

Gastronomic uses of forgotten foods such as chacha fruit and loquat

Usos gastronómicos de los alimentos olvidados como el chachafruto y el níspero

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Abstract

Forgotten foods are species relegated from the gastronomic scene as a consequence of a series of economic, historical and cultural changes that have caused them to be undervalued. The objective of this research was to investigate the uses of the Chachafruto (*Erythrina edulis*) and the Medlar (*Manilkara zapota*).

The research was divided into phases: 1. Interviews in market squares in the city of Bogotá seeking to establish the level of knowledge and availability; 2. Physical and bromatological analyses. 3. Application of recipe transformation and standardization techniques. 4. Sensory panel. The results obtained highlight the lack of knowledge of the two species and low availability. Products such as wrappers, chancacas, fritters, pasta, cookies, pickles were generated; which presented a high level of acceptance, evidencing a preference for the consumption of sweet preparations made from Níspero. In conclusion, both species have a high potential to be transformed

Keywords: native foods, endemic species, regional cuisine, gastrobotany

Resumen

Los alimentos olvidados son especies relegadas del panorama gastronómico como consecuencia de una serie de cambios de carácter económico, histórico y cultural que ha generado que sean subvaloradas. El objetivo de esta investigación fue indagar sobre los usos del Chachafruto (*Erythrina edulis*) y el Níspero (*Manilkara zapota*).

La investigación se dividió en fases: 1. Entrevistas en plazas de mercado de la ciudad de Bogotá buscando establecer el nivel de conocimiento y disponibilidad. 2. Análisis físicos y bromatológicos. 3. Aplicación de técnicas de transformación y estandarización de recetas. 4. Panel sensorial.

Los resultados obtenidos, destacan el desconocimiento de las dos especies y baja disponibilidad. Se generaron productos como envueltos, chancacas, buñuelos, pasta, galletas, encurtidos; los cuales presentaron un alto nivel de aceptación, evidenciando una preferencia por el consumo de preparaciones dulces hechas a partir de Níspero. En conclusión, las dos especies cuentan con un alto potencial para ser transformadas.

Palabras clave: alimentos nativos, especies endémicas, cocina regional, gastrobotánica.

1. Introduction

The term "forgotten foods" refers to plant species that have been relegated from the diets of the world's population and, as a consequence of a series of political, historical, environmental, economic, and cultural changes, are in danger of extinction (Global Forum on Agricultural Research [GFAR], 2011). These changes over the years have led to the loss of food species worldwide (Gonzales, 2008), which is why organizations such as the Food and Agriculture Organization of the United Nations (FAO), the World Health Organization (WHO), and the Global Forum on Agricultural Research (GFAR), pioneers in agriculture, nutrition and food security, have allocated resources and efforts for the revitalization of undervalued crops. The aim is to preserve the genomes of plant species with high nutritional value, thereby ensuring food security for vulnerable populations, mitigating food shortages, and strengthening the economies of small farmers through the trade of these plant species in local markets (GFAR, 2021).

However, these efforts have been overshadowed by various factors, including the low supply and demand for these foods in the market, as well as a partial lack of knowledge about the gastronomic and nutritional value provided by their consumption (GFAR, 2021). In Colombia, 22 plant species were recorded until 2019, including fruits and tubers such as *Erythrina edulis* (chacha fruit), *Manilkara zapota* (loquat), and *Hieronyma macrocarpa* Müll.Arg. (motilón), *Chrysobalanus icaco* L. (icaco), *Annona cherimola* Mill (custard apple), and *Annona squamosa* L. (anón), just to mention a few examples. These species, due to their low yields or the lack of knowledge among villagers, have seen a gradual decline in production in recent years, as they do not generate significant profits for small producers and farmers. Consequently, they have opted to replace these crops with more commercially viable ones (Alvarez et al., 2019).

The world's largest seed bank, located in Svalbard, houses more than 65,000 food species. It

promotes the cultivation of these plant species in small farming communities through entrepreneurship and crop substitution programs, which include hundreds of varieties of beans, cassava, and forages, aimed at preventing their extinction and encouraging their consumption (Gonzales, 2022). Other entities, such as the Botanical Garden of Bogota (JBB), promote the cultivation and propagation of some undervalued species, which, through research on their benefits, allow the identification of possible uses at the gastronomic and industrial level in order to promote their local consumption (Botanical Garden of Bogota, 2022). According to the above, of the 22 plant species identified at the national level, two were selected as the objects of study: the chacha fruit (*Erythrina edulis* Triana ex Micheli) and the Loquat (*Manilkara zapota* (L.) P.Royen).

The chachafruto, also known as balú, nupo, baluy, poroto, sachaporoto, jite, frisol calú or frijol de árbol (Acero et al., 1992). It is a native food of South America; its scientific name is *Erythrina edulis*, and it belongs to the Fabaceae family.

Its tree can reach heights of between 14 and 25 meters, and its fruit is spherical, ranging from reddish to brown, depending on its ripening stage. Its average diameter ranges from 2.5 to 7 cm (Molano, 2005). Its cultivation extends along the Andes mountain range in the sub-Andean forest zone (Prieto & Colonia, 2018). Regarding the ancestral uses attributed to chacha fruit, we find its sowing associated with the propagation of coffee or lulu crops, as it helps fix nitrogen in soils, an essential nutrient for the cultivation of other plant species. Its consumption as feed for fattening animals is widespread nowadays. However, there are records of its use for the preparation of sancochos, custard, recipes, salads, cakes, coladas, fried foods, compotes, empanadas, and cookies (Acero et al., 1992).

The loquat, on the other hand, is an exotic fruit; its scientific name is *Manilkara zapota*, and it belongs to the Sapotaceae family, genus *Mani-*

lkara (Royen, 2007), which comprises more than 700 species and over 40 genera. A tree native to the Americas, its growing area is in tropical and subtropical climates at an altitude of 1200 m or less above sea level (Karle Pravin & Dhawale Shashikant, 2019). Its tree can reach 25 to 40 meters in height, and its fruit presents an ovoid or circular shape with a diameter of approximately 6 to 9 cm. Its pulp is fibrous, juicy, sweet, and reddish brown; its peel is brown with a rough texture (Karle Pravin & Dhawale Shashikant, 2019). Each fruit contains 2 to 12 seeds. These have a flat oval shape and a shiny black color, approximately 1 cm in diameter (Carrillo, 2022). It is also known as zapotilla, níspero de monte, níspero de anís, chicle, or chicozapote. Regarding its gastronomic uses, it is usually consumed fresh in juices, ferments, jams, and preserves (Buitrago et al., 2004). According to figures

from the Ministry of Health, loquat consumption at the national level is 1%; the departments where this fruit is most produced and consumed are Guajira and Atlántico with 2.2% of people, Sucre with 1.4% at the regional level and Magdalena with 0.3% (Ministry of Health and Social Protection, FAO, (2013)).

The purpose of this research was to investigate the gastronomic uses of two vegetable species cataloged as forgotten foods, such as chacha fruit (*Erythrina edulis*) and Loquat (*Manilkara zapota*), to apply transformation techniques (dehydration, addition of sugar, thermal treatments, pH modification, described in the document Transformation and Culinary Preparations of High Andean Species (Torres & Corzo-Barragán, 2019), in order to diversify their form of consumption.

2. Materials and methods

Species selection

Two species were identified: Chachafruto (*Erythrina edulis*) and Níspero (*Manilkara zapota*). These were selected based on two criteria: first, they were classified as forgotten foods according to the group of endangered native species mentioned in the article by Álvarez et al. (2019), and second, their availability in the local capital market.

Experimental design

The development of this research was divided into four stages: (1) interviews in marketplaces in Bogotá, and (2)

species in question.

This format enabled the collection of both qualitative and quantitative data, including knowledge of cultivation areas, gastronomic and medicinal uses, memories associated with consumption, common names, harvest seasons, and consumption preferences, as well as quantitative data such as the level of knowledge, weekly sales in kilograms, frequency of consumption, and sales prices.

2.1. Interview in marketplaces

For the development of this stage, a semi-structured interview was used as a data collection instrument with 16 open and closed questions to measure the level of knowledge about the two

The sampling method was non-probabilistic, intentional, or convenience-based and was applied with prior informed consent. A previous survey was conducted among the sales stalls of the selected marketplaces to identify the distributors of the selected species. Thus, the interview was conducted with those who attended the sales stalls, comprising a sample of 60 people distributed as follows: 17 people at Paloquemao Market Square, 13 people at Siete de Agosto District Market Square, and 30 people at Las Ferias District Market Square.

2.2. Physicochemical and bromatological analyses

Physicochemical and bromatological analyses were conducted to determine aspects such as Brix degrees, pH, firmness (kg/cm), moisture content (%), total ash, crude protein (g), and fiber percentage, following the procedure described by Corzo and Plazas (2019). These data were obtained through primary and secondary sources.

2.3. Application of food preservation techniques and recipe generation.

For this stage, a total of 18 recipes were selected that obeyed three essential criteria: affinity with applied transformation techniques described in the document transformation and culinary preparations of high Andean species (Hernández et al., 2019); classification as high consumption products according to reports from ([ANDI], Asociación Nacional de Empresarios de Colombia, 2023) the gastronomic identity associated with the regional cuisines of Colombia ([ANDI], Asociación Nacional de Empresarios de Colombia, 2023). These recipes were: capacity negra fritters, envueltos, yogurt, chachalacas, pickled, chutney, arequipe, jam, bocadillo, fruit sauce,

fruit cheese, flavored oatmeal, bean casserole, frijoles cream, flavored rice pudding, sponged, starch extraction for panders elaboration, composite flours for making roscón with a substitution percentage of 15%, Ojo de buey cookie with a substitution percentage of 15%, pasta with a substitution percentage of 50% and buñuelos de Antioquia with a substitution percentage of 50%.

2.4. Sensory evaluation in untrained panel

The first group consisted of 20 children aged 7 to 13 years, for whom a format based on the 5-point facial hedonic scale was used. The second group consisted of 50 visitors to the Botanical Garden of Bogotá, aged between 18 and 65 years, who, after filling out the informed consent form, used the format based on the 5-point mixed hedonic scale, where criteria of taste, aroma, texture, appearance, and preference were evaluated.

After data collection, a factor analysis of variance (ANOVA) was performed to determine the significant differences in the average evaluation of each rating attribute (aroma, appearance, flavor, and texture) across at least two products at a significance level of 0.05. For this purpose, the 13 products subjected to the sensory panel were grouped into two categories according to their sensory qualities, specifically sweet and savory.

3. Results

3.1. Interviews in marketplaces

The results of the interviews revealed that of the 60 stalls interviewed, only 10 sell chacha fruit, of which 20% claim to sell between 11 and 14 kilos per week; in the case of loquat, of the 60 stalls surveyed, only three stalls sell loquat, of which 33% claim to sell only 3 kilos per week. The cost per kilogram of chacha fruit ranges between \$6,000 (1.35 USD) and 7,000 pesos (1.56 USD), while loquat is between \$9,000 (2.03 USD) and \$12,000 (2.71 USD) per kilogram; these prices vary according to the harvesting season.

Only 32% of those interviewed claimed to know either of the two species. Of these, 9% know the loquat, and 23% know the chachafruto. Respondents were asked about the names they use to identify these two plant species; for the species *Manilkara zapota*, 37% said they knew it as sweet sapote, another 37% knew it as loquat, and 13% said they recognized it as zapotilla. On the other hand, the species *Erythrina edulis* was recognized as Balú (62%), Chachafruto (29%), and 6% recognized it as proto, pites or chugas.

Regarding the frequency of consumption, 40% of the respondents stated that they consume chacha fruit once a month, followed by special occasions with 27%. As for loquat, 43% stated that they consume it according to its availability in the market.

As reported by the respondents on the origin of the species, (11.67%) reported that the chacha fruit came from Boyacá, and loquat (5%) reported that it came from the Caribbean zone. Regarding the harvest season for chacha fruit, most interviewees stated that it is grown throughout the year, while the loquat harvest was reported for December (5%) and June (3.33%).

The most common uses of the two species are human and medicinal consumption. The most popular forms of consumption of chacha fruit are soups and cooked dishes (43%) and sweetened beverages (33%); as for loquat, its most common consumption is associated with juices (72%) and jellies (14%).

3.2. Physical and bromatological analysis:

The results of the physicochemical and bromatological analyses are listed in (Table 1).

Table 1: Characterization of chacha fruit and Loquat.

Source: a. Corzo-Barragán D.C. (2023) b. (Karle Pravin & Dhawale Shashikant, 2019).

PHYSICAL CHARACTERIZATION		
	CHACHAFRUTO	NESPERO
Brix degrees	5.76	13.0
pH	6.5	5.4
Firmness (kg/cm2)	2.46	5.6
Edible part (%)	44	80
Total fruit weight (g)	165.76	275.4
Polar diameter (cm)	4.5	100.0
Equatorial diameter (cm)	2.02	50.0
BROMATOLOGICAL CHARACTERIZATION		
	CHACHAFRUTO ^a	NESPERO ^b
% humidity	84.59	77.7
Total ash (g)	0.94	0.4
Crude protein (g)	19.32	0.6
Fiber	3.5	3.2

3.3. Selection of recipes and transformation techniques applied:

The selection of recipes was based on the physical aspects of the food, so the application of some transformation techniques would enhance the organoleptic characteristics. The application techniques used are described in (Table 2); a total of 15 products were generated.

For the selected products, which were transformed using the sugar addition technique, the reference for the production of preserves, as described in NTC 285 of 2007-12-1, on the production of jams, sauces, and jellies, was followed, according to the Brix level that corresponds to the production

of the product. The formulation was carried out as shown in (Table 3).

On the other hand, for the preparation of chacha fruit and loquat composite flours (Table 4), the dehydration technique was applied at a temperature of 58 °C for 8 hours for chacha fruit and 15 hours for loquat. The dehydrated food was then processed, and the sample was classified according to ISO 3310-12000 grain size standards, using standard sieves to obtain three samples as follows: sample 1, standard sieve No. 10 with a size of 2.00 mm, sample 2 standard sieve No. 16 with a size of 1.18 mm and sample 3 standard sieve No. 30 with a size of 600µ.

Table 2: List of recipes and transformation techniques applied
Source: Own elaboration.

Applied preservation and processing technology Chachafruit Loquat		
Sugar addition	Fruit sauce	Fruit sauce
	Marmalade	Marmalade
	Arequipe	Sandwich
Dehydration	chacha fruit paste	
	-	Walleye cookies
	chacha fruit and loquat sandwich (Flour)	Buñuelos from Antioquia (fruit flour elaboration)
	Yogurt	Yogurt
Pulping	Wrapped (steaming)	-
	Fritters (Blanching process for mass production)	-
Scalding	Pickle	Chutney

Table 3: Formulation products processing technique sugar addition
Source: Own elaboration.

Preparation	Brix degrees	Formulation
Fruit Sauce (chacha fruit and Loquat)	40°	40% pulp+40%sugar+20%water
Loquat Jams	65°	50% pulp + 50% sugar
Loquat Sandwich	72°	50%pulp + 50%sugar +1%lemon juice+ 1%pectin

Table 4: Formulation of composite flours by dehydration technique
Source: Own elaboration.

Preparation	Percentage of substitution	formulation	Type of sample
chacha fruit paste	50%	50% sour chacha fruit flour +50% semolina	sample 3: standard sieve No. 30 with 600μ measurement
chacha fruit cake with medlar snack	15%	15% fruit sprout flour + %85 wheat flour	Sample 2 standard sieve No. 16 with a measurement of 1.18 mm.
Loquat Cookies	25%	25% Loquat flour + 75% wheat flour	sample 1, standard sieve No.10 with a size of 2.00 mm
Loquat Fritters	25%	25% Loquat Flour + 75% Corn Starch	Sample 2 standard sieve No. 16 with a measurement of 1.18 mm.

Products were also produced using the technique of pulping the two foods, partially substituting the main product, such as the chacha fruit fritters, where 70% of the bean mass was replaced by chacha fruit puree, chacha fruit wraps with 80% substitution of the corn mass by chacha fruit puree, and loquat chutney with 100% substitution of the main product.

Regarding the transformation through thermal treatments, two products were developed: chacha fruit cream (prepared by cooking) from a puree and chacha fruit sponge (prepared by refrigeration) from a chacha fruit milkshake for the elaboration of the pickle, scalding, and pH change were used as transformation methods. The product was then laminated with a thickness

of 3 mm, and subsequently, vinegar and water were added in a proportion of 10% vinegar, 85% water, and 5% salt.

Other products, such as loquat yogurt, chacha fruit yogurt, and loquat and milk rice, used the fruit sauce of the two foods as an additive ingredient after preparing the yogurt base and as an accompaniment in the case of the milk rice.

3.4. Sensory panel

A sensory sampling of salted products: Figure 1 shows the results of the sensory evaluation of the six products in the salted category concerning four attributes that correspond to organoleptic characteristics of the foods to be evaluated, such as aroma, texture, appearance, and aroma, where there is a clear preference for the chacha fruit fritter, whose rating on the mixed hedonic scale exceeded 4. The product least liked by consumers was the Chacha fruit wrap, whose rating, although the lowest, does not indicate a total rejection in terms of taste, appearance, texture, and aroma. The products with the highest scores concerning the evaluation of the four attributes were the chacha fruit Fritter, the chacha fruit Cream, and the chacha fruit Pickle. On the other hand, the chacha fruit wrap and the chacha fruit paste received the lowest scores, with appearance and texture being the determining factors in the qualification of these two foods.

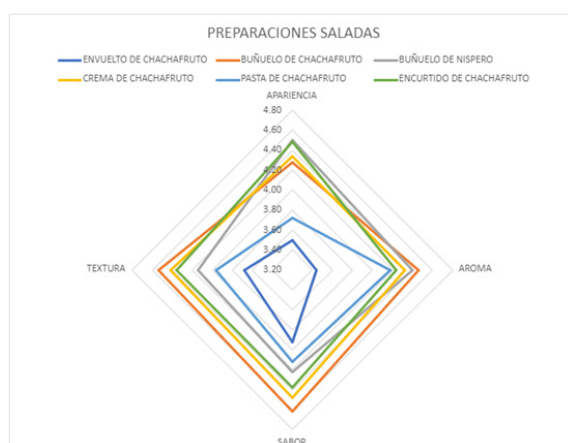


Figure 1: Sensory panel results for savory products
Source: Own elaboration

A sensory sampling of sweet products: Figure 2 shows the results of the sensory panel associated with the nine products of the sweet category evaluated, considering aroma, appearance, flavor, and texture corresponding to the organoleptic characteristics of the foods evaluated; where the most accepted product in terms of flavor was the chacha fruit roscón followed by loquat chancacas and loquat cookies. On the other hand, chacha fruit yogurt obtained the lowest score, followed by loquat yogurt; however, its score was not less than 3.5 on a scale of 1 to 5, indicating that consumers did not entirely reject the product. In terms of appearance, the sponge received the highest rating, while the chutney received the lowest; the aroma of the roscón received the highest rating, and in terms of texture, the loquat jam was the best rated.

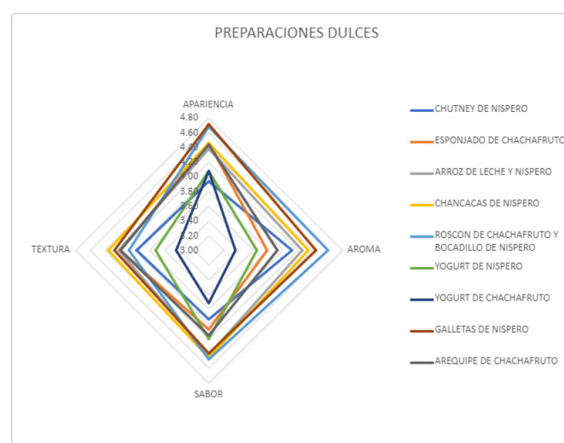


Figure 2: Sensory panel results sweet preparations
Source: Own elaboration

Analysis of Variance by factor (ANOVA)

A 1-way analysis of variance was applied for each attribute with samples grouped in preparations between salty (Table6) and sweet (Table7) compared in their category (Table 5) with the following results.

The Table 6 and the Table 7 show that there are significant differences in the sensory evaluation of both savory and sweet products, respectively.

Table 5: Categories of Sweet and Savory Products
Source: Own elaboration.

Sweet Products	LOQUAT CHUTNEY
	chacha fruit SPONGE
	RICE PUDDING AND LOQUAT
	LOQUAT CHANCACAS
	chacha fruit CAKE AND LOQUAT SNACK
	LOQUAT YOGURT
	chacha fruit YOGURT
	LOQUAT COOKIES
	chacha fruit AREQUIPE
Savory Products	chacha fruit WRAP
	chacha fruit FRITTER
	LOQUAT FRITTER
	chacha fruit CREAM
	chacha fruit PASTE
	chacha fruit PICKLE

Table 6: Analysis of variance: p-value for salted products.
Source: Own elaboration.

Sensory evaluation	p-value	Decision if $\alpha = 5\%$.
Appearance	~ 0 %	Significantly different
Aroma	~ 0 %	Significantly different
Taste	0.28 %	Significantly different
Texture	~0 %	Significantly different

Table 7: Analysis of variance: p-value for sweet products.
Source: Own elaboration.

Sensory evaluation	p-value	Decision if $\alpha = 5\%$.
Appearance	0.14 %	Significantly different
Aroma	~ 0 %	Significantly different
Taste	1.93 %	Significantly different
Texture	1.00 %	Significantly different

4. Discussion

Ethnobotanical studies are important because they allow knowing the traditional uses that have been given to the species according to the geographical area where they are conducted; in Bogotá, they have been conducted in popular markets (marketplaces) where a large number

of plants are marketed (Giraldo et al., 2015), in their study they describe the traditional use of medicinal plants from the knowledge and practices in eight marketplaces in the city of Bogotá, in order to identify promising plants for their therapeutic potential and additionally

evidence the possible irrational use that could be generated in the community.

In this research, interviews conducted in Bogotá marketplaces enabled us to determine the number of stalls where these species are commercialized, the quantity of material sold, and the sale price. This exploration allowed us to identify the common names and the most popular uses.

Rubio et al. (2022) emphasize that the plant species used in gastronomy have elements of cultural heritage, community customs, family relationships, ceremonies, myths, legends, emotions, and scents, among others.

The proximate analysis carried out in the case of Chachafruto coincides with that reported by Márquez (2021) in terms of moisture and protein parameters. However, the percentage of fiber differs, as this research reported 3.5%, whereas Márquez (2021) reported 8%. Likewise, the percentage of ash presents a difference.

As for the processing techniques used, the dehydration of the chacha fruit has been carried out in several studies in order to obtain flour, given its nutritional benefits, the methods of adaptation and processing are similar to those carried out by Conda (2021), but for use in dietary supplements in animals, showing promising results in terms of increased bovine milk production.

For loquat, the results of the bromatological analysis coincide with those reported by Navarro and Vega (2023). In addition, several studies have been conducted on the bioactive compounds present, and they have been used to treat various health symptoms, as they have been reported to be analgesic, anti-inflammatory, and antibacterial (Bashir, 2019).

Regarding the loquat transformation processes (Kaunsar & Shinwari, 2020), jam production was also carried out to extend the shelf life of

the raw material and preserve its organoleptic characteristics.

There is a lack of knowledge about the two species under study, both in the local market and among the participants in the sensory panel, which is exacerbated by the limited supply in the market and high prices. The people marketing these foods often lack accurate information about their origins, harvesting seasons, and production areas.

The chacha fruit enjoys greater recognition than loquat among respondents in marketplaces, who report that their consumption level is low. As for the nutritional contribution provided by the consumption of chacha fruit, it complements the daily diet's protein intake, as well as the fiber contribution from loquat consumption. The two species evaluated have high gastronomic potential, given their versatility in preparing both sweet and savory dishes. Their transformation through the application of preservation techniques is feasible; however, the low yield of the two foods during the dehydration process can lead to cost overruns in the production of flour-based products. On the other hand, the flavor of chacha fruit is more suitable for the production of salt products, while loquat is more suitable for sweet preparations.

The sensory panel revealed that both chacha fruit and loquat products received a high level of acceptance from the participants in the two groups that participated in the panel; however, there was a clear preference for loquat products over chachafruit. Of the 15 products submitted to the sensory panel, only three had an average rating below 4: the chacha fruit yogurt, loquat yogurt, and chacha fruit wrap.

Finally, according to the results, the most popular products were Chachafruto roscones with a loquat sandwich, loquat cookies, and Las Chancacas, indicating a preference for sweet foods, especially among children aged 7 to 13 years.

5. Recommendations

It is recommended to continue researching these species, given their potential, by conducting more detailed studies on their nutritional composition and health effects, as well as exploring the benefits

they provide and examining the production costs of the proposals presented. It is necessary to carry out socialization campaigns on how to use and benefit from these species to promote their consumption.

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7. References

ANDI (National Association of Colombian Businessmen) (2023). *How did food fare in household spending in October 2022? ANDI Alimentos*. ANDI. <https://www.andi.com.co/Uploads/2022%20-%2010%20Octubre.pdf>

Acero, Duarte, L., Barrera, M. N. & Rodríguez Montenegro, L. (1992). *The chacha fruit or Bahí, water and soil protector. Human superfood. Forage for livestock*. Bogotá D.C.: Fondo para la Protección y Recuperación del Medio Ambiente. https://repository.agrosavia.co/bitstream/handle/20.500.12324/1902/64156_57083.pdf?sequence=1&isAllowed=y

Agronet, Min Agriculture (2023). Chachafruit: everything you need to know about its characteristics and cultivation. *Agronet*.

<https://www.agronet.gov.co/Noticias/Paginas/Chachafruto-todo-lo-que-necesitas-saber-sobre-sus-caracter%C3%ADsticas-y-cultivo.aspx>

Alvarez, D., Espinosa, M. & Urieles, R. (2019). The countryside agonizes: 22 crops are disappearing across the country. *El Tiempo* <https://www.eltiempo.com/colombia/otras-ciudades/campo-colombiano-historias-de-cultivos-que-estan-desapareciendo-386222>

Bashir, S. (2019). Pharmacological significance of *Manilkara zapota* and its bioactive constituents. *Latin American and Caribbean Bulletin of Medicinal and Aromatic Plants*, 18(4), 347-358. <https://www.blacpma.ms-editions.cl/index.php/blacpma/article/view/93>

- Buitrago-Rueda, N., Ramírez-Villalobos, M., Gómez-Degraves, A., Rivero-Maldonado, G., & Perozo-Bravo, A. (2004). Effect of seed storage and post-sowing light condition on germination and some morphological characteristics of loquat (*Manilkara zapota*) plants. *Journal of the Faculty of Agronomy*, 21(4), 343-352. <https://produccioncientificaluz.org/index.php/agronomia/article/view/26505/27131>.
- Carrillo, G. (2022). *Proximal Bromatological Analysis and Determination of Minerals in Loquat (Manilkara zapota), grown at the Experimental and Practical Station of the University of El Salvador* [Undergraduate Thesis]. University of El Salvador. <https://ri.ues.edu.sv/id/eprint/29176/1/13101782.pdf>
- Corzo-Barragán, D. C. (2023). *Provide professional services to support the Scientific Sub-Directorate in the development of research on potential use and transformation of prioritized plant species, and laboratory support*. Unpublished technical report CTO-JBB-134-2023. Bogotá.
- Corzo, D. & Plazas, E. (2019). *Bromatology and phytochemistry of plant species*. Botanical Garden of Bogotá José Celestino Mutis.
- Global Forum on Agricultural Research [GFAR] (2011). *Global Manifesto on Forgotten Foods*. <https://www.gfar.net/sites/default/files/Global%20Manifesto%20on%20Forgotten%20Foods%20web%20version.pdf>.
- Giraldo-Quintero, S. E., Bernal-Lizarazú, M. C., Morales-Robayo, A., Pardo-Lobo, A. Z., & Gamba Molano, L. (2015). Traditional use of medicinal plants in markets in Bogotá, DC. *Nova*, 13(23), 73–80. http://www.scielo.org.co/scielo.php?script=sci_arttext&pid=S1794-24702015000100007
- Gonzales-Arce, R. (2008). Of flowers, buds and palm hearts: forgotten foods. *Agronomía Costarricense*, 32, 183-192. https://www.mag.go.cr/rev_agr/v32n02-183.pdf
- Gonzales, X. (2022). *The largest seed bank in the world is in Colombia*. (redagricola, Editor) <https://www.redagricola.com/co/el-banco-de-semillas-mas-grande-del-mundo-esta-en-colombia/>
- Hernández, M., Quiñónez, Y., Torres, M., & Corzo-Barragán, D. C. (2019). *Transformation and culinary preparations of high Andean species*. Botanical Garden of Bogotá José Celestino Mutis. Botanical Garden of Bogota.
- Bogota Botanical Garden launches agroecological seed bank (2022). <https://jbb.gov.co/jardin-botanico-de-bogota-lanza-banco-de-semillas-agroecologicas/>
- Kaunsar, J. & Shinwari, S. R. P. (2020). Rheological and physicochemical properties of a sugar-reduced loquat (*Manilkara zapota* L.) jam processed under high hydrostatic pressure. *Journal of Food Process Engineering*, 43, e13388.
- Karle-Pravin, P. & Dhawale-Shashikant, C. (2019). *Manilkara zapota* (L.) Royen Fruit Peel: A Phytochemical and Pharmacological Review. *Systematic Reviews in Pharmacy*, 10(1), 11-14. <https://doi.org/10.5530/srp.2019.1.2>. <https://doi.org/10.5530/srp.2019.1.2>
- Ministry of Health and Social Protection, FAO. (2013). *Perfil nacional de consumo de frutas y verduras*. Bogota D.C.: Ministry of Health and Social Protection. <https://www.minsalud.gov.co/sites/rid/Lists/BibliotecaDigital/RIDE/VS/PP/SNA/perfil-nacional-consumo-frutas-y-verduras-colombia-2013.pdf>
- Molano, A. (2005). *Obtaining and physicochemical and functional characterization of Erythrina edulis (Chachafruit) wholemeal flour for its application as nutritional food. Preliminary design of the production plant*. Universidad de los Andes. <https://repositorio.uniandes.edu.co/bitstream/handle/1992/22609/u270833.pdf?sequence=1>
- Navarro, J. A. & Vega-Figueroa, R. A. (2023). *Systematic review of the chemical and nutritional properties of the loquat fruit and leaf Manilkara huberi and its benefits on human health*. Universidad del Atlántico, Faculty of Chemistry and Pharmacy.

Prieto, A. & Colonia, A. (2018). *Comparative analysis of two drying systems in chacha fruit (Erythrina edulis) leaves*. Universidad Tecnológica de Pereira. <https://repositorio.utp.edu.co/server/api/core/bitstreams/1e356ede-be75-4258-8228-66d8a3c7e5e6/content>

Royen, P. (2007). *Manilkara zapota (L.) P. Royen - Sapotaceae*. National University of Colombia. <http://www.biovirtual.unal.edu.co/en/collections/result/species/Manilkara%20zapota/plants/>

Rubio-Huerta, L. M., Rodríguez-Corredor, M. A., Cote-Daza, S. P. & Barón-Chivara, J. A. (2022). Market squares as territorial spaces of gastronomic tourism, valuation of typical Bogota gastronomy. Cuadernos de Geografía: *Revista Colombiana de Geografía*, 31(1), 128-145. <https://doi.org/10.15446/rcdg.v31n1.88754>.

Torres, M. E. & Corzo-Barragán, D. C. (2019). *Transformation and culinary preparations of high Andean species*. Bogotá D.C.: Jardín Botánico de Bogotá José Celestino Mutis.