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Insect Dynamics in Sunflower Agroecosystems: Between Pest Pressure and Beneficial Insects

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INTRODUCTION & AIM

The sunflower (Helianthus annuus L.) historically cultivated for alimentary and medicinal purposes, has attained contemporary significance primarily as an industrial oilseed crop, valued for the high-oleic acid content of its achenes [1]. As an entomophilous species, sunflower relies on insect pollination for seed production [2], rendering plant–pollinator interactions a critical determinant of yield.

Population dynamics, defined as the temporal changes in biological communities governed by biotic and abiotic regulatory mechanisms [3], are influenced by factors including resource availability, interspecific competition, and physicochemical environmental conditions [3]. Abiotic factors correlate with the fluctuating abundances of both phytophagous pests and their natural enemies [4], with hexapod populations broadly modulated by host phenology and climatic variables [5].

In sunflower systems, bee-mediated pollination has been demonstrated to enhance seed weight substantially, with increments exceeding 90% [6]. Given this context, this study aimed to characterize the population dynamics of diurnal insect visitors in a sunflower agroecosystem.

METHOD

This study was conducted in the municipality of Cuautitlan Izcalli, State of Mexico. The region has temperate subhumid climate with summer rains, classified as the driest of the subhumid types. It features a cool summer with no intraestival drought, an average annual temperature of 15.4 °C, and average annual precipitation of 652.1 mm (Angeles,2022).

Entomological collections were carried out three days a week at 11:00 a.m. over a 79-day period. Insects were collected using aerial sweep net; specimens caught in the net were subsequently retrieved using a fine brush. Data were recorded using custom-designed monitoring forms, which included information on insect presence in relation to their distribution within the crop, their classification as beneficial or pests, and the number of visits according to the sunflower's phenological stage. Species identification was performed using dichotomous keys for the corresponding insect orders and/or families.

RESULTS & DISCUSSION

A total of 3,615 insects were recorded throughout the crop cycle, belonging to 7 orders, 21 families, and 27 distinct species (Table 1). The order exhibiting the greatest diversity was Hemiptera, with 8 recorded species, followed by Coleoptera and Diptera with 6 and 4 species, respectively.

Tabla 1. Insect species identified during the monitoring period in sunflower (*Helianthus annuus* L.).

Class	Order	Family	Genus/Species
Insecta	Hemiptera	Aleyrodidae	Bemisia tabaci Gennadius
		Cicadellidae	Neophilaenus campestris L.
		Aphididae	Acyrthosiphon pisum Harris
		Membracidae	Draeculacephala minerva Ball
		Coreidae	Acanthocephala terminalis Dallas
		Cicadellidae	Edwardsiana froggatti Baker
		Pentatomidae	Euschistus servus Say
		Pyrrhocoridae	Lygaeus kalmii Stäl
	Coleoptera	Coccinellidae	Hippodamia convergens Guérin-Méneville
		Chrysomelidae	Zygogramma signatipennis Stäl
		Scarabaeidae	Cotinis mutabilis Gory & Percheron
		Chrysomelidae	Disonycha politula Horn
		Scarabaeidae	Euphoria basalis Gory & Percheron
		Chrysomelidae	Diabrotica balteata LeConte
	Diptera	Sarcophagidae	Sarcophaga camaria L.
		Syrphidae	Toxomerus politus Say
		Tephritidae	Neotephritis finalis Loew
		Chloropidae	Chrysomya megacephala Fabricius
	Hymenoptera	Scoliidae	Xanthocampsomeris limosa Burmeiste
		Apidae	Apis mellifera L.
		Scoliidae	Pygodasis ephippium Say
		Apidae	Bombus sonorus Say
	Lepidoptera	Erebidae	Hyphantria cunea Drury
		Noctuidae	Acontia marmoralis Fabricius
	Orthoptera	Pyrgomorphidae	Sphenarium purpurascens Charpentier
		Acriidae	Schistocerca pisceifrons Walker
	Neuroptera	Chrysopidae	Chrysoperla carnea Sthephens

Insects associated with each phenological stage of sunflower (Helianthus annuus L.) were classified according to their ecological function and habits. Pest insects accounted for the highest number of visits across the agroecosystem. Among these, B. tabaci Gennadius was notable for its presence across multiple crop stages.

Regarding beneficial insects, the pollinator Apis mellifera L. was a significant presence [6]. Furthermore, Hippodamia convergens Guérin-Méneville demonstrated a clear interaction with the Acyrthosiphon pisum Harris population, acting as its primary predator (Figure 1).

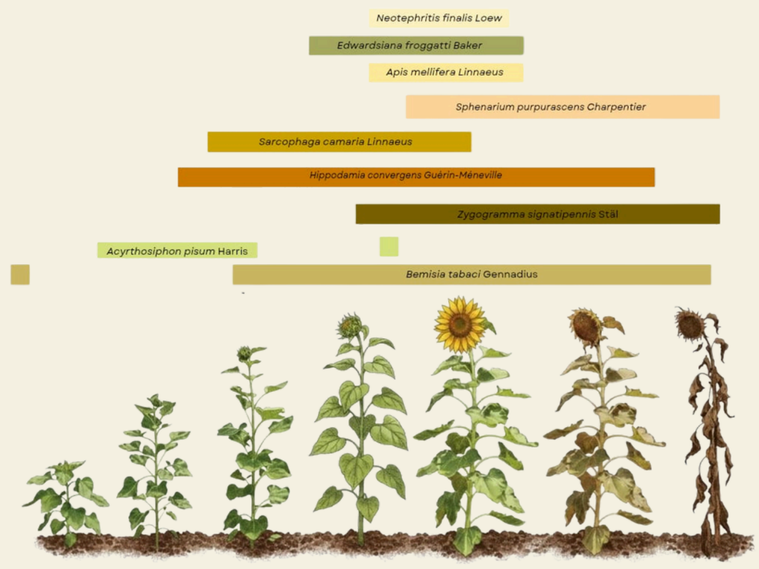

Figure 1. Insect occurrence across phenological stages of sunflower (*Helianthus annuus* L.)

Of the 7 orders identified, Hemiptera was the most abundant, comprising 54% of all specimens. This value is 31.3% higher than that of Coleoptera, which ranked second at 22.7%. Diptera placed third, accounting for 10.2% of the insects counted. The orders Orthoptera, Hymenoptera, Lepidoptera, and Neuroptera each represented less than 10%, reflecting a comparatively lower number of visits (Figure 2 y 3).

B. tabaci Gennadius was the species with the highest recorded number of visits, totaling 1,086 over the 79-day monitoring period. *A. pisum Harris* accumulated 656 visits, and *Z. signatipennis* Stäl 389 visits, all three being pest species of *Helianthus annuus* L. The two most significant beneficial species were *H. convergens* Guérin-Méneville and *A. mellifera L.* with 329 and 148 accumulated visits, respectively (Figure 2).

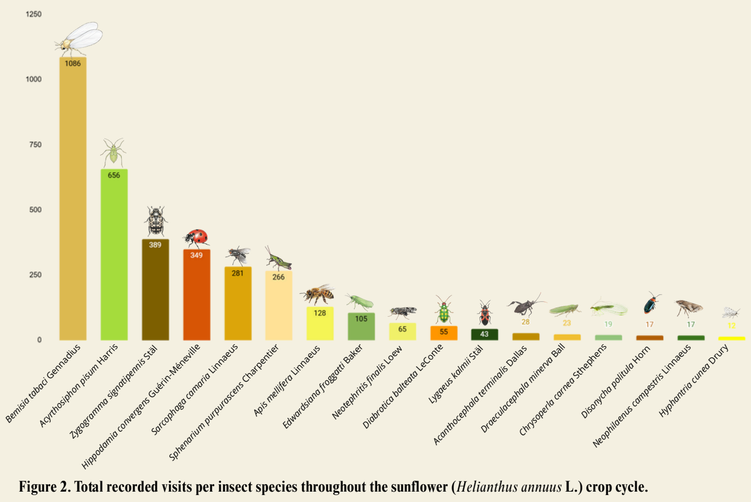

Figure 2. Total recorded visits per insect species throughout the sunflower (*Helianthus annuus* L.) crop cycle.

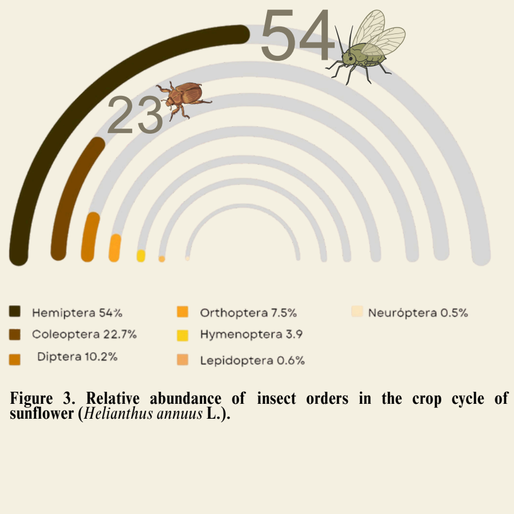

Figure 3. Relative abundance of insect orders in the crop cycle of sunflower (*Helianthus annuus* L.).

CONCLUSION

A total of 3,615 insects from 7 different orders were recorded within this agroecosystem, indicating that sunflower sustains a broad and variable entomofauna. This diversity confirms that insect populations respond to factors such as the crop's phenological stage, resource availability, and climatic conditions, a dynamic consistent with established principles of population ecology. The order Hemiptera comprised 54% of the total population, a predominance largely attributable to the high reproductive rates of Bemisia tabaci Gennadius and Acyrthosiphon pisum Harris. This finding underscores that sunflower is an attractive host not only for pollinators but also for phytophagous species.

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