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Original Paper

Wild edible plants of the Central Mountains in Argentina. Comparing subregions to understand the complexity of local botanical knowledge

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Abstract

This work evaluates similarities and differences in the processing and consumption of wild flora in three subregions of Central Argentina. It aims to both deepen the knowledge of present local food culture and to contribute to the interpretation of the archaeobotanical data previously generated in the area. Open and semi-structured interviews were conducted in each subregion and the cultural importance index was calculated for each mentioned plant. A total of 45 species and 24 practices were listed and, while 42% of the taxa were common to the subregions, 33% of the species (*e.g.*, *Ximenia americana* in the north) and 25% of the practices (*e.g.*, "milanesa" in the west) were mentioned exclusively in one of them. These particularities were attributed to both ecological (*i.e.* plant availability) and socio-cultural factors (*i.e.* presence of neo-rural settlers). Our results enhanced our understanding of the local botanical knowledge of the entire mountain area, increasing the understanding of the region as a biocultural system and contributing to the conservation of the area. Moreover, the comparison between the taxa mentioned in the present and those listed in previous archaeobotanical studies in the area, showed that 78% of the wild taxa recovered from archaeological sites are mentioned in the present (*e.g.*, *Lithraea molleoides*). Consequently, the present results about food processing are a basis for future studies of the human-plant relationship in the central mountains of Argentina over time.

Key words: Córdoba province, ethnobotany, food plants, knowledge transmission.

Resumen

En este trabajo se evalúan las similitudes y diferencias en el procesamiento y el consumo de flora silvestre en tres subregiones del centro de Argentina. Se pretende así profundizar el conocimiento sobre la actual cultura alimentaria local y contribuir a la interpretación de los datos arqueobotánicos generados previamente. Se realizaron entrevistas abiertas y semi-estructuradas en cada subregión y se calculó el índice de importancia cultural para cada planta. Se registró un total de 45 especies y 24 prácticas asociadas a ellas. Mientras que el 42% de los taxones fue común a todas las subregiones, el 33% de las especies (ej., *Ximenia americana* en el norte) y el 25% de las prácticas (ej., "milanesas" en el oeste) se mencionó exclusivamente en una de ellas. Estas particularidades fueron atribuidas a factores ecológicos (*i.e.* disponibilidad ambiental) y socio-culturales (*i.e.* presencia de pobladores neorrurales). Estos resultados profundizan nuestro conocimiento sobre los saberes botánicos locales de toda el área montañosa, lo cual constituye un importante avance en el conocimiento de la región como sistema biocultural y es de gran relevancia para su conservación. Asimismo, la comparación entre las especies mencionadas en el presente y aquellas enumeradas en estudios arqueobotánicos previos en el área mostró que el 78% de los taxones recuperados de sitios arqueológicos es mencionado en el presente (ej., *Lithraea molleoides*). Por ende, los resultados de este trabajo referidos al procesamiento vegetal actual constituyen una base para estudios futuros de las interrelaciones humano-plantas en las montañas centrales de Argentina a través del tiempo.

Palabras clave: provincia de Córdoba, etnobotánica, plantas alimenticias, transmisión de conocimientos.

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Introduction

Since ancient times, knowledge, collection, and consumption of wild edible plants have been vital activities for many human groups, not only from a nutritional viewpoint but also as an important aspect of their identity (Turner *et al.* 2011). Plants available in the surroundings are still used today, although not frequently; this use has persisted despite the accelerated and drastic changes resulting from globalization, the decline of traditional populations, the loss of natural habitats and the global preponderance of consumption of food provided by the market (Phillips 2006; Turner *et al.* 2011; Reyes-García *et al.* 2015; Aguirre 2017). Similarly, from the biocultural systems perspective (Maffi 2007), the relationships between people and plants are complex and dynamic. A community that is closely and continuously linked with its territory develops a system of knowledge, practices, and perceptions regarding the flora, known as Local Botanical Knowledge (LBK) (Toledo & Barrera-Bassols 2008; Vandebroek *et al.* 2011). Likewise, conceptions about food vary among cultures and are materialized in the diversity of activities for food collection, distribution, preparation and consumption (Goody 1995). In this sense, the choice of wild plants considered as food by each community and the transformations applied to them for their ingestion exceeds the mere environmental availability of taxa. Indeed, understanding LBK requires considering socio-cultural aspects, such as beliefs, cosmologies, relationship with other communities and urban centers, as well as the historical and political processes that people have undergone (Reyes-García *et al.* 2005; Arias Toledo *et al.* 2007; Biurrun *et al.* 2007; Pardo de Santayana *et al.* 2007; Bortolotto *et al.* 2015). Thus, the dependence of a community on biodiversity for its livelihood and cultural identity is expressed in LBK about food.

Ethnobotanical investigations conducted in the central mountain area of Argentina identified many botanical species currently recognized as edible by their inhabitants, as well as various products made with them (Arias Toledo *et al.* 2007; Torrico Chalabe & Trillo 2015; Martínez *et al.* 2016; Trillo 2016; Saur Palmieri *et al.* 2018; Fernández & Martínez 2019; Sánchez 2019; Saur Palmieri & Geisa 2019). However, the stages involved in the transformation of natural commons into food have been accurately described on few occasions. The diagnostic traits in botanical tissues after processing, which are required for archaeological interpretation of macro-remains, are even less detailed (see, for example, Saur Palmieri *et al.* 2018, 2019). Likewise, in Cordoba province, comparative studies between subregions describing certain local variations related to wild edible plants are scarce (Arias Toledo *et al.* 2007; Arias Toledo 2008). This has led to a homogeneous conception of the LBK about edible species, in particular about associated processing practices in the entire region. In contrast, archaeological studies in the area suggested interzonal differences in subsistence during the Late Pre-Hispanic Period (1500–350 BP), which could include divergences in plant selection and consumption (Recalde & López 2017; López 2018). Answering these archaeological questions is part of the aim of a major ethnobotanical-archaeological research project and requires other lines of evidence (such as those from ethnobotany conducted in this study).

Thus, this article aims to document and compare the diversity of wild edible plants known by the inhabitants of the north, central, and west subregions of the mountains of central Argentina, and how those species are prepared for consumption. The selection of subregions is based on the location of the archaeological sites whose archaeobotanical material is currently under analysis (Recalde & López 2017; López 2018). Thus, on the one hand, we expect to deepen the knowledge of the particular factors contributing to the diversity of preparations and production techniques that make up the local food culture; on the other hand, we intend to contribute to the detailed description of the current food processing activities that are necessary for the interpretation of archaeological remains.

Material and Methods

Study area

The present work was conducted in three subregions of the central mountains of Argentina, specifically in Córdoba province. Each subregion was delimited following López (2018), and towns and villages were chosen according to their proximity to archaeological sites under study. Thus, the north subregion included Cerro Colorado and its surroundings, the center included Las Chacras and Estancia Vieja, and the west was represented by Tala Cañada and its surroundings (Fig. 1).

The vegetation of this region belongs to the Chaco Serrano District, dominated by xerophilous-subxerophytic forests intermixed with grass steppes. In this study, we focused on the altitudinal belt of the woodland, between 500 and 1,300 m a.s.l. (Giorgis *et al.* 2017). At the regional scale, the floristic composition changes with altitude, latitude, and east-west rainfall gradient. At the local scale, disturbances have contributed to a highly heterogeneous system, with significant changes at short distances (Giorgis *et al.* 2017; Martínez & Manzano-García 2019).

In the north subregion, Cerro Colorado is located 160 km away from Córdoba city (province capital) and has approximately 285 inhabitants (INDEC 2010). The main economic activities are small and medium-scale family farming devoted to goat and cattle rearing, informal employment in ranches, sale of handicrafts and manufactured goods, and other occupations such as employment in small businesses, public employment, and rural tourism (Arias Toledo 2008; Cáceres *et al.* 2011). The advance of industrial agriculture in recent decades in the north of the province has generated a large out-migration of peasants to large urban centers (Cáceres *et al.* 2011).

In the central subregion, Las Chacras, 80 km away from the capital city, is a small village -of a few scattered houses- close to Villa Giardino (a locality of 6,810 inhabitants mostly settled in an urban area, INDEC 2010). Despite the high population growth resulting from the expansion of the neighboring city, Las Chacras retains its rural character. As the name of the village indicates, agriculture (formerly horticultural production, now corn) and cattle raising were traditionally practiced in the area, and are still practiced. On the contrary, Estancia Vieja (located 50 km away from Córdoba city and part of its Metropolitan Region), is a community of 909 inhabitants (INDEC 2010), with a high degree of urbanization. Its growing population is closely linked to tourist activity, due to its proximity to Villa Carlos Paz (with a large tourist influx).

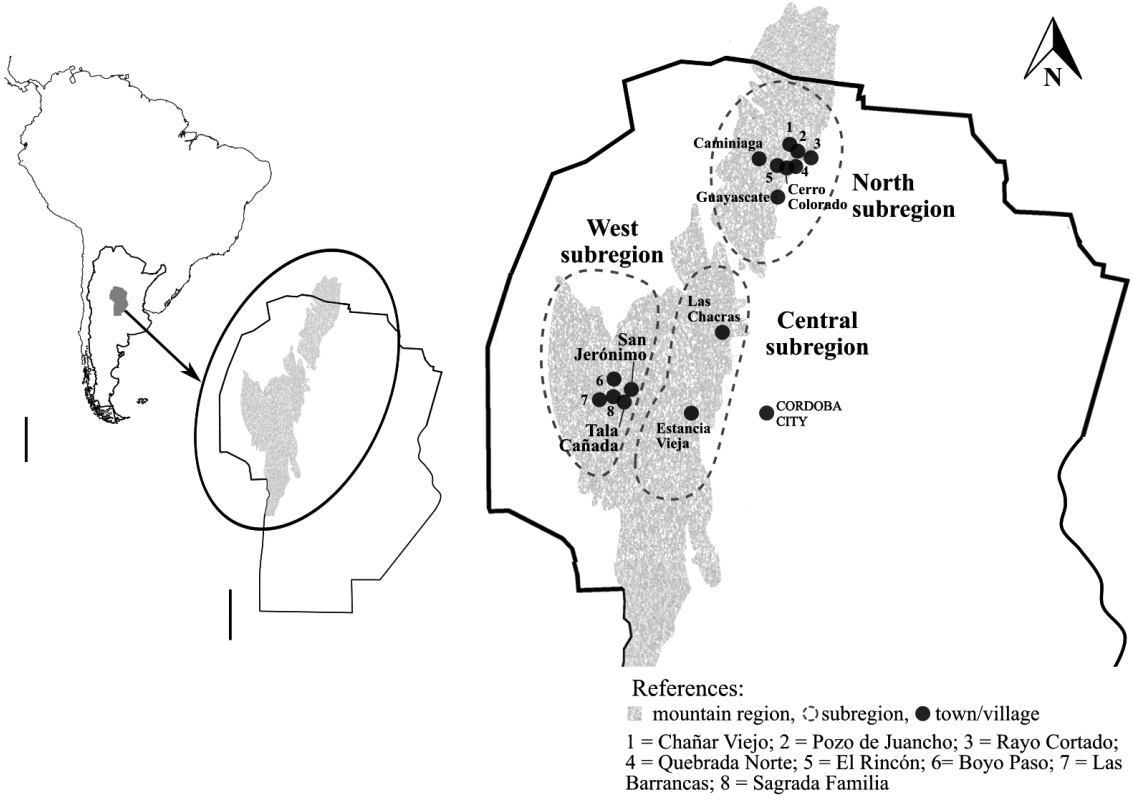

Figure 1 – a-c. Study area – a. location of Córdoba province, Argentina; b. mountain region (expanded in c); c. communities in north, west, and central subregions where the study was developed. Scale: a = 1,000 km; b = 100 km.

Tala Cañada, a town located in the west subregion and 130 km away from Córdoba, has 254 inhabitants (INDEC 2010), and most of them are dedicated to goat, sheep, and bovine raising, which is a traditional activity in the area. They also raise poultry and cultivate orchards and fruit trees. Other sources of income are jobs in the public administration and in small businesses. Collection and sale of medicinal herbs are also quite common. In addition, people recently moved from urban centers live in the area, who dedicate to family small-scale production of fruits and vegetables and the sale of cosmetics based on natural ingredients and bakery products at local fairs.

Fieldwork

Collaborators were selected using the snowball technique (Bernard 2006). We first visited the communities and contacted local referents (park rangers, community leaders and other authorities). They allowed us to establish contact with possible collaborators from the different communities, locally recognized for their knowledge about edible flora and food preparation. On the first meeting with each possible collaborator, we presented the research project and he/she was invited to participate. We also asked each collaborator to recommend someone else to interview. The informed oral consent was obtained from each interviewee, as indicated in the Code of Ethics of the Latin American Society of Ethnobiology (Cano-Contreras *et al.* 2016). Subsequently, open or unstructured interviews were conducted (Albuquerque *et al.* 2014), focusing on edible wild plants. The bond of trust was deepened with some of the collaborators, which made it possible to visit them several times and carry out semi-structured interviews with the support of photographs and herborized plants (Albuquerque *et al.* 2014). Thus, the wild species considered edible, the tools used, and the ways of processing and consuming them were explored (Capparelli *et al.* 2014; Saur Palmieri *et al.* 2019), as well as other related data, such as modes of knowledge transmission. The information was recorded in a field notebook and the mentioned plants were documented according to the local taxonomy, *i.e.*, as ethnospecies independent of the scientific classification categories and named with a folk name (Reyes-García *et al.* 2006; Badini *et al.* 2017). When possible, the specimens mentioned by the collaborators were collected, herborized and deposited in the Botanical Museum Herbarium of Córdoba (CORD) or the Biological Diversity Department (FCEFyN-Universidad Nacional de Córdoba). If it was not possible to collect an ethnospecies indicated by the interviewees, it was taxonomically identified in the field. In both cases, identifications allowed us to establish the correspondences with the academic botanical taxa (Zamudio & Hilgert 2015). They were based on Zuloaga *et al.* (2008) and the names were updated according to Tropicos (2021).

Fieldwork in the north subregion has been conducted since 2015, while the west and the center subregions were incorporated in 2018[1].

The origin of the interviewees was included in our analysis because this characteristic was highly mentioned during the conversations, including the explicit distinction of the use of certain plants according to people's provenance. On the one hand, "born and raised"[2] inhabitants, according to the native category documented by Quirós (2019), belong to families related to rural work and spent most of their lives in the region. On the other hand, some people have settled recently in the mountain area. They are known as neo-rurals, since they out-migrated from large cities to live more peacefully. Neo-rural collaborators who participated in this study have a great connection with rural life, since they are small-scale horticultural and fruit producers.

Data analysis

The results of the interviews were analyzed qualitatively; the species and practices mentioned in each subregion were compared, and the origin of the collaborators was considered. This approach was complemented with the estimation of the cultural significance of each ethnospecies in each subregion, using the Cultural Importance Index (CI, Tardío & Pardo de Santayana 2008). The CI was calculated as the sum of all the relative frequencies of references to each practice carried out with the ethnospecies (with frequencies being related to the total number of collaborators in the subregion), using the following formula: $CI = \Sigma P_i / N$, where P_i is the number of records of the practice i (i ranges from 1 to the total number of activities mentioned for the ethnospecies in the subregion, U) and N is the total number of collaborators in the subregion. The values obtained consider not only the dispersion in the number of practices mentioned by the interviewees for each ethnospecies, but also the diversity of food uses mentioned (Tardío & Pardo de Santayana 2008; Singh *et al.* 2016).

Ethnobotanical / archaeobotanical comparison

We compared the species mentioned by the interviewees from the current whole region with archaeobotanical data, updated and unified by López *et al.* (2020). These authors detailed a list of plants used by past communities in the Late Pre-Hispanic Period from previous archaeobotanical investigations in the area with macro- and micro-remains. The former remains include charred fruits and fragments of fruits recovered by fine-sieving, whereas the latter remains consist of phytoliths and starch grains found in pottery fragments, grinding tools, bone instruments and dental calculus (*e.g.*, Recalde & López 2017; López 2018; Tavarone *et al.* 2019).

Results

The number of interviewed people amounted to 15 in the north subregion (five in Cerro Colorado, three in El Rincón, two in Rayo Cortado and one in Pozo de Juancho, Quebrada Norte, Caminiaga and Chañar Viejo, respectively), 11 in the west subregion (five in Tala Cañada, two in Sagrada Familia, two in San Jerónimo, one in Boyo Paso and one in Las Barrancas), and three in the center (one in Las Chacras and two in Estancia Vieja) (Fig. 1). The age of the collaborators (68% women and 32% men) ranged between 35 and 88 years. In addition, 93% of them have lived for a long time in the region, whereas two interviews, those conducted in Sagrada Familia, involved neo-rural inhabitants (who moved to the village five and 15 years before the study).

A total of 40 wild plant ethnospecies mentioned as edible by the interviewees were recorded. In the north subregion the inhabitants mentioned 29 ethnospecies, while in the central and the west 22 and 28 were cited, respectively. Of the total amount of ethnospecies, 45 botanical taxa were identified (one was undetermined). Native species (35 spp.) were more frequently mentioned than exotic ones (10 spp.). In the north subregion, 35 species of the Linnaean classification (30 native and five exotic) were determined from the interviews. Also, in the central subregion, 28 taxa were recognized (22 native, five exotic, and one unidentified), whereas in the west subregion, 33 species of the academic categorization were recorded (26 native and seven exotic) (Tab. S1, available on supplementary material <https://doi.org/10.6084/m9.figshare.21350235.v1>). In addition, the interviewers mentioned seven edible plant parts: cladode, flowers, fruits (ripe and unripe), leaves, stem apex, tuber, as well as branch latex. The fruit was the plant organ most frequently mentioned: 36 species (80%) with edible fruits were mentioned, whereas the other plant structures were represented in a lower proportion of species (edible cladode, stem apex and tuber, one species each; two species with edible branch latex; four species with edible leaves and nine species with edible flowers).

Twelve species (27%) were mentioned in the three subregions, with high CI values for all of them (> 0.50): *Capsicum chacoense* Hunz. ("ají del campo"), *Condalia buxifolia* Reissek, *C. montana* A. Cast. and *C. microphylla* Cav. ("piquillín"), *Geoffroea decorticans* (Gillies *ex* Hook. & Arn.) Burkart ("chañar"), *Opuntia ficus-indica* (L.) Mill. ("tuna"), *Passiflora caerulea* L., trees of the genus *Prosopis*, known as "algarrobo blanco" (*Prosopis alba* Griseb. and *Prosopis chilensis* (Molina) Stuntz) and "algarrobo negro*"* (*Prosopis flexuosa* DC. and *Prosopis nigra* (Griseb.) Hieron.), and *Salpichroa origanifolia* (Lam.) Thell. ("uvita del campo") (Fig. 2). These ethnospecies were the ones with the highest number of records and with many associated practices. The consumption mode common to all these ethnospecies is raw as a sweet snack, unprocessed, except for the *C. chacoense* berry, which is dried (sometimes ground) to be used as a seasoning in sausages and sauces (although it is also used fresh). In addition, the elaboration of "arrope" was highly mentioned as a product made with the most significant taxa. This is a syrup made by prolonged cooking of fruits (of different species, see Scarpa 1999; Saur Palmieri *et al.* 2018) to increase the concentration of their sugars. It is consumed as a dessert; in the north subregion, it is cooked with flour to thicken it and used as a filling for "empanadillas" (a baked or fried turnover consisting of pastry and filling).

Concerning *Condalia* species, the local inhabitants distinguished subtypes based on differences in fruit color. In the north, they mentioned the "piquillín negro" (black piquillin), "anaranjado" (orange) and "rojo" (red) or "orco" (meaning "from the mountains"). In the center they also recognized three types, the "rosado" (pink), "negro" (black) and "colorado" (red), whereas in the west, they referred to those types as "rojo" (red), "amarillo" (yellow) and "negro" (black). However, although three different subtypes of the ethnospecies were mentioned in each subregion and

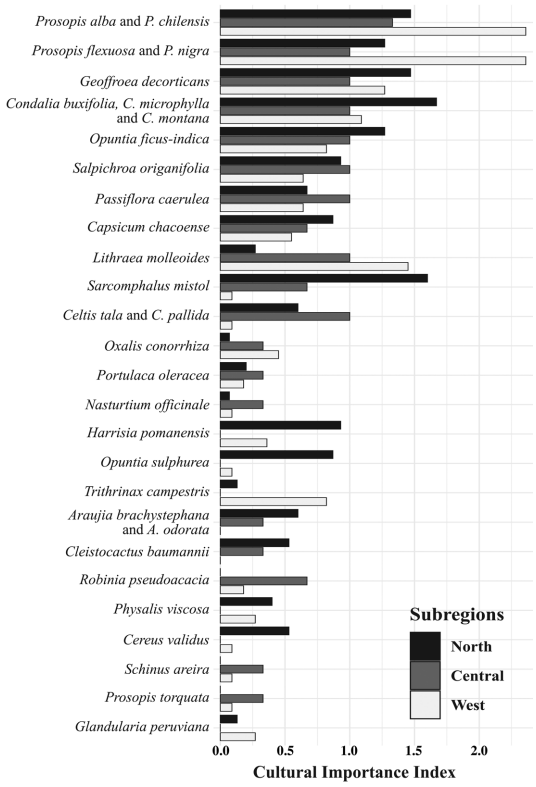

Figure 2 – Cultural importance of the most significant species.

the same number of botanical taxa were present, the local classification of each subregion did not necessarily coincide with the local classification of the other subregions or with the academic taxonomy. Anyway, the collaborators reported that there are no differences in the practices carried out with the different plant subtypes, *i.e.* if they find more than one "piquillín" with ripe fruits in the field, they collect and process them together.

Other seven plants (16%) were also mentioned in all the subregions, although in some of them the cultural importance was low (CI < 0.50), either due to a lower number of records or a lower number of associated culinary activities. These plants were *Lithraea molleoides* (Vell.) Engl., *Sarcomphalus mistol* (Griseb.) Hauenschild, *Celtis tala* Gillies *ex* Planch., *C. pallida* Torr., *Oxalis conorrhiza* Jacq., *Portulaca oleraceae* L. and *Nasturtium officinale* W.T. Aiton (Fig. 2). Additionally, species mentioned in two or all of the subregions differed spatially in their level of significance, depending on the number of practices attributed in each locality and the number of times they were mentioned in each area.

On the other hand, differences were observed between subregions regarding species and practices, with unique records in each of them. In the north, seven exclusive plants were mentioned: *Gymnocalycium schickendantzii* (F.A.C. Weber) Britton & Rose and *Stetsonia coryne* (Salm-Dyck) Britton & Rose, *Dioscorea microbotrya* Griseb., *Myrcianthes cisplatensis* (Cambess.) O. Berg., *Ximenia americana* L., *Taraxacum officinale* F.H. Wigg., and *Prunus persica* (L.) Batsch. For the former two, which belong to the Cactaceae family, the direct consumption of unprocessed fruits was mainly mentioned. Furthermore, the use of the tuber of *D. microbotrya* ("alpa sandía") to quench thirst was mentioned; this tuber has whitish flesh and water content. The collaborators mentioned that this underground organ was occasionally found in the recent past during field tasks involving soil removal (digging, plowing, etc.). This is the first record of the species in Córdoba and, although the present work focused on the mountain system, its use by the inhabitants of the northeastern plain of the province has also been mentioned. In addition, an interviewee expressed that the consumption of the fruit of *M. cisplatensis* ("mato") is unusual, although she tasted it. On the other hand, *X. americana* ("albarillo") is eaten raw.

Three species were exclusive to the center: *Margyricarpus pinnatus* (Lam.) Kuntze, *Pyracantha* sp. and "margarita". The fruit of *M. pinnatus* ("perlilla") is consumed raw when it is occasionally found in the field. Additionally, a collaborator stated that *Pyracantha* sp. ("crateus") is consumed by children, but that she had not tried it. Moreover, the white flowers of *Margarita*, an ethnospecies that has still not been collected for taxonomic identification, were consumed unprocessed in the past.

In the west, five unique species were mentioned. A liquor is made by fermenting the fruits of *Schinus fasciculata* (Griseb.) I.M. Johnst. ("moradillo"). The immature seeds of *Vachellia caven* (Molina) Seigler & Ebinger ("espinillo") are fermented before their ingestion or are consumed boiled. Likewise, the consumption of leaves of *Urtica* sp. ("ortiga") and *Amaranthus hybridus* L. ("ataco") in the form of "torrejas", and of the polydrupes of *Rubus ulmifolius* Schott ("zarzamora"), was mentioned. The first three species mentioned were associated with neo-rural inhabitants.

The fruits of *Schinus areira* L., known as "aguaribay" or "gualeguay", are used in the center and the west as a seasoning. In the same subregions,

the pods of *Prosopis torquata* (Cav. *ex* Lag.) DC. ("tintitaco") were mentioned as edible. An interviewee from Las Chacras argued that such use was common during her childhood in the northern provincial sector (north subregion). She reported that these pods were chewed to taste their sweetness. However, she said that she has not found the species in the area where she currently lives. By contrast, in the west, the tree is recorded in the vicinity of the home of the collaborator who mentioned it.

In addition to the differences found in the taxa among subregions, particularities in the practices were also observed. For example, in the north and west subregions, reference was made to the consumption of the soft stem apex of *Trithrinax campestris* (Burmeist.) Drude & Griseb ("palma caranday"), called "cogollo", whereas the use of its fruits was mentioned only in the west subregion. In the three subregions, the use of *L. molleoides* drupes ("molle de beber") was referred to as a sweetener in "mate" (stimulating infusion made of *Ilex paraguariensis* A. St.-Hil., "yerba mate"). However, the preparation of "aloja", an activity carried out in the recent past, was only mentioned in the west subregion. The fruits were collected by hitting the branches of the tree, which fell on a previously placed blanket. Subsequently, they were soaked in water and macerated at room temperature without reaching fermentation; a non-alcoholic beverage was obtained with this procedure. Another interviewee from the same subregion recalled the boiling of *L. molleoides* and the addition of sugar for its fermentation to obtain "aloja", an alcoholic beverage. Moreover, the fruits of *Celtis* spp., which are consumed in the center and the north, were related to the preparation of "arrope" only in the latter subregion.

Sarcomphalus mistol ("mistol") drupes are consumed unprocessed in the three subregions; however, differences about practices were found. Some activities were only mentioned in the north: the storage of its paste in small wooden boxes, the preparation of "arrope", jelly, "bolanchao" (also called "pichico", a ball-shaped candy made by crushing the fruit and coating it with corn [*Zea mays* L.] or *Prosopis* spp. flour, keeping the stones inside) and used boiled, dry and rehydrated. Furthermore, in the same subregion, the "arrope" of *Celtis tala* and *C. pallida* and the compote of *S. origanifolia* are known.

The fruits of *Araujia brachytephana* (Griseb.) Fontella & Goyder and *Araujia odorata* (Hook. & Arn.) Fontella & Goyder ("tasi") are eaten raw in the north and the center subregions, and, in the latter, it was indicated that during lactation mothers usually ingest the internal part, since it is thought that these fruits have galactogenic properties. Moreover, in the north, the interviewees referred to the use of those fruits in meals (such as soup), and its capacity to curdle milk was highlighted, which is done by pouring drops of latex released by this vine. In addition, the ripe fruit of *Passiflora caerulea* ("pasionaria" or "granadilla") is consumed fresh throughout the mountain region, in fruit salads in the center, and cooked in compote in the north. It is used in its immature state, boiled, or sautéed, by recent settlers. The cactus *Opuntia ficus-indica* was frequently mentioned, and its fruit is eaten raw or used to make "arrope" in all subregions. Likewise, the neo-rural inhabitants of the west subregion mentioned the collection of the paddles ("palas" in Spanish), the removal of thorns by scraping or burning and making "milanesas", coating them with eggs and breadcrumbs, and then cooking them in the oven. Moreover, the berries of *Physalis viscosa* L. ("tomatito") are eaten raw in the north and west and, in the latter subregion they are used to make jam.

Moreover, the production of "arrope" of various fruits may or may not involve the use of mortar. Particularly, a collaborator from the west subregion reported that the crushing of *G. decorticans* drupes in mortar for cooking "arrope" did not break the stones (they are very hard); this information is relevant to archaeobotanical studies, which require details of plant transformations during processing. Moreover, in the case of *Condalia* spp., in the west its prolonged boiling was mentioned, which dissolves the mesocarp and does not require kneading for the release of sugars.

On the other hand, and although fruits were the most relevant edible plant organs, the reference to flowers stands out, for example, of *Oxalis conorrhiza* ("vinagrillo"). In addition, in the center and the west, flowers of *Robinia pseudoacacia* L. ("acacia") are used to prepare "torrejas" or "tortillas", *i.e.*, salty preparations mixed with eggs to form a paste that is cooked in the pan. In turn, in the north and west, the flowers of *Glandularia peruviana* (L.) Small ("verbenita roja") are consumed fresh, even by children.

Additionally, interesting differences in the LKB were detected between the inhabitants "born and raised" in the rural area and the interviewees who have just settled in the place. The latter mentioned species and practices that are not used

or performed by the former cultural group. The most notable case is that of liquor made of *Schinus fasciculata*, a plant that has not been mentioned as edible by the native inhabitants. The infusion of the *Harrisia pomanensis* (F.A.C. Weber *ex* K. Schum.) Britton & Rose ("ulúa") flower was also exclusive to neo-rural settlers, as was the food use of *V. caven*, *Urtica* sp., and the cladodes of *O. ficus-indica,* as previously noted. Concerning *Urtica*, as well as the use of the immature fruit of *Passiflora caerulea*, those who have inhabited the place since childhood related it to the newcomers.

Another aspect that emerges from the interviews is the different transmission routes of knowledge related to edible wild flora. In general, traditional collaborators mentioned that their parents or grandparents taught them about plants. An inhabitant of Cerro Colorado even related how her daughter teaches her grandson which wild plants can be eaten. Likewise, some interviewees from the west reported having taken courses, and that they occasionally read information about vegetables in books and on the internet. However, these ways of acquiring knowledge are more linked to newcomers, who also consult native inhabitants about the uses of plants. The reading of specific bibliography is very notable among neo-rural people; for example, when referring to a plant, they use its scientific name ("That is the *Berberis* ..", female collaborator of Tala Cañada). It was verified that local people also taste new plants, as mentioned for *M. cisplatensis*. Similarly, a female collaborator from the north subregion was enthusiastic and expressed the desire to try the *Broussonetia papyrifera* (L.) L'Hér. *ex* Vent. species, cultivated as an ornamental in some localities of the region but not considered edible, when one of the authors mentioned the fact that it is usually consumed in other places (*e.g.*, Fernández & Martínez 2019).

Concerning archaeobotanical data, and as Lopez *et al.* (2020) reviewed, to date there are nine wild taxa identified in the central mountains of Argentina. According to the result of this study, seven of them (78%) are considered edible plants and are used at present. Among them, *G. decorticans*, *L. molleoides*, *Prosopis* sp. and *S. mistol* stand out, because they are among the most significant wild edible species of current communities (Fig. 2). As indicated in previous studies, there is certain continuity in their consumption between the Late Pre-Hispanic Period and the present (López 2018; Tavarone *et al.* 2019; López *et al.* 2020). Nevertheless, as already indicated in this study, the current use of *T. campestris* is remarkable for people from both periods of time. Moreover, the genus *Oxalis* is present in the archaeobotanical record and in LBK. However, while archaeological micro-remains suggest the use of its tuber (López *et al.* 2020), we recorded that current local communities take advantage of its flowers and stems. Although a species from the genus *Amaranthus* was mentioned in the interviews, it corresponds to an introduced taxon (*A. hybridus*). Although this particular species was not available in the environment in the pre-Hispanic period, *Amaranthus* is included in the archaeological taxa recovered in Córdoba as part of the *Chenopodium* sp./*Amaranthus* sp. complex. However, more studies are necessary to establish links between the consumption of the wild species of Amaranthaceae over time.

Discussion

In this study, carried out in the central mountains of Argentina, the interviewed inhabitants mentioned 40 wild edible ethnospecies (corresponding to 45 botanical taxa), which is a considerable number in comparison with other studies conducted in the sector (13 species, Arias Toledo *et al.* 2007; 19 species, Arias Toledo 2008; 10 species, Trillo 2016; 36 species, Fernández & Martínez 2019). Likewise, the fruit was the edible plant organ associated with most of the species listed (80%), in agreement with studies in the area (Arias Toledo *et al.* 2007) and in other regions of the world (Pardo de Santayana *et al.* 2007). The use of other plant structures was also mentioned (cladode, flowers, leaves, stem apex, tuber, and branch latex), as well as 24 forms of use, with the most important ones being eaten raw or used to prepare "arrope", fermented beverages and fruit storage being.

This initial comparative approach among the north, center, and west subregions of the central mountains of Argentina showed similarities and differences in the LBK on edible wild plants. First, many of the identified taxa (42%) were recognized as food in the three subregions, although the cultural importance (measured by the CI index) varied among sites. Such is the case of *Condalia* spp., *S. mistol*, *Prosopis* spp. and *G. decorticans*, which were highlighted as the most common in other ethnobotanical studies conducted in the same mountain area (Arias Toledo *et al.* 2007; Saur Palmieri *et al.* 2018; Fernández & Martínez 2019). In addition, the latter two taxa are part of

the group of plants with the greatest ubiquity in the archaeological sites of the central mountains (López *et al*. 2020). Second, dissimilarities were observed in the modes of using known species in more than one subregion. For example, *L. molleoides*, *S. origanifolia*, *Celtis* spp., *Araujia* spp., and *S. mistol* are used in some subregions in a mode that is not practiced in other subregions. Thus, *S. mistol* drupes are used in multiple modes in the north subregion (ground, pulped, dried, boiled) and *L. molleoides* in the west (dried, boiled, soaked, fermented). Likewise, in the same subregion, reference was made to the production of *G. decorticans* "arrope" by crushing the fruits in the mortar, a technique not documented in previous works carried out by the authors in the north (Saur Palmieri *et al.* 2019). The record of this technique, added to the reference of the transformations that occurred in the plant material, is of great importance for the interpretations of archaeological macro-remains. Indeed, the endocarps of *G. decorticans* found in the archeological sites of Córdoba correspond only to fragments that were possibly broken before its deposition in the past (Saur Palmieri *et al.* 2017).

Third, there were differences in the plants recognized as edible. One third (33%) of the identified taxa were mentioned exclusively in one subregion. The reasons that could explain these results are diverse and must be analyzed for each plant separately. On the one hand, ecological factors linked to the local biogeography determine the presence of species in a place and enable their finding and use (Ochoa & Ladio 2011). This is the case of *M. cisplatensis* and *D. microbotrya*, which were mentioned only by the inhabitants of the north subregion, since it is the only sector of the study area where these species are distributed (Documenta Florae Australis 2021). Likewise, the LBK related to the two cacti mentioned only in the north could be related to the abundance of these taxa in that subregion which, as we confirmed, is higher than in other places where they are also present (Documenta Florae Australis 2021). On the other hand, the opposite occurs in the case of *P. torquata*. An interviewee that lives in Las Chacras, an area where *P. torquata* tree is not present, mentioned having used these fruits in her childhood in the north. The same was detected for *S. mistol* in the center (although it is not a species exclusive to this subregion): two interviewees referred to its consumption but clarified that this tree does not grow near their homes. One of them remembered it from her childhood in the north, whereas the other might have eaten it because someone gave her fruits collected elsewhere. Therefore, *P. torquata* and *S. mistol* are part of the LBK of the central subregion and are a clear example that supports the dynamic and complex character of LBK: the presence of a species does not necessarily imply its use as food, and vice-versa, as Scarpa (2009) reported for the native communities of the Gran Chaco (northeastern Argentina). Furthermore, some species such as *P. viscosa*, *G. peruviana* and *M. pinnatus*, are widely distributed in the region (Documenta Florae Australis 2021), but were mentioned only in some of the subregions (the former two in the north and west, and the latter in the center). Likewise, the neo-rural inhabitants of the west use plants that were not mentioned in other subregions. In this sense, and as Arias Toledo (2008) concluded, it is the socio-cultural dimensions of the communities that ultimately allow us to understand the subregional particularities in the choice and processing of wild plants.

Among all the species mentioned in this work, the fruits and stem apex of *T. campestris* are particularly important. The use of the drupes as food was reported for other Argentine regions (Coluccio 2005). Particularly, for Córdoba province, Lorentz (1876) mentioned the use of fresh fruits of *T. campestris*, as well as in jam and as an alcoholic beverage. Toledo *et al.* (2015) agreed with these findings and added the practices of roasting and boiling, although they did not indicate which communities conduct these activities. Maqueda (1985) reported this palm tree as edible from interviews carried out in Cerro Colorado, but did not mention the structure used or how it is ingested. Regarding the use of the "cogollo" (pith of the stem apex and basal part of the leaves), Martínez (2012) recorded the food use of *Trithrinax schizophylla* Drude and *Trithrinax biflabellata* Barb. Rodr. by the *Qom* in northeastern Argentina, and Arenas (2003) indicated the roasting or boiling of *T. biflabellata* stem apex, which can also be eaten accompanied by fat. Furthermore, in a recently published review, Suárez *et al.* (2020) expressed the great value that Great Chaco peoples have given to the "cogollo" over time. Moreover, the author specified four modes of consumption of *T. schizophylla* stem apex: eaten raw, boiled, roasted on the fire and baked in the oven. In addition, Scarpa (2009) mentioned the food use of the *T. campestris* pith among the *Wichi*[3]. Thus, the results presented in this article are the first ethnobotanical record of the apical structure consumption for the

central mountain region in Argentina. Moreover, there was no ethnobotanical basis that could suggest the edible use of *T. campestris* in the central mountains of Argentina in the past (Tavarone *et al.* 2019; López *et al.* 2020). Therefore, palm micro-remains frequently found in archaeological sites from Córdoba have been mostly interpreted as belonging to leaf and associated with manufactured goods. Therefore, our results are important because, to date, and although this taxon is the only one species of Arecaceae present in the area (Demaio *et al.* 2015), it has not been possible to reliably clarify the mode of use of this natural common. In this sense, the edible character of the fruits and the stem apex of *T. campestris*, as part of the LBK of the current communities of the west and north subregions of the study area, allows us to reinforce the hypothesis of continuity in the consumption of this palm between the pre-Hispanic past and present.

Likewise, the reference to the edible underground storage organ of *D. microbotrya* is worth noting. Although there was a previous record about the ingestion of this type of plant structure in the vicinity of the north subregion (Saur Palmieri & Geisa 2019), in that study the taxon was not determined. Thus, this is the first record of the food use of this plant structure for the central mountain area, with previous records corresponding to northern Argentina (Spegazzini 1923; Arenas & Giberti 1993; Martínez *et al.* 2014). The consumption of *G. peruviana* flowers, which was indicated as LBK in other regions (Steibel 1997; Riat 2016; Rosso & Scarpa 2017), is also first reported for the study area.

Furthermore, an important differentiation in the LBK in terms of species and practices between cultural groups was observed. The inhabitants of urban origin who recently settled in the mountain area have been interested in learning about the local flora and its uses; indeed, they read books and take courses, a way of acquiring knowledge also reported by other authors (Fernández & Martínez 2019). Moreover, they carry out a true autobotanical task (*sensu* Baldauf 2019), by investigating, through talks with their *native* neighbors, about plants and their uses (not only food but also medicinal and others) and subsequently applying that LBK. Thus, and as has been observed in other countries (Ghirardini *et al.* 2007), knowledge about edible wild species is undergoing two simultaneous processes: LBK erosion, caused by the irruption of industrial agriculture, which has reduced the native forest cover and hindered social reproduction of peasant families in rural areas, and certain contemporary trends in the *rescue* of knowledge, especially among young people from urban sectors interested in its revalorization.

To conclude, the present comparative approach showed similarities and differences in the LBK of edible wild plants of the present-day communities of three subregions in the central mountains of Argentina. In this sense, a considerable number of species (45 taxa) was observed throughout the whole sector, and specific plants (33% of the total taxa) and practices (25% of 24 in total) were found at the subregional scale. The high number of edible species and practices mentioned indicates the great importance that the vegetation of the mountains of Córdoba have to local communities.

Moreover, to understand LBK, besides ecological factors, it is necessary to introduce other dimensions to the analysis, such as the differences between cultural groups living in a site, the ways of transmitting knowledge, as well as changes and continuities in plant processing across different time scales. Since LBK is shaped and transformed through a close link between human communities and their environment, the complexity involved in knowledge and practices related to plants can be understood only by broadening the scope of analysis. Although further studies of the central subregion are necessary, the first differences among subregions were established. The particularities of species and present practices in each subregion documented in this work contribute to the deconstruction of the tacit idea of LBK homogeneity previously assumed for the mountain area of Córdoba (see Río & Achával 1905; Pastor *et al.* 2012). In addition, these results enrich the knowledge about the regional food diversity and deepens the information about how local people use their environment which, from a biocultural perspective, must be considered in conservation programs (Maffi 2007; Vandebroek *et al.* 2011). Moreover, since wild native species were the most frequently mentioned (77% of the identified taxa), our results indicate the great importance that native forest and collection of wild plants have in local food culture. Wild exotic plants were also mentioned (33% of the total taxa), and they are used as food in the mountain area. Hence, and in agreement with Chamorro & Ladio (2021), we argue that introduced taxa contribute to enrich and increase the complexity of LBK.

Since the plants present in the mountainous region are of great significance in the local food identity, it is necessary to take into account local actors' perspective in conservation projects (Martínez & Manzano-García 2019).

Furthermore, in this study, we found that 78% of the wild taxa recovered in archaeological sites to date are recognized as edible by communities from the present. In addition, those botanical species now have a high cultural importance. The information recorded here about the use of wild plants by the surveyed inhabitants of the central mountains may contribute with future elaboration of models for the interpretation of macro-botanical remains; indeed, based on archaeobotanical evidences from whole sites excavated in Córdoba, López (2018) showed the possible existence of subregional differences in the selection of species and consumption practices towards approximately 400 AD.

Thus, a current information database that allows the elaboration of hypotheses of past plant use is being consolidated. Considering that, most of the wild botanical taxa archaeologically recovered from the central mountain region of Argentina to date are mentioned in the present (Tab. S1, available on supplementary material <https://doi.org/10.6084/m9.figshare.21350235.v1>), the comparison of ethnobotanical and archaeological data becomes fundamental to understand changes and continuities in the use of these plants over time.

Notes

[1] The social isolation measures implemented in 2020 and 2021 because of the COVID-19 pandemic hindered the continuation of the ethnographic work. For this reason, we only used the interviews performed until the end of 2019, since they have provided enough information to meet the objectives proposed in this work while we wait to resume the activities.

[2] "Nacidos y criados" (Quirós 2019), our translation.

[3] To consult more data about the use of the stem apex of another Arecaceae species in the south of South America, see Hilgert *et al.* (2020).

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