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PLANTS USED IN HUMAN FEEDING BY HALF-BREED AND KICHWA FARMERS IN SANTA CLARA, MERA, PASTAZA CANTONS, PASTAZA PROVINCE, ECUADOR

Plantas utilizadas en alimentación humana por agricultores mestizos y kichwas en los cantones Santa Clara, Mera y Pastaza, provincia de Pastaza, Ecuador

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ABSTRACT. This research was conducted in the Pastaza province, Ecuador, its aim was identify the main species used for human consumption on farms of Pastaza, Mera and Santa Clara cantons, comparing their reporting frequency depending on the canton and producer ethnia, for which a survey, consisting of aspects of identification of farmers, plants used in human food and ways of uses, which was applied to 214 producers in the province, corresponding to 30 % of producers identified was developed. Globally, 59 species were reported by canton bearing 32 species in Pastaza, 16 in Mera and 56 in Santa Clara, depending on the ethnia of the producer 44 species used by half-breeds and 46 species used by Kichwas were reported. 33 botanical families was obtained, Solanaceae and Arecaceae the highest number of species reported, frequency analysis reports through contingency tables with respect to the canton and producer ethnia, presented significant differences in the value of P for Pearson Chi Square statistics and Chi square MV-G2. The proportion comparison analysis showed nine species, being the highlights: *Musa* sp Schott, *Manihot esculenta* Crantz L. and *Colocasia esculenta* (L.), which are the most reported. It concludes that there is diversity in the use of plants for human consumption, in which variability is influenced by the canton components and the producer ethnia.

Key words: food, Amazon, plant species, ethnicity

RESUMEN. Esta investigación se realizó en la provincia de Pastaza, Ecuador, su objetivo fue identificar las principales especies vegetales utilizadas en alimentación humana, en las explotaciones agropecuarias de los cantones Pastaza, Mera y Santa Clara, comparando su frecuencia de reporte en función del cantón y etnia del productor, para lo cual se elaboró una encuesta, que consta de aspectos de identificación de los agricultores, plantas utilizadas en alimentación humana y sus formas de usos, la cual fue aplicada a 214 productores en la provincia, correspondiente al 30 % de productores identificados. A nivel global, se reportaron 59 especies, teniendo por cantón 32 especies en Pastaza, 16 en Mera y 56 en Santa Clara, en función de la etnia del productor se reportaron 44 especies utilizadas por mestizos y 46 especies utilizadas por Kichwas. Se obtuvo 33 familias botánicas, siendo Solanaceae y Arecaceae las que mayor número de especies reportan. El análisis de frecuencia de reportes, a través de cuadros de contingencia, con respecto al cantón y etnia del productor, presentó diferencias significativas en el valor de P para los estadísticos Chi cuadrado de Pearson y Chi cuadrado MV-G2. El análisis de comparación de proporciones mostró nueve especies, siendo las más destacadas *Musa* sp Schott, *Manihot esculenta* Crantz L. y *Colocasia esculenta* (L.). Se concluye que en la zona existe diversidad en el uso de plantas para la alimentación humana, en la cual su variabilidad está influenciada por los componentes cantón y etnia del productor.

Palabras clave: alimento, Amazonía, especies vegetales, etnia

INTRODUCTION

Relations among individuals, plants, management and use allowed understand the evolution of rural societies (1), being the ancestral knowledge of the identity reaffirmation of local communities, becoming media development (2).

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In ethnobotanical studies, reported more species are used in medicine and food, they are also used as ornamental species, for firewood, building material, fences, corrals, craft, material culture and magic-religious (3). Most researches focus on the analysis of the plants used by a specific ethnic group or comparing the plants used among indigenous groups belonging to different ethnic groups in specific locations that are nearby, not developing research in several precincts belonging to different cantons within the same province, which in turn provides for the differentiation between plant species used by half-breed and indigenous producers. To collect data, the semi elaborate interview (3) and questionnaire (4) were used among other techniques. In Ecuador, 408 studies were recorded in this area, being the Amazon, with 107 studies, the area of greatest report, focusing mainly on the general ethnobotany, medicinal plants and food plants (5).

These studies have been directed towards plant species used by ethnic groups, being the first work that considers three cantons simultaneously within the Pastaza province, which is home to several ethnic groups, taking into its territory Achuar, Andowa, Huaorani, Kichwa, Shiwiar, Shuar and Zápara[A], also taking half-breed population from other provinces of Ecuador, which generated a great cultural diversity that is reflected in their eating habits.

Statistical analysis suggests that in the surveys can be used frequency distributions and arithmetic media for performing a first approximation to the data (6). The statistical "Cramer V" is used to analyze the relationship of association among variables. At the same time, other authors state that the contingency analysis can be used to compare if the hypothesis is valid for the sample size, in which the value of P is calculated (7). If the sample size is large, it can apply the method of two-tailed hypothesis, based on probability distribution of Chi^2.

The cultural diversity in the study area generates the need to record the plants used for human consumption by farmers and to differentiate the behavior of their use depending on the locality and ethnicity; this allows analyzing the interaction of knowledge among these groups. This research raised its target, to identify the main plant species used for human consumption by farmers in Pastaza, Mera and Santa Clara cantons, in the Pastaza province, Ecuador, comparing their frequency of use report based on the canton and ethnicity producer.

MATERIALS AND METHODS

Location of the study area

This research was conducted in Ecuador, The Amazon of Pastaza province, Mera with 1043 m height s.n.m .; in Pastaza, with a height of 960 m.s.n.m. and Santa Clara with a height of 595 m s.n.m cantons. Weather conditions in Mera are: precipitation 5580,4 mm; medium temperature 21,6 °C; in Pastaza[B]: precipitation 4158 mm; average temperature 21,3 °C; Santa Clara: precipitation 3000 mm; temperature between 18 to 24 °C. In Mera and Pastaza there is Hydranteps soil and in Santa Clara, Distropepts soil (8).

A survey to know the producer ethnicity and plant species used for human consumption (9) was applied to 214 producers, corresponding to the number of respondents to 30 % of the producers identified in each sector was applied being its distribution: 58 in Mera canton, parish, "Madre Tierra" in eight precincts; 70 in Pastaza Canton, parishes "Tarqui" in four precincts, parish "Veracruz" in five precincts, parish, "Diez de Agosto", in four precincts, Parish "Fatima" in five precincts and 86 in Santa Clara Canton, in the parish "San Jose", in three precincts, and Santa Clara parish in 10 precincts.

The survey executed, consisted of the following elements:

Identification: respondent's name, date, parish, enclosure, farm area, ethnicity farmer.

Plant species used: species used, part of the plant used, purpose of use.

Samples of plant specimens of dubious identification to be conducted after the herbarium of the Amazon State University were collected. Geographical location data, photographs of species used in the collection of pruning scissors, telescopic pruner, camera, GPS, office recorded. In the cabinet work developed in the herbarium, samples of the collected species were identified through visual comparison with artwork found in specialized literature (10, 11) and Internet references through the Missouri Botanical Garden portal.

[A] Gobierno Autónomo Descentralizado de Pastaza. *Plan de ordenamiento de desarrollo estructural y territorial de la provincia de Pastaza, Mapa de síntesis de la estructura territorial: cultura (2011)* [en línea]. 2011, [Consultado: 3 de enero de 2015], Disponible en: <http://www.pastaza.gob.ec/mapas/25_nacionalidades_indigenasjpg/download>.

[B] Instituto Nacional de Meteorología e Hidrología. *Anuario meteorológico* [en línea]. no. 51-2011, Ecuador, 2014, [Consultado: 12 de diciembre de 2014], Disponible en: <http://www.serviciometeorologico.gob.ec/wp-content/uploads/anuarios/meteorologicos/Am%202011.pdf>.

The processed data were analyzed with the INFOSTAT program (12), depending on the frequencies reported by producers, through the analysis of contingency tables, both the frequency of use reported by species vs canton, species vs ethnicity producer. With the analysis showed significant differences in coefficient chi^2, we proceeded to an analysis of proportions, with Excel COMPAPRO application to determine which species showing major differences in their usage reports were; at the same time, these reports often permit to compare levels of interest rate for each descriptive categorical variable.

RESULTS AND DISCUSSION

In the study area, producers of the Kichwa ethnicity and half-breed were identified, where 33 botanical families are reported, with 59 plant species used for human consumption, with the largest number of species reported were the families Arecaceae and Solanaceae with five species each one and Euphorbiaceae and Rutaceae with four species.

In Table I we can find the number of producers in different areas, who reported the use of species for human consumption in Pastaza, Mera and Santa Clara canton, as well as producers of half-breed ethnicity and Kichwa, taking as most reported species: *Musa* sp. Schott, *Manihot* L. and *Colocasia esculenta* (L.)

The results show, the canton Santa Clara as the highest number of species reported, compared with the other two cantons; while among half-breed and Kichwas producers, no big difference is denoted in the number of species used; in turn, the kind used by producers are mostly cultivated, with a low proportion of species that grow in the wild, mainly related to the Kichwa ethnicity.

It also identifies that the food base, both in its distribution cantons, such as ethnic groups, primarily focuses on the species *Musa sp*. L., *Manihot* and *Colocasia esculenta* (L.) Schott, those are cultivated. Recent studies have begun to focus on the association between sociocultural and socioeconomic factors in the acquisition of traditional knowledge of plant use in mestizo communities (13). In the present study, an approach among the number of species used for human consumption by mestizos and Kichwas producers sample, which also shows a cultural mix in the area, between the mestizo population and Kichwa and can also be evidenced in other areas with nearby populations (14).

The number of families and species identified, is low when they were compared with the national result where 160 families and 1560 species are identified in addition to 290 species reported by the Kichwa ethnicity of the Amazon (15) but; in turn, it is higher compared to studies in Cane Iguaque (Boyaca-Colombia) (3) and Coreguaje high Caquetá in Colombian Amazon (16), having Arecaceae and Solanaceae families within the larger report as food use at national level (15).

The results of the survey on frequencies usage reports, report, analysis of contingency tables, significant differences in the P value for statistical Pearson Chi square and Mv-G2 Chi square , both in the analysis contingency frequency of reported use of species vs canton, presented in Table II, and contingency analysis reporting frequency of use vs producer ethnicity, shown in Table III.

The contingency tables analysis shows that there are differences in species and their frequency of usage report for the canton and ethnic components of the producer. As for the analysis performed with the frequencies reported use for the different cantons, although the number of species used for human consumption between mestizos and Kichwa producers, shows no difference in the amount, if in species each ethnic group uses. Other authors state that the use of species in different ecosystems, differs depending on the spectrum of life forms and climatic zones, this shows that the use of the species has a great relationship with the characteristics of the area and also with the culture of producer (17). With these results, we proceeded to the analysis of ratios to determine the species that show a different behavior, in terms of frequency of use by canton and type of producer, which can be seen in Table IV.

Within developed previous studies on the use of plant species in Ecuador, the following ones are reported: *Allium* sp., *Ananas comosus* L., *Annona cherimola*, *Artocarpus altilis*, *Bactris maraja*, *Bellucia pentámera*, *Beta cicla*, *Bixa orellana*, *Brassica oleracea*, *Brosimun utile*, *Brugmansia arbórea*, *Capsicum annoum* L., *Carica papaya*, *Caryodendron orinocense* H. Karst, *Chamaedorea pauciflora*, *Citrus médica*, *Citrus reticulada*, *Coffea arábiga*, *Colocasia esculenta*, *Coriandum sativum*, *Cyclatus bipartitus*, *Epiphyllum phyllantus*, *Grias neuberthii*, *Ilex guayusa*, *Inga densiflora* Benth, *Inga edulis* Mart., *Ipomoea batatas*, *Lactuca sativa*, *Manihot esculenta* Crantz., *Mauritia flexuosa*, *Musa* sp., *Musa x paradisiaca* L., *Oenocarpus bataua*, *Passiflora foetida*, *Persea americana*, *Phaseolus vulgaris*, *Phisalis peruviana*, *Piptadenia pteroclada*, *Plukenetia volubilis*, *Potalia amara*, *Pouteria caimito*, *Psidium guajava*, *Rollinia mucosa*, *Solanum quitoense* Lamarck, *Theobroma bicolor*, *Theobroma cacao*, *Phisalis peruviana, Zea mays,* also reporting food use in the species mentioned (5).

Table I. Frequency of reports in each species by canton and ethnicity producer

Family	Scientific name	Common name	Canton			Producer ethnicity	
			Pastaza	Mera	Santa Clara	Half breed	Kichwa
Amarantaceae	*Beta cicla* L.	chard	0	0	1	1	0
Annonaceae	*Annona cherimola* Mill.	Custard Apple	4	2	4	5	5
	Rollinia mucosa (Jacq.) Baill.	anon	2	0	6	0	7
Apiacea	*Coriandrum sativum* L.	coriander	0	0	1	1	0
Aquifoliaceae	*Ilex guayusa* Loes	guayusa	0	0	1	1	0
Araceae	*Colocasia esculenta* (L.) Schott	Chinese potatoes	46	23	36	58	47
	Dioscorea trifida L.f. (papa de monte)	Potato bush	0	0	1	0	1
Arecaceae	*Bactris gasipaes* Kunth	chonta duro	6	0	20	10	16
	Oenocarpus bataua Mart.	hungurahua	0	0	1	0	1
	Mauritia flexuosa L. f.	morete	0	0	4	0	4
	Dictyocaryum lamafckianum	palm	0	0	1	0	1
	Chamaedorea pauciflora Mart	palmetto	1	0	3	1	3
Asteraceae	*Lactuca sativa* L.	lettuce	0	0	2	2	0
Bixaceae	*Bixa orellana* L.	annatto	1	0	3	2	2
Brasicaceae	*Brassica oleracea* L.	cabbage	0	0	1	1	0
Bromeliaceae	*Ananas comosus* L.	pineapple	5	13	10	15	13
cactaceae	*Epiphyllum phyllanthus* (L.) Haw.	pitahaya	4	0	0	4	0
Caricaceae	*Carica papaya* L.	papaya	8	11	21	21	19
Convolvulaceae	*Ipomoea batatas* (L.) Lam	Sweet potato	0	0	1	1	0
Cyclantaceae	*Cyclanthus bipartitus* Poit. ex A. Rich.	chita papanku	0	0	1	0	1
Euphorbiaceae	*Plukenetia volubilis* L.	sacha inchi	0	0	2	1	1
	Manihot esculenta Crantz.	yucca	51	35	62	70	78
	Caryodendron orinocense H. Karst	wachanzo	0	0	2	0	2
Fabaceae	*Phaseolus vulgaris* L.	bean	2	0	4	4	2
Lauraceae	*Persea americana* Mill.	avocado	3	0	12	6	9

Continues...

Continuación Tabla I

Lecythidacae	*Grias neuberthii* J.F. Macbr	piton	0	0	4	0	4
Liliaceae	*Allium cepa* L.	onion	0	0	1	1	0
	Allium sp.	Chinese onion	1	0	1	1	1
	Allium schoenoprasum L.	scallion	2	0	0	2	0
Malvaceae	*Theobroma cacao* L.	cocoa	2	0	12	4	10
	Theobroma bicolor Bonpl	White cocoa	0	0	7	0	7
	Herrania purpurea (Pittier)	cambio de monte	0	0	1	0	1
Melastomatacea	*Bellucia pentamera* Naudin	Mountain Apple	0	0	13	2	11
Mimosaceae	*Inga edulis* Mart.	guaba liana	10	11	36	26	31
	Inga densiflora Benth.	guava machetona	10	0	6	9	7
Moraceae	*Artocarpus altilis* (Parkinson) *Fosberg*	breadfruit	4	0	6	4	6
Musaceae	*Musa x paradisiaca* L.	banana	0	0	12	1	11
	Musa sp. L.	plantain	48	29	74	79	72
Myrtaceae	*Eugenia stipitata* McVaugh	araza	8	5	1	10	4
	Psidium guajava L.	guava	15	6	11	25	9
	Syzygium jambos L.	pommarosa	1	0	1	1	1
Passifloraceae	*Passiflora foetida* L.	pomegranates	0	0	1	0	1
Piperacea	*Pothomorphe umbellata* (L.) Miq	maría panka	0	0	1	1	0
Poaceae	*Saccharum officinarum* L.	Sugar cane	38	10	19	41	26
	Zea mays L.	maize	4	3	2	4	5
	Triticum vulgare L.	wheat	0	0	1	0	1
Rubeaceae	*Coffea arabica* L.	coffee	0	0	1	0	1
	Borojoa patinoi Cuatrec	borojo	2	0	1	3	0
Rutaceae	*Citrus máxima* (Burm.) Merr.	lime	0	0	3	2	1
	Citrus × limon (L.) Osbeck	lemon	20	6	30	34	22
	Citrus reticulata Blanco	tangerine	16	2	9	23	4
	Citrus x sinensis Osberck.	orange	7	0	7	9	5
Sapotaceae	*Pouteria caimito* (Ruiz & Pav.) *Radlk.*	avío	5	6	18	13	16
Solanaceae	*Capsicum annuum* L.	pepper	0	1	1	0	2
	Brugmansia arborea (L.) Lagerh	floripondio	1	0	0	1	0
	Solanum quitoense Lam.	naranjilla	2	2	7	3	8
	Solanum lycopersicum L.	Tomato	0	0	1	1	0
	Physalis peruviana L.	gooseberry	0	0	1	0	1
Urticaceae	*Pourouma cecropiifolia* Mart	grape	4	0	10	6	8
	Number of reported species		**32**	**16**	**56**	**44**	**46**

In Ecuador other authors report the presence of the following species: *Ananas comosus* L., *Bactris maraja*, *Bixa orellana*, *Carica papaya*, *Citrus reticulada*, *Citrus x sinensis* Osberck, *Coffea arábiga*, *Colocasia esculenta*, *Ipomoea batatas*, *Musa* sp., *Musa x paradisiaca* L., *Persea americana*, *Saccharum officinarum* L., *Solanum quitoense* Lamarck, *Theobroma cacao*, *Zea mays* (18). In Southamerica also are reported the species, *Borojo pantinoi* (19) la *Colocasia sculenta* (20) y la *Psidium guajava* (21).

Other species are cited by some authors to human consumption, for example, *Allium schoenoprasum REGEL & TILING* (22), *Borojo pantinoi* (19), *Manihot esculenta* Crantz (23), *Psidium guajava* (24, 25), while other authors express that *Annona cherimola, present high organoleptic, digestive, nutricious qualities* (26).

The study also shows the great potential of other species such *Pourouma cecropiifolia* Mart, *Pouteria caimito* (Ruiz & Pav.) Radlk, *Syzygium jambos* L., *Grias neuberthii* J.F. Macbr, *Caryodendron orinocense* H. Karst, which although not within the species with the highest number of reports, represent a consumer culture and a food source, being native to the area, which grow wild, but they are also beginning to be sold in local markets in their production times.

Table II. Contingency analysis of the frequency of reported use of species vs canton

Statistical	Value	G.L	P
Chi Square Pearson	226,30	116	<0,0001
Chi Square MV-G2	270,82	116	<0,0001
Contingency coefficient Cramer	0,28		
Contingency coefficient Pearson	0,43		

G.L degrees of freedom

Tabla III. Contingency analysis of reporting frequency of use species vs ethnicity producer

Statistical	Value	G.L	P
Chi Square Pearson	112,45	58	<0,0001
Chi Square MV-G2	137,82	58	<0,0001
Contingency coefficient Cramer	0,24		
Contingency coefficient Pearson	0,32		

G.L: degrees of freedom

CONCLUSIONS

- The areas corresponding to Pastaza and Mera cantons and show diversity of plant families and species used for human consumption, which have the highest number of reports of species used in the Santa Clara canton.
- As for the reported use of species per type of producer are the Kichwa producers who reported more species.
- There are significant differences in the use of species in terms of its distribution per canton and producer ethnicity, indicating that these components affect the species used for human consumption.
- The species most reported and, simultaneously, which showed different behavior in the analysis of proportions, are Colocasia esculenta, Musa sp. and Manihot esculenta Crantz, these being essential in the diet of the population surveyed.

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Table IV. Species showed different behaviors, in their report on the frequency analysis of proportions

	Pastaza	Mera	Santa Clara	Mestizo	Indian
Carica papaya L				x	
Citrus × *limon* (L.) Osbeck	x		x	x	x
Citrus reticulata Blanco				x	
Colocasia esculenta (L.) Schott	x	x	x	x	x
Inga edulis Mart.			x		x
Manihot esculenta Crantz	x	x	x	x	x
Musa sp. L.	x	x	x	x	x
Psidium guajava L.				x	
Saccharum officinarum L.	x			x	x

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