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Nutritional Potential of Weeds on Suburban Farms in Santiago de Cuba

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Abstract

Context: Although weed species have traditionally been considered a problem, today, they are a resource in need of preservation.
Objective: To determine the food potential of weed vegetation on suburban farms in Santiago de Cuba
Methods: An ethnobotanical study was conducted in communities adjacent to various farms. The botanical composition, percentage of species with a food potential, and their most frequently used organs, food types, and most favored species for animal nutrition, were determined.
Results: A total of 22 weed species with food potential were identified, family *Poaceae* being the most commonly found, and *Bothriochloa pertusa* (L.) A. Camus, was the most dominating species. Together with *Megathyrsus maximus* (Jacq.) Sim. & Jac., their reference percentage was 100%. The most commonly used organ of weed was the leaves (77.27%), especially in animal nutrition (63.63%). Eight species are used in human nutrition, of which *Pithecellobium dulce* (Roxb.) Benth and *Chrysophyllum oliviforme* L. are consumed as scarce fruits.
Conclusions: The grass studied has a potential for use as human and animal nutrition.

Key words: Weed, nutrition, etnobotany, farms.

Introduction

Usually, spontaneous vegetation is given the anthropocentric term "*bad grass*". According to Fernández, Muiño & Ermini (2014), weeds began to prosper with the development of agriculture, and have accompanied humans since then, being adapted and even benefitted by their actions.

Today, grass vegetation is an important element that helps ecosystems. According to Egea et al., (2017), this group of plants can preserve the biodiversity stable against environmental variations. Besides contributing with exclusive biodiversity, it helps maintaining other taxons present in the crop fields, and provide certain ecosystem services, like pollination or biological pest control.

Within the agricultural ecosystems, weed species are plants that compete with crops, reducing their yields. However, the conception of sustainable agriculture requires proper handling of uncultivated plants, since they enhance or deal with soil erosion, coverage, and fertility. Moreover, they have a potential for medicinal, nutritional, and ornamental plants, and can fix nitrogen or act as repellents, which is beneficial to humans (Gámez et al., 2014).

Weeds have had a long interaction with humans. At first, many of them were used and then were domesticated, so quite a few became the parents of various modern crops. These species have proven their usefulness, and it would be interesting to determine what other implications (beside the harmful ones) they could have from a more social perspective (Fernández, Muiño & Ermini, 2014).

The aim of this paper is to determine the food potential of weed vegetation on suburban farms in Santiago de Cuba.

Materials and Methods

This study covered four geographical areas comprising communities near the farms chosen by Del Toro et al., (2018). An ethnobotanical study was conducted in these communities, which included 80 key reporters, basically farm people with different traditions. A semi-structured interview was made in order to gather the desired information. All the plant specimens used were fresh, to prevent misleading on certain species in the study. The responses were pooled by consensus among the participants (CI).

The richest family species and the most dominant taxa were considered within the botanical composition, following some of the indicators used by Vargas et al., 2017). The number of reporters who assured these species have a potential in nutrition were determined, together with the percentage of species holding this potential in relation to the total reported on the farms. Besides, the study considered the most frequently used plant organ, the type of food, and the more benefitted animal species with the plants. In all cases, their scientific names were paired to the work of Greuter & Rankin (2017).

Results and discussion

Overall, 22 817 individuals from 14 families, 22 genus, and the same number of species were sampled. *Poaceae*, *Leguminosae*, and *Boraginaceae* were the weed families with the most varieties, a proportion of 31.82% for the first, and 9.09% for the other two. Penicillin (*Bothriochloa pertusa* (L.) A. Camus.) was the most dominant species (53.1%). Other highly represented species were African Bermudagrass (*Cynodon nlemfuensis* Vanderyst.), Guinea grass (*Megathyrsus maximus* (Jacq.) Sim. & Jac.), and red spinach (*Amaranthus dubius* Mart. ex Thell.), with 21.12%, 8.38%, and 4.49%, respectively.

Mncube et al. (2017) did a study on the composition and management of weeds in small-scale agriculture, and reported *Poaceae* as one of the most widely represented family species. This family holds taxa that adapt easily to extreme conditions, which can explain its high representativeness. Therefore, out of the four most dominant species, three belong to this family, which along with *Leguminosae*, were reported by Vargas et al. (2017) as one of the most contributing plants in small-scale agriculture conditions.

Table 1. List of species reported in the community surveys to have human or animal usefulness

No.	Common name	Scientific name	% Rf	OU	% Rf	TF	% Rf	TAn	% Rf
1.	Coffee bush	*Leucaena leucocephala* (Lam.) de Wit.	5	L	5	A	5	C	5
2.	Yerbón	*Coleataenia petersonii* (Hitche & Ekman) Soreng.	8.75	L	8.75	A	8.75	H	7.5
3.	Manila tamarind	*Pithecellobium dulce* (Roxb.) Benth.	2.5	F	2,5	Hu	2.5	C	6.25
4.	Spearmint	*Mentha spicata* L.	1.25	L	1.25	Hu	1.25		
5.	African Bermudagrass	*Cynodon nlemfuensis* Vanderyst.	65	L	65	A	65	Ra	20
								C	12.5
								Go	8.75
6.	Chiggery grapes	*Tournefortia hirsutissima* L.	2.5	R	1.25	A	1.25	Go	1.25
						Hu	1.25		
7.	Goosegrass	*Eleusine indica* (L.) Gaertn.	17.5	L	17.5	A	12.5	C	12.5
								Ra	5
								Go	5
8.	Bamboo	*Bambusa vulgaris* Schrad.	1.25	Sht	1.25	Hu	1.25		
9.	Satinleaf	*Chrysophyllum oliviforme* L.	6.25	F	6.25	Hu	6.25		
10.	Red spinach	*Amaranthus dubius* Mart. ex Thell.	11.25	L	11.25	A	11.25	P	11.25
				St	7.5				
11.	White manjack	*Cordia dentata* Poir.	5	L	5	A	5	Go	5
12.	West Indian elm	*Guazuma ulmifolia* Lam.	18.75	L	18.75	A	18.75	Go	18.75
13.	White mulberry	*Morus alba* L.	1.25	L	1.25	A	1.25	Go	1.25
14.	Pitahaya	*Hylocereus triangularis* (L.) Britton & Rose.	1.25	L	1.25	A	1.25	Go	1.25
				F	1.25	Hu	1.25		
15.	Guinea grass	*Megathyrsus maximus* (Jacq.) Sim. & Jac.	100	L	100	A	100	H	90
								C	82.5
16.	Penicillin	*Bothriochloa pertusa* (L.) A. Camus.	100	L	100	A	100	H	83.75
								C	96.25
17.	Johnson grass	*Sorghum halepense* (L.) Pers.	41.25	L	41.25	A	41.25	H	33.75
								Ra	25
18.	Verdolaga	*Portulaca oleracea* L.	97.5	L	97.5	A	87.5	P	85
								Ra	26.25
						Hu	20		
19.	Bitter melon	*Momordica charantia* L.	6.25	L	5	A	6.25	Go	5
				F	1.25			Br	1.25
20.	Nightshade	*Solanum americanum* Mill.	1.25	L	1.25	Hu	1.25		
21.	Cardo santo	*Argenome mexicana* L.	2.5	S	2.5	A	2.5	Do	2.5
22.	Fireplant	*Euphorbia heterophylla* L.	1.25	L	1.25	A	1.25	P	1.25
				St	1.25			Ga	1.25

Legend: **%Rf**: reference percentage, **OU**: organ used, **TF**: type of food, **TAn**: type of animal, **R**: root, **Sht**: shoot, **St**: stem, **L**: leaf, **F**: fruit, **S**: seed, **A**: animal, **Hu**: human, **C**: cow, **P**: pig, **H**: horse, **Ra**: rabbit, **Go**: goat, **Br**: bird, **Do**: dove

Vargas et al. (2016) during a plant diversity study, reported *B. pertusa* and *M. maximus* as two of the most abundant species. They said that these species are considered invading plants, and are included within the first 100 species of that type worldwide.

Overall, 22 weed species were reported useful for nutrition, which accounts for 25.29% of weeds reported by Del Toro et al. (2018). *B. pertusa*, *M. maximus*, verdolaga (*Portulaca oleracea* L.), *C. nlemfuensis* , and Johnson grass (*Sorghum halepense* (L.) Pers.) were the species with the highest reference percentage reports. The first two species referred to were recognized by 100% of the surveyed individuals, and *P. oleracea* was recognized by 97.5% (Table 1).

In these five species, the most commonly used organ was the leaves, especially for animal nutrition, except *P. oleracea* with 20% of responses also admitting it can be used in human nutrition as green salad. Generally, these species are used to feed rabbit, cattle, goats, horses, and pigs, which is important for small-scale agriculture, as they provide a source of

food for pen animals and humans under exceptional scenarios.

The reporters mentioned five the number of organs with the highest preference. The leaf was the most frequently cited organ in 17 species (77.27%). Fruits and stems were also important (18.18% and 9.09%, respectively). Also, the roots and seeds (4.55%). *A. dubius*, pitahaya (*Hylocereus triangularis* (L.) Britton & Rose), bitter melon (*Momordica charantia* L.), and fireplant (*Euphorbia heterophylla* L.), representing 18.18% of species, they can provide two organs.

As to the type of food, the reports said that 63.63% can be used for animal nutrition, and 36.36% can be supplied to humans. Eight species can be eaten by humans, of which Manila tamarind (*Pithecellobium dulce* (Roxb.) Benth.), satileaf (*Chrysophyllum oliviforme* L.), spearmint (*Mentha spicata* L.), bamboo (*Bambusa vulgaris* Schrad.), and nightshade (*Solanum americanum* Mill.), are only for humans. The first two species, along with *H. triangularis* are consumed as scarce fruits.

The previous reports on species eaten as fruits back the findings of Fuentes (2004), that within edible plants, fruits and nuts comprise almost 3 000 species, of which many are wild, and are mainly located in tropical regions of the planet. The usefulness of these species confers them a potential to be utilized more thoroughly. Fuentes (2008) noted that frequently, plant species are known for one property or interest (mostly economic), which limits their utility.

Seven animal groups can benefit from these plants as sources of food. Overall, 40.91% of species can be used in the nutrition of goats, 27.27% in bovines, 18.18% in horses and rabbit, and 4.55% can feed doves and birds in general. An interesting fact is that eight species (36.36%) may be used to feed more than one animal species. Of them, *C. nlemfuensis* and goosegrass (*Eleusine indica* (L.) Gaertn) may be used to feed three species each.

Cruz & Price (2012) reported that a group of 43 weeds had been cited by farmers as species consumed as green vegetable salads, and they had other attributes and multiple additional uses. According to Blanco (2016) in Guatemala, farmers allow weeds to grow alongside their crops to take advantage of their values as food for humans and animals, or for medicinal use. In Mexico, around 40 species associated to maize fields are consumed as green vegetables by farmers, and some of these species are allowed to spread their seeds to enhance their growth.

The above author also cited that weeds play a key role in the cropland of most traditional tropical farmers, who make intensive use of them. Some weeds used in human nutrition are *Solanum* spp. and *P. oleracea*, whereas *C. nlemfuensis* is administered to domestic animals.

For the most part, all reference percentage in relation to human nutrition reported are low, except those found in some species already mentioned in this paper. It indicates that (*i*) these ethnobotanical uses are known by a reduced population; hence it is important to rescue them. Especially, if most reporters in this study are not original from the suburban areas of the city, but moved from other municipalities of the province, bringing their tastes, knowledge, and costumes; (*ii*) it is possible that this knowledge was transmitted, according to Fernández, Muiño & Ermini (2014), by socializing and everyday practice, as they have lived part of their lives on farms or other settings with some agricultural experiences; (*iii*) they confirm the problematic observed in relation to the population of weed species, because the traditional knowledge associated to this vegetation type is that of "just weeds".

Many of the species mentioned in this study have been considered annoying when it comes to farming; however, research refers to their multiple potential. In that sense, Candó et al. (2015) and Del Toro (2015) reported that all the 12 weed species found in this study have a potential in addition to nutrition, in medicine, farming, forestry practices, industry, honey production, decoration, energy, household, and magical-religious. The multiple usefulness of these plants is broad and provides sufficient grounds to work on their preservation.

Conclusions

The weed population studied has a potential for use as human and animal nutrition, based on the utilization of leaves and fruits for the former, and the leaves alone for the latter. Goats, cattle, and pigs are the animals that can benefit most from these plants as sources of food.

Author contribution

José Orlando del Toro Rivera: research planning, analysis of results, manuscript redaction, final review.

Belyani Vargas Batis: research planning, analysis of results, manuscript redaction, final review.

Rubert Rodríguez Fonseca: literature review, analysis of results, final review.

Ernesto Jesús Rodríguez Suárez: field work, literature review, final review.

Daliena Fernández Baño: field work, final review.

Yordi Mauro Ramos García: literature review, final review.

Conflicts of interest

The authors declare the existence of no conflicts of interest, according to the journal's guidelines. All the

authors agree on the information published, and the order of authors.

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