. Mulberry leaves, being nutritionally valuable, are used to feed livestock in addition to silkworms. Furthermore, Baiku Yao fully utilize limited land by cultivating *Broussonetia papyrifera*, *Fagopyrum dibotrys*, and other plants suitable for local conditions with high yield and nutritional value as supplements for pig feed. Combined with wild forage plant collection, this ensures adequate daily nutrition for domestic pigs. Consequently, *Broussonetia papyrifera*, *Ipomoea batatas*, *Morus alba*, and *Fagopyrum dibotrys* exhibit both high usage frequency and high GR values, making them highly preferred by Baiku Yao. These plants not only pose no threat to human staple foods but also offer high nutritional value and low environmental requirements.

Sustainable livestock production typically involves effective utilization of locally available resources, particularly feed resources. Understanding the importance of wild forage plants is crucial for effective forest resource utilization. Our results indicate that locals prefer cultivated plants as primary pig feed, consistent with our field observations. This approach not only enhances overall space and land utilization efficiency but also improves utilization of cultivated crops. Collecting wild plants for pig feed supplements feed sources while providing potential health benefits. This integrated "forest-farmland-garden" model fully demonstrates local management wisdom in smallholder systems. Such system integration can mitigate increasing pressure on land and forest resources from expanding agricultural and pastoral demands. The combination of traditional and scientific knowledge has proven effective in optimizing selection of useful forage plants. Therefore, documentation of forage plants, laboratory evaluation of wild forage plants, and their rational application are all significant and worthy of vigorous promotion.

3.2 Current Status and Conservation of Baiku Yao Forage Plant Traditional Knowledge

Farmers have altered their attitudes and management methods toward pig farming in response to increasingly strict regulations and socio-economic development. These production changes have been accompanied by major shifts in feeding practices, with modern feeding modes using less green forage. Traditional wild forage plants have been replaced by nutritional concentrates and other readily available cultivated plants (such as sweet potatoes, cabbage, mustard, and radishes). Wild forage plant collection has become less necessary, leading to gradual erosion of traditional knowledge about forage plant utilization and management. Yang et al.' s (2021) study in Zhuxi County reflected that only a small portion of elderly villagers occasionally used wild forage plants for pigs. As the number of small-scale pig farmers decreases and younger generations abandon traditional feeding methods, local traditional knowledge about wild forage plant utilization and management faces significant risk of disappear-

ance (Yang et al., 2021).

Our study found that Baiku Yao areas are rich in wild forage resources, and local people have accumulated extensive traditional knowledge about forage plant utilization and management. However, unlike Yang et al.' s (2021) case, we still observed numerous Baiku Yao villagers continuing traditional practices of forage plant collection and management. The likely reason is that locals have consistently preferred local black pig breeds and insist that only free-range black pigs fed natural forage produce more delicious and healthier meat. This traditional culture is probably key to the well-preserved state of related forage plant knowledge. In contrast, we observed that surrounding Zhuang and Han villages used modern methods to raise white pigs, which although more productive, had relatively weaker immunity, and traditional knowledge about using wild plants as feed was more severely eroded. This demonstrates that traditional breeds and germplasm resources may be important factors in maintaining the stability of local traditional knowledge networks. Future efforts in rescuing and preserving traditional knowledge should focus on traditional breeds (including animal and plant varieties) and germplasm resources of local communities.

3.3 Functional Development and Research of Forage Plants

Although this study revealed local preference for cultivated forage plants through utilization frequency and comprehensive scoring, wild forage plants also serve as valuable supplements. Many wild forage plants possess excellent development potential, with locals rating many species as having good nutritional value (scoring high in nutritional value within GR values). Currently, few scientific studies have reported on these plants, and some are unrelated to animal husbandry. With rapid development of the livestock industry and high demand for green feed, scientific validation, development, domestication, and cultivation of these wild forage plants are of great significance. Our plant inventory can provide a theoretical foundation for such research. China currently lacks comprehensive surveys of wild forage plants, and more researchers should be encouraged to engage in this field.

Baiku Yao areas have abundant wild forage plant resources. During our interviews, we discovered that many forage plants have additional local uses. Among the recorded forage plants, over 50% were used for other purposes, primarily medicinal and food uses. For example, the whole plant of *Lobelia angulata* is boiled for oral administration to treat stones and mashed for external application to treat shingles. Locally, *Artemisia lactiflora* is consumed as a wild vegetable. Some forage plants also serve as veterinary medicines; for instance, *Polygonum nepalense* can be used to treat swine fever and internal heat in pigs. These additional uses of forage plants fully demonstrate local wisdom in plant resource utilization and reflect the dietary supplementation and health promotion effects of these wild forage plants for livestock, warranting further analysis and promotion through different disciplinary approaches.

Conclusion

This study, using Baiku Yao areas in China as an example, investigated traditional knowledge about pig forage plant resources among local residents. We recorded 104 forage plant species along with information on local names, life forms, utilized parts, collection seasons, and processing methods. Through statistical analysis of utilization frequency and group discussion-based grading/ranking of Baiku Yao pig forage plants, we identified plants with high comprehensive utilization value. Our analysis suggests that the local "forest-farmland-garden" resource utilization model is not only efficient but also sustainable. Local preference for native black pig breeds and adherence to traditional farming methods are key to the well-preserved state of related forage plant knowledge. The recorded forage plants demonstrate development potential. Overall, traditional knowledge about local pig forage plants is well-preserved, with scientific collection and management practices, and the related forage plant resources warrant further research and development.

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Table 1 Inventory of Baiku Yao forage plants for swine

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Musaceae	xo sao	*Musa basjoo*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC732
Plantaginaceae	mu	*Plantago asiatica*	Cultivated	Whole year	Whole plant	Smash and cook thoroughly	HRC858

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Dipsacaceae	xi qi cuo	*Dipsacus asper*	Cultivated	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC859
Lamiaceae	qi li cao	*Ajuga decumbens*	Cultivated	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC190
Euphorbiaceae	裂苞铁苋	*Acalypha australis*	Cultivated	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC823
Euphorbiaceae	[illegible]	*A. supera*	Cultivated	Whole year	Seed	Cut up and cook thoroughly or feed freshly	HRC965
Cannabaceae	[illegible]	*Cannabis sativa*	Cultivated	Winter	Seed and tender leaf	Smash and cook thoroughly	HRC86
Fabaceae	ai jie	*Glycine max*	Cultivated	Whole year	Tender branch and leaf	Smash and cook thoroughly	HRC341

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Poaceae	–	*Coix lacryma-jobi*	Cultivated	Summer and Autumn	Seed	Cut up and cook thoroughly or feed freshly	HRC283
Poaceae	–	*Oryza sativa*	Cultivated	Whole year	Husk and tender leaf	Cut up and cook thoroughly or feed freshly	HRC648
Poaceae	–	*Pennisetum purpureum*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC835
Poaceae	–	*Setaria italica*	Cultivated	Whole year	Seed	Cut up and cook thoroughly or feed freshly	HRC340
Poaceae	–	*Sorghum bicolor*	Cultivated	Whole year	Seed	Cut up and cook thoroughly or feed freshly	HRC948

Vernacular Family name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Poaceae	*Zea mays*	Cultivated	Whole year	Seed and tender leaf	Cut up and cook thoroughly or feed freshly	HRC339
Cucurbitaceae	*Cucurbita moschata*	Cultivated	Summer and Autumn	Fruit	Cut up and cook thoroughly or feed freshly	HRC951
Cucurbitaceae	*Gynostemma pentaphyllum*	Cultivated	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC125
Violaceae	*Viola diffusa*	Shrub	Whole year	Whole plant	Cut up and cook thoroughly or feed freshly	HRC452
Violaceae	*V. japonica*	Shrub	Whole year	Whole plant	Cut up and cook thoroughly or feed freshly	HRC71

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Violaceae	zui jiao bo	*V. philippica*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC593
Malvaceae	wei wai	*Hibiscus syriacus*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC950
Campanulaceae	yan hong die	*Lobelia angulata*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC302
Asteraceae	cao ho	*Artemisia argyi*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC848
Asteraceae	cao huo	*A. indica*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC877

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Asteraceae		*A. lactiflora*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC857
Asteraceae	yao bu sai	*Aster ageratoides*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC852
Asteraceae	白花鬼针	*Bidens alba*	Cultivated or wild	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC821
Asteraceae	cao zong	*B. tripartita*	Cultivated or wild	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC962
Asteraceae	cao suan gao	*Crassocephalum crepidioides*		Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC824

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Asteraceae	黄瓜假还	*Crepidiastrum denticulatum*	—	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC909
Asteraceae	粗毛牛膝	*Emilia sonchifolia*	—	Summer and Autumn	Whole plant	Cut up and cook thoroughly or feed freshly	HRC304
Asteraceae		*Galinsoga quadriradiata*	—	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC953
Asteraceae		*Gynura japonica*	—	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC328
Asteraceae		*Ixeris polycephala*	—	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC119

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Asteraceae	jiu	*Siegesbeckia orientalis*	—	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC838
Asteraceae		*S. pubescens*	—	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC883
Asteraceae	xiao niao sao	*Synedrella nodiflora*	—	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC820
Asteraceae		*Youngia japonica*	—	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC960
Acanthaceae		*Asystasia chelonoides*	—	Whole year	Whole plant	Cut up and cook thoroughly or feed freshly	HRC316

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Acanthaceae		*Dicliptera chinensis*	—	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC89
Acanthaceae	九头狮子草	*Justicia procumbens*	—	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC849
Acanthaceae	九头狮子	*Peristrophe japonica*	—	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC959
Acanthaceae		*Strobilanthes dimorphotricha*	—	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC822
Gesneriaceae		*Chirita tribracteata*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC138

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Chenopodiaceae	灰藜	*Chenopodium album*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC82
Polygonaceae	荞麦	*Fagopyrum dibotrys*	Cultivated	Whole year	Tuber	Cut up and cook thoroughly or feed freshly	HRC781
Polygonaceae	萹蓄	*Polygonum aviculare*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC916
Polygonaceae	尼泊尔蓼	*P. nepalense*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC148
Polygonaceae	习见蓼	*P. plebeium*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC969

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Polygonaceae	Suanmu	*Rumex japonicus*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC831
Polygonaceae		*R. nepalensis*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC91
Basellaceae		*Anredera cordifolia*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC111
Portulacaceae		*Talinum paniculatum*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC850
Cannaceae		*Canna edulis*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC973

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Cannaceae		*C. indica*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC826
Vitaceae	白毛乌蔹	*Cayratia albifolia*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC827
Vitaceae	chou teng	*C. japonica*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC830
Vitaceae	ye ba jie	*Parthenocissus suberosa*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC971
Rubiaceae	shi tao teng	*Paederia scandens*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC974

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Rubiaceae	鸡矢藤	*Rubia alata*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC954
Solanaceae	枸杞	*Lycium chinense*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC955
Solanaceae	少花龙葵	*Solanum americanum*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC961
Solanaceae	番茄	一	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC828
Begoniaceae	秋海棠	*Begonia grandis*	Cultivated	Fall and winter	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC964

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Saururaceae	ye e cai	*Houttuynia cordata*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC834
Apiaceae	ye hong duo wu	*Cryptotaenia japonica*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC963
Apiaceae	ye qin	*Oenanthe javanica*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC947
Moraceae	ye mian pi	*Broussonetia papyrifera*	Cultivated or wild	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC829
Moraceae	ye sang jie	*Morus alba*	Cultivated	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC972

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Phytolaccaceae	zaozicong	*Phytolacca acinosa*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC854
Brassicaceae	荠菜	*Capsella bursapastoris*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC851
Brassicaceae	yecaihuaya	*Cardamine hirsuta*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC959
Caryophyllaceae	huanniang	*Myosoton aquaticum*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC822
Caryophyllaceae	~~~~	*Stellaria media*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC138

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Saurauiaceae		*Saurauia thyrsiflora*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC82
Araceae		*Colocasia gigantea*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC178
Cactaceae		*Hylocereus undatus*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC949
Amaranthaceae		*Achyranthes longifolia*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC831
Amaranthaceae		*Alternanthera sessilis*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC91

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Amaranthaceae		*Amaranthus spinosus*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC111
Amaranthaceae		*A. tricolor*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC850
Amaranthaceae		*Celosia argentea*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC973
Convolvulaceae		*Dinetus racemosus*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC826
Convolvulaceae		*Hewittia malabarica*	Shrub	Summer and Autumn	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC827

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Convolvulaceae	yuanduo	*Ipomoea batatas*	Cultivated	Whole year	Tuber	Cut up and cook thoroughly or feed freshly	HRC830
Urticaceae	序叶苎麻	*Boehmeria clidemioides*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC971
Urticaceae	长序苎麻	*B. dolichostachya*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC974
Urticaceae	wowegu	*B. nivea*	Shrub	Whole year	Tender branch and leaf and infructescence	Cut up and cook thoroughly or feed freshly	HRC954
Urticaceae	wowegu biao	*B. tricuspis*	Shrub	Whole year	Tender branch and leaf and infructescence	Cut up and cook thoroughly or feed freshly	HRC955

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Urticaceae	长叶水麻	*Debregeasia longifolia*	Shrub	Whole year	Branch and leaf	Cut up and cook thoroughly or feed freshly	HRC961
Urticaceae		*Elatostema involucratum*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC828
Urticaceae		*Gonostegia hirta*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC964
Urticaceae		*Oreocnide frutescens*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC834
Urticaceae	广西紫麻	*O. kwangsiensis*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC963

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Urticaceae	wa'eon	*Pellionia radicans*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC947
Urticaceae	wazong jie	*Pilea platanifolora*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC829
Urticaceae	wa'eon ya	*P. pumila*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC972
Urticaceae	红霉水葛	*Pouzolzia sanguinea*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC844
Commelinaceae		*Commelina benghalensis*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC845

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Commelinaceae		*C. diffusa*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC851
Commelinaceae		*Murdannia triquetra*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC959
Melastomataceae		*Melastoma dodecandrum*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC822
Melastomataceae		*Oxyspora paniculata*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC138
Papaveraceae		*Corydalis balansae*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC82

Family	Vernacular name	Scientific name	Collection resource	Collection time	Used part	Preparation	Voucher
Boraginaceae	—	*Cynoglossum furcatum*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC781
Nyctaginaceae	wa dou bai	*Mirabilis jalapa*	Shrub	Whole year	Tender branch and leaf	Cut up and cook thoroughly or feed freshly	HRC916

Notes: Family name, plant name, and scientific name are based on the Flora of China in http://www.iplant.cn/. The order is in alphabetical order of family name, and secondarily in alphabetical order of scientific name. "—" indicates missing data.

Table 2 Taxonomic composition of Baiku Yao forage plants for swine

Category	Number of families	Percentage of total families (%)	Number of species	Percentage of total species (%)
Multiple-species families (5 species)	6	14.29	51	49.04
Oligotypic families (2–4 species)	14	33.33	31	29.81
Monotypic families (1 species)	22	52.38	22	21.15

Category	Number of families	Percentage of total families (%)	Number of species	Percentage of total species (%)
Total	**42**	**100**	**104**	**100**

Note: Figure translations are in progress. See original paper for figures.