

Identification of functional groups of insects associated with family agricultural production systems in the province of Sumapaz, Colombia*

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Abstract

Objective: Knowing and studying insects associated to an agroecosystem allow us to establish functional groups that enable the populations' self-regulation and promote the provision of ecosystem services. **Scope:** In order to assess the presence of functional groups of insects associated to family farming and agroecological practices in the province of Sumapaz, Cundinamarca (Colombia), a pilot test was designed. **Methodology:** Sampling was performed on 11 family farms in the municipalities of Arbelaez, Fusagasuga, Granada and Tibacuy. The farms were also classified into 3 different groups: group 1 (organic producers), group 2 (producers in organic conversion process), group 3 (conventional producers). Two samples were taken on each farm between March and June-2017, using pitfall traps and capture of flying insects with an entomological net. **Main Results:** One thousand six hundred fifty-one specimens were collected and classified in 11 orders, 60 families and 179 morphospecies, 976 of them were beneficial insects (predators, decomposers, parasitoids and pollinators) and 675 insects were considered pests (defoliating phytophagous, sucking phytophagous and generalist phytophagous). Group 1 reported the highest number (425) of beneficial insects, while group 3 had the highest number (356) of pest insects. The most representative family in the three groups was Formicidae, with 421 specimens. In addition, the finding of genus *Mordellistena* (Coleoptera: Mordellidae: Mordellistenini) was registered for the first time for the department of Cundinamarca. **Conclusions:** From this information, the establishment of functional groups indicates the state of these agroecosystems, where the organic farms guarantee a better pollination and pest control, unlike the conventional ones.

Key words: Agroecology, diversity, entomology.

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Identificación de grupos funcionales de insectos asociados a sistemas de producción de agricultura familiar en la Provincia del Sumapaz, Colombia.

Resumen

Objetivo: El conocimiento de insectos asociados a agroecosistemas es importante para establecer grupos funcionales y así fomentar la autorregulación y sostenibilidad del sistema productivo. Alcance. Se identificó la diversidad funcional de insectos en fincas con diferentes tipos de manejo agrícola (orgánico, transición a orgánico y convencional) en la región de Sumapaz, Cundinamarca. **Metodología:** El muestreo se realizó en 11 fincas de los municipios de Arbeláez, Fusagasugá, Granada y Tibacuy. Las fincas fueron clasificadas en 3 grupos diferentes: grupo 1 (productores orgánicos), grupo 2 (productores en procesos de conversión a orgánicos), grupo 3 (productores convencionales). En cada finca se realizaron dos muestreos entre marzo y junio de 2017, se pusieron trampas de caída y se recolectaron insectos voladores utilizando una red entomológica. **Resultados principales:** Se encontraron 1651 individuos distribuidos en 11 órdenes, 60 familias y 179 morfo-especies; a partir de los cuales, 976 fueron insectos benéficos (depredadores, degradadores, parasitoides y polinizadores) y 675 insectos fueron considerados plaga (fitófagos defoliadores, fitófagos chupadores y fitófagos generalistas). El grupo 1 reportó el mayor número de insectos benéficos (425), mientras que el grupo 3 presentó el mayor número de insectos plaga (356). La familia más representativa en los tres grupos fue Formicidae, con 421 especímenes. Además, se registra por primera vez el hallazgo del género *Mordellistena* (Coleoptera: Mordellidae: Mordellistenini) para el departamento de Cundinamarca. **Conclusiones:** De acuerdo con la información obtenida, el establecimiento de grupos funcionales indica el estado de estos agroecosistemas, donde las fincas orgánicas garantizan una mejor polinización y control de plagas, a diferencia de las convencionales.

Palabras clave: Agroecología, diversidad, entomofauna.

Introduction

Colombia has been characterized by its rich biodiversity as a result of its topography and ecological complexity (Hartshorn, 2002). However, the country's native ecosystems have been degrading due to agricultural expansion (Mizutani et al., 2011), causing their fragmentation, and consequently, forcing many organisms to form metapopulations (Perfecto and Vandermeer, 2015). Thus, insects have been able to colonize a large number of these habitats acquiring different eating habits. Besides, as agroecosystems are complex, they provide favorable conditions for the establishment of their communities (Lozano-Gutiérrez et al., 2015), where insects can keep developing different cycles in diverse fruits or vegetative structures where they can cause damage or, on the contrary, provide an ecosystem service such as pollination (Gullan and Cranston, 2010).

Agroecology seeks good agricultural practices that interact with a set of components (soil, plants, organic matter, microorganisms and insects) to generate stability with the

environment through the productive system (Adesope et al. 2012; Mora Delgado et al., 2019). However, conventional practices are frequently used (high dependence on synthetic chemical inputs, use of mechanical technologies of high consumption and negative impact in many agroecosystems in Colombia). This can have a negative impact on our planet (pollution, diversity loss, increased resistance to pests, among others); therefore, agroecological practices to promote the adoption of sustainable agricultural productions have been implemented by some producers (Alexopoulos et al., 2010; Escobar et al., 2019). This type of study allows us to assess the importance of insects in relation to the ecosystem services they generate provide when agroecological practices are adopted and sustainable farming systems are encouraged (Escobar et al., 2013).

A pilot test was designed to assess the presence of functional groups of insects associated to family farming and agroecological practices in the province of Sumapaz, Cundinamarca (Colombia).

Materials and methods

Study area.

This study was performed in the province of Sumapaz, Department of Cundinamarca, in the municipalities of Arbeláez, Fusagasugá, Granada and Tibacuy. The database registered by the research group 'Area Verde' of the University of Cundinamarca allowed to have information on agricultural production and to select 11 family farms. The farms were also classified into 3 different groups according to the results of a previous typology process, which mainly took into account the agricultural practices implemented. Group 1. Organic producers: not using chemical inputs, use compost and organic fertilizers, crop rotation, diversify crops between 8-10 productions. Group 2. Producers in organic conversion process: occasionally use chemical inputs and organic fertilizers and do crop rotation between 3-5 productions. Group 3. Conventional producers: use chemical inputs with dominance of monoculture (Escobar et al., 2019).

According to Escobar et al., (2019), small producer's farms are between 1500 -1900 m.a.s.l. The main crops are coffee (*Coffea arabica*), banana (*Musa × paradisiaca*) and peas (*Pisum sativum*), followed in lower production area by beans (*Phaseolus vulgaris*), corn (*Zea mays*), passion fruit (*Passiflora edulis*) and golden berry (*Physalis peruviana*

Field stage.

Two sampling modules were performed between high and low rainfall, between March and June-2017. In each group of farms, two 100m line transects were established, and 10 sampling stations separated every 10m were formed; in each station a pitfall trap was set (disposable glasses buried at ground level, with 90% alcohol) and left there for 12 h.

A manual collection of flying insects was made with an entomological net 'jama' in the high, medium and low part of the plants for each station. (Mizutani et al., 2011).

Taxonomic determination.

Specimens were determined to the lowest possible taxonomic level using keys (Fernandez, 2003; Villarreal et al., 2006; Park et al., 2016).

Establishment of functional groups.

Functional groups were established according to their dietary habits, as proposed by (Fernandez, 2003; Villarreal et al., 2006; Gullan and Cranston, 2010; Aristizabal et al., 2013; Park et al., 2016), as follows: Beneficial insects (predators, decomposers, parasitoids and pollinators) and insects considered pests (defoliating phytophagous, sucking phytophagous and general phytophagous).

Results

A total of 1651 specimens were collected. They were classified in 11 orders, 60 families and 179 morphospecies, 976 of those insects are considered beneficial and 675 pests. Organic productions (group 1) showed a higher number (425) of beneficial insects, especially predators (172), as well as decomposers (88), parasitoids (125) and pollinators (40) that may be involved in pest control (Table 1). Likewise, there were fewer pest insects (121) in relation to group 2 and 3.

Table 1. Functional families identified on group 1 with their number of specimens.

Beneficial insects	predators	Formicidae (101), Vespidae (8), Cantharidae (18), Carabidae (25), Coccinaelidae (3), Lycidae (2) & Staphylinidae (15)
	decomposers	Lauxaniidae (22), Phoridae (34), Sepsidae (28) & Isoptera (3) Mordellidae (1)
	parasitoids	Braconidae (22), Chalcididae (23), Chrysididae (14), Eulophidae (14), Ichneumonidae (33) & Pteromalidae (19)
	pollinators	Apidae (11), Formicidae (3), Vespidae (4), Mycetophilidae (3), Tipullidae (15) & Cucujidae (4)
Insects considered pests	defoliant phytophagous	Phasmatodea (10), Acrididae (11), Gryllidae (4), Chrysomelidae (4) & Scarabaeidae (12)
	sucking phytophagous	Alydidae (10), Aphididae (2), Cicadellidae (2), Cydnidae (8), Lygaeidae (1), Agromyzidae (17), Miridae (1), Nabidae (1) & Pyrrhocoridae (12)
	generalist phytophagous	Drosophilidae (4), Curculionidae (12) & Tephritidae (10)

Group 2, producers in conversion process, they have got a lower quantity of fewer beneficial insects (375) in relation to group 1, and fewer pest (198) families in relation to group 3 (Table 2). Otherwise, conventional producers (group 3) showed the highest number of pest insects (356), specially sucking phytophagous (219), as well as defoliant phytophagous (76) and generalist phytophagous (61), as well as fewer beneficial insects (176) in relation to groups 2 and 3 (Table 3).

Table 2. *Functional families identified on group 2 with their number of specimens.*

Beneficial insects	predators	Chrysopidae (2), Formicidae (161), Cantharidae (1), Carabidae (3), Coccinellidae (2) & Staphylinidae (1)
	decomposers	Heleomyzidae (22), Phoridae (8), Sepsidae (1), Staphylinidae (7) & Isoptera (2)
	parasitoids	Braconidae (11), Chalcididae (11), Eulophidae (31) & Ichneumonidae (2)
	pollinators	Apidae (6), Formicidae (102) & Nitidullidae (2)
Insects considered pests	defoliant phytophagous	Acrididae (22), Chrysomelidae (18) & Scarabaeidae (9)
	sucking phytophagous	Aleyrodidae (10), Aphididae (2), Cicadellidae (11), Coreidae (11), Lygaeidae (30), Miridae (2), Pentatomidae (8), Pyrrhocoridae (8) & Tingidae (18)
	generalist phytophagous	Drosophilidae (17) & Curculionidae (32)

Table 3. *Functional families identified on group 3 with their number of specimens.*

Beneficial insects	predators	Chrysopidae (2), Formicidae (54), Vespidae (7), Cantharidae (2), Carabidae (12), Coccinellidae (1) & Staphylinidae (11)
	decomposers	Heleomyzidae (11), Phoridae (6) & Blattellidae (13)
	parasitoids	Chalcididae (2), Eulophidae (13), Ichneumonidae (3) & Pteromalidae (10)
	pollinators	Vespidae (10), Mycetophilidae (12) & Nitidullidae (7)
Insects considered pests	defoliant phytophagous	Tettigonidae (25), Cerambicidae, (17) Chrysomelidae (21) & Scarabaeidae (13)
	sucking phytophagous	Alydidae (8), Aphididae (22), Cercopidae (12), Cicadellidae (17), Cydnidae (12), Larguidae (5), Lygaeidae (15), Nabidae (32), Pentatomidae (15), Pyrrhocoridae (35) & Tingidae (46)
	generalist phytophagous	Drosophilidae (16), Curculionidae (28) & Tenebrionidae (17)

The most representative family of beneficial insects for the three groups was Formicidae, with (104) specimens for group 1, (263) for group 2, and (54) for group 3. This information was useful to infer biological aspects to establish their role in the ecosystem, considering the following groups.

Genus *Mordellistena* sp. (Costa, 1854) (Coleoptera: Mordellidae) (Fig. 1) was registered for the first time for the department of Cundinamarca. They measure from 2 to 4 mm, at most they reach 5 mm. They feed on plants in the Asteraceae family, some trees, oaks; their host plants are not known in many cases.



Figura 1. View of the pleura of species (Mordellidae: Mordellistena) first recorded in Cundinamarca, Colombia. *Mordellistena* sp. 1 individual, ♂. Colombia. Cundinamarca. Fusagasuga. Sardinias province, Patio Bonito farm, Premontane rainforest. 4° 17' 44.52" N 74° 21' 51.012" W. 1949 m.a.s.l. Manual capture. Jun- 20 -2017 by Garzon, Y. Canon Camera.

Discussion

Group 1, characterized by organic production, showed the highest number of beneficial insects, probable because in this production type, agroecological practices prevail (application of organic fertilizers, diversification and crop rotation, minimum tillage, biological control, among others), which encourage system self-regulation, nutrients cycling, increase in organic matter, microbiota and beneficial insects, among others (Escobar et al., 2013). Beneficial insects are an economically important group in farming systems as they provide different ecosystem services and act as natural enemies in different types of crops, in addition to being pollinators and, thus,

benefiting and increasing production (Cusser et al., 2016). In this regard, biological aspects that allow understanding the role of insects in the ecosystem can be inferred.

A key interaction for the farming systems of the Sumapaz province is shown by insect communities, leading us to infer that functional biodiversity responds to agroecological principles, since according to Altieri and Nicholls (2007), if a system is capable of subsidizing processes such as organic matter accumulation, soil fertility, pest regulation and good crop productivity, it responds to good farming practices. However, based on this principle and for this study, we seek to understand the interaction insect-plant, and beneficial insects-insects considered pests. According to Leeuwen et al. (2015), microarthropods are affected by agricultural practices, depending on whether the system to be evaluated is conventional or organic.

The predator group was made up of beneficial insects with the highest number of families in organic production as well as the Formicidae family. Predator insects like Cantharidae, Formicidae and Lycidae have toxic or repelling substances such as acetyl, ligid, glyceride and alkaloid acids that dissolve with haemolymph and are released while attacking their prey. They are commonly active predators of small mollusks, annelids and larvae of other Coleoptera when they are in the larval stage. Carabids are generalists of arthropods, insect eggs or pupae, and in larval stage they are potential predators in their first three stages (Martinez, 2005). Likewise, coccinellids or ladybugs are known as excellent predators, widely used for biological control of larvae of chrysomelidae, aphids, coccids and other soft-bodied insects (Aristizabal et al., 2013). Chrysopidae is an insect family widely used as a control agent because as a generalist insect, its diet includes large numbers of soft-bodied arthropods such as aphids, whitefly, grasshoppers, thrips, psyllids, larvae of Lepidoptera and mites (Garzón et al., 2015). Finally, according to Vandermeer and Perfecto (1997), genus *Pachycondyla* sp. ants are aggressive and efficient controllers of Hemiptera of the Cercopidae family, and they have been registered as garden ants due to their relation to diverse plant families such as Araceae, Bromeliaceae, Cactaceae, Gesneriaceae, Moraceae, Piperaceae, Orchidaceae and Solanaceae because they do not only help the plant to escape from phytophagy performed by different pest insects, but they also control the populations of leaf-cutting ants of *Atta* sp. and *Acromyrmex* sp. genera (Fernandez, 2003).

Pollinators and parasitoids were also representative insect groups of organic production. Pollination is an ecosystem service provided by different types of animals, mainly insects and especially bees (Frankie & Thorp, 2008). In this case, for the Sumapaz province, Coleoptera (Cucujidae and Nitidulidae), Diptera (Culicidae, Mycetophilidae and Tipullidae) and Hymenoptera (Apidae, Formicidae and Vespidae) are benefiting from improved crop production, contributing to crop yield and quality (Cusser et al., 2016).

Parasitoid insects, especially the Hymenoptera order, are in charge of the control because according to (Myartseva et al., 2013), Hymenoptera parasitoid have economic importance because they are natural enemies of insects that affect crops, which is key in biological control programs such as integrated pest management. For its part, Braconidae can act as ectoparasitoid, endoparasitoid or hyperparasitoid in insects because over the years, it has been documented as a host for the following individuals: Lepidoptera (Gelechiidae, Geometridae, Noctidae, Pyralidae, Tortricidae), Coleoptera (Carabidae, Cerambycidae, Chrysomelidae, Coccinellidae, Curculionidae, Scolytidae), Diptera (Agromyzidae, Anthomyiidae, Drosophilidae, Sepsidae, Phoridae, Tephritidae, Heleomyzidae, Muscidae and Sarcophagidae), Hemiptera (Aphididae and Pentatomidae) (Park et al., 2016).

The organic production of group 1 and the transition from conventional to organic of group 2 favor the diversity of beneficial insects such as predators and parasitoids that are acting directly on pest insect populations existing in these groups. Therefore, the following biological control interactions can be found in both groups: in group 1, the most abundant pests are diptera (Tephritidae and Agromyzidae), coleoptera (Chrysomelidae and Scarabaeidae) and hemiptera (Aphididae, Alydidae and Cicadellidae); in contrast, in group 2 where the pests are coleoptera (Chrysomelidae and Scarabaeidae) and hemiptera (Aleyrodidae and Tingidae). Aphids are attacked by beetles of the Coccinellidae family (ladybugs) (Markovic & Glinwood, 2014), beetles (Scarabaeidae) are preyed on in their larval stage by carabids (Aristizabal et al., 2013), and the others are parasitized by hymenoptera of Braconidae, Chrysididae, Chalcididae, Eulophidae and Ichneumonidae families (Fernandez & Sharkey, 2006). Group 3 is more abundant in the following pests: diptera (Drosophilidae), coleoptera (Chrysomelidae and Scarabaeidae), and hemiptera (Aphididae, Cicadellidae, Cercopidae, Cydnidae, Nabidae, Pyrrhocoridae and Tingidae).

Group 2, producers in conversion process, showed fewer beneficial insects in relation to group 1, probably because occasionally they apply chemical synthesis inputs that can affect in part the microbiota, the system self-regulation and the presence of beneficial insects (Tittonell et al., 2015). This group had few parasitoids. According to Zaragoza-Caballero and Pérez-Hernández (2014), parasitoid populations are affected by pesticides or other chemicals used in conventional crops for pest control and management, which causes their displacement; moreover, they do not tolerate abrupt changes in the environment. Pests probably increase if they do not have established parasitoids, although there are predators such as carabids that, which, despite being generalists (Martinez, 2005), would be limited to soil pests. Concerning decomposer insects in this region, they are vital for the cycle of soil nutrients, thanks to their nutritional habits because their nutrition is based on the intake of a large volume of soil containing decomposed plant and animal matter, as

well as different microorganisms. Moreover, microarthropods and fungi interaction in the rhizosphere or elsewhere helps in nitrogen and phosphates mineralization in the soil, generating availability for plants (Gullan and Cranston, 2010).

Parasitoid like Ichneumonidae also present in this group 2, can acts as ectoparasitoid, endoparasitoid or hyperparasitoid in insects, and their hosts were the following: Lepidoptera (Pylalidae, Gelechiidae, Pylalidae), as well as coleopteran larvae, prepupae and pupae (Triplehorn and Johnson, 2005). The Chalcididae family is a parasitoid or primary hyperparasitoid of Lepidoptera (young pupae) and Diptera (mature larvae); Chrysididae is the main parasitoid of Phasmatodea eggs (Park et al., 2016), while Eulophidae has been considered host of spiders, insect eggs, nematodes, mites, thrips, or other hymenoptera; they commonly attack Lepidoptera, Diptera, Coleoptera and Hymenoptera larvae and have high economic importance as they are associated with pests such as whitefly and leaf miners. However, Pteromalidae is the ectoparasitoid of a large number of insects, in addition to being an important controller of the boll weevil and being related to the fruit fly (Diptera: Tephritidae) (Park et al., 2016).

Group 3, producers in conversion, showed the highest number of pest insects. This result may be related to conventional practices such as monocultures, intensive tillage, and excessive use of chemical inputs, among others. These practices can affect the presence of beneficial insects and encourage the appearance of pests and their resistance. The ecological consequences of insecticide use are deeply troubling, as they are among the agricultural tools most associated with environmental damage. Their specific objective is to kill insect pests and, consequently, to have a lethal or sublethal impact on non-target organisms (beneficial insects) and reduce or contaminate food products for higher trophic levels (Sutton et al., 2013).

Insects considered pests cause reduction or loss in crop production, as a result of herbivory and transmission of pathogens that directly affect the physiology of their host (plants), generating economic losses to the farmer (Gullan and Cranston, 2010). This is why defoliating phytophagous insects such as stick insects, crickets, grasshoppers and beetles (Cerambycidae, Chrysomelidae, Scarabaeidae) have caused high losses due to defoliation in different types of plants and crops (Gullan and Cranston, 2010). Chrysomelids are an abundant and diverse group (Villarreal et al., 2006), commonly known as leaf beetles since the act as specific defoliating herbivores, both in their larval and adult stages, in the following plant families: Asteraceae, Solanaceae, Convolvulaceae, Fabaceae, Malvaceae, Salicaceae and Verbenaceae, among the most important (Burgos-Solorio and Anaya-Rosales, 2004; Kher et al., 2016). Additionally, according to Aristizabal et al. (2013) the Acrididae, Gryllidae and Tettigonidae families have been reported feeding on plants of the genera *Anthericum*, *Pandanus* and *Pittosporum*.

It is very common to find the order Hemiptera as sucking phytophagous insects that suck sap without removing the foliage to the point that they cause symptoms that may provoke huge economic losses in different crop types (Aristizabal et al., 2013). However, the Aleyrodidae family, where the white fly is found, is a very detrimental group of invasive pest insects (Nieves-Aldrey et al., 2006). According to Lorenzo et al. (2016), its economic importance lies in the direct damage when they feed on crops, and indirect damage when they produce waxy or cottony secretions that favor the establishment of fungi. They also transmit viruses to plants that cause diseases, mainly in tomato and paprika crops (Lorenzo et al., 2016). It has also been found associated with *Cocos nucifera*, *Persea americana*, *Psidium guajava* and other trees (Nieves et al., 2006). Besides, many of the species of the Alydidae family are detrimental in different types of crops such as rice (Dutta and Roy, 2016), soy (Perfecto et al., 2009), or other types of crops where they create serious damage that includes leaves, stems and pods consumption in the different insect stages (nymphs-adult) (Moreira et al., 2011), in the first stages of the plant growth (Dutta and Roy, 2016). The Aphidae family, according to Delfino et al. (2007), has been reported as one of the most important pests due to the direct result of its feeding, that stagnates the plant growth, it also causes premature dropping of leaves and discoloration, deformities and development of fungi (sooty molds). Furthermore, it transmits phytopathogenic viruses that lower the yield and seed quality, due to the narrow aphid-host relationship (Markovic and Glinwood, 2014). Besides, Cercopidae, Cicadellidae and Membracidae families, known as little cicadas are significant agricultural pests in Colombia (Aristizabal et al., 2013), as they affect the plant by infection of fungal pathogens, and damage vascular tissues and foliage, as well as fruits through the liquid they excrete (Aristizabal et al., 2013). Unlike these, Cercopide (*Cercopis vulnerata*) can cause malformations in fruits and brown marks in the visible leaves on both sides, due to fungi (Alford, 2014).

Finally, generalist phytophagous, mostly Coleoptera and Diptera have been affecting the regional crops. According to Cusser et al., (2016) both adult and larval tenebrionids have been reported as crop pests of the Cucurbitaceae family, where they cause damage by cutting and feeding on young leaves, in addition to perforating their fruits. The Curulionidae family is well known for causing major harm in different types of crops, where most of its species attack the plant completely, from the root to the fruits; larvae usually feed on plant tissues and adults, perforate fruits and other associated organs (Villarreal et al., 2006). In Diptera, Tephritidae is a pest capable of causing reduction in crop yields. After fruit infestation by larvae, fruits may fall prematurely and the pH may be altered, which affects fruit quality and increases its oxidation (Alford, 2014). The flies of the Drosophilidae family usually reproduce in decomposition or fermentation matter. Although they help with degradation, they usually propagate pathogenic fungi spores that affect crops; while in the Agromyzidae family, commonly known as leaf miner flies, females produce necrosis in plant tissues by perforating them

with their ovipositor for oviposition and feeding (Alford, 2014). Likewise, their larvae consume the hemophilic leaves or internal tissues of other plant organs by making mines inside them. The mines are perceived as white lines following an irregular path or as round spots (Gullan and Cranston, 2010). As a consequence, the plant reduces its photosynthesizing foliar area, therefore, there is premature leaf fall, decreased fruit production and premature death (Mazumdar and Bhuiya, 2014).

Group 1 is more stable than groups 2 and 3, and the difference lies in the ecosystem services offered, such as pollination and degradation. Pollination helps to increase crop production and quality, which is important for the agroecosystems (Gullan and Cranston, 2010). Thus, for group 3, the low presence of pollinators depends on the loss of biodiversity that limits this group, due to different changes in the landscape as a consequence of the implementation of monocultures and excessive use of chemicals that destroys the niches variety, diminishes resources and causes the loss of bees, flies, butterflies and other arthropods (Cusser et al., 2016).

Therefore, it can be inferred that the farming practices carried out in group 3 are affecting insects that are important for the economy, such as pollinators. However, the abundance of insects in this group is not only linked to pests, since there is high presence of degraders associated to nutrient cycling, providing fertile soil and improving the organic matter level (Leeuwen et al., 2015), as well as group 1 and 2. However, it does not guarantee its sustainability as a system that applies good management practices like group 1, which despite its high abundance of pests, guarantees a relevant biological control through its predators and parasitoids, in addition to having higher production, thanks to the services offered by pollinators and soil degraders. Therefore, sustainability is increased by group 1, according to their good management practices as organic farms (Kopali, 2013). Finally, as group 2 is in a transition state, it is committed to good farming practices, and gradually establishes insect communities that are not only regulating pests, but offering a service that in the future will guarantee higher and better crop production.

Genus *Mordellistena* sp. (Costa, 1854) (Coleoptera: Mordellidae) was registered for the first time in the Department of Cundinamarca. In Colombia, there is little information about the Mordellidae family. However, Martinez (2001) reported the subtribe Mordellini with *Glipodes* sp. and *Bioatia* sp., in addition to the species *Glipodes sericans*. Nevertheless *Mordellistena* sp., has been reported for the country by Hallan (2008) in his synopsis of world Coleoptera where the species *Mordellistena beyrodti* (Legerken, 1922) and *Mordellistena carinatipennis* (Rey, 1944) are registered, but without a specific location. Taxonomic and biological knowledge about this family is very scarce. This study confirms the distribution of this genus for the country.

Conclusions

Knowing the entomofauna associated with Sumapaz province has led to the establishment of functional groups, which indicate the system status through the abundance of beneficial insects or considered pests; in this case, group 1 registers the highest functional diversity, as it ensures better pollination and higher pest regulation. Unlike group 3 where ecological processes may not be working properly, the use of agrochemicals could be generating an environmental impact, causing the loss of beneficial insects.

The establishment of the seven functional groups provides a preliminary diagnosis and knowledge of the insects associated to family farming and agroecological practices in the province of Sumapaz, which are possibly affecting and/or benefiting the agricultural family. The information provided by the research can contribute to the development of integrated pest management plans and the promotion of agroecological practices that allow the system to self-regulate.

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Supplementary materials

The three groups with their respective production area location

Group	Owner	Municipality	Province	Coordinates
1	Hugo Enrique Jiménez Castellanos	Granada	Sabaneta	N: 04° 32 m 573 s; O: 074° 18 m 217 s
	Floriberto Cubillos	Silvania	Noruega Baja	N: 04° 19 m 625 s; O: 074° 21 m 678 s
	Maria Leticia Bernal	Fusagasuga	Sardinas	N: 04° 17 m 777 s; O: 074° 21 m 917 s
	Sabarain Caldas	Fusagasuga	San Jose de Piamonte	N: 04° 22 m 301 s; O: 074° 22 m 521 s
2	Julio Alberto Cubillos Peñalosa	Arbelaez	El Vergel	N: 04° 15 m 010 s; O: 074° 27 m 609 s
	Elizabeth Alvarado	Fusagasuga	Cucharal	N: 04° 21 m 46.25 s; O: 074° 23 m 10.41 s
	Maria Yorleny Ortiz	Granada	Santa Fe	N: 04° 31 m 985 s; O: 074° 18 m 612 s
3	Luis Alberto Abril	Tibacuy	La Gloria	N: 04° 21 m 497 s; O: 074° 26 m 956 s
	Carlos Adelmo Baquero Diaz	Arbelaez	El Salitre	N: 04° 13 m 476 s; O: 074° 20 m 156 s
	Wiliam Oswaldo Gonzalez Cruz	Arbelaez	La Victoria	N: 04° 14 m 309 s; O: 074° 21 m 549 s
	Luz Nelly Osorio Bejarano	Pasca	San Pablo	N: 04° 17 m 22 s; O: 074° 20 m 46 s