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Ethnobotanical review of traditional use of wild food plants in Japan

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Abstract

Background Japan, which has a diverse climate, is home to 8118 species of wild vascular plants, with more than 1000 of these species considered edible. However, there are fewer studies on the use of wild food plants in Japan than in other parts of the world. This research aims to provide an ethnobotanical review of the traditional food use of wild plants in Japan. It draws upon the largest database of traditional Japanese foodways, with a specific focus on the period approximately 1930. This occurred prior to Japan's rapid economic growth, which resulted in significant changes in the use of wild plants.

Methods The use of wild food plants in Japan was reviewed by studying the collection of Japanese foodways (*Nihon no shokuseikatsu zenshu*), which is the largest database on Japanese traditional foodways and contains records of approximately 52,000 dishes, including food uses of wild plants. The review extracted the local and common names, use locations, uses, processing and cooking methods, habitats and other relevant details pertaining to the reported use of wild food plants. This information was subsequently analyzed via Excel.

Results A total of 268 taxa belonging to 87 families used in Japan approximately 1930 were documented. Asteraceae was the most frequently reported family as well as the most species-rich family. In terms of use, vegetables composed the largest group, followed by dessert fruits. The majority of species have been documented in only a limited number of reports. The review revealed local traditional uses of plants, including the use of plants as binders for making rice cake, the selection of plants according to their sex, and techniques for detoxifying toxic plants.

Conclusion A comparison with those of previous studies on wild species used in other Asian regions revealed a similar preference for vegetables. However, notably, in Japan, ferns are also consumed in considerable quantities. Conversely, further elucidation is clearly needed with respect to certain matters, including the perception of plant sex and the relationships between diverse ash components and detoxification techniques. It is evident that further ethnobotanical research is needed, both in the form of an examination of ethnographic records and in the field, to gain a deeper understanding of the use of wild food plants in Japan.

Keywords Wild food plants, Food, Wild edible plants, Ethnobotany, Wild species, Traditional knowledge, Foraging, Japan, Asia

Introduction

Among more than 50,000 edible plant species in the world, only nine account for more than 66% of all crop production [1], while there are diverse land- and culture-based food uses of wild plants in different parts of the world. Understanding the patterns of use and cultural significance and value of wild food plants worldwide has been an important challenge in terms of ecology,

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culture, nutrition, economics and agriculture, as well as of genetic resources and biocultural diversity [2–5]. Previous ethnobiological studies have investigated the use of wild food plants in different populations around the world. In Europe in particular, there is an accumulation of ethnobotanical studies and reviews in various regions and countries [6–14]. An international review noted that most studies on gatherings are from the Americas, Europe, Central Asia and Africa, and there are fewer literatures and studies available from Asia [3]. The studies on wild edible plants and traditional knowledge in Asia are mainly in China, Southeast Asia and Central Asia, covering various social populations, such as farmers, indigenous communities and ethnic minorities [15–26]. In South Korea in East Asia which flora and climate are similar to Japan, studies have been conducted on the gathering practices and knowledge of wild edible plants in specific geographical areas including islands [27–29], and on the presence of these plants in the marketplace [30].

Japan, the subject of this research, is located off the northeast seaboard of the Eurasian continent and has a surface area of nearly 378,000 km^2. The climate in Japan is diverse, with variations from subarctic in the northern regions to subtropical in the southern areas. A total of 8118 species of wild vascular plants are known to be grown in Japan [31], with more than 1000 of these species considered edible [32].

The use of wild food plants and mushrooms has been the subject of considerable interest in various academic disciplines in Japan. This has focused on a range of topics, including natural resources, nontimber forest products (NTFPs) and forest management in forestry [33–35]; the distribution of natural resources and territory in human geography [36, 37]; and the practice of gathering and understanding human–nature relations in folklore studies and anthropology [38–41].

Among these traditional interdisciplinary interests in wild food plants, for example, in the field of forestry, some studies have investigated the potential for the versatile use of wild plant resources, in the context of the difficult economic situation of private forest management and agroforestry in the late 1970s and 1980s. This was driven by the recognition that a combined agroforestry management approach, rather than one focused solely on timber production, could offer a more sustainable and resilient solution. The studies encompass an understanding of the state of multipurpose use of wild plants in Japan at the time, including food, folk art and craft, medicine and ritual use. Additionally, they address cultivation techniques for wild plants and urban consumers' preferences for mushrooms and wild vegetables.

The use of wild food plants in Japan, as in other global contexts, was primarily driven by the need to source food to meet subsistence requirements and to provide a source of nutrition during periods of famine. In particular, during the Edo period (1603–1868), there was a history of nationwide famines due to a combination of various causes, including abnormal weather conditions such as cold damage and drought. In the context of these famines, several books on wild edible plants were published to guidance on how to choose, prepare and eat these plants. To illustrate, the Yonezawa clan, currently situated in Yamagata Prefecture, published Hanroshu (collection of famine foods) in 1783 and Katemono (emergency foods) in 1802, by the order of Youzan Uesugi (1751–1822), a *daimyo*, lord of the Yonezawa clan and they introduced a total of 144 plant species. Another famous book is Bikousomokuzu (famine preparation botanical drawings) published in 1833,[1] primarily authored by the physician Seian Takebe (1712–1782), which introduced 104 species with accompanying illustrations and disseminated throughout Japan.

Japanese folklore and anthropological studies have noted the cultural role of wild food plants, such as how they serve as intermediaries for communication and social interaction, particularly in the form of gift-giving practices. These studies have suggested that the foraging practices are not merely the acquisition of food in Japan; rather, it is a process through which perceptions and sense of nature, resources, and community are shaped [41]. These studies referred to the cultural significance of wild food plants including those used as special foods and offerings for rituals, ceremonies and special occasions, including the New Year and Bon festival [35]. Manyoshu, Japan's oldest anthology of waka poetry, assembled in after 759 CE, also contains poems describing scenes of people gathering wild food plants in the mountains and fields. These poems, in particular, offer insight into the practice of foraging plants during the spring season. Thus, previous studies demonstrate that wild food plants not only satisfy the nutritional requirements of the Japanese population, but also possess cultural uses and meanings that are deeply rooted in the diverse regions of Japan.

Folklore studies also indicate that foraging in Japan constituted one component of a multifaceted system of livelihoods [41]. Although rice cultivation, which produces the staple food rice, tends to be regarded as the primary source of livelihood in Japan, numerous mountain villages have sustained themselves by integrating a range of practices, including slash-and-burn farming, forestry,

[1] The first draft was completed in 1771, however it was published in 1833 after Takebe's death with a help from other physicians and scholars.

hunting, fishing, charcoal production, and also foraging. Foraging practices in Japan have been shown to vary depending on the region, village, household, and time period. These practices have ranged from gathering for subsistence to pursuing cash value.

On the other hand, the number of studies that have been conducted to determine the actual state of wild food plants uses at the national level is very limited; except a questionnaire survey conducted approximately 1980 which revealed that more than 250 species of wild vegetables were used in Japan excluding Okinawa [42]. Several previous studies in Japan have employed a variety of methods, including questionnaires, field surveys, and literature reviews, to ascertain the actual pattern of the use of wild food plans with focus on specific prefecture and area. For example, a study suggested that 178 species from 46 families of vascular plants and 10 species of ferns are consumed as wild plants in northern Japan [40]. The same study also revealed that 101 species of seeds, including nuts and fruits belonging to 34 families, are consumed for medicinal and food purposes. Another study conducted in Nagano Prefecture based on literature reviews revealed the use of 161 species of wild vegetables and 100 species of wild fruits in traditional foods between 1868 and 1955 [43]. A more recent study conducted in the Noto Peninsula, Ishikawa Prefecture, revealed the presence of 176 species belonging to 65 families of edible plants, however, the number of species actually consumed was limited [44]. In Fukushima Prefecture in the Tohoku Region, a total of 45 taxa of wild vegetables and 26 taxa of nuts were used; however, these species have been used less frequently in recent years [45]. It should be noted that most of these previous studies were published in Japanese and therefore limited accessibility to international audience.

It is suggested that the use of wild food plants is declining in Japan as a whole [35]. In particular, the postwar period of rapid economic growth from the late 1950s onward saw a shift in the use of wild food plants [35, 39, 45, 46]. During this period, the social and natural environment, including industrial patterns, lifestyles and land use, underwent substantial transformation [47]. The study in Fukushima mentioned earlier considered several specific factors that have contributed to the decline in the use of wild food plants [45]. These include social changes, such as changing lifestyles and the introduction of purchasable foods, and environmental changes, including land development, the use of pesticides, and the reduction in habitats.

Conversely, since the period of economic growth, the popularity of foraging and consuming wild food plants has increased [38]. This popularity is referred to as the *sansai* (mountain vegetable) boom and can be considered the period when the new term '*sansai*' to describe mountain vegetables spread, especially among urban populations. This phenomenon has given rise to novel trends in recreational foraging [35] and the publication of introductory books and illustrated reference books on wild food plants. These developments have also facilitated the utilization of previously unused species in some region [45]. In more recent years, the practice of recreational foraging wild food plants has retained a notable degree of popularity. In particular, within the Tohoku and Hokuriku regions, the foraging and eating of wild food plants have been utilized as a means of promoting local tourism. At the same time, there have been concerns regarding the depletion and deterioration of resources due to unplanned collection by external parties, as well as incidents resulting from the inadvertent collection of poisonous species including mushrooms.

Given these backgrounds, this research aims to provide an ethnobotanical review of the traditional food use of wild plants in Japan via the largest database of traditional Japanese foodways, with a specific focus on approximately 1930, which was before rapid economic growth, when major changes in the use of wild plants occurred. The specific focuses of this study were: (1) to identify how many species of plants were used as food in Japan around 1930, (2) to analyze which plant families and species were commonly used in local food categories, and (3) to understand the cultural uses of wild species in the context of Japanese traditional food culture.

Methods

Materials

The use of wild food plants in Japan was reviewed by studying the collection of Japanese foodways (*Nihon no shokuseikatsu zenshu*) [48]. The collection aimed to archive Japanese traditional foodways on the basis of an oral history of dietary habits during the late 1920s and early 1930s. The data were collected from interviews with 5,000 speakers who were mostly women in their late 70s or older at the time of the survey and were involved in food preparation around the late 1920s to early 1930s. The collection was selected as it is the largest database on Japanese traditional foodways and contains records of approximately 52,000 dishes, including daily recipes as well as culinary uses of wild plants as well as on the basis of its uniformity of criteria and format, which were applied consistently throughout all prefectures in Japan during the survey. The collections consisted of 50 volumes covering all 47 prefectures from Hokkaido to Okinawa as well as one indigenous population, Ainu, in Hokkaido. This review examined 47 volumes, one for each prefecture (Fig. 1). The review extracted the local and common names, use locations, uses, processing and

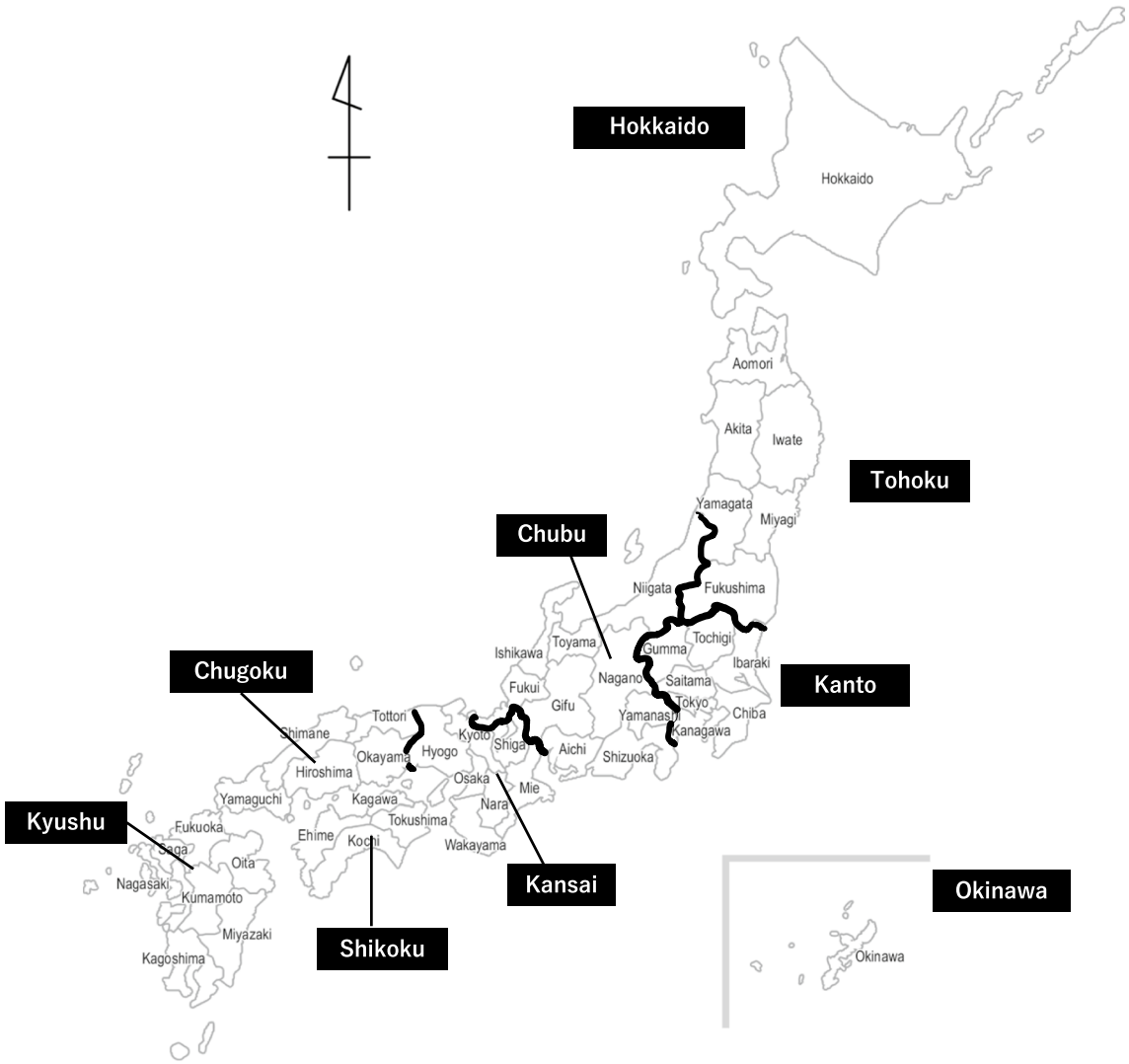

Fig. 1 Locations of regions and prefectures in Japan

cooking methods, habitats and other relevant details pertaining to the reported use of wild food plants when available. This information was subsequently analyzed via Excel.

Wild species

In this study, wild plants refer to noncultivated vascular plants, as suggested by a previous study [7]. Only species that could be identified as noncultivated plants were extracted on the basis of their description, including their habitats, such as mountains, fields, and river margins, as well as their growth conditions. In certain instances, both wild and cultivated forms, such as *Eutrema japonicum*, *Diospyros kaki*, *Castanea crenata*, and *Phyllostachys edulis*, can be found growing in the same study area. Only those species that are explicitly described as wild forms were included. Species that grow in areas with some degree of human intervention, such as the banks of rice paddies, or those that were cultivated but have escaped, such as *Eleutherococcus sieboldianus*, are also included if they are described as wild plants in the literature.

In the collections, the local and Japanese common names of the plants are provided, with the exception of those for which only one name is available. In cases where only the local name was known, the common name was identified by consulting the Collection of Plants Dialects of Japan [49] and the Folklore Research Card Collection Database, which was collected by Tama Saito, an independent folklore researcher who collected folklores that included uses of plants throughout Japan [50], and other

literature specific to each study area [51–56]. A checklist of Japanese plant names [57] was used to check the distribution of the species as well as to determine the scientific name from the Japanese name. The scientific name follows Plants of the World Online [58], and synonyms have been corrected.

Categories

First, the study included plants that are consumed as food or beverages, while plants used only as famine food or medicines were excluded. In accordance with the Economic Botany Data Collection Standard [59], the uses of plants were first categorized into the following food categories: cereals, pseudocereals, pulses, nuts, dessert fruits, vegetables (including green and root/tuber vegetables), leaf protein concentrates, starches, oils/fats, gums/mucilages, sugars, and other food types. The vegetable category also included plants that are used in relatively small quantities and serve as flavor-adding seasonings. Among these categories, the categories of cereals, pseudocereals, pulses, leaf protein concentrates, gums/mucilages, and sugars were excluded, as there were no reports in these categories.

In addition, by referring to folk perceptions of food uses, snacks, beverages, and binders were added as categories. Plants eaten between or after meals, with the exception of dessert fruits, were classified as snacks. Beverages include both alcoholic beverages such as liquors and nonalcoholic beverages such as tea. Binders include plants that are used to combine food ingredients. This usage is called "*tsunagi*" in Japanese and is used to make various foods such as *mochi* (rice cakes), *dango* (rice dumplings), and *soba* (buckwheat noodles). In total, 9 types of food categories were established as follows: nuts, dessert fruits, vegetables, starches, oils/fats, snacks, beverages, binders, and other food types.

The plant parts used were classified into the following categories: entire plants, unspecified aerial parts, galls, stems, bark, leaves, inflorescences, infructescences, seeds, roots, exudates, shoots, and propagules. When parts used were not specified in the literature, they were classified as N/A (not available).

Data analysis

In this study, a report refers to a citation of the use of a wild food plant species (or taxa) in the literature at a single study site. For example, at one study site, if the fruit of species A was eaten as a dessert fruit and the shoot was eaten as a vegetable, the number of reports was counted as one. On the other hand, when the analysis was conducted in relation to the food categories and parts used, the calculation was based on the number of species in each category. In other words, if species A was eaten as a vegetable or fruit, it was counted as one species in each food category.

Some reports were able to be identified only at the genus or subfamily level. The reason for this was that a single folk name encompassed multiple species. For example, *azami* is a general term for *Cirsium* spp. (Asteraceae), similar to the English thistle, and there are more than 150 species of *azami* in Japan. Similarly, *noichigo* or *kiichigo* is a generic name for strawberry plants that grow wild. Most of them belong to *Rubus* spp. (Rosaceae), and there are more than 30 wild species of *Rubus* spp. in Japan. The diversity of folk taxa and their species are noteworthy [6]. However, to avoid confusion in calculations, these folk taxa identified to the genus or subfamily level were calculated as one taxon, only if no botanical species from the genus or subfamily were recorded at the study site.

Results and discussion

General data

Among the 310 study sites across Japan, 278 reported the food use of wild plants. The study sites where no use was reported were mostly urban and coastal areas. In total, 3699 reports were recorded, 36 of which could not be identified by scientific names. As a result, 251 species belonging to 86 families that were used as food and beverages approximately 1930 in Japan were recorded. In addition, some reports (456 reports) were able to be identified only at the genus or subfamily level. Among the 17 such folk taxa, 16 genera and 1 subfamily belonging to 13 families were identified. A total of 268 taxa belonging to 87 families were used in Japan, including those specified above.

All of the taxa documented in this study have been previously reported as edible for instance, in two encyclopedias which cover most of the wild edible plants in Asia [60, 61] except *Maianthemum viridiflorum*. This study identified one report of a young stem of *M. viridiflorum* being boiled and consumed as a vegetable in the vicinity of a mountain lodge in Tateyama, Toyama Prefecture, although the use has been reported previously in several local histories published in Japanese language. The wild food plants identified in this study, along with their Japanese common names, food types, parts used, common uses, and number of reports, are listed in Table 1.

Overall, Asteraceae (643 reports) was the most frequently reported family, followed by Poaceae (320), Araliaceae (239), Apiaceae (227), and Dennstaedtiaceae (199). The most species-rich family was Asteraceae (29 species), followed by Rosaceae (28), Poaceae (17), Apiaceae (11), Ericaceae (10), and Fabaceae (10). Of the Asteraceae and Poaceae, which had the largest number of reports and species were observed, all 29 species of Asteraceae were

Table 1 A list of wild food plants identified in the study

Family	Scientific name	Common Japanese names		Local names (selected)	Number of reports	Food types	Part used	Common uses
Actinidiaceae	*Actinidia arguta* Miq.	kokuwa, sarunashi	コクワ、サルナシ	koka, kokubo, kokuou, kouka	12	beverages	infructescences	liqueurs
						dessert fruits	infructescences	raw; children's snack
	Actinidia polygama (Siebold & Zucc.) Planch. ex Maxim.	matatabi	マタタビ	nekozura, mantabu	10	beverages	infructescences	liqueurs
						vegetables	leaves	cooked (young leaves)
							shoots	cooked (young shoots)
							infructescences	salt-pickled and eaten with fish dishes
	Actinidia rufa Franch. & Sav.	shimasarunashi	シマサルナシ	kuga	1	dessert fruits	infructescences	raw; children's snack
Aizoaceae	*Tetragonia tetragonoides* (Pall.) Kuntze	tsuruna	ツルナ	hamachisha	4	vegetables	leaves	cooked
Alismataceae	*Sagittaria trifolia* L.	kuwai	クワイ	guyanbo	3	snacks	roots	grilled; children's snacks
						vegetables	roots	cooked
Alliaceae	*Allium* × *proliferum*	wakegi	ワケギ	senmoto	1	vegetables	NA	boiled
Amaranthaceae	*Amaranthus blitum* L.	inubiyu	イヌビユ	hiyu, hii, fui	2	vegetables	NA	boiled
	Bassia scoparia (L.) A.J.Scott	houkigi	ホウキギ	houkin, houken	1	vegetables	seeds	boiled
	Chenopodium album L.	akaza	アカザ	N/A	8	vegetables	shoots	boiled
Amaryllidaceae	*Allium macrostemon* Bunge	nobiru	ノビル	shuruko, hirkk, harubira, hirogo, hiro	68	vegetables	entire plants	raw, cooked, pickled
	Allium ramosum L.	nonira	ノニラ	N/A	1	vegetables	NA	cooked
	Allium schoenoprasum L.	asatsuki	アサツキ	asazuki, kimoto, chimoto	22	vegetables	entire plants	raw, cooked, seasonings
	Allium tuberosum Rottler ex Spreng.	nira	ニラ	N/A	4	vegetables	NA	cooked
	Allium victorialis L.	gyojaninniku	ギョウジャニンニク	ainunegi, kitobiro	4	vegetables	leaves	raw, cooked
	Lycoris radiata (L'Hér.) Herb.	higanbana	ヒガンバナ	shiroi	1	starches	roots	simmered and pounded and starch extracted in water, to make dumplings(*dango*)
Anacardiaceae	*Toxicodendron vernicifluum* (Stokes) F.A.Barkley	urushi	ウルシ	N/A	2	vegetables	shoots	boiled
							leaves	boiled (young leaves)
Annonaceae	*Asimina triloba* (L.) Dunal	popo	ポポー	poppo	1	dessert fruits	infructescences	raw; children's snack
Apiaceae	*Angelica keiskei* Koidz.	ashitaba	アシタバ	ashitabo	2	vegetables	shoots	cooked
	Angelica ursina Regel	ezonyu	エゾニュウ	nio, mizusaku, udosaku	6	vegetables	shoots	raw, cooked, pickled
							stems	raw, cooked, pickled (young stems)
	Anthriscus sylvestris (L.) Hoffm.	shaku	シャク	kojyaku, noninjin	3	vegetables	shoots	cooked, pickled
	Cnidium japonicum Miq.	hamazeri	ハマゼリ	N/A	1	vegetables	unspecified aerial parts	cooked
	Cryptotaenia japonica Hassk.	mitsuba	ミツバ	mitsupa, yamamitsuba, mitsubazeri	62	vegetables	unspecified aerial parts	raw, cooked, seasonings
	Glehnia littoralis F.Schmidt	hamabofu	ハマボウフウ	bofu	3	vegetables	shoots	cooked
	Heracleum moellendorffii Hance	hanaudo	ハナウド	udejika, shakuna, shakushina	3	vegetables	shoots	boiled
	Oenanthe javanica DC.	seri	セリ	tazeri, suidenzeri	138	vegetables	entire plants	cooked; porriage, boiled and pickled in miso paste or salts
	Ostericum sieboldii (Miq.) Nakai	yamazeri	ヤマゼリ	kakezeri, takazeri, yatsuba	7	vegetables	unspecified aerial parts	cooked
	Peucedanum japonicum Thunb.	botanbofu	ボタンボウフウ	bunna	1	vegetables	leaves	raw, cooked
	Spuriopimpinella brachycarpa (Nakai) Kitag.	hitokagemitsuba	ヒトカゲミツバ	takezeri	1	vegetables	stems	cooked, pickled
Araceae	*Amorphophallus konjac* K.Koch	konnyaku	コンニャク	N/A	3	other food types	roots	cooked to make konnyaku cakes
Araliaceae	*Aralia cordata* Thunb.	udo	ウド	yamaudo, douzen, honudo, tsuwakushika, shika	121	vegetables	leaves	raw, cooked, picked in salts or miso paste
							shoots	raw, cooked, picked in salts or miso paste
							stems	raw, cooked, picked in salts or miso paste
	Aralia elata (Miq.) Seem.	taranoki	タラノキ	tarabo, trappe, togenoki, onigui, tadapoi, dara	93	vegetables	shoots	cooked; porriage
	Chengiopanax sciadophylloides (Franch. & Sav.) C.B.Shang & J.Y.Huang	koshiabura	コシアブラ	shirogi, boka	4	vegetables	shoots	cooked
							leaves	cooked (young leaves)
	Eleutherococcus sieboldianus (Makino) Koidz.	himeukogi	ヒメウコギ	okogi, ukugi	2	vegetables	shoots	cooked

Table 1 (continued)

	Eleutherococcus spp. including *Eleutherococcus spinosus* (L.f.) S.Y.Hu	ukogi	ウコギ	okoge, gokuna, okogi,	19	vegetables	shoots	cooked; boiled and mixed with rice
							leaves	cooked; boiled and mixed with rice (young leaves)
Arecaceae	*Livistona chinensis* (Jacq.) R.Br. ex Mart.	birou	ビロウ	kuba	1	vegetables	stems	peeled and boiled well
Asparagaceae	*Hosta sieboldiana* (Hook.) Engl.	obagiboshi, urui	オオバギボウシ、ウルイ	uri, ginbari, urippa, takina, kore, ginbo, yamakanpyo	41	vegetables	leaves	cooked, pickled
							stems	cooked, pickled
	Maianthemum viridiflorum (Nakai ex Makino & Nemoto) H.Li	yamatoyukizasa	ヤマトユキザサ	obayukizasa, amana	1	vegetables	stems	boiled (young stems)
Asphodelaceae	*Hemerocallis fulva* (L.) L.	nokanzo, yabukanzo	ノカンゾウ、ヤブカンゾウ	hanso, kakko, nekku, karasogi, kanzu, amana, kakkona	15	vegetables	inflorescences	cooked, pickled
							leaves	cooked, pickled
							shoots	cooked, pickled
							stems	cooked, pickled
	Hemerocallis fulva var. *littorea* (Makino) M.Hotta	hamakanzo	ハマカンゾウ	N/A	1	vegetables	leaves	boiled
							stems	boiled
Aspleniaceae	*Asplenium antiquum* Makino	otaniwatari	オオタニワタリ	N/A	1	vegetables	shoots	cooked
Asteraceae	*Artemisia indica* Willd.	nishiyomogi	ニシヨモギ	fuuchibab	5	binders	leaves	boiled and added to make mochi cakes
						vegetables	leaves	cooked; porriage
	Artemisia princeps Pamp.	yomogi	ヨモギ	yomugi, mochigusa, futsu, yugumi,	209	beverages	leaves	tea
							shoots	tea
						binders	leaves	boiled and added to make mochi cakes
							shoots	boiled and added to make mochi cakes
						vegetables	shoots	cooked
	Aster yomena (Kitam.) Honda	yomena	ヨメナ	hagina, nogiku, yomehagi	27	vegetables	leaves	cooked; boiled and mixed with rice (young leaves)
							shoots	cooked; boiled, mixed with rice
	Atractylodes lancea DC.	okera	オケラ	okerappa	3	vegetables	unspecified aerial parts	cooked
	Cirsium spp.	azami	アザミ	N/A	22	vegetables	leaves	cooked, mixed with rice
							shoots	cooked, mixed with rice
							stems	cooked, mixed with rice
							roots	cooked; miso soups, simmered dishes
	Cirsium arvense (L.) Scop.	ezonokitsuneazami	エゾノキツネアザミ	hanakusa	1	binders	unspecified aerial parts	boiled and added to make mochi cakes
	Cirsium dipsacolepis Matsum.	moriazami	モリアザミ	yamagobo	1	vegetables	roots	pickled in miso paste
	Cirsium japonicum DC.	noazami	ノアザミ	nobara, ketsunaazami	3	snacks	shoots	raw; children's snacks
						vegetables	roots	boiled
							unspecified aerial parts	boiled and stir-fried
	Cirsium maritimum Makino	hamaazami	ハマアザミ	hamagobo	1	vegetables	roots	cooked; miso-soups, boiled
							leaves	cooked; stir-fried, boiled (young leaves)
							stems	cooked; stir-fried, boiled (young stems)
	Cirsium otayai Kitam.	tateyamaazami	タテヤマアザミ	N/A	1	vegetables	leaves	cooked
	Cirsium yezoense Makino	sawaazami	サワアザミ	oazami	1	vegetables	shoots	cooked
							stems	cooked
	Crepidiastrum lanceolatum Nakai	hosobawadan	ホソバワダン	nigana, njyana	4	vegetables	unspecified aerial parts	cooked
	Farfugium japonicum (L.) Kitam.	tsuwabuki	ツワブキ	tsuwa, tsuya, isobuki	32	vegetables	leaves	cooked
							shoots	cooked
							stems	cooked
	Hasteola robusta (Tolm.) Pojark.	yobusumaso	ヨブスマソウ	bonna, udona, honako	11	vegetables	unspecified aerial parts	cooked
	Helianthus tuberosus L.	kikuimo	キクイモ	karaimo, gashiimo	4	vegetables	roots	pickled in miso paste or salt
	Japonicalia delphiniifolia (Siebold & Zucc.) C.Ren & Q.E.Yang	momijigasa	モミジガサ	shidoke, shidoki, katena, shinzuki, kinoshita	27	vegetables	shoots	cooked; tempra, boiled
							stems	cooked; tempra, boiled
							leaves	cooked; tempra, boiled (young leaves)
	Lactuca indica L.	akinonogeshi	アキノノゲシ	N/A	1	vegetables	unspecified aerial parts	NS
	Lapsanastrum apogonoides (Maxim.) Pak & K.Bremer	konitabirako	コオニタビラコ	tabirako, htokenoza	3	vegetables	unspecified aerial parts	cooked; boiled, mixed with rice
	Parasenecio tanakae (Franch. & Sav.) Kadota	inudona	イヌドウナ	kadena, kuwadai, takado	3	vegetables	unspecified aerial parts	cooked

Table 1 (continued)

	Petasites japonicus (Siebold & Zucc.) Maxim.	fuki	フキ	yamabuki, azebuki, nobuki, bakkya, jyaouji, fukinbo, kibuki	218	snacks	stems	preserved in sugar
						vegetables	leaves	cooked
							stems	cooked
		fukinoto	フキノトウ			vegetables	inflorescences	cooked (buds)
	Pseudognaphalium affine (D.Don) Anderb.	hahakogusa	ハハコグサ	houko, hako, ogyo, chichiko	14	binders	leaves	boiled and added to make mochi cakes
						vegetables	leaves	cooked; porridge
	Saussurea gracilis Maxim.	hokuchiazami	ホクチアザミ	sasagobo, kesakihouko	2	binders	leaves	boiled and added to make mochi cakes
	Sonchus oleraceus L.	nogeshi	ノゲシ	fukuna	2	vegetables	unspecified aerial parts	N/A
	Syneilesis palmata Maxim.	yaburegasa	ヤブレガサ	honna, bonna	1	vegetables	shoots	cooked; boiled, tempura
	Synurus deltoides (Aiton) Nakai in Tozawa & Nakai	kikubayamabokuchi	キクバヤマボクチ	yamahouko	1	binders	leaves	boiled and added to make mochi cakes (young leaves)
	Synurus excelsus (Makino) Kitam.	habayamabokuchi	ハバヤマボクチ	yamahouko	1	binders	leaves	boiled and added to make mochi cakes and soba noodles (young leaves)
	Synurus pungens (Franch. et Sav.) Kitam. var. *pungens*	oyamabokuchi	オヤマボクチ	goboppa, yamagobo, urajiro, gobo, nenenboi,	28	binders	leaves	boiled and added to make mochi cakes (young leaves)
	Taraxacum spp. including *Taraxacum platycarpum* Dahlst.	tanpopo	タンポポ	tanpoko, gujina	*16*	vegetables	leaves	boiled
							shoots	boiled
	Tephroseris pierotii (Miq.) Holub	sawaogurum a	サワオグルマ	yachibuki	1	vegetables	unspecified aerial parts	cooked
Betulaceae	*Corylus heterophylla* Fisch. ex Besser var. *heterophylla*	hashibami	ハシバミ	kuwashibami, hasenba, kashibami	5	nuts	seeds	raw; children's snack
Brassicaceae	*Brassica juncea* (L.) Czern.	karashina	カラシナ	takana	1	vegetables	unspecified aerial parts	boiled
	Capsella bursa-pastoris (L.) Medik.	nazuna	ナズナ	hatakenazuna, penpengusa	22	vegetables	unspecified aerial parts	cooked; porriage
	Cardamine occulta Hornem.	tanetsukebana	タネツケバナ	N/A	1	vegetables	unspecified aerial parts	cooked
	Cardamine scutata Thunb.	obatanetsukebana	オオバタネツケバナ	teireki	2	vegetables	unspecified aerial parts	cooked
	Eutrema japonicum (Miq.) Koidz.	wasabi	ワサビ	senna, fusube, senno	22	vegetables	entire plants	raw, cooked, pickled, added to foods
	Eutrema tenue (Miq.) Makino	yuriwasabi	ユリワサビ	N/A	2	vegetables	entire plants	cooked, pickled in sake lees
	Nasturtium officinale R.Br.	orandagarashi	オランダガラシ	kawanazunna, mizugarashi	3	vegetables	unspecified aerial parts	cooked
	Raphanus raphanistrum L.	daikon	ダイコン	N/A	1	vegetables	roots	pickled
Cabombaceae	*Brasenia schreberi* J.F.Gmel.	junsai	ジュンサイ	N/A	4	vegetables	shoots	cooked; soup, boiled and vinegared
Campanulaceae	*Adenophora triphylla* var. *japonica* (Regel.) Hara	tsuriganeninjin	ツリガネニンジン	totoki, nunoba, tottsukina, amana	13	vegetables	leaves	cooked
							shoots	cooked
	Platycodon grandiflorus (Jacq.) A.DC.	kikyo	キキョウ	N/A	1	vegetables	roots	pickled with pickled plums
Cannabaceae	*Aphananthe aspera* (Thunb.) Planch.	mukunoki	ムクノキ	N/A	6	dessert fruits	infructescences	raw; children's snack
	Celtis sinensis Pers.	enoki	エノキ	enomi	4	dessert fruits	infructescences	raw; children's snack
	Humulus cordifolius Miq.	karahanaso	カラハナソウ	sakebana, kitsunenochochin	2	other food types	inflorescences	added when making grape wine or unfiltered sake(*doburoku*), considerd to accelerate the fermentation, only female flowers are used in one area
Caprifoliaceae	*Lonicera gracilipes* Miq.	uguisukagura	ウグイスカグラ	azukiichigo,obachichi, kotojyo	3	dessert fruits	infructescences	raw
	Lonicera japonica Thunb.	suikazura	スイカズラ	nindo, suikobana	3	beverages	unspecified aerial parts	tea
						snacks	exudates	raw; nectar sucked by children
	Patrinia villosa (Thunb.) Juss.	otokoeshi	オトコエシ	tochina, odochina	3	vegetables	unspecified aerial parts	cooked
	Weigela hortensis (Siebold et Zucc.) K.Koch	taniutsugi	タニウツギ	doppa, roppa	2	binders	shoots	boiled and added to make mochi cakes
						binders	leaves	boiled and added to make mochi cakes (young leaves)
						vegetables	shoots	cooked; boiled and mixed with rice
Caryophyllaceae	*Stellaria media* (L.) Vill.	kohakobe	コハコベ	hizuri, hakobe	3	other food types	unspecified aerial parts	added when pickling ume plums(for better color and sour taste)
						vegetables	unspecified aerial parts	cooked; porridge
Clethraceae	*Clethra barbinervis* Siebold & Zucc.	ryobu	リョウブ	gyobu, jyoba, yobu, shobo	14	vegetables	leaves	cooked
						vegetables	shoots	cooked
Cornaceae	*Cornus kousa* Buerger ex Hance subsp. *kousa*	yamaboshi	ヤマボウシ	boshi	3	dessert fruits	infructescences	raw; children's snack

Table 1 (continued)

Cucurbitaceae	*Momordica charantia* L.	nigauri	ニガウリ	tsurureishi	1	vegetables	infructescences	cooked
	Trichosanthes kirilowii Maxim.	kikarasuuri	キカラスウリ	urune	1	starches	roots	grated and starch extracted in water, to make dumplings
Cyatheaceae	*Plagiogyria matsumurana* Makino	yamasotetsu	ヤマソテツ	yamawarabi	1	vegetables	shoots	N/A
	Cycas revoluta Thunb.	sotetsu	ソテツ	N/A	3	other food types	seeds	pounded seeds are used for making koji molds for making fermented soy bean paste(miso)
						starches	stems	de-barked, fermented and pounded,starch extracted in water, used for dumplings, porridge. Only stems of male plants are used in one area
							seeds	pounded and starch extracted in water, used for porridges, koji mold
Dennstaedtiaceae	*Pteridium latiusculum* (Desv.) Hieron.	warabi	ワラビ	mogusa	199	starches	roots	pounded and starch extracted in water, used for mochi cakes, hot beverage
						vegetables	shoots	cooked
Dioscoreaceae	*Dioscorea japonica* Thunb.	yamanoimo	ヤマノイモ	tsukuneimo, jinenjyo, toroimo	75	snacks	propagule	cooked
						starches	roots	grated and added to make soba noodles, desserts
						vegetables	propagule	cooked; roasted, boiled
							roots	raw, cooked
	Dioscorea polystachya Turcz.	nagaimo	ナガイモ	tsuguneimo	2	vegetables	propagule	cooked
							roots	raw, cooked
	Dioscorea spp. including *D. tokoro* Makino and *D. tenuipes* Franch. & Sav.	tokoro	トコロ	N/A	5	vegetables	roots	boiled
Ebenaceae	*Diospyros ferrea* (Willd.) Bakh.	yaeyamakokutan	ヤエヤマコクタン	kokutan	1	dessert fruits	infructescences	raw; children's snack
	Diospyros kaki L.f.	kakinoki	カキノキ	yamagaki,toubos hi, shibugaki	14	dessert fruits	infructescences	raw, dried
Elaeagnaceae	*Elaeagnus* spp.	gumi	グミ	shashabu, gomi, asadori, yamagumi, guimi, guyumi	57	dessert fruits	infructescences	raw; children's snack, drink the juice
	*Elaeagnus macrophyll*a Thunb.	obagumi	オオバグミ	marubagumi	1	dessert fruits	infructescences	raw; children's snack
	Elaeagnus multiflora Thunb.	natsugumi	ナツグミ	tawaragumi	4	dessert fruits	infructescences	raw; children's snack
	Elaeagnus pungens Thunb.	nawashirogumi	ナワシロイチゴ	harugumi, naeshirogumi	5	dessert fruits	infructescences	raw; children's snack
	Elaeagnus umbellata Thunb	akigumi	アキグミ	asadare, asadori	8	dessert fruits	infructescences	raw; children's snack
						beverages	leaves	tea; dried and roasted
							inflorescences	tea; stemed and dried
Equisetaceae	*Equisetum arvense* L.	sugina	スギナ	sunagusa, houshiko, higanbozu, suginanbo	53	other food types	leaves	added when making grape wine, considerd to accelerate the fermentation
						vegetables	shoots	cooked
Ericaceae	*Epigaea asiatica* Maxim.	iwanashi	イワナシ	iiwashikko, ohaguro, ibanashi	8	dessert fruits	infructescences	raw; children's snack
	Rhododendron indicum (L.) Sweet	satsuki	サツキ	kuwarebana	8	snacks	galls	raw; children's snacks
							inflorescences	raw; children's snacks
	Rhododendron spp.	tsutsuji	ツツジ	N/A	2	snacks	galls	raw; children's snacks
							inflorescences	raw; children's snacks
	Vaccinium bracteatum Thunb.	shashanbo	シャシャンボ	shashabu, kuromamenoki, zungiri, sashibisango	5	dessert fruits	infructescences	raw; children's snack
	Vaccinium hirtum var. *pubescens* (Koidz.) T.Yamaz.	usunoki	ウスノキ	akadokuri	1	dessert fruits	infructescences	raw; snack
	Vaccinium oldhamii Miq.	natsuhaze	ナツハゼ	atamahage, yamanasubi, tetemaru, kansubo	15	dessert fruits	infructescences	raw; children's snacks
						other food types	infructescences	sugared fruits are mixed with rice to make sushi
	Vaccinium ovalifolium Sm.	kurousugo	クロウスゴ	tonbinokuchibashi	1	dessert fruits	infructescences	raw
	Vaccinium oxycoccos L.	tsurukokemomo	ツルコケモモ	N/A	1	dessert fruits	infructescences	salted and sugared

Table 1 (continued)

	Vaccinium smallii A.Gray	sunoki	スノキ	yamasuikogi, suibi	2	dessert fruits	infructescences	raw; children's snack
						snacks	leaves	raw; children's snacks
	Vaccinium wrightii A.Gray	gima	ギーマ	zamaki	1	dessert fruits	infructescences	raw; children's snack
Fabaceae	*Apios fortunei* Maxim.	hodoimo	ホドイモ	N/A	5	vegetables	roots	cooked
	Chamaecrista nomame (Makino) H.Ohashi	kawaraketsumei	カワラケツメイ	kishimame, hamacha	2	beverages	unspecified aerial parts	tea; dried and roasted
	Gleditsia japonica Miq.	saikachi	サイカチ	N/A	1	vegetables	shoots	cooked
	Pueraria montana var. *lobata* (Willd.) Maesen & S.M.Almeida ex Sanjappa & Predee	kuzu	クズ	inoko	8	starches	roots	pounded and starch extracted in water, used for dango dumplings, hot beverage (kuzuyu)
	Senna occidentalis (L.) Link	habuso	ハブソウ	N/A	1	beverages	unspecified aerial parts	tea
	Vicia bungei Ohwi	toendo	トウエンドウ	noendo	1	beverages	unspecified aerial parts	tea
	Vicia nipponica Matsum.	yotsubahagi	ヨツバハギ	azukina	1	vegetables	unspecified aerial parts	cooked
	Vicia sativa L. subsp. *nigra* (L.) Ehrh.	yahazuendo	ヤハズエンドウ	karasunoendo	1	beverages	unspecified aerial parts	tea
	Vicia unijuga A.Braun	nantenhagi	ナンテンハギ	azukina	6	vegetables	shoots	cooked
	Wisteria floribunda (Willd.) DC., *Wisteria brachybotrys* Siebold & Zucc.	fuji	フジ	N/A	5	beverages	shoots	tea; steamed and dried
							leaves	tea; steamed and roasted
						vegetables	shoots	cooked
							inflorescences	cooked
Fagaceae	*Castanea crenata* Siebold et Zucc.	kuri	クリ	yamaguri, sasaguri, shibaguri	123	nuts	seeds	cooked, raw; snacks, added to make desserts
	Castanopsis spp. including *C. sieboldii* (Makino) Hatus. or *C. cuspidata* (Thunb.) Schottky	shii	シイ	shidaji	33	starches	seeds	roasted and pounded into flour, cook with rice
						nuts	seeds	raw, roasted
	Fagus crenata Blume	buna	ブナ	N/A	1	nuts	seeds	raw; children's snack
	Lithocarpus edulis (Makino) Nakai	matebashii	マテバシイ	mategashi	1	nuts	seeds	boiled
	Quercus acuta Thunb.	akagashi	アカガシ	N/A	1	starches	seeds	pounded and soaked in water, used for dango dumplings
	Quercus dentata Thunb.	kashiwa	カシワ	N/A	1	nuts	seeds	raw; children's snack
	Quercus gilva Blume	ichiigashi	イチイガシ	ichiigashi	2	starches	seeds	pounded and strained in water, used for konjac jelly type food
	Quercus glauca Thunb.	arakashi	アラカシ	arakashi	1	starches	seeds	pounded and simmered to make acorn tofu(*kashikiri*)
	Quercus sp. such as *Q. serrata* Murray	nara	ナラ	N/A	1	nuts	seeds	raw; children's snack
Gentianaceae	*Swertia japonica* (Schult.) Makino	senburi	センブリ	senfuri	1	beverages	unspecified aerial parts	tea; roasted
Geraniaceae	*Geranium thunbergii* Siebold ex Lindl. et Paxton	gennoshoko	ゲンノショウコ	N/A	4	beverages	unspecified aerial parts	tea, liqueurs
Ginkgoaceae	*Ginkgo biloba* L.	icho	イチョウ	N/A	8	nuts	seeds	roasted
Grossulariaceae	*Ribes rubrum* L.	fusasuguri	フサスグリ	karinzu	2	dessert fruits	infructescences	raw; children's snacks
	Ribes sinanense F.Maek.	suguri	スグリ	chochinichigo, barasuguri	7	dessert fruits	infructescences	raw; children's snacks
Helwingiaceae	*Helwingia japonica* (Thunb.) F.Dietr. subsp. *japonica*	hanaikada	ハナイカダ	mamakona, tezutsu, tudde	7	vegetables	leaves	cooked
							shoots	cooked
Hydrangeaceae	*Hydrangea bifida* (Maxim.) Y.De Smet & Granados	ginbaiso	ギンバイソウ	ushinotsume	1	vegetables	unspecified aerial parts	cooked
	Hydrangea paniculata Siebold	noriutsugi	ノリウツギ	sabita	1	vegetables	leaves	cooked
Juglandaceae	*Juglans mandshurica* Maxim	kurumi, onigurumi	クルミ, オニグルミ	N/A	36	nuts	seeds	cooked, raw
Lamiaceae	*Clerodendrum trichotomum* Thunb.	kusagi	クサギ	kusagina,toyoba, kujyu, kussana	27	vegetables	leaves	cooked
							shoots	cooked
	Perilla frutescens (L.) Britton var. crispa (Benth.) W.Deane	shiso	シソ	chiso	8	vegetables	infructescences	raw, cooked, pickled
							leaves	raw, cooked, pickled
	Salvia glabrescens (Franch. et Sav.) Makino var. *glabrescens*	akigiri	アキギリ	mukonakase	1	vegetables	unspecified aerial parts	NA
	Stachys affinis Bunge	chorogi	チョロギ	chorogen, choronko	2	vegetables	roots	pickled
Lardizabalaceae	*Akebia* spp. including *A. quinata* (Houtt.) Decne. or *A. trifoliata* (Thunb.) Koidz.	akebi	アケビ	akubi, kinome(shoots)	86	dessert fruits	infructescences	raw
						vegetables	shoots	cooked
							infructescences	cooked, pickled (paricarps)

Table 1 (continued)

						beverages	leaves	tea; steamed and roasted
							stems	tea; steamed and roasted
	Stauntonia hexaphylla (Thunb.) Decne.	mube	ムベ	gube, ube, munbe	10	dessert fruits	infructescences	raw
Lauraceae	*Cinnamomum sieboldii* Meisn.	nikkei	ニッケイ	nikkei	2	snacks	roots	raw; children's snacks
Liliaceae	*Amana edulis* (Miq.) Honda	amana	アマナ	mugiguwai, niniku	6	starches	roots	boiled for a week and mixed with barley flour
						vegetables	leaves	cooked
							roots	cooked
	Cardiocrinum cordatum (Thunb.) Makino	ubayuri、oubayuri	ウバユリ、オオウバユリ	shire, obera, yaka	7	starches	roots	steamed and make mochi cakes, pounded and starch extracted in water, only female plants are used in some areas
						vegetables	leaves	cooked
							roots	cooked
	Erythronium japonicum Decne.	katakuri	カタクリ	katanko, katakko, katako	12	starches	roots	pounded and starch extracted in water, used for hot beverage
						vegetables	inflorescences	cooked
							unspecified aerial parts	cooked
	Lilium auratum Lindl. var. *auratum*	yamayuri	ヤマユリ	nioiyuri	30	starches	roots	garated and starch extracted in water, used for making mochi cakes, hot beverage. only female plants are used in one area
						vegetables	roots	cooked
	Lilium lancifolium Thunb.	oniyuri	オニユリ	N/A	2	vegetables	roots	cooked
Loranthaceae	*Taxillus kaempferi* (DC.) Danser var. *kaempferi*	matsugumi	マツグミ	matsubibi	2	dessert fruits	infructescences	raw
Lythraceae	*Punica granatum* L.	zakuro	ザクロ	N/A	1	dessert fruits	infructescences	raw
	Trapa natans var. *bispinosa* (Roxb.) Makino	hishi	ヒシ	N/A	9	nuts	seeds	boiled, roasted
Melanthiaceae	*Trillium apetalon* Makino	enreiso	エンレイソウ	yamasoba,	3	dessert fruits	infructescences	raw
				gurumeki, sanbaena		vegetables	unspecified aerial parts	cooked
	Trillium tschonoskii Maxim.	miyamaenreiso	ミヤマエンレイソウ	yamasoba	1	dessert fruits	infructescences	raw
Menispermaceae	*Nephroia orbiculata* (L.) L.Lian & Wei Wang	aozurafuji	アオズラフジ	tonzuru	1	dessert fruits	infructescences	raw
Moraceae	*Ficus erecta* Thunb.	inubiwa	イヌビワ	itabu, ushinoshita	4	dessert fruits	infructescences	raw
	Morus indica L.	yamaguwa	ヤマグワ	N/A	1	dessert fruits	infructescences	raw
	Morus spp. including *M. alba* L.	kuwa	クワ	kuwaichigo, kantsuaba, kuwago	53	dessert fruits	infructescences	raw
Musaceae	*Musa* sp.	banana	バナナ	N/A	1	dessert fruits	infructescences	raw
Myricaceae	*Myrica rubra* (Lour.) Siebold & Zucc.	yamamomo	ヤマモモ	yamamon	26	beverages	infructescences	liqueurs
						dessert fruits	infructescences	raw
Myrtaceae	*Psidium guajava* L.	banjiro	バンジロウ	N/A	3	dessert fruits	infructescences	raw
Nelumbonaceae	*Nelumbo nucifera* Gaertn.	hasu	ハス	N/A	3	nuts	seeds	raw
						vegetables	roots	cooked
Nymphaeaceae	*Euryale ferox* Salisb.	onibasu	オニバス	N/A	2	nuts	seeds	roasted; snacks
						starches	seeds	cooked and powdered; dango
						vegetables	stems	cooked
Onocleaceae	*Oncoclea struthiopteris* (L.) Hoffm.	kusasotetsu	クサソテツ	kogomi, gugumi, kawarazenmai, yogomi, kogome, kakuma,	45	vegetables	shoots	cooked
Orchidaceae	*Cymbidium goeringii* (Rchb.f.) Rchb.f.	shunran	シュンラン	hokkuri	1	vegetables	shoots	cooked
Osmundaceae	Osmunda japonica Thunb.	zenmai	ゼンマイ	murasakiwarabi	160	vegetables	shoots	cooked
Oxalidaceae	Oxalis corniculata L.	katabami	カタバミ	ronbogusa	3	other food types	unspecified aerial parts	added when making agar jelly(tokoroten) instead of vinega
						snacks	unspecified aerial parts	raw; children's snacks
Pandanaceae	*Pandanus odorifer* (Forssk.) Kuntze	adan	アダン	N/A	1	vegetables	shoots	NA
Pentaphylacaceae	*Eurya japonica* Thunb. var. *japonica*	hisakaki	ヒサカキ	shashaki	1	beverages	leaves	tea; roasted
						beverages	stems	tea; roasted
Pinaceae	*Pinus densiflora* Siebold et Zucc.	akamatsu	アカマツ	akamatsu	2	binders	barks	boiled and added to make mochi cakes

Table 1 (continued)

	Pinus sp.	matsu	マツ	matsu	1	snacks	exudates	exudates on burls are eaten raw as children's snacks
Plantaginaceae	*Plantago asiatica* L. var. *asiatica*	obako	オオバコ	onbako, jyushi, hirahagusa, kaeroppa	10	beverages	entire plants	tea; roasted
						vegetables	leaves	cooked
							shoots	cooked
Poaceae	*Bambusa multiplex* (Lour.) Raeusch. ex Schult. et Schult.f.	horaichiku	ホウライチク	chinchikutake	1	vegetables	shoots	cooked
	Bambusoideae	take	タケ	sasatakenoko, takenko	83	vegetables	shoots	cooked
	Chimonobambusa quadrangularis (Franceschi) Makino	shihochiku	シホウチク	N/A	1	vegetables	shoots	cooked
	Imperata cylindrica (L.) Raeusch.	chigaya	チガヤ	tsubana, tsubaneko, yatsubana, subo, tsunstun, zunbai, nobose, makaya	32	beverages	roots	tea
						snacks	inflorescences	raw; children's snacks
							roots	raw; children's snacks
							shoots	raw; children's snacks
							stems	raw; children's snacks
	Miscanthus sinensis Andersson	susuki	ススキ	kuronbo	2	snacks	stems	raw; children's snacks(young and white parts of stems)
	Phyllostachys aurea Carrière ex A. et C.Rivière	hoteichiku	ホテイチク	gosantake	9	vegetables	shoots	cooked
	Phyllostachys edulis (Carrière) Houz.	mosochiku	モウソウチク	N/A	65	vegetables	shoots	cooked
	Phyllostachys nigra (Lodd. ex Loud.) Munro var. *henonis* (Bean ex Mitford) Stapf ex Rendle	hachiku	ハチク	hachiko, kurodake	48	vegetables	shoots	cooked
	Phyllostachys nigra (Lodd. ex Loud.) Munro var. *nigra*	kurochiku	クロチク	sitake, hondake	4	vegetables	shoots	cooked
	Phyllostachys reticulata (Rupr.) K.Koch	madake	マダケ	karako, hontake, kuwanoko, nigatake	45	vegetables	shoots	cooked
	Pleioblastus simonii (Carrière) Nakai	medake	メダケ	shibobitake, gamatake, onagotake	5	snacks	seeds	raw; children's snacks
						vegetables	shoots	cooked
	Pleioblastus variegatus (J.Dix) Makino	shimadake	シマダケ	N/A	1	vegetables	shoots	cooked
	Pseudosasa japonica (Siebold et Zucc. ex Steud.) Makino ex Nakai	yadake	ヤダケ	shinobetake	1	vegetables	shoots	cooked
	Sasa kurilensis (Rupr.) Makino et Shibata	chishimazasa	チシマザサ	sasatake, susudake, nemagaritake, yamadake,heitoko, suzunoko	19	vegetables	shoots	cooked
	Sasa spp.	sasa	ササ	N/A	2	snacks	seeds	roasted: children's snacks
						vegetables	shoots	cooked
	Sinobambusa tootsik (Makino) Makino ex Nakai	tochiku	トウチク	karatake, daimyo	6	vegetables	shoots	cooked
	Zizania latifolia (Griseb.) Turcz. ex Stapf	makomo	マコモ	makomo	1	vegetables	stems	cooked
Podocarpaceae	*Podocarpus macrophyllus* (Thunb.) Sweet	inumaki	イヌマキ	maki	3	dessert fruits	infructescences	raw
Polygonaceae	*Persicaria hydropiper* (L.) Delarbre	yanagitade	ヤナギタデ	N/A	2	vegetables	leaves	raw, seasonings
	Reynoutria japonica Houtt.	itadori	イタドリ	ponpon, sado, tappo, gonpachi, sukanpo, konkon, kishibo, sashidori, danjin, kappo, shajina, sashi	67	snacks	leaves	raw; children's snacks
							shoots	raw; children's snacks
							stems	raw; children's snacks
						vegetables	shoots	cooked, pickled
							stems	cooked, pickled
	Rumex acetosa L.	suiba	スイバ	suisui, gishin, sukasshi, suikogi, jinto, suikonto, suito, gishighishi, shinzai, suikoki	34	snacks	unspecified aerial parts	raw; children's snacks
						vegetables	unspecified aerial parts	cooked, pickled
	Rumex japonicus Houtt.	gishigishi	ギシギシ	karasunohappa, hikohiko, surikonbo, suikogi	8	snacks	unspecified aerial parts	raw; children's snacks, sometime eaten with salts
						vegetables	unspecified aerial parts	cooked, pickled
Portulacaceae	*Portulaca oleracea* L.	suberihiyu	スベリヒユ	hyuna, hyo	9	vegetables	unspecified aerial parts	cooked
Ranunculaceae	*Anemonastrum flaccidum* (Fr.Schmidt) Mosyakin	nirinso	ニリンソウ	fukubera, kojyaku	3	vegetables	unspecified aerial parts	cooked
	Caltha palustris var. *barthei* Hance	ezonoryukinka	エゾノリュウキンカ	yachibuki	1	vegetables	unspecified aerial parts	cooked
Rhamnaceae	*Berchemia lineata* DC.	himekumayanagi	ヒメクマヤナギ	achikunnai	1	dessert fruits	infructescences	raw
	Hovenia dulcis Thunb.	kenponashi	ケンポナシ	otsukenbo, kodenashi	14	dessert fruits	infructescences	raw, dried
						vegetables	infructescences	pickled in miso paste
	Sageretia thea (Osbeck) M.C.Johnst.	kuroige	クロイゲ	N/A	1	dessert fruits	infructescences	raw

Table 1 (continued)

	Ziziphus jujuba Mill.	natsume	ナツメ	N/A	2	dessert fruits	infructescences	raw
Rosaceae	*Aruncus dioicus* (Walter) Fernald	yamabukishoma	ヤマブキショウマ	iwadara, shunanko	5	vegetables	unspecified aerial parts	cooked
	Cerasus spp.	sakura(sakuranbo)	サクラ、サクランボ	N/A	3	dessert fruits	infructescences	raw
	Chaenomeles japonica (Thunb.) Lindl. ex Spach	kusaboke	クサボケ	jinashi, shidome	3	dessert fruits	infructescences	raw
	Chaenomeles speciosa (Sweet) Nakai	boke	ボケ	N/A	2	dessert fruits	infructescences	raw
	Eriobotrya japonica (Thunb.) Lindl.	biwa	ビワ	N/A	5	dessert fruits	infructescences	raw
	Fragaria × *ananassa* (Weston) Duchesne ex Rozier	orandaichigo	オランダイチゴ	kusaichigo	1	dessert fruits	infructescences	raw
	Malus × *zumi* (Matsum.) Rehder	ozumi	オオズミ	sunashi	1	dessert fruits	infructescences	raw
						other food types	infructescences	farmented to make vinegars
	Malus toringo (Siebold) Siebold ex de Vriese	zumi	ズミ	konashi	2	dessert fruits	infructescences	raw
						other food types	infructescences	juices are fermented and used for pickling vegetables
	Micromeles japonica (Decne.) Koehne	urajironoki	ウラジロノキ	urajiro	2	binders	leaves	boiled and added to make mochi cakes (young leaves)
						dessert fruits	infructescences	raw; children's snack
	Pourthiaea villosa (Thunb.) Decne.	kamatsuka	カマツカ	kamagara	1	dessert fruits	infructescences	raw; children's snack
	Prunus grayana Maxim.	uwamizuzakura	ウワミズザクラ	anningo	1	vegetables	infructescences	salted
	Prunus jamasakura Siebold ex Koidz. var. *jamasakura*	yamazakura	ヤマザクラ	N/A	2	dessert fruits	infructescences	raw
	Prunus mume Siebold et Zucc.	ume	ウメ	N/A	1	vegetables	infructescences	pickled
	Prunus salicina Lindl.	sumomo	スモモ	siume, hadankyo, sunbai	4	dessert fruits	infructescences	raw
	Prunus tomentosa Thunb.	yusuraume	ユスラウメ	koume	6	dessert fruits	infructescences	raw
	Pyrus pyrifolia (Burm.f.) Nakai	yamanashi	ヤマナシ	ishinashi	18	dessert fruits	infructescences	raw, boiled
						other food types	infructescences	juices are fermented and used for pickling vegetables
	Rhaphiolepis indica (L.) Lindl. var. *umbellata* (Thunb.) H.Ohashi	sharinbai	シャリンバイ	tekachi	2	dessert fruits	infructescences	raw
	Ribes uva-crispa L.	marusuguri	マルスグリ	guzuberi	1	dessert fruits	infructescences	raw
	Rosa multiflora Thunb.	noibara	ノイバラ	igenmi, ibara	2	dessert fruits	infructescences	raw
						snacks	shoots	raw; children's snacks
	Rubus buergeri Miq.	fuyuichigo	フユイチゴ	kiichigo	4	dessert fruits	infructescences	raw
	Rubus crataegifolius Bunge	kumaichigo	クマイチゴ	tachibaraichigo	7	dessert fruits	infructescences	raw
	Rubus hirsutus Thunb.	kusaichigo	クサイチゴ	ushiichigo	7	dessert fruits	infructescences	raw
	Rubus illecebrosus Focke	baraichigo	バライチゴ	N/A	2	dessert fruits	infructescences	raw
	Rubus microphyllus L.f.	nigaichigo	ニガイチゴ	N/A	2	dessert fruits	infructescences	raw
	Rubus palmatus Thunb.	momijiichigo	モミジイイゴ	sangariichigo	4	dessert fruits	infructescences	raw
	Rubus parvifolius L.	nawashiroichigo	ナワシロイチゴ	satsukiichigo	3	dessert fruits	infructescences	raw
	Rubus sieboldii Blume	horokuichigo	ホウロクイチゴ	shiozui, kashiwaichigo	3	dessert fruits	infructescences	raw, drink the juice
	Rubus spp. L	kichigo	キイチゴ	yamaichgo	67	beverages	infructescences	liqueurs
						dessert fruits	infructescences	raw; children's snack
Rubiaceae	*Gardenia jasminoides* Ellis	kuchinashi	クチナシ	N/A	3	other food types	infructescences	used for coloring foods such as mochi, rice, pickled vegetables
Rutaceae	*Citrus* × *junos* Siebold ex Yu.Tanaka	yuzu	ユズ	yuzu	1	vegetables	infructescences	raw; seasonings
	Citrus deliciosa Ten.	shikuwasha	シイクワシャー	hiramiremon	2	vegetables	infructescences	raw; seasonings
	Phellodendron amurense Rupr.	kihada	キハダ	N/A	1	other food types	barks	de-barked, dried and simmered. boiled extracts are mixed with dried persimmon fruits to make sugar
	Zanthoxylum piperitum (L.) DC.	sansho	サンショ	kinome, kinobe, sanshu	61	vegetables	barks	raw, cooked, seasonings
							infructescences	raw, cooked, seasonings
							leaves	raw, cooked, seasonings
							shoots	raw, cooked, seasonings
Sapindaceae	*Aesculus turbinata* Blume	tochinoki	トチノキ	tochi	32	starches	seeds	soaked in water with ashes, boiled and starch excracted, used for mochi cakes, dumplings, porridge
Saururaceae	*Houttuynia cordata* Thunb.	dokudami	ドクダミ	N/A	2	beverages	entire plants	tea
Saxifragacea	*Astilbe rubra* Hook.f. &	toriashishom	トリアシショウ	jyudeko, jyona,	3	vegetables	shoots	cooked

Table 1 (continued)

e	Thomson	a	マ	toriashi			leaves	cooked (young leaves)
	Saxifraga stolonifera Curtis	yukinoshita	クキノシタ	kinginso	4	vegetables	unspecified aerial parts	cooked
Schisandraceae	*Schisandra repanda* (Siebold et Zucc.) Radlk.	matsubusa	マツブサ	matsubunza	1	dessert fruits	infructescences	raw; snack
Smilacaceae	*Smilax riparia* A.DC.	shiode	シオデ	shundeko, hideko, sode, sodeko	11	vegetables	unspecified aerial parts	raw, cooked
Solanaceae	*Alkekengi officinarum* Moench	hozuki	ホオズキ	N/A	3	dessert fruits	infructescences	raw; snack
	Lycium chinense Mill.	kuko	クコ	N/A	1	vegetables	shoots	cooked
	Physalis angulata L.	hirohafurinhozuki	ヒロハフウリンホオズキ	sennarihozuki	1	dessert fruits	infructescences	raw; children's snack
	Withania echinata (Yatabe) Hunz.	igahozuki	イガホオズキ	suppatsu, hanze	3	dessert fruits	infructescences	raw; snack
Staphyleaceae	*Staphylea bumalda* DC.	mitsubautsugi	ミツバウツギ	shougina, yanokinoha	2	vegetables	shoots	cooked
Taxaceae	*Cephalotaxus harringtonii* (Knight ex J.Forbes) K.Koch	inugaya	イヌガヤ	henda	1	dessert fruits	infructescences	raw
	Torreya nucifera (L.) Siebold et Zucc.	kaya	カヤ	bai	19	nuts	seeds	raw, roasted
						oils/fats	seeds	oils
						starches	seeds	pounded into flour to make mochi cakes
Theaceae	*Camellia japonica* L.	tsubaki, yabutsubaki	ツバキ、ヤブツバキ	kateshi, katashi	7	dessert fruits	infructescences	raw; children's snack(young fruits)
						oils/fats	seeds	oils
	Camellia sasanqua Thunb.	sazanka	サザンカ	kateshi, katashi	1	oils/fats	seeds	oils
	Camellia sinensis (L.) Kuntze var. *sinensis*	chanoki	チャノキ	N/A	3	beverages	leaves	tea
Urticaceae	*Elatostema involucratum* Franch. et Sav.	uwabamiso	ウワバミソウ	mizu, takina, yoshina, mizuna, tanibuki, kataha	50	vegetables	entire plants	raw, cooked, pickled
							propagule	raw, cooked, pickled
	Laportea cuspidata (Wedd.) Friis	miyamairakusa	ミヤマイラクサ	irako, aiko, idana, ira	10	vegetables	unspecified aerial parts	cooked
Viburnaceae	*Sambucus sieboldiana* var. *pinnatisecta* G.Y.Luo & P.H.Huang	niwatoko	ニワトコ	N/A	2	vegetables	shoots	cooked
	Viburnum dilatatum Thunb.	gamazumi	ガマズミ	shimofuri, yoshizumi, shigure, fushibutai, yoshibutai, yosozu	8	beverages	infructescences	liqueurs
						dessert fruits	infructescences	raw; snacks
	Viburnum suspensum Lindl.	gomoju	ゴモジュ	gumuru	1	dessert fruits	infructescences	raw
Vitaceae	*Ampelopsis glandulosa* var. *heterophylla* (Thunb.) Momiy.	nobudo	ノブドウ	gunda, garabu, ganbi, garame	6	dessert fruits	infructescences	raw; children's snacks
	Vitis coignetiae Pulliat ex Planch.	yamabudo	ヤマブドウ	ebissho, matsuebi, obundo, karabi, ganebu, guibi, bunza, yamaebi	50	beverages	infructescences	juice, liqueurs, wine
						binders	leaves	boiled and added to make mochi cakes (young leaves)
						dessert fruits	infructescences	raw, pickled
						other food types	exudates	saps from vines are added when making agar jelly(tokoroten); gelling agents?
							infructescences	young fruits are boiled and added when making agar jelly(tokoroten); gelling agents?, fermented with rice, juices are fermented and used for pickling vegetables; fermenting agents?
	Vitis ficifolia Bunge	ebizuru	エビズル	ebikzura, gunda, gabu, kobundo, ganbi	8	beverages	infructescences	wine
						binders	shoots	boiled and added to make mochi cakes
						dessert fruits	infructescences	raw; snack
Zingiberaceae	*Zingiber mioga* (Thunb.) Roscoe	myoga	ミョウガ	myogadake	39	vegetables	inflorescences	raw, cooked, pickled
							stems	raw, cooked, pickled (young stems)
	Zingiber officinale (Willd.) Roscoe	shoga	ショウガ	N/A	1	vegetables	roots	raw, cooked

used as either vegetables or binders. Of the 17 species of Poaceae, 14 were identified as various types of bamboo, with the shoots used as vegetables and other species were consumed as raw snacks mainly by children. The high number of reports of Araliaceae and Apiaceae is due to the presence of species with a high number of reports,

such as *Aralia cordata* (121 reports), *A. elata* (93) of Araliaceae, and *Oenanthe javanica* (183) of Apiaceae. The 299 reports of Dennstaedtiaceae are due to frequent reports of the use of one species, *Pteridium latiusculum* (*warabi* bracken).

Table 2 lists the species with more than 100 use reports in all Japanese regions. Among the 278 study sites, *Petasites japonicus* was used in 78%, *Artemisia princeps* in 75%, *Pteridium latiusculum* in 72%, *Osmunda japonica* in 58%, *Oenanthe javanica* in 50%, *Castanea crenata* in 44%, and *Aralia cordata* in 44%. All of these plants were eaten as vegetables except *A. princeps,* which was used as a binder. All seven species are still commonly consumed at present and are also found in both cultivated and wild forms. These are available for purchase at supermarkets and other retail outlets, and products that have been processed to facilitate consumption are also on the market. Of particular note is the cultivation of *Aralia cordata* (*udo*) and *Oenanthe javanica* (*seri*), with numerous cultivated varieties now in existence. While wild *udo* is frequently consumed as a vegetable, primarily for its shoots and leaves, cultivated *udo* is cultivated in a manner that blanches the stems, making them the primary edible portion. It is noteworthy that these cultivated species are classified and designated as *sansai* (mountain vegetables). On the other hand, the majority of species were sparsely reported. Eighty-three species (31% of the total taxa) were reported only once, 38 (14%) were reported twice, and 33 (12%) were reported three times.

In comparison with the use of wild food plants in South Korea, where the flora and climate are similar to Japan, there is a commonality in the use of Asteraceae as vegetables and binders. Conversely, the larger number of reports and species of Poaceae can be regarded as distinctive to Japan. Previous researches conducted in South Korea indicate that Poaceae does not represent a significant proportion of species or reported uses [27, 29, 30] while a study conducted on Jeju Island in South Korea has revealed that the majority of reported Poaceae are wild millets and other seeds, a finding that differs from that observed in this study [28]. On the other hand, seven species with over 100 reported uses, as outlined in Table 2, are also commonly consumed in South Korea.

Figure 2 shows choropleth maps of Japan showing the numbers of wild food plant reports (a) and species (b) in each prefecture. Gifu Prefecture in the Chubu region had the greatest number of species (71 species), followed by Okayama (62), Niigata (61), Hiroshima (57), and Shizuoka (55) (Fig. 2a). Concerning the number of reports, Gifu also had the highest number of reports (134 reports), followed by Niigata (123), Akita (120), Nagano (116), and Aomori (106) (Fig. 2b). The areas with the lowest use of wild species in terms of numbers of both reports and species were urban and coastal regions. In coastal areas, the uses of geographically distinctive wild species, including *Farfugium japonicum*, *Glehnia littoralis* and *Tetragonia tetragonoides*, were reported. However, the overall number of reports and species identified was comparatively lower than in other regions.

In previous studies, regional differences in the use of wild food plants in Japan have been discussed according to different forest zones [62, 63]. Several studies have suggested that the gathering and consumption of wild food plants and mushrooms has been more active in deciduous broad-leaved forests (or beech (*Fagus crenata*) forest zones in Japanese terminology), which primarily cover eastern Japan, especially in the heavy snowfall area from the Tohoku to Chubu regions, than in evergreen broad-leaved forests (or lucidophyllous forest zones), which primarily cover western Japan [35, 38, 64, 65]. As the number of study sites in each prefecture varies, the frequency and diversity of wild food plant use among prefectures are not comparable comprehensively with those in this study alone. Nevertheless, the findings of this study do not contradict those of previous studies.

All of the species listed in Table 2 were widely used throughout the country, with no regional differences. On the other hand, some species were used only in limited

Table 2 List of wild species traditionally used as food in Japan with more than 100 reports

Species	Family	Common name	Number of reports
Petasites japonicus (Siebold & Zucc.) Maxim	Asteraceae	*fuki*	218
Artemisia princeps Pamp	Asteraceae	*yomogi*	209
Pteridium latiusculum (Desv.) Hieron	Dennstaedtiaceae	*warabi*	199
Osmunda japonica Thunb	Osmundaceae	*zenmai*	160
Oenanthe javanica DC	Apiaceae	*seri*	138
Castanea crenata Siebold et Zucc	Fagaceae	*kuri*	123
Aralia cordata Thunb	Araliaceae	*udo*	121

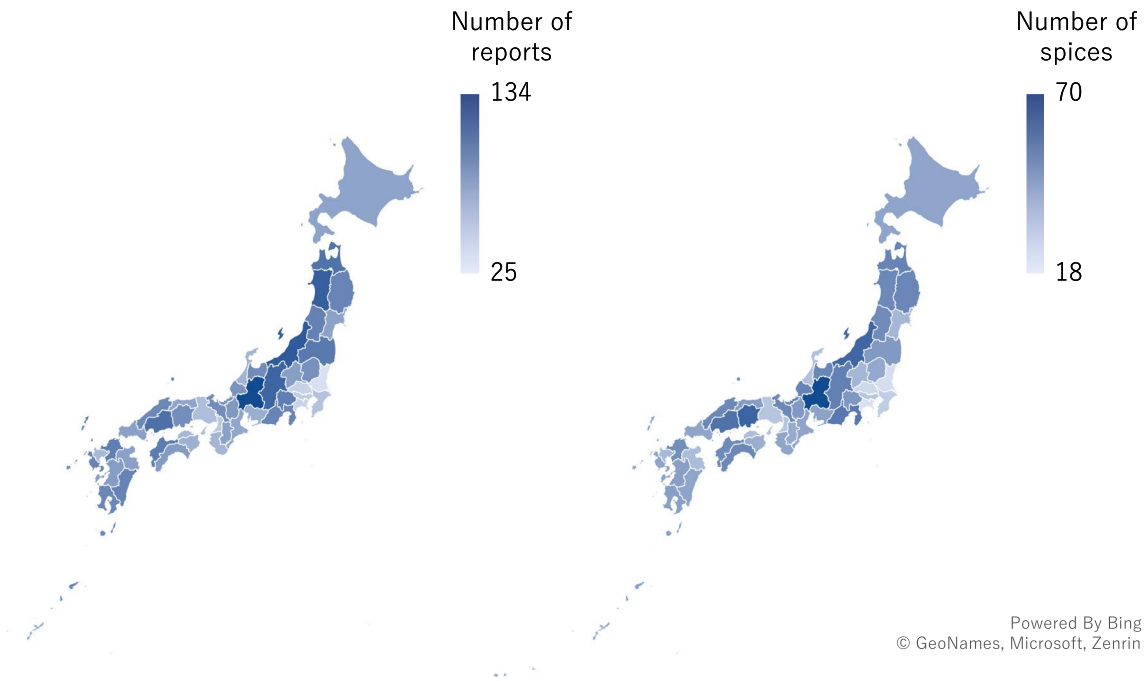

Fig. 2 The number of reports and species of wild food plants used in each prefecture

areas. For example, all of the 33 reports of *Castanopsis sieboldii* or *C. cuspidata* which seeds were eaten, were from regions west from Chiba prefecture, and all 27 reports of *Clerodendrum trichotomum*, which is used as a vegetable for its shoots and leaves, were from Shizuoka to the west. *Castanopsis sieboldii* and *C. cuspidata* are representative component of the evergreen broad-leaved forests (or lucidophyllous forest zones), while *Clerodendrum trichotomum* grows throughout Japan, from Hokkaido to Okinawa. A previous study focusing on the differences in the use of wild plants in eastern and western Japan has indicated that, in addition to species commonly used throughout Japan, eastern Japan is characterized by the use of species that grow in the forest understory, such as *Onoclea struthiopteris*, while western Japan is characterized by the use of plants found in close proximity to human settlements, such as *Equisetum arvense* [35]. Thus, the comparison of the number of reports and types of species used in different regions may be due to cultural reasons such as regional history and interaction with other regions, in addition to the relationship with the forest zone as pointed out in previous studies. Further studies that consider species- and region-specific backgrounds will be required in order to gain a better understanding of these regional differences.

Food category

Among the 9 food categories that were considered, vegetables were the largest group with 146 species, followed by dessert fruits with 78, beverages with 23, and snacks with 19 (Fig. 3).

The uses of most species (219 species, 82% of the total species) were limited to only one category, while 42 species were used for two categories, and 6 species were used for 3 categories. Only one species (*Vitis coignetiae)* was used in four categories: binders, beverages, dessert fruits, and other food types. The young leaves were used as binders in the production of mochi cakes. The infructescences were eaten raw as dessert fruits and were also used to make various beverages, such as juice, homemade liqueurs, and wine. Young fruits and exudates from vines were used in the production of agar jelly called *tokoroten,* and fruits were used to make local fermented foods such as lactic fermented vegetables.

Vegetables

Wild vegetables are generally called *sansai* (mountain vegetables) in Japan. As mentioned, the term *sansai* is believed to have been used since approximately 1960 [40]. The folk nomenclature of wild vegetables varied across different regions. For example, they were referred to as *aomono* (green/blue things), *yama no mono* (mountain things), *okazu no kusa* (grasses for side-dishes) and so forth. *Aomono*, which can be directly translated as 'blue things', is a common name for vegetables in general and was used in the case of wild vegetables such as *yama no aomono* (blue things of mountains).

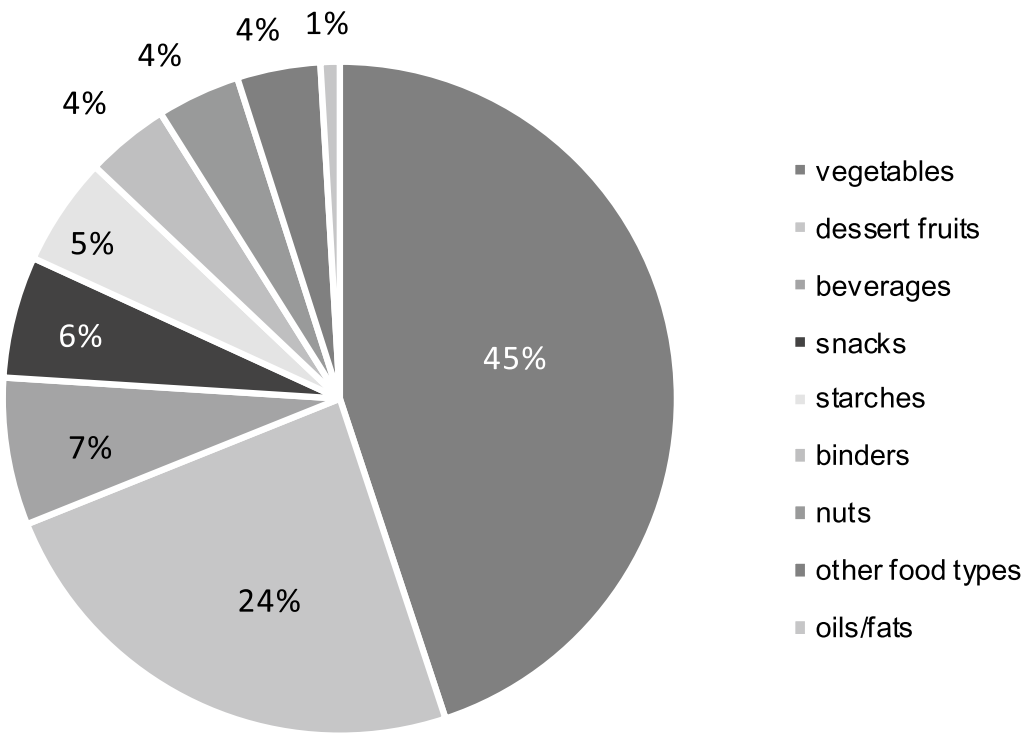

Fig. 3 The percentage of species in each food category ($n = 268$)

The most represented families for vegetables were Asteraceae (24 species), followed by Poaceae (15), Apiaceae (11), and Brassicaceae (8) (Fig. 4a). These plants were eaten in various ways, including *aemono* (boiled and dressed with seasonings) and *nimono* (simmered dishes). Some vegetables consumed raw included those used in small quantities for flavoring and seasoning, such as *Allium schoenoprasum* and *Zanthoxylum piperitum*. Some species of *Dioscorea*, including *D. polystachya* and *D. japonica*, were also consumed raw in the form of grated roots, which were used in the preparation of *tororo*. Pickling was also a common method of cooking and preservation, utilizing a variety of ingredients, including salt, miso, sake lees and rice bran. As the majority of the species were collected during the spring season, these pickles were consumed as preserved food and were valuable foodstuffs during the winter months when vegetables were scarce.

Other methods of preservation were employed, such as sun drying, salting and simmering down with soy sauce and sugar, known as *tsukudani*. Some plants, such as *Aster yomena* and *Cirsium* spp., were incorporated into rice dishes, including porridge. These vegetables contribute to the overall texture and flavor while also increasing the volume of the dishes. The ingredients used to increase the volume of rice-based dishes are referred to as "*kate*" or "*katemono*". Historically, these were regarded as famine foods [66]. The use of plants to increase the volume of rice dishes has been similarly reported in other parts of Asia, for example, the use of the roots of *Dioscorea bulbifera* in Thailand [19].

The most common parts used as vegetables were shoots (61 species), which represent nearly half of the species used as vegetables. This was followed by leaves, unspecified aerial parts (both 33 species), roots (19) and stems (18). Five species of inflorescences were used as vegetables, with *Petasites japonicus* being the most commonly consumed throughout the country. The young flower buds are called *fukinoto* and are consumed in a variety of ways, including as tempura and cooked with miso. The *fukinoto* was described as a plant that sprouts first in spring and heralds the arrival of spring at several study sites. Other species whose inflorescences were eaten as vegetables include *Wisteria* spp. and *Erythronium japonicum*. Propagules of 3 species were used as vegetables during autumn.

The propagules are called *mukago* in Japanese, and two species of *mukago* yams (*Dioscorea japonica* and *D. polystachya*) were commonly eaten. They were eaten by roasting, boiling or as the *kate* ingredients as mentioned previously. The propagules of *Elatostema involucratum* were also eaten, although this was limited to one report. The leaves of these plants were removed, and only the stems with propagules were marinated in miso paste.

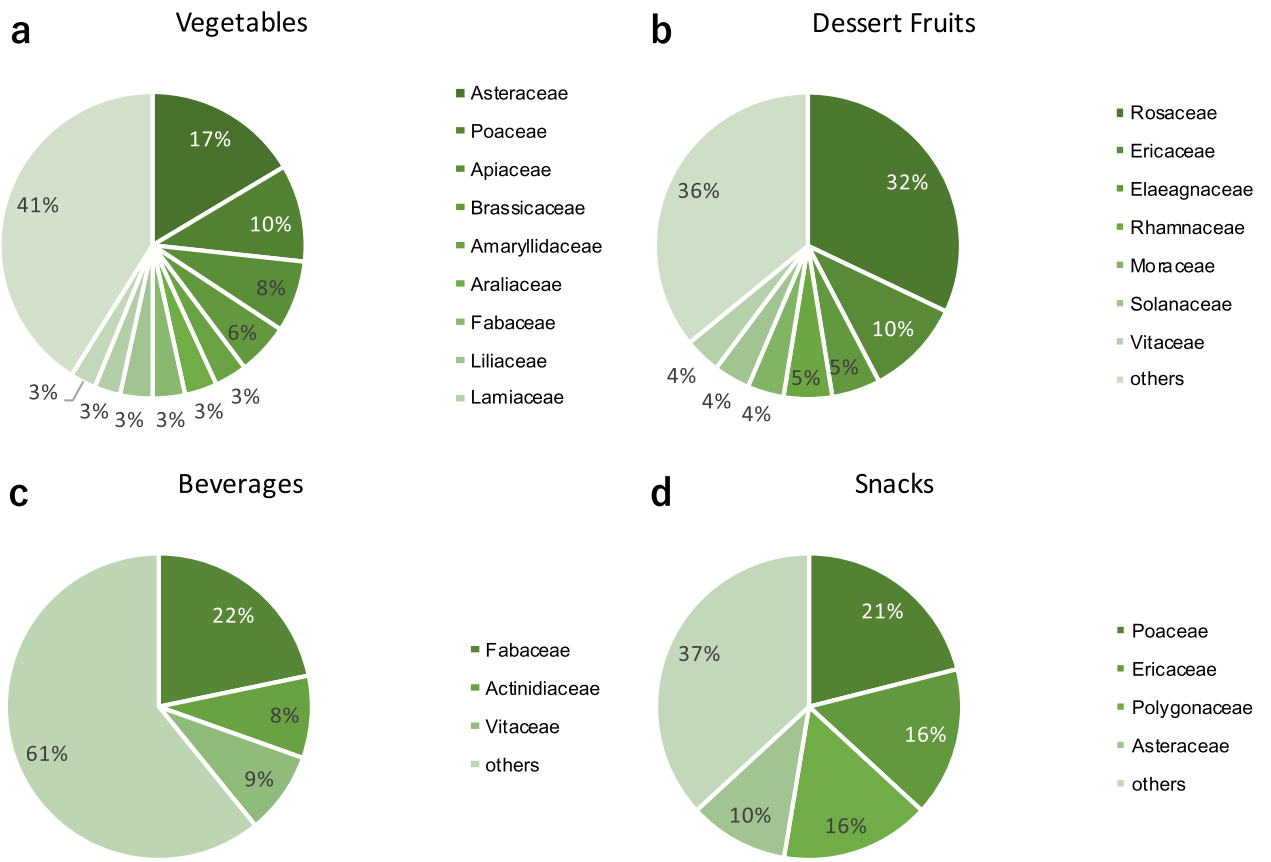

Fig. 4 Botanical families with the greatest number of species used for the four major food categories. Percentages of botanical families for **a** vegetables ($n=146$), **b** dessert fruit ($n=78$), **c** beverages ($n=23$), and **d** snacks ($n=19$)

They continue to be consumed in modern times in the northern part of Japan, such as Akita Prefecture. Due to their rarity, they are also used as a premium ingredient in traditional high-end Japanese restaurants such as *ryotei*, and have been employed as an accent as part of innovative dishes in non-Japanese restaurants such as Italian and French due to their distinctive texture.

These results are consistent with previous studies from other parts of Asia, such as in Thailand, Laos, and China, which demonstrated a preference for shoots and leaves [15–17, 19], also known as herbophilia [6]. However, this study was characterized by the fact that ferns such as *Pteridium latiusculum*, *Osmunda japonica*, and *Onoclea struthiopteris* were also frequently consumed as vegetables in Japan. Studies from South Korea have indicated both similarities and differences between the two countries. The cooked shoots of species from the Asteraceae family have been frequently consumed as vegetables during the spring season in both Japan and South Korea [27, 28, 30]. The findings of the present study were consistent with those previously reported from South Korea in terms of the plant taxa and part used, the preparation status (i.e., cooked or uncooked), and the season of use (i.e., spring). As mentioned earlier, there was also a notable difference in the use of bamboo shoots, with Japan demonstrating a higher frequency and diversity of usage compared to South Korea.

Dessert fruits

In total, there were 78 species of wild plants eaten as dessert fruits, of which almost one-third of the dessert fruits belonged to the Rosaceae family, followed by Ericaceae (8), Elaeagnaceae (4), and Rhamnaceae (4) (Fig. 4b). The most popular wild fruit was *Akebia* spp. (*A. squinata* and *A. trifoliata*). Their arils were eaten raw sometime as children's snacks. Other parts of *Akebia* were also consumed as vegetables and tea. The stems and buds were consumed as tea and vegetables, while the pericarps were eaten as vegetables in various ways, such as pickled and stir-fried. The second most popular wild fruit was *Rubus* spp. As mentioned in the Methods section, wild strawberries are called *noichigo* (wild strawberry) or *kiichigo* (tree strawberry), and there are more than 30 wild *Rubus* species in Japan, including *R. crataegifolius*, *R. parvifolius*

and *R. sieboldii*. Their infructescences were eaten raw, in many cases as children's snacks. Boiled or pickled fruits were also eaten in some cases. For example, fruits of *Pyrus pyrifolia* were eaten mostly raw, but in some areas, they were boiled for consumption. There was also a record of fruits of *Vaccinium oxycoccos* being pickled in salt and then sprinkled with sugar and eaten with green tea in the mountainous Oze area in Gunma Prefecture.

Beverages

There were 23 species used as beverages, including both alcoholic and nonalcoholic drinks (Fig. 4c). Alcoholic beverages were of two types: so-called wines, in which infructescences were naturally fermented, and so-called liqueurs, in which plants were soaked in spirits such as *shochu*. Nonalcoholic beverages included tea and juice.

Sixteen species were used as teas, including five species of Fabaceae, namely *Vicia bungei* and *Wisteria* spp. Most of them used their aerial parts, such as leaves, shoots and inflorescence, and were processed by steaming, drying or roasting. On the other hand, one study reported that roots were used as tea. The roots of *Imperata cylindrica* were sun-dried and drunk as tea, which was favored by elderly people because it improves the production of urine.

Following the tea, seven species were used to make liqueurs. Most of them use infructescences, except for the species *Geranium thunbergii,* whose aerial parts were used.[2] In contrast, only two species (*Vitis coignetiae* and *V. ficifolia*) were used for making wine. Although the berries were used, the method of making wine exhibited slight regional variations, including the collection of berries when they were ripe or after frost or fermentation with or without sugar.

Snacks

Snacks are plants eaten between meals, excluding dessert fruits and nuts. In total, 19 species were eaten as snacks, including 4 from Poaceae and three each from Ericaceae and Polygonaceae (Fig. 4d). Many of these snacks were eaten raw as children's snacks. Many were aerial parts, such as shoots, leaves, stems, and flowers, and there were many records of children foraging freely for snacks in the fields and mountains.

Among the snacks, many sour-tasting plants, such as *Rumex japonicus* and Japanese knotweed (*Reynoutria japonica*), were eaten raw. They were sometimes eaten with salt on the spot of foraging. Similarly, children eating these acidic-tasting species have been documented in various European countries, including Spain, Sweden, and Poland [8]. There were other snacks that have a sweet taste, such as common grass (*Imperata cylindrica*), whose young ears and other parts were eaten; nectar from some flowers, such as Azalea; and the roots of *Cinnamomum sieboldii*. Another interesting finding was that leaf galls of *Rhododendron* spp. (Azalea gall) were eaten raw as snacks, although this finding was limited to three reports. Azalea leaf galls are caused by fungi, including *Exobasidium* spp. [67], and locally called *mochi* (rice cake), the disease is called *mochi* disease. There have been reports of the use of plant galls in other parts of the world, including as folk medicine and for dyeing [68–70].

Starches

The 17 species used as starches were largely divided into those that use roots and those that use seeds. The most common family associated with the roots was Liliaceae (4 species), whereas the most common family associated with the seeds was Fagaceae (4 species), which included 3 *Quercus* spp. (*Q. acuta*, *Q. gilva,* and *Q. glauca*). Various techniques were used to extract starches, such as pounding, grating, soaking in water and strain. These extracted starches were used for making rice cakes, noodles, porridges and jelly type foods.

Two toxic plants (*Lycoris radiata* and *Cycas revoluta*) were included in this category. Although it was limited to only one report, bulbs of *L. radiata* were used for making starches. *L. radiata* contains lycorine, which is commonly found in the Amaryllidaceae [71]. People were aware of this toxicity; therefore, they took a long time to remove the poison by being exposed to water repeatedly over a long period of time. Another poisonous plant was *Cycas revoluta*. Their seeds and stems were used for extracting starches, particularly from the Ryukyu and Amami Islands of southern Japan. Like the use of *L. radiata*, to remove toxins, including cycasin, the plant parts used were exposed to water repeatedly over time. In some areas, people fermented them, and some reported the infestation of maggots as a sign of detoxification.

Binders

Plants used to combine food ingredients are categorized as binders or "*tsunagi*" in Japanese. They were mostly used for rice cakes (*mochi* and *dango*) and sometimes for *soba* (buckwheat noodles). Among the 13 species used in this category, there were 8 species of Asteraceae, including two *Artemisia* spp. (*A. princeps* and *indica*) and 3 *Synurus* spp. (*S. pungens, deltoides* and *excelsus*). Young leaves and shoots of these species were boiled and added

[2] *G. thunbergii* was a common folk medicine in Japan. A number of reports in the collection also showed that they were used as a medicine. As explained in the Methods, plants that were only used as medicines were not included in this study. This particular report was included since *G. thunbergii* was described as a wild plant used to make herbal liquors which had both food and medicinal purposes.

to food, and their trichomes and fibers contribute to the binding of other ingredients. In addition, some binder plants, such as *Artemisia* spp. and *Pseudognaphalium affine,* also contribute to the aroma or color of the prepared food. Although it was limited to two reports, the bark and cortex of red pine (*Pinus densiflora*) were used to make rice cakes called *matsukawa mochi* (pine skin rice cakes). Compared with other parts of the world, *A.* spp. and other species have been used as ingredients for rice cakes in China and South Korea [72–74]. Some research has also indicated that the use of *P. affine* for *mochi* in Japan was originally introduced from China and was later replaced by the use of *Arstemisia*spp. as an alternative to *P. affine* [75].

Nuts

Among the 13 species consumed as nuts, Fagaceae presented the greatest number of species (6 species). Although most species were tree plants, the seeds of 3 species of aquatic plants were also eaten as nuts (*Trapa natans* var. *Bispinosa, Nelumbo nucifera,* and *Euryale feroxe*). These nuts were eaten raw, roasted, or boiled and sometimes as snacks.

Oils/fats

There were only 3 species used for oils/fats (*Terreya nucifera*, *Camellia japonica*, and *C. Sasanqua*). Oils were extracted from seeds of these species. Among the three species, *C. japonica* was the most frequently reported, although its use was limited to only 6 reports in western Japan, particularly in the Kyushu region. The other two species were reported only once each. These oils were considered valuable and were sometimes sold and given as gifts.

Other food types

This category included the 13 species used for coloring, flavoring, fermented foods, or algae jelly making. For coloring and flavoring, for example, *Gardenia jasminoides* was used to add yellow color to food, including rice cakes and pickled vegetables. Another example is chick weeds (*Stellaria media*). In addition to their use as vegetables, they were also used for coloring and flavoring. In the Nasu area of Tochigi Prefecture, their aerial parts were used along with *shiso* leaves (*Perilla frutescens*) to provide sourness and better color when pickling plums (*Prunus mume*).

There were 8 species used for fermented foods, and their reports were all regionally specific. Some species (*Humulus cordifolius* and *Equisetum arvense*) were added when alcoholic beverages such as rice wine were made, since they were considered to accelerate fermentation in the Tohoku region. In Nagano Prefecture, juices made from infructescences of 3 species (*Malus toringo*, *Pyrus pyrifolia*, *and Cycas revoluta*) were used for unsalted lactic-fermented pickles called *sunki*. These compounds are called "sources" or "essences" of *sunki* pickles and are believed to contribute to pH control and the production of lactic acid, etc. [76]. As mentioned previously, the use of *Cycas revoluta* was limited to only southern islands. On Amami islands, seeds of *C. revoluta* were also used to make *koji* molds (fermentation starters) for making fermented soy bean paste, *miso*. The production of *sunki pickles* in Nagano and *miso* of *C. revoluta* in Amami islands persists to the present day, and each is acknowledged as a local delicacy, with both also available for purchase including online.

Two species (*Oxalis corniculata* and *Vitis coignetiae*) were used to make *tokoroten*, jelly noodles made from red algae, including *Gelidium amansii*. The use of *O. corniculata* was reported only once in Ishikawa Prefecture, while there were 3 reports of the use of *V. coignatiae* in the Tohoku and Hokkaido regions. The parts used and how to use them differed from each other. Aerial parts of *O. corniculate* or unripen fruits of *V. coignetiae* were used when boiling red algae instead of vinegar. These compounds are considered to help extract agarose from red algae [77]. Sour-tasting saps from vines of *V. coignetiae* were used after red algae were boiled, but they were used to curdle the agar jelly. Thus, these sour plants were used to extract or solidify the jelly.

Toxic plants

There were several reports of the use of toxic plants, although the type and degree of toxicity vary. For example, species containing carcinogens were eaten. As mentioned, bracken (*Pteridium latiusculum*) is commonly eaten throughout Japan, with shoots being eaten as vegetables and bracken starch extracted from the roots. Bracken contains a carcinogen called ptaquiloside [78]. Another plant that contains carcinogens is *Cycas revoluta.* Stems and seeds of *C. revoluta* were used to make starch and fermentation starters; however, *C. revoluta* contains a carcinogen called cycasin, which is found in other cycads [79].

Alkaloid-containing species were also consumed. For example, rhizomes of *Dioscorea* spp. (specifically *D. tokoro*) were boiled and consumed. Their rhizomes contain dioscin, a type of saponin that is commonly found in *Dioscorea* spp. [80]. For example, *D. tokoro* was initially reported to have a very bitter taste but became palatable once people became accustomed to it in Saga Prefecture. Interestingly, in two of the five use reports of *D. tokoro*, they were also used as an offering. The use as offerings to the gods has been reported in several places in Japan [41]. Another alkaloid-containing species consumed was

Lycoris radiata for starch from its bulbs, as mentioned previously.

One of the most toxic plants eaten was the lacquer tree (*Toxicodendron vernicifluum*), which widely grows in China, South Korea and Japan. In Asia, sap is used as a lacquer, but it contains an allergen called urushiol [81]. In Miyagi and Ibaraki prefectures, their shoots were consumed as vegetables. In Miyagi, older individuals liked to consume shoots because of their soft texture, whereas in Ibaraki, they were regarded as tasty but potentially irritating food, with the decision to consume them dependent on the individual. It has been reported that individuals engaged in lacquer production, such as artisans, adhere to the custom of eating lacquer plants as a means of reducing their susceptibility to lacquer rash in Japan [82]. However, the two regions reported in this study were not lacquer-producing areas and therefore cannot be relevant to this case of lacquer eating for immunity. On the other hand, the consumption of leafy shoots of *T. vernicifluum* as vegetables has been reported among ethnic minority groups in China, such as Lemo and Dulong in Yunnan Province and Yi in Sichuan Province [22, 83, 84]. To understand the food use of lacquers in Japan, it is necessary to consider the food use of lacquers in the wider context of Asia.

Processing techniques

The majority of plants, particularly vegetables, were consumed primarily in cooked form. A range of other processing techniques were also employed. In particular, almost 300 reports of *akunuki,* a food processing technique used to remove *aku*, which are unpalatable and undesirable substances or tastes such as harshness and astringency, existed. The *akunuki* methods include the followings: (1) the use of various ingredients, such as ash, rice water (water used to wash rice), rice bran, baking soda, vinegar, and camellia leaves; (2) prolonged soaking in water; (3) prolonged burial in soil; (4) fermentation; and (5)a combination of these methods. Some of these techniques are capable of removing not only unpleasant tastes but also toxic substances from wild species.

The most common *akunuki* method was the use of ashes (179 reports). In many cases, the plant parts were soaked in water with ash for a long time or boiled. Among the species that were pretreated with ashes, *warabi* bracken (*Pteridium latiusculum*) was reported most frequently (80 reports), followed by *Artemisia princeps* (31), *Osmunda japonica* (28) and *Aesculus turbinata* (22). These reports included detailed descriptions of the specific types of ash to be used, for example, ash from stoves and hearths, rice straw ash and wood ash. There were several reports of the use of specific types of ash, particularly in the pretreatment of *Aesculus turbinata* seeds when they were mixed with glutinous rice to produce rice cakes (*tochi mochi*). Among the 22 reports, more than half described specific types of ashes to be used, including those of hardwoods, mainly *Quercus* spp. The use of ash, which is alkaline, for plant detoxification is a well-known traditional method involving pH control [85]. The reason for the use of hardwood ashes, such as those derived from *Quercus* spp., is likely due to the pronounced alkalinity of these ashes, which has a greater impact on detoxification [86].

The second most common method used for *akunuki* was the use of rice bran (58 reports). The plant parts were boiled in water with rice bran or, alternatively, left over water after rising rice was used. This method is commonly employed for the preparation of a variety of bamboo shoots. The use of rice bran is likely to facilitate the adsorption of undesired substances [85]. In other Asian countries where bamboo shoots are widely consumed, boiling in water or saltwater is the predominant pretreatment method [87]. A previous study suggested that the method of using rice bran is a relatively recent phenomenon that emerged after the late Meiji period (1868–1912) [88].

Medicinal plants

Previous studies have demonstrated a blurred boundary between food and medicine in the use of wild plants [89, 90]. This study also identified 28 plant species that were used for food, medicinal and health-promoting purposes (Table 3). These plants were consumed for the treatment of various health conditions, including detoxification, deworming, cough, fever, tinnitus, and dizziness. Some of them were consumed specifically by infants, children, pregnant women, postpartum women and elderly individuals. The most frequently occurring species were those belonging to the Asteraceae family (5 species), followed by those of Lamiaceae (3 species). The species that were consumed as medicines included those that were commonly eaten as food throughout the country. For example, there were three reports of juice extracted from buds or roots of *Petasites japonicus* being given to newborns to detoxify the embryotoxic (*taidoku*)[91, 92].[3] Another example was *Osmunda japonica.* In the Tohoku region, they were believed to be beneficial for consumption after childbirth, with the aim of improving blood circulation or cleansing blood. Conversely, in Niigata Prefecture, eating them after birth was prohibited because they believed that they could cause blood

[3] At the time, it was believed that *taidoku* could cause neonatal illnesses such as boil and rash, and plants and medicines were given to infants shortly after birth. This theory of embryonic poisoning is thought to have originate in China.

Table 3 A list of species consumed as food as well as for medicinal and health-related purposes

Scientific name	Family	Parts used and preparations	Functions
Actinidia polygama	Actinidiaceae	Seeds	Stomach
Tetragonia tetragonoides	Aizoaceae	Leaves	Gastrointestinal
Oenanthe javanica	Apiaceae	Shoots, boiled and mixed with miso or soy-sauce	Detoxification
Artemisia indica	Asteraceae	Juice from aerial parts	Fever
Artemisia princeps	Asteraceae	Herbal tea	N/A
Aster yomena	Asteraceae	Shoots, boiled and mixed with miso or soy-sauce	Detoxication
Cirsium spp.	Asteraceae	Leaves, shoots	N/A
Crepidiastrum lanceolatum	Asteraceae	Brew herbal tea	Fever
Farfugium japonicum	Asteraceae	Stems, boiled or salted	Detoxication
Petasites japonicus	Asteraceae	Juice roots	Detoxication particularly for newborn(roots)
Pseudognaphalium affine	Asteraceae	Brew herbal tea	Cough
Platycodon grandiflorus	Campanulaceae	Roots, pickled	Cough
Elaeagnus umbellata	Elaeagnaceae	Herbal tea	Tinnitus, deafness
Pueraria montana var. *lobata*	Fabaceae	Drink hot water mixed with starch extracted from roots	Food for the sick
Geranium thunbergii	Geraniaceae	N/A	N/A
Clerodendrum trichotomum	Lamiaceae	Shoots, cooked	Deworming, prevent summer fatigue
Erythronium japonicum	Liliaceae	Drink hot water mixed with starch extracted from roots	Food for the sick
Osmunda japonica	Osmundaceae	Shoots, cooked	Cleansings of blood during childbirth
Plantago asiatica var. *asiatica*	Plantaginaceae	Shoots, boiled and mixed with miso or soy-sauce, herbal tea	Detoxication
Imperata cylindrica	Poaceae	Roots, brewed as herbal tea	Promoting urination
Hovenia dulcis	Rhamnaceae	Infructescences, dried	N/A
Pyrus pyrifolia	Rosaceae	Riped infructescences, raw	Cough, prevent asthma
Phellodendron amurense	Rutaceae	Debarked stems, brewed	Stomach ache
Houttuynia cordata	Saururaceae	Herbal tea	N/A
Alkekengi officinarum	Solanaceae	Infructescences, raw	N/A
Torreya nucifera	Taxaceae	Seeds	Deworming
Camellia japonica	Theaceae	Oils from seeds	Deworming for children
Vitis coignetiae	Vitaceae	Infructescences, wine	Dizziness, good for health in general and for pregnant woman

to become "rough". There were also six species, including *Artemisia princeps,* that were consumed as herbal teas, which are generally regarded as beneficial for the body.

Male and female plants

There were 6 reports on the uses of male and female plants of the 5 species. In Gifu Prefecture, stems of *Reynoutria japonica* were eaten raw as snacks with salt. The stems of the female plants were preferred because they were thicker, softer, and tasted sour, whereas the stems of the male plants were thinner and harder.

Additionally, some reports indicate that plant sex determines whether a plant is used. For example, in Amami Ōshima Island of Kagoshima Prefecture, stems of *Cycas revoluta* were processed and used as starches. Only male plants were selected for starch extraction, as male plants were considered to store more starch. Another example involves 2 species of Liliaceae (*Cardiocrinum cordatum* and *Lilium auratum var. auratum*), where the roots of the female plants were only selected for starch extraction. *Reynoutria japonica* and *Cycas revoluta* are dioecious plant species, whereas *Lilium auratum var. auratum* and *Cardiocrinum cordatum* are not.

Thus, preferences for texture and flavor and whether to use plants were determined according to the sex of the plants. However, how male and female plants were locally identified for some of these species was not described in the literature. As there are only a few studies on traditional knowledge of plant dioecy and the folk concepts of plant sex, further research is needed on the local perceptions of plant sex, as suggested by previous studies [93, 94].

Cultural significance of wild species

The results indicated that many of wild food plants hold cultural significance in Japan. These include their use as (1) essential foodstuffs for various special occasions, (2) cash plants for income generation, (3) their presence as

ingredients for local cuisines and in relation to local identity, and (4) precious and valuable foods. There were 64 reports citing the use of wild food plants for special occasions such as New Year celebrations, Bon festivals, Shinto and Buddhist rituals, local rituals, *Risshun*, the first day of spring in the Chinese lunar calendar and *Gosekku*, the five seasonal festivals. The most commonly used species for special occasions was *zenmai* (*Osmunda japonica*), which was reported as an essential food ingredient for several dishes, including a simmered dish (*nimono*) served during special occasions as Buddhist memorial services throughout the country.

Secondly, there were reports of plants being collected for selling purposes. Of these, chestnuts (*Castanea crenata*) and *zenmai* (*O. japonica*) were each mentioned in six reports. In some areas, traders came to the area to buy wild species including chestnuts in Akita prefecture and *zenmai* fern in Tokushima prefecture. There was a report that people accumulated enough money to buy a mountain by selling *warabi* (*Pteridium latiusculum*) in Hyogo prefecture. The trade in wild food plants persists to the present day. In addition to being transported to markets, foraged wild food plants are also sold as souvenirs at local outlets, including roadside stations called *michi-no-eki* as well as in community-powered marketplaces on the Internet for smaller-scale trading.

Furthermore, there were reports indicating that wild food plants were associated with local identity. For instance, they were identified as a vital component of regional cuisine, or as a highly preferred food among the local population, with some species such as *Hasteola robusta* and *Smilax riparia* even featured in folk songs in Akita prefecture. In the present era, the dishes with wild food species represent a further aspect of the regional cuisine as they are based on the specific utilization, culinary techniques, and methods of preparation and processing of wild food plants that are distinctive to the region.

Some wild food plants were also described as being precious and valuable. In addition to the direct statement, for example, horse chestnuts (*Aesculus turbinata*) in Niigata were a luxury item and not regularly eaten, there were indirect descriptions which suggests that some of the wild food plants were perceived as precious foods. In Yamagata Prefecture, if you were given bracken fern (*Pteridium latiusculum*), you have to thank many times, and that in Niigata Prefecture, people were considered to be rude if they did not praise a long piece of *zenmai* (*O. japonica*) served at a celebration.

Taste and flavor

Taste and flavor and their appreciation have also been considered to be a part of cultural significance of wild food species [95]. There were a number of descriptions pertaining to the taste and flavor of wild species. These can be broadly classified into those pertaining to flavor, texture, and taste. Flavors were described as being of good quality, specific to wild species, in the spring, with all of them being perceived as positive. For example, in Akita, *Hasteola robusta* was carefully cooked as *tempura* to retain its distinctive aroma, which is considered important.

There were several reports about texture, including the sliminess of *Elatostema involucratum*, the crispness of *Astilbe rubra*, and the stickiness and gooeyness of *Lilium auratum* var. *auratum*. These attributes were all regarded as positive. In terms of taste, wild species were often described as having a distinctive and slightly bitter taste, which were also perceived as good. This was exemplified in the preparation of seeds of *Aesculus turbinata* and bulbs of *L. auratum* var. *auratum*, where some described taking care not to lose all of the bitterness. There were also nine reports that the taste of wild species was better than that of cultivated or purchased species or those grown in proximity to their residences. Examples of these include *udo* (*Aralia cordata*), butterbur (*Petasites japonicus*), chestnut (*Castanea crenata*) and yam (*Dioscorea japonica*). Thus, wild food plants were considered a source of enjoyment through their unique tastes and flavors in Japan.

Several previous studies have shown that wild vegetables were appreciated and preferred because of their tastes, for example, in southern Italy, Thailand, Himalaya and Japan [44, 96–99]. In the field of Japanese folklore, studies have examined the unique taste and cleansing properties of wild vegetables. For instance, there is a dialect word, *'kidoi'*, which is used to describe the nature of wild food plants, particularly in Tohoku region [41]. The term denotes a harsh, bitter, and astringent quality, including a distinctive olfactory sensation characterized by a potent and pungent flavor. In these areas, this quality of spring wild vegetables is perceived as a means of cleansing and detoxifying the body from the impurities and fatigue accumulated during the winter months.

While no expressions were identified as pertaining only to the taste of wild species such as *kidoi* in this study, the taste and flavor of wild species were observed to be linked to the arrival of spring. In many areas, these were regarded as spring tastes that people look forward to, particularly in regions where winter is long. It may be of interest to note that species mentioned as having a taste associated with spring include *Adenophora triphylla var. japonica*, *Capsella bursa-pastoris* and *Oenanthe javanica*, which were used as wild vegetables. All species have been previously reported for their antioxidant and phytochemical properties [73, 100, 101]. Given that previous

studies have suggested how the specific tastes and flavors of wild species are associated with their health properties [96, 102], it seems plausible to suggest that these perceptions of the spring taste of wild species Japan are likely to be related to their health properties.

Use of rare species

There were few reports on the use of threatened species according to their current conservation status. Among the 2163 species of vascular plants listed on the 2020 Japanese Red List [103], the following four species were used approximately 1930: *Platycodon grandifloras*, prickly waterlily (*Euryale ferox*), and bird's nest fern (*Asplenium antiquum*), which are listed as endangered, and *Cinnamomum sieboldii*, which is listed as near threatened. The roots of *P. grandifloras* were pickled in plum vinegar and were traditionally consumed in Hiroshima Prefecture. They are also used as a cough medicine, although their taste was not very tasty. There were 2 reports about the use of *Euryale ferox*. The cooked stems were eaten as vegetables, whereas the roasted or boiled seeds were eaten as snacks. Additionally, dried and ground seeds were used as starches to make dumplings (*dango*). *Asplenium antiquum* was reported once in Ishigaki city in Okinawa, where the shoots were used as vegetables in simmered or dressed dishes. *Cinnamomum sieboldii* was reported twice. The roots were eaten raw as snacks for the children.

Conclusions

This study examined Japan's largest food culture database and reviewed the food use of wild plants in the early Showa period (1926–1989). At least 268 taxa of plants belonging to 88 families were used to make food and beverages in Japan. Asteraceae was the most frequently reported and most species-rich family. The majority of species was documented in only a limited number of reports, and the number of species used at the national level was limited. In other words, each region and locality had its own distinctive culinary traditions involving wild food species. A comparison with those of previous studies on wild species used in other Asian regions revealed a similar preference for vegetables, namely shoots and leaves. However, notably, in Japan, ferns and bamboos were also consumed in considerable quantities. Furthermore, there were some other similarities with other Asian regions, including folk uses of plants such as binder plants and *kate* plants and the consumption of toxic plants (lacquers). Conversely, further elucidation is clearly needed with respect to certain matters, including the perception of plant sex, the relationship between the consumption of lacquer and immunity, and the relationships between diverse ash components and detoxification techniques.

At present, data on the use of wild food plants in Japan are largely confined to specific plant species and select regions. Consequently, there is a lack of comprehensive understandings of the current use of wild food plants over Japan. While there are reports indicating a decline in the use of wild food plants, there are also emerging trends such as the practice of wild vegetable gathering for recreational purposes and the formation of wild food plants gathering groups in urban areas. The situation surrounding wild food species in Japan is evolving rapidly, with an increase in the number of popular books, illustrated books and online resources, as well as reports of species that were previously only consumed in specific regions now being incorporated into the diet. This study provided insight into the use of wild food plants which once existed in Japan around 1930. To gain a comprehensive understanding of the changes that have occurred and the current status of wild food plant use in Japan, it is essential to conduct interdisciplinary research. The study also revealed that wild food plants are not only natural resource or source of nutrition, but that their use is also deeply rooted in culture. It is therefore evident that further ethnobotanical research is needed, both in the form of an examination of ethnographic records and in the field, to gain a deeper understanding of the cultural use of wild food plants in Japan.

Abbreviations

N/A Not available
Fig. Figure

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Author Contribution

The author confirms sole responsibility from conceptualizing and designing study, data collection, analysis and interpretation of results, and to manuscript preparation.

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Availability of data and materials

The data that support the findings of this study are available from the corresponding author on reasonable request.

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