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Wild Vegetable Diversity and their Contribution to Household Income at Patshaling Gewog, Tsirang

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Abstract

Collection and use of wild vegetables have been a part of rural communities in Bhutan. Wild vegetables provide food as well as cash income for rural population and ensure food security. This study assessed the diversity of wild vegetables and their contribution to the household income at Patshaling *Gewog*, Tsirang Dzongkhag. Through simple random sampling 53 community members were identified to participate in the research. The semi-structured questionnaire interview and focus group discussions were used to collect the data from the respondents. About 32 species of wild vegetables were identified that are consumed by households, sold or used for medical purposes. Among the wild vegetables, mushrooms are perceived to be more important than cane, fern, *damru*, and orchid species due to their high value and scarcity. The respondents harvest wild vegetables almost throughout the year, except in November and December. According to the respondents, about 66% of the wild vegetables collected are used for medical purposes and 34% for household consumption. Wild vegetables are consumed to add diversity to the household diet and the excess are sold in the local market for cash income. Importance of wild vegetables needs to be emphasized and integrated into polices for conservation, food-security and agriculture.

Keywords: Diversity, household income, medicinal values, wild vegetables

Introduction

Forests have always played a major role in influencing patterns of economic development, sustaining livelihood (Baruchua and Pretty, 2010) and helping to promote sustainable growth within the community. Since time immemorial, forests were the source of land for cultivation, settlement, construction materials, fuel, food, and nutrition (Agrawal *et al.,* 2012). Wild plants have been used by people for medicinal and nutritional purposes (Grivetti and Ogle, 2000; Matsushima *et al.,* 2008; Joshi and Siwakoti, 2012). They are consumed to prevent diseases associated with nutritional deficiencies (Odhav *et al*., 2007; Orech *et al.,* 2007).

Wild vegetables are essential in sustaining the livelihood of rural communities. They are an integral part of the subsistence strategy of people in many developing countries. Collection of wild vegetables for self-consumption and sale is a common practice in developing countries (Matsushima *et al.,* 2008). Studies on economic contribution from wild vegetables are limited to generation of income including consumption and sale (Brucha and Pretty, 2010; Joshi and

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Siwakoti, 2012). It is estimated that wild vegetables and animals provide $ 170–900 worth to the rural household of South Africa and Tanzania. In Bolivia, dependence of Tsimane community for household food from market is only three per cent. The rest are sourced from forest and freshwater (Barucha and Pretty, 2010).

Globally, rich diversity of wild plants is found in the forest. In Yunnan region of China, 168 wild plant species (Ju *et al.,* 2013) and 600 plant species in India (Rathore, 2009) are identified to have food value. Wild fungi of 1,069 species consumed for protein are important source of income (Boa, 2004) for people of developing countries. Bhutan is popular for its rich biodiversity and has a record of more than 600 medicinal plants, 97 mushrooms, 14 canes and 77 forest vegetables among the Non Wood Forest Products (NWFPs) (RGOB, 2006). Collection of wild vegetables is considered an important activity in enhancing livelihood (Duba *et al.,* 2007) of rural communities in Bhutan. According to Namgyel (1996), NWFPs contributes around 21% and 19% to household diet and income respectively in western Bhutan. Wild vegetables are important to rural communities, but very little or no information is available on diversity and abundance of wild vegetables and its contribution to household income. Therefore, the study was conducted to assess the existing diversity of wild vegetables and their contribution to household income at Patshling *Gewog*, Tsirang *Dzongkhag*.

Materials and Method

Study area

The study was conducted at Patshaling Gewog under Tsirang Dzongkhag, located at 600-1900 m above sea level. Patshaling Gewog consists of 9 villages with 235 households. The main crops grown are maize, millet, paddy, and vegetables. The cool climatic condition favours year round collection of diverse wild vegetables from the local forests. Patshaling Gewog has rich biodiversity and its people are involved in collection of wild vegetables for their household income. Interestingly, the former name of study area was "*Beteni*" which is believed to be named after the abundance of cane growing in the wild of the gewog. The area is popular for diverse wild vegetables due to its suitable climatic conditions and natural habitats.

Data collection

Data were collected through semi-structured questionnaire interview and focus group discussions with key respondents in January and February, 2014. A total of 53 households were selected through simple random sampling and the sample size was determined using Yamane formula with 10% margin error. A few key informants above 50 years of age were interviewed individually for information on the medicinal properties derived from wild vegetables. Wild edible vegetables were identified based on the external morphology by comparing with analog and digital pictures and further confirmed using reference book of edible wild plants of Bhutan by Matsushima *et al*. (2008) and Fungi of Bhutan by Mata *et al*. (2010).

Results and Discussion

Diversity of wild vegetables

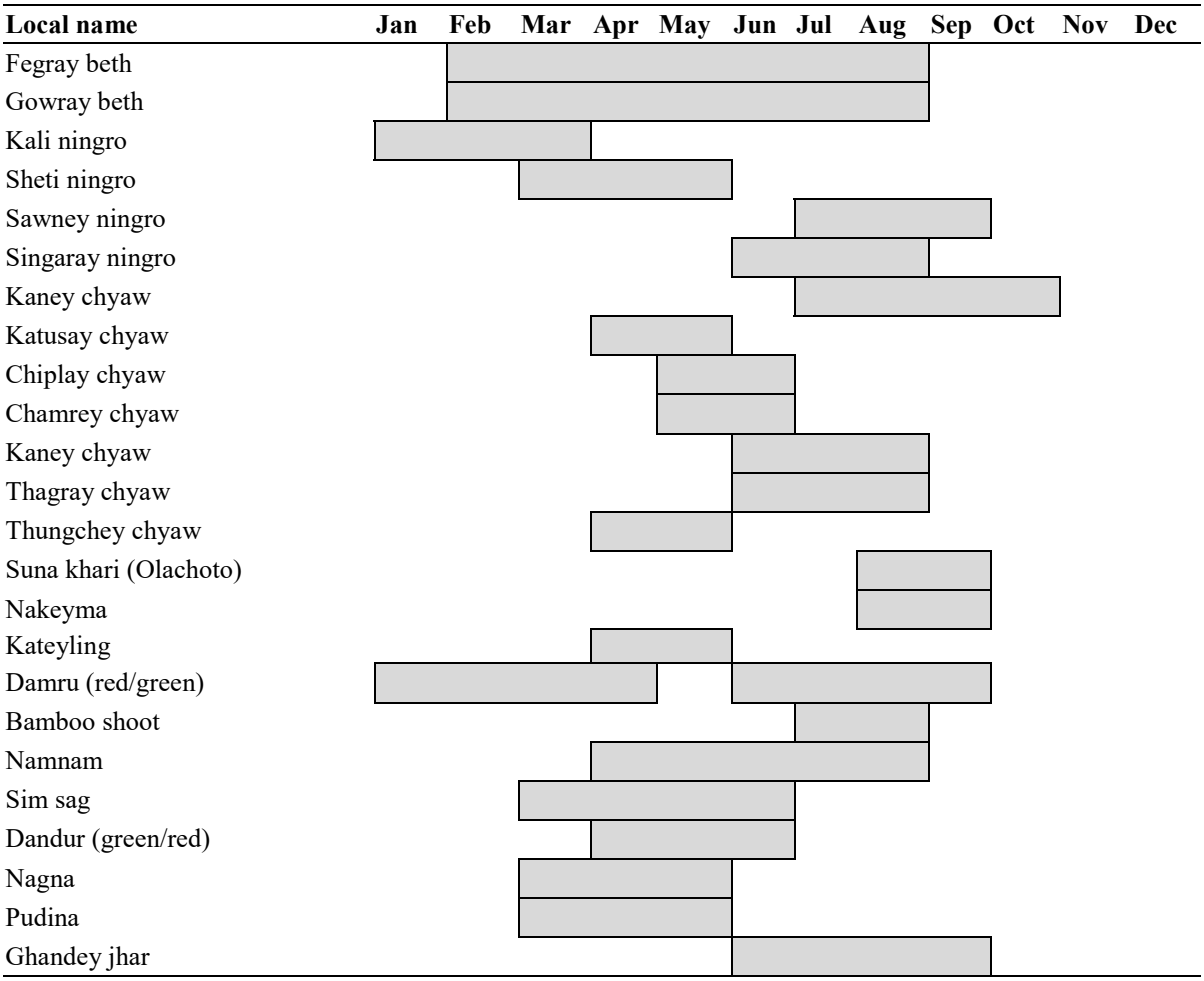
The study identified 32 kinds of wild vegetables used by local people. There were six species of mushroom, four species of fern, three species of orchids and stinging nettles each, and two species of Phytolocca, cane, and damru each. Remaining 10 species of wild vegetables were of tama, namnam, piralu, ghandey jhar etc. (Appendix 1). Considering the abundance, ferns were the most available species collected by people round the year.

Besides recording the diversity, an attempt was also made to describe the morphological characteristics, habitat, edible parts, used and taste characteristics of wild vegetables. The taste of the vegetables provided is as per the perception of respondents. Taste varied from having good, bitter, sour, and spicy flavor to rough and smooth feeling. However, a separate research

approach is required to validate the information with empirical data.

According to the respondents among the wild vegetables, mushroom, cane, fern, damru, and orchid are considered relatively important due to their high medicinal and nutritional value, as well as for high price. Whereas, kateyling, piralu, kukurdrenga, sisnu, nagna, pudina and ghandey jar were considered economically less important and were collected primarily for self-consumption.

Table 1: Seasonal availability of wild vegetables



Source: field study, 2014

Seasonal availability

Availability of wild vegetables varies from season to season in a year. Mushroom collection begins from April till October, coinciding with rainy season. Canes are available from February to August (Table 1). Overall, the study found that the different species of wild vegetables were available in the study area throughout the year except for the months of November and December. Owing to the seasonality of wild plants, different species are available in the local markets. The native population enjoy consumption of wild vegetables and they are considered to be part of the Bhutanese traditional cuisine.

Seasonal availability of wild vegetables minimises the risk of seasonal food insecurity for rural households. Seasonality of forest food benefits the marginal and shifting population of cultivators and forest dwellers in times of food shortages (Sahoo *et al.,* 2010) and crop failures (Subba, 1996). However, threats from growing population, socio-economic developments and unsustainable harvesting practices could reduce the availability of wild vegetables in future.

High demand and better price for wild vegetable in the market have persuaded collectors to harvest more, leaving behind little or no more for subsequent seasons. Such practices of over and unsustainable harvesting could lead to extinction and loss of diversity in future.

Reasons for collection

Access to a wide range of wild vegetables directly benefits rural communities in enhancing the livelihood. Wild vegetables provide food for families during the lean season (Babalola, 2009) and serve as source of income to access food from market (Awe *et al.,* 2011). In this study, majority (59%) of the respondents collected wild vegetables for household consumption and for market. While 24% of the respondents collected for home consumption that added variety to their diet. Similarly, harvesting of wild vegetables remains significant in the local diet and economy for the communities of Ura, Genekha, and Haa (living above 3000 m asl). These communities have limited cultivated crops, and wild edible mushrooms are collected to create seasonal employment and generate cash income (Mata *et al.*, 2010). Thus, collection of wild vegetables was practiced for long time by the rural households for consumption and income generation to purchase basic necessities.

Quantity of wild vegetables collected

Out of 17 wild vegetables, 10 were collected for meeting household consumption and the surplus was sold for cash income (Table 2). The highest quantity (1,895 bundles) of fern was collected for sale as well as for household consumption by the respondents in 2013. Pudina and ghandey jhar were least collected by the respondents for only home consumption. It shows that many wild vegetables were collected for meeting household subsistence requirements and the surplus were marketed for cash income.

Table 2: Quantities of wild vegetables sold and consumed in 2013

Types (Local name)	Qty. sold	% sold	Qty. consumed	% consumed	Total Qty.
Shamu (Chyaw)	86 kg	50.9	51 kg	71.7	137 kg
Ningro	1,540 bundles	58.5	355 bundles	75.5	1,895 bundles
Beth	54 bundles	26.4	13 bundles	20.8	67 bundles
Damru (Gurmangay)	660 bundles	37.7	168 bundles	52.8	828 bundles
Suna khari	50 bundles	15.1	29 bundles	26.4	79 bundles
Nakeyma	280 bundles	30.2	71 bundles	30.2	351 bundles
Namnam	75 bundles	15.1	25 bundles	17.0	100 bundles
Simsag	60 bundles	11.3	45 bundles	24.5	105 bundles
Bamboo shoot	28 kg	22.6	15 kg	20.8	43 kg
Dandur	30 bundles	9.4	20 bundles	18.9	50 bundles
Kateyling			20 bundles	9.4	20 bundles
Piralu			10 kg	13.2	10 kg
Kukurdrenga			20 bundles	18.8	20 bundles
Sisnu			20 bundles	18.8	20 bundles
Nagna			20 bundles	11.3	20 bundles
Pudina			10 bundles	9.4	10 bundles
Ghandey jhar			10 bundles	9.4	10 bundles

Gender in wild vegetable collection

Majority of the respondents reported that both (55%) genders were involved in vegetable collection followed by (32%) male and (13%) female respondents. However, males were more involved in cane collection that required longer distance to walk into the forest. Since cane was not available near the settlements, more male were engaged in the collection. This contradicts the findings by Kajembe *et*

al. (2000) and Dankelman (2010) that women played important roles in gathering and processing of wild vegetables.

Utilisation of wild vegetables

Majority (66%) of the respondents consumed wild vegetables for their medicinal properties and 34% found them nutritious. Some of the medicinal properties and plant parts used are described in Table 3. Medicinal properties possessed by wild vegetables include curing of body ache, cough and cold, blood purification, reduction of blood pressure and consumption as an appetizer. Dutta (2012) reported that wild edible plants are very rich in minerals, vitamins, and other source of nutrients in addition to their medicinal values. However, in depth study on nutritional content was not done but respondents were aware of the nutritional values from wild vegetables.

There is also a growing ignorance among the young generation on medicinal values contained in wild vegetables. This knowledge gap between the generations creates a risk of degeneration of traditional values.

Table 3: Medicinal properties in wild vegetables

Scientific name	Local name	Parts used	Medicinal properties
Plectocomia himalayana Griff.	beth	shoot	alleviates nausea, body ache
Diplazium maximum (D.Don). C. Chr.	ningro	frond	alleviates body ache
Elatostema lineolatum Wight.	gurmangay	stems, leaves	alleviates body aches, appetizer
Nasturtium officinale W.T. Aiton	sim sag	stems, leaves	improve blood
Pogostemon amaranthoides Benth.	namnam	leaves	improve blood
Tupistra wattii (C.B.Clarke) Hook. f.	nakeyma	inflorescences	appetizer
Phytolocca acinosa Roxb.	dandur	stems, leaves	appetizer
Asparagus racemosus Willd.	kurilo	shoot	kidney and ulcer
Girardiana palmata (Forssk.) Gaud.	sisnu	leaves, shoots	reduces blood pressure
Mentha spicata Linn.	pudina	stems, leaves	cold, cough
Houttuynia cordata Thunb.	ghandey jhar	leaves, roots	blood purifier, appetizer

Income generation

Figure 1 presents the income generated through sale and the consumption of wild vegetables by households in 2013. The quantities consumed were converted into monetary value and presented in relation with the amount earned from sold quantities. Sale of fern earned the highest (Nu. 11, 650) amount followed by cane and mushroom. And sale of dandur generated the least amount of Nu. 320. The total amount earned from sale of wild vegetables was Nu. 40,850 while the respondents' family consumed wild vegetables worth of Nu. 18,100.

Market places

The wild vegetables were sold at Damphu weekend market, along national highway, Gelephu-Sarpang market, and to middle men. Damphu weekend market provided a suitable place for sale of wild vegetables collected in bulk quantities. The vegetables fetched better price due to more consumers and also remaining commodities were sold to vegetable sellers of Damphu market.

Vansickle (2007) reported that types of markets include local market; roadside stands, city and local farmers market, local retail outlets, regional and national markets, cooperatives, and direct selling. Among these various marketing systems, roadside stands are relatively popular in developing countries. Similarly, the study found that road side marketing is gaining popularity in the study area with the intervention from the government by establishing market sheds along the national high way.

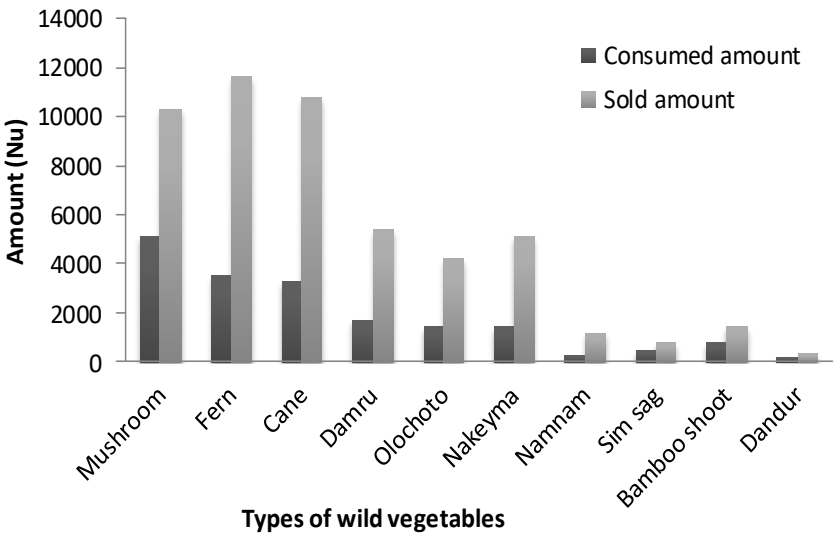


Figure 1: Total value of wild vegetables, 2013

Conclusion

Wild vegetables are important sources of food in the rural parts of Bhutan for the subsistence farmers. About 32 different species of wild vegetables have been identified in Patsaling Gewog showcasing rich diversity. Important wild vegetables were collected for their self-consumption and economic benefits. Seasonal availability of wild vegetables made it feasible for local people to collect throughout the year except from November to December. Wild vegetables were consumed with the belief that they possess medicinal properties that cure some ailments. They are also nutritious and add to the diversity of local diet. Among the wild vegetables, sale of fern contributed highest income (Nu.11,650) followed by cane and mushroom. Availability of wild vegetables in future is a concern with threats from growing population, socio-economic developments, and unsustainable harvesting practices. Moreover, the traditional knowledge of wild vegetables is observed to be gradually disappearing among the younger generation.

Integration of polices on conservation, food -security, and agriculture is essential to promote importance of wild foods. Over harvesting of wild vegetables threatens the availability from the forest. Such practices would affect the nutritional security of rural population that depends on wild vegetables. So, sustainable management of these resources as well as conserving biodiversity is of utmost importance. The local regulatory system should be formulated with the participation of the local people considering their social customs and norms. Such initiatives could designate community-based harvesting areas and advise the community on sustainable harvesting.

Further, nutrient content analysis is required to comprehensively evaluate medicinal and nutritional values of wild vegetables. Findings from the study can be compared with other cultivated vegetables of high value. However, the study also lacks economic analysis of wild vegetable collection and proportion of household income derived from wild vegetables and other sources.

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References

Agrawal, A., Cashore, B., Miller, D., and Shepherd, G. (2012). *Economic contributions of forest: Background paper prepared for the United Nations Forum on Forests.* United Nations: Centre for Science and Environment.

Awe, F., Osadebe, C.O., Imoagene, E., Fashina, A.Y., Eniola, T.S., and Adeleke, E.O. (2011). Assessment of rural households' objectives for gathering non-timber forest products in Kogi State Nigeria. *African Journal of Environmental Science and Technology.* 5 (2): 143-148.

Babalola, F.D. (2009). Prospects and challenges of production and marketing of non-timber forest products by rural farmers in South west Nigeria. *Nigeria Academic Journal of Plant Science.* 2 (2): 222-230.

Baruchua, Z. and Pretty, J. (2010). The roles and values of wild foods in agricultural system. *Philosophical Transaction of the Royal Society B* 365, 2913–2926. doi:10.1098/rstb.2010.0123.

Boa, E. (2004). *Wild edible fungi: a global overview of their use and importance to people (Non-Wood Forest Products)*. FAO, Rome, Italy.

Dankelman, I. (2010). *Gender and climate change: An introduction.* Earth Scan Limited, UK.

Duba, S., Ghimiray, M., and Gurung, T.R. (2007). Promoting organic farming in Bhutan: A review of policy, implementation and constraints. Council for RNR Research of Bhutan, Ministry of Agriculture. Royal Government of Bhutan.

Dutta, U. (2012). Wild vegetables collected by the local communities from the Chirang Reserve Forest of BTAD, Assam. *International Journal of Science and Advanced Technolog. 2(4)*.

Grivetti, L.E. and Ogle, B.M. (2000). Value of traditional foods in meeting macro- and micronutrient needs: the wild plant connection. *Nutrition Research Review* 13, 31–46. doi: 10.1079/095442200108728990.

Joshi, N., and Siwakoti, M. (2013). Wild vegetables used by local community of Makawanpur district and their contribution to food security and income generation. *Nepal Journal of Science and Technology.* 13 (1): 59-66. doi: http://dx.doi.org/10.3126/njst.v13i1.7442.

Ju, Y., Zhuo, J., Liu, B. and Long, C. (2013). Eating from the wild: diversity of wild edible plants used by Tibetans in Shangri-la region, Yunnan, China. *Journal of Ethnobiology and Ethnomedicine.* 9:28. doi**:** 10.1186/1746-4269-9-28

Kajembe, G.J., Mwenduwa, M.I., and Ramadhani, H. (2000). *Potential of non-wood forest products in household food security in Tanzania. The role of gender based local knowledge. Gender, Biodiversity and Local Knowledge System,* Tanzania.

Mata, M., Penjor, D., and Pradhan, S. (2010). *Fungi of Bhutan.* National Mushroom Centre, Department of Agriculture, Ministry of Agriculture and Forests. Royal Government of Bhutan.

Matsushima, K., Minami, M., Nemoto, K., Pradhan, N.K., Thapa, L., and Delma, D. (2008). *Edible wild plants of Bhutan and their associated traditional knowledge.* Graduate School of Agriculture, Shinshu University, Japan.

Namgyel, P. (1996). *Beyond timber-what value of the forest?: A rapid appraisal study on non-timber forest products in the Nahi geog, Wangduephodrang, Western Bhutan.* Bhutan: Forest research centre in collobora-tion with Bhutan-German integrated Forest Managment Project.

Odhav, B., Beekrum, S., Akula, U., and Baijnath, H. (2007). Preliminary assessment of nutritional value of traditional leafy vegetables in Kwazulu-Natal. *Journal of Food Composition and Analysis.* 20: 430-435. doi.org/10.1016/j.jfca.2006.04.015.

Orech, F.O., Aagaard, H.J., and Friis, H. (2007). Ethnoecology of traditional leafy vegetables of the Luo people of Bondo district, Western Kenya. *International Journal of Food Science and Nutrition.* 58 (7): 522-530.doi:10.1080/09637480701331163.

Rathore, M. (2009). Nutrient content of important fruit trees from arid zone of Rajasthan. *Journal of Horticulture and Forestry*. 1(7): 103 –108.

RGoB. (2006). *Forest Resources Development Division.* Department of Forest, Ministry of Agriculture, Royal Government of Bhutan.

Sahoo, U.K., Lalremruata, J., Jeceelee, J.H., and Lalliankhuma, H. (2010). *Utilization of non-timber forest products by the tribal around Dampa tiger reserve in Mizoram.* Department of Forest, Mizoram University, India.

Subba, K. J. (1996). *Overview of non wood forest products of Bhutan.* The Food and Agriculture Organization of the United Nations. Bangkok, Thailand.

Vansickle, J. J. (2007). *Marketing strategies for vegetable growers. IFAS Extenison Chapter 19.* University of Florida.

Annexure 1: Wild vegetables diversity found in Patshaling gewog, Tsirang Dzongkhag

Local name	Scientific name	Morphological Characteristics	Habitat	Edible Part	Taste
Fegray beth	*Plectocomia himalayana*	Thorny, climber, big size	Cool, high altitudes	Stem pith	Bitter
Gowray beth	*Calamus* sp.	Thorny, climber, small size	Cool, high altitudes	Stem pith	Bitter
Kali ningro	*Microlepia* sp.	Dark green, no hair curved head, small	Cool, dry area	Young frond	Bitter
Sheti ningro	*Diplazium* sp.	White, hairy, curved head	Cool, wet, marshy areas	Young frond	Not bitter
Sawney ningro	*Diplazium* sp.	Green, more hairy, curved head, big size	Wet, Stream, gullies areas	Young frond	Not bitter
Singaray ningro	*Diplazium* sp.	Green, less hair, curved head, medium	Cool, stream, open areas	Young frond	Not bitter
Gaklayto (red)	*Elatostema* sp.	Red stem, small leaves	Cool, wet, stream, High altitudes	Stem, leaves	Good
Gaklayto (green)	*Elatostema lineolatum*	Green stem	Cool, wet, stream, gully, rocky, High altitudes	Stem, leaves	Good
Kaney chyaw	*Lyophyllum* sp.	Light brown, grey	Log, wet	Whole part	Good
Katusay chyaw	*Pleurotus* sp.	Pale brown, dark	Log	Whole part	Good
Chiplay chyaw	*Pleurotus* sp.	Pale brown, dark	Log, wet	Whole part	Good
Chamrey chyaw	*Schizophyllum* sp.	White grey, wholly surface	Log, wet	Whole part	Good
Kaney chyaw	*Auricularia auricula-judae*	Ear-shaped, Fleshy, slippery	Log, stumps	Whole	Good
Thagray chyaw	*Pleurotus* sp.	Bright yellow	Log, wood	Whole part	Good
Dandur (Red)	*Phytolocca acinosa*	Red stem, dark green leave	Cool, wet areas	Stem, leaves	Good
Dandur (white)	*Phytolocca acinosa*	White stem, light green leave	Cool, wet areas	Stem, leaves	Good
Suna Khari (Olachoto)	*Cymbidium* spp.	-	Cool	Inflorescence	Good
Nakeyma (Wangpeim)	*Calanthe plantaginea*	-	Cool	Inflorescence	Bitter
Kateyling	*Tupistra wattii*	-	Cool	Inflorescence	Bitter
Bhangre sisnu	*Girardiana palmata*	Hairy, string	cool	Flowers, leaves	Good
Patley sisnu	*Urtica* sp.	Less hair, string	cool	Leaves	Good

Garaia sisnu	*Urtica* sp.	Hairy, string	cool	Flowers, leaves	Good
Tama	*Dendrocalamus hamiltonii*	Yellow shoot	Cool	Shoots	Rough & sour
Namnam	*Pogostemon amaranthoides*	Leafy, green	Cool, wet	Stem, leaves	Good
Sim sag	*Nasturtium officinale*	Water plants, Succulent	Cool, wet, marshy	Stem, leaves	Good
Nagna	*Allium* spp.	Green leave	Cool	Stem, leaves	Good
Piralu	*Colocasia esculenta*	Yellow petiole, Tuber	Cool	Rhizomes, petiole base	Smooth & tasty
Shido/ chuchum	*Aconogonon molle*	Shrubs	Marshy	Tender shoot	Good
Henshuw	*Chenopodium album*	Shrubs	Dry land	Stem, leaves	Good
Kukurdrengna	*Asparagus racemosus*	Climber	Cool	Shoot	Good
Pudina	*Mentha spicata*	Shrubs	Cool	Stem, leaves	Spicy
Ghandey jhar	*Houttuynia cordata*	Shrubs	Marshy	whole plant	Soft &tasty