Scientific Paper

Botanical characterization of six goat farms in the Southern Circuit of Cumanayagua, Cienfuegos, Cuba[1]

Dariel Morales-Querol[1*] https://orcid.org/0000-0002-2935-7260, Miguel Ángel Benítez-Álvarez[1] https://orcid.org/0000-0001-6265-936X, Maritza Rizo-Álvarez[1] https://orcid.org/0000-0003-3880-0428, Yailen Array-Arteaga[2] https://orcid.org/0009-0006-5241-5496 and Yhosvanni Pérez-Rodríguez[3] https://orcid.org/0000-0002-2078-8961

[1]*Estación Experimental de Pastos y Forrajes Indio Hatuey, Universidad de Matanzas, Ministerio de Educación Superior, Central España Republicana, CP 44280, Matanzas, Cuba.* [2]*Empresa Pecuaria La Sierrita, Carretera San Blas, La Sierrita, Cumanayagua, Cienfuegos, Cuba.* [3]*Universidad de Cienfuegos Carlos Rafael Rodríguez. Cienfuegos, Cuba.* [*]*E-mail:* dariel.morales@ihatuey.cu

Abstract

Objective: To characterize the botanical composition of farms dedicated to goat production in the Southern Circuit of Cumanayagua, Cienfuegos, Cuba.

Materials and Methods: The study was carried out in six farms dedicated to goat breeding during the dry season. Ten rectangular subplots of 50 x 2 m (1 m on each side of the 50-m long line) were established in the grazing areas of the animals, which together represent one tenth of a hectare (0,1 ha = 1,000 m^2). The location of the subplots was random and at 360 degrees within the study area.

Results: A total of 23 families, 43 genera and 49 botanical species were counted during the research. The farm with the highest number of identified genera (25) and species (30) was Playa Fría; while Los Castillos, with 9 genera and 10 species, had the lowest number of taxonomic categories. The Fabaceae family showed the highest number of species with 14, followed by Boraginaceae and Malvaceae with 4. The botanical families present in all farms were Fabaceae and Poaceae; while Moringaceae, Lamiaceae, Rubiaceae and Sapotaceae are present in only one farm.

Conclusions: The study carried out in six farms dedicated to goat breeding in the Southern Circuit of Cumanayagua, Cienfuegos, during the dry season, showed a remarkable botanical diversity. Although the farms are located in the same geographical sector, significant variations in botanical composition were observed among them.

Keywords: goat, botanical composition, shrublands

Introduction

Livestock production systems based on grazing reduce feeding costs. In tropical regions, traditional animal husbandry systems are characterized by grazing grasses as the main feeding source, which have low to moderate forage yields and are of poor quality, especially during the dry season. In addition, these animal husbandry systems are associated with problems of deforestation, soil degradation, water scarcity, climate changes and low animal productivity (Murgueitio *et al*., 2012).

In Cienfuegos province, forest coverage is 18,0 % and with a forest estate of 73 647 ha. Natural forests occupy an area of 66 192 ha and established plantations 7 455 ha. The deforested area is 10 139 ha and the non-forested area is 3 725,3 ha. In addition, there are 752,7 ha under forest development, of which 694 ha are young plantations and 58,7 ha are under natural regeneration management, corresponding to the 11 municipalities of the province (ONEI, 2022).

Particularly, there are two types of forests in Cumanayagua: natural forests (2 202 ha) and coastal protection forest (1 378 ha), including 427 ha of mangroves, 13 ha of seagrape groves and 106 ha of coastal bush. The rest corresponds to coastal xerophytic scrub. It should be noted that the forest in this region is characterized, according to Lemus-Barrios *et al*. (2022), by having a community subject to water stress most of the year, which is accentuated by the influence of the coast. This peculiarity of the environment can influence the morphoecological characteristics of the species that are established in the area. In this context, goat production is developed in the Southern Circuit of Cienfuegos.

On the other hand, knowledge of the vegetation structure of a forest ecosystem is important, since the distribution of species and their abundance is not similar among the different seasons of the year, due to the influence of some edaphic or climate factor. Thus, the generated information can be a means to

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make management, conservation and regeneration proposals in reduced areas or fragments of the area (Rosenzweig, 1995).

Likewise, the study of botanical composition is one of the aspects to be considered, since the plant species present and their morphology have a direct impact on dry matter yield, forage quality, voluntary intake and production quality (Botha *et al*., 2008). Considering the above, the present research aimed at characterizing the botanical composition of farms dedicated to goat production in the Southern Circuit of Cumanayagua, Cienfuegos, Cuba.

Materials and Methods

Geographical location. The study was carried out in six goat farms in the Southern Circuit of Cumanayagua in the Cienfuegos province, which carry out extensive grazing in forests and natural thickets.

Climate conditions. Figure 1 shows the spatial pattern of extreme temperatures in the Southern Circuit of Cumanayagua, Cienfuegos. It is observed that the lowest average minimum temperatures are found in the highest areas, varying between 15 and 16 ºC, and increase towards the coast, reaching values of 22-23 ºC (figure 1, left side). On the other hand, the highest mean maximum temperatures are recorded near the coast, with values of 29,5-31,0 ºC (figure 2, right side). This phenomenon is attributed to the thermoregulatory effect of the sea, which prevents significant drops in temperature during the night and early morning.

Soil. The farms under study are distributed in different soil types (figure 2a). In the People's Councils of Gavilán and Arimao, the soils are Alluvial. In La Vega, Skeletal soils are found. In Camilo Cienfuegos and Yaguanabo, the soils are Fersialitic Reddish Brown; while in Cabagan, the soils are Red Rendzina (Figure 2b).

Experimental procedure. The study was conducted during the dry season, in the months of April and June, 2024. With the farmers, the areas where the goats graze were walked and identified and 10 rectangular subplots of 50 x 2 m (1 m on each side of the 50-m long line) were established, which together represent one tenth of a hectare (0,1 ha = 1 000 m^2). The location of the subplots was random and at 360 degrees within the study area (Aymard and Cuello, 1995).

The information obtained from the count (common name of the plants and number of species observations) in each of the subplots was recorded on field sheets designed for the research. Identification was carried out using the Botanical Dictionary of Cuban Common Names according to Roig (1988). In all cases, scientific names were checked against the work of Acevedo-Rodríguez and Strong (2012) and the preliminary inventory of the Vascular Plants of Cuba by Greuter and Rankin (2017). Once the different species were identified, a floristic list was made for the characterization of the botanical composition of the farms.

Results and Discussion

The evaluated farms are located in the same geographical sector, so variations in flora should not be very evident. The vegetation of these farms is characterized by being of the scrub type, where the woody plants present in this type of vegetation formation are economically important for the rural

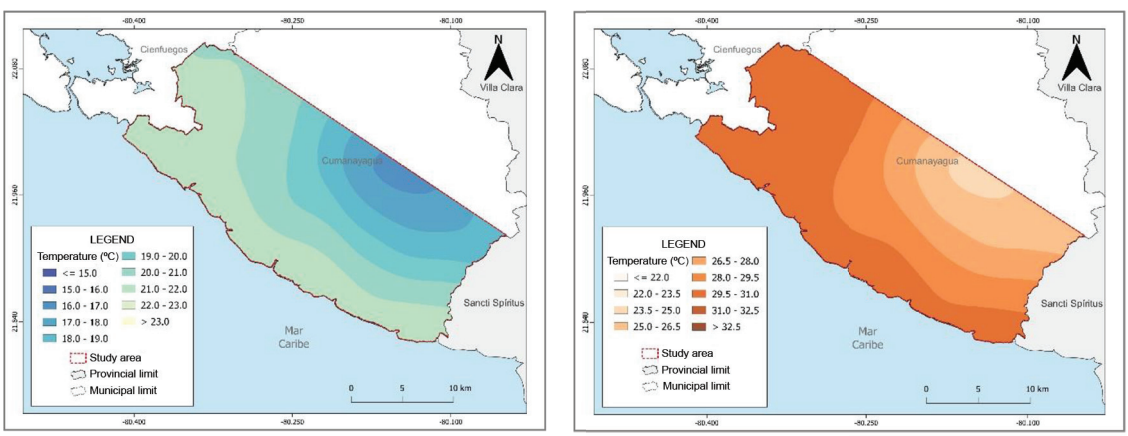

Figure 1. Mean annual minimum temperature (left) and mean annual maximum temperature (right) of the Southern Circuit of the municipality of Cumanayagua. Period 1991-2020. Source: Viera-González *et al*. (2024).

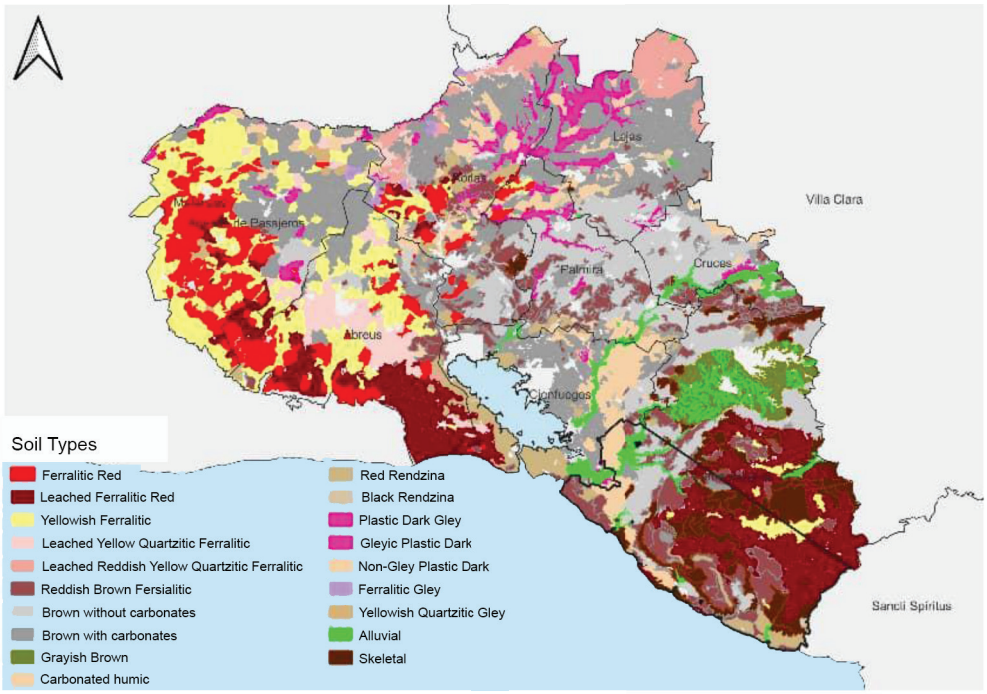

Figure 2a. Map of soil types in Cienfuegos province.
Source: Department of Soils and Fertilizers

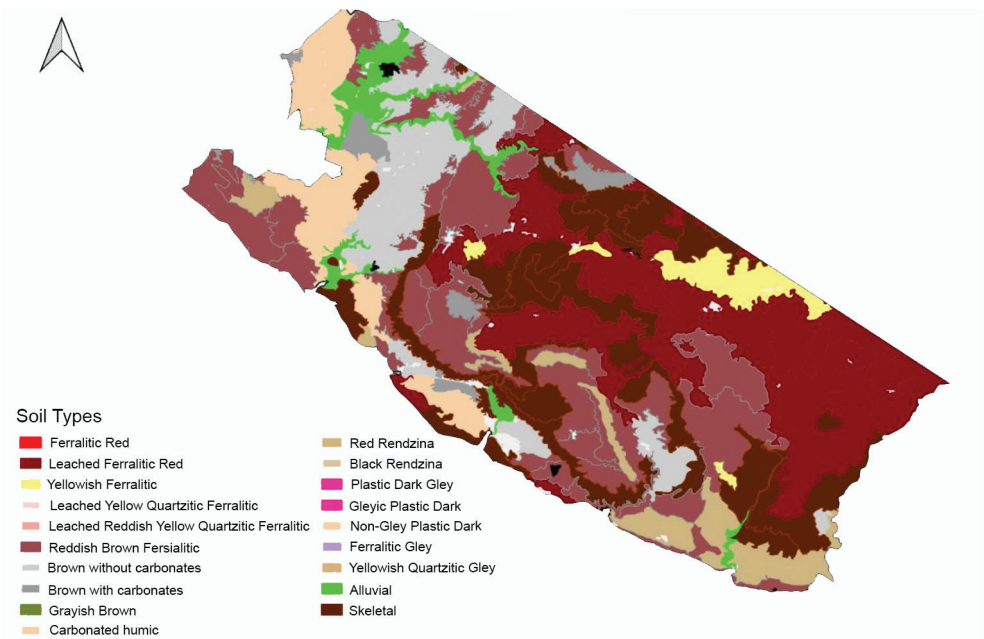

Figure 2b. Map of soil types of the area under study.
Source: Department of Soils and Fertilizers.[2]

[2] Prepared by the soil department of the province for the project Municipal Climate Governance and Sustainable Agroforestry Production of Food with Low Emissions and Adapted to Climate Change in Cienfuegos and Pinar del Río, Cuba (CIENPINOS).

population, since they are used as a source of fodder for animals (Von-Maydel, 1996). Moreover, this type of vegetation provides ecosystem services such as carbon sequestration, erosion reduction, improved water infiltration, landscape beauty and habitat for wildlife (Molina-Guerra *et al*., 2023).

A total of 23 families, 43 genera and 49 botanical species were counted during the research. The performance of the botanical composition per farm during the evaluated period is shown in table 1.

The farms with the highest number of botanical families were Las Canitas (17), Rancho Alto (14), Playa Fría (13) and Finca Marelis (12); while La Vega and Los Castillos, with 9 and 4 families, respectively, had the lowest number (table 1). A similar performance was observed for the number of genera and species, where the Playa Fría farm had the highest number of identified genera and species. Similarly, La Vega and Los Castillos had the lowest number of botanical genera and species, possibly because these farms graze animals in backyards where the diversity of plant species is lower.

Figure 3 shows the number of species identified by family during the evaluated period. A total of 23 botanical families were identified. The family with the highest number of species was Fabaceae with 14.

The Boraginaceae and Malvaceae families had four species; while the grass family showed three during the evaluated period (figure 3). The other identified botanical families reached between 1 and 2 species.

The variation in the number of species per family was probably due to the fact that some of the species have their optimum period in the dry season. However, others remain with a reduced number.

Table 1. Botanical composition of 6 farms dedicated to goat rearing in the Southern Circuit of Cumanayagua, Cienfuegos, during the dry season.

Farm	Taxonomic categories		
	Families	Genera	Species
La Vega	9	15	18
Playa Fría	13	25	30
Las Canitas	17	23	27
Finca Marelis	12	20	22
Rancho Alto	14	24	25
Los Castillos	4	9	10

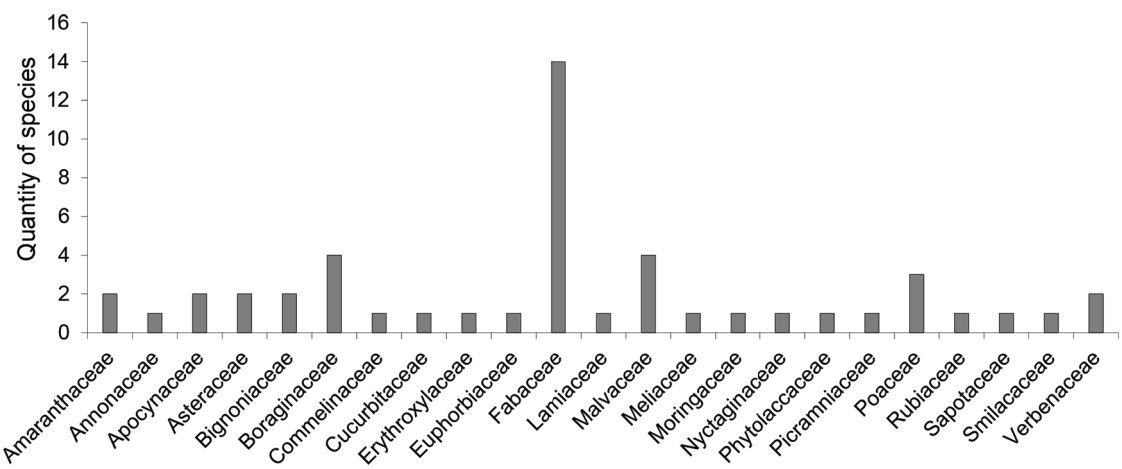

Figure 3. Botanical families of six farms dedicated to goat rearing in the Southern Circuit of Cumanayagua, Cienfuegos, during the dry season.

On the other hand, some species are affected by management, which is always influenced by the use that grazing animals might make of the area occupied by these plant species, which they partially or totally eradicate, explaining the loss of individuals. Yet, despite the fact that legumes are preferred for goat consumption, they showed the greatest number of species, because most of these were found in the shrub stratum and the resource used by the goats as feedstuff, in addition to the foliage, was the seed.

The advantage of scrub species as a source of animal feed lies in the fact that they have leaves during most of the year, with relatively high crude protein content. In contrast, grassland herbaceous species are an important source of forage only during the rainy season (Moya-Rodríguez *et al*., 2002).

Likewise, the practice of livestock grazing in scrublands reduces fuel material and slows down the scrubbing of the territory. This reduces the probability, frequency and intensity of fires (Lasanta-Martínez, 2024).

This type of vegetation is characterized by a wide range of growth patterns, diversity in leaf longevity, growth dynamics and contrasting phenological developments, which could influence the presence of these species during the sampling period.

Table 2 shows the number of species by family and in each farm during the evaluation period. The Fabaceae and Poaceae families were present in all the evaluated farms. The Playa Fria farm showed the highest number of legume species with 9; while Rancho Alto with only 3 had the lowest number of these species during the evaluation period. However, the latter farm had the highest number of grasses, with 3 species, one of which was *Megathyrsus maximus* (Jacq.) B.K. Simon & S.W.L. Jacobs.

Table 2. Number of plant species by botanical family in 6 farms dedicated to goat rearing in the Southern Circuit of Cumanayagua, Cienfuegos, during the dry season.

Family	Farm					
	La Vega	Playa Fría	Las Canitas	Marelis	Rancho Alto	Los Castillos
Amaranthaceae	2	2			2	
Annonaceae				1	1	
Apocynaceae	1	2	2	2	2	
Asteraceae	1		1		1	
Bignoniaceae		1	1	1		
Boraginaceae		4	1		2	
Commelinaceae		1				
Cucurbitaceae				1	1	
Erythroxylaceae		1	1			
Euphorbiaceae	1	1	1	1	1	
Fabaceae	6	9	5	6	3	4
Lamiaceae			1			
Malvaceae	3	4	3	3	4	3
Meliaceae	1	1	1	1	1	
Moringaceae						1
Nyctaginaceae	1		1	1	1	
Phytolaccaceae		1			1	
Picramniaceae			1			
Poaceae	2	2	2	2	3	2
Rubiaceae			1			
Sapotaceae			1			
Smilacaceae			1	1		
Verbenaceae		2	2	2	2	

The families Moringaceae, Lamiaceae, Rubiaceae and Sapotaceae with the species *Moringa oleifera* Lam, *Salvia* sp., *Hamelia patens* Jacq. and *Chrysophyllum oliviforme* L. were present only in the farms Los Castillos and Las Canitas, respectively (table 2).

Several studies on floristic diversity have shown that the Fabaceae and Poaceae families are frequently found in certain ecological systems, whether natural or anthropogenic. When analyzing the existing diversity in two Agricultural Biodiversity Dissemination Centers (CDBA, for its initials in Spanish) for incorporation in peasant farms, Terán-Vidal (2013) and Machado-Castro (2013) reported the predominance of species belonging to these families. However, Prieto-Duarte *et al*. (2024) when characterizing the floristic biodiversity of a farm of the Southern Circuit in Cumanayagua, Cienfuegos province, Cuba, reported that the most represented botanical families were Fabaceae, Malvaceae and Cyperaceae, which coincides with this research only with the Fabaceae family.

The variation in botanical composition among farms may be due to factors such as grazing management and climate conditions. Scrub species, such as legumes, offer advantages as a year-round feed source, making them valuable for animal husbandry in areas with prolonged dry seasons.

Conclusions

The study carried out in six farms dedicated to goat rearing in the Southern Circuit of Cumanayagua, Cienfuegos, during the dry season, showed a remarkable botanical diversity. Despite the fact that the farms are located in the same geographical sector, significant variations in botanical composition were observed among them.

The study highlights the importance of plant diversity in goat grazing areas and suggests that the Fabaceae family plays a crucial role in the diet of these animals. It also highlights the need for sustainable management strategies that promote the conservation of plant biodiversity and optimize goat production.

Acknowledgments

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Conflict of interests

The authors declare that there is no conflict of interests among them.

Authors' contribution.

- Dariel Morales-Querol. Conducted the botanical composition evaluations, as well as data recording and processing. Participated in the search for bibliographic information. Executed the drafting and revision of the manuscript.
- Miguel Ángel Benítez-Álvarez. Performed the botanical composition evaluations, as well as data recording and processing.
- Maritza Rizo-Álvarez. Conducted the botanical composition evaluations. Participated in the search for bibliographic information.
- Yailen Array-Arteaga. He participated in the selection of the farms and in the execution of the research, as well as in the search for bibliographic information.
- Yhosvanni Pérez-Rodríguez. He participated in the selection of the farms and in the execution of the research, as well as in the search for bibliographic information.

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