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Research paper

A preliminary study of insect faunal diversity of the district central of metropolitan city of Karachi, Pakistan

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Abstract

Present study was aimed at collection, identification and comparison of species richness, abundance and evenness of insect fauna from various localities of central district of Karachi city during January to December 2019. A total number of 43 species and subspecies belonging to 34 families and representing 10 orders were recorded. Among which Sarcophaga, Musca, Culex, Xylocopa, Apis, Cimex, were found to be most prevalent whereas Necrobia, Acrida, Anacridium, Tabanus, were found least in number during study period. Due to insect pollinators' relatively small functional requirements, habitat range, life cycle, and nesting behavior relative to larger mammals, we argue that pollinators put high priority and high impact urban conservation within reach. The present insect data base will be helpful in designing future integrated pest management studies.

Keywords: *Insect Fauna; Diversity; Population; Karachi Central District.*

1. Introduction

Biodiversity is variation of life. Species rich ecosystems are more stable than poor ecosystems. Widespread practices can cause changes in average environmental conditions that change the performance of an agro-ecosystem. Persistent association between constancy and biodiversity shows significant outcomes for the long term viability of an area that support a variety of natural and human ecosystem (Minor, 2005, Schoowalter, 2006, Inayat et al., 2010). Insects are cosmopolitan invertebrates; they are vectors, pests, parasites and above all, the most abundant members of phylum Arthropoda. They have been the topic of many researches in past and present. Biodiversity is variation of life. In agro-ecosystems, biodiversity is generally a measure of the relative numbers of types of organisms present. When considering the effects of biodiversity on a system, two concepts are especially important to consider: stability and productivity. Stability in ecosystems is a measure of resilience, or ability of the system to recover from a disturbance, and the resistance of the system to change (Schowalter, 2006). Research on urban insect pollinators is changing views on the biological value and ecological importance of cities. The abundance and diversity of native bee species in urban landscapes that are absent in nearby rural lands evidence the biological value and ecological importance of cities and have implications for biodiversity conservation. Lagging behind this revised image of the city are urban conservation programs that historically have invested in education and outreach rather than programs designed to achieve high priority species conservation results.

Karachi is the largest and most populous city in Pakistan. It is located in southeastern part of the country. The city is an important industrial center and port on the coast of Arabian Sea. It covers an area around 3,527 km² and mostly comprises flat or rolling plains with hills on the western and northern boundaries of the urban sprawl. The two rivers namely River Malir and River Lyari flow through the city. The population of Karachi is estimated to be around 20 million. It is the capital of Sindh Province and consists of six main districts and 18 towns. Only two towns (Malir and Gadap) have agricultural lands while other 16 towns have no agricultural lands. The geographical co-ordinates of the city are: 24°51′36″N and 67°00′36″E. As the city is located on the coast of Arabian Sea; it tends to have a moderate climate due to marine affects. The average rainfall of the city is around 7 inches per annum. However, the city experiences bulk precipitation during the monsoon season in July-August. Summers are scorching in the city, with May and June being the hottest months of the year, when temperatures often reach the 43°C mark. Winters are mild and January is the coldest month with temperature as low as 5°C. December and January have a pleasing weather when most of the social events frequently take place in the city (https://www.karachi.com/v/geography/). Karachi has an arid climate and a little bit moderate climates. Karachi is located on the coast and as a result has a relatively mild climate. Karachi has two main seasons; Summer & Winter, while spring and autumn are very short. Summer season persists for longest period during the year. Karachi also receives the monsoon rains from July to September. The city enjoys a tropical climate encompassing warm winters and hot summers. The humidity levels usually remain high from March to November, while very low in winter as the wind direction in winter is North Easterly.

Unfortunately, insect fauna have always been claimed as pest fauna only, otherwise of the total insect fauna, pests constitute only 38% while rest includes beneficial/useful like bio-control agents (Chrysoperla camea, Coccinella spp. Brumus spp., Bracon spp. and Apenteles spp.), bees, silkworm, scavengers, decomposers, pollinators, competitors etc. It has been estimated that 140plants and animal species are lost every day in the world and loss of one plant means the extinction of 30 insects + other animal species. This awesome situation can only be avoided by strengthening the efforts to explore the insect faunal diversity and to conserve the beneficial insects in the country. The

biodiversity of insects is also subjected to change due to changes in the environment and agro-ecosystems Out of 32 insect orders only ten orders have been explored in Pakistan (Suhail et al. 2007). 1. Diptera 2. Thysanoptera 3. Neuroptera 4. Lepidoptera 5. Homoptera 6. Hemiptera 7· Dictyoptera 8. Orthoptera 9. Odonata 10. Hymenoptera

The purpose of this paper is to present a preliminary list of insect fauna of Central district of Karachi. Such a study is of particular interest as the study area is a part of coastal belt of the Arabian Sea which touches two of the world's main zoogeographical regions: the Palearctic and the Oriental region.

2. Materials and methods

Karachi district central covers an area of 3780km2, which is the smallest by area and 2nd most populous district in Pakistan. Therefore the crops, forest and major vegetation is lacking due to major anthropogenic activities and huge population density. A survey was made to select the different gardens and wild vegetation in different areas of study area. The collection though random, but has been mainly conducted in summers and winters. Adult specimens were captured/trapped through Malaise trap, Yellow pan, water trap and insect hand net. The time of collection was primarily from morning till afternoon for some insects like the members of order Hymenoptera and Diptera. However, moths and some beetles were captured after dark. Some insects like Bradinopyg, Cimex being common were collected when found in sight. Orthopterans were mostly collected in dawn. The insects were frozen in deep freezer for the purpose of preservation. Some insects were also found dead and simply preserved. Identification was made possible by the help of different online sites and apps like:
https://www.pctonline.com/article/pest-identifier-app-android-users/, https://play.google.com/store/apps/details?id=com.mm.insects.identification&hl=en
https://www.insectidentification.org/bugfinder-start.asp
https://apps.apple.com/us/app/insect-identification/id1380105102

3. Results and discussion

The pooled up data of Insects of current study showed insect fauna comprising of 43 species and sub species belonging with 34 families of 10 Orders. It was also interesting that species richness were more in some plants (Tab. 1)

Table 1: List of Favoured Plants with Genera of Insects

Favoured Plants	Genus of Specimen
Cycads	Eubolina, Trigonodes, Hypolimnas, Circobotys, Lamoria
Hibiscus	Argotis
Paw paw	Papilio
Milk weed plants	Venessa
Herbaceous plants	Hellensia
Solanaceae	Acherontia

The orders of more diversity were Diptera and Lepidoptera. The most common Lepidopterans were moths. Eight species were recorded from family Muscidae. Some other common families were family Apidae of order Hymenoptera, Family Acrididae of order Orthoptera and family Nocturidae as well as family Nymphidae of order Lepidoptera. Three species of Xylocopa of family Apidae have been recorded. Only one species of order Odonata and family Libelluridae were found. Four orders like Odonata, Blattodae, Dictyoptera and Thysanura have been recorded with single family and single genus in each order (Tab. 2; Fig. 1)

Table 2: Collected Orders with Families and Genera Diversity

Orders		Families	Genera
1.	Diptera	Sarcophagidae	Sarcophaga
		Muscidae	Musca, Neomiya
		Tephritidae	Bactrocera
		Tabanidae	Tabanus
		Calliphoridae	Chrysomya
		Stratiomyidae	Chloromyia
		Culicidae	Culex
2.	Hymenoptera	Rhopaludae	Scantius
		Evaniidae	Evania
		Apidae	Xylocopa, Apis
		Vespidae	Vespa, Vespula
		Formicidae	Camponotus
3.	Lepidoptera	Eribidae	Eubolina
		Nocturidae	Argotis, Trigonodes
		Papilionidae	Papilio
		Nymphalidae	Venessa, Hypolimnas
		Sphingidae	Acherontia
		Crambidae	Circobotys
		Pterophoridae	Hellinsia
		Pyralidae	Lamoria
4.	Hemiptera	Miridae	Deraeocoris
		Lygaeidae	Caenocoris
		Cimicidae	Cimex
5.	Coleoptera	Cleridae	Necrobia
		Scarabaeidae	Anomala, Heliocopris
		Curculionidae	Hylobius
		Coccinellidae	Cheilomenes
		Elateridae	Agriotes
		Nitidulidae	Brassicogethes
6.	Orthoptera	Tettigonidae	Ruspolia

		Acrididae	Acrida, Anacridiumm, Schistocerca,
7.	Odonata	Libelluridae	Bradinopyg
8.	Blattodae	Blattidae	Periplaneta
9.	Dictyoptera	Mantodea	Mantis
10.	Thysanura	Lepismatidae	Lepisma

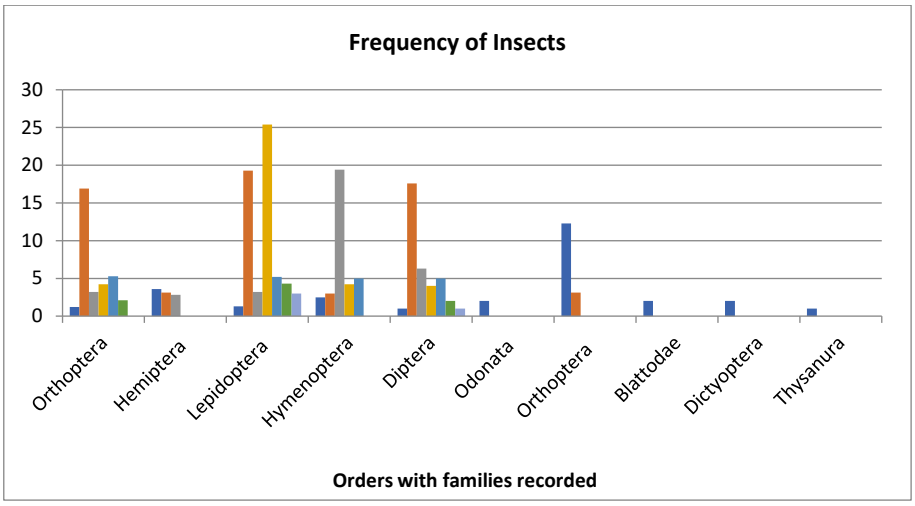

Fig. 1: Represents the Frequency of Animals in Each Order.

In conclusion, the study highlights the fact that the composition and structure of the insect communities in an area are characterized by a high turnover of species. Rapid waves of colonization, drastic physical and climatic changes along with global warming in the area are main factors which decline the species population and diversity. The findings also highlight the existence of unstable relationships between the insect pests and their insect natural enemies, under moderate biocide application. Natural biological control which maintains the diversity and integrity of this man-made agro-ecosystem should be given prime importance in deciding environmentally safe and effective integrated pest management strategies. The role of biodiversity in the dynamics and management of insect of flora highlighted by Way and Heong (1994) is further substantiated by the present study. Pollinators put high-priority and high-impact urban conservation within reach. The relatively small spatial and temporal scales of insect pollinators in terms of functional ecology (for example, habitat range, life cycle, and nesting behavior compared with larger mammals) offer opportunities for small actions to yield large benefits for pollinator health. The approach for improving the habitat value within urban areas is relatively simple and easily understood by urban residents. Several analyses of urban insect pollinators show the consistent variable correlated with pollinator health is forage (i.e., the presence of flowers) (Bates et al. 2011; Hennig & Ghazoul 2012; Cariveau & Winfree 2015). These findings extend to forage species planted on urban vacant lands (Gardiner et al 2013), and these plantings have similar effects on specialist and generalist insect pollinators (Williams et al. 2010). Bees and other insect pollinators benefit from both native and nonnative plants (e.g., Matteson & Langellotto 2011; Hanley et al. 2014; Pardee & Philpott 2014; da Silva Mouga et al. 2015), although for managerial purposes natives are preferred (Williams et al. 2011). Other under-explored topics include social dimensions of self-organizing neighbors who transform lawns (and their affiliated cultural models) to attract bees and butterflies for conservation (van Heezik et al. 2012) and the effectiveness of different citizen conservation activities (Asah & Blahna 2013).

Cities offer several advantages for exploring conservation practices, such as a lack of agriculture pesticides (Larson et al. 2013; Muratet & Fontaine 2015) (although home and horticultural use of pesticides may be widespread) and volunteers who can install and maintain restoration plantings. Many of these urban resources are absent in rural areas. Cities also have concentrations of philanthropic donors, funding resources, and development specialists who can mobilize resources for conservation projects.

Research on urban insect pollinators is changing how the biological value and ecological importance of cities is viewed. Conservation must be repositioned within this unfolding image of the city. Rather than treating urban conservation as solely outreach and education aimed to improve plantation in the city. Attending to the needs of insect pollinators in conjunction with a suite of other conservation measures (e.g., green infrastructure and environmental quality of life provision and climate change mitigation) can inform current and future generations how to urbanize sustainably. To do so, requires an ecological understanding of the city and a requisite conservation that fits the conservation for the city.

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