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Arthropod Diversity Associated with Botanical Garden and Nursery Habitats at a University Campus in Southern Punjab, Pakistan

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Email: usman.abid@hsa.edu.pk**ARTICLE INFO****ABSTRACT****Received:**

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Managed green spaces like botanical gardens and plant nurseries can serve as valuable sources of arthropod diversity within the otherwise arid, built up and developed institutional landscape; however, such spaces are under-represented in the botanical garden survey of southern Punjab, Pakistan. The present study is a baseline field survey of arthropod fauna associated with botanical garden and nursery plantations of Islamia University of Bahawalpur, Rahim Yar Khan (RYK) Campus for a period of 6 weeks (late March to early June 2026) with three-day sampling interval of each week. Forty-three confirmed families, genera and species (arthropod taxa) representing two classes, 12 orders and 29 families were recorded, including an estimated 3,239 individuals reconstructed from the numbers recorded in the field based on ranges. The numerically dominant classes were Hymenoptera (33.3% of total estimated abundance) and Diptera (26.8%) followed by Orthoptera (11.1%) and Araneae (8.6%). Shannon-Wiener diversity ($H' = 3.28$), Simpson's diversity ($1-D = 0.94$) and Pielou's evenness ($J' = 0.87$) showed a moderately-to-highly diverse and fairly even distribution of the community. One other taxon, *Coccinella* sp. was noted provisionally, waiting for pictures to confirm against *C. septempunctata* and is reported separately. Key pollinators (*Apis mellifera*, *Cataglyphis setipes*), pollinators and public-health relevant synanthropic species (*Musca domestica*, *Culex quinquefasciatus*, *Aedes aegypti*), and natural predators (*Mantis religiosa*, *Lycosa terrestris*, *Pholcus phalangioides*) were the dominant taxa. The useful results of this work will help inform the importance of the conservation of arthropods in vegetated institutional landscapes in arid agro-ecological zones, and will help to provide a baseline for this campus that is quantitative. We emphasize that abundance is an estimate (midpoints of field-observed abundance ranges) and not a total count based on traps, and some identifications were restricted to genus or family level; both are discussed along with proposed suggestions for longer-term, trap-standardized monitoring.

Introduction

Arthropoda is the most diverse animal phylum and arthropods play vital ecological roles in terrestrial ecosystems such as pollination, decomposition, natural pest control and food resources for higher trophic levels. Arthropods are sensitive to environmental changes, have short generation times, and are small in body size which make them useful as indicators of habitat quality (Wagner et al., 2021).

A significant reduction in the biomass of flying insects has been reported from protected areas in temperate Europe over the long term (Hallmann et al., 2017), and this overall decrease in insects has been blamed on habitat loss, agricultural intensification, and urbanisation (Wagner et al., 2021). In this context, urban and institutional green spaces, including parks, botanical gardens, and university campuses, are emerging as possibilities for the conservation of arthropod communities as refugia and stepping-stones in otherwise heavily-altered landscapes.

Southern Punjab including Rahim Yar Khan district is in semi-arid to arid agro-ecological zone. Although managed green spaces are of significant ecological value, the authors have not been able to find systematic and quantitative arthropod surveys of university campus gardens and nursery areas in this particular region within the peer-reviewed literature. This gap restricts the capacity of campus management to take evidence-based decisions in the field of landscaping, pesticide usage and biodiversity conservation. Insect faunal knowledge is still limited in most parts of the country except for a few intensively studied agricultural districts, where a countrywide DNA-barcode survey of insects resolved about 6,590 provisional species-level units in Pakistan, but most of the groups are still taxonomically under-resolved (Ashfaq et al., 2022), and recent district-level surveys have recorded moderate to high insect diversity (Shannon's H' from ~2.5 to 3.8) in agricultural and mixed agricultural ecosystems of the province of Punjab (Abid et al., 2024; Amin et al., 2024; Junaid & Sheraz, 2025). None of these studies specifically focused on a botanical garden or nursery habitat on a university campus in the arid southern part of the province, however, which is a gap not addressed by studies in the region. Managed vegetated patches in otherwise built landscapes are now more and more acknowledged as locally important patches of managed arthropod resources, with outcomes depending on the context: urbanisation may negatively affect the richness of some arthropod groups (e.g., Chatelain et al., 2023) but vegetation complexity, in terms of shrub and flower cover, may facilitate more abundance and diversity of invertebrates (e.g., Sharmin et al., 2024; Lewthwaite et al., 2024).

This study aims at filling this gap by giving a systematic baseline inventory and quantitative diversity evaluation of the arthropod fauna of the botanical garden and nursery habitats of Islamia University of Bahawalpur, Rahim Yar Khan Campus by applying the standard diversity indices (Shannon–Wiener H' , Simpson's D , Pielou's J' ; Pielou, 1966) to delineate community structure.

Materials and Methods

Study area

This study has been carried out in managed green spaces of The Islamia University of Bahawalpur, Rahim Yar Khan (RYK) Campus, southern Punjab, Pakistan, in the botanical/ornamental garden and the nursery plant areas and immediately associated green space areas.

Survey duration and sampling schedule

A six-week period of field sampling took place from late March through early June 2026 with observations made at 14 discrete sampling visits, every 3 days.

Sampling and identification

A series of general field entomological survey methods were combined for the collection of arthropods: visual observation, hand collecting conspicuous arthropods, and opportunistic netting.

Morphological characters were used for the identification of specimens and field observations to the lowest confident taxonomic level. Records where the species could not be identified with certainty are given at genus level (denoted "sp. ") or family level, and are indicated as such in Table 1 and in the abundance analysis, rather than being given an unconfirmed species name. One other taxon recorded as *Coccinella* sp. A provisional 44th record for (as opposed to the confirmed *Coccinella septempunctata*) is reported, but this species has not been considered in the confirmed species richness ($S = 43$) or in any of the diversity-index calculations reported here.

Abundance estimation

An estimated abundance range (number of individuals seen on the minimum and maximum of the 14 visits) was recorded in the field for each confirmed taxon. Midpoints of each of the ranges reported were used as the working estimate of abundance for quantitative analyses. The values are not necessarily raw counts of individuals taken in a trap but are abundances explicitly reconstructed/estimated based on the values, and should be interpreted as such; they are subject to observer-based estimation error, which may be significant for highly mobile, cryptic or nocturnal taxa.

Diversity indices

Species richness (S), Shannon–Wiener diversity ($H' = -\sum p_i \cdot \ln p_i$), Simpson's index ($D = \sum p_i^2$, reported as $1-D$) and Pielou's evenness ($J' = H'/\ln S$) were calculated using the confirmed 43-taxon dataset and the reconstructed abundance estimates described above.

Limitations

There are several limitations to this survey that should be considered when interpreting the results: (i) abundance values are based on the range observed in the field and not standardized, replicated trap counts, thus abundance values should be treated as relative rather than absolute measures of abundance; (ii) several taxa have been resolved only to genus or family level; (iii) the survey window for this survey (late March – early June) is only a portion of one of the seasonal cycles and does not reflect full annual turnover; (iv) not all of the available data records describe the exact location, equipment used, and the extent of sampling effort for each zone, and will be completed by the author prior to submission.

Results

Sixty-three confirmed taxa of arthropods belonging to two classes, 12 orders, and 29 families were registered during the 6 weeks survey (Table 1). Of these the 35 were identified to species, the 7 to genus only and the 1 to family only. An additional taxon, *Coccinella* sp., has been recorded provisionally, but is excluded from S and reported separately (Section 3.5) and not included in any index calculations below.

Table 1. Confirmed arthropod species inventory ($S = 43$)

#	Taxon	Order	Family	ID level
1	<i>Lycosa terrestris</i>	Araneae	Lycosidae	species
2	<i>Pholcus phalangioides</i>	Araneae	Pholcidae	species
3	<i>Blatta orientalis</i>	Blattodea	Blattidae	species
4	<i>Periplaneta americana</i>	Blattodea	Blattidae	species
5	<i>Adalia</i> sp. *	Coleoptera	Coccinellidae	genus
6	<i>Aulacophora foveicollis</i>	Coleoptera	Chrysomelidae	species
7	<i>Coccinella septempunctata</i>	Coleoptera	Coccinellidae	species
8	<i>Tenebrionidae</i> sp. *	Coleoptera	Tenebrionidae	family
9	<i>Aedes aegypti</i>	Diptera	Culicidae	species
10	<i>Calliphora</i> sp. *	Diptera	Calliphoridae	genus
11	<i>Chrysomya megacephala</i>	Diptera	Calliphoridae	species
12	<i>Culex quinquefasciatus</i>	Diptera	Culicidae	species
13	<i>Musca domestica</i>	Diptera	Muscidae	species
14	<i>Sarcophaga</i> sp. *	Diptera	Sarcophagidae	genus
15	<i>Tabanus rubidus</i>	Diptera	Tabanidae	species

16	Tabanus striatus	Diptera	Tabanidae	species
17	Oxycarenus hyalinipennis	Hemiptera	Lygaeidae	species
18	Apis mellifera	Hymenoptera	Apidae	species
19	Camponotus sp. *	Hymenoptera	Formicidae	genus
20	Cataglyphis setipes	Hymenoptera	Formicidae	species
21	Polistes olivaceus	Hymenoptera	Vespidae	species
22	Acherontia sp. *	Lepidoptera	Sphingidae	genus
23	Catopsilia pomona	Lepidoptera	Pieridae	species
24	Danaus chrysippus	Lepidoptera	Nymphalidae	species
25	Eurema hecabe	Lepidoptera	Pieridae	species
26	Junonia orithya	Lepidoptera	Nymphalidae	species
27	Papilio demoleus	Lepidoptera	Papilionidae	species
28	Pieris brassicae	Lepidoptera	Pieridae	species
29	Spodoptera litura	Lepidoptera	Noctuidae	species
30	Utetheisa pulchella	Lepidoptera	Erebidae	species
31	Mantis religiosa	Mantodea	Mantidae	species
32	Crocothemis servilia	Odonata	Libellulidae	species
33	Ischnura senegalensis	Odonata	Coenagrionidae	species
34	Orthetrum sabina	Odonata	Libellulidae	species
35	Acheta domesticus	Orthoptera	Gryllidae	species
36	Acrida exaltata	Orthoptera	Acrididae	species
37	Aiolopus thalassinus	Orthoptera	Acrididae	species
38	Gryllotalpa sp. *	Orthoptera	Gryllotalpidae	genus
39	Gryllus bimaculatus	Orthoptera	Gryllidae	species
40	Oedaleus senegalensis	Orthoptera	Acrididae	species
41	Schistocerca gregaria	Orthoptera	Acrididae	species
42	Androctonus robustus	Scorpiones	Buthidae	species
43	Galeodes sp. *	Solifugae	Galeodidae	genus

* Genus- or family-level identification; not resolved to species. See Section 2.3.

Class-wise distribution

Insecta was represented by 39 species (90.7% of the richness) and 2934 individuals (90.6% of the abundance). The class Arachnida (Araneae, Scorpiones, Solifugae) included 4 species (9.3%) and an estimated 305 individuals (9.4%).

Order- and family-wise distribution

The most abundant order was Hymenoptera (33.3% of total estimated abundance across 4 species) with *Cataglyphis setipes* and *Apis mellifera* the most common species. Diptera was the second (26.8%, 8 species) which included built structure

associated synanthropic flies and mosquitoes associated with built structures and standing water. Orthoptera (11.1%) and Araneae (8.6%) followed (Table 2; Figure 1).

Order	No. of taxa	Est. abundance	Relative abundance
Hymenoptera	4	1080.0	33.34%
Diptera	8	869.5	26.84%
Orthoptera	7	359.0	11.08%
Araneae	2	278.0	8.58%
Lepidoptera	9	254.0	7.84%
Coleoptera	4	130.0	4.01%
Blattodea	2	92.5	2.86%
Hemiptera	1	72.5	2.24%
Odonata	3	54.0	1.67%
Mantodea	1	22.5	0.69%
Scorpiones	1	17.0	0.52%
Solifugae	1	10.0	0.31%

Table 3. Family-wise distribution of arthropod taxa

Family	Order	No. of taxa	Est. abundance	Rel. abundance
Formicidae	Hymenoptera	2	560.0	17.29%
Apidae	Hymenoptera	1	370.0	11.42%
Muscidae	Diptera	1	300.0	9.26%
Acrididae	Orthoptera	4	241.0	7.44%
Pholcidae	Araneae	1	220.0	6.79%
Culicidae	Diptera	2	220.0	6.79%
Calliphoridae	Diptera	2	157.5	4.86%
Vespidae	Hymenoptera	1	150.0	4.63%
Sarcophagidae	Diptera	1	105.0	3.24%
Gryllidae	Orthoptera	2	105.0	3.24%
Blattidae	Blattodea	2	92.5	2.86%
Pieridae	Lepidoptera	3	92.5	2.86%
Tabanidae	Diptera	2	87.0	2.69%
Lygaeidae	Hemiptera	1	72.5	2.24%
Nymphalidae	Lepidoptera	2	65.5	2.02%
Lycosidae	Araneae	1	58.0	1.79%
Coccinellidae	Coleoptera	2	52.5	1.62%

Noctuidae	Lepidoptera	1	47.5	1.47%
Tenebrionidae	Coleoptera	1	42.5	1.31%
Libellulidae	Odonata	2	40.0	1.23%
Chrysomelidae	Coleoptera	1	35.0	1.08%
Mantidae	Mantodea	1	22.5	0.69%
Erebidae	Lepidoptera	1	22.5	0.69%
Papilionidae	Lepidoptera	1	17.5	0.54%
Buthidae	Scorpiones	1	17.0	0.52%
Coenagrionidae	Odonata	1	14.0	0.43%
Gryllotalpidae	Orthoptera	1	13.0	0.40%
Galeodidae	Solifugae	1	10.0	0.31%
Sphingidae	Lepidoptera	1	8.5	0.26%

Ranked abundance

Cataglyphis setipes was the single most abundant taxon (11.9% of total estimated abundance), followed by Apis mellifera (11.4%) and Musca domestica (9.3%) (Table 4; Figure 3).

Table 4. Ranked species/taxon abundance (all confirmed taxa)

Rank	Taxon	ID level	Order	Family	Est. N	Rel. %
1	Cataglyphis setipes	species	Hymenoptera	Formicidae	385.0	11.89%
2	Apis mellifera	species	Hymenoptera	Apidae	370.0	11.42%
3	Musca domestica	species	Diptera	Muscidae	300.0	9.26%
4	Pholcus phalangioides	species	Araneae	Pholcidae	220.0	6.79%
5	Camponotus sp.	genus	Hymenoptera	Formicidae	175.0	5.40%
6	Polistes olivaceus	species	Hymenoptera	Vespidae	150.0	4.63%
7	Culex quinquefasciatus	species	Diptera	Culicidae	135.0	4.17%
8	Sarcophaga sp.	genus	Diptera	Sarcophagidae	105.0	3.24%
9	Chrysomya megacephala	species	Diptera	Calliphoridae	95.0	2.93%
10	Schistocerca gregaria	species	Orthoptera	Acrididae	91.0	2.81%
11	Aedes aegypti	species	Diptera	Culicidae	85.0	2.62%
12	Oxycarenus hyalinipennis	species	Hemiptera	Lygaeidae	72.5	2.24%
13	Calliphora sp.	genus	Diptera	Calliphoridae	62.5	1.93%
14	Gryllus bimaculatus	species	Orthoptera	Gryllidae	62.5	1.93%
15	Lycosa terrestris	species	Araneae	Lycosidae	58.0	1.79%
16	Oedaleus senegalensis	species	Orthoptera	Acrididae	57.5	1.78%
17	Periplaneta americana	species	Blattodea	Blattidae	55.0	1.70%

18	<i>Tabanus striatus</i>	species	Diptera	Tabanidae	51.0	1.57%
19	<i>Acrida exaltata</i>	species	Orthoptera	Acrididae	50.0	1.54%
20	<i>Spodoptera litura</i>	species	Lepidoptera	Noctuidae	47.5	1.47%
21	<i>Danaus chrysippus</i>	species	Lepidoptera	Nymphalidae	43.0	1.33%
22	<i>Acheta domesticus</i>	species	Orthoptera	Gryllidae	42.5	1.31%
23	<i>Aiolopus thalassinus</i>	species	Orthoptera	Acrididae	42.5	1.31%
24	<i>Tenebrionidae</i> sp.	family	Coleoptera	Tenebrionidae	42.5	1.31%
25	<i>Blatta orientalis</i>	species	Blattodea	Blattidae	37.5	1.16%
26	<i>Tabanus rubidus</i>	species	Diptera	Tabanidae	36.0	1.11%
27	<i>Catopsilia pomona</i>	species	Lepidoptera	Pieridae	35.0	1.08%
28	<i>Aulacophora foveicollis</i>	species	Coleoptera	Chrysomelidae	35.0	1.08%
29	<i>Pieris brassicae</i>	species	Lepidoptera	Pieridae	30.0	0.93%
30	<i>Coccinella septempunctata</i>	species	Coleoptera	Coccinellidae	30.0	0.93%
31	<i>Eurema hecabe</i>	species	Lepidoptera	Pieridae	27.5	0.85%
32	<i>Mantis religiosa</i>	species	Mantodea	Mantidae	22.5	0.69%
33	<i>Junonia orithya</i>	species	Lepidoptera	Nymphalidae	22.5	0.69%
34	<i>Utetheisa pulchella</i>	species	Lepidoptera	Erebidae	22.5	0.69%
35	<i>Adalia</i> sp.	genus	Coleoptera	Coccinellidae	22.5	0.69%
36	<i>Orthetrum sabina</i>	species	Odonata	Libellulidae	22.5	0.69%
37	<i>Papilio demoleus</i>	species	Lepidoptera	Papilionidae	17.5	0.54%
38	<i>Crocothemis servilia</i>	species	Odonata	Libellulidae	17.5	0.54%
39	<i>Androctonus robustus</i>	species	Scorpiones	Buthidae	17.0	0.52%
40	<i>Ischnura senegalensis</i>	species	Odonata	Coenagrionidae	14.0	0.43%
41	<i>Gryllotalpa</i> sp.	genus	Orthoptera	Gryllotalpidae	13.0	0.40%
42	<i>Galeodes</i> sp.	genus	Solifugae	Galeodidae	10.0	0.31%
43	<i>Acherontia</i> sp.	genus	Lepidoptera	Sphingidae	8.5	0.26%

Biodiversity indices

Parameter	Value	Interpretation
Species richness (S)	43	Confirmed taxa recorded
Total estimated abundance (N)	3,239	Sum of reconstructed range-midpoint estimates
Shannon–Wiener (H')	3.279	Moderately-to-highly diverse
Maximum possible H' (ln S)	3.761	Theoretical maximum at full evenness
Simpson's index (D)	0.055	Probability two random individuals share a species

Simpson's diversity ($1-D$)	0.945	Higher = more diverse
Simpson's reciprocal ($1/D$)	18.10	Effective no. of equally-abundant species
Pielou's evenness (J')	0.872	Fairly even distribution among taxa

Provisional taxon

A single ladybird beetle record (probably *Coccinella* sp.) different from the confirmed *Coccinella septempunctata* record was recorded during the survey. This record is reported as a separate 44th taxon, and was not included in the S, N and index calculations above since at the time of writing no photographic documentation can definitively prove that the two are two morphotypes and not the same population twice recorded. This record should only be included in any published species lists with confirmation through direct photographs or specimen examination.

Figures

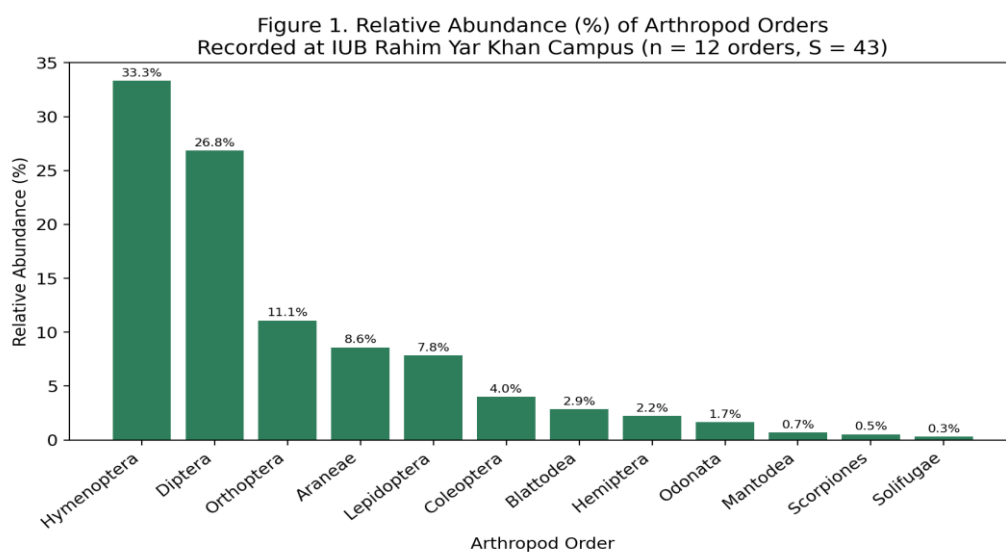


Figure 1. Relative abundance (%) of the 12 recorded arthropod orders.

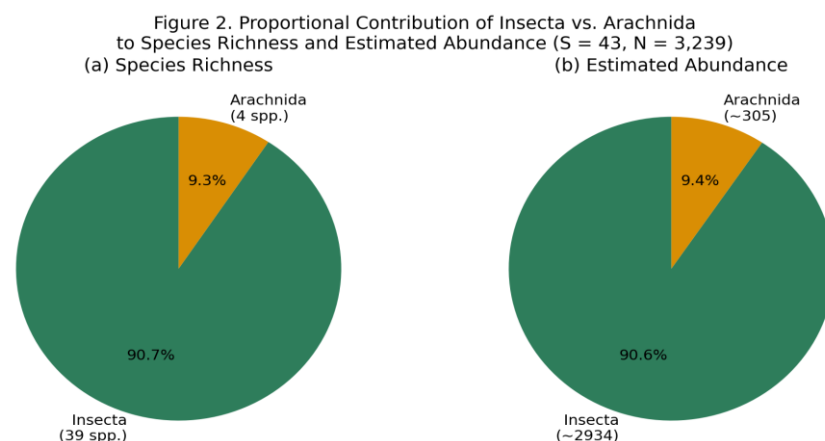


Figure 2. Proportional contribution of Insecta vs. Arachnida to species richness and estimated abundance.

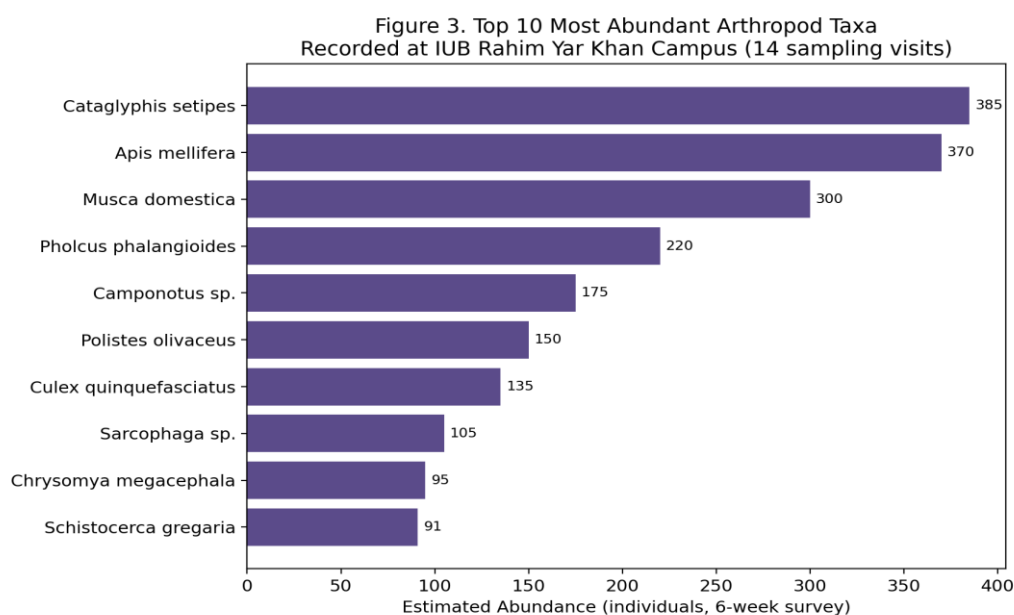


Figure 3. Top 10 most abundant arthropod taxa recorded during the six-week survey.

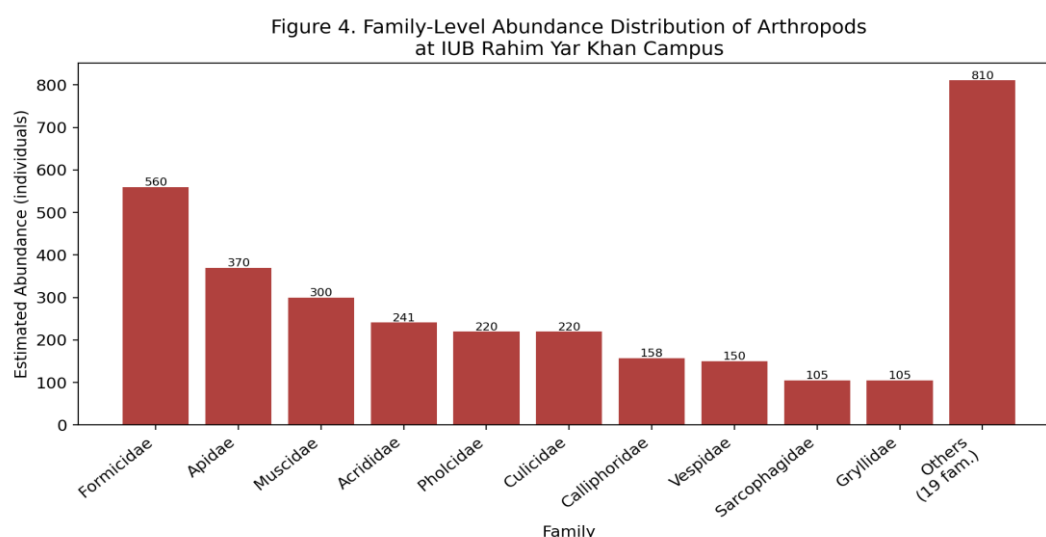


Figure 4. Family-level abundance distribution of recorded arthropods.

Discussion

The recorded species richness ($S = 43$ confirmed taxa belonging to 12 orders and 29 families) suggests a taxonomically diverse arthropod assemblage in association with botanical garden and nursery habitats of IUB Rahim Yar Khan Campus. The abundance of social insects (ants, bees, wasps) and synanthropic flies (Diptera) is more or less equally high, both groups taken together making up about 60% of the total estimated abundance, as expected for managed, irrigated green spaces near buildings and standing water (Wagner et al., 2021).

The Shannon–Wiener index ($H' = 3.28$) and Pielou's evenness ($J' = 0.87$) indicate that the community has a significant overall diversity, although a few of the more successfully recorded taxa (*Apis mellifera*, *Musca domestica* and *Cataglyphis setipes*) account for about a third of the total recorded numbers. This trend of a high overall diversity with a few well-adapted synanthropic or eusocial species is rather widespread for human-associated managed green spaces in arid environments, where irrigation and floral resources provide for a broad spectrum of taxa, but built structures and waste allow for a small suite of highly abundant generalists.

From an ecological aspect the recorded fauna includes several functional guilds such as pollinators (*Apis mellifera* and *Cataglyphis setipes* as opportunistic forager), predators (*Mantis religiosa*, *Lycosa terrestris*, *Pholcus phalangioides*, *Coccinella*

septempunctata), phytophagous (*Schistocerca gregaria*, several species of Lepidoptera and Acrididae) and decomposers/synanthropes of public health importance (*Musca domestica*, *Chrysomya megacephala*, *Culex quinquefasciatus* and *Aedes aegypti*). Global considerations of trade-offs for urban water features (Hallmann et al., 2017; Wagner et al., 2021, in the context of the structure of insect communities) are reflected here by the presence of both *Culex quinquefasciatus* and *Aedes aegypti*, which are vectors for filariasis/West Nile and dengue/Zika, respectively.

The following are three caveats to the interpretation of these findings. First, the abundance data are based on ranges estimated in the field, and absolute abundance comparisons must be made with caution if studies were conducted using quantitative trapping (e.g., Malaise or pitfall trapping). Second, several taxa are only identified to genus level (*Camponotus* sp., *Sarcophaga* sp., *Calliphora* sp., *Adalia* sp., *Gryllotalpa* sp., *Galeodes* sp., *Acherontia* sp.) and/or to family level (*Tenebrionidae* sp.) and the use of these names throughout the paper means that fine scale taxonomic comparison with other studies is limited. Third, the six-week period of sampling does not adequately represent the spring-early summer sampling season and cannot fully sample the seasonal turnover; a multi-season, extended study would be necessary to determine if this dominance structure will hold throughout the year.

This interpretation is supported by the regional comparison. H' values have been reported between approximately 2.5 and 3.8 in different districts of Punjab according to different habitat types and techniques, such as year-round light trapping in Faisalabad (agricultural/urban) and 2.75 in Hafizabad (Abid et al., 2024) or sweep net sampling and pitfall trapping in Chakwal croplands (Junaid & Sheraz, 2025). The actual garden of the present campus has a $H' = 3.28$ and lies in the upper half of this range, in keeping with the notion that a managed garden, floristically diverse and irrigated, has a more diverse assemblage compared to mono-culture cropland, although the window of observation is limited to a 6-week period and not the full annual cycle. In a 3-year light-trap survey of forested, agricultural, and peri-urban habitats in the nearby Multan district, the same trend was observed that the insect diversity was the highest in the forested/vegetated areas and the lowest in agricultural areas close to urban centres (Amin et al. 2024), thus overall suggesting that the structure of vegetation and floral resources, rather than urban proximity in itself, is a major determinant of the diversity of local arthropods in the present agro-ecological zone. The regional results are in line with the global literature on urban and managed green spaces; more structural diversity and floral resources are repeatedly correlated with greater invertebrate abundance and richness, despite occasional effects of urbanisation on diversity for some taxonomic groups and sampling design (Chatelain et al., 2023; Lewthwaite et al., 2024). A multi-taxon monitoring system over time to which this campus baseline could be usefully extended is exemplified in the standardized, trait-annotated baseline checklists compiled for other urban arthropod communities (Gardini et al., 2026).

Conclusion and Recommendations

43 arthropod taxa from 12 orders and 29 families were confirmed in this six-week baseline survey with a moderately-to-highly diverse community structure ($H' = 3.28$) and fairly even community structure ($J' = 0.87$) dominated by Hymenoptera and Diptera for the botanical garden and nursery habitats of the IUB Rahim Yar Khan Campus. The results will support the identification of these managed green spaces as a locally important arthropod habitat in an otherwise arid built landscape.

We recommend the following: (1) timing pesticide use in the garden and nursery zones selectively to avoid broad impacts to pollinators; (2) routine larval source management of any standing water that removes mosquito species of public-health concern, but does not reduce beneficial aquatic-associated taxa; (3) maintenance and diversification of flowering plant stock to support pollinator and lepidopteran diversity; (4) confirmation of the genus/family-level records identified in this study at the species level, preferably via expert taxonomic guidance or DNA barcoding; and (5) implementation of this baseline in a trap-standardized, full-year monitoring program to capture seasonal turnover not revealed by a six-week spring survey.

Author roles

Faiz-Ur-Rehman contributed to field sampling, data collection, and manuscript preparation; Ayesha Nadeem contributed to taxonomic identification and species verification; Sundas Sana and Jawaria Jameel contributed to botanical identification and plant documentation; Bilal Hussain contributed to field sampling, data analysis, and manuscript preparation; and Sobia Abid and H. M. Usman Abid supervised the study, contributed to study design, data interpretation, critical review, and final approval of the manuscript.

References

Abid, K., Rana, N., Majeed, W., Alotaibi, N. J., Khan, H. A., Manzoor, S., Maalik, S., Kiran, R., & Arif, M. Z. E. (2024). Diversity and abundance of insects in two different districts of Punjab, Pakistan. *Journal of Animal and Plant Sciences*, 34(2), 435-446.

- Amin, M., Sarwar, Z. M., & Ali, H. (2024). Exploring nocturnal insect biodiversity and distribution across diverse habitats. *Biologia*, 79(5), 1351–1358. <https://doi.org/10.1007/s11756-024-01621-9>
- Ashfaq, M., Khan, A. M., Rasool, A., Akhtar, S., Nazir, N., Ahmed, N., Manzoor, F., Sones, J., Perez, K., Sarwar, G., Khan, A. A., Akhter, M., Saeed, S., Sultana, R., Tahir, H. M., Rafi, M. A., Iftikhar, R., Naseem, M. T., Masood, M., Tufail, M., Kumar, S., Afzal, S., McKeown, J., Samejo, A. A., Khaliq, I., D'Souza, M. L., Mansoor, S., & Hebert, P. D. N. (2022). A DNA barcode survey of insect biodiversity in Pakistan. *PeerJ*, 10, e13267. <https://doi.org/10.7717/peerj.13267>
- Chatelain, M., Rüdiger, J., & Traugott, M. (2023). Urban-driven decrease in arthropod richness and diversity associated with group-specific changes in arthropod abundance. *Frontiers in Ecology and Evolution*, 11, 980387. <https://doi.org/10.3389/fevo.2023.980387>
- Gardini, P., Piquet, A., Audisio, P., Piano, E., Degiovanni, A., Fattorini, S., Galimberti, A., Gardini, G., Milano, F., Mori, E., Pioltelli, E., Zapparoli, M., Isaia, M., & Sabatelli, S. (2026). Checklist and trait dataset of ground-dwelling arthropods across urban habitats in four major Italian cities. *Biodiversity Data Journal*, 14, e173221. <https://doi.org/10.3897/BDJ.14.e173221>
- Hallmann, C. A., Sorg, M., Jongejans, E., Siepel, H., Hofland, N., Schwan, H., Stenmans, W., Müller, A., Sumser, H., Hörren, T., Goulson, D., & de Kroon, H. (2017). More than 75 percent decline over 27 years in total flying insect biomass in protected areas. *PLOS ONE*, 12(10), e0185809. <https://doi.org/10.1371/journal.pone.0185809>
- Junaid, A., & Sheraz, A. (2025). Diversity of insect fauna in croplands of District Chakwal, Punjab, Pakistan. *Biharean Biologist*, 19(1), 14–24.
- Lewthwaite, J. M. M., Baiotto, T. M., Brown, B. V., Cheung, Y. Y., Baker, A. J., Lehnen, C., McGlynn, T. P., Shirey, V., Gonzalez, L., Hartop, E., Kerr, P. H., Wood, E., & Guzman, L. M. (2024). Drivers of arthropod biodiversity in an urban ecosystem. *Scientific Reports*, 14, 390. <https://doi.org/10.1038/s41598-023-50675-3>
- Pielou, E. C. (1966). The measurement of diversity in different types of biological collections. *Journal of Theoretical Biology*, 13, 131–144. [https://doi.org/10.1016/0022-5193\(66\)90013-0](https://doi.org/10.1016/0022-5193(66)90013-0)
- Sharmin, M., Tjoelker, M. G., Esperon-Rodriguez, M., et al. (2024). Urban greening with shrubs can supercharge invertebrate abundance and diversity. *Scientific Reports*, 14, 8735. <https://doi.org/10.1038/s41598-024-58909-8>
- Wagner, D. L., Grames, E. M., Forister, M. L., Berenbaum, M. R., & Stopak, D. (2021). Insect decline in the Anthropocene: Death by a thousand cuts. *Proceedings of the National Academy of Sciences*, 118(2), e2023989118. <https://doi.org/10.1073/pnas.2023989118>
- Magurran, A. E. (2004). *Measuring Biological Diversity*. Blackwell Publishing, Oxford, UK.



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