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Research Article

Arthropod Fauna on Conocarpus Plants in Urban Landscapes

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ABSTRACT

The two species *Conocarpus erectus* (Buttonwood) and *Conocarpus lancifolius* (Damas tree) commonly known as Conocarpus are an important part of urban landscaping and reforestation due to their remarkable adaptability to various environmental conditions. These species are mainly found in tropical and subtropical regions and can withstand saline and arid environments. In this study arthropod biodiversity associated with Conocarpus was investigated in urban environment. A total of 13 distinct taxa of two arthropod classes: Insecta and Arachnida was identified belonging from orders Diptera, Hemiptera, Hymenoptera, Coleoptera, and Araneae. The arthropod fauna of Conocarpus showed multi-trophic structure, including herbivores (e.g., *Myzus persicae*, *Agromyza pseudoreptans*), predators (e.g., *Phidippus* sp., *Colonus* sp.), and parasitoids (e.g., *Lycorina glaucomata*, *Macrocentrus* sp.). Community diversity was moderate ($S = 14$, $N = 37$) with Shannon $H' = 2.4048$, Simpson's diversity $(1-D) = 0.9174$ and Pielou's evenness $J' = 0.9112$, indicating moderate richness coupled with high evenness. The biodiversity of Conocarpus plants suggests that they are valuable resources and habitats for a variety of arthropods in urban environments. The observed complex food chain highlights the significance of urban green areas as refuges for biodiversity in modified environment. This research contributes to urban ecology and can have a significant impact on conservation and urban planning.

Keywords: Arthropod biodiversity, Conocarpus, urban ecology, trophic interactions, Biodiversity conservation.



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INTRODUCTION

Conocarpus is originating from two Greek words, konos (meaning "cone") and karpos (meaning "fruit"), the term Conocarpus means "cone shaped fruit". The Gulf Cooperation Council region refers to it as Damas (Ramanjaneyulu et al., 2023). Conocarpus genus belongs to the family Combretaceae and order is Myrtales (Gere et al., 2015). It was introduced first in Kuwait in 1988 (Alissa, 2024). Conocarpus tree is well known because of its dark leaves and ability of tree to withstand in the non-favorable environmental conditions. Growth of Conocarpus is more accelerated in the summer and withstands the winter's low temperatures. This tree grow in all type of the soil from sandy to clay soil, this tree can flourish in anything. Given the likelihood that this tree may become endangered in the near future, it is listed as a Threatened species in the IUCN Red Data Book (Ramanjaneyulu et al., 2023). Conocarpus genus having two specialized species *Conocarpus erectus* L. and *Conocarpus lancifolius* Engl. (Keighery and Long, 2022). It is native to shoreline areas of Africa southern drift of Florida, Mexico, Bahamas, West Indies, Galapagos Island and Central America (Ramanjaneyulu et al., 2023). *C. erectus* commonly known as buttonwood and silver buttonwood (Bashir et al., 2015) that is widely distributed in tropical and sub-tropical region of the world (Keighery and Long,

2022). It grows well in the brackish water areas and also grows in inland habitat. *C. erectus* can tolerate salinity above 40 dSm⁻¹ areas but high salinity soil slow down the growth of tree and even cause the death of tree (Asif et al., 2014). *C. lancifolius* is indigenous to Yemen, Somalia, coastal and riverine regions of East Africa, and some parts of Pakistan (Redha et al., 2021). The Arabian Peninsula, as well as eastern and northern Africa, is home to its cultivation. It is an ornamental tree and has glossy appearance (Saadullah et al., 2016). *Conocarpus* species are found in mangrove settings throughout the world, although one species is restricted to a small area around the shores of the southern Red Sea, where it lives next to seasonal rivers. *Conocarpus* grow successfully along sides throughout the world and can withstand in the polluted environment because this tree have the ability to absorb the heavy metals and grow in brackish water areas (Al Thobaity et al., 2017). This tree is planted in different areas of Pakistan as an ornamental plant.

Conocarpus have great ecological importance as it is used for landscaping and for decorative purpose and its wood is used for fences posts, vessels buildings and for home decoration (Carneiro et al., 2010). *Conocarpus* also have huge medicinal importance as it used commercially as anti-diabetic, anti-malarial and in the treatment of conjunctivitis, gonorrhoea, syphilis antipyretic, orchitis, diarrhea, prickly heat and swelling, and for the treatment of anemia etc (Nascimento et al., 2016; Raza et al., 2016). Their use as street trees and for reforestation has increased their presence in many cities, yet the role of these trees as habitat for arthropod communities remains poorly documented. Urban arthropod communities respond strongly to local vegetation and to the structure of green space, and trees can act as important refuges or stepping-stones for insects and spiders in modified landscapes.

This study therefore targets two linked goals: first, to describe the arthropod assemblage associated with *Conocarpus* in an urban setting; and second, to evaluate the its value as habitat by quantifying species richness, community evenness and trophic composition. Results aim to inform urban planting and conservation decisions by clarifying whether *Conocarpus* supports multi-trophic arthropod communities or primarily hosts a small set of generalist taxa.

MATERIALS AND METHODS

Study Area and Plant Selection

There is sympatric distribution of two species *C. erectus* and *C. lancifolius*. We conducted our study in Multan, Pakistan, a bustling urban area where *Conocarpus* trees are a common sight in parks, streets, and residential neighborhoods. Because both *Conocarpus erectus* and *Conocarpus lancifolius* are widely planted and often occur together, we treated them as a single group. Healthy trees of *Conocarpus* have been selected from the different location of urban areas. These trees were chosen randomly while ensuring that each one had a similar canopy size and was located in areas with comparable levels of urban disturbance.

Data Collection

In this study method of sweep net used to sample insects flying around and resting on the foliage. For each tree, we spent a few minutes sweeping around the canopy, ensuring that we covered all sides of the tree. Method of sweep net permit us to capture both barely attached and fast-moving insects. Spiders and dislodged insects were quickly collected when we gently swayed selected branches. Each branch was swayed for about few seconds.

This method helped to capture insects that might not be collected by the sweep net. After using beating sheets and net collection method we carefully examine trunks, branches and leaves of the trees. Method of sweep net capture insects that are visible but did not fly and fall easily. This method confirmed that we did not miss species that are firmly attached or camouflaged to the plant. During sampling period which extended from March to June 2024 all methods were applied consistently.

Specimen Handling and Identification

Instantly after the collection each collected specimen was put in a labeled container. Practically we kept specimen cool and later shift them to our laboratory. In the lab 75% ethanol were used to preserve smaller arthropods, while medium and large size specimens were mounted for the detailed examination. We identify collected specimen with the help of standard taxonomic keys and with local field guides and with the consultation from regional taxonomy experts. When it was possible we determined species level; otherwise, we noted them as distinct taxa. We also recorded the role of each species in the ecosystem (herbivore, predator, or parasitoid).

Diversity Indices

Specimens were separated by taxon and counted to obtain abundance data used for diversity calculations. Total sample size (N) and observed taxa (S) were recorded. Proportions p_i were computed as the abundance of taxon i divided by N . Standard diversity indices were calculated to describe richness, evenness and dominance using: Shannon–Wiener index (Shannon, 1948):

$$H' = - \sum_{i=1}^s p_i \ln p_i$$

where $P_i = S / N$

S = number of species

N = total number of individuals

ln = logarithm to base e

Simpson's dominance (Simpson, 1949):

$$1 - D = \frac{\sum_{i=1}^s n_i(n_i - 1)}{N(N - 1)}$$

where n_i is number of individuals of taxon i , N is total individuals

Pielou's evenness (Pielou, 1966):

$$J' = \frac{H'}{\ln S}$$

where H' is the Shannon–Wiener index and S is species richness

RESULTS

A total of 13 different taxa were identified, comprising 11 insect species and 2 arachnid genera (Table 1). Shannon H' was 2.4048, indicating moderate diversity from both species number and relative abundances. Simpson's diversity ($1-D$) was 0.9174, showing a low probability that two randomly drawn individuals belong to the same taxon. Pielou's evenness (J') was 0.9112, indicating a highly even distribution of individuals among taxa (Table 2). At the order level, Hymenoptera showing the highest number of species (5 species) (Figure 1).

Table 1. List of arthropod fauna collected on conocarpus

Order	Family	Species	No. individuals	Relative abundance (p)
Hymenoptera	<i>Formicidae</i>	<i>Monomorium minutum</i>	5	0.1351
		<i>Solenopsis</i> (sp.)	3	0.0811
	<i>Braconidae</i>	<i>Macrocentrus</i> (sp.)	1	0.027
	<i>Braconidae</i>	<i>Meteorus</i> (sp.)	2	0.0541
	<i>Ichneumonidae</i>	<i>Lycorina glaucomata</i>	3	0.0811
Diptera	<i>Muscidae</i>	<i>Musca domestica</i>	7	0.1892
	<i>Culicidae</i>	<i>Culex pipiens</i>	5	0.1351
	<i>Agromyzidae</i>	<i>Agromyza pseudoreptans</i>	4	0.1081
	<i>Stratiomyidae</i>	<i>Oplodontha rubrithorax</i>	2	0.0541
Hemiptera	<i>Lygaeidae</i>	<i>Spilostethus hospes</i>	1	0.027
		<i>Nysius caledoniae</i>	1	0.027
	<i>Aphididae</i>	<i>Myzus persicae</i>	1	0.027
Araneae	<i>Salticidae</i>	<i>Phidippus</i> (sp.)	1	0.027
		<i>Colonus</i> (sp.)	1	0.027

Table 2. Diversity indices of arthropods in Conocarpus

Index	Value
Species richness (S)	14
Total individuals (N)	37
Shannon–Wiener H' (ln)	2.4048
Simpson's diversity ($1-D$)	0.9174
Pielou's evenness J'	0.9112

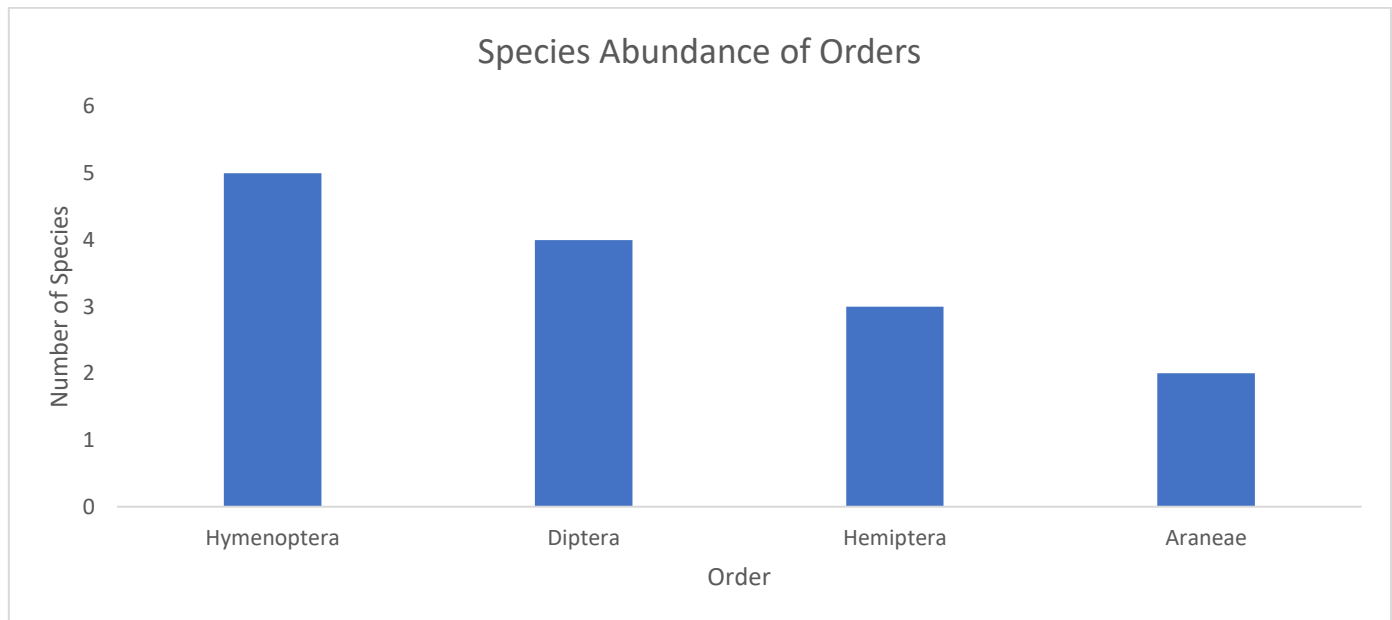


Figure 1. Abundance of species at order level

DISCUSSION

Conocarpus has an important ecological role by supporting a diverse community of arthropods. The soldier flies (*O. rubrithorax*) are associated with decomposing organic matter and also pollination (Rozkošný, 1982). The leaf-miner fly (*A. pseudoreptans*) may be a sign of herbivory on Conocarpus leaves (Spencer, 2013). The presence of the common mosquito species *C. pipiens* indicates that there may be enough places to breed close to Conocarpus plant. Considering its connection to the spreading of diseases like West Nile Virus (Farajollahi et al., 2011). It could be the cause of public health problems. The common house fly is generalist species that often live in a range of habitats (Malik et al., 2007). The green peach aphid *M. persicae* is a potential herbivore of the Conocarpus. Due to its polyphagous nature this aphid species recognized as significant pest in agriculture and a vector for viruses with Conocarpus serving as a potential alternative host (Van Emden et al., 1969). Lygaeid bugs that are commonly known as seed bugs may be exploiting plant resources (Henry, 2017; Schaefer and Panizzi, 2000).

Hymenopterans diversity that found on Conocarpus including Ichneumonid *Macrocentrus* and *Meteorus* wasp are parasitoids and may play role in regulating the population of herbivorous insects (Gauld, 1988; Shaw and Huddleston, 1991). The significant abundance of ant species precedes the ants ecological role in the seed dispersal, predation, and the aeration of soil (Hölldobler and Wilson, 1990; Taber, 2000). The two genera of jumping spider that are identified on Conocarpus are major predator of arthropod community. Jumping spiders are well-known for the controlling of insects population because of excellent vision and assertive hunting habits (Jackson and Pollard, 1996; Maddison and Hedin, 2003). The community exhibit mixture of ordinary species richness and high evenness. This trend observed in studies of other agricultural and semi-agricultural insects survey where samples contain mixture of common generalist and some of the less abundant taxa (Ghani and Maalik, 2020; Goshami et al., 2022).

High evenness indicate that no taxa monopolize resource sampled, this pattern is consistent with studies showing balanced communities in heterogenous and controlled ecosystem with multiple available niches (Song et al., 2023). If arthropods are monitored over long period of time they can provide important information about seasonal changes, and population dynamics. Such studies will upgrade our understanding about ecological values of Conocarpus plant and help to develop more effective conservation and management plans. Furthermore, research studies should look into how richness and distribution of arthropods communities that are connected to the Conocarpus plant may be affected by environmental changes like urbanization and climate change.

Therefore, present research results suggest that Conocarpus plant playing important role for the maintenance of wide-ranging arthropod fauna by occupying different trophic positions and functional niches. The study's finding supports the need to include information on plants and arthropods relationship into ecosystem maintenance, urban planning and nature conservation. The modest sampling size of study, lack of seasonal replication and use of cross-sectional sampling limited to a single city limit its ability to conclude regarding temporal turnover and more general spatial trends. Future studies should device long-term monitoring at multiple-sites in combination of active/passive method and trap

arrays, apply sample-based methods of nonparametric, rarefaction and integrate functional analyzes (e.g., predation/parasitism rates) to link classification methods to ecosystem processes. With the continue problem of species extinction and ecosystem degradation this type of research is important for the understanding of relation that underpin biosphere.

CONCLUSIONS

Conocarpus species *erectus* (Buttonwood) and *lanceifolius* (Dama's tree) are essential part of urban landscape and reforestation especially in tropical and sub-tropical regions due to their ability to adapt different environmental conditions. This study investigates biodiversity of arthropods in urban environments that is associated with *Conocarpus*. Across several orders of Coleoptera and Diptera 13 taxa from the class Insecta and Arachnida are identified. The multitrophic structures include predators, parasitoids and herbivores. From the moderate metrics of community diversity indicate that for the variety of arthropods *Conocarpus* serve as an important habitat, highlights the importance of urban green spaces for biodiversity and informing conservation efforts in urban ecology.

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AUTHOR CONTRIBUTIONS

All authors contributed equally to this research

COMPETING OF INTEREST

No conflicts of interest have been disclosed by the authors.

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