Short Communication

Soil macrofauna in mountain livestock production ecosystems in Guisa, Granma, Cuba

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ABSTRACT: The objective of this work was to identify the soil macrofauna present in mountain livestock production ecosystems, in Guisa, Granma province. The samplings were conducted in October, 2012, in 7 livestock production farms. The edaphic macrofauna was collected according to the methodology proposed by the TSBF (Tropical Soil Biology and Fertility). Three 25 x 25 x 20 cm test pits were excavated in each study area. The individuals of the edaphic macrofauna were manually selected, the earthworm were preserved in 4 % formaldehyde and the remaining invertebrates in 70 % alcohol, for their later identification; which was made through the consultation of different taxonomic documents, among others. The edaphic macrofauna was grouped in two phyla, four classes, six orders, six families and 11 species, from which six belong to ants. It is concluded that in the mountain livestock production ecosystems of Guisa, Granma, the highest quantity of species belonged to the Formicidae family. The earthworms were the prevailing organisms, because they were collected in 100 % of the sampled areas and most individuals were found in the farm where star grass prevailed. It is recommended to evaluate other livestock production units in the mountain using variables that best characterize the performance of the soil macrofauna (for example: density and biomass).

Keywords: pasturelands, earthworm, soil microorganisms

INTRODUCTION

In recent years the importance of the diversity of the edaphic biota in the global functioning of the ecosystem and especially in the interpretation of the soil fertility status has been revaluated (Rodríguez *et al*., 2011).

From the biological point of view, in the evaluation of the conservation/disturbance status of the soil and the ecosystem the edaphic macrofauna, which groups invertebrates higher than 2 mm of diameter, should be considered. Many macrofauna organisms are important in the transformation of the soil properties, among them: earthworms (Annelida: Oligochaeta), termites (Insecta: Isoptera) and ants (Insecta: Hymenoptera: Formicidae), which act as ecosystem engineers in pore formation, water infiltration and organic matter humidification and mineralization. Another part of macroinvertebrates participates in the trituration of plant remains (e.g. Coleoptera, Diplopoda, Isopoda Gastropoda) and some work as predators of living animals of the edaphic macrofauna and mesofauna (e.g. Araneae, Chilopoda Cabrera, 2012).

The macrofauna communities vary in their composition, abundance and diversity, depending on the soil disturbance status, caused by the change of land use, which allows to evaluate these communities as bioindicators of environmental quality or disturbance (Cabrera *et al*., 2011a). In this sense, in Cuba the studies about the diversity of the edaphic macrofauna in the pasturelands and their importance in the monitoring and management of soil fertility in this type of agroecosystem have increased (Lok, 2010; Rodríguez *et al*., 2011; Cabrera *et al*., 2011b).

In spite of the above-mentioned facts no studies have been conducted about these groups of the edaphic biota in mountain livestock production ecosystems, which show soils affected by erosion, low fertility and unproductivity (Ramírez, 2011), which would be singularly important to monitor the conservation or degradation status caused by livestock production practices in these fragile ecosystems. That is why the objective of this work was to identify the soil macrofauna present in mountain livestock production ecosystems, in Guisa, Granma province.

MATERIALS AND METHODS

The samplings were conducted in October, 2012, time described as ideal for the macrofauna collection due to its higher activity. The evaluation sites were 7 farms located in the Macanacú, Guamá and Ojo de

Agua communities, in the Guisa municipality, Granma province (table 1). The prevailing pasture species were *Dichanthium caricosum* (L.) A. Camus, *Paspalum notatum* Alain ex Flüggé, Guinea grass [(*Megathyrsus maximus* (Jacq.) B. K. Simon & S. W. L. Jacobs)] and star grass (*Cynodon nlemfuensis* Vanderyst).

Sampling of the edaphic macrofauna. The method recommended by the Tropical Soil Biology and Fertility (TSBF) program (Anderson and Ingranm, 1993) was used. In the diagonal of an enclosed pasture, of approximately 1 ha three 25 x 25 x 20 cm test pits were excavated in each farm according to the criterion expressed by Cerón *et al.* (2008). The macrofauna of a single 0-20 cm stratum was manually selected; the earthworms were preserved in 4 % formaldehyde and the remaining invertebrates in 70 % alcohol, for their later identification.

Identification of the edaphic macrofauna. It was made through consultation of different taxonomic documents (Alayo, 1974; Hickman *et al.*, 2001; Brusca and Brusca, 2005; Fontenla and Matienzo, 2011).

RESULTS AND DISCUSSION

The edaphic macrofauna was grouped in two phyla, four classes, six orders, six families and 11 species (table 2).

Regarding the specific richness, a higher quantity was found in the Formicidae family, because six species were recorded from the 11 identified ones. Equally, Cabrera and Menéndez (2013) in a silvopastoral system of *Leucaena leucocephala* and *M. maximus* and a pastureland with only the latter, reported the presence of 18 orders, with superiority in quantity of individuals, just like in this study. On the other hand, García *et al*. (2014) reported the presence of 14 orders in a silvopastoral system with *L. leucocephala* and different grasses, while in pasturelands of natural and cultivated grasses only found 9 orders, in the Matanzas province. On the contrary, Cabrera *et al*. (2011b) found 14 orders and 18 families in pasturelands of Guinea grass and star grass, in the San José de las Lajas municipality, Mayabeque province.

With regards to the higher representativeness of the members of the Formicidae family, Matienzo *et al*. (2010) stated that ants are considered among the insects with higher specific and ecological diversity in the tropical latitudes and many studies have been conducted in natural environments and agrecosystems, due to their high diversity and abundance, to the variety of niches they occupy and to their fast response to agricultural practices.

Earthworms were present in all the farms which could have been related to the soil type and the similar climate conditions.

On the other hand, the farm where more species were collected was La Gloria; this could have been related to the good conservation status of the pasturelands, which favors the development of the

Table 1. Characteristics of the farms.

No.	Name of the farm	Productive unit	Soil type	Slope degree (%)	Surface (ha)	Pastureland composition	Pastureland conservation status
1	La Gloria	UBPC Antonio Sánchez Díaz	Brown with carbonates	20	13,42	D. caricosum-C. nlemfuensis	Good
2	La Majagua	UBPC Antonio Sánchez Díaz	Brown with carbonates	15	8,6	D. caricosum	Bad
3	La Mariposa	UBPC Antonio Sánchez Díaz	Brown without carbonates	30	4,2	D. caricosum-M. maximus-P. notatum	Regular
4	Las Delicias	CCSF Emiliano Reyes Gómez	Brown without carbonates	30	5,6	D. caricosum	Regular
5	Roberto López	CCSF Emiliano Reyes Gómez	Brown with carbonates	15	6,8	D. caricosum-M. maximus-C. nlemfuensis	Regular
6	El Recreo	CCSF Camilo Cienfuegos	Brown without carbonates	40	16,1	P. notatum	Regular
7	El Progreso	CCSF Braulio Coroneaux Betancourt	Brown without carbonates	35	11,7	D. caricosum-P. notatum	Regular

Table 2. Edaphic macrofauna in mountain livestock production systems.

Phylum	Class	Order: Family	Species	Common name	Farms where they were found
Artropoda	Insecta	Hymenoptera: Formicidae	*Tetramonium guineensis* (Fabricius)	Ant	1,2
			Wasmannia auropunctata (Roger)	Electric ant	1,2,3 ,5,7
			Paratrechina fulva (Mayr)	Tawny crazy ant	1, 2,7
			Paratrechina sp.	Crazy ant	1,3,6
			Pseudomyrmex flavidulus (Smith)	Ant	5
			Tapinoma melanocephalum (Fabricius)	Ghost ant	6
		Dermaptera: Labiduridae	*Labidura riparia* (Pallas)	Striped earwig	1,2, 3, 7
		Dermaptera: Forticulidae	*Cipex schwarzi* (Rehn)	-	1,7
		Orthoptera: Gryllidae	*Acheta assimilis* (Fabricius)	Field cricket	1,2,3,7
		Hemiptera: Cercopidae	*Prosapia bicincta (Say)*	Two-lined spit-tlebug	4,6
	Diplopoda	Spirobolida: Spirobolidae	*Spirobolus* sp.	Millipede	1,7
	Chilopoda			Centipede	1,7
Annelida	Oligochaeta	Haplotaxida		Earthworm	1,2,3,4,5,6,7

macrofauna individuals and it can be inferred that in that system there is a lower negative impact of the livestock production activity on the soil.

Many authors report earthworms as the prevailing group within the edaphic macrofauna in most livestock production systems, and especially in the most humid ecosystems and pasturelands (Suthar, 2009). In Cuba some studies have been reported about this zoological group in pasturelands, including the study conducted by Sánchez and Hernández (2011) who when evaluating the performance of earthworm communities in two livestock production ecosystems found that the species *Onychochaeta elegans* was the most abundant of the three species present in the ecosystem of grasses as well as in the silvopastoral system (composed by: *M. maximus* and *L. leucocephala*).

In the case of millipedes, although they were found in only two farms, in literature it is reported that they are not less important in the pastureland ecosystems, because they consume large quantities of leaves of little nutritional value and excrete most of them relatively without any physical change but very fragmented, which facilitates their utilization by microrganisms (Sánchez and Reinés, 2001). Likewise, Zaldívar *et al*. (2007) reported, just like in this research, the presence of this zoological group in studies conducted in three livestock production systems (silvopastoral system, association of grasses with herbaceous legumes and a monocrop system) in the Granma province.

It is concluded that in the mountain livestock production ecosystems of Guisa, Granma, the highest quantity of species belonged to the Formicidae family. Earthworms were the organisms that predominated because they were collected in 100 % of the sampled areas and most individuals were found in the farm where star grass prevailed. It is recommended to evaluate other livestock production units on the mountain using variables that characterize best the performance of the soil macrofauna (for example: density and biomass).

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