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Investigation note

Beneficial entomofauna in the tree diversity of urban agriculture in Pinar del Río, Cuba

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Abstract

This work determines the beneficial entomofauna associated with tree species in urban agriculture scenarios of Pinar del Río, Cuba. Between September 2019 and March 2020, a floristic inventory of tree biodiversity was conducted and samples of bioregulators were collected. Twenty-three tree species were inventoried and 65% of them were represented by fruit trees. The greatest species richness was detected in the orders Diptera, Mesostigmata, Hymenoptera and Araneae. The most frequent bioregulators were *Condylostylus* sp., *Ocyptamus costatus* and *Phytoseiulus* sp.; while the tree species with the highest proportion of associated arthropods were *Persea americana*, *Citrus limon*, *Morinda citrifolia* and *Psidium guajava*. The results corroborate the need to promote tree strata as a reservoir of bioregulators and deepen the activity of these beneficial organisms as an alternative for pest management.

Keywords:

arthropods, parasitoids, predators.

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Today, most food is still produced in rural areas and travels long distances to urban markets, however agricultural production in and around cities is increasing (Doural *et al*., 2019). Maintaining adequate levels of biodiversity in cultivated urban ecosystems contributes to increasing productivity, in which insect diversity plays a fundamental role (Mendoza *et al*., 2021), although the presence of pests involves the application of pesticides for their control, which degrade the quality of the environment.

Therefore, the regulation of pest organisms is part of biodiversity management and is of great importance in achieving a more biological and sustainable urban agriculture (Cucchi, 2020). In this sense, the beneficial entomofauna associated with the diversity of tree species in this system of agriculture, especially in the conditions of Cuba, is little addressed and can provide elements for its use in the productive field and pest management.

Between September 2019 and March 2020, in order to determine the beneficial entomofauna associated with tree species in urban agriculture (organoponic) scenarios of Pinar del Río (Cuba), the floristic inventory was carried out up to the levels of family and species. This component of biodiversity was randomly sampled for the collection of the observed beneficial arthropods. The samples were placed in nylon bags, numbered and preserved, until their transfer to the Laboratory of Entomology of the University of Pinar del Río where the identification was made.

Specimens were processed using a Novel® stereomicroscope, tweezers and scalpels for dissections and comparisons with available keys (Alayo and Garcés, 1989; CAB International, 2007; Vásquez *et al*., 2008; Mani, 2022). The eulophids were separated from the rest of the insects to mount them on slides and coverslips and later identify them.

The composition of tree species was integrated by 110 individuals belonging to 21 species distributed in 18 botanical families. These results differ from those obtained in suburban ecosystems of Santiago de Cuba (Cuba), where 39 269 individuals corresponding to 45 families were inventoried (Vargas *et al*., 2017). It was noted that some tree species are used as a subsistence alternative; while others are promoted as plants with pesticide properties, with the purpose of harvesting their organs and making botanical preparations for use in pest management. The largest proportion of these were fruit trees (65%), in accordance with studies in suburban production farms in Havana, Cuba (Hernandez *et al*., 2019).

The results showed that the presence of strata with tree species, less intervened by man, favor the stability of biodiversity since they function as a reservoir for 18 species of beneficial arthropods (Table 1), which were distributed in two classes (Insecta and Arachnida), seven orders and 14 families. The orders with the greatest species richness were: Diptera, Hymenoptera, Mesostigmata and Araneae.

Table 1. List of beneficial arthropods associated with tree species in urban agricultural (organoponic) systems of Pinar del Río, Cuba.

Order	Family	Species	Common Name
Coleoptera	Coccinellidae	*Cycloneda sanguinea limbifer* Linneus	Lady beetle* Ladybird*
		Cryptolaemus montrouzieri Mulsant	
	Syrphidae	*Ocyptamus costatus* Macquart	Hoverfly*
Diptera	Muscidae	*Coenosia attenuata* Stein	Tiger fly*
	Dolichopodidae	*Condylostylus* sp.	Scarlet fly*
Hemiptera	Miridae	*Nesidiocoris tenuis* Reuter	Mirid*

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Order	Family	Species	Common Name
	Reduviidae	*Zelus longipes* (Linnaeus)	Assassin bug*
Hymenoptera	Vespidae	*Polistes cubensis* Lepeletier	Wasp*
	Encyrtidae	*Ageniaspis citricola* Logvinovskaya	Parasitoid of the citrus leafminer°
	Eulophidae	*Tamarixia radiata* Waterston	Parasitoid of the Asian psyllid°
Neuroptera	Chrysopidae	*Chrysopa* sp. Leach in Brewster	Aphid lion*
	Phytoseiidae	*Phytoseiulus* sp.	Phytoseiids*
Mesostigmata	Phytoseiidae	*Amblyseius* sp.	Phytoseiids*
	Phytoseiidae	*Euseius* sp.	Phytoseiids*
Araneae	Thomisidae	*Misumenoides* sp.	Crab spider*
	Salticidae	*Thiodina* sp.	Jumping spider*
	Araneidae	*Araneus* sp.	Cross spider*
Araneidae	*Neoscona* sp.	Elegant spider*	

°= parasitoids; *= predators.

Recent studies report that predators are more prevalent at any time of the year (Vargas *et al*., 2017), which could justify that 88% of the identified species presented predatory function. In addition, predators can change prey when it becomes scarce and are not usually specific like parasitoids. It is also suggested that coccinellids are predators with a wide distribution in agricultural systems of Cuba (Duarte and López, 2020). On the other hand, predatory mites in general, and phytoseiids in particular, could become an alternative for the management of phytophagous mite and insect populations (Rodríguez *et al*., 2020).

It was verified that *P. americana* and *C. limon* presented greater concurrence of bioregulatory arthropods (60%), followed by *P. guajava* and *M. citrifolia* (40%). It should be noted that other studies inventoried chrysopids, coccinellids and phytoseiid mites associated with citrus plants (López and Segade, 2017) whereas it is common to find *Euseius* sp. in avocado crops (Chávez *et al*., 2017). Likewise, evaluations carried out in noni and guava plantations showed a richness of 13 and 10 species of associated beneficial insects, among which the following were detected: coleopterans, hymenopterans, dipterans, hemipterans and neuropterans (Matienzo *et al*., 2015).

The bioregulators with the highest frequency (100%) at the sampling points were *Condylostylus* sp., *O. costatus* and *Phytoseiulus* sp., which showed high predatory activity. *A. citricola*, *Z. longipes*, *Araneus* sp. and *Neoscona* sp. also reached values above 60% (Figure 1).

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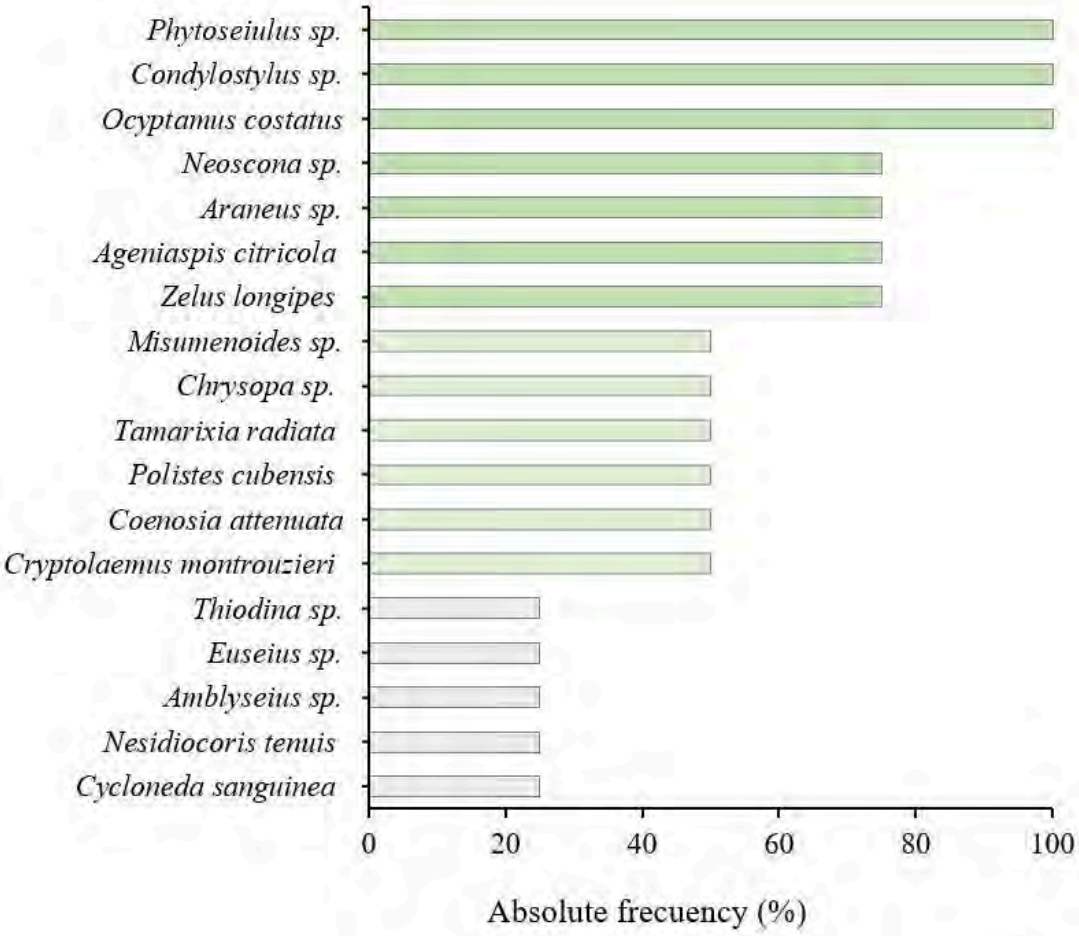
Figure 1

Absolute frequency of bioregulatory arthropods at sampling points.



These results indicate that predatory species presented greater richness and frequency in the scenarios where prospecting was carried out, although abundance values and other diversity indices should be estimated at different times of the year to establish relationships with the stages of greater bioregulatory activity and its use in the agroecological management of pests.

Conclusions

The results constitute the first approach in Pinar del Río (Cuba) to the study of the beneficial entomofauna associated with tree vegetation in urban agroecosystems. The need to promote this component of biodiversity as a reservoir of bioregulators to favor its activity and conservation is corroborated. The bioregulatory activity of the beneficial arthropods identified on pests of vegetables and other short-cycle crops established in these agricultural production scenarios should also be deepened.

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