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RESEARCH ARTICLE

Wild edible plants traditionally gathered in Gorbeialdea (Biscay, Basque Country)

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Abstract This ethnobotanical study aims to describe the domain of wild edible plants in Gorbeialdea (Biscay, Iberian Peninsula), and to assess the cultural importance of the different species and food categories. Field work was conducted between 2008 and 2010, interviewing 103 informants about the traditional use of wild plants for food. The edible use of 49 species was recorded, 45% of them gathered for their fruits. The most important species coincide with those registered in other regions in the north of the Iberian Peninsula (*Prunus spinosa*, *Rubus ulmifolius*, *Castanea sativa*, *Fragaria vesca*, *Rumex acetosa*, *Vaccinium myrtillus* and *Arbutus unedo*). However, the importance of some species and uses that had not been previously recorded as edible in the ethnobotanical literature of the Iberian Peninsula, highlights the singularity of the area. The consumption of the leaves of *Fagus sylvatica*, the seeds of *Pinus radiata,* and the shoots of *Pteridium aquilinum* are some examples of specific uses. The eating of the fruits of *Quercus robur*, and *Q. ilex* was common until some decades ago and is still remembered by the informants. However, the consumption of those fruits has now a social stigma, and as shown in this paper, it can be overlooked by a methodology only based on open interviews. The most important use-category was 'fruits', following the trend found in other northern regions of the Iberian and Italian Peninsulas. 'Snack vegetables' is also a relevant category, including 35% of the cited species, with a high diversity of chewed plants, mainly as hunger or thirst quenchers. On the contrary, there was a low valorization of condiments and elaborated vegetables.

Keywords Ethnobotany · Wild edible plants · Traditional knowledge · Iberian Peninsula

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Introduction

Wild food plants are still relevant for many agricultural and hunter-gatherer communities (Turner et al. 2011). In fact, hunter-gatherers and foragers usually farm and manage their environments, and cultivators use many wild plants and animals. Because the role of wild plant consumption on agrarian societies is often

neglected, the importance of wild edible plants for the global food basket is usually underestimated (Bharucha and Pretty 2010; Heywood 2011). For instance, research suggests that wild edible plants have been used in Europe to complement staple agricultural foods as an additional nutrient resource, especially during times of shortage. However, many of these species are no longer gathered and the knowledge related to them remains only in the memory of elderly people (Hadjichambis et al. 2008; Pardo-de-Santayana et al. 2010).

Despite this general trend of decline in the habit of eating wild edible plants, the last decades have seen a renewed social and scientific interest in these plants. For example, many recent ethnobotanical surveys have focused on the traditional consumption of wild edible plants around the world, such us Africa (e.g. Addis et al. 2005; Tabuti 2007; Termote et al. 2011), America (Van den Eynden et al. 2003; Lawrence et al. 2005; Arenas and Scarpa 2007; Farfán et al. 2007; Ladio et al. 2007), Asia (Ogle et al. 2001; Batal and Hunter 2007; Setalaphruk and Price 2007; Bhattarai et al. 2009) and Europe (Rivera et al. 2007; Pieroni 2008; Cornara et al. 2009; Redžić 2010; Schunko and Vogl 2010). At the same time, many popular books on wild edible plants have been published in the last decade (e.g. Fleischhauer 2003; Irving 2009) and every year more courses and festivals on wild edible plants are offered (Harford 2011; Łuczaj 2011; Slow Food 2011; Wildfoods Festival 2011).

Several reasons explain this renewed interest. First, wild edible plants have shown a great potential as functional foods or nutraceuticals (Dhyani et al. 2010; Ruiz-Rodríguez et al. 2011), and their role in the prevention of cancer and age-related diseases is being studied (Heinrich et al. 2005; The Local Food-Nutraceutical Consortium 2005). Second, knowledge of wild edible plants is a valuable cultural heritage, and can play an important role in revitalizing local identity and traditions (Pardo-de-Santayana and Gómez Pellón 2003; Pieroni et al. 2005). Third, wild edible plants are an important part of the biodiversity managed by local communities, and the in situ conservation of wild edible plants offers socio-cultural, economic, and ecological benefits to local communities and to societies at large (Delang 2006; Pérez-Negrón and Casas 2007). Finally, a new trend in foraging wild plants seems to be increasing. Individual consumers or even food providers (e.g. restaurants) are foraging wild edible plants looking for an environmentally friendly way of life (Carrell 2009; Colombo et al. 2010).

In Spain, this renewed interest has translated in an important number of ethnobotanical studies on the consumption of wild edible plants (e.g. Tardío et al. 2006; Pardo-de-Santayana et al. 2007; Fajardo 2008; Polo et al. 2009; Rigat et al. 2009; González et al. 2011), resulting in Spain being one of the European countries with the largest number of ethnobotanical studies on wild edibles. However, there are still understudied regions. For example, although Basque ethnic and cultural singularities have historically attracted ethnographical research (e.g. Barandiaran and Manterola 1990), Basque culture have rarely been addressed with an ethnobotanical perspective (Pérez 2007; Alarcón 2010).

Furthermore, recent research (Pérez 2007) suggests that some of the previous work by classic Basque ethnographers, such as Telesforo de Aranzadi or José Miguel Barandiaran are somehow biased in their report of consumption of wild edibles. Specifically, Pérez (2007) mentions than previous ethnographers have been unwilling to admit the edible use of acorns (*Quercus* fruits), although acorn consumption has been very common in other parts of the Iberian Peninsula (Tardío et al. 2006).

Given the lack of ethnobotanical research in the Basque Country and the controversy regarding some edibles, we studied the use of wild edible plants in Gorbeialdea, a Basque speaking rural mountainous region located in the south of Biscay. The specific aims of this work were: (1) to describe the domain of wild edible plants in Gorbeialdea, (2) to assess the cultural importance of the different species and food categories and its ethnopharmacological relevance (3) to explore whether the consumption of acorns is stigmatized in the region.

Materials and methods

Study area

Gorbeialdea is a Biscayan Basque speaking region located in the south of the province of Biscay (Basque Country, northern Iberian Peninsula) and is bounded by Bilbao city to the north (Fig. 1). It covers approximately 450 km^2 and represents 19.5% of Biscay. Its

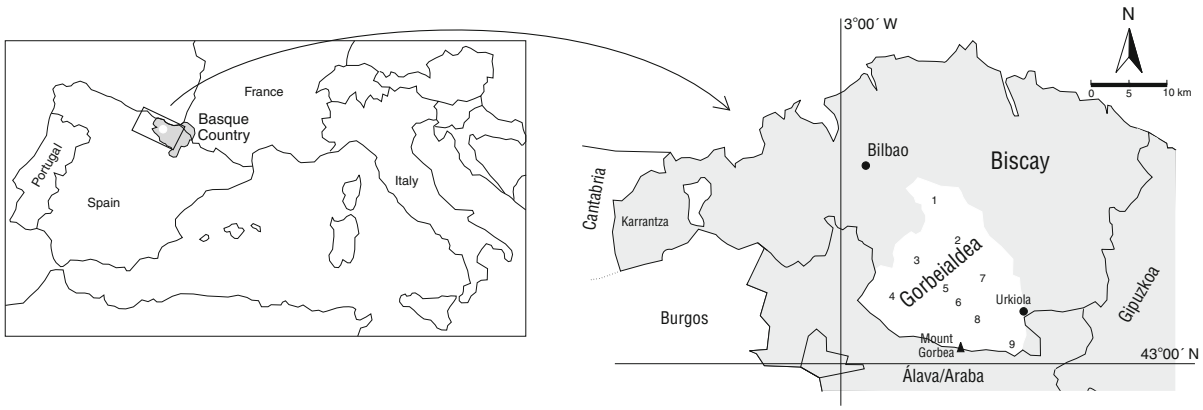

Fig. 1 Map showing Gorbeialdeia where the study was carried out. Localities visited: *1* Galdakao, *2* Igorre, *3* Zeberio, *4* Orozko, *5* Artea, *6* Areatza, *7* Dima, *8* Zeanuri, *9* Ubidea

24,594 inhabitants are distributed in the region's 16 municipalities (Mendikoi 1999).

Gorbeialdea is a very mountainous area included in the Eurosiberian biogeographical region. The highest point in the region is the mount Gorbea (1,481 m), which gives name to the region and to one of its two protected areas (Natural Park of Gorbea). The other protected area on the region is Urkiola's Nature reserve. The potential vegetation includes beech forests in the supratemperate belt and several oak species (*Quercus ilex* L. subsp. *ilex*, *Q. robur* L., and *Q. pyrenaica* Willd.) in the mesotemperate. Nevertheless, the current natural vegetation is highly degraded, especially in the mesotemperate floor which is dominated by industrial plantations of *Pinus radiata* (Loidi et al. 1997).

Until the second half of the twentieth century, the local economy was based on the traditional management of the farmhouse, called *baserri* in Basque (plural, *baserriak*). The main aim of this unit was the production of goods for household consumption. Thus, maize, wheat, potato, common bean and turnip were mainly cultivated and a few livestock heads were raised for household consumption, including one or two dairy cows and pigs, and some hens. Moreover, there was a great tradition of sheep herding that it is still quite alive, there being many active professional shepherds.

With the industrialization of the region in the 1950s, most people began a mixed agrarian-industrial activity, working in factories on a part time basis without leaving the *baserri*. Despite the farming activity diminished, people continued tending their gardens, kept a few animals, and maintained the pine plantations. Those *baserriak* that continued the agrarian activities full-time changed their activities to adapt to the market trends, mainly specializing in livestock farming. Therefore, during that period the *baserriak* were not abandoned, but transformed.

The economy in the area is now based on industry and services, and agriculture and livestock are of minimal importance for gross domestic product. Nowadays, the *baserri* is not a self-sufficient production unit anymore and only several aspects of its traditional management survive.

Wheat, corn and potatoes fields have been replaced by livestock grazing pastures and *Pinus radiata* plantations. Small home gardens are still common even in peri-urban areas.

Definitions: what is a wild edible?

The term 'wild edible' plant is widely used in the ethnobotanical literature, but its definition is not always clear. The first part of the term, 'wild', refers to those plants that grow without being cultivated. In the local language, the informants used the term *berez ernea* (sprouted itself) or *basokoa* (from the field) to refer to these plants. The local terms mostly include native species growing in their natural habitat, but sometimes managed, as well as introduced species that have been naturalized. For example, informants used the previous terms to refer to some native species such as *Castanea sativa* and *Fagus sylvatica* that have been so intensively managed, even promoted by planting their seeds that cannot be considered strictly wild in a

botanical sense. A similar case is *Pinus radiata*, a species that was introduced as a plantation timber during the last century and nowadays has become naturalized. There are also domesticated species that grew both cultivated and feral in the area (*Juglans regia, Mespilus germanica, Corylus avellana, Prunus avium* and *Ficus carica*). As it was impossible to differentiate among spontaneous or sown specimens, for the purpose of this work we included the reports of all the species that were referred by informants as *berez ernea* or *basokoa*, independently of considerations on their potential management.

Interestingly, when we asked about wild edible plants, people told us edible uses of species that are mainly cultivated for non-edible purposes or for other edible purposes. For instance, informants mentioned that the immature inflorescences of turnips, a species that is cultivated for the consumption of its roots, were usually eaten cooked. The young shoots of cultivated roses and grape vines were peeled and eaten in the same way as those from blackberry brambles (*Rubus ulmifolius)*. These species are cultivated for harvesting a different part of the plant. Therefore, people associate these food-uses to gathering more than farming. These reports were obviously not considered.

The second part of the term, 'edible' (*jateko*) has also blurry limits. We defined edible widely, including all liquids and solids ingested in a food context, i.e. before, after or during main and secondary meals. Therefore, as in other Iberian studies (e.g. San Miguel 2004; Tardío et al. 2005; Rigat et al. 2009), we included beverages such as herbal teas and liqueurs flavoured with herbs or fruits. The local term *jateko* does not include all the concepts included in our definition of edible, since it usually only refers to 'proper' food, i.e. food that is eaten at home during the main meals. However, we also considered plants that are just chewed (*maskau, mamurtu*) or sucked (*txupau*) while in the field, such as leaves, young shoots or flowers. The chewing of those plants is halfway between food and entertainment.

All food uses reported were classified in five use-categories based on local perception. The first of them, 'vegetables' (VEG) included two subcategories. Plants whose leaves, stems, shoots or even unripe fruits were consumed after being prepared (raw in salads, stewed or fried) were placed in the subcategory of 'processed vegetables' (VEGp). Plants that were eaten in the field without any preparation, or chewed and spitted for entertainment or as hunger or thirst quencher, were classified as 'snack vegetables' (VEGs). Ripe fruits or seeds were classified as 'fruits' (FRU). Another group were 'flowers' (FLO) sucked for their sweet nectar. Other plants were used for making 'beverages' (BEV), both alcoholic and non-alcoholic. Finally, some species were used for 'seasoning' (SEA). One species could be classified in more than one category. *Urtica dioica,* for instance, was consumed stewed in omelette or raw in the field, being therefore classified as 'processed vegetable' and also as 'snack vegetable'.

Ethnobotanical data collection

Fieldwork was conducted between September 2008 and October 2010, through consented semi-structured interviews with 103 informants that had a sound traditional knowledge of wild plants in the area (Martin 1995; Alexiades 1996). The mean age of informants was 74 (minimum 50, maximum 95). Forty-three percent of informants were men. The informants were selected using a snowball sampling technique, consisting in asking to local people for those community members considered to be 'knowledgeable persons' (see Ghirardini et al. 2007).

The interviews were conducted in Basque at the informant's home, and were recorded and later transcribed. Pictures and illustrations of the plants were shown when needed. Whenever possible, short walks with the informants through the surroundings of the *baserriak* were carried out in order to identify and collect samples for botanical identification (Albuquerque et al. 2008). Samples were identified with the help of a botanical dichotomous key (Aizpuru et al. 1999), pressed, labelled and deposited at the herbarium BIO (Leioa, Universidad del País Vasco). Several works were followed for taxonomy and plant nomenclature: *Flora iberica* (Castroviejo et al. 1986–2010) for families included therein, and *Flora Europaea* (Tutin et al. 1964–1980) for the remaining families.

During the interviews informants were asked to report the wild food plants that were traditionally consumed in the area (*Basotik zehozer jaten zan? Berezernekoa*?). We also asked about how those plants were gathered, conserved, prepared, and eaten and whether informants continued to consume them. We accepted as traditions those habits that have been practiced in the area for about one generation

(25 years) or more (see Ogoye-Ndegwa and Aagaard-Hansen 2003). In addition, information regarding sex, age, origin and occupation of the informants was systematically compiled.

Since the local term, *jateko*, does not include all the concepts included in our definition of edible, we also asked about other ways of consuming wild edibles. For example, we asked 'Did you ever chewed leaves or young shoots?' or 'Did you use any plants for making liqueurs?'

To achieve our third objective, regarding the stigmatization of acorn consumption, at the end of the interview we systematically asked about it. We made the following closed question: 'Have you ever consumed acorns or know of other people in the valley that have traditionally consumed them?'

Data analysis

The data collected during fieldwork were entered in a database and later analyzed. As in most ethnobotanical surveys, information was structured in use-reports (UR, the informant i, mentions the use of the species s in the use-category u). From now on, the term food-use refers to the specific use of the species s in the use-category u. For instance, *Fagus sylvatica* had two different food-uses, as 'snack vegetable' and as 'fruit'.

The Cultural Importance index (CI) was used to assess the cultural significance of each taxon (Tardío and Pardo-de-Santayana 2008). This index is obtained by adding the number of UR of all the informants (from i_1 to i_N) in every use-category (u, varying from u_1, only one use-category to u_{NC}, the total number of use-categories, 5 in our case) mentioned for a species, divided by 103, the number of informants in the survey (N).

$$CI_s = \sum_{u=u_1}^{u_{NC}} \sum_{i=i_1}^{i_N} UR_{ui}/N$$

In a similar way, we calculated the CI for the botanical families (Pardo-de-Santayana et al. 2007) and for the use-categories (Aceituno-Mata 2010) adding the CI of all the species included in each group. This is equivalent to sum all the UR of each group (family or use-category) and divide the result by the total number of informants.

Although some authors do not consider uses mentioned by only one informant when calculating cultural significance (Johns et al. 1990), we decided to include them as valid statements depending on the reliability of the informants and the consistency of their reports (see Alexiades 1996; Scarpa 2000).

Finally, data collected were compared with published (Barandiaran and Manterola 1990) and unpublished ethnobotanical information on wild food plants on the Basque country (Daniel Pérez, personal communications). We also compared with other references from the rest of the Iberian Peninsula: the review of Tardío et al. (2006) and other 20 subsequent references for Spain, and Mendonça de Carvalho (2006) and Carvalho (2010) for Portugal. Moreover, our results were contrasted with a selection of other Mediterranean surveys (e.g. Pieroni 1999; Ertug 2000; Guarrera 2006; Ali-Shtayeh et al. 2008; Hadjichambis et al. 2008) and with the online database 'Plants for a Future' (PFAF 2011).

Results and Discussion

Overall results and uncommon food-uses

Table 1 summarizes the information about the 49 wild food plants that have been traditionally consumed in the area. They account for 2.3% of the 2100 species of the Basque Country flora (Aseginolaza et al. 1984). Similar proportions were found in Asturias (San Miguel 2004), other northern Spanish region, being clearly lower than the 6% found for the whole Spain (Tardío et al. 2006). All the taxa correspond to 27 families and 42 genera. Most of the species (10) belong to the Rosaceae, half of them being among the 10 most important species according to the CI (Fig. 2). The next family in number of species is Fagaceae (4). Both families are also the most important according to their CI (Rosaceae, 3; Fagaceae, 1.04). Only 5 families are represented by more than two species and most families (74%) are represented by only one species. The importance of the Rosaceae among the wild edible plants consumed in the North of the Iberian and Italic Peninsulas was previously pointed out by Pardo-de-Santayana et al. (2007) and Ghirardini et al. (2007).

As can be seen in Fig. 2, seven of the 12 most important wild edible plants in Gorbeialdea (*Prunus spinosa, Rubus ulmifolius, Castanea sativa, Fragaria vesca, Rumex acetosa, Vaccinium myrtillus* and *Arbutus unedo)* are also among the most important

Table 1 Wild species used for food purposes in Gorbeialdea (Biscay, Basque Country)

Family/species (voucher number)	Local name(s)	Food categories[a]	Part(s) used and mode of consumption	UR[c]	CI[d]	Collecting habitat[b]
Apiaceae						
Apium nodiflorum (L.) Lag. (GM 626)	Berroak	VEGp	Leaves, raw in salads	2	0.02	AE
Asteraceae						
Bellis perennis L. (GM 846)	Pitxi lora	FLO	Inflorescences eaten as a children snack	1	0.01	UA
Chamaemelum nobile (L.) All. (GM 665)	Mantzanillea	BEV*	Inflorescences, as herbal tea and for making liqueur	7	0.07	SP
Taraxacum officinale Weber (GM 823)	Diente de leon, kardue	VEGp*	Leaves, raw in salads; leaves and inflorescences, stewed	10	0.11	CA
		BEV	Root, roasted as a coffee substitute called '*akeita*'	1		
Betulaceae						
Corylus avellana L. (GM 725)	Urretxa, basurrek	FRU*	Fruits, eaten raw and stored	16	0.16	FO/CA
Brassicaceae						
Rorippa nasturtium-aquaticum (L.) Hayek (GM 811)	Berroak	VEGp*	Leaves, raw in salads	2	0.02	AE
Caprifoliaceae						
Lonicera periclymenum L. (GM 721)	Jesu kristoren atzamarra, jesu kristoren eskue, jaungoikoan eskue	FLO	Sucking flower nectar	10	0.10	CA/FO
Dioscoraceae						
Tamus communis L. (GM 642)	Irustarbie	VEGp	Young shoots, boiled and prepared in several dishes	2	0.02	CA
Ericaceae						
Arbutus unedo L. (GM 717)	Burbuxe, purpuxea	FRU*	Fruits, raw as a snack	17	0.17	FO
Vaccinium myrtillus L. (GM 716)	Eubie, eumie, abie	FRU*	Fruits, raw as a snack	16	0.17	FO
		VEGs#	Young shoots, chewed	1		
Fabaceae						
Robinia pseudacacia L. (GM 762)	Azkazia	FLO	Eating the flowers	1	0.02	CA
		VEGs	Young leaves, chewed	1		
Trifolium pratense L. (GM 657)	Sekule bedarra	FLO	Sucking flower nectar	3	0.03	CA
Ulex europaeus L. (GM 722)	Otea	VEGs#	Young shoots, chewed	1	0.01	SP

Table 1 continued

Family/species (voucher number)	Local name(s)	Food categories[a]	Part(s) used and mode of consumption	UR[c]	CI[d]	Collecting habitat[b]
Fagaceae						
Castanea sativa Mill. (GM 720)	Gastaña	FRU*	Fruits, eaten raw, boiled with salt, roasted, or in pastry	48	0.47	FO
Fagus sylvatica L. (GM 776)	Pagoa	FRU*	Fruits, eaten raw	25	0.35	FO
		VEGs	Stem and leaves, chewed	11		
Quercus ilex L. subsp. *ilex* (GM 707)	Artea	FRU	Fruits, eaten raw, roasted, dried and grinded for making flour	14	0.14	FO
Quercus robur L. (GM 727)	Aretxa, aratxa	FRU	Fruits, eaten raw, roasted, dried and grinded for making flour	17	0.17	FO/CA
		VEGs#	Young leaves, chewed	1		
Grossulariaceae						
Ribes uva-crispa L. (GM 856)	Galdratza, agarratza	FRU	raw	3	0.03	CA
Hypolepidaceae						
Pteridium aquilinum (L.) Kuhn (GM 726)	Idea	VEGs	Tender stem, chewed	3	0.03	SP
Juglandaceae						
Juglans regia L. (GM 828)	Basointxurrek	FRU*	Fruits, eaten raw	5	0.05	FO
Lamiaceae						
Lamium galeobdolon (L.) L. (GM 847)	_	FLO	Sucking flower nectar	1	0.01	CA
Lamium maculatum L. (GM 682)	_	FLO	Sucking flower nectar	1	0.01	CA
Mentha aquatica L. (GM 629)	Patana	SEA	Leaves, added to milk for flavouring	1	0.02	AE
		VEGs	Stems and leaves, chewed	1		
Mentha suaveolens Ehrh. (GM 741)	Astopatana, patana	SEA	Leaves, added to milk for flavouring	3	0.03	CA
Origanum vulgare L. (GM 848)	Oreganue	SEA	Inflorescences, for seasoning pork black pudding (*odoloste*)	1	0.01	CA
Lauraceae						
Laurus nobilis L. (GM 737)	Ereinotza	SEA	Leaves, for seasoning stews	6	0.06	CA
Liliaceae						
Allium sp.	Kimpulle bedar, baso kimpullea	VEGs	Leaves, chewed	2	0.02	CA

Table 1 continued

Family/species (voucher number)	Local name(s)	Food categories[a]	Part(s) used and mode of consumption	UR[c]	CI[d]	Collecting habitat[b]
Malvaceae						
Malva sylvestris L. (GM 679)	Mamukioa	VEGs	Immature fruits, raw as a children snack	1	0.01	CA
Moraceae						
Ficus carica L. (GM 849)	Basoikoak	FRU	Fruits, eaten raw	2	0.02	FO
Oxalidaceae						
Oxalis acetosella L. (GM850)	Bedar garratza, hiruorrikoa	VEGs	Leaves, chewed	10	0.10	FO/CA
Oxalis corniculata L. (GM855)	–	VEGs	Inmature fruits, chewed	1	0.01	CA
Pinaceae						
Pinus radiata D. Don (GM 851)	Pinue	FRU#	Seeds, eaten raw (extracted after warming the fruit up)	4	0.04	FO
Plantaginaceae						
Plantago lanceolata L. (GM 685)	Sambedarra	VEGs	Leaves, eaten raw	1	0.02	CA
		VEGp	Leaves, boiled for preparing omelettes	1		
Poaceae						
Dactylis glomerata L. (GM 767)	Si bedarra	VEGs*#	Stems, chewed	3	0.03	CA
Polygonaceae						
Rumex acetosa L. (GM 668)	Bedar garratza	VEGs*	Leaves and stems, chewed	24	0.24	CA
		VEGp	Leaves, raw in salads	1		
Ranunculaceae						
Aquilegia vulgaris L. (GM 735)	Kukufraka	FLO	Sucking flower nectar	3	0.03	CA
Rosaceae						
Crataegus monogyna Jacq. (GM 738)	Arantza zurie, arantzea, elorrie	FRU*	Fruits, eaten raw	8	0.12	CA/SP
		VEGs*	Young stems, chewed	4		
Fragaria vesca L. (GM 761)	Mallukiek, mallubiek	FRU*	Fruit, eaten raw	26	0.25	CA
Malus sylvestris (L.) Mill. (GM 852)	Basosagarra	BEV	Fruits, eaten raw and for making apple jelly	11	0.17	SP/FO
		FRU	Fruits, for making liqueur (*pitikin*)	7		
Mespilus germanica L. (GM 812)	Mesmerue, misperue	FRU*	Fruits, eaten overripe, after stored	15	0.15	CA/FO
Prunus avium L. (GM 831)	Txorikerizak, basokerizak, kerizabaltzak	FRU*	Fruits, eaten raw	7	0.07	CA

Table 1 continued

Family/species (voucher number)	Local name(s)	Food categories[a]	Part(s) used and mode of consumption	UR[c]	CI[d]	Collecting habitat[b]
Prunus cerasus L. (GM 777)	Gindek	BEV*	Fruits, for making liqueur	4	0.05	CA
		FRU*	Fruits, eaten raw	1		
Prunus insititia L. (GM 853)	Basokeranak, okeran silbestreak	FRU	Fruits, eaten raw	2	0.02	CA
Prunus spinosa L. (GM 723)	Arantzea, arantza baltza	FRU*	Fruits, eaten overripe, after the first frosts	50	0.85	CA/SP
		BEV*	Fruits, for making liqueur (*patxaran*)	38		
Pyrus cordata Desv. (GM 718)	Basomakatza	FRU*	Fruits, eaten overripe, after stored	46	0.55	SP/FO
		BEV	Fruits, for making liqueur (*pitikin*)	11		
Rubus ulmifolius Schott (GM 766)	Zazie, matea	FRU*	Fruits, eaten raw or for making jam	50		CA
		VEGs*	Peeled young stems, chewed or eaten raw	28	0.80	
		BEV	Fruits, smashed and mixed with water and sugar as a children drink, and for making liqueur	4		
Scrophulariaceae						
Veronica beccabunga L. (GM 647)	Berroak	VEGp	Leaves, raw in salads	5	0.05	AE
Taxaceae						
Taxus baccata L. (GM 854)	Hagine	FRU*	Seed aril, raw as a snack	1	0.01	SP
Urticaceae						
Urtica dioica L. (GM 719)	Asune	VEGp*	Aerial part raw in salad and boiled for preparing omelette	19	0.19	CA
		VEGs	Young leaves, eaten raw	1		

The food-uses marked with an asterisk (*) are still practiced nowadays in the area and those food-uses marked with a hash (#) are not cited as edible in the databases PFAF (2005), or in other ethnobotanical works of the Mediterranean area reviewed (see "Methods")

[a] Food-categories: *VEGp* processed vegetables, *VEGs* snack vegetables, *FRU* wild fruits, *SEA* seasonings, *BEV* beverages, *FLO* flowers

[b] Collecting habitat: *FO* forests (holm oak woods. beech woods. etc.), *SP* scrublands and pastures, *AE* aquatic environments (streams. ponds. etc.), *CA* cultivated areas and inhabited areas (orchards. roads. surrounding farmhouses etc.)

[c] UR Use-report, i.e. number of informants that mention the use of the species in this use-category

[d] CI Cultural importance index

wild edible plants of other northern Iberian regions (Pardo-de-Santayana et al. 2007). A common biocultural background may explain this similarity since these mountainous regions share environmental, historical and cultural factors, although they do not share key cultural aspects such as language (Spanish, Basque, Galician, Asturian and Portuguese).

Interestingly there are also species that are only important in the studied area such as *Pyrus cordata*, *Fagus sylvatica*, *Urtica dioica*, and *Quercus robur* that reflect the singularity of Gorbeialdea (Fig. 2).

Other remarkable results are those uncommon plant food-uses that have been quoted only rarely in the Iberian and European ethnobotanical literature. Ten taxa (*Aquilegia vulgaris, Bellis perennis*, *Dactylis glomerata,* wild *Ficus carica, Lamium galeobdolon, Oxalis corniculata, Pinus radiata, Plantago lanceolata, Quercus ilex* subsp. *ilex,* and *Ulex europaeus*) were not registered as edible in the previous Iberian ethnobotanical sources consulted. In other five species (*Fagus sylvatica, Mentha aquatica, Quercus robur, Robinia pseudacacia, Vaccinium myrtillus)* the plant part or the food-use is not the same that have been previously reported (Tardío et al. 2006). This high percentage of plants or plant food-uses that had not been previously cited in other Spanish areas may reflect the strong singularity of the wild food ethnobotany of the area.

Among these remarkable food-uses, *Fagus sylvatica* young leaves were chewed as a pastime or to quench thirst. This food-use seems to have been more widespread in Europe in the past. Although there are reports that beech leaves have been eaten in salads, this use is nowadays nearly abandoned (Coupland 1989; Facciola 2001; Łuczaj and Szymański 2007). The chewing of other young leaves and shoots of trees and bushes has not been previously cited either (*Robinia pseudacacia, Quercus robur, Ulex europaeus* and *Vaccinium myrtillus)*.

In a similar way, the consumption of *Pteridium aquilinum* in the Iberian Peninsula has been only previously reported in Catalonia (Bonet and Vallès 2002), where the fiddleheads were bitten as a snack. Despite its toxicity, the consumption of *Pteridium aquilinum*, although rare in the Iberian Peninsula, is common in many regions, especially in some Asiatic and American countries where it is even grown commercially (Turner 1981; Gaur and Bhatt 1994; Rook 2004).

Interestingly, we also found that in only one century the seeds of the American pine *Pinus radiata* had entered and disappeared from the local food tradition. In the first half of the twentieth century, when the plantations spread, people learnt to use their seeds for sowing and as a food resource. However, the seeds are not gathered anymore, since nowadays young pines are not planted from seeds but bought in nurseries, and nobody reported the consumption of pine seeds.

Another interesting food-use is the elaboration of a local cider, called *pitikin*, with the fruits of *Pyrus cordata*. The raw consumption of *Pyrus cordata* fruits and other wild pears has been widespread in Europe

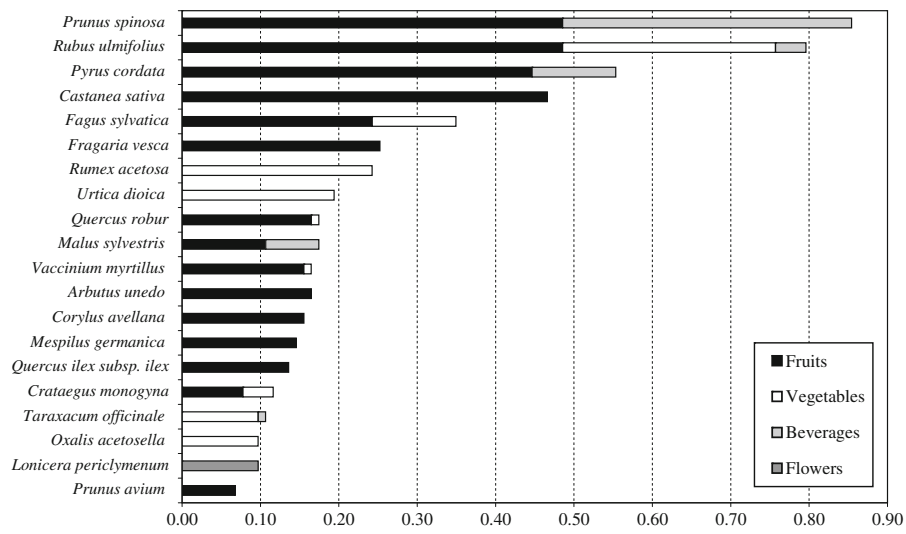

Fig. 2 Cultural importance index (CI) of the 20 most relevant wild edible plants of Gorbeialdea with the CI component of each use-category

(Guarrera 2006; Tardío et al. 2006; Pardo-de-Santayana et al. 2007; Fajardo 2008). Although we could not find any contemporary references of the elaboration of cider with *P. cordata* fruits, according to the historical references reviewed (de Herrera 1513) it is likely that this kind of beverage was more common in the past.

According to our informants, most of the reported food-uses are totally abandoned or only seldom practiced nowadays since they are commonly regarded as old fashioned, too time-consuming famine food, and are no longer gathered. We could only verify the current use of 21 species, most of them (16) by less than five informants (Table 1). There are only few food-uses that are common today: preparing a home-made liqueur made with *Prunus spinosa* fruits called *patxaran*, eating the fruits of *Castanea sativa*, *Fragaria vesca*, and *Rubus ulmifolius*. Interestingly, preparing jam with the latter species and *patxaran* seem to be modern customs in the area.

Most of these species grow in managed ecosystems of the surroundings of the *baserriak*, roadsides, hedgerows or pastures. These habitats were daily visited while tending the livestock and other farming activities.

Cultural importance and diversity of the use-categories

Table 2 shows the cultural importance and diversity of the food-use categories. The use-category 'fruits' stands out for its highest CI, more than four times the CI of the next category. This category has both the highest proportion of species (45%) and of UR (62%). There are several species with many UR in this category. More than half of the species have more than 10 UR, having also the highest mean number of UR per species (17.45). The next category in importance was 'snack vegetables' (35% of spp. and 15% of UR). It has a relatively high number of species, but the mean number of UR per species is nearly four times lower than in the category 'fruits'. These data indicate that a lot of people know about many edible fruits, and a few people know about a great variety of snack vegetables. Additionally, eight species were used as 'processed vegetables', seven were consumed as 'beverages', seven were used for sucking their 'flowers', and four for 'seasoning'. The mean of the UR per species was in general quite low in all these categories, except for 'beverages' with more than 10, especially due to the high number of UR of *Prunus spinosa*. Even in these categories with a low mean of UR per species, we found one or two species which stand out with a much higher number of use-reports.

As shown in Table 2, in all the categories but 'fruits' and 'beverages' we found that a high percentage of the species were reported by less than three informants. The small number of people referring to each food-use might be related to a strong erosion of traditional knowledge during the last century, and/or to previous variation in the individual knowledge of wild edible plants, with certain people knowing more and/or different food-uses than others.

Two different types of erosion can explain this strong loss of knowledge and practice. Firstly we can assume a general erosion trend with less people conserving this knowledge, and therefore less people referring to each food-use. Secondly, a different erosion of traditional knowledge among the categories, as has been found in other Iberian areas (Aceituno-Mata 2010; Gómez-Baggethun et al. 2010) and other parts of the world (Reyes-García et al., under review). Some food categories tend to suffer less erosion and therefore, within them several species whose knowledge is still shared by a high number of informants can be found. This may be the case of

Table 2 Cultural importance and diversity of the food use-categories and subcategories considered

Use-category	# species	CI	UR	Mean UR/species	# sp. with UR < 3 (%)	# sp. with UR > 10 (%)
FRU	22	3.73	384	17.45	4 (18%)	13 (59%)
VEG	22	1.32	136	6.28	12 (55%)	4 (18%)
VEGs	17	0.91	94	5.53	10 (67%)	3 (18%)
VEGp	8	0.41	42	5.25	5 (62%)	1 (12%)
BEV	7	0.70	72	10.29	1 (14%)	2 (29%)
FLO	7	0.19	20	2.86	4 (57%)	0 (0%)
SEA	4	0.11	11	2.75	2 (50%)	0 (0%)

'fruits' in the studied region or 'vegetables' in Sierra Norte de Madrid (Aceituno-Mata 2010). These food-uses are still highly appreciated in their respective areas and people continue reserving some time for gathering these species.

On the contrary, other use-categories such as 'flowers' or 'snack vegetables' seem to have experienced stronger erosion. Therefore, these use-categories are represented by fewer and more dispersed reports and most species have a small frequency of citation. This may be explained by the deep changes in the way of life of the *baserri* in the last four or five decades. Children nowadays have access to candies and many kinds of sweets that substitute many of the wild edible plants that children consumed in the past. Furthermore, nowadays children do not need to make long walks for going to school nor stay long time in the field herding livestock, so they have fewer opportunities to gather those plants. Adult activities have also changed a lot. In the past shepherds or charcoal burners had to sleep in the field while taking care of livestock or charcoal. Therefore, food-uses that were more commonly practiced when people passed many hours in the field, such as sucking sweet flowers or consuming thirst or hunger quenchers, are nearly abandoned nowadays.

As mentioned above, variation in knowledge of wild edible plants may also explain the small number of UR of certain food-uses. For instance, some snack vegetables such as *Pteridium aquilinum* were mainly consumed by specific groups within the community such as shepherds or charcoal burners. This can be also true for species that were not common throughout the region such as *Arbutus unedo* that was only abundant in two of the villages visited.

Fruits

Besides being the most important, this use-category was also the most diverse as the fruits of 22 wild species were reportedly eaten. Similar results have been found in other surveys carried out in the north of the Iberian and Italian Peninsula (Ghirardini et al. 2007; Pardo-de-Santayana et al. 2007).

According to the number of use-reports, the most important wild fruit species were *Rubus ulmifolius* and *Prunus spinosa* (50 informants), followed by *Castanea sativa* (48), *Pyrus cordata* (46), *Fragaria vesca* (26), and *Fagus sylvatica* (25). *Rubus ulmifolius* berries, although mainly consumed in the field, are also used nowadays by some people to make jam. The fruits of *P. spinosa* were directly consumed in the field after the first frosts, when they became overripe to avoid astringency. As it was said before, the consumption of the fruits of *Pyrus cordata* is not so common in other parts of the north of the Iberian Peninsula. However, in this area these wild pears were traditionally harvested in autumn, while fern bracken was gathered for livestock bedding. Although also eaten in the field, they were typically placed in bundles of straw or hay to help ripen and acquiring a sweet flavour, like other fruits such as *Mespilus germanica*.

According to our results, the most relevant wild species in the daily diet of the *baserri* was likely *Castanea sativa*. Chestnuts were stored in the field inside their spiny cupules in rudimentary constructions consisting of circular unroofed dry-stone walls, called *kirikiñausi.* They were also stored buried and covered with fern fronds. They were mainly consumed cooked, boiled with salt, roasted, or raw in the field.

Other fruits commonly consumed were *Corylus avellana* (reported by 16 informants), still consumed nowadays. The fruits of *Quercus robur*, *Arbutus unedo* (17), *Vaccinum myrtillus* (16), *Quercus ilex* subsp. *ilex* (14) and *Malus sylvestris* (11) seem to have been frequently consumed in the past, but not anymore.

In the region, *Quercus* and *Fagus* fruits form a folk category labelled *uzkurrek*. The most valued *uzkurrek* were that of *Fagus sylvatica*, followed by *Quercus ilex* and *Q. robur*, being the latter the most bitter. *Quercus* acorns have been mainly eaten raw and ripe to avoid its excessive bitterness called *zumikea*. People also roasted *Quercus* acorns or grinded them into flour to make a flat cake called *talo,* or a black bread that some people called *ogi baltza*. It is clear that acorn consumption has played an important role in the past as in other Iberian regions (Pardo-de-Santayana et al. 2006; García Gómez 2009).

Vegetables

As shown in Table 2, a high number of species (22) were consumed as vegetables, mainly as snacks (17) but some of them (8) also brought home and consumed processed cooked or in salads. Three of them (*Plantago lanceolata, Rumex acetosa* and *Urtica dioica)* were consumed either as snacks or processed.

Snack vegetables

The most diverse subcategory of vegetables was snack vegetables (17 species). Most of them were just chewed, swallowing the juice and spitting out the fibres. People said that these plants were consumed as a pastime, as thirst quenchers, appetite suppressants or to enjoy its flavour.

In the study area, the most important species in this category were *Rubus ulmifolius* (28), *Rumex acetosa* (24), *Fagus sylvatica* (11) and *Oxalis acetosella* (10). Peeled young shoots of *Rubus ulmifolius* as well as young shoots and leaves of *Rumex acetosa* were eaten raw in spring. The use of *Fagus sylvatica* tender leaves as a masticant was mainly associated to men who worked in the field, such as shepherds or charcoal burners. The young leaves and shoots of other trees and bushes were also chewed (*Crataegus monogyna*, *Robinia pseudacacia, Quercus robur, Ulex europaeus, Vaccinium myrtillus*). Finally, *Pteridium aquilinum* fiddle heads were consumed, in a similar way.

The richness of chewed plants is outstanding and reflects the singularity of Gorbeialdea, since many of the species in this category had not been reported as thirst quenchers in other Iberian ethnobotanical surveys. The consumption of young shoots and leaves of trees and bushes has been scarcely reported in previous Iberian literature, with the exception of *Rubus* sp. pl., *Rosa* sp. pl., *Crataegus monogyna, Laurus nobilis* or *Berberis vulgaris* L. (Tardío et al. 2006). Other herbs species frequently reported as thirst quenchers or breath refreshers in Spain are *Foeniculum vulgare* Mill. (e.g. Tardío et al. 2002; Sánchez-Romero 2003; Parada 2008) or *Scandix australis* L. (e.g. Mesa 1996; Verde et al. 1998; Fajardo 2008).

In the ethnobotanical literature reviewed about Mediterranean and European wild edible plants, masticants seem to have played a marginal role as well. In these studies, the percentage of masticants is markedly lower than in Gorbeialdea. However, in East African cultures they have shown a much more relevant role among wild edible plants (Johns 1996; Johns et al. 2000).

Processed vegetables

Only eight species have been consumed as processed vegetables both cooked or in salads in the area. The most important was *Urtica dioica* (19), which was usually eaten stewed in omelette, followed by *Taraxacum officinale* (10), consumed stewed or raw in salads. A significant number of interviewees (19) mentioned the consumption in salads of *berroak,* a plant complex that includes various water plants (*Apium nodiflorum, Rorippa nasturtium-aquaticum, Veronica becabunga*).

There is a general feeling among the interviewees that the consumption of some wild vegetables is not traditional in the area. In fact, many people referred to the consumption of wild asparagus, wild onions, or even the watercress as 'foreigner's food' or food consumed by migrants from the south of Spain. Although many of those migrants have been living in the area for more than 40 years, as they were not born there, their customs are not easily disseminated or adopted by the native population.

As stated in other regions of the north of Spain (Pardo-de-Santayana et al. 2005; San Miguel 2004), people reported not having suffered famine during and after the Spanish Civil War (1936–1939). Informants reported that home gardens provided enough vegetables and fruits, so they did not need to resort to wild food resources even during that period.

Beverages

Among the seven species used as beverages, the most quoted were *Prunus spinosa* (38), *Pyrus cordata* (11), and *Malus sylvestris* (7). These species were mainly used to make liqueurs and cider. Wild fruits such as *Prunus spinosa, P. cerasus, Pyrus cordata, Malus sylvestris* or herbs such as *Chamaemelum nobile* were traditionally soaked in liquor during several months. According to our respondents, although liqueur preparation was not a widespread custom in the past, nowadays many people elaborate a liqueur, called *patxaran*, with the fruits of *Prunus spinosa.* Most informants agree that this is a modern custom in the region. Since this liqueur is marketed at a large scale, it is possible that *Prunus spinosa* may have a higher social valuation than other wild species.

Another important but forgotten beverage was a traditional cider, called *pitikin*, made with the fruits of *Pyrus cordata* and *Malus sylvestris* that was reported by a few informants (7). Wild pears and apples were harvested, crushed, and put into a barrel. After fermentation, *pitikin* could be bottled or drunk directly from the barrel. The term *pitikin* also refers to liqueurs

prepared with *Malus sylvestris* and *Pyrus cordata* and sometimes to other simple beverages elaborated with crushed grapes or apples.

Among the non-alcoholic drinks reported, three informants referred that children used to prepare a beverage mixing sugar, water and *Rubus ulmifolius* fruits that received the name *sasiardaua* (false wine).

Flowers

We only recorded seven species which flowers were sucked or eaten for obtaining their sweet nectar, being *Lonicera peryclimenum* (10), *Aquilegia vulgaris* (3) and *Trifolium pratense* (3) the most cited. According to our informants, the consumption of flowers was especially common during childhood. People consider it more a children amusement than a feeding behaviour.

Seasoning

As happened with the category of cooked vegetables, the custom of using herbs for seasoning was not very popular in Gorbeialdea with only four species reported. For instance, only six interviewees used *Laurus nobilis* and only one used *Origanum vulgare,* two very important herbs in other northern Iberian regions (Pardo-de-Santayana et al. 2007) including the neighbour Biscayan region of Karrantza (G. Menendez, personal observations). The first species was used for seasoning stews and the latter as a condiment for pork black pudding (*odoloste*). More people (16) reported having used *Mentha* species for flavouring milk and *talosopa*, a kind of soup made with hot milk and pieces of corn cake. A few leaves were added on the milk while it was boiling. Although most people (12) used cultivated species, wild mints (*Mentha suaveolens*, 3; *M. aquatica*, 1) were also used in the preparation.

The scarce use of plants for seasoning may be related with the resistance in the region to be conquered by Al-Andalus Muslims in the Middle Ages. The high esteem of spices and seasoning plants did not penetrate in the region as did in other Iberian regions (García-Sánchez 1997), a trend that persists even nowadays.

Medicinal edibles

It is a well-known fact that many wild food plants are also used as medicines (Etkin 1996; Bonet and Vallès 2002; Guarrera 2003) and that the nutritional and medicinal role of many species is intermingled. In general, these plants are known as nutraceuticals (Etkin and Johns 1998; Heinrich et al. 2005).

Etkin and Ross (1982) proposed a food-medicine continuum in which the categories of spices and beverages have an intermediate position. However, data from this study suggest that none of these two use-categories have a clear medicinal role in the region. First, the use of condiments is very scarce in Gorbeialdea. An exception was the use of mints for seasoning milk, since it was recommended against intestinal worms. Second, the use of herbal teas in Gorbeialdea cannot be considered a nutraceutical since it is mainly linked to pathological processes and are only seldom consumed in a food context as can be seen in other Iberian cultures (Pardo-de-Santayana et al. 2005, 2007; Tardío et al. 2006).

On the contrary, the importance of 'snack vegetables' in Gorbeialdea might be due in part to the hidden medicinal role of chewing leaves and stems while being in the field. The role of masticants as a source of phytochemicals in populations living a traditional subsistence life-style has been previously highlighted by Johns et al. (1996). This likely primitive behaviour might have some relation with the prophylactic effect of secondary chemicals present in leaves and other plant parts. As stated by Johns et al. (1996), diets that are rich in animal products and concentrated carbohydrate lack the prophylactic effects of diets rich in a range of plant allelochemicals from leaves and non-processed foods. The inclusion of wild leaves and shoots in the local cuisine of Gorbeialdea is very rare, but they are consumed in a casual way chewing these plant parts in the field. Therefore, chewing and spitting the leaves might be a way to keep up the secondary compounds of wild plants in the diet, avoiding the excess of fibre linked to their ingestion. Masticants might be a missing link in the food-medicine continuum.

Stigmatized Foods

When we asked direct questions about acorn (*uzkurrek*) consumption, we realized that the local term not only referred to *Quercus* fruits, but also to *Fagus sylvatica* fruits. Figure 3 shows the CI fruit component of the three species called *uzkurrek* (*Fagus sylvatica*, *Quercus robur* and *Quercus ilex*) before and after the closed question about its consumption had been made.

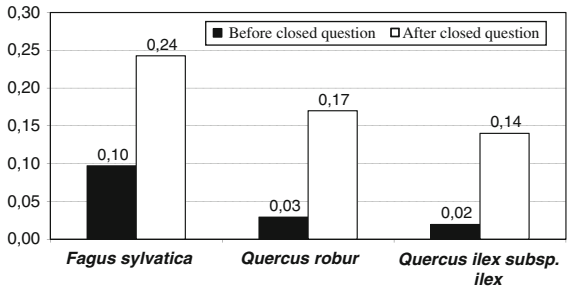

Fig. 3 CI-fruit component of the three stigmatized species before and after the closed question about its consumption had been made

As wild staples or widespread species such as *Castanea sativa* or *Rubus ulmifolius* were mentioned by around 50% of the respondents without any direct question, we can accept this figure as a normal percentage of oversight. This was the case in *Fagus sylvatica*, with a little more of 50% of increase (CI passed from 0.10 to 0.24), but not in *Q. robur* or *Q. ilex* subsp. *ilex*, where the increase of positive answers after the direct question was 5 times (CI passed from 0.03 to 0.17) and 6 times (CI passed from 0.02 to 0.14), respectively.

The cultural facts related to the consumption of these plants may explain these differences in reports. In the study area, *Quercus* fruits are mainly considered a food for livestock, especially pigs. Furthermore, people that reported the use of acorns emphasized that they ate it only during scarcity times, in particular the post-war period. Moreover, some people told us that eating acorns retarded child growth and considered it a toxic food. Other people associated its consumption with people from the south of Spain, and considered acorns 'foreigner's food'.

Therefore, despite acorns have been consumed until recent times, their consumption have negative connotations and they were not quoted spontaneously. Social stigmas linked to the consumption of other wild edibles have been reported in other regions of the world (Cruz-García 2006). This stigma has clear methodological implications. If we only would have done open questions, such as those made when using free listing techniques, for not conditioning the informant's answer, significant information would have not been recorded during our field work in Gorbeialdea.

In a review of several ethnobotanical studies carried out in other northern Iberian regions (Pardo-de-Santayana et al. 2007), the human consumption of fruits of *Quercus* was not registered, with the exception of Picos de Europa. Whether this absence is real or due to a stigma has to be further studied. In other Iberian regions where the consumption of *Quercus* acorns was common until 1960, this social rejection has also been detected (García Gómez 2009).

Conclusions

After this first systematic ethnobotanical prospection on the wild food plants of the south of Biscay, the three following conclusions can be highlighted (1) the area displays specificity of wild edible plant uses, including a high diversity of masticants, (2) there is a prevalence of the use-category fruits and low valorization of condiments and some elaborated vegetables, and (3) there are methodological implications of the stigmatization of acorn consumption.

Although the number of species consumed in the region is lower than the number of species consumed in other Iberian areas, Gorbeialdea shows significant specificity. An important number of new and uncommon uses have been reported when compared with other Iberian and European regions. Some examples are the consumption of *Pinus radiata* seeds, *Fagus sylvatica* young leaves or *Pyrus cordata* fruits for preparing a kind of cider. There were many other unreported edible uses of ligneous plants that were chewed as thirst quenchers and appetite suppressants. These plants might also have a non-explicit prophylactic medicinal function.

The second conclusion relates to the prevalence of the use-category 'fruits', which is shared with other regions in the north of the Iberian and Italian Peninsulas (Ghirardini et al. 2007; Pardo-de-Santayana et al. 2007). The importance of fruits in these cultures might be related to their pleasant flavour and a higher content of carbohydrates than vegetables, which turns them a valuable food resource. Fruit diversity and availability are also higher in the northern regions of these Peninsulas than in the South and Center. On the contrary, condiments and some elaborated vegetables are poorly valued in Gorbeialdea and many informants considered them as 'foreigner's food'.

Last, the consumption of *Quercus* acorns seems to be stigmatized and has therefore been unnoticed by some ethnographers. Interview techniques based in closed systematic questions have shown very interesting

results for capturing this stigma, highlighting the need for systematic enquiry when conducting ethnobotanical research (Molina et al. 2009; Polo et al. 2009; Reyes-García et al. 2010).

The consumption of wild edible plants in Gorbeialdea was mainly linked to traditional management activities such as tending livestock, charcoal burning or fern harvesting. In some cases it was also linked to casual walks in the woods, such as walking to the school. As these activities are not common anymore, people have also abandoned those behaviors associated to them. Moreover, the consumption of many wild edible plants is regarded as an old fashioned custom, too time-consuming famine food, and as consequence wild edible plants are no longer gathered in the area. As mentioned in other surveys (Bonet and Vallès 2002; Della et al. 2006), it is urgent to document the traditional knowledge related to wild food plant uses in Mediterranean countries before it is too late.

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