BIODIVERSITY OF THE ANTS (INSECTA: HYMENOPTERA) ASSOCIATED WITH THE CENTER AGROECOSYSTEMS OF ARGENTINA

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ABSTRACT: The world change in land use and crop modification has been, at the expenses of forests, pastures and swamps. Argentina pampean plains have not been an exception because of this global tendency with an agricultural border continuous advance from the east to the semiarid west. This generates a loss of biological diversity that affects a great number of organisms among which we find the ants, which play a very important role in the communities structure doing a balance between living creatures and their habitat. The aim of this work is compare the myrmecofauna associated with productive agroecosystems in the central region of Argentina, through the evaluation richness of these insects and diversity. The hypothesis of this study is to test the diversity of Formicidae in fields where little anthropogenic is greater than in agroecosystems of central Argentina. Three farms were chosen as study sites, each of them divided into two sampling sites that correspond to cultivated or natural areas. A total of 5.647 ants were collected among which three dominant species were found in all the sites: *Dorymyrmex breviscapis*, *Solenopsis saevissima* and *Pheidole bergi*. Significant differences were observed between the agroecosystems myrmecofauna and the natural environments.

KEY WORDS: Ants, richness, abundance, agricultural ecosystems.

Diversity is an important attribute of a community, where wealth is one of the characteristic used for measurement. Species richness, functional groups and genotypes are aspects that govern the magnitude and effectiveness of the processes and ecosystem characteristics (Chaplin et al., 1997).

Man's actions usually reduce ecosystems species richness, generating losses of biodiversity (Wilson, 1988), modifying the natural environment by developing crops and introduction of animals, causing habitat fragmentation (Cabrera, 1976; MacKay et al., 1991; Perfecto, 1996; Demaria et al., 2008).

Formicids play an important role in the structure of communities, and are also one of the most abundant terrestrial ecosystems and agro-ecosystems animal groups (Hölldobler & Wilson, 1990), (Camacho, 1995), playing an important role as predators, herbivores or detritivores, and participating in soil physicochemical processes, including decomposition and nutrient cycling (Lobry de Bruyn & Conacher, 1990). To date approximately 12,763 have been described (http://.www.antbase.org) species and an estimated formicids remains to describe the same. Several authors have considered that ants may be good bioindicators because of their high diversity and abundance, the variety of niches they occupy, their rapid response to environmental changes, sampling and its easy identification compared to other groups insect (Andersen, 1991; Peck et al.,

1998; Kaspari & Majer, 2000; Alonso, 2000). They have also been found useful in assessing biotic responses against agricultural practices such as fertilization, spraying and burning (Folgarait & Farji Brener, 2005).

The anthropogenic changes in land use have led to significant changes in the diversity of the natural community, changing the perception of formicids by man, considering crop pests (Folgarait & Farji Brener, 2005). With the increasing agricultural development, ants diversity food has decreased dramatically, changing the scale at which these insects perceive the environment, for that reason we must study and retain spatial levels formicids "mosaic" because of the high degree of fragmentation that can occur habitats for the development of monocultures, which limit their diet, presenting general behaviors (Roth, 1994). On the other hand, the environment impoverishment impacts in several ways on ants either eliminating natural enemies, making homogeneous microclimate, changing the relationship between ant species and introducing exotic vegetation (Folgarait & Farji Brener, 2005).

In the province of La Pampa, Argentina, recent years of agricultural frontier expansion has increased considerably, causing a change in the affected areas biodiversity, few taxonomic surveys refer to this problem (Quiran & Casadio, 1988, 1991; Casadio & Quiran, 1990; Pilati & Quiran, 1996).

Because the issues presented by the region under study, it's expected to check that the diversity of bit fields anthropogenic formicids is greater than in agroecosystems of central Argentina.

The aim of this study is to evaluate richness and diversity ants in central Argentina Republic.

STUDY AREA

The study area is located in the east of the province of La Pampa (Fig. 1), Argentina (36° 18' 34.17" S, 64° 16' 51.55" W), in the transition between Espinal and Pampa phytogeographical regions. Espinal region is mainly characterized by moderately dense forests of *Prosopis caldenia*, steppe and halophytic vegetation grasses with hot and humid climate is in the north and mild dry climate in the west and south, and sandy. The Pampas region, in particular the Eastern Pampa district is characterized by prairie grasses (*Estipeas*, *Festuceas* and *Eragrosteas*) samófilas steppes, steppes halophytes, bushes, reeds and grasses, among others, the climate ranges from sub-humid to semiarid (annual average T °: 14° to 16°) with heavy seasonal rains (300-500 mm), the soil is characterized by mollisols and entisols with loess or silt subsoil (Cabrera, 1976, Natural Resources Inventory, 2004).

MATERIALS AND METHODS

Samples were taken at six plots of one hectare, four of them were found cultivated or tillage tasks (alfalfa, corn, pasture and sorghum) and other two maintained the appearance of a natural field called caldenales. Three samplings were performed, for the months of April, May and June 2008, respectively, which ranged from autumn to early winter of that year. This season was optimal in the region due to low rainfall and dry temperate presented, encouraging mobility and fall of arthropods.

The two sites considered natural, due to low human impact, consist caldenes (*Prosopis caldenia*), this is distributed in arid dry temperate Argentina, is endemic in this country, it is used in times of drought by animals for food as it consists of a fruit (legume) pastures rich in sugars and characterized by grasses

(*Estipeas*, *Festuceas* and *Eragrosteas*), generally used as fodder for cattle animals by man, are both sites 1 and 2.

The four sites contained agrocultivados: alfalfa (*Medicago sativa*), are used as fodder and frequently naturalized vegetation is this site 3; corn (*Zea mays*) is widely cultivated in arid areas to be used as fodder and food for living human, is the site 4; sorghum (*Sorghum vulgare*), make the site 5, is widely cultivated as fodder for cattle, since it is very nutritious because it contains sugars; pasture (composed by: Vetch and Oats) Site part 6, vicia (*Vicia faba*) are set as the monofilament cultivation accompanied by some cereal (oats, barley), is used as fodder. oats (*Avena sativa*), is frequently used as fodder.

Formicids capture was performed by trapping 750 cc. drop with a diameter of 7 cm (Agosti et al., 2000), barrier, completed to its 2/3 parts with 75% diluted alcohol and a few drops of glycerin or detergent. They set five pitfall traps spaced 20m each, on three transects of 100m in length, spaced from each other 25m. They were collected at the end of five days, allowing discard any disturbance produced by the installation thereof. It is part of the material prepared in the laboratory, using 72X stereomicroscope; subsequently analyzed material was placed in small vials (20 cc. capacity) with 70% alcohol for preservation, another part of the specimens were mounted pasting them into 2x1 cm paper triangles with entomological pins No. 4, then placed in boxes entomological specimens. Species were then identified using keys (Bolton, 2007). The identified material was deposited in the chair of Invertebrates II, National University of La Pampa, Argentina. Individuals were counted in each trap and diversity calculated two indices: the inverse of Simpson (1 / D) and Shannon. We performed a cluster analysis for the abundance of species based on the distance from Canberra, with the Ward method in order to identify groups of similar composition environments formicids in the study period. For this purpose we used the software R version 2.9 (Software R, 2009) and the R statistical package Biodiversity (Biodiversity R, 2009).

RESULTS

There were a total of 5,647 formicidae belonging to 3 subfamilies, 10 genera and 11 species in six study sites. The subfamily Myrmicinae was the five species best represented: *Crematogaster quadriformis* Roger, *Solenopsis saevissima* (Fr.Smith), *Pheidole bergi* Mayr, *Pheidole taurus* Emery, *Acromyrmex striatus* Roger. The Dolichoderinae and Formicinae subfamilies were represented by three species each: *Forelius breviscapus* Forel, *Dorymyrmex breviscapis* Forel, *Linepithema humile* Mayr and *Camponotus borellii* Emery, *Brachymyrmex patagonicus* Mayr and *B. fiebrigi* Forel. The species with dominance in all sites were S*olenopsis saevissima* (37%), *Pheidole bergi* (33%) and *Dorymyrmex breviscapis* (25%), corresponding to three dominant species omnivorous guild soil (Table 1).

The richness was similar for all sites except the pasture, which in turn, had the lowest value, unlike alfalfa had higher wealth, followed by caldenal and sorghum (Table 2).

Site Diversity sorghum (1.63) was higher than the rest of the other sites, in turn caldenales both had similar diversity $p > 0.2$ and above crops, with the exception of Sorghum, above (Table 2).

The rank-abundance curves (Fig. 2) were similar among all sites sampled, in which there were one or two dominant species, and a high proportion of low abundant and rare species. The dendrogram developed using cluster analysis

based on the distance from Canberra has three groups, one composed exclusively pasture site (less diversity), the second by the sorghum (greater diversity) and the third place by both caldenales, the alfalfa and maize (Fig. 3).

DISCUSION

Omnivores formicids guild floor predominance which was present mostly in the areas of study, consistent with the assertions of Fragoso & Rojas (2000) and is proposed to be because in these sites, generalist species not are subject to the presence of a resource, but use the wide variety of foods, which are available at any time of year, as stated in their work Whitford (1978).

High crop wealth may be due to the high heterogeneity of adjacent vegetation possessing sites, as confirmed Fernandez (1999), which were not typical of cultivation made possible the creation of microenvironments.

Consistent with Magurran (1989, 2004) accumulation curves were fitted to a logarithmic distribution, inequitable environments (Table 3).

CONCLUSION

Few differences were found between the ant fauna of agroecosystems and natural environments (caldenales), since all sites shared 90% of the species collected. The results show that the region contains a richness and diversity of these insects like, explained by the anthropic ecosystems suffering in these places, where they generate patches or islands of natural vegetation surrounded by crops, which allow homogeneity Formicidae species in the region Quiran & Casadio (1991), which thrive and colonize disturbed areas at the same time as natural, this is consistent with Roth (1994) and Vasconcelos (1999).

For these reasons we can say that the hypothesis for the present work has not been confirmed, because no significant differences found between the ant fauna of sites consist of natural vegetation and agroecosystems of central Pampas. For these reasons it is suggested agroecosystem management but recommended maintenance of high plant diversity, decrease of agrochemicals and reduced soil compaction to prevent the loss of the same in this region.

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Table 1. Formicids taxonomic description found in 2008 in the prov. La Pampa, Argentina.

Subfamily	**Genera**	**Species**
Myrmicinae	*Pheidole*	*bergi*
Myrmicinae	*Pheidole*	*taurus*
Myrmicinae	*Solenopsis*	*saevissima*
Myrmicinae	*Acromyrmex*	*striatus*
Myrmicinae	*Crematgaster*	*quadriformis*
Dolichoderinae	*Dorymyrmex*	*breviscapis*
Dolichoderinae	*Forelius*	*breviscapis*
Dolichoderinae	*Linepithema*	*humile*
Formicinae	*Brachymyrmex*	*patagonicus*
Formicinae	*Brachymyrmex*	*fiebrigi*
Formicinae	*Camponotus*	*borellii*

Table 2. Formicids richness, Shannon diversity index and Simpson and total number of individuals of the six sites studied during the months of April, May and June 2008 in the prov. La Pampa, Argentina.

	Sorghum	Caldén a	Caldén b	Alfalfa	Corn	Pasture
S	8	8	8	9	7	5
H'	1.63	1.22	1.19	1.16	1.10	0.71
1/Simpson	4.09	3.12	2.84	2.79	2.53	1.55
N	440	963	1468	1450	1048	364

Table 3. Values of statistical significance of the t test on the Formicidae of the six sites studied during the months of April, May and June 2008 in the prov. La Pampa, Argentina.

	Caldén a	Caldén b	Alfalfa	Corn	Pasture
Sorgo	<0.001	<0.001	1E-23	1.1E-23	1.1E-23
Caldén a		0.200	0.043	0.00021	1.2E-18
Caldén b			0.441	0.00881	1.5E-16
Alfalfa				0.055	3.2E-15
Maíz					2.8E-11

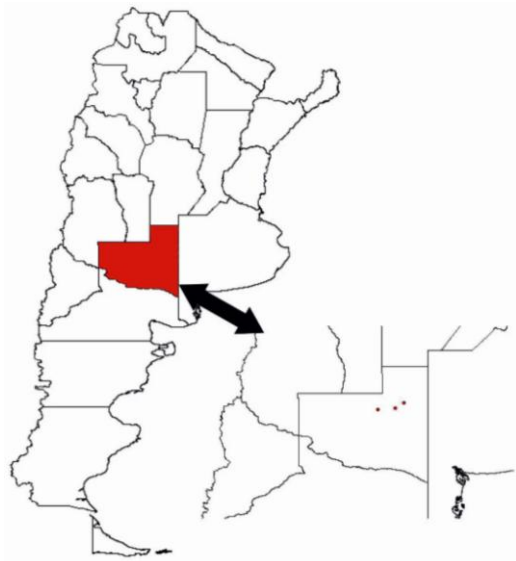

Figure 1. Geographical location of the sampling sites in the Province of La Pampa, Argentina.

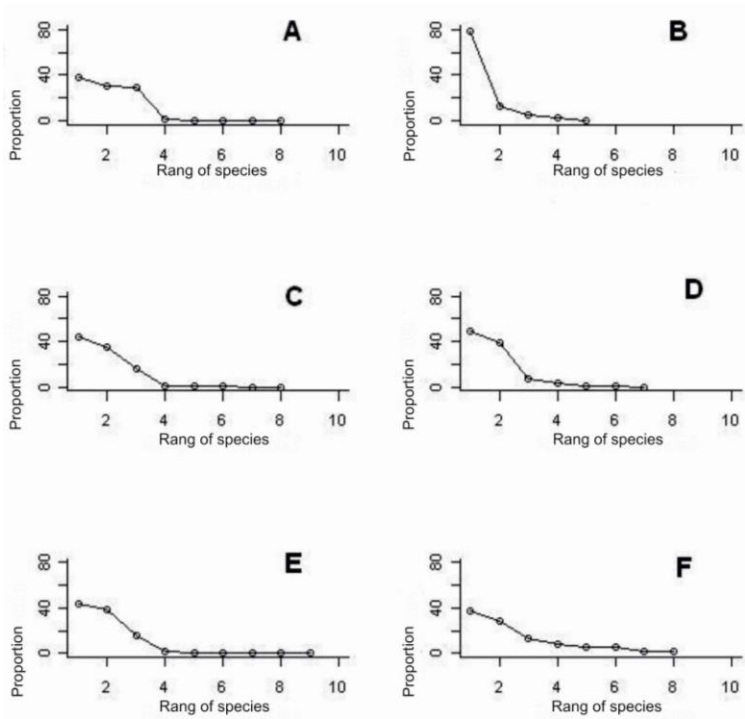

Figure 2. Rank-abundance curves of Formicidae of the sites studied in prov. La Pampa, Argentina. A: caldenal (a), B: pasture, C: caldenal (b), D: corn, E: and F alfalfa: sorghum.

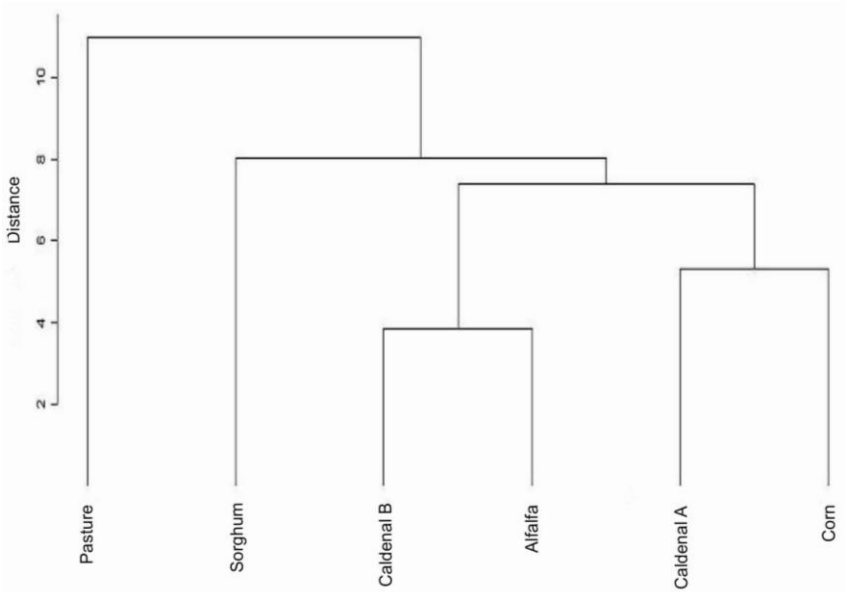

Figure 3. Cluster analysis of the sites studied during the months of April, May and June 2008 in the prov. La Pampa, Argentina.